

THE HENRY M. JACKSON
SCHOOL OF INTERNATIONAL STUDIES
UNIVERSITY *of* WASHINGTON

TASK FORCE REPORT



Positioning Washington State in the NewSpace Race

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Executive Summary

This report highlights the central role Washington state can play in fostering the next generation of space startups as a renowned space hub. The NewSpace industry is estimated to become a trillion-dollar industry by 2030, according to Morgan Stanley.¹ Nano-satellites, big data, and rocket innovation are unleashing a torrent of commercial opportunity for companies capable of harnessing unprecedented access to space. With a legacy of innovative aerospace and technology companies, world-class research institutions, and an entrepreneurial culture, Washington already has a vital foundation for cultivating the next generation of companies in the NewSpace sector.

Current and future NewSpace companies, however, face a variety of challenges. A lack of clear regulation from government and a severe shortage in labor and capital are three central obstacles in the commercial space industry.² Additional constraints include rising cost of living, traffic congestion, and racial diversity in the workforce. This report outlines eight initiatives aimed at supporting Washington state to evolve as a NewSpace hub. Recommendations include:

- Increasing the supply of local talent through private-public partnerships in education
- Investing in 'intelligent' transportation system
- Increasing affordability in King County
- Mandating greater transparency in hiring and salary data
- Expanding paid-leave programs
- Establishing a joint private-public seed fund
- Establishing a local NewSpace sector coalition for lobbying
- Positioning Moses Lake as a Spaceport

- **Section 1. Global Trends and Forecasts in the Startup Space Race** informs the reader on the global 'space startup race', underscoring the global nature of competition and regulation. Indeed, the contemporary space race is governed not only by local dynamics.

National and international rules and regulations are as relevant to the commercial space industry as aviation laws are to commercial aerospace. A principal difference, however, is that space law remains anachronistic, with laws and treaties that are reflective of a foregone era when countries, not companies, vying for dominance. Section 1 will also address several pertinent laws that play a role in the commercial space industry. In sum, we hope that our report adds to the ongoing conversation between lawmakers and business leaders on what space law should become in the 21st century.

- **Section 2. State of Play: Washington state in the Startup Space Race** will narrow our attention on Washington – specifically, by taking stock of the vibrant state of the commercial space and technology sectors, venture capitalists, and research institutions. In doing so, the report profiles the local labor force, companies and technologies, delineating the competitive advantages of this region. This section answers the question of why the tech companies will choose to innovate in here.
- **Section 3. Washington state: Constraints and Opportunities**, highlights several local factors – political, economic, and social – constraining the growth of an active commercial space sector. There are areas where Washington state can improve upon to better foster a space startup climate. As such, We propose several short-term and long-term solutions that aim to advance the State as a destination for startups.
- **Section 4. Conclusion**, we summarize our main findings and recommendations. If enacted, these measures, would benefit Washington state in attracting NewSpace entrepreneurs and cultivate innovation in the commercial space industry.

1: Global Trends and Forecasts in the Startup

Space Race

The Space Industry Snapshot

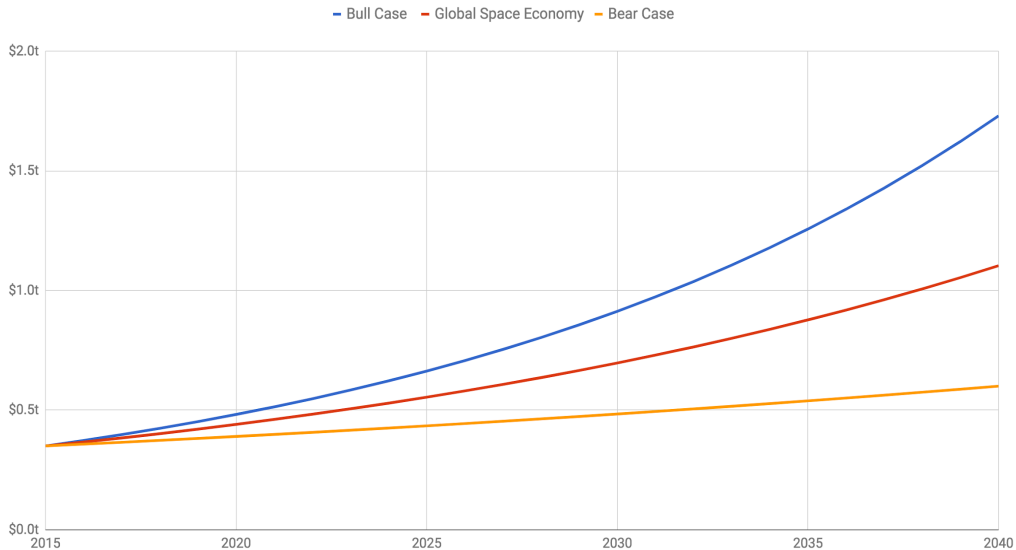
The NewSpace sector represents a novel stage in space technology, bringing both opportunity and evolution to Washington's economy. In the first stage of the space race, nation-states competed for unprecedented access to space, channeling billions of dollars into research and development.³ Legacy aerospace, technology and defense firms all benefited from these early investments, jettisoning the second wave of space exploration in the 1990s and early 2000s. The emergence of new private players, namely SpaceX, Blue Origin, and Planet, heralded a new stage in space exploration.⁴ The growth of a nascent commercial space sector – an independent commercial space market – signals a turning point in humanity's relationship with space. For the first time, private-sector actors are the primary agents promoting innovation, growth, and cooperation in the realm of space. The declining cost to access space is expanding the space economy, which some estimate to stand at \$323 billion in 2015, worldwide.⁵ In a few numbers, the space economy looks like this:

- In 2016, it was estimated that there was an estimated 158 NewSpace companies in existence; and that there will be 10,000 NewSpace companies in the next decade, according to some estimates;⁶
- Morgan Stanley Research estimates that the Global Space economy will grow to a range of half a trillion to nearly two trillion dollars by 2035 (See graph: The Global Space Economy);⁷
- The global space launch market share is valued at \$6 billion dollars – 76 percent of the outer space market share is international;⁸
- 76 percent of the total market is allocated to commercial infrastructure and systems, where satellite television is the largest sub sector valued at \$95 billion (See chart: Global Revenue of Commercial Space);⁹
- It is estimated that the commercial space transportation sector helps industries create \$208.3 billion in economic activity just in the United States;¹⁰

- And in 2017, investors channeled \$3.9 billion into NewSpace companies, a year that also featured 88 launches, with the commercial sector contributing to 37 of those (See Graph: Investment Growth in the NewSpace Industry, and Graph: To a Billion and Beyond).¹¹

The Global Space Economy, 2015-2035 (\$t)

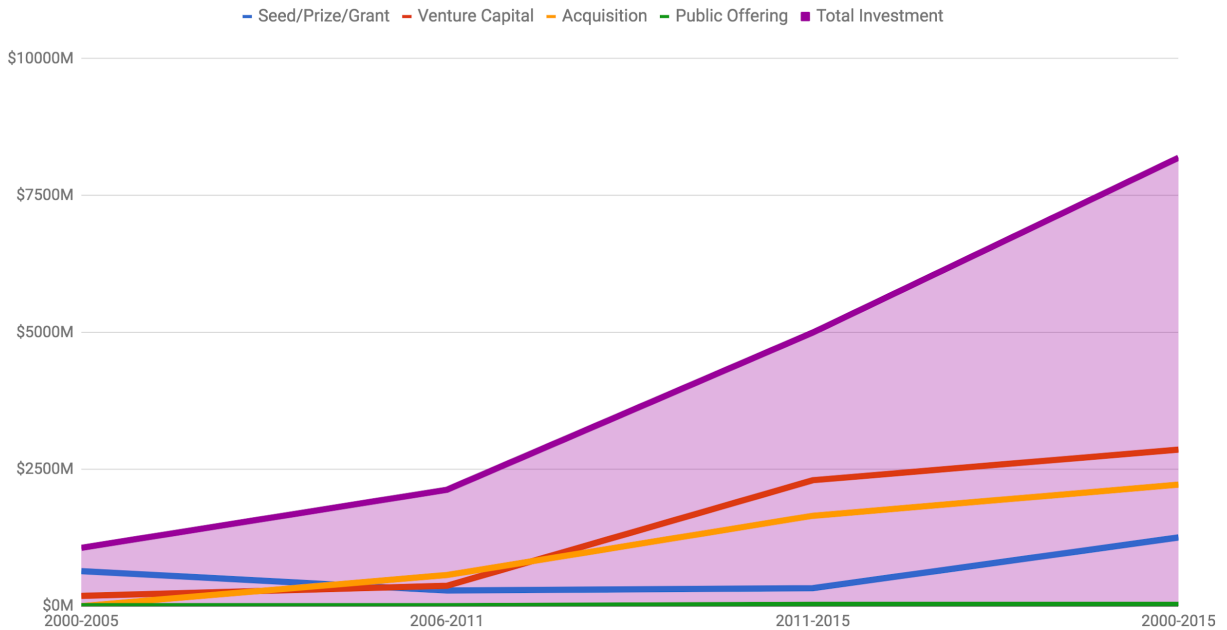
Source: Satellite Industry Association, Morgan Stanley Research, Thomson Reuters.



Both Washington state and the NewSpace sector stand to benefit from developments in commercial space. The region is home to the headquarters of three of the biggest companies in software and aerospace – Microsoft, Amazon, and Boeing – and is already the destination of two of the most prominent NewSpace companies: Blue Origin and SpaceX. This report shows how nexus between technology and aerospace engineering will contribute to the broader ascendance in the commercial space industry. The vital ingredients to innovation are abundant in the region and cultivating the space industry will require a coherent policy from stakeholders in elected office, academia, and the private-sector. This report will serve as a guide, navigating stakeholders across the issues and opportunities of evolving Washington state into a NewSpace hub.

Investment Growth in the NewSpace Industry, 2000-2015

Source: The Tauri Group



What is NewSpace?

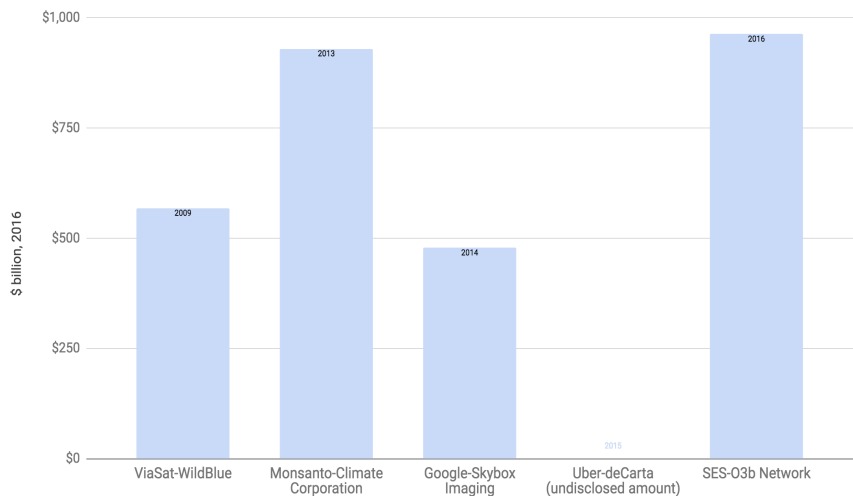
The startup space industry is a broad term, encompassing many subsectors and technologies. For this report, we define it as companies formed in the past two decades as an angel- or venture capital-backed startups and are enterprises that provide services related to space, including:

- The manufacturing of satellites, launch vehicles, or other space-based systems and ground equipment
- Services that depend upon these systems, including: satellite TV, radio, and broadband
- Analytic services stemming from data collected from space-based systems¹²

Such ‘NewSpace’ ventures are a recent phenomenon but stem from familiar elements: the plummeting cost of computing and the scalability of data products among user bases, for instance, are factors that enabled the successes of tech giants ranging from Microsoft, Google, and Amazon. Moore’s law will likewise drive growth in the emerging class of space ventures. On this point, Spaceflight CEO and president, Jason Andrews, comments, “The photos on Google Earth came from a satellite as big as a Suburban and cost \$150 million to launch.” Today, however, “computing and processing power has gotten to a point where you no longer need these “Battlestar Galactica” satellites.”¹³

Space ventures recently acquired by big tech

Source: The Tauri Group



Increasingly, distinguishing between technology giants and smaller scale space ventures is not clear cut. Big ticket acquisitions of space startups by large tech companies are a growing trend (See Exhibit: Space ventures recently acquired by big tech), underscoring the broad appeal of harnessing space for commercial use.¹⁴ Between 2000 and 2016, acquisitions in the space startup sphere totaled \$3.2 billion, with the majority of such deals conducted in the last 6 years.¹⁵

The growing scale of acquisitions reflects not only the big tech’s interest in capitalizing the commercial space industry; the magnitude of investments from investors worldwide further indicates that space ventures promise of large returns.¹⁶ The ingredients that continue to fuel pioneering software companies—venture capital, a STEM-educated workforce, plummeting cost of computing, to name a few—are now fueling an emerging commercial space industry;

ingredients that Washington state has in abundance. As Chris Lewicki, the CEO of Planetary Resources remarks, “The difference today is technology is much more commoditized and affordable,” making it easy to deploy in space. With lower barriers to space, Lewicki continues, brings more opportunity for local, and small-scale startups. “I don’t need a team of a thousand engineers anymore to do it,” Lewicki concludes, “I can do it with a team of 45 engineers from Redmond.”¹⁷

Increasingly, space startups have access to the financial and technological capital for long-term development. It is estimated that deals in the NewSpace sector has increased by more than 400 percent between 2012 and 2015. And that in 2016, there were 40 deals spanning \$1.5 billion in funding.¹⁸ The space startup trend is not ephemeral: the money flowing into the sector are tied to global investors expecting sustained future returns. Not only that, the technological capability of NewSpace ventures exceeds their predecessors, too.¹⁹

To a Billion and Beyond: Dollars invested into the Start-up Space Sector Exceeds \$1B
Source: The Tauri Group



The promises of these NewSpace ventures extend beyond their public-sector predecessors.²⁰ Space startups are less engaged in the quixotic search for answers to celestial questions than in the pursuit for profit. As our report will show, many of the space ventures that Washington

state aims to attract are developing products with practical use-cases and a global addressable market. To add, the technologies that future space ventures are developing will expand beyond the limits of the contemporary technology sector; artificial intelligence and commercial space are intertwined, for instance, because of the sweeping, constantly updated dataset 'smart' orbital satellites provide.²¹ If Washington state emerges as a space hub, it is likely to concomitantly stand as a leader in artificial intelligence, machine learning, and robotics research and development.

To get there, Washington state will have to recognize the opportunities – commercial and societal – that a thriving space startup sector will bring. But first, we will highlight developments occurring in other parts of the world, in countries and cities where the space startup sector has already taken off.

Reasons for Washington state

Washington state's business and cultural climate is ideal for NewSpace startups. The state offers commercial space companies a unique nexus of aerospace and tech ecosystems, and a region with capacity to flourish.²² Indeed, the state's achievement in sprouting a nascent commercial space sector, while, at the same time, sustaining the growth of homegrown giants in aerospace and software, is evidence of the region's distinction recipe for success. As Joe Landon reports in a New York Times article, Seattle is "a powerhouse on both the software and hardware side."²³ The ingredients of Washington state's commercial space ecosystem include:

- The founding of international headquarters for major aerospace and tech companies
- A highly skilled and experienced workforce
- A leading university, supplying the region with a many as 90,000 developers²⁴
- A vibrant ecosystem of technology startups, reaching nearly 2,600 in 2017²⁵
- A quality of life that attracts talent from other tech hubs
- A culture that values community and building a thriving ecosystem

Future and current NewSpace companies are looking for a destination with a tech-focus zeitgeist and a workforce with expertise.²⁶ Check. “There’s lots of opportunity for growth in that sector,” claims Alex Pietsch, the associate vice president of industry relations at Washington state University and former director of the governor’s aerospace office.²⁷ Investors are primed to back entrepreneurs situated in a nexus of research and development, too. Engineers, data scientists, and skilled manufactures are all looking for a place where they can live a satisfying life, triple check. Washington state is a showcase for technological innovation, business growth, and a diverse and skilled workforce. More than that, Washington state also provides a quality of life superior to other metropolitan cities.

At the core of Washington state's appeal is King County, the state's rapidly growing metropolitan region. Thanks to a burgeoning tech and biomedical sectors, its population has increased to two million in 2017, with a gross domestic product of \$301 billion in 2017.²⁸ Roughly 250,000 of those people work in the tech sector, growing by 10 percent each year.²⁹ Noteworthy, too, is that King County is home to a number of the world's leading software companies: Microsoft, Google, Amazon have either headquarters or satellite offices in the region. Office employment as a total of the population is high at 14 percent.³⁰ And the proportion of tech employment is higher, tech employment as a percentage of the workforce is approximately 5.5 percent – second only to San Francisco.³¹ The state's biggest employers include Amazon and Microsoft, the University of Washington, and Boeing.³²

These factors explain why some herald Seattle as the new Silicon Valley.³³ True, many Silicon Valley giants like Facebook and Alphabet have campuses in the city. They are likely attracted to factors such as King County's lower cost of doing business: office rent in Seattle is times cheaper than San Francisco, where the cost of office space grew by roughly 13 percent year-over-year in 2016 and is now has the most expensive rents in the country.³⁴ The cost of living here, too, is less than in Silicon Valley where rents continue to skyrocket. But the region offers a more appealing picture to young entrepreneurs and venture capitalists. King County, like Silicon Valley, is a flourishing epicenter for technology and business; unlike Silicon Valley, King County

provides a quality of life that surpasses the Valley's suburban sprawl. Indeed, where Silicon Valley growth reflects an unsustainable bubble that will eventually pop, Seattle, by contrast, is fertile for new companies to propagate and has room to grow.

The NewSpace industry will want a region capable of absorbing an influx of business and workforce.³⁵ On that measure, King County and Washington state are favorable. The region is a mix of urban communities, greater Seattle, and suburban ones too, the Eastside, which includes Redmond, Bellevue, and Kirkland. Data alone tell a compelling story. The region's assets – access to public transportation, cost of doing business, technology and professional labor force concentrations, to name only a few – provide a strong reason as to why the state is the ideal location for a NewSpace hub.

For instance, in 2016, venture capitalists channeled hundreds of millions of dollars into the region, with local startups raising an estimated \$583 million.³⁶ With new companies comes a demand for a larger workforce, a prerogative that King County facilitates with a stock of new housing, high salaries, and high quality of life. Michael Schutzler, the CEO of the WTIA, remarks that "We are the number one tech-importer of talent in the country," in an interview with CNBC.³⁷ The leading exporter of tech-related jobs is, according to LinkedIn, San Francisco.³⁸

The growing number of tech-workers relocating to Seattle from the Bay area is important to the scope of this report. The qualities that companies in the NewSpace industry mirror the reasons why software engineers decide to move to King County: this region provides entrepreneurs the autonomy and support to make a difference with their startup ventures.³⁹ Washington state can empower NewSpace entrepreneurs by providing the ingredients necessary for success: local aerospace and tech clusters; qualified and diverse human capital in the workforce and academia; billionaire angel investors; and a treasured quality of life. All of this without the cost of locating in the Bay Area, where the high-price of living and group-think mentality is excluding a new generation of entrepreneurs to pursue their vision.⁴⁰

That salaries are higher in Seattle, while the cost of living is lower is another compelling factor in attracting talent; annual salaries for software engineers are \$180,000 in Seattle compared with \$134,000 when adjusting for the cost of living.⁴¹ Moreover, the median price for a home in the Bay Area is nearly twice that of a home in King County. The lack of an income-tax, too, is a plus.

The quality of life and culture in the state is another principal appeal to the NewSpace industry. Food trucks line the city's street, museums convey the region's rich cultural history, and nightlife is varied and abundant. The region is a home to families and young twentysomethings, too, and offers high-quality K-12 public education. The University of Washington, located in the metropolitan area, is also one of the county's highest ranking public universities and is home to the Paul. G. Allen School of Computer Science, one the nation's highest-ranking CSE departments.⁴²

The Seattle mindset is less about material wealth and more about taking risks to fix palpable problems; navigating through unprecedented technological opportunities. That will appeal to NewSpace entrepreneurs. As the president and CEO of Spaceflight Industries, Jason Andrews observes, "All the ingredients are here [in Washington], but most importantly, it's the mindset about taking risk."⁴³ The NewSpace industry likely sees their work as a testament to human ingenuity and industriousness. In this vein, Andrews adds that the NewSpace industry "put[s] the power in the person's hands...and then it opened up all these new businesses and applications."⁴⁴

Exploring the frontiers of space tends to draw a workforce that is forward-thinking and distinct from innovators in, say, social media platforms. As Rob Hoyt, head of Tethers Unlimited, the local nanosat company, remarks, "We really like to push the boundary of what is science fiction versus science reality...My overall motivation is to enable mankind to settle the solar system."⁴⁵ Washington state offers a community oriented culture, a factor based in the fact that Seattle has the highest percentage of startups that give stock options to all of their employees. Across

the country, 42 percent of the startup ecosystem gives such stock option plans to their employees; whereas 58 percent of Seattle startups do.⁴⁶ The state is open to experimentation and fosters responsible tech talent. The region is conducive to enabling NewSpace companies to fulfill their respective missions, by allowing their imaginations to be realized.

Foreign and Domestic Competition

A decade ago, China, the United Arab Emirates, and India spent close to nothing on their space efforts.⁴⁷ Today, these countries have modern space agencies with plans to send astronauts to Mars; not only that, each country sees space as a frontier for private-sector innovation. The modern day ‘Space Race’ is less about dueling national agencies than it is about private-sector competition: *which company* will build the cheapest rockets, the smallest satellite, and smartest software is, today, the principal question. A regional strategy for Washington state’s private-sector space industry must take into account the global nature of competition.

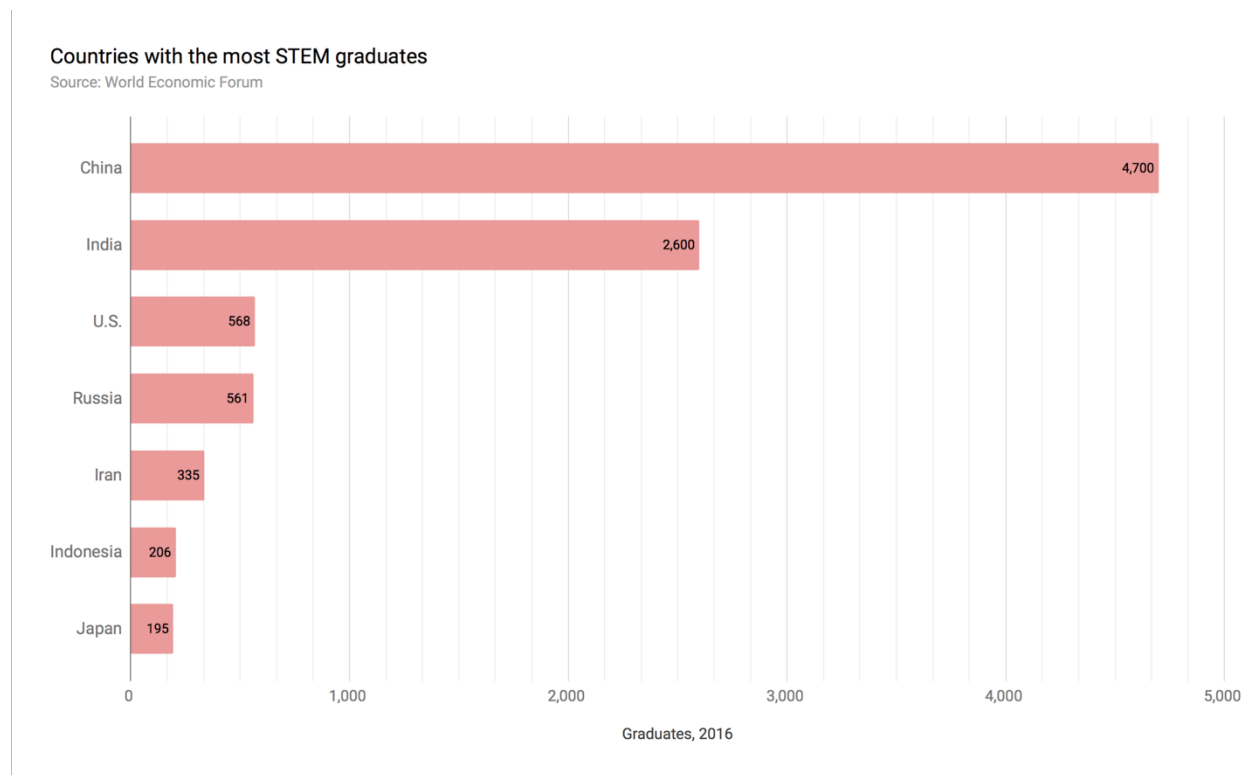
The following section will highlight recent developments in several countries leading in the commercial space sector. Doing so, we intend to situate Washington state as a competitor – and competitive with – not only with other US cities, but also in relation to space hubs across the globe.

China

China’s rapid economic growth in the past decade has come with a concomitant development: a pioneering national space agency and an entrepreneurial climate conducive to private sector innovation. China’s space program has caught up to other rich countries, spending a roughly equal proportion of GDP as other leading space exploring nations.⁴⁸ And the country is tied with the US in the number of orbital launches, with each sending 22 satellites in 2016 – more than any other country.⁴⁹

A number of private-sector companies have broken-ground in developing commercial-level capabilities, specifically in robotics, aviation, astronautics, and artificial intelligence.⁵⁰ Private companies pursuing commercial space enterprises have benefited from state financing and a pool of highly educated STEM graduates (See Graph: Countries with the Most STEM Grads). Key players include the rocket startup is One Space Technology, Tianyi Space Research Institute, and Kuang-Chi Science – led by the "Elon Musk" of China – each of them securing substantial investments from state-owned banks and venture capitalists. And like the tech giants in the US (Google, Amazon, and Facebook), China's Tencent, Alibaba, and Baidu are pursuing their own strategy to foster and harness innovation in commercial space.⁵¹

Even Xi Jinping, President of the Chinese Communist Party, has declared the space enterprises are a vital part to the countries overall economy. His promise to land astronauts (“Taikonauts”) on the moon by 2036 is part of a broader strategy to develop domestic innovation in AI and robotics.⁵²



Japan

JAXA, Japan's space agency, is reaping dividends from early investments into the private sector. While JAXA has a history of pioneering experiments and continues to conduct research on space exploration, it's prominent role in funding private-sector startups is noteworthy.⁵³ Revenue from rockets, satellites, and software was 307 billion yen in 2015.⁵⁴ The goal for the next decade is to reach an annual revenue amount of 500 billion. Given that JAXA's annual budget of 182 billion yen (\$1.62 billion USD), a fraction of NASA's, Japan is leveraging the country's capacity to innovate in sub-sectors and collaborate with global partners.

Japan benefits from recent trends in the space industry. The country is a leader in software and hardware development and has a highly (STEM) educated workforce. Startups targeting new sub-sectors have popped up in Japan, aided by government funding, local investment from major conglomerates, and global capital.⁵⁵ A startup to follow includes Infostellar, which provides companies access to satellite services and has received a total of 800 million yen (\$7.27 million) from Sony, Airbus among other investors. Japan's space commercial space industry is calculated to be 1.2 trillion yen and is predicted to double by 2030, according to government plans.

Luxembourg

For decades, Luxembourg has profited from its unique role in global finance, offering companies tax-loopholes and intricate "fixes" to regulatory problems.⁵⁶ Now the country is positioning itself to become the "Silicon Valley" of space mining by playing a similar role in the commercial space sector. Specifically, Luxembourg has become an answer to the ethical, legal and financial concerns that new companies face in the nascent industry of space resource mining.⁵⁷ The Luxembourg Space Act provides legal protection to space mining companies "recovering and exploiting for profit raw materials taken from the Moon, asteroids or any other celestial body."⁵⁸ And in 2016, the government announced that it planned to invest more than \$200 million in research and development, and in the purchase of company equity.

In fact, Washington state benefits from Luxembourg's policies: Planetary Resources of Redmond, Washington, has opened up an office in Luxembourg to centralize their European operations. The Luxembourg government will invest at least \$225 million in the company, providing Planetary Resource additional capital for research and development regarding space mining, as well as a pledge from the government for long-term support. Planetary Resource will also benefit from the favorable regulatory environment, underlining a significant limitation of current U.S. space law, which limits space exploration and capital for startups.

United Arab Emirates

The United Arab Emirates is the only Arab nation with a space program.⁵⁹ The nation jump-started its program in 2006 with the founding of the Emirates Institution for Advanced Science and Technology (EIAST).⁶⁰ Since then, the UAE has collaborated with researchers worldwide to research, develop, and put to market new technologies for space exploration and foster commercial enterprises. A steady supply of capital is one reason the private-sector space industry will be drawn to – and emerge from – the UAE. It calculated that the space agency has raised nearly \$5.2 billion among government and private investors.⁶¹ And in 2010, the government invested in Virgin Galactic, owning roughly 37.8 percent of the company's shares. Another, equally important reason, are the country's investments in education.

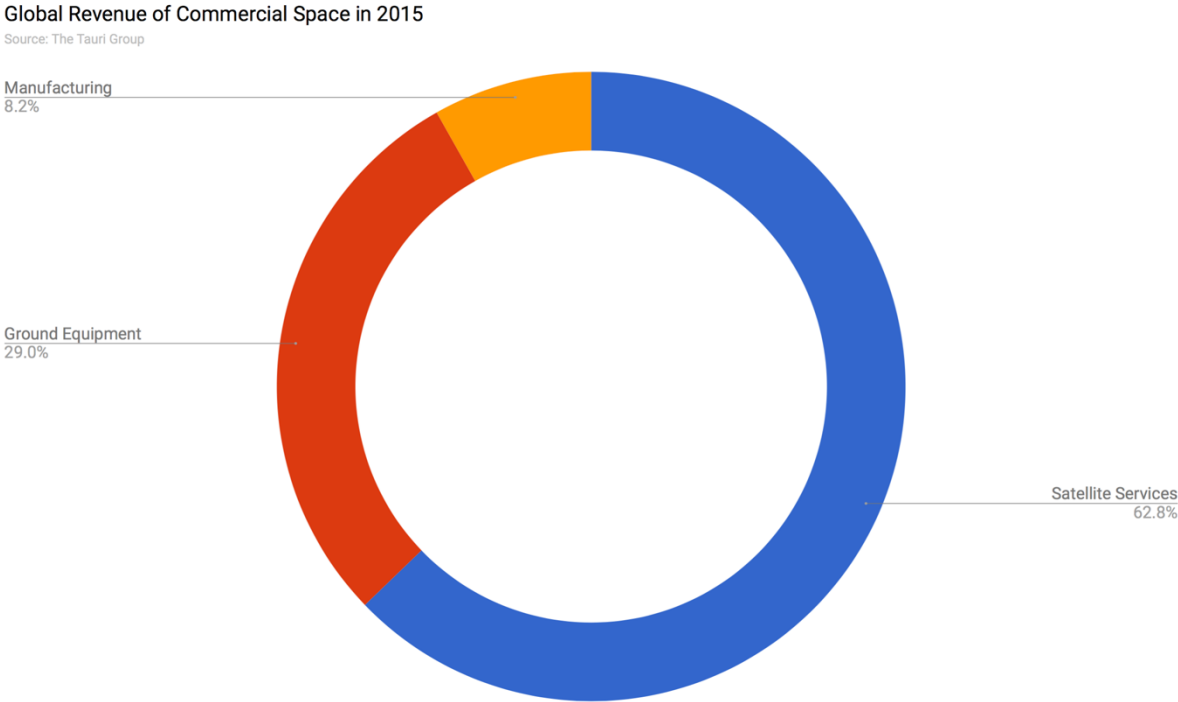
A central plank of the UAE's space policy is the development of K-12 and university STEM education.⁶² The goal is to inspire and educate students, encouraging students to participate in space camps and apply for internships. This approach will enrich domestic knowledge and spur innovation, building capabilities for the long-term. The country has also prioritized the inclusion of women in STEM education; it has been reported that women make up 38 percent of the agency's workforce.⁶³

India

If there is one country that stands to benefit most from the shift to nano-satellites it's probably India – a country that recently broke the world record in satellite launches by launching 104 of

them into orbit in 2017.⁶⁴ Indeed, the country's national space agency, Indian Space Research Organization, is a leading force in facilitating the shift to nano-satellites. The agency's ascendancy in this sub-sector has signaled to other ventures that India is emerging as a key player in the NewSpace race, capable of building rockets and launching them at a fraction of the price it takes NASA and even private juggernauts like SpaceX.

The recent world record-breaking event was not only notable for the number of satellites launched. Another reason this event underscores an important shift in the NewSpace sector is that it positioned India as a competitor to private space enterprises. The low-cost of the mission and India's track record of reliability drew in international clients: 96 of the 104 satellites launched were from the United States, many of them from the company Planet; other the clients included Israel, Kazakhstan, the United Arab Emirates, Switzerland and the Netherlands.⁶⁵ The previous two decades heralded a period of unprecedented economic growth in India, expanding a population of highly educated engineers and ambitious financiers. Moving forward, India will position itself as a dependable and thrifty alternative to the commercial space sector (See graph: Global Revenue of Commercial Space in 2015).⁶⁶

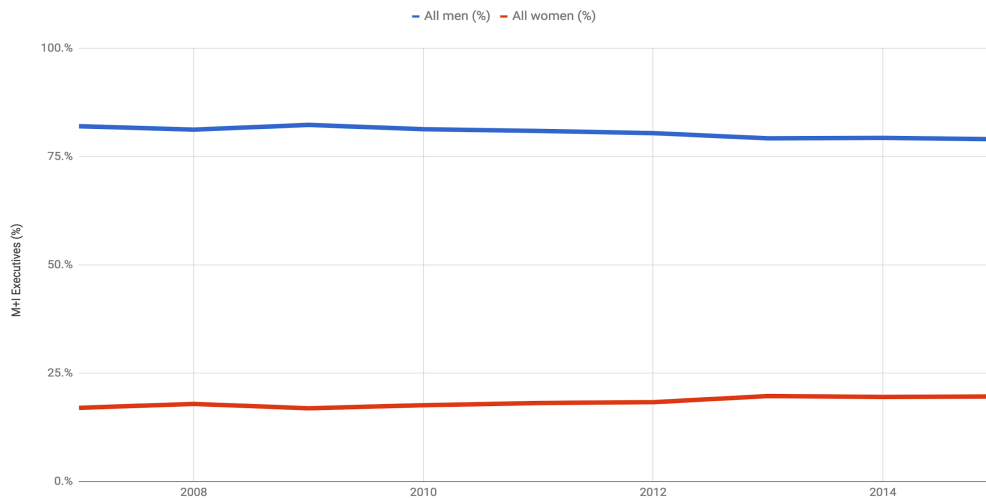


Silicon Valley

The marriage of big-data analytics and high-tech hardware are natural extensions to Silicon Valley's forte.⁶⁷ To add, the excess of venture capital, on the hunt for the next breakthrough tech company, makes the Valley a prime location for future space startups to grow. In fact, Silicon Valley appears to have all the ingredients to incubate the ideas of space entrepreneurs: access to investor capital; an abundance of million- and billionaire angel investors; STEM-educated workforce; a robust network of engineers and business leaders; an unceasing entrepreneurial zeitgeist; and the cache of being an "SV" startup.⁶⁸ Three of the biggest space startups, for instance, are located in San Francisco – and together, Planet, UrtheCast, and Terra Bella have received an estimated total of \$308.2 million from local venture capital.⁶⁹

Despite the Valley's history of success in launching software entrepreneurs into self-made billionaires, it's success in attracting future startup talent is in question.⁷⁰ Not only is the cost of living in the Valley becoming prohibitively expensive; a culture of racial and sexual discrimination throughout the Valley is likely to deter bidding entrepreneurs from locating there.⁷¹ Indeed, according to one study women-led companies receive just 5 percent of venture capital funding in Silicon Valley, while African-American and Latino founders secure merely 1 percent.⁷² Silicon Valley is decidedly white and male, a demographic skew certain to fortify bias and elitism.⁷³ In this report, we predict that future of space startup ventures is more diverse – in gender, race, and worldview – a phenomena Washington state should incubate (See Graph: Bay Area M+I Executives by Gender). A thriving space hub must nurture inclusivity and diversity to attract the best talent from around the world. Increasingly, Silicon Valley appears unable to do so.⁷⁴

Bay Area Manufacturing and Information Sectors by Gender, M+I Executives (%): 2007-2015
Source: EEOC



Existing Constraints: A Lack of Regulation

The rising industry in commercial space throughout the world is a fascinating representation of innovative ideas. Even in Washington state, the encouragement of innovation and advantages in technology and data provides a unique competitive advantage in its growing space industry. However, considering that the commercial space industry is relatively new, there are still many limitations in the international and federal level when applying space laws that were made in the 20th century. With many of the existing laws applied towards former government space use, most of it lacks specific regulation in the upcoming new private space projects. As of now, it is a matter of interpretation.

Overall, the growth of the new commercial space industry is undermined by the lack of regulation. The dearth of law pertaining to the subject of private companies exploring space is an obstacle that hinders growth in commercial NewSpace sub-sectors. In asteroid mining, for instance, the lack of laws and regulations limits the market development of such services.⁷⁵

The Outer Space Treaty of 1967 is aimed to provide a framework for nations on what practices are considered acceptable in outer space.⁷⁶ However, as these regulations become outdated,

there have been arising challenges regarding the interpretation of the treaty and has in result limited some ability for private companies to create opportunities for space exploration. Since many space technologies have dual-use capability, there are additional issues concerning what is deemed as non-military or non-aggressive for the purpose of peaceful space use.⁷⁷

The U.S. SPACE Act of 2015 is a favorable legal approach towards fostering the growth of NewSpace with opportunities in practices like asteroid mining. There is however a concern over how these laws may contradict the Outer Space Treaty Article II by asserting that no state can claim sovereignty of objects in space.⁷⁸ This serves as an example that the future of enforcing a positive regulatory framework for the NewSpace industry is limited by overarching international law.

There are other obstacles for the commercial space industry. Liability and insurance for these businesses are of concern due to the high-cost and high-risk nature of many commercial space goods and services.⁷⁹ Indeed, liability for any spacecraft or satellite damages that involve other countries is still under the responsibility of the federal government, according to current laws.⁸⁰ The federal level assess the risks of third-party liabilities when launching.

Washington state can play a role in nudging policy makers to ratify and reform federal laws regulating commercial space. The control of ITAR is one prominent example of a regulation that limits the industry's local growth. The outdated laws of today will eventually need to be more specified towards commercial space to accommodate the growth of the industry. If not, smaller businesses in this industry may not be able to succeed in the long run and the industry may be unable to expand into cutting-edge sub-sectors. Changes in ITAR can contribute as a significant factor to advance the industry and assist the potential in international collaboration or diversification in workforces specifically in Washington state.

International Traffic in Arms Regulation (ITAR):

The strict control of International Traffic in Arms Regulation (ITAR) over the exporting of spacecraft and information in space-related technologies is a major constraint in advancing the commercial space industry globally.⁸¹ There are also regulations toward foreigners working in specific fields of engineering or manufacturing that work on these restricted space-related technologies because of its dual-use capability and risk towards national security and foreign policy.⁸² Recently, there has been a new rule allowing for flexibility in exporting components and information of satellites or remote sensing technologies.⁸³

This change proves that there is the possibility for a step-forward towards future leniency in regulations and acceptance of the various space technologies that exist. Because current regulations generalize many classifications of space technology and in some cases classify it under the aerospace industry, this recent exception towards satellite technology is an advantage for many space-related businesses in the U.S.⁸⁴

In addition to the exports, the ITAR also enforces a constraint in foreign workers having any type of access to material or sensitive information that is in the U.S. Munitions List. A worker must be a U.S. National or have permanent residency.⁸⁵ Although it is important to ensure national security, these regulations can restrict opportunities for diversity in the commercial space industry as well as a chance in international collaboration. According to an immigration attorney, even janitors, dishwashers, and cooks that are hired at these commercial space companies have to go through a clearance for U.S. nationality status.⁸⁶

Ideally, Elon Musk wants to hire foreign talent that could offer exceptional progression to the industry, similar to how he hires foreign talent for his Tesla company, however is restricted by these strict limitations.⁸⁷ Unfortunately, the ITAR consequently affects the potential lack of diversity in the space industry.

Overall, the generalized subject of spacecraft classification, exporting, and ITAR still is a work in progress towards favoring the NewSpace industry. Although this issue may not be easily resolved at the state-level, it is important to consider the arising challenges for the growing commercial space industry involving diversifying the workforce and collaborating internationally.

In the following sections, the report will detail the specific attributes of Washington state and several key companies that are leading the way in the local NewSpace industry. Later on, in the report, however, we will identify several constraints Washington poses, addressing them head-on with practical, actionable solutions.

2: Washington State in the Startup Space Race

Washington state was and remains a leader in the modern aerospace industry; local companies will likewise pioneer the future of the commercial space industry in the region. Just as the greater Seattle area continues to evolve as the destination for leading talent in software, communities within Washington will stand to attract jobs, investment, and broader prosperity with this cutting-edge sector.

This section will highlight the current state of Washington's space industry and the vital ingredients this region has for expanding the NewSpace sector. The section will begin by giving a brief overview of Washington's tech- and aerospace-focused industries. From that, we will highlight several factors that are conducive to the NewSpace industry – namely, Washington's workforce and expertise in relevant new technology. Next, the report will profile several local companies and investment organizations – the state's principal stakeholders in building the local spacehub. We believe that in order to build a vision for the future of the local space industry, it is essential to evaluate the people and technologies located in Washington.

Why Aerospace and Software Thrive in Washington State

For over a century the greater Seattle metropolitan region has been a pioneering center for technological innovation. Both the aerospace and software industries have taken root in Seattle and around the region, becoming both intertwined with and transformative to the State's economic flourishing. Companies like Boeing, Microsoft, and Amazon are integral to the local business ecosystem, becoming powerhouses in their respective industries. The presence of these companies has served to bring and foster a highly skilled and technically proficient local workforce. As such, these companies provide evidence that the region can be an incubator for innovative industries over the long-term.

This passage will briefly summarize Boeing and Microsoft's development in Seattle. We underline how this region and its two largest companies have formed cohesive partnerships that benefit both the public and each companies' success. Moreover, because of Microsoft and Boeing, a cluster of aerospace and software engineering firms have sprouted in the region, with resources, skills, and expertise that would benefit the development of a local NewSpace industry. Being in its relative infancy, the NewSpace industry will benefit from residing in a city that has a precedent of developing forward-thinking industries.

Aerospace-Airplanes from Boeing, and rockets from NewSpace

Washington state's greatest private employer is Boeing, one of the largest commercial aircraft manufacturers in the world.⁸⁸ It put Seattle on the map as a hub for aerospace when the region was a peripheral West Coast city. The company has a long history in the state dating back to 1916 when Bill Boeing started the company along the shores of Lake Union in Seattle.⁸⁹ Mr. Boeing kept the company in the area because of Washington's vibrant timber industry, the primary material used in the first planes.⁹⁰ Even though the material of choice became aluminum, Washington was still a great choice because of its cheap hydropower.⁹¹

For much of the company's history, it has in large part been staffed by generations of smart and driven Washingtonians and still employs almost 66,000 individuals in the state today.⁹² Not only does Boeing have a large direct employment base, the company generates hundreds of thousands of jobs indirectly via manufacturing suppliers, composite manufacturers, avionics firms and other aerospace related industries.

The aerospace industry grew up with Boeing at its center. As airplanes became more complex, parts were outsourced to specialists, and supporting industries were formed. A more recent example is the formation of a composite industry in Washington due to Boeing's use of the materials in their new model, the 787.⁹³ Based on data from 2016, through this aerospace ecosystem Boeing induces another 242,800 jobs and \$21 billion in annual wages within the

state.⁹⁴ In the aerospace industry of Washington as a whole, \$69 Billion in revenue was generated in 2015.⁹⁵

Not only has Boeing been a major economic contributor to the state over the course of the past 100 years, Boeing has also been an integral community member through their philanthropy and commitment to education. Some of the first engineers Mr. Boeing hired were from the University of Washington, and so began a relationship that exists still to this day. As of 2016, nearly 10 percent of Boeing's staff received a degree from UW, 16 percent of which are mechanical engineering.⁹⁶ Boeing has also established the Boeing Advanced Research Center, pairing company employees with students at the university to direct curriculum towards relevant industry topics.⁹⁷ CEO Ray Conner said, "Boeing will be a significant jobs provider in Washington for decades to come. Our hope and goal are that those future jobs will continue to be filled by kids who grow up right here."⁹⁸ Additionally, with Microsoft, Boeing helped start the Washington Opportunity Scholarship which helps support low and middle-income students pursuing STEM degrees by contributing an initial \$25 Million.⁹⁹

One of Washington state's central advantages in developing as a NewSpace hub is that Boeing's prestige attracts many aerospace engineers to the King County area where their operations concentrate, and this workforce could transfer to the commercial space industry. This development has already been witnessed with four former employees of Boeing creating Aerojet Rocketdyne, a rocket manufacturing company, located in Redmond, WA. While Boeing has begun a contraction of its presence in the region, most heavily in manufacturing, the emerging NewSpace industry in Seattle could potentially fill in the void left behind and become the new magnet for aerospace engineering instead. With less activity in Washington by Boeing, this affects the chain of advanced manufacturing suppliers that sprung up around Boeing. The manufacturing expertise of these companies can be redirected towards supplying parts and materials for commercial space companies. In turn, Boeing's local aerospace cluster strengthens and matures the NewSpace industry as a whole in Washington.

Software-first Microsoft then NewSpace

Similar to Boeing, Microsoft was the trailblazer that kick started the King County region as a epicenter for software. The company was founded in 1975 by Seattle natives Bill Gates and Paul Allen in Albuquerque, NM, but was moved to Bellevue, WA in 1979. It made one last transfer to Redmond, WA in 1986, where it is headquartered to this day. When Microsoft first came to Bellevue it had 30 employees and made \$3 million.¹⁰⁰ For fiscal year 2017 Microsoft made \$89.5 billion in revenue, with \$21.2 billion was in profits.¹⁰¹ Microsoft is the second largest private employer of the state and is a great contributor to the state's economy because 47,000 of Microsoft's 126,000 employees worldwide are employed in Washington.¹⁰² And through its employment multiplier effect, it creates another 6.81 jobs in for every 1 job at Microsoft, meaning another 320,070 jobs.¹⁰³

Microsoft has been a huge magnet for tech talent because of its prestige as one of the leaders in the tech industry. Many software developers flocked to Microsoft, causing the Seattle area to have a large concentration of such workers. There are numerous prominent companies in Seattle that were started by former Microsoft employees; notable examples are Expedia, Zillow, Glassdoor, and of relevance to the aerospace industry, Seattle Avionics Software.¹⁰⁴

This fertile tech ecosystem has even attracted NewSpace companies to the area. Elon Musk established his satellite communications office in Seattle because software engineers didn't want to move to California, so he came to the workforce instead.¹⁰⁵

The technology industry is the second pillar in the workforce of Washington that allows for a NewSpace industry to grow. With the merging of aerospace engineering and software engineering, the proximity of these two industries gives fertile ground for the NewSpace industry. Next, we will highlight how the software industry's rise is similar to that of the NewSpace industry, and why that model should be used by NewSpace startups.

Washington Technology Association: Model for a Private-Sector Coalition

Because the software industry became successful so suddenly in the 1980s, it is quickly becoming clear that Seattle did not have the necessary infrastructure to nurture its nascent industry.¹⁰⁶ Business leaders from the Puget Sound area began to draft up a plan to improve infrastructure and gain more business resources to push the tech industry - at that time made mostly of software development - forward.

Their solution was the creation of a non-profit trade organization that would support the development of software firms in Seattle. The coalition worked hard to develop guidelines for businesses to improve the business climate for future tech companies in the area, helping drive the local industry toward success.

The group came to be known as the Washington Technology Industry Association and became a national partner with TechAmerica. Today, they strive to include a wider array of companies into the association instead of only allowing software companies in.

Much like the software industry did in the 1980's, the NewSpace industry would do well to form a coalition. Not only would the group be a strong lobbying force to help enact policies allowing more industry growth, but it would also provide a useful forum for leaders in the industry to tackle regional issues together.

Translating Washington state's Capacity in aerospace and software into NewSpace

The tech industry's rise in the Seattle area is important to note because of the similarities it shares with the NewSpace industry. The space industry was able to get a foothold in the area because of the already present tech sector and aerospace manufacturing and design clusters; but it's also grown into something vastly different. The prominence of the aerospace industry in Washington has also allowed for natural expansion into developing more space technologies and helped push it further. Although, much like the beginning of the tech industry, it lacks a lot of the necessary infrastructure to push startups toward success, and the need for a coalition

similar to the Washington Technology Industry Association will be necessary in the future to provide a clear set of guidelines for companies to follow.

Along with innovations in the Seattle area have come better tax incentives for businesses. In order to help technology startups, acclimate to the area better, Seattle has created a great tax environment to help business thrive, something that will be very beneficial to the NewSpace industry as well.

Local Trends in NewSpace

The NewSpace industry has emerged from the drastic decline in computing costs and technological advances manufacturing – two factors that Washington state plays a chief role in. Three big tech trends in Seattle have emerged as the forerunners in the NewSpace industry: satellite imaging, big data, and machine learning. Space companies, like Spaceflight, are planning to develop and launch satellites to provide images to other industries like farming.¹⁰⁷ Other companies are also developing satellites to help push big data forward. Two important trends that have become extremely important to the NewSpace industry are reusable rockets and CubeSat's, and both have incorporated these three tech trends as well to develop further in the Seattle area. In this section, we will discuss the five important trends and how they are working together, as well as companies in the Seattle area that are utilizing them.

Reusable Rocket

In an effort to make space travel cheaper, NewSpace companies are now building and launching reusable rockets. SpaceX has been working on a reusable rocket, and now other NewSpace companies are working towards doing the same thing. The goal is to be able to launch these rockets and bring them back to Earth in order to reuse their parts, or their rockets entirely as SpaceX is trying to achieve, in the future to lower the cost of having to build a new rocket with entirely new materials.¹⁰⁸

The cost associated with the space industry have always been high, so NewSpace companies are trying to change that. SpaceX initially estimated that they would be able to lower the cost of Falcon 9 by 30 percent by making the boosters reusable.¹⁰⁹ The future of reusable rockets is bright, and it will become a vital sector within the industry in order to lower the barrier costs of entry.

Notable reusable rocket company in Seattle: Blue Origin.

Satellite Imagery

Satellite imagery has been steadily growing to become a large sector within the NewSpace industry. In 2016 small satellites increased 11 percent in annual revenue, with a total of \$127.7 billion, according to the same report.¹¹⁰

This is important to the NewSpace industry because it shows it is likely to continue to grow in the future as other industries like telecommunications and farming are coming to rely on it more and more to be successful. Space startups that are focusing on satellites can take comfort in the fact that they will have a plenty of customers.

As technology advances in the Seattle area, more and more satellite startups are moving to the area in order to gain from the other budding industries and technological trends. This translates into growth for the space industry in the area and is further positioning Washington as a leader.

The increasing number of satellite companies is also encouraging crossover with other successful tech trends, like machine learning and big data, with the latter relying more and more on satellites because of their abilities to produce large data sets.¹¹¹

Notable satellite imagery companies in Seattle: Black Sky and Spaceflight.

Cubesats

Small satellites can provide a platform for more advanced services. Unlike traditional, large, and expensive satellites, CubeSat's – referring to a class of very small satellites called Nano-Satellites – are much easier to build.¹¹² They are, in a sense, expendable satellites, capable of being built cheaply and deployed rapidly.¹¹³

With the development of existing NewSpace companies and establishment of start-up NewSpace companies in Seattle, demand of small-scale satellites (include CubeSat's) will increase. This demonstrates that having a strong and steady satellite manufacturing sector is a precondition for the establishment of a clustery NewSpace industry complex in Seattle.

Notable companies in the Seattle area using CubeSat's: Tethers Unlimited. The University of Washington also has a CubeSat research team.

Big Data

Big data has been around for many years, but recently larger companies in the Seattle area like Amazon and Microsoft have been making their own advances in the sector. Essentially, big data is the collection of information from traditional and digital sources that can be analyzed to help with things like decision making, or simply the storage of information, a practice widely used by the biotech industry in Seattle.¹¹⁴

Within big data, there is unstructured data and multi-structured data. Unstructured data is comprised mainly of text, and unorganized. It's also not easily put into traditional data models or bases - an example of this type of data would be social media posts. Multi-structured data is the kind that is used in the NewSpace Industry and can be in a variety of data formats.

Generally, this kind of data comes from interactions between machines and people, like web log data.

Notable big data companies in Seattle: Payscale, DS-IQ, and Inrix.

Machine Learning

Machine learning was “born out of computer pattern recognition” and is the process of computers learning from a set of data.¹¹⁵ Machine learning enables computers to learn from past computations and apply them to new situations to make decisions. It’s being used for things like face recognition in social media applications and fraud detection.

Both machine learning and big data can now be used together, further benefiting the space industry. When computers are presented with big data sets, they are able to analyze them and use machine learning to perform actions like assigning them certain categories.

Although these three trends are different, all of them are being utilized by the space industry, and work together to help move the industry - and others - forward. They are becoming increasingly intertwined and are being used together by various industries. For example, satellites can use imagery to produce large data sets about crop yields, and machine learning can be applied to those data sets in order to analyze them and improve farming techniques for future crops.

Notable machine learning companies in Seattle: Mynd and Scaled Recognition.

The Companies of Washington state’s NewSpace Sector

Boeing and Microsoft catapulted Washington on the map as a leading center for aviation and software, and the state may once again stand at the center of innovation in both industries. Today, Washington state is home to several pioneering NewSpace companies, and is in a ripe position to cultivate the next generation of innovators. According to Bill Virgin, a reporter for the *Seattle Business Magazine*, the local NewSpace industry has thrived from the region’s “tech-intense, opportunity-rich, and risk-intensive business cluster.”¹¹⁶ And companies like Planetary Resources, Spaceflight Industries, and Blue Origin, among others, are leveraging the state’s core strengths to spearhead advances in the commercial space industry.

The following section will highlight several local NewSpace companies and investment organizations. By profiling these enterprises, the report hopes to underline the ripe state of the commercial space industry already prospering. These companies include:

- Tethers Unlimited Inc.
- Planetary Resources
- Spaceflight Industries
- BlackSky
- Blue Origin
- Vulcan Capital
- Space Angels Network

While all of these companies are private, and are not obligated to disclose information, news reports and released documents paint a valuable picture of factors important to each company.

As such, the report addressed several aspects related to each company, including:

- Their respective sub-sector
- How the companies acquire financial and human capital
- How they utilize access to academic research facilities
- The overall cost of business

From this perspective, policymakers and other stakeholders can craft policy addressing specific issues and opportunities in NewSpace. Among the numerous companies we have selected seven to showcase the state's current abilities as well as its potential to become a hub for the industry.

Table: NewSpace Companies in Washington state:

Company	Location	Sub-Cluster	Employee No.	Gov't contracts
Tethers unlimited	Bothell, WA	In-space Manufacturing, trusses in orbit (Trusselator) and water-fueled-hydros thrusters	50	NASA, DOD
Planetary Resources	Redmond, WA	Asteroid mining, Water propellant	70	None
Spaceflight Industries	Seattle, WA	Space flight, rideshare service of launch vehicle, and satellites	200	NASA, DOD
Black Sky	Seattle, WA	Geospatial Intelligence Service, high-quality satellite imaging	11-50	NASA, DOD
Blue Origin	Kent, WA	Space flight, Launch Services and Vehicles, reusable rockets	250-500	NASA

Tethers Unlimited Inc.

Founded in 1994, Tethers Unlimited, Inc. is one of the world's earliest private commercial space company and engineers a broad array of technologies related to manufacturing and satellite components.¹¹⁷ The Bothell-headquartered company began as a research and development lab for products related to space tether technologies—devices and concepts that can play a role in removing space debris and launching payloads into high orbits, and more.¹¹⁸ This same technology is expected to revolutionize space travel, too.¹¹⁹ A space tether, which can be described as a half-mile-long woven string, may propel objects in outer space without rockets. It was first envisioned in the mind of Rob Hoyt, TUI's current CEO, when reading science fiction as a physics graduate student.¹²⁰

If such a technology were produced, the cost of space travel would drop significantly. Rocket fuel is heavy and expensive; orbiting tethers, by contrast, would be cheaper and more resilient, relying on a reticulated network of woven Kevlar cradles and cables.¹²¹ Seeing potential in Hoyt's idea, NASA jumpstarted Hoyt's idea, funding TUI in its earliest stages.¹²²

The company continues to receive contracts from NASA and other government agencies¹²³. It is estimated that annual revenues reach \$3.8 million and that the company currently has thirty employees.¹²⁴ Most recently, Tethers was awarded a NASA grant to develop prototype 3-D printers for use in space.¹²⁵

Planetary Resources

The Redmond-headquartered asteroid mining company, Planetary Resources, was founded in 2009 with the mission to "expand Earth's natural resource base."¹²⁶ In that vein, Planetary Resources has pioneered asteroid mining technologies and low-cost space telescopes, technologies expected to lead to breakthroughs in space resource extraction.¹²⁷ In a 2017 report on commercial space, Goldman Sachs wrote that the future of space mining was "more realistic than perceived," promising fortune to the companies capable of mining asteroids for valuable materials.¹²⁸ With a vision to bring the natural resources of space within humanity's sphere of influence, Planetary Resources received early funding from Alphabet's Larry Page and Microsoft's top executive, K. Ram Shriram, who similarly expects to see asteroid mining in his lifetime.¹²⁹

Planetary Resources estimates that there are two trillion tons of water and valuable minerals and metals available on asteroids.¹³⁰ "The resources of Earth pale in comparison to the wealth of the solar system," says Eric Anderson, the founder of the commercial space tourism company Space Adventures.¹³¹ Accordingly, these asteroids can be accessed and utilized for resource extraction, with the company's technology that is currently being developed. By 2030, the company is expected to launch its initial spacecraft for prospecting suitable asteroids.¹³²

Despite not mining asteroids, the asteroid mining company is a “positive cash-flow company,” according to a claim made by co-founder Peter Diamandis.¹³³ The company is currently making a profit from lucrative “contracts with NASA, some private companies, and even a few private individuals.”¹³⁴ “One of the first things we did,” Chris Lewicki, president and CEO of Planetary Resources remarked, “was to identify the road map that would get us from now until we got to the asteroids.” And essential to that plan was first and foremost, a viable company.¹³⁵ Mining asteroids “is a long-term endeavor,” says Lewicki, adding that “Despite the fact that we have the backing of wealthy funders, it's irresponsible to just throw money away. We're building a business, not performing a stunt.”¹³⁶ Planetary Resources is not alone in this perspective. A pragmatic mindset is a through line between other NewSpace startups who must simultaneously balance ambitions for distant, but huge rewards with the responsibility to generate revenue today.¹³⁷

The company currently employs an estimated seventy people and has raised close to \$50.2 million dollars from venture capitalists and individual investors.¹³⁸ The backing from Google's Executive Larry Page and a former.¹³⁹

Spaceflight Industries

Founded by local aerospace and software veterans in 2010, Spaceflight Industries plays a dominant role in the local commercial space sector.¹⁴⁰ That is because the company's business model, akin to ride-sharing platforms like Uber and Lyft, provides companies a low-cost and scalable way to send payloads into space. Spaceflight's expertise in logistics and engineering enables it to package multiple payloads—typically CubeSat's—into a single unit, and then added to a Commercial Launch Vehicle with excess space.¹⁴¹ Spaceflight's 'rideshare' service utilizes excess capacity of launch vehicles, reducing the cost of accessing space. And in doing so, the company has diminished the obstacles that have traditionally kept other space startups from engaging with space.¹⁴² To date, the company has launched 112 satellites, with an additional

4,900 kilograms of satellites contracted to launch.¹⁴³ They have served clients from more than thirty countries and have ten Commercial Launch Vehicles in their network.¹⁴⁴

The company is the recipient of the 2018 Innovation Award from the *Puget Sound Business Journal*. In the company's acceptance speech, Nick Merski, VP of Space Operations remarked that Spaceflight is “solving fundamental problems in the space industry,” by making it easier to “access space and use data from space to understand our changing world.” This has the spillover effect of enabling other “new innovators in the market to get traction and get to space,” underscoring just how fertile the region of Washington state is for NewSpace innovation.¹⁴⁵

BlackSky

BlackSky is a division of Spaceflight Industries that focuses on Geospatial Intelligence Service. The company is poised to become the leader of looking at our planet in real time, providing easy, affordable way to order and access high-quality satellite imaging to vastly improve our understanding of the world.¹⁴⁶ With 11-50 employees, Black sky currently utilizes satellites; including “Airbus’ Pléiades, SPOT6/7, KazEOSat-1, TerraSAR-X.21AT’s TripleSat, SIIS’s KOMPSAT2/3/3A/5 and UrtheCast’s Deimos-2.¹⁴⁷ In addition, the company expected to have 60 satellites in the earth orbit by 2020.¹⁴⁸

The geo-spatial imagery service from BlackSky can be adopted in military operations, humanitarian operations, maritime observation, and other areas where visual images can be utilized. Recently, BlackSky signed the two-year, \$ 16.4 million contract with the Air Force Research Laboratory to provide geospatial database platform.¹⁴⁹ Also, United Nation Institute for Training and Research (UNITAR) has announced an official partnership with BlackSky.¹⁵⁰ For example, BlackSky’s cloud-based platform was utilized in Aleppo, Syria by the United Nations (UN) to facilitate its humanitarian aid. Jodi Anderson, Vice President of Marketing and Communications at Spaceflight described the cloud platforms ability to track critical events and provide insights on particular areas makes it ideal for the UN to coordinate its humanitarian

assistance in Aleppo.¹⁵¹ In both cases, the decision makers are hoping to enhance its decision-making process with real-time images and analysis to make a swift and more informed decision.

Blue Origin

Blue Origin is another groundbreaking company that operates in the NewSpace industry. It was founded in 2000 in Kent, Washington by Amazon founder Jeff Bezos. It is a privately held capital mainly funded by its founder Jeff Bezos. The company focuses on lowering the cost of spaceflight and helping to explore the solar system efficiently. The company quickly expanded its size with over one thousand employees throughout Washington, Virginia, Texas and Florida.

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The company invasions enabling millions of people living and working space. To realize this, Blue Origin has designed a space vehicle called New Shepard that has capability of reaching suborbital space. In addition to the space vehicle, Blue Origin is developing a powerful orbital-class rocket called New Glenn. The New Shepard space vehicle added with the New Glenn orbital-class rocket are scheduled to be utilized for the Lunar Mission that is known as Blue Moon. According to the director of Business development and Strategy Brett Alexander, the Blue Moon mission will enable the company to reach the Moon cheaper and efficiently. He also pointed out Blue Moon is paired with NASA's Space Launch System that aims to deliver 5 tons of cargo to the lunar surface.¹⁵³

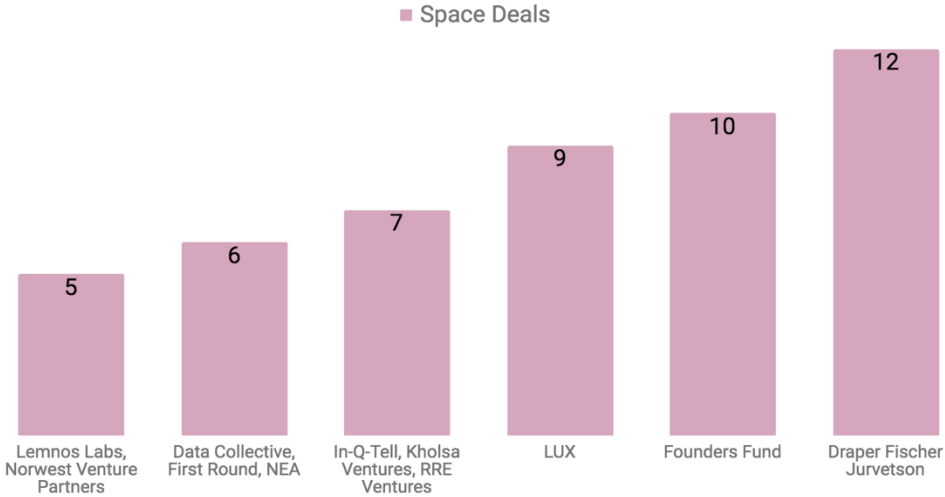
In addition to the Blue Moon, Blue Origin has successfully flown its Crew Capsule 2.0, the latest version of the vehicle that is built to first passenger flight. The Crew Capsule 2.0 craft is made to be flew with a New Shepard reusable booster, up to an altitude of over 322,000 feet.¹⁵⁴ This launch has increased the reliability of reusable New Shepard rocket with seventh successful landing. The further adaptation of reusable rocket will reduce not only the cost of spaceflight but contribute to decrease the amount of debris that are left in the space.

Blue Origin has won contracts with various governmental and nongovernmental clients to launch satellites. Recently, Blue Origin’s has signed a deal with France's Eutelsat, to utilize Blue Origin’s New Glenn rocket to launch its communication satellites by 2022. The New Glenn project will develop Blue Origin capabilities to be a leader in the competitive satellite launching business.¹⁵⁵ The company is firmly placing its presence on the commercial space industry by its innovative reusable rockets, capsules and satellite launching technology. Having its headquarter in Washington state gives the company access to the pool of talent that already exist in Washington and will play a crucial role on building an ecosystem that will attract future companies to set up shop in the state.

Venture Capital in Washington

Since 2000, VCs have participated in a growing number of NewSpace startup deals

Source: Bryce Space and Technology



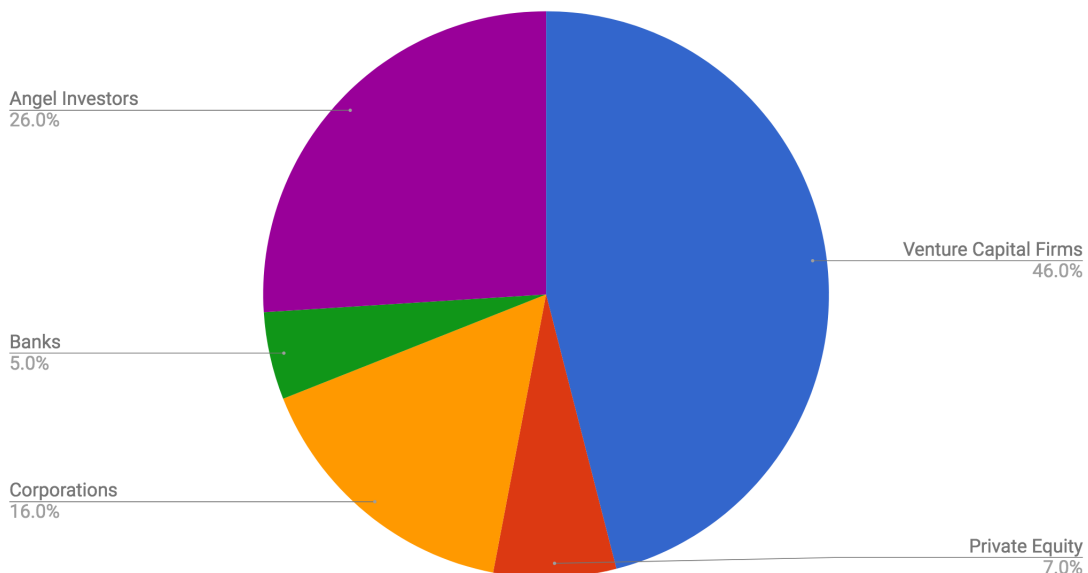
Access to capital is a central reason why Washington state stands as a prime location for a NewSpace hub. Four of the commercial space industry's largest angel investors are Seattleites: Jeff Bezos (Blue Origin), Paul Allen (Vulcan Aerospace), Bill Gates (Kymenta), and Charles Simonyi (Planetary Resource). Angel and venture capital bring opportunities to NewSpace entrepreneurs; and in Washington, where local investors are the industry’s most prominent, audacious ideas have the opportunity to become reality (See graph: Since 2000, VCs have been

participated in a growing number of NewSpace deals). In no small part, it is the enthusiasm for NewSpace among local billionaires that is propelling the industry forward.

The following will profile Space Angels and Vulcan Aerospace – two of the space industry’s leading financiers. To sustain growth in Washington's nascent NewSpace sector it is necessary to channel capital and interest from investors. Doing so brings credibility to the sector that is often seen as impractical and quixotic. VC and Angel investment is also crucial for companies to form and succeed. Vulcan and Space Angels are local, but their impact and vision extend beyond the Pacific Northwest. In fact, the NewSpace industry has received \$13.3 billion in investment since 2000; approximately two-thirds of that amount came in the past five years, according to the Bryce, an aerospace research firm (Insert investment chart).¹⁵⁶ As the market grows, it will be increasingly necessary to draw attention to our local investors and support their endeavours. There is a formidable deficit in funding that only the private sector can address (See chart: NewSpace Investors).

NewSpace Investors, Share by Type, 2000-2016

Source: Bryce Space and Technology



Space Angels Network

Space Angels Network, founded in 2007, is the NewSpace sector's leading investment firm.¹⁵⁷ They are based in New York City with offices in Seattle, Los Angeles, Zurich, and other parts of the world, backing companies on nearly every continent.¹⁵⁸ Thanks to them, Space Angels Network has played a key role in maturing the sector, financing companies when the industry was only budding.¹⁵⁹ With credibility came interest; the firm went from having 20 accredited investors in 2012 to more than 220 in 2017.¹⁶⁰ Their role in the development of a local space hub will be crucial. They are NewSpace's gatekeepers and the technologists, bringing not only credibility to the industry but also expertise and guidance.

Since their founding, Space Angels Network has backed more the 30 companies, including Planetary Resource, the Redmond, WA, company.¹⁶¹ A standard investment is relatively small for a venture capital firm, ranging from half a million to \$1 million.¹⁶² But like most VCs, they look for companies that have bold visions and practical use-cases. A common feature shared by the companies Space Angels Network backs is the capacity to leverage high-tech and a skilled team to bring products to market in the short-term.¹⁶³

Unlike other firms, Space Angels Network is uniquely focused on several sub-sectors of the NewSpace industry – the terrestrial, in-space, and the planetary.¹⁶⁴ Terrestrial includes the manufacturing of launchers and satellites, whereas in-space refers to products that are manufactured in space and made for space. Planetary is broader and visionary. It includes goods and services that bring value to other planets. These three areas, according to Space Angels Network are ripe for innovation and have innate value.¹⁶⁵

Another aspect distinguishes Space Angels from other VCs. They are vocal advocates for space funding and regulation and have coalesced a sector coalition on this issue.¹⁶⁶ In 2016, Space Angels spearheaded a coalition of 13 companies to publish a report on the US space efforts title, *Ensuring US Leadership in Space*.¹⁶⁷ This action should be seen as a vital measure to ensure that NewSpace companies are unified and heard from policymakers. In Section 4 we will

reiterate the need to align private sector stakeholders into an industry coalition. In this respect, Space Angels offer a valuable platform that brings the private sector and policymakers together to tackle the constraints the industry face.

Vulcan Aerospace

Vulcan Aerospace is an investment arm of the private equity and venture capital fund, Vulcan Capital, founded in 2003 by Paul Allen, Microsoft's co-founder.¹⁶⁸ The multibillion-dollar fund has its headquarter in Seattle's South Lake Union with another office in Palo Alto.¹⁶⁹ Vulcan Capital primarily invests in software, media and entertainment, internet services, mobile, and telecommunication companies. Its commercial space arm, Vulcan Aerospace, targets promising NewSpace companies and is the organization behind Stratolaunch.¹⁷⁰ Vulcan Capital's investments range from \$10 million to \$100 million or more, in addition to funding smaller projects.¹⁷¹

Paul Allen's interest in reducing barriers to space is auspicious. Paul Allen sees the role of Vulcan Aerospace as a vital instrument in developing a local commercial space ecosystem, writing about his personal ambition to go to space in his memoir.¹⁷² "Other enthusiasms came and went, but my obsession with rocketry endured," Allen writes. "After Apollo, NASA shifted to unmanned probes. Space lost its cachet, but it never lost my interest."¹⁷³ The company will be a reliable source of capital for the NewSpace companies the state will host in the future as it has been for the existing NewSpace companies that already call Washington state their home.

In the following section, we will bring attention to the constraints and opportunities with centering NewSpace in Washington state. These issues reflect the consequences of adding to the region's already rapid development. Given, a thriving NewSpace sector will bring long-term prosperity, innovation, and forward thinking to Washington's economy. But in the short-term,

an influx of workers and capital has the capacity to overwhelm the broader quality of life system, which makes the state appealing in the first place.

Section 3 focuses on the issues related to:

- The workforce supply gap;
- Housing affordability;
- Transportation and congestion;
- Workplace diversity and inclusion;
- Washington state spaceport

And in section 4, the report will give concrete solutions to these constraints. Addressing such issues with the report's policy recommendations will enhance the opportunities the state offer of the NewSpace industry.

3: Washington state: Constraints & Opportunities

The NewSpace sector stands as the catalyst for the next evolution of Washington’s economy. But unbridled growth comes at a cost, indeed, the sky-high rents in San Francisco is one bellwether for Seattle, a city that is similarly facing a dramatic increase in the cost of living. This section considers the likely consequences of expanding business growth in the region with respect to quality of life and inclusion and diversity. With foresight, stakeholders in academia, government, and business can ensure that the local NewSpace industry contributes to long-term, sustainable growth. Section 3 addresses the issues of:

- The relatively severe shortage of STEM-educated labor in the region;
- Rising rents up and the affordability crisis in King County;
- Traffic and transportation;
- Taxation;
- Gender and inclusion;
- Developing a local spaceport

Education and Developing Washington’s Workforce

Jobs in NewSpace are highly technical and require very skilled and educated workers. If the industry is to become intertwined with the region for sustained growth over the long-term, akin to Boeing over the last century, Washington must be able to provide companies with an adequate supply of local talent. The economic ecosystem in Silicon Valley has benefited immensely from the nexus of world-class institutions such as Stanford, Berkeley and CalTech in California, and Washington would do well to try and replicate that network.

Seattle is already one of the most well-educated metropolitan areas in the United States: 39.4 percent of the Seattle residents hold at least a Bachelor’s degree, making it the ninth most educated city in the country.¹⁷⁴ This is unsurprising, given that Seattle is considered the nation’s per-capita leader for STEM employment with leading firms in technology, aerospace, biotech, and healthcare all in the city.¹⁷⁵ Of all degrees conferred within the state of Washington, nearly one-third, 32.9 percent, are science and engineering related.¹⁷⁶ The world

famous companies with roots in the Seattle area, Boeing, Microsoft, and Amazon, are companies that recruit heavily from STEM fields.

The University of Washington, one of the principle suppliers of workers in these industries within the state, is located right in the middle of the city. It has the only aeronautics and astronautics engineering program in the northwest, a result of its collaboration with Boeing and the aerospace cluster. Additionally, companies in Washington like Microsoft and Boeing has invested in integrated workforce training programs aimed at filling workforce needs in key industries, including aerospace, communication technologies, and manufacturing to help fine tune graduates to make an immediate impact within the industry after graduation.¹⁷⁷

Despite these efforts, Washington is struggling to supply enough local talent. Experts attribute this to a lack of spots within the public universities, a severe underrepresentation of certain minority groups within the community, and a failure by elementary and high schools to provide students an introduction to the skills needed. For example, there are approximately 50,000 unfilled jobs in the tech sector alone today, yet 60 percent of high schools in the region don't have even introductory courses to computer science.¹⁷⁸ For every 1,000 engineering jobs in Washington, the state graduated only 42 people, placing it 49th out of 50 in the United States.¹⁷⁹ It's clear that curriculum below the college-level has yet to adapt to the quickly changing realities of the city and state economy. And despite women making up more than half the workforce in Seattle, they represent less than 25 percent of all STEM jobs; blacks and Hispanics hold only 1 in 5.¹⁸⁰ For these reasons, Washington is one of the biggest importers of Bachelor's Degrees in the country.¹⁸¹

Companies in Seattle have realized the importance of repairing the STEM pipeline to their continued and sustained growth in Seattle. An example of action taken to correct the educational deficiencies is the Washington state Opportunity Scholarship, a public-private partnership that provides funding to women and students of color from low and middle-income family seeking degrees in STEM disciplines. More than 60 percent of recipients are female, and

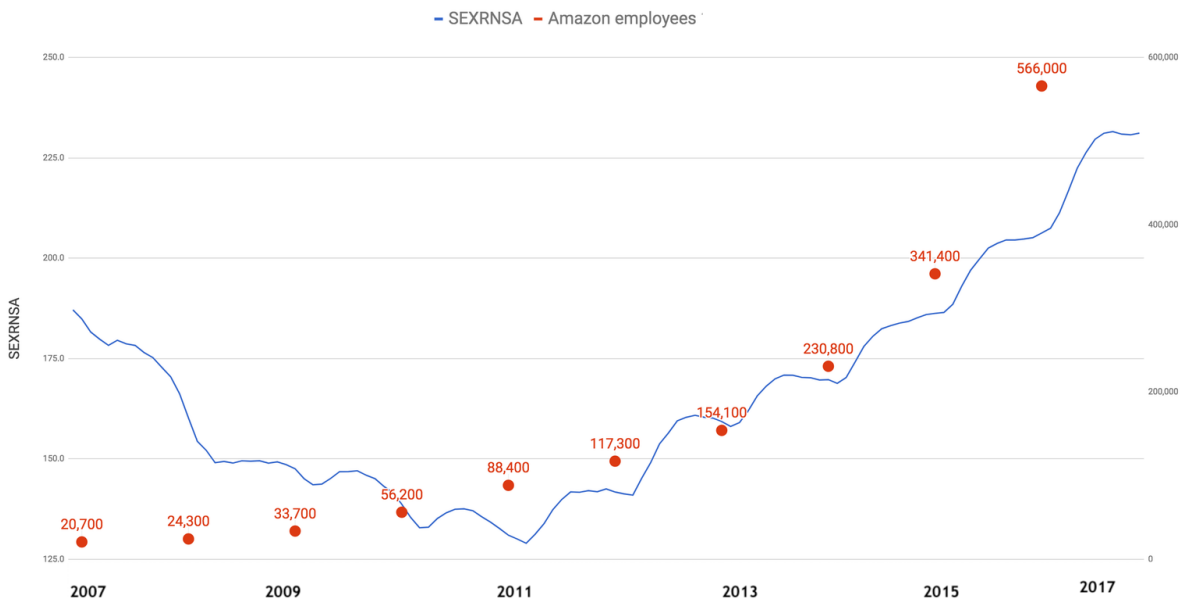
52 percent are students of color.¹⁸² These coalitions between businesses and the state will be crucial to address educational shortcomings in the region. A similar one focused on NewSpace and related fields should be a goal for the commercial space sector to strive for.

Housing Prices and Unaffordability

In the vigorous competition for talent within the commercial space industry the skyrocketing cost of living in Seattle (and some surrounding regions) will prove to be one of the primary obstacles holding the city back from attracting top tier talent over the long term. Seattle is the hottest housing market in the United States, with prices rising 16.2 percent year over year (YoY) for single family homes to an average value of \$718,000 in December of 2017 (See: Chart: Seattle Home Price Index).¹⁸³ This price surge is almost double that of next hottest market in the country, Portland, and nearly three times the national average.¹⁸⁴

Seattle Home Price Index (SEXRNSA) and Amazon Employee growth, 2007-2017

Source: S&P Dow Jones Indices LLC, FRED, Amazon



Additionally, Seattle’s rental market has experienced a notable surge, rising 5.2 percent YoY to a median monthly rent of \$2,203 a month.¹⁸⁵ An election poll released in June 2017 by

SurveyUSA on Seattle mayoral candidates showed that 76 percent of Seattle adults say that there is “too little” affordable housing in the city,¹⁸⁶ and over the last half-decade home prices have grown four times faster than pay in King County.¹⁸⁷ These high prices have created a housing “gridlock,” in which would-be sellers are reluctant to put their house on the market out of fear that they won’t be able to buy another affordable home.

The rapidly rising prices are the result of an increasing demand surpassing what is a very limited supply. Seattle is currently the fastest growing big city in the country, adding on average 57 people a day and increasing the overall population by 3.1 percent in 2016.¹⁸⁸ With big tech companies like Microsoft, Amazon, and Expedia owning big campuses in and around Seattle, many people are moving from other parts of the countries to take up jobs here. No state sends more people to the Seattle area than California, more than three times more than the next state¹⁸⁹, with a large portion of these people moving from their tech jobs in and around Silicon Valley to work here. According to Redfin, nearly 20 percent of Bay Area residents looking for homes outside of California are looking to Seattle.¹⁹⁰ Seattle homes, despite appreciating at a breakneck pace, are still valued at less than the average \$1.29m home in San Francisco.¹⁹¹ This represents an opportunity for Seattle to continue to tap into the pool of skilled workers and attract them to come work here, given that tech salaries in San Francisco and Seattle are equitable, if it’s able to keep its housing prices lower.

With a population growing so quickly the demand for housing shows no signs of subsiding, especially given the supplies of homes in Seattle. Seattle has the third smallest inventory of homes in the nation, behind Oakland and San Francisco. According to Redfin, an online residential real estate company, Seattle has experienced a 35 percent decrease in inventory YoY while the number of customers making offers rose 36.5 percent.¹⁹² About two-thirds of homes for sale in the region spark bidding wars.¹⁹³

However, it is not simply the rising population of tech workers seeking a home that is the cause of this quickly diminishing supply of inventory. Another supply-related issue is the lack of

condominiums, an affordable alternative to single-family homes, in Seattle and the preference for developers to build apartments to rent out instead.¹⁹⁴ Over the past two decades King County has averaged about 2,000 condominiums on the market at peak selling time, but in 2017 that number was just 350, “a record low.”¹⁹⁵ Apartments are more surefire investments than condos, mainly due to the state laws that make it very easy for lawsuits to be brought against developers even long after construction is finished on condos.¹⁹⁶ These laws, designed initially to protect consumers, are now acting as an added cost that deters developers from adding buyable, rather than rentable, homes to the inventory. A reform of these laws to better protect developers would almost surely increase the number of condominiums being built.

Additionally, Seattle, like many of the largest metropolitan areas around the world, have seen large swathes of property bought up by investors, both domestic and foreign. Real Estate Investment Trusts (REITs), hedge funds, and equity funds on Wall Street have been buying up scores of apartment buildings and starter homes in Seattle and renting them out to residents at continuously increasing rents. REITs now own around 8.2 percent of all inventory in the city, the eighth highest ownership of multifamily housing developments in the nation. Investors outside of the United States are also taking advantage of a similar strategy, buying up apartment complexes and homes to turn their cash into physical assets and profit off the appreciating values and rent prices.

In 2015, it is estimated that \$1.1b was invested in Seattle real-estate from just China alone.¹⁹⁷ One needs only to look at Vancouver to see the result of allowing foreign investors to buy up too much property. In 2006, only 19 percent of single-family homes were valued at over \$1,000,000. Ten years and billions of dollars later in foreign real estate investment and 91 percent of homes meet that valuation. Many of these houses sit empty with no tenants, while thousands of Vancouver natives are being pushed out of the city.¹⁹⁸ If Seattle is to slow down rising rents, something must be done to give preference to local citizens who actually plan on living in these properties. There exists today no database that can be used to track who buys what properties, which makes it very difficult to implement any policies or oversight in this

regard. A database such as this would allow policymakers and brokers alike to better assess the nature of real-estate investment.

When NewSpace Arrives: Addressing the Affordability Crisis

The city of Seattle is undertaking a few measures to combat these rising prices – measures that are necessary to keep the region a compelling place for NewSpace entrepreneurs reside in.

There is no consensus on how best to tackle housing affordability, but the shortage of available homes is the most apparent catalyst for these increasing rates. As a result, downtown is in the middle of a historic construction boom, with the number of active building projects doubling in the last five years. There are currently 9,000 residential units under construction with another 18,000 planned for the future. However, most of these are luxury towers and charge about 40 percent higher rents than the buildings already built.

This increase in supply has slowed down rents downtown somewhat, but these luxury towers are unlikely to be the answer to this problem at a regional level.¹⁹⁹ The City Council has also introduced a new policy called Mandatory Housing Affordability (MHA) to provide more low-income housing. Along with zoning changes to several neighborhoods in the city, the MHA requires any developers building within the specified zones to either include a certain amount of income-restricted housing or pay fees that goes into the development of affordable housing.²⁰⁰ Companies in NewSpace can also help increase the supply of affordable housing by following a strategy similar to that of investors from the tech industry in the nonprofit fund established by Forterra. This fund, which offers annual returns of around 2 percent to investors, aims to secure affordable housing in Seattle’s Central District. This strategy offers NewSpace companies an opportunity to not only improving the region in which they work, but also make a tidy return on top of it.²⁰¹

Nearby cities such as Bellevue and Redmond on the Eastside, who already house several NewSpace firms, are currently working to increase housing supply for all income levels.

Bellevue, currently in a rapid housing development phase, will be especially important in the

effort to keep up supply. The city is planning to add 15,800 additional housing units by 2035, 50 percent of which will be in the downtown area.²⁰² Via organizations such as A Regional Coalition for Housing (ARCH), an intergovernmental agency working to increase supply of moderate to low-income households, King County Eastside cities are displaying efforts to try adding lower-income housing.²⁰³

It remains to be seen whether the addition of more affordable housing will help slow down price appreciation, but the amount of planned development in Seattle and surrounding regions indicates that developers have not been scared off by the added costs. Rezoning will also play a big part in the future of Seattle's housing crisis. Given the space restrictions downtown, it is imperative that more areas of the city are built up and height limits are increased to accommodate the growing population. Additionally, the city must emphasize the importance of maintaining the city's culture, to prevent this growth from pushing out the lower-income and long-time residents. If Seattle is to be a draw for NewSpace workers, it must enact measures to stifle price appreciation and supply shortage. This growth will affect not only housing, but transportation and congestion as well.

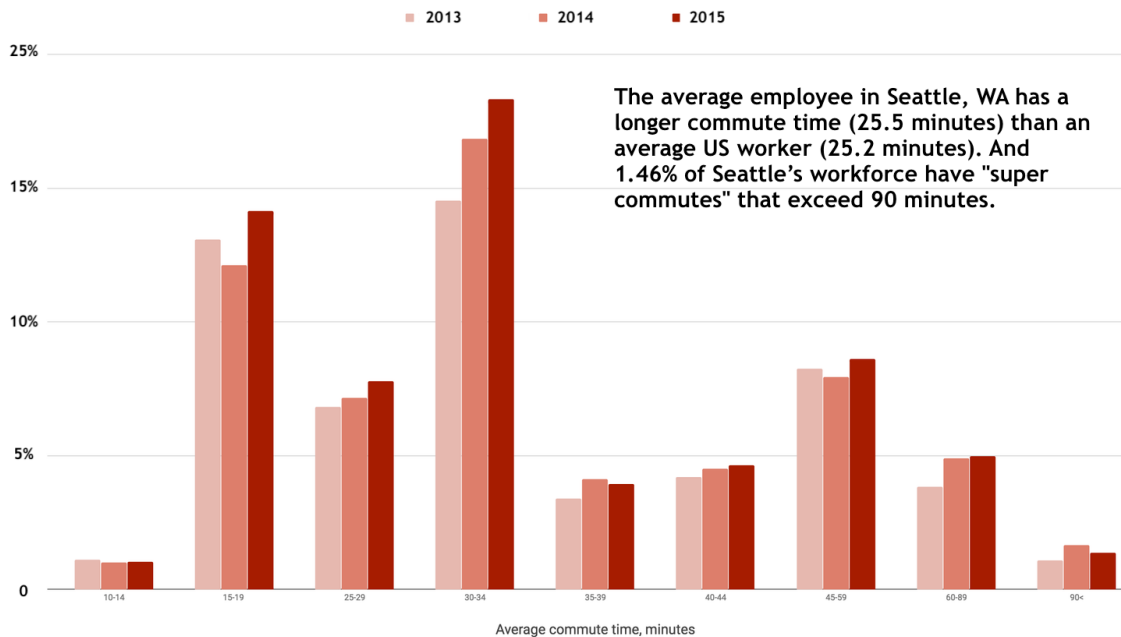
Traffic Congestion

Seattle has been experienced historic population growth in recent years. Nearly 21,000 people moved into Seattle in 2015-2016.²⁰⁴ The rapid population growth is a cause for another key issue; traffic congestion. One common conclusion is that Seattle ranks as one of the top five worst cities for overall congestion throughout the U.S; not only that, Seattle ranks as the 20th worst city for traffic worldwide. It is estimated that Seattle drivers average nearly 55 hours of delay in 2017.²⁰⁵ In addition, drivers spend an average of 58 hours every year to find a parking space, which is more than triple for nation average, according to the report from INRIX.²⁰⁶

An abrupt increase of population is the main issue. As tech giants like Amazon are expanding and migrating to Seattle, inflow of new residents causes traffic congestion issues, with more people simply driving to and from work. At an extreme, workforce commuting over 90 minutes are 1.46 percent in Seattle, according to 2015 ACS from Census Bureau (See: Chart: Commute

Times of Average Seattle Worker).²⁰⁷

Commute Times of the Average Seattle Worker
Source: Census Bureau



Moreover, the metro-region's design consisted of urban and suburban sprawl, exacerbates the congestion issue. The vast majority of people often use private vehicles to move from suburban to urban areas. This can be simply for the convenience, but at the same time the US city design is developed along with highway system.

Along with the city design, the public transportation is insufficient to meet the demands of the growing metropolis and periphery suburbs. The problems with public transportation in the metro region forces people to commute by car, often the most reliable and convenient option. And with the growing popularity of app-based ride services, such as Uber and Lyft, people do not own a private vehicle still contribute to traffic congestion. Overall, the traffic congestion is not the problem itself; instead, the result of failure on providing mobility options.

The simplest way to resolve the current traffic congestion issue is that provide the environment that allows people not to rely on the use of private vehicle. Because it is impossible to change the city design all at once, there should to be logical way to either incentivize the alternative

mobility options, or disincentivize current problem-making mobility option, the use of private vehicle. One of possible disincentive for the use of private vehicle is charging peak-hour tolls. By setting high enough toll fee, this disincentive induces people to seek for alternative option. However, this option can cause more congested conditions on regular lanes, and not popular among Americans. According to the study, people perceive paying a toll as another type of tax and may feel advantage for wealthier people.²⁰⁸

Unlike other successful cases in countries that experience the traffic congestion only in crowded downtown, Seattle experience the issue all over Puget Sound area and King County. Also, the current tolls system on SR 520 bridge and certain part of I-405 does not alleviate the traffic congestion, instead brings same issue in alternative route, such as I-90.

Seattle has developed its own solutions. The most notable of which is the Link Light Rail, a public transportation system that currently connects north and south King County by a single light rail line. The current bus system does not play an adequate role in supplying alternative mobility options, due to factors such as infrequent scheduling and limited coverage. To address these shortcomings, the Link Rail system introduced in 2013 with two separate rails; Central Link, located in Seattle metropolitan area, and Tacoma Link, located in Tacoma downtown. In addition to the initial line, Central Link connected from Sea-Tac Airport up north to University of Washington in 2016. The second phase plan of Sound Transit includes extension of Central Link to north, south and east. The North Link will extend from University of Washington, further north to Northgate, and the Everett station.²⁰⁹ The entire plan of Sound Transit 2 is expected to be completed by 2030. In addition, voters agreed on Sound Transit 3 in 2016 for an expansion of the link system over Ballard and West Seattle on the west, and Issaquah on the east. ST3 is projected to grow by an additional 62 miles in the next 25 years.

The ambitious proposal of building rail system is the government's main suggested solution toward traffic congestion. However, there are many concerns the arise due to its fast-paced expansion. One study shows that the Sound Transit's cost for first phase exceed the 1996 initial

plan by 86 percent.²¹⁰ In addition to bulging costs, the latest Sound Transit 3 program estimates additional \$54 billion dollars for further expansion. Also, Sound Transit recently ordered 152 more railcars for \$ 685 million to expand its capacity²¹¹ As the result of large spending on rail system, more tax will be levied on voters and residents. Sound Transit states that the local taxes (car tab, property, sales tax, and rental car sales) makes up over half of total funding.²¹² As a political matter, Republicans in Olympia are arguing for reductions in the Sound Transit car-tab taxes.²¹³

In addition to financial concern, there are some concern of its effectiveness to solve the current congestion problem. Anthony Downs introduced Triple Convergence theory to show skepticism of rail system as a solution. In theory, if some numbers of commuter freed up space on the road by choosing public transportation, the reduced traffic will attract other drivers. Eventually, the removal of commuter from the road will be replace by others because of convergence effect. He then argues that link rail system would not resolve the congestion issue. In fact, doubled expansion on Portland light rail system in 1990s and new light rail system opened in Dallas did not have enough reducing effect as a solution.²¹⁴

Taxation in Washington state: A Competitive Advantage

State tax incentives matter when the businesses and corporation decide their location. A well-guided state tax system can enhance the competitiveness of business environment and generate economic growth. At the same time, overambitious tax incentives and subsidies could result in unpleasant outcomes in state revenue and economy. Washington state, as the home of Boeing, Amazon, Microsoft, and Blue Origin, has successfully adopted tax incentives programs that are favorable for businesses and more competitive than other states. The recent migration of tech companies from Silicon Valley proves that Seattle is a more attractive business environment for tech companies.

In this section, 1) we will examine Washington state tax programs that lure corporations, including ones in the NewSpace industry, and 2) compare and examine the efforts of other

states to attract space companies.

Washington state is ranked 17th place in the 2018 State Business Tax Climates, according to Tax Foundation.²¹⁵ Considering that California, well known for startups and tech companies, was 48th, Washington has had competitive tax incentive programs in general, and has the potential to successfully attract NewSpace companies. We will examine three state tax elements that are favorable for business; income tax, research & development tax preference (R&D tax), and business & occupation tax (B&O tax).

Income Tax

Washington state does not have a personal or corporate income tax. Although there is a debate of whether no income tax causes an economic growth or not, research from the American Legislative Exchange Council shows that states with no income tax outperforms states with the highest income tax.²¹⁶ No income tax alone can bring the economic growth, however the research on taxes and economic growth points out the corporate taxation is one of the most harmful taxation for economic growth.²¹⁷ Washington state currently collects revenue from corporations under the form of taxation called “Business and Occupation” tax, which we will discuss later on.

In addition to corporate income tax, personal income tax is also crucial, because companies seek better living conditions for their employees. No-income states like Washington often decide to fill the revenue gap by boosting economic growth and expanding the population. In fact, net domestic migration in the term of 2005-2014 was increased by 4.4 percent in Washington state.²¹⁸ It is uncertain whether migrants will work in tech fields, more specifically in the space industry. However, Washington state Department of Commerce’s report shows that there were 93,800 workers in the Aerospace industry alone in the year of 2015. Through the great advantage of no income tax, Washington state is standing ahead to attract people and business to move.

Research and Development (R&D) Tax incentives

Washington state recently passed the renewing bill (HB 1894) that provides tax preferences for tech research and development. The recent bill was extended after 1994 legislation that expired January 1, 2015. The legislation (under RCW 82.04.4452 & 82.63.020(3)) created a program of providing B&O tax credits for qualified R&D industry, and a Sales and Use tax deferral program for tech R&D and manufacturing facilities.²¹⁹ B&O tax credit is available to eligible companies that R&D expenditure exceed 0.92 percent of the taxable income. The cap of B&O tax credit was up to 2 million per year. According to the State DOR, companies claimed total of 44 million in the term of 2012-2013.²²⁰

The second part of the legislation is Sales and Use Tax deferral for the investment project in construction or machinery and equipment, including labor and services. The state department of revenue conducted the analysis study of this tax preference program in 2013. Even with aftermath of economic recession in 2008-2009, Washington state successfully raised the tech industry. The R&D investment increased by 1.58 percent in 2012, and 15 companies moved into Washington in the same year.²²¹

A new extending bill (HB 1894) was supported by top-ranking House lawmakers from both parties and passed with some revisions. The tax credit limit for both B&O tax credit changed to \$750,000.²²² Also, the eligibility on Sales and Use tax deferral was expanded. One of the noticeable revisions is the explicit statement of “spacecraft-related” activities in the context.

B&O tax preference for aerospace industry

The Business and Occupation (B&O) tax is one of the major business taxes in Washington state. B&O tax is a gross receipts tax, which is measured by business’ gross income. The B&O tax rate varies depending on the activities and may have more than one rate that can be applied.²²³ Current B&O tax rates in Washington are “0.471 percent for retailing; 0.484 percent for manufacturing, wholesaling, and extracting; and 1.5 percent for services and activities not classified elsewhere”.²²⁴

HB 2226, adopted in 2016, has three tax incentives: a preferential B&O tax rate specifically for aerospace industry, Sales and Use tax exemptions to spacecraft manufacturer, and B&O tax credit for property taxes used for manufacturing commercial airplanes and components. First, the B&O tax rate for the manufacturing of commercial airplane reduces down to 0.2904 percent and 0.9 percent for aerospace product development.²²⁵ This rate is almost half of the regular B&O tax rate; 0.484 percent for manufacturing and 1.5 percent for services and activities not classified. The second incentive is Sales and Use tax exemption for hardware and software, used in development of aerospace products, and for the construction of airplane manufacturing facilities. Lastly, B&O tax credit for property taxes and leasehold excise easements over property for manufacturing commercial airplanes.

The substitute bill specifically uses the word of “spacecraft” and “space exploration” for all of these tax incentive elements. The term of “commercial airplane” in the original bill did include spacecraft in an extended term. This change, though not substantial, demonstrates an encouraging recognition of the space industry as separate from the aerospace industry.

Other State’s tax preference programs

Virginia

Virginia was one of the space race starters in passing the bill at the state level to encourage the space transportation industry. Zero Gravity, Zero Tax act with the same name was introduced at the federal level in 2003 and failed to pass, because it lacked support and inclusions of tax credits. The Virginia bill provides state income tax exemption over either launching, or resupply services launched from Virginia air.

Florida

Similar to Virginia’s attempt to grant tax exemptions, Florida introduced the Qualified Spaceflight Contractor tax refund Act, granting tax refunds to spaceflight contractors when they reach the agreement of job creation and wage increase. Participants would receive a credit of \$3,000 per job created, or \$6,000 to business in rural or enterprise zone. There is also an

additional \$1,000 per job bonus if it pays 150 percent of the average private sector wage, or \$2,000 per job bonus when the job pays 200 percent.²²⁶

The limit of tax refunds may be claimed up to \$2.5 million per fiscal year, which is higher than the limit of Washington state's B&O tax credit for R&D industry. The advantage of the program is that it can be claimed through different tax elements depending on its project activities. It includes corporate income, sales, intangible personal property, and certain other taxes. Another tax incentive program is "Sales tax exemption for machinery and equipment used in semiconductor, defense, or space technology production". The term "space technology production" included not just space launch vehicles, but satellites, research payloads, and associated control systems and processing system.²²⁷ There is a 25 percent sales tax exemption on machinery and equipment for the space technology industry, and 100 percent tax exemption for rockets, satellites, and payloads.²²⁸

Currently, the QSC program merged with the defense area and became the Qualified Defense & Space Contractor Tax Refund. The legislation expired on July 2014 and has not been reinstated since. According to the analysis of QDSC in 2015 from the Office of Economic & Demographic Research, the report concluded that there is no direct relationship between the tax incentive program and economic growth. Also, it claims that it is difficult to determine the outcome of the QDSC program on job creation because it is not solely on the tax incentive itself.²²⁹ During the review period of 2013-15, only six projects were granted tax credits through the QDSC program and two of the projects also received funds from the Sales Tax exemption.²³⁰

Also, important to note in Washington state are the technological trends present that have translated to the NewSpace industry. Both provide a great climate for the NewSpace industry to thrive in the area.

Not only are taxes an important aspect to businesses, so too are people. In the section below, we will discuss ways to attract more workers to NewSpace companies.

Paid Leave in NewSpace and Washington state

Employees are NewSpace companies' biggest asset. They are the company's intellectual property and the key to the future.²³¹ In the competition to attract a diverse base of engineering and business talent, it is vital for NewSpace companies to support their employees ranging in gender, age, race, and experience. Offering paid-family leave is a principal means to invest in a company's workforce.²³² The following details the central role that paid-family leave can play in attracting talent, fostering greater gender equity in the workforce, and also improve a company's bottom line.²³³

Paid-family leave refers to a government or company policy that allows mothers and fathers time off from work for the purpose of caring for a newborn or for a health-related emergency. Critically, the time that the employee takes off is compensated for, often with the payment amount a percentage of a worker's annual wage. The United States is the only OECD nation without a national paid-leave policy; only 13 percent of U.S. workers have access to paid leave from their employer.²³⁴ While the Family and Medical Leave Act of 1993 (FMLA) attempted to benefit American families by guaranteeing a federal right to twelve weeks of job-protected leave, it falls short on many levels.²³⁵

Principally, FMLA does not make the promise of pay a right for workers; while a mother may have access to time off for a pregnancy, she does not have the concomitant benefit of receiving pay for this away from work, for instance. And when there is pay, it is often insufficient for a prolonged period.²³⁶ As a result, 40 percent of workers who take time off claim to have returned to work prematurely due to the issue of not receiving pay.²³⁷ Worse, 46 percent of workers who needed time off said that they could not afford to do so, according to the Department of Labor.²³⁸ In turn, American workers are often forced back into their jobs too soon, with their child receiving insufficient care. Or more commonly, mothers leave the workforce entirely to become their child's primary caregiver.²³⁹ These trends have a pernicious effect on the economy and family health, and gender parity.

Without access to paid family leave, workers are more vulnerable to economic hardship and poor health outcomes.²⁴⁰ The fact that one in four women return to the workforce just two-weeks after giving birth attests to the unnecessary burden placed on mothers and fathers to return to work.²⁴¹ Such pressure results in inadequate time to recover and bond with one's child, which has shown to contribute to worse health outcomes for newborns. An additional ten-weeks of time off, as several studies have shown, has reduced, on average, post-neonatal mortality by 4.5 percent.²⁴²

Moreover, paid family leave mitigates against economic instability, benefiting young, entrepreneur-types employed at startups. Data from the Bureau of Labor suggests that 60 percent of Americans without fully paid leave have difficulty making ends meet.²⁴³ This group tends to draw on their savings, postpone bill payments, and choose to end federally mandated leave sooner than twelve weeks. For employees at a startup, which are often not able to provide adequate benefits (but provides employees company equity instead), workers must choose between their company or the prospect of raising a child. For workers employed at startups, not having access to paid leave is likely the primary obstacle to having a child.²⁴⁴

In turn, the lack of paid family leave has made the tech workforce more gender unequal. More often than not, women, who bear the brunt of childrearing, exit the workforce when they choose to have a child.²⁴⁵ Despite the fact that women are the primary or co-earners in 60 percent of American households, their share of the workforce has been declining largely due to America's lack of paid family leave.²⁴⁶

By contrast, women with access to paid leave are more likely to work after childbirth and more than half are likely to report a wage increase within a year, according to studies done by the Center for Women and Work at Rutgers University.²⁴⁷ Critics of paid family leave claim that such policy will deter employers from hiring women, since the likelihood that women will disproportionately use paid leave, at a greater cost to the company.²⁴⁸ What this claim overlooks, however, is that when paid leave is gender-neutral, the use of leave is equalized. In

the case of California's expansion of paid family leave, the rate at which fathers used family leave increased by 400 percent. Such increase is expected when time off is paid for.²⁴⁹

Paid leave not only improves women's workforce participation and father's involvement in family caretaking, but can also play a role in providing necessary benefits to lesbian, gay, bisexual, or transgender (LGBT) families.²⁵⁰ It is calculated that 3 million of LGBT families have kids, and in Washington state where 4.1 percent of the population identifies as LGBT, 29 percent of LGBT individuals have families.²⁵¹ Paid family leave can provide a vital service to LGBT families in Washington and increase diversity within the NewSpace industry.

Paid Leave in Washington state

In 2020, Washington state is set to become one of five states to require paid family leave among private employers.²⁵² This law will benefit NewSpace companies in attracting and retaining talent. Washington state's paid leave policy is considered the country's most generous, covering pay for up to 12 weeks.²⁵³ It is progressive too, guaranteeing that low-wage workers receive 90 percent of their weekly income and higher earners roughly 60 percent.²⁵⁴ While small companies employing less than 50 people are exempted from the tax (a benefit for NewSpace startups), employees are still covered by the state law; companies that provide employees equal or better benefits can opt-out.²⁵⁵

Among tech employers, there is an arms race among companies to provide generous family and health benefits.²⁵⁶ This is a competition that advantages larger, and publicly traded technology firms with easy access to capital. As a result, NewSpace startups will be forced to compete with the robust benefit packages offered by the like of Netflix (whole year paid time off), or Amazon.²⁵⁷ The Washington law, however, will equalize the playing field, and bolster the benefits that startups provide to their employees. The law requires that both employers and employees pay into the system; with employers paying roughly 63 percent and employees paying 37 percent.²⁵⁸

As a result of Washington's new law, mothers and fathers of all companies will have access to a generous leave plan. NewSpace startups located in Washington, in particular, will be able to market this policy favorably to potential employees.²⁵⁹ Indeed, access to paid family leave signals to current and future employees that it values its employees and is committed to retaining a diverse workforce. And we recommend that this policy is expanded upon for companies with the means to offer a more comprehensive paid leave package.

Diversity in the NewSpace Industry

Growth in Washington's NewSpace sector can bring trade-offs. A growing tech sector creates winners and losers, and as the experience of Silicon Valley underscores, a flourishing hub can also bring trenchant social issues to the fore.

In the following, we attempt to highlight some of the social consequences of what may come as a result of growth in the NewSpace sector. These issues are twofold:

- NewSpace industry's racial and gender imbalance;
- And how institutional structures, what this report terms 'Silicon Valley culture', have impacts on diversity in the local NewSpace industry.

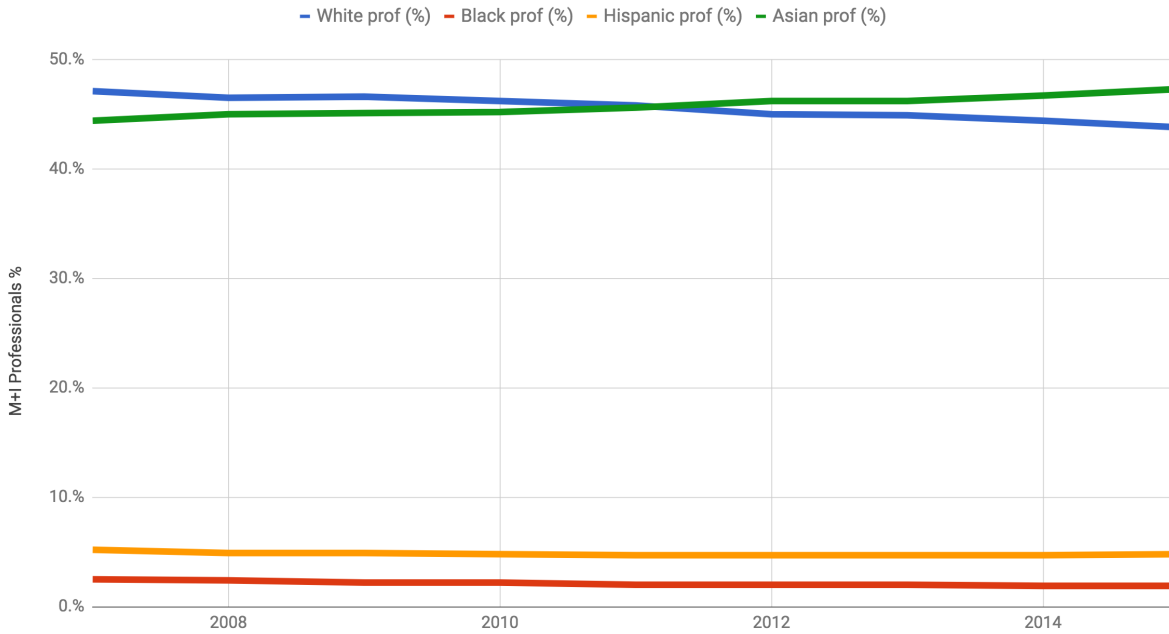
By unpacking some of these workplace-equity issues can then serve as a guide for attracting, retaining talent for Washington's commercial space industry. To realize this potential, we use Silicon Valley as a lesson in how ignoring the issue of race can have devastating consequences—in both the market place for employees and in innovation. It is a stated goal to establish a local NewSpace industry that is both innovative and socially inclusive.

Race and diversity in NewSpace

The growth of America's tech sector has produced a severe diversity gap—the tech industry workforce lacks representation of minority races and women and is dominated by white men and Asians. A 2014 study reveals that Silicon Valley companies on average have a male-female

imbalance of 4:1, and whites and Asians together makeup 91 percent of the workforce. By contrast, blacks represent just 2 percent of the workforce while Hispanics makeup 3 percent.²⁶⁰ Because of this imbalance, discrimination becomes deep-rooted, with the tech industry becoming even more so if left unchecked (See Chart: Professional Representation by Race).

Professional Representation by Race: 2007–2015 Bay Area Manufacturing and Information (M+I) Sectors
Source: EEOC

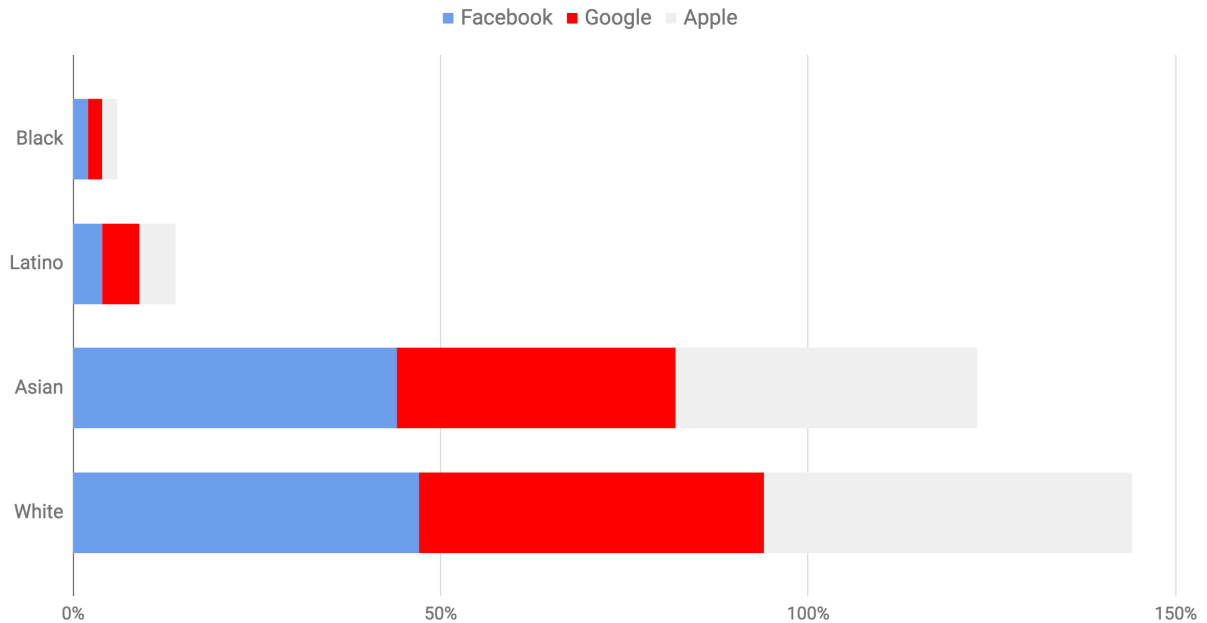


The diversity gap in Silicon Valley presents an opportunity for NewSpace hiring practices in Washington state. Given, Silicon Valley is often regarded as the technology hub of the tech industry, but data suggest that the region struggles to make significant progress on inclusion and is perhaps getting worse.²⁶¹ Despite efforts to hire more blacks, Latinos, and women, especially in technical and leadership positions, Silicon Valley remains dominated by white and Asian men.²⁶² Diversity at the most significant tech companies is scornful (See Graph: Silicon Valley Employees by Race). The diversity gap in many Silicon Valley’s largest tech companies, such as Google and Facebook, suggests that Washington state can position itself as an industry that stands for inclusion, a compelling factor in attracting and retaining qualified talent. By understanding why there is an absence of diversity in the Valley’s labor force, private-sector

stakeholders in the NewSpace industry can better strategize ways to generate inclusion and diversity.²⁶³

Silicon Valley Employees by Race, percentage professionals: 2016

Source: Reveal research



Thus, it is important for Washington's NewSpace companies to invest in diversity. The goal here is to highlight the vast, underutilized potential of people of color in tech, and how this will become vital for the success of the regional NewSpace sector. If diversity is overlooked, the consequences can reach beyond the experience of individual employees. Research shows that a homogenous workforce, particularly in high innovation industries, could hurt organizations products and ventures, stemming from limited perspectives in the decision and innovation process.²⁶⁴ Therefore, this section argues that by mobilizing different insights, from various groups across the nation, will ultimately contribute to Washington's NewSpace sector in producing the competitive edge it needs from inception: a diverse, inclusive tech workforce.

Diversity makes business sense

A workforce composed of different genders and races is vital to business success. Regarding organizations adaptability, competitiveness in a fast-changing global market environment, a employee base that is more diverse is more successful in each category, according to an

integral study from the *Harvard Business Review*.²⁶⁵ Different backgrounds act as a form of cross-pollination for ideas and business strategies; even more, the inclusion of people from different backgrounds and races brings new problems for businesses to tackle.²⁶⁶ Diverse enterprises tend to be the most innovative, the Harvard study finds, indicating that freshness of revenue mix increases as measures of diversity increases (See Graph: Companies with Above-Average Diversity Also Have Higher Innovation Revenues). The report concludes that all dimensions of diversity “had statistically significant correlations with innovation,” with industry, the nation of origin, and gender having most significant impacts.

Companies with Above-Average Diversity Also Have Higher Innovation Revenues



NOTE N=1,606, R²=0.257 (SIGNIFICANT AT P=0.001 LEVEL); *TOTAL DIVERSITY INDEX IS THE AVERAGE OF THE BLAU INDICES FOR SIX DIMENSIONS OF DIVERSITY: MIGRATION, INDUSTRY, CAREER PATH, GENDER, EDUCATION, AND AGE.
SOURCE BCG ANALYSIS OF MORE THAN 1,600 COMPANIES ACROSS EIGHT COUNTRIES © HBR.ORG

Recently, tech companies in Silicon Valley have understood the importance of having a diverse labor force and its net benefits to their products.²⁶⁷ For example, Google executives claim that diversity initiatives on their behalf had little to do with being politically correct; instead, evidence suggested that by increasing diversity in Google's workforce, their bottom line had positive net results.²⁶⁸ Following this point, Facebook's CEO Mark Zuckerberg was

asked on his stance as to why diversity mattered. Zuckerberg explains, “Because it's good for society, and its beneficial for companies from a commercial perspective too” and is the only way he believes serves communities best.²⁶⁹ Diversity and inclusion is not only a socially responsible step, but it is also a good business move that ultimately affects companies bottom line.²⁷⁰ Indeed, Facebook has developed a comprehensive diversity training plan, which includes ways to address ‘unconscious bias’ in recruiter training. These programs increase access and opportunities to underrepresented minorities students interested in software engineering, and would be an important policy for local NewSpace companies to follow in order to diversify their workforce.²⁷¹

The actions of Google and Facebook, among others, is important to Washington's NewSpace sector, because it emphasizes the point that diverse, inclusive workforce contributes to a business’s success. This understanding should serve as a fundamental blueprint for NewSpace start-ups and sets the foundation for successfully hiring, retaining important tech workers of color, who perhaps, otherwise would have been overlooked.

To that end, this evidence attempted to highlight that cultivating diversity in the workplace is not merely a matter of reaching quotas based on gender or race; rather it’s a concept that seeks to capitalize on the abundance of insightful perspectives that are without question necessary conditions for innovative, revolutionary ideas.²⁷² Furthermore, if Washington's NewSpace sector can capitalize on diversity lessons learned from D.C and the Silicon Valley, it then could serve as an efficient model for building on existing frameworks locally that's conducive to the NewSpace sectors objectives in respects to attracting, retaining talent from inception.

Where is Washington Positioned?

Although Washington’s tech industry is booming, there’s still some work to be done in the diversity department. For instance, demographic data from the largest tech employers in the region—Microsoft and Amazon—reveal that Microsoft is 79 percent male while Amazon is

roughly 75 percent male, respectively.²⁷³ In addition, neither companies are have a significant number of women in executive positions, nor in the boardrooms; the local tech hub is principally white and Asian men—a reality that NewSpace can change.²⁷⁴ And although Seattle is not flawlessly diverse, there are many signs of progression.

Currently, improvement in regard to diversity and inclusion is what places Washington in a unique position. Compared to other tech-hubs that have attracted and retained tech-workers of color, such Washington D.C. For instance, the University of Washington and Microsoft have teamed up to develop programs that are specifically designed to further diversify the computer science and engineering field.²⁷⁵ When Microsoft CEO, Satya Nadella, was asked about why he thought promoting diversity, especially for women in the tech industry, to be of importance, Nadella said: “One of the things we learned about recruiting is you really need to understand your population, and, once they get here, you need to create an environment that is supportive for them.”²⁷⁶ NewSpace should take this lesson in order to grow as a sustainable and innovative industry in Washington.

By following Microsoft’s footsteps, Washington’s NewSpace industry will have the potential to attract, retain, and materialize the benefits of having a diverse and qualified workforce. In turn, this reinforces the local NewSpace sector’s competitive advantage: an industry that is both innovative, socially inclusive, and competitive.²⁷⁷

Washington state spaceport

It is evident that Washington state has a number of local constraints limiting the growth of the NewSpace sector. These constraints include some of the drawbacks in its economic and social infrastructure. In addition to these shortcomings, the state and the Pacific Northwest region still lacks the availability of a commercial space port. With the rise of the global commercial space industry, cities around the United States are constructing space ports for companies to assist in launching spacecrafts and satellites into orbit.

Currently, states like Texas, Florida, and California have developed spaceports specifically for major companies like Blue Origin, SpaceX, and Stratolaunch. That infrastructure allows for the launching and testing of their spacecraft technologies. Alaska, too, in Kodiak Island, has a launching facility for low orbit launches and small lifts into polar orbit.²⁷⁸ The development of spaceports overall has given cities and states an economic advantage.²⁷⁹ Because of Washington's existing advantage in this industry, having an accessible spaceport may give opportunities for the industry and local businesses in the state to advance.

Back in 1999, Washington state's Moses Lake was one of the finalists for the development of a spaceport for the Lockheed Martin's Venture Star Project. It was proposed as an ideal location because of the Grant County International Airport having one of the largest airfields and runways in the nation with a runway as long as 13,500 feet by 200 feet.²⁸⁰ Moses Lake was and still is considered to have excellent weather conditions for launching and has easy accessibility to major cities like Seattle and Spokane.²⁸¹

Recently, Moses Lake has grown into a prime location in Eastern Washington for aerospace, technology, and manufacturing with companies such as Boeing, BMW Carbon Fiber manufacturing, Mitsubishi Aircraft Corp., and Microsoft all being present there. The city is currently aiming to develop as a premiere data center location considering the industries and environment that already exists.²⁸² The presence of Japanese aerospace in the city too can also encourage future collaboration with local NewSpace companies if the industry considers growing here. Ultimately, there is an economic and industrial advantage that the city provides that can help drive the economy through not only the opportunities of establishing an official spaceport but also through the promotion of expanding space companies to other parts in Washington state as well.

Although the absence of a Washington state spaceport is not negatively impacting the growth of its commercial space industry today, it may be important to consider the implications of how

to maintain progression of private space in the long run. In fact, spaceports are considered to be a platform for innovation.²⁸³ If Washington state already has an existing supply of commercial space companies, workers, and innovation, a spaceport may be the next step. Thus, a practical suggestion is to propose a development of an official inland spaceport. There is no doubt that there will be heightened competition throughout the nation for organization of spaceports, however Washington state's existing advantage in the commercial space industry and accessibility to already established companies can help towards the possibility for Moses Lake.

The location of Washington state does not support the ideal launching conditions in comparison to other spaceports in southern United States because of its higher latitude from the equator. Realistically, launching spacecraft from a location near the equator is preferred because of the extra boost in speed it gives to successfully stay in orbit.²⁸⁴ There are also certain requirements from the FAA that state that a launching location must be within a coastal range, if the spacecraft is an expendable launch vehicle (ELV) or releases parts during the launching process.²⁸⁵ These regulations and expectations limit the opportunities for launching large rockets and other spacecraft into equatorial orbit. However, the Alaska Aerospace program in Kodiak Island, Alaska serves as an example of what Washington state can aim towards in terms of launching. Their spaceport supports the launching of satellites and suborbital rockets into the polar orbit, which travels around the planet.²⁸⁶

Although Washington state will not be capable to launch large spacecrafts made by Blue Origin or SpaceX, a local spaceport can provide smaller Washington commercial space companies to test and launch their satellites and spacecrafts. Additionally, as innovation of commercial spacecraft progresses throughout the years, more technology such like Paul Allen's Stratolaunch that takes off from a runway, rather than a vertical launch system, may be compatible to a possible location like Moses Lake.

There are definitely existing advantages in Moses Lake by establishing a spaceport that would not only benefit the growth of the commercial space industry in Washington state, but also assist the prosperity of the city as well. With Seattle becoming denser in population and causing rises in prices and congestion, proposing a spaceport in Central Washington and promoting the companies to branch out to other cities in the state may help the control of the long-term issue in Western Washington. Ultimately, if Washington state wants to remain a leader in the commercial space industry, it is essential for local businesses and policymakers to consider opportunities in advancement of space-use infrastructure in the long-run.

Although all of these constraints are possible factors in limiting the growth of the Newspace industry in Washington state, they all offer opportunities for economic and social growth at the local level. This chapter highlighted the weaknesses in the state's economic and social infrastructure and emphasized the potential for growth to adapt Seattle and the state into a developed space hub. The last section will provide a framework for Washington state to strategically establish an ecosystem that would strengthen the position of the Newspace industry in the community.

4: Conclusion and Policy Recommendations

In Washington state, the NewSpace industry represents a leap in pushing the boundaries of local aerospace and high-tech industries. With Boeing and its accompanying cluster of local suppliers, the state has shown expertise in designing and manufacturing commercial aircrafts and satellites. Washington has also evolved into one of the foremost technology hubs in the world, sprouting homegrown talent such as Microsoft and Amazon; but also attracting the likes of Google, Facebook, and a network of new startups.²⁸⁷ Venture capital, vital for the germination and sprouting of future NewSpace startups is increasingly abundant, too. While there is a shortage in early-stage financing, local investors have evolved with the demands of entrepreneurs with vision, and a business plan: Seattle now ranks 10th in the share of global venture capital investment and with an aggregate \$873 million invested in local startups.²⁸⁸

The State's local residents have another vital ingredient necessary for NewSpace: the originality of vision. This is witnessed in the classrooms of the University of Washington and at startup incubators, like Commotion, and among the many new residents who find common ground in the pursuit of transformative innovation. The recent development of Moses Lake, the once sleepy town in Eastern Washington, into a world-class launching station, is another example of how NewSpace and Washington state have the capacity to coevolve.

But despite these attributes, Washington does not have an organized strategy to cultivate its strengths and address likely challenges. Our report highlights seven core issues that need to be addressed:

- Shortage of labor
- Transportation and congestion
- Housing affordability
- Workplace racial diversity and wage gap
- Gender diversity
- Insufficient supply of early-stage venture capital

- Haphazard approach to commercial space laws and regulation

Some of these problems are specific to the NewSpace industry; others are broader constraints that the region is likely to experience if policies are left unchanged. If the region is to position itself as a destination for NewSpace, policymakers and business leaders must confront the issues of a region already suffering from an unprecedented growth and a sector that is unified. This report concentrates on these issues, proposing eight recommendations respective leaders can use as guidelines for policy. Our recommendations include:

- **NewSpace Education:** Partnerships between NewSpace companies and local colleges/universities and increased STEM mentorships in K-12 schools.
- **Traffic and Congestion:** Intelligent transportation
- **Housing Affordability:** Rezoning and private-sector affordable housing funds
- **Workplace Diversity:** Hiring and salary transparency
- **Paid Family Leave:** Supporting and expanding upon Washington's paid-leave law
- **Startup Funding Gap:** The formation of a private-public seed fund
- **Inadequate political and regulatory understanding of NewSpace:** The organization of a NewSpace coalition
- **Launching in Washington:** Development of a local small-scale spaceport

In the following, the section provides a deeper look into our recommendations. They are intended as guidelines for securing Washington state's future as a prosperous and equitable destination for the NewSpace industry.

Recommendation #1: Education for a NewSpace Future

Just as Boeing became a tradition spanning generations for many families in Washington, the NewSpace could become the same. However, Washington state is the largest importer of technology talent in proportion to its population in the US.²⁸⁹ The current education pipeline is unable to supply enough engineering graduates to keep up with the fast rising demands of local tech companies.²⁹⁰ With the NewSpace industry, which pulls from this pool of talent, starting to

take off, it is unsustainable to continue to draw talent from other cities while the state does not make more efforts to engage in workforce development.

There are two main areas to be addressed. One is at the higher education level: there is insufficient focus within engineering curriculums on astronautics; and as a result, a broader lack of quality of graduates in the pipeline for NewSpace companies.²⁹¹ With the booming software industry, UW has been expanding its CSE department. But the present lack of astronautic courses and intrigue prevents many qualified graduates from entering the local NewSpace sector.²⁹² Aside from UW's Aerospace and Astronautics departments there are a few aerospace technical or apprenticeships programs in Washington, but based on future projections even with these programs, there are still a shortage of talent being produced.²⁹³

The other area is at the early, K-12 stage where there is trouble garnering interest among kids towards STEM and many kids are not up to standards in STEM basics. Washington still has a way to go to help its children meet standards for math and science, and this is especially true when it comes to low-income households. In 2014-15 about half of kindergartners met the math standard, while only 31 percent of low-income children met the standard.²⁹⁴ In high school, only 40 percent of students graduate with competency in STEM topics.²⁹⁵ About 28% of SAT test takers indicated that they are interested in pursuing a STEM major in university.²⁹⁶ In this case, in order for Washington state to contribute to the forming ecosystem of the NewSpace industry, encouragement towards STEM programs starting from younger ages can strengthen the long-term workforce development in this field. To facilitate these changes, recommended actions include:

- Partnerships between NewSpace companies, and university and technical colleges officials to better gear the curriculum towards the industry's needs
- Increase capacity for university engineering departments
- Expand STEM mentorship programs to more K-12 schools

- Business professionals give career advice to interested middle and high school kids
- For elementary kids create more fun experiences such as museum activities to garner interest in STEM

Recommendation #2: Intelligent Transportation System

Washington's metropolitan region consistently ranks as one of the worst U.S. cities with regards to traffic congestion.²⁹⁷ The growth of the metro region, in population and business, means that more people are commuting – in cars and on outdated infrastructure. The region's growth is expected to continue to grow, so as Washington positions itself as a destination for NewSpace companies, it must tackle the problem of traffic. There is a severe social and economic cost if commutes are unbearable.

Traffic congestion is a problem and currently the local government is working together with Sound Transit to further develop the Link Rail system within the region. The expansion of off-road and separate rail system will be a suitable alternative mobility option for commuters. However, Down's Triple Convergence theory explains that less crowded road or better traffic attract more drivers. In theory, replacing of certain number of commuter to Link Rail will eventually attract other drivers from another road, time, or mobility option to the road.²⁹⁸ In addition to the current Link Rail plan, there should be other projects planned to ease the traffic congestion.

There are two components that we should consider: Capacity and Control. To increase the capacity, we simply need to build more roads. Although it opposes the Triple Convergence Theory, the main cause of Seattle traffic congestion is rapid population growth. Building more lanes on highway would not solve the congestion issue, but at least it has direct effect to increase road capacity. Alternatively, the state can create more High Occupancy Vehicle (HOV) lanes. According to ACS from the Census Bureau, the most common form of transportation is 'driving alone', which nearly half of all Washingtonians did in 2015.²⁹⁹ HOV lanes not only allows

vehicles with high occupancy to travel fast, but also promote commuters to carpool, or share the vehicle.

To increase the Control, we need a real-time data update on pedestrian and car traffic flow. Vehicle-to-infrastructure (V2I) technology allows to send and receive information between vehicle and infrastructure. The collected traffic data, based on V2I technology will help to develop the Intelligent Transportation System (ITS), which monitors and control the traffic flow. Developed ITS will allow us to respond traffic-blocking car accidents and incidents and adopt dynamic speed limits and automated traffic signals. To attract NewSpace startups and create a favorable ecosystem, it is essential for improvements in local infrastructure such as traffic management. The following actions are suggestions to help reduce the rising traffic congestion in Seattle:

- Build more roads in fast growing areas.
- Create more HOV lanes
- Create Intelligent Transportation System to effectively monitor and control the Real-Time traffic flow
- Respond to car accidents and incidents more rapidly
- Use dynamic speed limits and automated traffic signals

Recommendation #3: Housing Affordability

The region is suffering from growing pains, the most notorious of which is the housing affordability crisis. Just in the past year, housing prices grew by 15.7 percent, to a median home value of \$700,000.³⁰⁰ Without appropriate action with regards to the cost of living, the metropolitan region could easily be facing an exodus of skilled workers and a crisis of city culture. Today, this trend is seen in San Francisco as a result of the city's failure to put on a cap on soaring prices.³⁰¹

While housing supply must rise, it must not come at the expense of Seattle’s culture nor should it overlook the already problematic rate of congestion. It is imperative that a higher portion of the houses put on the market in the future are for sale rather than for rent, so that owners, Washington’s perspective NewSpace entrepreneurs, can maintain more control over rents. Additionally, the zoning actions already pursued by the city must be continued, and encouragement from the private sector will be imperative as a new administration moves in. As the NewSpace industry continues to grow in Washington state, it is important to consider the measures in maintaining a sustainable ecosystem to favor the community. If the growth in housing prices is to be slowed, it will require cohesive action from relevant actors in both the private and public sector. Such actions should include:

- Reform condominium development laws, either by adding additional protections to developers or by shortening the period after construction in which a tenant can sue them.
- Encourage the city of Seattle to continue rezoning more portions of the city, allowing for higher buildings and more rent-restricted zones. This will simultaneously increase supply while helping to maintain the culture of the city.
- Create an accessible database of homeowners, especially from out of state, allowing experts to better understand the reality of REITs and foreign investors in Seattle
- Encourage NewSpace companies to establish funds for creation of affordable housing

Recommendation #4: Diversity in NewSpace

What this report has revealed is that a diverse labor force can contribute to a business’ overall success; and that ensuring diversity in Washington’s NewSpace industry will require a substantial commitment. It's also important to keep in mind that real change cannot merely happen overnight.

However, by addressing some common reasons that have attributed to tech workers of color being underrepresented in the tech industry, such as discriminatory hiring practices or pipeline issues, for example, is better suited to be addressed from inception in the NewSpace sector.³⁰² With proactive measures—greater hiring and salary transparency— Washington’s NewSpace industry can stand as a pillar of social inclusion and innovation in the broader tech and engineering industries nationwide. The overarching goal here is that by shedding light on these sensitive areas yields a more sustainable development framework in Washington state. Our intent is to produce a blueprint transparency policy for local NewSpace startups that other companies and industries can model. The goal is to generate greater equality with regards to race in the least forceful manner. Our proposals follow:

- Local NewSpace companies should pledge to release reports on employee salaries and hiring data. This would encourage companies to assess potential imbalances in the workforce and, in turn, may contribute to greater parity.
- Organization should approach recruiting talent nationally. Organizations should seek out potential employees of color from historically black colleges, community colleges, and universities, including Hispanic serving institutions.
- Organization should be required to incorporate ‘unconscious bias’ training for recruiters, aimed towards commitments to hiring from different talent pools.
- Organizations plans should be based on a robust assessment—such as a cultural audit—of firms, and the results should be translated into tangible targets, including percentages of employees, a measure of workplace satisfaction, and inclusion, that can be evaluated over time to identify progress and push continuous improvement.

Recommendation #5: Expanding Paid Leave in NewSpace

Local NewSpace enterprises should incorporate paid leave benefits beyond the requirements of Washington state law. Such policy would stand as an effective strategy to compete against other technology companies to attract and retain a diverse talent pool, specifically in retaining qualified women in the workforce.³⁰³ Paid leave policies commensurate with the local

technology sector will position the NewSpace industry as a long-term, and constructive industry in Washington state.

Local companies such as Microsoft, Amazon, and Zillow are models for paid leave programs. All three companies have made it an explicit goal to attract and retain talent, and increase workforce productivity through generous paid leave programs.³⁰⁴ For instance, in 2015, Microsoft redesigned its paid parental leave program for U.S. employees, making the policy gender-neutral and increasing mothers' time off from 12 to 20 weeks.³⁰⁵ Accordingly, 95 percent of qualifying employees have used this benefit, says Fred Thiele, Microsoft's General Manager for global business.³⁰⁶ Acknowledging the success of Microsoft's paid-leave program, Mr. Thiele told the *Seattle Times* that "We wanted to really communicate the equal nature of the parenting responsibilities." "We've heard that's had a positive effect on the work environment."³⁰⁷

Further, Zillow's experience also underscores the role paid leave programs can aid NewSpace startups in attracting and retaining qualified employees. A smaller, and relatively new company that is headquartered in Seattle, Zillow offers employees 16 weeks of paid leave to both mothers and fathers. Dan Spaulding, the company's chief people officer has said that most fathers have taken leave, and that the program has played a role in funneling women to leadership positions (from 26 to 37 percent year-over-year).³⁰⁸ And when Google increased its paid maternity leave to 18 months in 2007, attrition of new mothers declined by 50 percent.³⁰⁹ This also had the benefit of reducing workforce expansive turnover, and retain the value of mothers employees in the workforce.

Their experiences suggest that paid leave programs are a key factor in keeping women in the workforce and reduce costly re-staffing.³¹⁰ And yet, most startups don't offer paid leave programs.³¹¹ In one notable survey by a Bay Area startup, 61 percent of women reported that they "wouldn't work for a startup or tech company that didn't have a maternity policy."³¹² This is a major gap that Washington's NewSpace sector can fill. Paid-leave benefits have been

essential for generating greater gender inclusion in the tech workforce, and NewSpace companies can stand as a source of diversity and inclusion for business sake.

Given, early-stage NewSpace startups have resource constraints that larger companies are not faced with. Washington state's mandatory leave policy, however, can supplement the limited resources that startups do have. For local businesses, the Washington state law will cost between two and three dollars per week for each employee – a reasonably low cost for a paid 12-week benefit. The law also requires that the program be funded by both employer and employee, reducing the financial burden for smaller startup to fund paid-leave. The low cost, and simple mechanics of Washington's paid-leave program suggests that local startups will be able to offer a compelling benefit program for its workforce. It is a reasonable expectation that Washington state will appeal to startups because of its paid-leave benefit.

Recommendation #6: Private-Public Seed Fund

Washington state has a funding gap.³¹³ Early-stage startups are underfunded, with local venture capital firms wary to invest in early-stage NewSpace startups – and for good reason. Investing in startups is risky; investing in a NewSpace startup is considered even riskier, considering that many of the promises of commercial space – asteroid mining or on-demand meteor showers, for instance – seem like intangible prospects. “Space tends to take a long time for things to come to fruition,” says Simon Halpern, founder and CEO of Phase Four the small satellite company.³¹⁴ A typical venture capital timeline, Halpern continues, “sometimes doesn't line up with being a space company.” But key trends, like big data, cubesats, reusable rockets, and more, are rapidly evolving into marketable goods and services.³¹⁵

Currently, Washington state lacks a strong presence of venture capitalists focused on investing in space startups.³¹⁶ It receives roughly 2 percent of all venture capital dollars in the country.³¹⁷ And it is estimated that of all the VCs investing in space companies, 74 percent of them are located in California, with New York and Maryland as the runner-up.³¹⁸ While it is common for companies to receive investments from VCs out-of-state, a lack of local early-stage investors

limits the growth of a local NewSpace hub and encourages entrepreneurs to go where the capital is: Silicon Valley.³¹⁹ This has the result of hindering would-be entrepreneurs from pursuing their business ideas in Washington, limiting the overall growth of local NewSpace innovation. But by focusing on seed-funding, Washington could become an incubator for the industry, supplying capital necessary for early-stage companies to form.

Venture capital is vital to expanding the commercialization of space. And in Washington state, where many of the ingredients necessary for growth in this sector are abundant, venture capital, specifically in the seed-stage is in short supply. We suggest that the state would benefit from the formation of a local private-public seed fund. With this initiative, Washington would play a key role in enabling entrepreneurs to necessary risks and intensify innovation in NewSpace sub-sectors.

Translating ideas into a startup is costly: they require human capital, equipment, office space, and other basic necessities. That's where seed-funding has traditionally played a role. Seed funding is the capital a startup initially receives from investors, with amounts typically ranging \$500,000 to \$1 million.³²⁰ The objective is to get the startup off the ground, enabling companies that may have a viable business plan an opportunity to develop it.³²¹ Nearly all startups have begun with seed funding; an alternative, "bootstrapping," is rare since it requires the founders to fund the company themselves. The capital-intensive nature of many NewSpace companies makes bootstrapping highly improbable.

We recommend that Washington state partner with local private-sector actors to develop a seed-fund, or 'Accelerator', for local NewSpace startups. We propose that local aerospace and software companies, like Boeing, Amazon, and Microsoft, partner with this fund, providing capital and expertise to young entrepreneurs. The advantage of combining both public and private partners in the fund is severalfold. To begin with, the private-sector – which could include industry-individuals with experience in the industry and private-investment groups – would have the knowledge and expertise necessary to make a judgment on a startup's

prospects. The private-sector, too, brings credibility to this venture, which can motivate other institutional investors and corporations to support the NewSpace sector.³²²

Whether it's the state or local government, the inclusion of the public sector would signal that Washington is committed to the sector's growth and has a coherent strategy implemented, much like the United Arab Emirates.³²³ The public side should also be seen as a potential customer and resource for technical and regulatory expertise. Local governments can provide startups with data, technology, and personnel from relevant agencies. They would also be able to advise startups on issues regarding licensing and other regulatory matters. As an investor, the government would be more proximate to the industry and in the position to utilize services from potential startups.

Recommendation #7: Private-Sector Coalition

For the NewSpace industry to be successful, there needs to be stronger cooperation between private companies, similar to the Washington Technology Industry Association. This group would be able to push for better regulations within the industry and put better business infrastructure in place in order to provide better structure for small startups to follow. It would also be best if larger NewSpace startups, like Blue Origin, took the lead and form an executive board to counsel smaller businesses.

The Washington Technology Industry Association was able to help create an extremely fertile ecosystem for software development, and ultimately, the tech industry as a whole to flourish. If an association for the NewSpace industry was created, a similar outcome could occur. While the NewSpace industry is often referred to as a race, it will benefit more from business-to-business cooperation.

Washington is in a great position to be the NewSpace hub and creating a private-sector coalition would solidify that position even more. Other cities do not have a program that we are suggesting and linking NewSpace companies together as a political force is an appealing

proposition to current and prospective entrepreneurs. Seattle has been known for innovation, and a collaborative NewSpace association would help aid that process and move the industry farther along.

The association should also have a lobbying group within it to help push for better regulations that will allow the industry to expand and make international cooperation (read: international workers) easier. Blue Origin has already formed a lobbying office in D.C. in order to try and update antiquated regulations for commercial rocket launching.³²⁴ This is helping the NewSpace industry as a whole, and if there was an industry coalition fighting for better regulations, they would be more cognizant of the demands of NewSpace startups.

Since the industry already has a lot of crossover between companies and subsectors, an association would help incubate that process and foster good relations between small startups. The different trends within the industry are naturally interconnected so all that is necessary is a board to better look over those relationships and provide an outline of what that cooperation should look like.

Recommendation #8: Washington state Spaceport

Private NewSpace companies and local governments in Washington state should consider options for developing a spaceport that can advance opportunities for the local NewSpace industry and the economy. The city of Moses Lake already offers an advantage with a large runway, favorable weather, and access to major interstate roads.³²⁵ Their current support in fostering the growth of aerospace, manufacturing, and technology also can benefit the position of the space industry's success in central Washington with opportunities for recruiting local skilled labor forces.³²⁶ By aiming for a development in a small-scale spaceport to launch satellites or suborbital rockets into polar orbit, or even recent innovations similar to Paul Allen's Stratolaunch, there can be predictable acceleration in the local private space industry. Other states around the nation are already considering the options for a commercial spaceport and weighing its economic benefits to gain an advantage to the emerging industry.³²⁷ In this case,

the vision of creating an official Washington spaceport in a large NewSpace community with existing talented workers can shape the perspective of the overall global commercial space industry with Washington taking the lead.

Additionally, encouraging the decentralization of startups from Western Washington to Central Washington's Moses Lake may ease the pressures of rising costs of living and heavy congestion that exists in cities such as Seattle. Business leaders and local governments should come together to discuss and measure the opportunities of a local spaceport. Such actions include:

- Position Grant County International Airport in Moses Lake as a small-scale commercial spaceport
- Encourage development of start-ups in Moses Lake with accessibility to a spaceport

Conclusion

Washington's ecosystem brings opportunity and expertise to the NewSpace industry. While the commercial space industry began with billionaire-funded rocket companies like SpaceX and Blue Origin, it is now expanding into new subsectors; the NewSpace is as much about sending rockets to space as it is leveraging big data and designing pioneering materials, and more.

Washington state's companies and university students are at the leading-edge in such fields, increasingly venturing into the area of commercial space. The state hosts a workforce leading in areas of data science, telecommunications, software development, and robotics. Our region's taxes also encourage risk-taking and business growth. The report shows that the commercial space sector could benefit from locating in an area with a deeply-rooted space and software industry.

If the possibility to evolve human knowledge was the promise of space exploration in the 20th century; today, NewSpace ventures offers entrepreneurs and investors, dreamers and engineers, to launch their ideas into a global marketplace. As such, Washington state holds a competitive advantage in attracting and empowering the next generation of Space startups.

Advisor and Author Biographies



Saadia M. Pekkanen [Advisor]

*Saadia M. Pekkanen works on outer space security, law, and policy. Her regional expertise is in the international relations of Japan/Asia. She earned Master's degrees from Columbia University and Yale Law School, and a doctorate from Harvard University in political science. She holds the Job and Gertrud Tamaki Professorship at the University of Washington. She has published a half-dozen books on space technology and geopolitics, and is working now on *The Age of Newspace*. She serves as Co-Chair of the U.S. Japan Space Forum, and directs both the Space Security Initiative (SSI) and the project on *Emerging Frontiers in Newspace*. She is a contributor for *Forbes* on the space industry.*



Euihyun Bae [Coordinator]

Euihyun Bae is double majoring in International Studies, with a focus of Security, Peace, and Diplomacy, and Political Science. He is interested in international relations and humanitarian assistance in both domestic and international level. Euihyun has worked as an intern at Consulate General of ROK in Seattle and Political Campaign for Congresswoman Pramila Jayapal. He chose this task force, because he found an interest to closely look at commercial space industry in Washington as an example of policy making progress going along with fast-paced technology development.



Erisa Steckler [Coordinator]

Erisa Steckler is majoring in International Studies at the Jackson School under the Japan track and is also minoring in Japanese. Her interests revolve around Japan's global position and its relations with the U.S. She is particularly interested in the role foreign policy and international relations play a part in the shaping of their societies. Erisa chose this task force to familiarize herself in the advancements of the space industry and to also gain knowledge about the importance of Seattle's role in the growth of the commercial space industry.



Nick Steele [Co-Editor]

Nick Steele is majoring in International Studies at Jackson School, with a focus of China Track. He has worked as an intern for US Senator Patty Murray, and the King County Bar Association, as well as C2FO, a software startup in Seattle. His interest is in learning about the evolving business strategies regarding space. He chose this task force to explore new use-cases for commercial space startups. He also wanted to be an advocate for Washington state regarding an industry that we can excel in.



Kendra Stricklin [Co-Editor]

Kendra Stricklin is a JSIS International Studies major with a focus in Security, Peace, and Diplomacy and is also minoring in English. She is interested in the regulation of technology and cybersecurity and also how they will affect international relations in the future. She was the social media director for the Student Philanthropy Education Program for the 2016-2017 school year, a public relations intern for a retirement firm - Leading Retirement Solutions - in downtown Seattle. She chose this task force because she has always been fascinated with space, and is interested in where the industry is moving.



Shirshore Arte

Shirshore Arte is an JSIS International Studies major under Security, Peace, and Diplomacy track. He is interested in sustainable economic and urban development. Shirshore was enlisted in the United States Army for seven years as a mechanic. He served several tours overseas, including a combat tour to Afghanistan. When he chose this task force, he wanted to learn the process by which data is collected and analyzed. He also wants to advocate for a space industry in Seattle that is both socially equitable and competitive.



Eliko Hagen

Eliko Hagen is a double major in both International Studies, under the Japan track, and Japanese Linguistics. She is interested in international relations and helping facilitate connections between peoples. When she chose this task force, the image she had of space and the space industry was one that focused on the romance of space travel. She realized that space products are in fact already a big part of everyone's lives and how they'll become more important. She hopes to gain a better understanding of the industry itself while getting some experience doing policy proposals and data collection and analysis.



Yuchen Jiang

Yuchen Jiang is double majoring in International Studies and Philosophy. For JSIS, he is particularly studying under the international politics and economy track. He is interested in international relations from a cultural and historical perspective which is overlapped in his interests in Philosophy. He wants to further pursue his career in the direction of philosophy, where he regards interdisciplinary and intercultural studies as crucial means to form a comprehensive philosophical viewpoint. Thus, he is always enthusiastic to study and understand something novel and unprecedented.



Sertseluel D Kebede

Sertseluel Kebede is majoring in International Studies and minoring in Political Science. His specific track for JSIS is foreign policy. He is interested in researching and data analyzing the topics on the cybersecurity of developing nations, economic development and nationalism. Sertseluel has worked as an intern at Microsoft data center for a year familiarizing himself with data analytics and data storage. He finds interest on the space industry as it acts as the new frontier in research and innovation.



Jack McGivern

Jack McGivern is double majoring International Studies, under Security, Peace, and Diplomacy, and Political Science. His interest is in humans' future interactions with technology in society, and its integration into daily life. Jack chose this task force because it has to do with future technologies that has the possibility to affect dramatically the way we live. He believes the space industry to be an especially appealing topic, because it is futuristic technology.

Works Cited

- (2004), "Two in Five Low-Wage Working Parents Receive No Paid Leave," Urban Institute. Accessed February 14, 2018, <http://www.urban.org/publications/900701.html>.
- (2009, October 21), "Washington Technology Industry Association." History Link. Accessed January 22, 2018, <http://www.historylink.org/File/9190>.
- (2010), "Microsoft Has 'Ripple' Effect on Washington state Economy," Microsoft.com. Accessed February 14, 2018, <https://news.microsoft.com/2010/04/09/microsoft-has-ripple-effect-on-washington-state-economy/>.
- (2013, June 1), "Stuck to the ground by red-tape," The Economist. Accessed February 1, 2018, <https://www.economist.com/news/technology-quarterly/21578517-space-technology-dozens-firms-want-commercialise-space-various-ways>.
- (2015, May 26), "Silicon Valley Exodus is Real, Even Techies Can't Afford the Bay Area Anymore," CBS BayArea. Accessed February 14, 2018, <http://sanfrancisco.cbslocal.com/2015/05/26/silicon-valley-exodus-is-real-even-techie-cant-afford-the-bay-area-anymore/>.
- (2015, September 4), "The Cost of Doing Nothing: The Price We All Pay without Paid Leave Policies to Support America's 21st Century Working Families," U.S. Department of Labor. Accessed February 18, 2018, <https://www.dol.gov/featured/paidleave/cost-of-doing-nothing-summary.pdf>.
- (2015), "Children Benefit When Parents Have Access to Paid Leave," National Partnership for Women & Families. Accessed February 18, 2018, <http://www.nationalpartnership.org/research-library/work-family/paid-leave/children-benefit-when-parents.pdf>.
- (2015), "Economic Basics King County: Largest Employers in King County," Economic Development Council. Accessed February 17, 2018, <http://www.edc-seaking.org/service/economic-data/economic-basics>.
- (2015), "Paid Leave Works in California, New Jersey and Rhode Island," National Partnership for Women & Families. Accessed February 16, 2018, <http://www.nationalpartnership.org/research-library/work-family/paid-leave/paid-leave-works-in-california-new-jersey-and-rhode-island.pdf>.
- (2016, April 28), "BlackSky Inks Partnership with United Nations to Enhance Global Decision-Making", BlackSky. Accessed February 26 2018, <https://www.blacksky.com/2016/04/28/blacksky-inks-partnership-with-united-nations-to-enhance-global-decision-making/>.
- (2016, August 16), "Brave New World's - Space exploration," The Economist. Accessed February 1, 2018, <https://www.economist.com/news/leaders/21705825-new-discoveries-intelligent-devices-and-irrepressible-dreamers-are-once-again-making-space>.
- (2016, January 10), "STEM Education Report Card," Washington state Achievement Council. Accessed February 18, 2018, <http://www.wsac.wa.gov/sites/default/files/2016.01.10.STEM.report.cardpdf.pdf>.
- (2016, June 29). "The Space Economy - Space Angels Network." Space Angels. Retrieved February 13, 2017. <https://www.spaceangels.com/post/the-space-economy>.
- (2016, November 22), "Big data a big market for small satellites." SpaceNews. Accessed February 3, 2018, <http://spacenews.com/big-data-a-big-market-for-small-satellites/>.
- (2016, October), "Washington state Aerospace Economic Impacts 2016 Update," Washington state Department of Commerce. Accessed February 12, 2018, <http://www.commerce.wa.gov/wp-content/uploads/2016/11/Aerospace-Impact-Update-2016.pdf>.
- (2016), "A highly skilled, motivated workforce," Washington state Department of Commerce. Accessed February 18, 2018, <http://choosewashingtonstate.com/why-washington/our-strengths/highly-skilled-workforce/>.
- (2017, April 4), "The Space Tech Market Map: 57 Startups Charting The Final Frontier," CB Insights, <https://www.cbinsights.com/research/space-tech-startups-market-map/>.
- (2017, December), "Market Overview: Real Estate," Zillow.com, <https://files.zillowstatic.com/research/public/realestate/ZHVI.Seattle.395078.pdf>
- (2017, December), "Market Overview: Real Estate," Zillow.com. Accessed February 18, 2018. <https://files.zillowstatic.com/research/public/realestate/ZHVI.Seattle.395078.pdf>
- (2017, February 15), "India launches record 104 satellites in single mission," BBC News. Accessed February 1, 2018, <http://www.bbc.com/news/world-asia-india-38977803/>
- (2017, January 10), "New Rules Refine Satellite export Controls," Office of Space Commerce. Accessed February 1, 2018. <http://www.space.commerce.gov/new-rules-refine-satellite-export-controls/>

- (2017, July 11), "Small satellites driving space industry growth: report," Reuters. Accessed February 3, 2018, <https://www.reuters.com/article/us-space-satellites/small-satellites-driving-space-industry-growth-report-idUSKBN19W2LR>.
- (2017, June 20), "Results of SurveyUSA Election Poll #23565," SurveyUSA.com. Accessed February 18, 2018. <https://assets.documentcloud.org/documents/3870797/Survey-Results-on-Seattle-Mayoral-Candidates.pdf>
- (2017, September 17), "Investment in Japan space startups blasting off," Nikkei Asian Review. Accessed February 1, 2018, <https://asia.nikkei.com/Business/Trends/Investment-in-Japan-space-startups-blasting-off>.
- (2017), "Boeing in Washington 2017 Impact Report," Boeing.com. Accessed February 23, 2018, http://www.boeing.com/Boeing_in_Washington2017_Impact_Report/index.html#/4/.
- (2017), "Facts About Microsoft: Revenue and Headcount," Microsoft.com. Accessed February 12, 2018, <https://news.microsoft.com/facts-about-microsoft/#RevenueHeadcount>.
- (2017), "Global Startup Ecosystem Report," Startup Genome. Accessed February 18, 2018, <https://startupgenome.com/thank-you-enjoy-reading/>.
- (2017 November) "Labor Force and Industry Employment." Port of Moses Lake: Employment Security Department. Accessed Feb 20 2017. <http://www.portofmoseslake.com/economic-dashboard/labor-market/>.
- (2018, January 18), "In heaven as it is on Earth: The NewSpace race," The Economist. Accessed February 1, 2018, <https://www.economist.com/news/leaders/21735023-events-space-reflect-those-back-home-new-space-race>.
- (2018), "Boeing - General Information: Employment Data," Boeing.com. Accessed February 14, 2018, <http://www.boeing.com/company/general-info/#/employment-data>.
- (2018), "Data Science in Biotechnology," Master's in Data Science. Accessed February 3, 2018, <http://www.mastersindatascience.org/industry/biotech/>.
- (2018), "LGBT Data and Demographics: Washington," The Williams Institute. Accessed February 15, 2018, <https://williamsinstitute.law.ucla.edu/visualization/lgbt-stats/?topic=LGBT&area=53#density>.
- (2018), "Machine Learning What it is and why it matters," SAS. Accessed February 3, 2018, https://www.sas.com/en_us/insights/analytics/machine-learning.html#.
- (2018), "San Francisco Home Prices & Values," Zillow.com. Accessed February 18, 2018. <https://www.zillow.com/san-francisco-ca/home-values/>
- (2014), "The Diversity Gap in Silicon Valley," Lee and Low Books. Accessed, February 18, 2018, <http://blog.leeandlow.com/2015/03/12/the-diversity-gap-in-silicon-valley/>
- Adam Mann, (2012, April 23), "Tech Billionaires Plan Audacious Mission to Mine Asteroids," *WIRED*. Accessed February 23, 2018, <https://www.wired.com/2012/04/planetary-resources-asteroid-mining/>.
- Aime Williams, (2017, March 17), "Space: The final frontier for investors," The Financial Times. Accessed February 14, 2018. <https://www.ft.com/content/05f24014-07e1-11e7-97d1-5e720a26771b>.
- Alaina G. Levine, (2016, July 11) "Looking to Space as an Asteroid miner," *Sciencemag.org*. Accessed February, 12, 2018, <http://www.sciencemag.org/careers/2016/07/looking-space-asteroid-miner>.
- Alan Boyle ,(2016,December 29), "Syria crisis tests BlackSky Satellite data Portal", *cosmiclog.com* Accessed Feb 21 2018.<https://cosmiclog.com/2016/12/14/syria-crisis-tests-blacksky-satellite-data-portal/>.
- Alan Boyle, (2017, August 29), "Spaceflight's BlackSky wins \$16.4M Air Force contract for geospatial data platform", *GeekWire.com*. Accessed Feb 14 2018, <https://www.geekwire.com/2017/spaceflights-blacksky-wins-16-4m-air-force-contract-provide-geospatial-data-platform/>.
- Alan Boyle, (2017, December 7), "Tethers Unlimited wins NASA grant to work on future FabLab for 3-D printing in space," *GeekWire*. Accessed February 26, 2018, <https://www.geekwire.com/2017/tethers-unlimited-fablab-3d-printing/>.
- Alan Boyle, (2017, November 10), "Why data analytics is becoming the next frontier for the commercial space industry," *GeekWire*. Accessed February 2, 2018, <https://www.geekwire.com/2017/data-analytics-becoming-next-frontier-commercial-space-industry/>.
- Alan Boyle, (2017, November 8), "'New Space Age' Gathering Sets the Stage for Commercial Spaceflight's Big Year," *Geekwire*. Accessed January 29, 2018, <https://www.geekwire.com/2017/new-space-age-gathering-sets-stage-commercial-spaceflights-big-year/>.

Alan Boyle, (2017 September 7), "Jeff Bezos' Blue Origin makes its pitch to Congress for delivering cargo to the moon", GeekWire. Accessed February 26 2018, <https://www.geekwire.com/2017/jeff-bezos-blue-origin-makes-pitch-congress-delivering-cargo-moon/amp/>.

Alaska Aerospace, Comprehensive Launch Capabilities. Accessed January 29, 2018. <http://akaerospace.com/comprehensive-launch-capabilities>.

Alex Knapp, (2012, April 27), "How Billionaire Asteroid Miners Make Money -- Without Mining Asteroids," Forbes. Accessed February 23, 2018, <https://www.forbes.com/sites/alexknapp/2012/04/27/how-billionaire-asteroid-miners-make-money-without-mining-asteroids/#253e42df14e0>.

Amanda Robert, (June 13, 2017), "States Bet on Spaceports, Future Economic Benefits," Forbes.com. Accessed February 28, 2018. <https://www.forbes.com/sites/legalnewslines/2017/06/13/states-bet-on-spaceports-future-economic-benefits/#5dc57db51639>

Andrew Liptak, (2017, June 17), "Planetary Resources is pulling the plug on its Earth observatory satellite network," The Verge. Accessed February 23, 2018, <https://www.theverge.com/2017/6/17/15823988/planetary-resources-ending-earth-observatory-system-ceres>.

Anne Seckinger, (2014, August 15), "Why Is Seattle Not Like Silicon Valley", Crunch Network. Accessed February 19 2018, <https://techcrunch.com/2014/08/15/why-seattle-is-not-like-silicon-valley/>

Anthony Downs, (2004, Jan.,1) "Traffic: Why It's Getting Worse, What Government Can Do." Brookings <https://www.brookings.edu/research/traffic-why-its-getting-worse-what-government-can-do/>

Anurag Kotoky, (2016, November 30), "The Cheapest trip to Mars Leaves from this Tiny Indian Island," Bloomberg. Accessed February 1, 2018, <https://www.bloomberg.com/graphics/2016-asia-space-race/india.html>.

Arthur B. Laffer et al., (2015) Rich states, poor states, 8th ed. Accessed February 3 2018.

Asees Sing, (2014, May 1), "The Lost Startup Benefit: Paid Maternity Leave," Thunder Blog. Accessed February 20, 2018, <https://www.makethunder.com/blog/maternity-leave-benefit/>.

Ashlee Vance, (2017, June 29), "The Tiny Satellites Ushering in the New Space Revolution," Bloomberg News. Accessed February 23, 2018, <https://www.bloomberg.com/news/features/2017-06-29/the-tiny-satellites-ushering-in-the-new-space-revolution>.

Atossa Araxia Abrahamian, (2017, September 15), "How a tax haven is leading the race to privatise space," The Guardian. Accessed February 1, 2018, <https://www.theguardian.com/news/2017/sep/15/luxembourg-tax-haven-privatise-space>.

Barbara Byrne Denham and Victor Calanog (2017, October). "Amazon HQ2: Location Decisions and Scoring Analysis," REIS, <https://www.reis.com/hubfs/Amazonpercent20HQpercent20percent20Locationpercent20Decisionpercent20andpercent20Scoringpercent20Analysispercent202017.pdf>.

Bill Virgin, (2016, January), "The Next Generation: How Seattle innovators are leading the new race into space," Seattle Business Magazine. Accessed February 13, 2018, <http://www.seattlebusinessmag.com/article/space-race-look-sky>.

Binsal Abdul Kader, (2015, May 25), "UAE space agency unveils ambitious plans," Gulf News. Accessed February 1, 2018, <http://gulfnews.com/news/uae/government/uae-space-agency-unveils-ambitious-plans-1.1521609>.

Blanca Torres, (2016, April 30), "Seattle condos: Short supply puts extra squeeze on housing market," Seattle Times. Accessed February 18, 2018. <https://www.seattletimes.com/business/economy/condo-conundrum-dealing-with-shortage-might-ease-pressures-on-all-homebuyers/>

Bloomberg News, (2016, November 28), "China's Secretive Space Program Threatens NASA's Dominance," Bloomberg. Accessed February 2, 2018, <https://www.bloomberg.com/graphics/2016-asia-space-race/china.html>

Bob Heller, (2015, April), "Washington's High-Tech R&D Credit." Seattle Business, Accessed February 4 2018. <http://www.seattlebusinessmag.com/article/washingtonpercent25E2percent2580percent2599s-high-tech-rd-credit>.

Brad Smith and Jon Fine, (2016, July 14), "How Boeing has helped Washington state thrive," The Seattle Times. Accessed February 11, 2018, <https://www.seattletimes.com/opinion/how-boeing-has-helped-washington-state-thrive/>.

Carly Fiorina, (2015, August 13), "The Status Quo Isn't Working for Women in America," Huffington Post, http://www.huffingtonpost.com/carly-fiorina/the-status-quo-isnt-working-for-women-in-america_b_7983718.html?ir=Politics&utm_hp_ref=politics.

CB Insights, (2017, April 11), "Space Tech Funding Drops Back to Earth While Deals Push Up," CB Insights. Accessed February 1, 2018, <https://www.cbinsights.com/research/space-tech-startup-funding/>.

Census Bureau, (2015), Accessed February 12 2018. https://datausa.io/profile/geo/seattle-wa/#mode_transport

Charles Mudede, (2017, April 20), "Hot Money and Seattle's Growing Housing Crisis: Part One," TheStranger.com. Accessed February 18, 2018. <https://www.thestranger.com/slog/2016/08/08/24442014/hot-money-and-seattles-growing-housing-crisis-part-one>

Chelsea Yates, (2016, July 5), "A Riveting Combination: The UW and Boeing Advance Research Together Through BARC," UW College of Engineering. Accessed February 18, 2018, <https://www.engr.washington.edu/news/barc>.

Chris Gebhardt, (2017, November 10), "Blue Origin remains on course for 2020 debut of New Glenn heavy lift rocket", NASA Spaceflight. Accessed February 28, 2018, <https://www.nasaspaceflight.com/2017/11/blue-origin-2020-debut-new-glenn-rocket/>

Chris Taylor (2012, April 2) "The \$20 Trillion Rok Could Turn a Startup Into Earth's Richest Company" Mashable.Com, Accessed Feb 12 2018, https://mashable.com/2012/04/26/planetary-resources-asteroid-mining-trillions/#Q_hUjPDRGq2.

Christopher Mims, (2012-04-18), "Are Ross Perot Jr. and Google's Founders Launching a New Asteroid Mining Operation?" Technology Review. Accessed February 28, 2018, <https://www.technologyreview.com/s/427624/are-ross-perot-jr-and-googles-founders-launching-a-new-asteroid-mining-operation/>.

City of Seattle, (2017), "Implementing Mandatory Housing Affordability (MHA) Citywide," City of Seattle. Accessed February 18, 2018. http://www.seattle.gov/Documents/Departments/HALA/Policy/How_MHA_Works.pdf.

Clare Mcgrane, (2017, October 15), "The pipeline' isn't causing tech's diversity problem: The workplace is, and here 3 ways to fix it," The Geek Wire. Accessed, February 11 2018, <https://www.geekwire.com/2017/pipeline-isnt-causing-techs-diversity-problem-workplace-heres-3-ways-fix/>

Claudia Rowe, (2017, July 6), "Washington's new family-leave law is among the most generous in the nation," The Seattle Times. Accessed February 18, 2018, <https://www.seattletimes.com/seattle-news/politics/washingtons-new-family-leave-law-is-among-the-most-generous-in-the-nation/>.

Dana Liebelson, (2013, May 23), "Can Facebook and Reddit Fix America's Maternity Leave Problem?" Mother Jones. Accessed February 18, 2018, <http://www.motherjones.com/politics/2013/05/silicon-valley-maternity-leave-paternity-leave>.

Darrell Etherington, (2017, December 13), "Blue Origin flies its Crew Capsule 2.0 for the first time", Techcrunch.com, Accessed February 14, 2018, <https://techcrunch.com/2017/12/13/blue-origin-flies-its-crew-capsule-2-0-for-the-first-time/>.

Dave Mosher, (2017, May 2), "Jeff Bezos has job openings for nearly 100 people at Blue Origin --here's who his rocket company is hiring," *Business Insider*. Accessed February 14 2018, <http://www.businessinsider.com/open-positions-blue-origin-2017-5>.

Dave Wallace et al., (2015, February), "Aerospace Manufacturing Skills: Supply, Demand, and Outcomes for Washington's Aerospace Training Programs 2014 Annual Report," Washington Workforce Training Board and State Board for Community and Technical Colleges. Accessed February 18, 2018, <http://wtb.wa.gov/Documents/AerospaceManufacturingSkills2014.pdf>.

Davey Alba, (2016, October 2), "It's Embarrassing How Few Black Female Founders Get Funded," WIRED. Accessed February 1, 2018, <https://www.wired.com/2016/02/its-embarrassing-how-few-black-female-founders-get-funded/>.

David Gutman (2018, February 1) "Republicans in Olympia continue their push to cut Sound Transit car-tab taxes", The Seattle Times, Accessed February 12 2018, <https://www.seattletimes.com/seattle-news/transportation/republicans-in-olympia-continue-their-push-to-cut-sound-transit-car-tab-taxes/>

Deborah Feldman, (2016, September 21), "Boeing Awards \$6 Million in Grants to Support Education in Washington," Boeing.com. Accessed February 14, 2018, <http://www.boeing.com/company/about-bca/washington/education-in-washington-09-16-16.page>.

DigitalGlobe, (2010, April 9), "Commercial Remote Sensing: An Historical Chronology." Accessed February 23, 2018, http://lasp.colorado.edu/~bakerd/files/Uzzle_Remote_Sensing_04_06_2010.pdf.

Dominic Gates, (2015, May 30), "Local space entrepreneurs take on the new frontier," The Seattle Times. Accessed February 12, 2018, <https://www.seattletimes.com/business/boeing-aerospace/greater-seattle-area-companies-embrace-space-quest/>.

Donna Morris, (2015, August 10), "Helping Our Employees Care for Their Families," Adobe News. Accessed February 16, 2018, <http://blogs.adobe.com/conversations/2015/08/donna-morris-enhanced-leave.html>.

Douglas Burdett, (2017), "Top 100 Aerospace Companies -- 2017," Artillery Marketing. Accessed February 12, 2018, <https://www.artillerymarketing.com/fs/top-100-aerospace-companies-2017>.

Ed Lazowska, (2013), "STEM Education in Washington: the Facts of the Matter," UW. Accessed February 17, 2018, lazowska.cs.washington.edu/STEM.pdf.

Eileen Appelbaum and Ruth Milkman, (2011), "Leaves that Pay: Employer and Worker Experiences with Paid Family Leave in California," Center for Economic Policy Research. Accessed February 20, 2018, <http://www.cepr.net/documents/publications/paid-family-leave-1-2011.pdf>.

Elizabeth Segran, (2016, April 15), "The Next Frontier for Ambitious Entrepreneurs: Space," Fast Company. Accessed February 23, 2018, <https://www.fastcompany.com/3058795/the-next-frontier-for-ambitious-entrepreneurs-space>.

Elizabeth Segran, (2017, January 1), "Four Out-of-this-world predictions for the space industry in 2017," Fast Company. Accessed February 1, 2018, <https://www.fastcompany.com/3066520/four-out-of-this-world-predictions-for-the-space-industry-in-2017>.

Emily Parkhurst, (2014, August 14), "How do Seattle's tech company demographics compare to Silicon Valley? A bit older and just as white," Puget Sound Business Journal. Accessed, February 19 2018, <https://www.bizjournals.com/seattle/blog/techflash/2014/08/how-do-seattles-tech-company-demographics-compare.html>

Emily Parkhurst, (2016, January 20), "Seattle one of top 10 best educated cities," Puget Sound Business Journal. Accessed February 18, 2018, <https://www.bizjournals.com/seattle/blog/techflash/2016/01/seattle-one-of-top-10-most-educated-cities.html>

Eric Berger, (2017, May 31), "Paul Allen showed off his new rocket-launching plane today, and it's BIG," Ars Technica. Accessed February 23, 2018, <https://arstechnica.com/science/2017/05/paul-allen-showed-off-his-new-rocket-launching-plane-today-it-is-big/>.

Evan I. Schwartz, (2010, May 24), "The Looming Space Junk Crisis: It's Time to Take Out the Trash," WIRED. Accessed February 26, 2018, https://www.wired.com/2010/05/ff_space_junk/.

FAA, (2010), "The Economic Impact of Commercial Space Transportation on the U.S. economy in 2009." Accessed January 10, 2018, https://www.faa.gov/news/updates/media/Economic%20Impact%20Study%20September%202010_20101026_PS.pdf.

Farah Manjoo, (2014, September 26), "The Business Case for Diversity in the Tech Industry", The New York Times. Accessed, February 26 2018, <https://bits.blogs.nytimes.com/2014/09/26/the-business-case-for-diversity-in-the-tech-industry/>

Francois Chopard, founder of the NewSpace accelerator, Starburst Accelerator, in an interview on Bloomberg Technology, (2016, April 1). Accessed February 23, 2018, <https://www.youtube.com/watch?v=x1xyN9u0ddQ>.

Gene Balk, (2017, May 25), "Seattle once again nation's fastest growing big city; population exceeds 700,000," Seattle Times. Accessed February 18, 2018. <https://www.seattletimes.com/seattle-news/data/seattle-once-again-nations-fastest-growing-big-city-population-exceeds-700000/>

Geoff Ralston. (2017, January 7). "A Guide to Seed Fundraising." blog.ycombinator.com. Accessed February 14, 2018. <http://blog.ycombinator.com/how-to-raise-a-seed-round/>.

GovTribe, "Tethers Unlimited, Inc. Bothell WA," govtribe.com. Accessed February 17, 2018, <https://govtribe.com/vendor/tethers-unlimited-inc-bothell-wa>.

Hayat Norimine, (2017 February), "With Seattle's Housing Crisis, Could Inaction be the Best Action?" Seattle Met. Accessed February 14, 2018, <https://www.seattlemet.com/articles/2017/10/18/with-seattles-housing-crisis-could-inaction-be-the-best-action>.

- Heidi Groover, (2017, July 5), "What the New State Paid Family Leave Plan Means for Seattle," *The Stranger*. Accessed February 17, 2018, <https://www.thestranger.com/slog/2017/07/05/25262374/what-the-new-state-paid-family-leave-plan-means-for-seattle>.
- Helen Roxburg, (2017, November 21), "China's Space Industry: Arriving at the Final Frontier," *CKGSB Knowledge*. Accessed February 1, 2018, <http://knowledge.ckgsb.edu.cn/2017/11/21/technology/china-space-industry-final-frontier/>.
- Ian Yamamoto, (2012, April 30) "Asteroid Mining Company Planetary Resources Is Already Making Money." *Mic Network Inc.*, Accessed Feb 13 2018, <https://mic.com/articles/7718/asteroid-mining-company-planetary-resources-is-already-making-money#.g3rRLHQ6u>.
- Jack Crosbie, (2016, September 28), "Elon Musk Explains Why SpaceX Only Hires Americans," *Inverse: Life in Space*. Accessed January 29, 2018, <https://www.inverse.com/article/21487-elon-musk-spacex-foreign-workers>.
- James Rathz, (2015, December 31), "Law Provides New Regulatory Framework for Space Commerce," *The Regulatory Review*. Accessed February 12, 2018, <https://www.theregreview.org/2015/12/31/rathz-space-commerce-regulation/>
- James Risley, (2015, July 13). "Spaceflight Industries inks partnerships to improve its 'cellphone network for space'", *GeekWire*, Accessed Feb 11 2018, <https://www.geekwire.com/2015/spaceflight-industries-inks-partnerships-to-improve-its-cellphone-network-for-space/>.
- Jason Koebler, (2015, June 3), "SpaceX Has Quietly Opened a New Office to Work on Internet-Providing Satellites," *Vice*. Accessed February 23, 2018, https://motherboard.vice.com/en_us/article/xyw3va/spacex-has-quietly-opened-a-new-office-to-work-on-internet-providing-satellites.
- Jason Koebler, (2017, February 9), "Why Space Companies Are Untouched by Trump's Travel Ban," *Vice: Motherboard*. Accessed January 24, 2018 https://motherboard.vice.com/en_us/article/ae45b5/why-space-companies-are-untouched-by-trumps-travel-ban.
- Jeanne Lang Jones, (2017, September), "The Evolution of the Seattle Startup Scene," *Seattle Business Magazine*. Accessed February 2018, <http://seattlebusinessmag.com/business-operations/evolution-seattle-startup-scene>.
- Jeff Foust, (2017, July 17), "Luxembourg adopts space resources law," *Spacenews.com*. Accessed February 1, 2018, <http://spacenews.com/luxembourg-adopts-space-resources-law/>.
- Jesse Dunietz, (2017, August 18), "Floating Treasure: Space Law Needs to Catch Up with Asteroid Mining," *Scientific American*. Accessed February 14, 2018, <https://www.scientificamerican.com/article/floating-treasure-space-law-needs-to-catch-up-with-asteroid-mining/>.
- Jessica Guynn, (2017, October 3), "Silicon Valley's race gap is getting worse, not better, new research shows", *USA Today*. Accessed, February 23, 2018, <https://www.usatoday.com/story/tech/news/2017/10/03/diversity-and-silicon-valley-race-not-gender-gap-gets-worse/727240001/>
- Jessica Lee, (2017, July 12), "Study: Here's How Many Hours Seattle Drivers Spend Looking for Parking" *The Seattle Times* Accessed February 5 2018, <https://www.seattletimes.com/seattle-news/transportation/study-heres-how-many-hours-seattle-drivers-spend-looking-for-parking/>
- Jessica Shortall, (2015, November 4), "The American Case for Paid Maternity Leave," *TEDxSMU*, <https://www.youtube.com/watch?v=SJyE40koQyA&list=PLsRNoUx8w3rMwPgmKexZdkPVW0BNk733A&index=1>.
- Jim Edwards, (2017, April 6), "Goldman Sachs: space-mining for platinum is 'more realistic than perceived'," *Business Insider*. Accessed February 23, 2018, <http://www.businessinsider.com/goldman-sachs-space-mining-asteroid-platinum-2017-4>.
- Jim Kershner, (2015, September 8), "Boeing and Washington's Aerospace Industry, 1934-2015," *History Link.org*. Accessed February 19, 2018, <http://www.historylink.org/File/11111>.
- Joanna Glasner and Gene Teare. (2016, September 7). "Crunchbase sees rise in average seed round in 2016." *TechCrunch*. Accessed February 14, 2018. <https://techcrunch.com/2016/09/07/crunchbase-sees-rise-in-average-seed-round-in-2016/>.
- John Cook, (2013, October 10), "VC deal activity hits highest mark since dot-com boom," *GeekWire*. Accessed February 18, 2018, <https://www.geekwire.com/2013/vc-deal-activity-hits-highest-market-dotcom-boom-days/>.
- John Cook, (2016, March 18), "Company builders wanted: Can you find any Seattle investors on this list of the top 100 venture capitalists?" *GeekWire*. Accessed February 20, 2018,

<https://www.geekwire.com/2016/company-builders-wanted-can-find-seattle-investors-list-top-100-venture-capitalists/>; John Cook, (2013, October 22), "Contrarian view: Entrepreneurs say lack of capital in Seattle is actually a healthy thing," GeekWire. Accessed February 20, 2018, <https://www.geekwire.com/2013/contrarian-view-entrepreneurs-lack-capital-seattle-good/>.

Jonathan Shiber, (2018, January 12), "Larry Page-backed asteroid mining company launches CubeSat with experimental water detection tech," Techcrunch.com, Accessed February 11, 2018, <https://techcrunch.com/2018/01/12/larry-page-backed-asteroid-mining-company-launches-cube-sat-with-experimental-water-detection-tech/>.

Jon Talton, (2012, April 30), "What would it take to become the Silicon Valley of Space," The Seattle Times. Accessed February 18, 2018. <https://www.seattletimes.com/business/economy/what-would-it-take-to-become-the-silicon-valley-of-space/>.

Jorge Dan Lopez, (2014, May 14), "US, Papua New Guinea, Oman are only nations without paid maternity leave—UN," Reuters. Accessed February 18, 2018, <https://www.rt.com/usa/158776-paid-maternity-leave-usa/>. "Key characteristics of parental leave systems," OECD Family database, August 17, 2015, Accessed February 19, 2018, http://www.oecd.org/els/soc/PF2_1_Parental_leave_systems.pdf.

Josh Lipton and Morgan Bransfield, (2017, March 17). "Silicon Valley techies are fleeing to Seattle," CNBC, <https://www.cnbc.com/2017/03/17/silicon-valley-tech-talent-fleeing-to-seattle.html>.

Joshua Hampson, (2017, January 25), "The Future of Space Commercialization," Niskanen Center. Accessed February 21, 2018, <https://science.house.gov/sites/republicans.science.house.gov/files/documents/TheFutureofSpaceCommercializationFinal.pdf>.

Julie Johnsson, (2015, April 13), "Paul Allen Wants Path to Space to Start on World's Biggest Plane," Bloomberg. Accessed February 27, 2018, <https://www.bloomberg.com/news/articles/2015-04-13/paul-allen-wants-path-to-space-to-start-on-world-s-biggest-plane>.

Julie Kashen, (2015, November 10), "Tech Companies Are Leading the Way on Paid Family Leave," The Century Foundation. Accessed February 17, 2018, <https://tcf.org/content/report/tech-companies-paid-leave/>.

Julie Snider, (2014, June 26), "Lack of Diversity could undercut Silicon Valley", USA Today. Accessed, February 22, 2018, <https://www.usatoday.com/story/tech/2014/06/26/silicon-valley-tech-diversity-white-asian-black-hispanic-google-facebook-yahoo/11372421/>

Juro Osawa, (2015, April 14), "Behind China's Billion-Dollar Startups: Alumni of Alibaba, Tencent," Wall Street Journal. Accessed February 1, 2018, <https://www.wsj.com/articles/alibaba-tencent-alumni-fuel-chinas-startup-success-1429028237>.

Kate Green, (2017, March 30), "Why the United Arab Emirates Is Building a Space Program From Scratch," Slate. Accessed February 1, 2018, http://www.slate.com/articles/technology/future_tense/2017/03/why_the_united_arab_emirates_is_building_a_space_program.html.

Kate Greene, (2017, March 17), "Why India is investing in Space," Slate. Accessed February 2, 2018, http://www.slate.com/articles/technology/future_tense/2017/03/why_india_is_investing_in_space.html.

Katherine Long, (2017, February 19), "Students Frustrated Trying to get into UW's Strict Engineering Program," Seattle Times. Accessed February 22, 2018, <https://www.seattletimes.com/seattle-news/education/students-frustrated-trying-to-get-into-uws-strict-engineering-program/>.

Kathleen Hogan, (2015, August 5), "The employee experience at Microsoft: Aligning benefits to our culture," The Official Microsoft Blog. Accessed February 20, 2018, <https://blogs.microsoft.com/blog/2015/08/05/the-employee-experience-at-microsoft-aligning-benefits-to-our-culture/>.

Katie Benner, (2017, June 30), "Woman in Tech Speak Frankly About a Culture of Harassment," The New York Times. Accessed February 1, 2018, https://www.nytimes.com/2017/06/30/technology/women-entrepreneurs-speak-out-sexual-harassment.html?_r=0.

Kenneth Matos, (2015), "Modern Families: Same- and different-sex couples negotiating at home," Families and Work Institute. Accessed February 16, 2018, <http://www.familiesandwork.org/downloads/modern-families.pdf>.

Kim Vu, (2016), "Washington state's STEM Pipeline in Broken. Here's How to Fix It," Seattle Business Mag. Accessed February 18, 2018, <http://www.seattlebusinessmag.com/business-corners/washington-states-stem-pipeline-broken-heres-how-fix-it>

KING Staff, (2017, May 25), "Seattle's population growth leads nation: Report." K5News. Accessed February 5 2018. <http://www.king5.com/article/news/local/seattle/seattles-population-growth-leads-nation-report/281-442879395>

Kurt Schlosser, (2017, May 30), "Big demand, little supply: Seattle's hot housing market gets hotter with highest price gains in U.S." Geekwire.com. Accessed February 18, 2018. <https://www.geekwire.com/2017/big-demand-little-supply-seattles-hot-housing-market-gets-hotter-highest-price-gains-u-s/>

Laffer Associates, U.S. Census Bureau, Bureau of Labor Statistics and Bureau of Economic Analysis, Accessed February 3 2018.

Laura Turczanski, Paula Simon, Gillian Murphy, and Angela Vogel, (2017, October 15), "Update on Washington state Paid Sick Leave, Effective January 1, 2018," Davis Wright Tremaine LLP. Accessed February 18, 2018, <https://www.dwt.com/New-Details-on-Washington-State-Paid-Sick-Leave-Effective-January-1-2018-10-24-2017/>.

Lee Moriwaki, "Business - Paul Allen To Move Headquarters Of Vulcan Northwest Downtown - Seattle Times Newspaper," The Seattle Times. Accessed February 23, 2018, <http://community.seattletimes.nwsourc.com/archive/?date=19980313&slug=2739413>.

Letter from Business School Professors to Congress, September 15, 2015. Accessed February 15, 2018, <http://worklife.wharton.upenn.edu/wp-content/uploads/2012/11/Final-Business-School-Professors-Letter-to-Congress-in-Support-of-the-FAMILY-Act-September-15-2015.pdf>.

Lisa Arthur, (2013, August 15), "What Is Big Data?," Forbes. Accessed February 3, 2018, <https://www.forbes.com/sites/lisaarthur/2013/08/15/what-is-big-data/#5c5559455c85>.

Lloyd, Sarah Anne, (2017, October 26), "What states are bringing the most new Seattle-area residents?" Curbed.com. Accessed February 18, 2018. <https://seattle.curbed.com/2017/10/26/16554852/seattle-out-of-state-residents-move>

Lubna Hamdan, (2018, February 11), "UAE Launches \$545k fund to support space research," arabianBusiness.com. Accessed February 14, 2018. <http://www.arabianbusiness.com/technology/389590-uae-launches-545k-fund-to-support-space-research>.

Mark Boucher, (2016, March 4). "Coalition of 13 Space Organizations Release Space Policy White Paper." NASA Watch. Retrieved February 13, 2018. <http://nasawatch.com/archives/2016/03/coalition-of-13.html>.

Mark Nowlin, (2017, April 12), "UW will let freshmen apply to engineering school in 2018," Seattle Times. Accessed February 18, 2018. <https://www.seattletimes.com/education-lab/uw-will-let-freshmen-apply-to-engineering-school-in-2018/>

Martin Kenney, Understanding Silicon Valley: The Anatomy of an Entrepreneurial Region, (2000): Stanford Business Books (Paperback). First Edition.

Matt Day, (2016, November 21), "College's computer science diversity a lesson for tech firms", The Seattle Times. Accessed, February 19 2018, <https://www.seattletimes.com/business/technology/colleges-computer-science-diversity-a-lesson-for-tech-firms/>

Matthew Gravatar, (2016, March 3), "Impact of Export Control Reform on Small Businesses," Defense Trade Law. Accessed January 29, 2018. <https://defensetradelaw.com/2016/03/03/impact-of-export-control-reform-on-small-businesses/>

Matthew Richard Crook, (2009, June), "NPS CUBESAT LAUNCHER DESIGN, PROCESS AND REQUIREMENTS". Accessed February 12, 2018, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.736.9674&rep=rep1&type=pdf>.

Maxine Williams, (2017, August 2), "Facebook Diversity Update: Building a More, Diverse, Inclusive Workforce". Facebook Newsroom. Accessed, February 26 2018, <https://newsroom.fb.com/news/2017/08/facebook-diversity-update-building-a-more-diverse-inclusive-workforce/>

Michael J. Listner, (2015, may 11), "Op-ed | UAE Moving To Become a Player in Outer Space Activities," Spacenews.com. Accessed February 1, 2018,

Michael Sheetz, (2017, September 13), "The spaceport industry is booming in every corner of the US, from Alaska to Virginia," CNBC. Accessed January 24, 2018. <https://www.cnbc.com/2017/09/13/the-spaceport-industry-is-booming-in-every-corner-of-the-us.html?view=story&percent24DEVICEpercent24=native-android-mobile>

Michael Sheetz, (2018, January 18), "Space companies received \$3.9 billion in private investment during the 'year of commercial launch': Report," CNBC. Accessed February 23, 2018,

<https://www.cnn.com/2018/01/18/space-companies-got-3-point-9-billion-in-venture-capital-last-year-report.html>.

Michelle Ranken, (2016, December 12), "Why Tech Companies Aren't Hiring More Local Grads," Crosscut. Accessed February 2, 2018, <http://crosscut.com/2016/12/why-tech-companies-arent-hiring-more-local-grads/>.

Microsoft Philanthropies, (2017, December 6), "Technical skills training can address the jobs gap in Washington," Seattle Times, Accessed February 18, 2018. <https://www.seattletimes.com/sponsored/technical-skills-training-can-address-the-jobs-gap-in-washington/>.

Microsoft Philanthropies, (2017, December 8), "Higher education struggling to catch up to tech workforce demand," Seattle Times. Accessed February 18, 2018. <https://www.seattletimes.com/sponsored/higher-education-struggling-to-catch-up-to-tech-workforce-demand/>

Mike Cassidy, (2015, July 27), "How You Can Make More by Working Less," The Century Foundation. Accessed February 18, 2018, <http://www.tcf.org/blog/detail/how-you-can-make-more-by-working-less>.

Mike Lindblom, (2017, February 21) "Seattle Is a World-Class City — for Traffic Congestion" The Seattle Times Accessed February 5 2018, <https://www.seattletimes.com/seattle-news/transportation/seattle-is-a-world-class-city-for-traffic-congestion/>

Mike Lindblom, (2017, January 18), "Sound Transit's cost overruns for first phase hit about 86 percent", The Seattle Times, Accessed February 12 2018, <https://www.seattletimes.com/seattle-news/transportation/sound-transits-cost-overruns-for-first-phase-hit-about-86-percent/>

Mike Lindblom, "If you think Seattle traffic is bad now, just wait until these projects start", The Seattle Times, Accessed February 12 2018, <https://projects.seattletimes.com/2018/one-center-city/>

Mike Pena, (2016, November 23), "Ignoring Diversity Hurts Tech Products and Ventures," Ecorner Stanford University. Accessed, February 26 2018, <https://ecorner.stanford.edu/article/ignoring-diversity-hurts-tech-products-and-ventures/>

Mike Rosenburg, (2017, December 6), "\$500,000 for a 1-bedroom: Condo shortage worse than ever in King County," Seattle Times. Accessed February 18, 2018. <https://www.seattletimes.com/business/real-estate/500000-for-a-1-bedroom-condo-shortage-worse-than-ever-in-king-county/>

Mike Rosenburg, (2017, January 5), "Seattle-area home pickings slimmer than ever: high demand, limited supply," Seattle Times. Accessed February 18, 2018. <https://www.seattletimes.com/business/real-estate/seattle-area-home-price-gains-slow-a-tad-but-new-low-in-houses-for-sale-is-bad-sign-for-2017/>

Mike Rosenburg, (2017, July 20), "Downtown Seattle's construction boom surges to new record, with no end in sight," Seattle Times. Accessed February 18, 2018. <https://www.seattletimes.com/business/real-estate/downtown-seattles-construction-boom-surges-to-new-record-with-no-end-in-sight/>

Mike Rosenburg, (2017, October 5), "As Seattle-area home prices soar, some would-be buyers are now giving up," SeattleTimes.com. Accessed Feb 13 2018. <https://www.seattletimes.com/business/real-estate/as-seattle-area-home-prices-soar-some-would-be-buyers-now-giving-up/>

Mike Rosenburg, (2017, September 26), "Seattle home price growth is nearly double any other U.S. city", SeattleTimes.com. Accessed February 13 2018. <https://www.seattletimes.com/business/real-estate/seattle-home-price-growth-is-nearly-double-any-other-u-s-city/>

Mike Wall, (2017, April 10), "SpaceX Rocket Could Be 100-Percent Reusable by 2018, Elon Musk Says," Space.com. Accessed February 26, 2018, <https://www.space.com/36412-spacex-completely-reusable-rocket-elon-musk.html>.

Morgan Brasfield, (2017, March 17), "Silicon Valley techies are fleeing to Seattle," CNBC.com. Accessed February 18, 2018. <https://www.cnn.com/2017/03/17/silicon-valley-tech-talent-fleeing-to-seattle.html>

Morgan Stanley, (2017, November 1), "Space: Investment Implications of the Final Frontier," Morgan Stanley Research. Accessed February 1, 2018, https://fa.morganstanley.com/griffithwheelwrightgroup/mediahandler/media/106686/Space_%20Investment%20Implications%20of%20the%20Final%20Frontier.pdf.

Nat Levy, (2017, July 18), "Look out, Bay Area: Seattle rises to 2nd best tech city in the U.S, passing Washington D.C", The Geek Wire. Accessed, February 18 2018, <https://www.geekwire.com/2017/look-bay-area-seattle-rises-2nd-best-tech-city-u-s-passing-washington-d-c/>

Neal Ungerleider, (2018, January 23), "How To Launch a Space Startup," Fast Company. Accessed February 23, 2018, <https://www.fastcompany.com/40507858/space-startups-record-investment-rocket-labs-interorbital-phase-four>.

Nell Greenfieldboyce, (2007, April 13), "Space Tethers: Slinging Objects in Orbit?," NPR. Accessed February 23, 2018, <https://www.npr.org/templates/story/story.php?storyId=9574513>.

Nick Wingfield, (2016, January 8). "San Francisco Office Rents Pass Manhattan as Most Expensive in Country," The New York Times, https://bits.blogs.nytimes.com/2016/01/08/san-francisco-office-rents-pass-manhattan-as-most-expensive-in-country/?_r=0.

Nick Wingfield, (2016, July 26), "The Silicon Valley of Space Start-Ups? It Could be Seattle," The New York Times. Accessed February 20, 2018, <https://www.nytimes.com/2016/08/02/science/seattle-space-flight-innovation-center.html>.

Nour Malas, (February 7, 2018), "Tech Wealth Turns Attention to Affordable Housing in Seattle, WSJ.com, <https://www.wsj.com/articles/tech-wealth-turns-attention-to-affordable-housing-in-seattle-1518015600>

Patricia Hynes, (2014, September 8) "Commentary: So You Want to Build a Spaceport," SpaceNews. Accessed February 21, 2018.

Patrick May, (2014, February 4), "Silicon Valley startups in forefront of NewSpace race," The Mercury News. Accessed February 1, 2018, <https://www.mercurynews.com/2014/02/04/silicon-valley-startups-in-forefront-of-new-space-race/>.

Paula L. Geisz, (2010, April 29), "U.S. Export Control Laws and Regulations," NASA. Accessed January 29, 2018. https://www.nasa.gov/pdf/457653main_PI2_Export_geisz.pdf.

Paul Allen, (2011), "Idea Man: A Memoir by the Co-founder of Microsoft," Penguin Group. USA.

Peter B. de Selding, (2016, June 3), "Luxembourg invests to become the 'Silicon Valley of space resource mining'," Spacenews.com. Accessed February 1, 2018, <http://spacenews.com/luxembourg-invests-to-become-the-silicon-valley-of-space-resource-mining/>.

Port of Moses Lake: Aeronautics. Accessed January 29, 2018. <http://www.portofmoseslake.com/aeronautics/#1477951474319-ad390a9f-8614>

Preeti Kasireddy, (2017, November 19), "Why I'm Leaving Silicon Valley," Medium. Accessed February 23, 2018, <https://medium.com/@preethikasireddy/why-im-leaving-silicon-valley-72919edb3297>.; Kerry Flynn, (2017, December 6), "San Francisco was the obvious choice for tech workers. Not anymore," Mashable. Accessed February 23, 2018, <https://mashable.com/2017/12/06/why-they-leave-san-francisco-silicon-valley/#PueBizabQiqG>.

Press Release, (2012, June 11), "Spaceflight Inc. and SpaceX Sign Secondary Payload Deal". SpaceRef. Accessed February 12, 2018, <http://spaceref.biz/2012/06/spaceflight-inc-and-spacex-sign-secondary-payload-deal.html>.

Rachel Emma Silverman, (2015, November 2), "Joining Tech Rivals, Amazon Adds Paternity Leave, More Paid Time Off for Mothers," Wall Street Journal. Accessed February 20, 2018, <http://www.wsj.com/articles/joining-tech-rivals-amazon-adds-paternity-leave-more-paid-time-off-for-mothers-1446503585?alg=y&cb=logged0.15335040958598256>.

Rachel Lerman, (2017, October 20), "Washington state's new parental leave law could change workplace for moms — and dads," The Seattle Times. Accessed February 20, 2018, <https://www.seattletimes.com/business/encouraging-fathers-to-take-parental-leave-could-give-women-a-boost-in-the-workplace/>.

Railway Technology, Accessed February 12 2018. <https://www.railway-technology.com/projects/central-link-seattle/>

Richard Florida, (2016, January 26), "The Rise of Global City Startups," City Lab. Accessed February 14, 2018 <https://www.citylab.com/life/2016/01/the-rise-of-global-startup-cities/426780/>.

Richard Florida. (2016, January 26), "The Global Cities Where Tech Venture Capital Is Concentrated." The Atlantic. Accessed February 14, 2018, <https://www.theatlantic.com/technology/archive/2016/01/global-startup-cities-venture-capital/429255/>.

Richard Florida and Karen M. King, (2016, February 22), "Spiky Venture Capital: The Geography of Venture Capital Investment by Metro and Zip Code," Martin Prosperity Institute. Accessed February 14, 2018 <http://martinprosperity.org/content/spiky-venture-capital/>.

Rob Price, (2017, March 12), "Mark Zuckerberg: 'I don't think it's a secret' the tech sector has 'an issue with diversity'," The Business Insider. Accessed, February 26 2018, <http://www.businessinsider.com/facebook-mark-zuckerberg-tech-industry-diversity-issue-2017-3>

Rocio Lorenzo and Martin Reeves, (2018, January 30), "How and Where Diversity Drives Financial Performance," Harvard Business Review. Accessed, February 1, 2018, <https://hbr.org/2018/01/how-and-where-diversity-drives-financial-performance?autocomplete=true>.

Samantha Masunaga, (2016, July 26). "Angels sending money into space." Los Angeles Times. Accessed February 13, 2017, <http://www.providencejournal.com/news/20160714/angels-sending-money-into-space>.

Sam Howe Verhovek, (2010, October 2), "The Tale of Boeing's High-risk Flight into the Jet Age," The Seattle Times. Accessed February 12, 2018, <https://www.seattletimes.com/pacific-nw-magazine/the-tale-of-boeings-high-risk-flight-into-the-jet-age/>.

Sarah Cruddas, (2015, August 11). "Rocketing prices: the investors eyeing the riches of space." BBC News. Retrieved February 13, 2018, <http://www.bbc.com/future/story/20150810-rocketing-prices-the-investors-eyeing-the-riches-of-space>.

Sarah Jane Glynn, (June 2014), "Breadwinning Mothers, Then and Now," Center for American Progress. Accessed February 18, 2018. <https://cdn.americanprogress.org/wp-content/uploads/2014/06/Glynn-Breadwinners-report-FINAL.pdf>.

Sarah Kessler, (2010, September 23), "Life After Microsoft:15 Startups Founded by Ex-employees," Mashable. Accessed February 18, 2018, <https://mashable.com/2010/09/23/microsoft-employee-startups/#nGXfU.Rs95qA>; (2018), "Company: Management," Seattle Avionics Company. Accessed February 18, 2018, <https://www.seattleavionics.com/Management.aspx>.

Sarah Kulin, Jessica Rohman,(2017, January 17), " Why Diversity and Innovation Play a Role in Becoming a Great Tech Company", Fortune. Accessed, February 22 2018, <http://fortune.com/2017/01/17/best-tech-workplaces-innovation-diversity/>

Sharon Lerner, (2015, August 18), "The Real War on Families: Why the U.S. Needs Paid Leave Now," In These Times. Accessed February 12, 2018, <http://inthesetimes.com/article/18151/the-real-war-on-families>.

Sheelah Kolhatkar, (2017, November 20), "The Tech Industry's Gender-Discrimination Problem," The New Yorker. Accessed, January 25 2018, <https://www.newyorker.com/magazine/2017/11/20/the-tech-industrys-gender-discrimination-problem>

Spaceflight Industries, (2017), "Spaceflight Industries is a next-generation space company enabling access to space and redefining global intelligence" Accessed Feb 12 2018. <https://www.spaceflightindustries.com/about/>.

Spaceflight Industries, "News," Accessed February 23, 2018, <http://spaceflight.com/spaceflight-industries-wins-puget-sound-business-journal-innovation-award/>.

Spaceflight Industries, "Spaceflight Industries - About," spaceflight.com. Accessed February 23, 2018, <http://spaceflight.com/>.

Susan Wojcicki, (2014, December 16), "Paid Maternity Leave is Good for Business," Wall Street Journal. Accessed February 20, 2018, <http://www.wsj.com/articles/susan-wojcicki-paid-maternity-leave-is-good-for-business-1418773756?alg=y>.

Tax Foundation, (2017) "2018 State Business Tax Climate Index." Accessed February 3 2018.

Taylor Soper, (2016, June 7), "Venture capitalist Fred Wilson calls Seattle a 'third-tier' startup city," GeekWire. Accessed February 18, 2018, <https://www.geekwire.com/2016/venture-capitalist-fred-wilson-calls-seattle-third-tier-startup-city/>.

Taylor Soper, (2016, March 22), "Study: Traffic in Seattle still horrible, ranks 2nd-worst in U.S. for evening rush hour congestion," GeekWire. Accessed February 20, 2018, <https://www.geekwire.com/2016/study-traffic-seattle-still-horrible-ranks-2nd-worst-u-s-evening-rush-hour-congestion/>.

Tethers Unlimited Website, "TethersUnlimited - News," tethersunlimited.com. Accessed February 18, 2018, <http://www.tethers.com/News.html>.

The Associated Press, (2017, June 30), "Family-leave measure passed by Washington state legislature," The Seattle Times. Accessed February 18, 2018, <https://www.seattletimes.com/seattle-news/politics/washington-legislature-passes-paid-family-leave-measure/>.

The City of Bellevue, (2016), "Bellevue Comprehensive Plan," The City of Redmond. Accessed February 26, 2018. <https://user-ashnxej.cld.bz/Bellevue-Comprehensive-Plan-2015-Volume-1/84>.

The City of Redmond, (September 2012), "Redmond 2030," The City of Redmond. Accessed February 26, 2018. <https://cld.bz/fCYgSht#110>.

Theo Eicher, (2010, March), "The Microsoft Economic Impact Study," Accessed February 17, 2018, richardsdavis.typepad.com/files/ms-impact_public.pdf.

The Space Foundation, (2016), "The Space Report: 2016." Accessed January 1, 2018, http://www.spacefoundation.org/sites/default/files/downloads/The_Space_Report_2016_OVERVIEW.pdf

Tim Fernholz, (2017, March 29), "Reusable rockets could disrupt the space industry, and not always in a good way," Quartz. Accessed February 26, 2018, <https://qz.com/944145/reusable-rockets-could-disrupt-the-space-industry-and-not-always-in-a-good-way/>.

Todd Bishop, (2013, April 1), "Paul Allen's Vulcan Capital expanding to Silicon Valley". geekwire.com. Accessed February 23, 2018, <http://www.geekwire.com/2013/paul-allens-vulcan-capital-expanding-silicon-valley/>.

Tony Romm, (2015, November 6), "Bezos space startups boosts D.C. Game," Politico. Accessed February 18, 2018. <https://www.politico.com/story/2015/11/bezos-space-startup-boosts-dc-game-215596>.

United Nations: Office for Outer Space Affairs, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies. Accessed January 24, 2018. <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html>

US Census Bureau (2018).; (2017), "Global Startup Ecosystem Report," Startup Genome. Accessed February 18, 2018, <https://startupgenome.com/thank-you-enjoy-reading/>.

Valentina Zarya, (2017, March 13), "Venture Capital's Funding Gender Gap Is Actually Getting Worse," Fortune. Accessed February 1, 2018, <http://fortune.com/2017/03/13/female-founders-venture-capital/>.; Kaya Thomas, (2015, July 25), "Dear Investors, Fund More Underrepresented Founders in Tech," TechCrunch. Accessed February 1, 2018, <https://techcrunch.com/2015/07/27/dear-investors-fund-more-underrepresented-founders-in-tech/>.

Vulcan Capital, Company Profile - Bloomberg." Bloomberg.com, Bloomberg, Accessed Feb 12 2018. <https://www.bloomberg.com/profiles/companies/270128Z:US-vulcan-capital>.

Washington (State), House. Committee on Technology & Economic Development, An act relating to extending specific aerospace tax preferences to include spacecrafts to encourage the migration of good wage jobs in the state (HB 2226): Report. Accessed February 3 2018.

Washington (state), House. Committee on Technology & Economic Development, An act relating to reinstating tax preference for certain high-technology research and development (HB 1894): Report (to Accompany SB 5630). Accessed February 4 2018.

Washington state Dep. of Revenue, (2013, December), "High Tech Study: Analysis of High Technology Programs" Accessed February 4 2018.

Wayne Sutton, (2017, July 13), "The Future Epicenter of Startups Won't Be Silicon Valley," New America Weekly. Accessed February 1, 2018, <https://www.newamerica.org/weekly/edition-171/future-epicenter-startups-wont-be-silicon-valley/>.

"Analysis of Defense and Space Incentives", (2015, December) Office of Economic & Demographic Research. Accessed February 4 2018.

"BlackSky Global", Crunchbase, <https://www.crunchbase.com/organization/blacksky-global>

"Business & Occupation Tax", Washington Department of Revenue. Accessed February 3 2018, <https://dor.wa.gov/find-taxes-rates/business-occupation-tax>.

"Data Center," Grant County Economic Development Council. Accessed January 29, 2018. <http://www.grantedc.com/grant-county-key-industries/data-centers>.

"Family and Medical Leave in 2012: Executive Summary," Abt Associates prepared for the U.S. Department of Labor, September 7, 2012; updated September 13, 2013, Accessed February 18, 2018, <http://www.dol.gov/asp/evaluation/fmla/FMLA-2012-Executive-Summary.pdf>.

"Frequently Asked Questions," Alaska Aerospace. Accessed January 29, 2018. <http://akaerospace.com/frequently-asked-questions>.

"Handbook for New Actors in Space," (February 2017), 1st ed, E-book, The Secure World Foundation. Accessed February 28, 2018. https://swfound.org/media/205710/handbook_for_new_actors_in_space_2017_web2.pdf.

"How America's two tech hubs are converging - Silicon Valley North," The Economist. (2017, May 11). <https://www.economist.com/news/business/21721950-more-ever-seattle-and-silicon-valley-are-joined-hip-how-americas-two-tech-hubs-are>.

"Largest Employers in King County," Economic Development Council & King County. (2018). <http://www.edc-seaking.org/service/economic-data/economic-basics>.

- “Regional Transit Taxes”, Sound Transit, Accessed February 12 2018, <https://www.soundtransit.org/About-Sound-Transit/Taxing-district>.
- “Seattle Area Economic Summary,” U.S. Bureau of Labor Statistics. (2018, February 6). https://www.bls.gov/regions/west/summary/blssummary_seattle.pdf.
- “Space Angels Network | Crunchbase.” www.crunchbase.com. Retrieved February 13, 2018. https://www.crunchbase.com/organization/space-angels/investments/investments_list.
- “State Support for Commercial Space Activities,” Federal Aviation Administration, Accessed January 24, 2018. https://www.faa.gov/about/office_org/headquarters_offices/ast/media/Statepercent20Supportpercent20forpercent20Commercialpercent20Spacepercent20Activities.pdf.
- “State Support for Commercial Space Activities”, Federal Aviation Administration. Accessed February 2 2018.
- “Why is it Better to Launch a Spaceship from Near the Equator,” Northwestern University: Navigation. Accessed January 29, 2018. <http://www.qrg.northwestern.edu/projects/vss/docs/navigation/2-why-launch-from-equator.html>.

Endnotes

- ¹ Morgan Stanley, (2017, November 1), "Space: Investment Implications of the Final Frontier," *Morgan Stanley Research*. Accessed February 1, 2018, [https://fa.morganstanley.com/griffithwheelwrightgroup/mediahandler/media/106686/Space %20Investment%20Implications%20of%20the%20Final%20Frontier.pdf](https://fa.morganstanley.com/griffithwheelwrightgroup/mediahandler/media/106686/Space%20Investment%20Implications%20of%20the%20Final%20Frontier.pdf).
- ² Joshua Hampson, (2017, January 25), "The Future of Space Commercialization," *Niskanen Center*. Accessed February 21, 2018, <https://science.house.gov/sites/republicans.science.house.gov/files/documents/TheFutureofSpaceCommercializationFinal.pdf>.
- ³ DigitalGlobe, (2010, April 9), "Commercial Remote Sensing: An Historical Chronology." Accessed February 23, 2018, [http://lasp.colorado.edu/~bakerd/files/Uzzle Remote Sensing_04_06_2010.pdf](http://lasp.colorado.edu/~bakerd/files/Uzzle_Remote_Sensing_04_06_2010.pdf).
- ⁴ Joshua Hampson, (2017, January 25), "The Future of Space Commercialization," *Niskanen Center*. Accessed February 21, 2018, <https://science.house.gov/sites/republicans.science.house.gov/files/documents/TheFutureofSpaceCommercializationFinal.pdf>.
- ⁵ The Space Foundation, (2016), "The Space Report: 2016." Accessed January 1, 2018, [http://www.spacefoundation.org/sites/default/files/downloads/The Space Report 2016 OVERVIEW.pdf..](http://www.spacefoundation.org/sites/default/files/downloads/The_Space_Report_2016_OVERVIEW.pdf..)
- ⁶ Elizabeth Segran, (2016, April 15), "The Next Frontier for Ambitious Entrepreneurs: Space," *Fast Company*. Accessed February 23, 2018, <https://www.fastcompany.com/3058795/the-next-frontier-for-ambitious-entrepreneurs-space>.
- ⁷ Morgan Stanley Research (2016).
- ⁸ The Space Foundation, (2016).; The Space Foundation, (2015), "The Space Report: 2015." Accessed February 23, 2018, [https://www.spacefoundation.org/sites/default/files/downloads/The Space Report 2015 Overview TOC Exhibits.pdf](https://www.spacefoundation.org/sites/default/files/downloads/The_Space_Report_2015_Overview_TOC_Exhibits.pdf).
- ⁹ The Space Foundation, 2016.
- ¹⁰ FAA, (2010), "The Economic Impact of Commercial Space Transportation on the U.S. economy in 2009." Accessed January 10, 2018, https://www.faa.gov/news/updates/media/Economic%20Impact%20Study%20September%202010_20101026_PS.pdf.
- ¹¹ Michael Sheetz, (2018, January 18), "Space companies received \$3.9 billion in private investment during the 'year of commercial launch': Report," *CNBC*. Accessed February 23, 2018, <https://www.cnbc.com/2018/01/18/space-companies-got-3-point-9-billion-in-venture-capital-last-year-report.html>.
- ¹² Bryce, 2017.
- ¹³ (2017, April 4), "The Space Tech Market Map: 57 Startups Charting The Final Frontier," *CB Insights*, <https://www.cbinsights.com/research/space-tech-startups-market-map/>.
- ¹⁴ See, for instance, Google's (now Alphabet) purchase of Terra Bella for \$478 million. Bryce (2017).
- ¹⁵ Bryce, 2017.
- ¹⁶ Bryce, 2017.
- ¹⁷ Virgin, 2016.
- ¹⁸ CB Insights, (2017, April 11), "Space Tech Funding Drops Back to Earth While Deals Push Up," *CB Insights*. Accessed February 1, 2018, <https://www.cbinsights.com/research/space-tech-startup-funding/>.
- ¹⁹ (2016, August 16), "Brave New World's - Space exploration," *The Economist*. Accessed February 1, 2018, <https://www.economist.com/news/leaders/21705825-new-discoveries-intelligent-devices-and-irrepressible-dreamers-are-once-again-making-space>.
- ²⁰ (2018, January 18), "In heaven as it is on Earth: The NewSpace race," *The Economist*. Accessed February 1, 2018, <https://www.economist.com/news/leaders/21735023-events-space-reflect-those-back-home-new-space-race>.
- ²¹ *The Economist*, 2016.

-
- ²² Bill Virgin, (2016, January), "The Next Generation: How Seattle innovators are leading the new race into space," *Seattle Business Magazine*. Accessed February 13, 2018, <http://www.seattlebusinessmag.com/article/space-race-look-sky>.
- ²³ Nick Wingfield, (2016, July 26), "The Silicon Valley of Space Start-Ups? It Could be Seattle," *The New York Times*. Accessed February 20, 2018, <https://www.nytimes.com/2016/08/02/science/seattle-space-flight-innovation-center.html>.
- ²⁴ (2017), "Global Startup Ecosystem Report," *Startup Genome*. Accessed February 18, 2018, <https://startupgenome.com/thank-you-enjoy-reading/>.
- ²⁵ (2017), "Global Startup Ecosystem Report," *Startup Genome*. Accessed February 18, 2018, <https://startupgenome.com/thank-you-enjoy-reading/>.
- ²⁶ See, Francois Chopard, founder of the NewSpace accelerator, Starburst Accelerator, in an interview on Bloomberg Technology, (2016, April 1). Accessed February 23, 2018, <https://www.youtube.com/watch?v=x1xyN9u0ddQ>.
- ²⁷ Bill Virgin (2016).
- ²⁸ US Census Bureau (2018).; (2017), "Global Startup Ecosystem Report," *Startup Genome*. Accessed February 18, 2018, <https://startupgenome.com/thank-you-enjoy-reading/>.
- ²⁹ Josh Lipton and Morgan Bransfield, (2017, March 17). "Silicon Valley techies are fleeing to Seattle," *CNBC*, <https://www.cnbc.com/2017/03/17/silicon-valley-tech-talent-fleeing-to-seattle.html>.
- ³⁰ "Seattle Area Economic Summary," *U.S. Bureau of Labor Statistics*. (2018, February 6). https://www.bls.gov/regions/west/summary/blssummary_seattle.pdf.
- ³¹ "Seattle Area Economic Summary," 2018.; Barbara Byrne Denham and Victor Calanog (2017, October). "Amazon HQ2: Location Decisions and Scoring Analysis," *REIS*, <https://www.reis.com/hubfs/Amazonpercent20HQpercent20percent20Locationpercent20Decisionpercent20andpercent20Scoringpercent20Analysispercent202017.pdf>.
- ³² "Largest Employers in King County," *Economic Development Council & King County*. (2018). <http://www.edc-seaking.org/service/economic-data/economic-basics>.
- ³³ See for instance, "How America's two tech hubs are converging - Silicon Valley North," *The Economist*. (2017, May 11). <https://www.economist.com/news/business/21721950-more-ever-seattle-and-silicon-valley-are-joined-hip-how-americas-two-tech-hubs-are>.
- ³⁴ Nick Wingfield, (2016, January 8). "San Francisco Office Rents Pass Manhattan as Most Expensive in Country," *The New York Times*, <https://bits.blogs.nytimes.com/2016/01/08/san-francisco-office-rents-pass-manhattan-as-most-expensive-in-country/?r=0>.
- ³⁵ Jason Koebler, (2015, June 3), "SpaceX Has Quietly Opened a New Office to Work on Internet-Providing Satellites," *Vice*. Accessed February 23, 2018, https://motherboard.vice.com/en_us/article/xyw3va/spacex-has-quietly-opened-a-new-office-to-work-on-internet-providing-satellites.
- ³⁶ Lipton et al. 2017.
- ³⁷ Lipton et al. 2017.
- ³⁸ Lipton et al. 2017.
- ³⁹ Chopard, 2016.
- ⁴⁰ Preeti Kasireddy, (2017, November 19), "Why I'm Leaving Silicon Valley," *Medium*. Accessed February 23, 2018, <https://medium.com/@preethikasireddy/why-im-leaving-silicon-valley-72919edb3297>.; Kerry Flynn, (2017, December 6), "San Francisco was the obvious choice for tech workers. Not anymore," *Mashable*. Accessed February 23, 2018, <https://mashable.com/2017/12/06/why-they-leave-san-francisco-silicon-valley/#PueBizabQiqG>.
- ⁴¹ Lipton et al. 2017.
- ⁴² (2017), "Global Startup Ecosystem Report," *Startup Genome*. Accessed February 18, 2018, <https://startupgenome.com/thank-you-enjoy-reading/>.
- ⁴³ Virgin, 2016.
- ⁴⁴ Virgin, 2016.
- ⁴⁵ Dominic Gates, (2015, May 30), "Local space entrepreneurs take on the new frontier," *The Seattle Times*. Accessed February 12, 2018, <https://www.seattletimes.com/business/boeing-aerospace/greater-seattle-area-companies-embrace-space-quest/>.

-
- ⁴⁶ (2017), "Global Startup Ecosystem Report," *Startup Genome*. Accessed February 18, 2018, <https://startupgenome.com/thank-you-enjoy-reading/>.
- ⁴⁷ The Space Report (2016).
- ⁴⁸ The Space Report (2016).
- ⁴⁹ The Space Report (2016).
- ⁵⁰ Helen Roxburg, (2017, November 21), "China's Space Industry: Arriving at the Final Frontier," *CKGSB Knowledge*. Accessed February 1, 2018, <http://knowledge.ckgsb.edu.cn/2017/11/21/technology/china-space-industry-final-frontier/>.
- ⁵¹ Juro Osawa, (2015, April 14), "Behind China's Billion-Dollar Startups: Alumni of Alibaba, Tencent," *Wall Street Journal*. Accessed February 1, 2018, <https://www.wsj.com/articles/alibaba-tencent-alumni-fuel-chinas-startup-success-1429028237>.
- ⁵² Elizabeth Segran, (2017, January 1), "Four Out-of-this-world predictions for the space industry in 2017," *Fast Company*. Accessed February 1, 2018, <https://www.fastcompany.com/3066520/four-out-of-this-world-predictions-for-the-space-industry-in-2017>.
- ⁵³ Bloomberg News, (2016, November 28), "China's Secretive Space Program Threaten's NASA's Dominance," *Bloomberg*. Accessed February 2, 2018, <https://www.bloomberg.com/graphics/2016-asia-space-race/china.html>
- ⁵⁴ Bloomberg News, 2016.
- ⁵⁵ (2017, September 17), "Investment in Japan space startups blasting off," *Nikkei Asian Review*. Accessed February 1, 2018, <https://asia.nikkei.com/Business/Trends/Investment-in-Japan-space-startups-blasting-off>.
- ⁵⁶ Atossa Araxia Abrahamian, (2017, September 15), "How a tax haven is leading the race to privatise space," *The Guardian*. Accessed February 1, 2018, <https://www.theguardian.com/news/2017/sep/15/luxembourg-tax-haven-privatise-space>.
- ⁵⁷ Abrahamian (2017); Jeff Foust, (2017, July 17), "Luxembourg adopts space resources law," *Spacenews.com*. Accessed February 1, 2018, <http://spacenews.com/luxembourg-adopts-space-resources-law/>.
- ⁵⁸ Peter B. de Selding, (2016, June 3), "Luxembourg invests to become the 'Silicon Valley of space resource mining'," *Spacenews.com*. Accessed February 1, 2018, <http://spacenews.com/luxembourg-invests-to-become-the-silicon-valley-of-space-resource-mining/>.
- ⁵⁹ Kate Green, (2017, March 30), "Why the United Arab Emirates Is Building a Space Program From Scratch," *Slate*. Accessed February 1, 2018, http://www.slate.com/articles/technology/future_tense/2017/03/why_the_united_arab_emirates_is_building_a_space_program.html.
- ⁶⁰ Michael J. Listner, (2015, may 11), "Op-ed | UAE Moving To Become a Player in Outer Space Activities," *Spacenews.com*. Accessed February 1, 2018,
- ⁶¹ Binsal Abdul Kader, (2015, May 25), "UAE space agency unveils ambitious plans," *Gulf News*. Accessed February 1, 2018, <http://gulfnews.com/news/uae/government/uae-space-agency-unveils-ambitious-plans-1.1521609>.
- ⁶² Green, 2017.
- ⁶³ Green, 2017.
- ⁶⁴ Kate Greene, (2017, March 17), "Why India is investing in Space," *Slate*. Accessed February 2, 2018, http://www.slate.com/articles/technology/future_tense/2017/03/why_india_is_investing_in_space.html.
- ⁶⁵ (2017, February 15), "India launches record 104 satellites in single mission," *BBC News*. Accessed February 1, 2018, <http://www.bbc.com/news/world-asia-india-38977803/>.
- ⁶⁶ Anurag Kotoky, (2016, November 30), "The Cheapest trip to Mars Leaves from this Tiny Indian Island," *Bloomberg*. Accessed February 1, 2018, <https://www.bloomberg.com/graphics/2016-asia-space-race/india.html>.
- ⁶⁷ Patrick May, (2014, February 4), "Silicon Valley startups in forefront of NewSpace race," *The Mercury News*. Accessed February 1, 2018, <https://www.mercurynews.com/2014/02/04/silicon-valley-startups-in-forefront-of-new-space-race/>.
- ⁶⁸ On Silicon Valley history see, Martin Kenney, *Understanding Silicon Valley: The Anatomy of an Entrepreneurial Region*, (2000): Stanford Business Books (Paperback). First Edition.
- ⁶⁹ See Crunchbase.com
- ⁷⁰ Katie Benner, (2017, June 30), "Woman in Tech Speak Frankly About a Culture of Harassment," *The New York Times*. Accessed February 1, 2018, https://www.nytimes.com/2017/06/30/technology/women-entrepreneurs-speak-out-sexual-harassment.html?_r=0.

-
- ⁷¹ Wayne Sutton, (2017, July 13), "The Future Epicenter of Startups Won't Be Silicon Valley," *New America Weekly*. Accessed February 1, 2018, <https://www.newamerica.org/weekly/edition-171/future-epicenter-startups-wont-be-silicon-valley/>.
- ⁷² Valentina Zarya, (2017, March 13), "Venture Capital's Funding Gender Gap Is Actually Getting Worse," *Fortune*. Accessed February 1, 2018, <http://fortune.com/2017/03/13/female-founders-venture-capital/>; Kaya Thomas, (2015, July 25), "Dear Investors, Fund More Underrepresented Founders in Tech," *TechCrunch*. Accessed February 1, 2018, <https://techcrunch.com/2015/07/27/dear-investors-fund-more-underrepresented-founders-in-tech/>.
- ⁷³ Sutton, 2017.
- ⁷⁴ Davey Alba, (2016, October 2), "It's Embarrassing How Few Black Female Founders Get Funded," *WIRED*. Accessed February 1, 2018, <https://www.wired.com/2016/02/its-embarrassing-how-few-black-female-founders-get-funded/>.
- ⁷⁵ Jesse Dunietz, (2017, August 18), "Floating Treasure: Space Law Needs to Catch Up with Asteroid Mining," *Scientific American*. Accessed February 14, 2018, <https://www.scientificamerican.com/article/floating-treasure-space-law-needs-to-catch-up-with-asteroid-mining/>.
- ⁷⁶ United Nations: Office for Outer Space Affairs, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies. Accessed January 24, 2018. <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html>
- ⁷⁷ "Handbook for New Actors in Space," (February 2017), 1st ed, E-book, *The Secure World Foundation*. Accessed February 28, 2018. https://swfound.org/media/205710/handbook_for_new_actors_in_space_2017_web2.pdf
- ⁷⁸ James Rathz. (2015, December 31), "Law Provides New Regulatory Framework for Space Commerce," *The Regulatory Review*. Accessed February 12, 2018, <https://www.theregview.org/2015/12/31/rathz-space-commerce-regulation/>
- ⁷⁹ (2013, June 1), "Stuck to the ground by red-tape," *The Economist*. Accessed February 1, 2018, <https://www.economist.com/news/technology-quarterly/21578517-space-technology-dozens-firms-want-commercialise-space-various-ways>
- ⁸⁰ United Nations: Office for Outer Space Affairs. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies. Accessed January 24, 2018. <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html>
- ⁸¹ (2013, June 1), "Stuck to the Ground by Red-Tape," *The Economist*. Accessed February 1, 2018, <https://www.economist.com/news/technology-quarterly/21578517-space-technology-dozens-firms-want-commercialise-space-various-ways>.
- ⁸² Paula L. Geisz, (2010, April 29), "U.S. Export Control Laws and Regulations," *NASA*. Accessed January 29, 2018. https://www.nasa.gov/pdf/457653main_PI2_Export_geisz.pdf.
- ⁸³ (2017, January 10), "New Rules Refine Satellite export Controls," *Office of Space Commerce*. Accessed February 1, 2018. <http://www.space.commerce.gov/new-rules-refine-satellite-export-controls/>
- ⁸⁴ Matthew Gravatar, (2016, March 3), "Impact of Export Control Reform on Small Businesses," *Defense Trade Law*. Accessed January 29, 2018. <https://defensetradelaw.com/2016/03/03/impact-of-export-control-reform-on-small-businesses/>
- ⁸⁵ Jason Koebler, (2017, February 9), "Why Space Companies Are Untouched by Trump's Travel Ban," *Vice: Motherboard*. Accessed January 24, 2018 https://motherboard.vice.com/en_us/article/ae45b5/why-space-companies-are-untouched-by-trumps-travel-ban
- ⁸⁶ Koebler, 2017.
- ⁸⁷ Jack Crosbie, (2016, September 28), "Elon Musk Explains Why SpaceX Only Hires Americans," *Inverse: Life in Space*. Accessed January 29, 2018, <https://www.inverse.com/article/21487-elon-musk-spacex-foreign-workers>
- ⁸⁸ Douglas Burdett, (2017), "Top 100 Aerospace Companies -- 2017," *Artillery Marketing*. Accessed February 12, 2018, <https://www.artillerymarketing.com/fs/top-100-aerospace-companies-2017>.
- ⁸⁹ Brad Smith and Jon Fine, (2016, July 14), "How Boeing has helped Washington state thrive," *The Seattle Times*. Accessed February 11, 2018, <https://www.seattletimes.com/opinion/how-boeing-has-helped-washington-state-thrive/>.
- ⁹⁰ Sam Howe Verhovek, (2010, October 2), "The Tale of Boeing's High-risk Flight into the Jet Age," *The Seattle Times*. Accessed February 12, 2018, <https://www.seattletimes.com/pacific-nw-magazine/the-tale-of-boeings-high-risk-flight-into-the-jet-age/>.
- ⁹¹ Verhovek, 2010.

-
- ⁹² (2018), "Boeing - General Information: Employment Data," *Boeing.com*. Accessed February 14, 2018, <http://www.boeing.com/company/general-info/#/employment-data>.
- ⁹³ Jim Kershner, (2015, September 8), "Boeing and Washington's Aerospace Industry, 1934-2015," *History Link.org*. Accessed February 19, 2018, <http://www.historylink.org/File/11111>.
- ⁹⁴ (2017), "Boeing in Washington 2017 Impact Report," *Boeing.com*. Accessed February 23, 2018, http://www.boeing.com/Boeing_in_Washington2017_Impact_Report/index.html#/4/.
- ⁹⁵ (2016, October), "Washington state Aerospace Economic Impacts 2016 Update," *Washington state Department of Commerce*. Accessed February 12, 2018, <http://www.commerce.wa.gov/wp-content/uploads/2016/11/Aerospace-Impact-Update-2016.pdf>.
- ⁹⁶ Chelsea Yates, (2016, July 5), "A Riveting Combination: The UW and Boeing Advance Research Together Through BARC," *UW College of Engineering*. Accessed February 18, 2018, <https://www.engr.washington.edu/news/barc>.
- ⁹⁷ Yates, 2016.
- ⁹⁸ Deborah Feldman, (2016, September 21), "Boeing Awards \$6 Million in Grants to Support Education in Washington," *Boeing.com*. Accessed February 14, 2018, <http://www.boeing.com/company/about-bca/washington/education-in-washington-09-16-16.page>.
- ⁹⁹ Smith and Fine, 2016.
- ¹⁰⁰ (2010), "Microsoft Has 'Ripple' Effect on Washington state Economy," *Microsoft.com*. Accessed February 14, 2018, <https://news.microsoft.com/2010/04/09/microsoft-has-ripple-effect-on-washington-state-economy/>.
- ¹⁰¹ (2017), "Facts About Microsoft: Revenue and Headcount," *Microsoft.com*. Accessed February 12, 2018, <https://news.microsoft.com/facts-about-microsoft/#RevenueHeadcount>.
- ¹⁰² "Facts About Microsoft: Revenue and Data," 2017.; (2015), "Economic Basics King County: Largest Employers in King County," *Economic Development Council*. Accessed February 17, 2018, <http://www.edc-seaking.org/service/economic-data/economic-basics>.
- ¹⁰³ Theo Eicher, (2010, March), "The Microsoft Economic Impact Study," Accessed February 17, 2018, richardsdavis.typepad.com/files/ms-impact_public.pdf.
- ¹⁰⁴ Sarah Kessler, (2010, September 23), "Life After Microsoft: 15 Startups Founded by Ex-employees," *Mashable*. Accessed February 18, 2018, <https://mashable.com/2010/09/23/microsoft-employee-startups/#nGXfU.Rs95qA>;
- (2018), "Company: Management," *Seattle Avionics Company*. Accessed February 18, 2018, <https://www.seattleavionics.com/Management.aspx>.
- ¹⁰⁵ Alan Boyle, (2017, November 8), "'New Space Age' Gathering Sets the Stage for Commercial Spaceflight's Big Year," *Geekwire*. Accessed January 29, 2018, <https://www.geekwire.com/2017/new-space-age-gathering-sets-stage-commercial-spaceflights-big-year/>.
- ¹⁰⁶ (2009, October 21), "Washington Technology Industry Association." *History Link*. Accessed January 22, 2018, <http://www.historylink.org/File/9190>.
- ¹⁰⁷ Alan Boyle, (2017, November 10), "Why data analytics is becoming the next frontier for the commercial space industry," *GeekWire*. Accessed February 2, 2018, <https://www.geekwire.com/2017/data-analytics-becoming-next-frontier-commercial-space-industry/>.
- ¹⁰⁸ Mike Wall, (2017, April 10), "SpaceX Rocket Could Be 100-Percent Reusable by 2018, Elon Musk Says," *Space.com*. Accessed February 26, 2018, <https://www.space.com/36412-spacex-completely-reusable-rocket-elon-musk.html>.
- ¹⁰⁹ Tim Fernholz, (2017, March 29), "Reusable rockets could disrupt the space industry, and not always in a good way," *Quartz*. Accessed February 26, 2018, <https://qz.com/944145/reusable-rockets-could-disrupt-the-space-industry-and-not-always-in-a-good-way/>.
- ¹¹⁰ (2017, July 11), "Small satellites driving space industry growth: report," *Reuters*. Accessed February 3, 2018, <https://www.reuters.com/article/us-space-satellites/small-satellites-driving-space-industry-growth-report-idUSKBN19W2LR>.
- ¹¹¹ (2016, November 22). "Big data a big market for small satellites." *SpaceNews*. Accessed February 3, 2018, <http://spacenews.com/big-data-a-big-market-for-small-satellites/>.
- ¹¹² Matthew Richard Crook, (2009, June), "NPS CUBESAT LAUNCHER DESIGN, PROCESS AND REQUIREMENTS". Accessed February 12, 2018, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.736.9674&rep=rep1&type=pdf>.

-
- ¹¹³ Ashlee Vance, (2017, June 29), "The Tiny Satellites Ushering in the New Space Revolution," *Bloomberg News*. Accessed February 23, 2018, <https://www.bloomberg.com/news/features/2017-06-29/the-tiny-satellites-ushering-in-the-new-space-revolution>.
- ¹¹⁴ (2018), "Data Science in Biotechnology," *Master's in Data Science*. Accessed February 3, 2018, <http://www.mastersindatascience.org/industry/biotech/>; Lisa Arthur, (2013, August 15), "What Is Big Data?," *Forbes*. Accessed February 3, 2018, <https://www.forbes.com/sites/lisaarthur/2013/08/15/what-is-big-data/#5c5559455c85>.
- ¹¹⁵ (2018), "Machine Learning What it is and why it matters," SAS. Accessed February 3, 2018, https://www.sas.com/en_us/insights/analytics/machine-learning.html#.
- ¹¹⁶ Virgin, 2016.
- ¹¹⁷ Nell Greenfieldboyce, (2007, April 13), "Space Tethers: Slinging Objects in Orbit?," *NPR*. Accessed February 23, 2018, <https://www.npr.org/templates/story/story.php?storyId=9574513>.
- ¹¹⁸ Evan I. Schwartz, (2010, May 24), "The Looming Space Junk Crisis: It's Time to Take Out the Trash," *WIRED*. Accessed February 26, 2018, https://www.wired.com/2010/05/ff_space_junk/.
- ¹¹⁹ Greenfieldboyce, 2007.
- ¹²⁰ Greenfieldboyce, 2007.
- ¹²¹ Greenfieldboyce, 2007.
- ¹²² Greenfieldboyce, 2007.
- ¹²³ Tethers Unlimited Website, "TethersUnlimited - News," *tethersunlimited.com*. Accessed February 18, 2018, <http://www.tethers.com/News.html>.
- ¹²⁴ GovTribe, "Tethers Unlimited, Inc. Bothell WA," *govtribe.com*. Accessed February 17, 2018, <https://govtribe.com/vendor/tethers-unlimited-inc-bothell-wa>.
- ¹²⁵ Alan Boyle, (2017, December 7), "Tethers Unlimited wins NASA grant to work on future FabLab for 3-D printing in space," *GeekWire*. Accessed February 26, 2018, <https://www.geekwire.com/2017/tethers-unlimited-fablab-3d-printing/>.
- ¹²⁶ Christopher Mims, (2012-04-18), "Are Ross Perot Jr. and Google's Founders Launching a New Asteroid Mining Operation?" *Technology Review*. Accessed February 28, 2018, <https://www.technologyreview.com/s/427624/are-ross-perot-jr-and-googles-founders-launching-a-new-asteroid-mining-operation/>.
- ¹²⁷ Jonathan Shiber, (2018, January 12), "Larry Page-backed asteroid mining company launches CubeSat with experimental water detection tech," *Techcrunch.com*, Accessed February 11, 2018, <https://techcrunch.com/2018/01/12/larry-page-backed-asteroid-mining-company-launches-cube-sat-with-experimental-water-detection-tech/>.
- ¹²⁸ Jim Edwards, (2017, April 6), "Goldman Sachs: space-mining for platinum is 'more realistic than perceived'," *Business Insider*. Accessed February 23, 2018, <http://www.businessinsider.com/goldman-sachs-space-mining-asteroid-platinum-2017-4>.
- ¹²⁹ Shiber, 2018.
- ¹³⁰ Adam Mann, (2012, April 23), "Tech Billionaires Plan Audacious Mission to Mine Asteroids," *WIRED*. Accessed February 23, 2018, <https://www.wired.com/2012/04/planetary-resources-asteroid-mining/>.
- ¹³¹ Mann, 2012.
- ¹³² Andrew Liptak, (2017, June 17), "Planetary Resources is pulling the plug on its Earth observatory satellite network," *The Verge*. Accessed February 23, 2018, <https://www.theverge.com/2017/6/17/15823988/planetary-resources-ending-earth-observatory-system-ceres>.
- ¹³³ Alex Knapp, (2012, April 27), "How Billionaire Asteroid Miners Make Money -- Without Mining Asteroids," *Forbes*. Accessed February 23, 2018, <https://www.forbes.com/sites/alexknapp/2012/04/27/how-billionaire-asteroid-miners-make-money-without-mining-asteroids/#253e42df14e0>.
- ¹³⁴ Ian Yamamoto, (2012, April 30) "Asteroid Mining Company Planetary Resources Is Already Making Money." *Mic*, Mic Network Inc., Accessed Feb 13 2018. <https://mic.com/articles/7718/asteroid-mining-company-planetary-resources-is-already-making-money#.g3rLHQ6u>.
- ¹³⁵ Yamamoto, 2012.
- ¹³⁶ Knapp, 2012.

-
- ¹³⁷ Ashlee Vance, (2017, June 29), "The Tiny Satellites Ushering in the New Space Revolution," *Bloomberg News*. Accessed February 23, 2018, <https://www.bloomberg.com/news/features/2017-06-29/the-tiny-satellites-ushering-in-the-new-space-revolution>.
- ¹³⁸ Alaina G. Levine, (2016, July 11) "Looking to Space as an Asteroid miner," *Sciencemag.org*. Accessed February, 12, 2018. <http://www.sciencemag.org/careers/2016/07/looking-space-asteroid-miner>.
- ¹³⁹ Chris Taylor (2012, April 2) "The \$20 Trillion Rok Could Turn a Startup Into Earth's Richest Company" *Mashable.Com*, Accessed Feb 12 2018. https://mashable.com/2012/04/26/planetary-resources-asteroid-mining-trillions/#Q_hUjPDRGq2.
- ¹⁴⁰ Spaceflight Industries, (2017), "Spaceflight Industries is a next-generation space company enabling access to space and redefining global intelligence" Accessed Feb 12 2018. <https://www.spaceflightindustries.com/about/>.
- ¹⁴¹ Press Release, (2012, June 11), "Spaceflight Inc. and SpaceX Sign Secondary Payload Deal". SpaceRef. Accessed February 12, 2018, <http://spaceref.biz/2012/06/spaceflight-inc-and-spacex-sign-secondary-payload-deal.html>.
- ¹⁴² James Risley, (2015, July 13). "Spaceflight Industries inks partnerships to improve its 'cellphone network for space'", *GeekWire*, Accessed Feb 11 2018. <https://www.geekwire.com/2015/spaceflight-industries-inks-partnerships-to-improve-its-cellphone-network-for-space/>.
- ¹⁴³ Spaceflight Industries, "Spaceflight Industries - About," *spaceflight.com*. Accessed February 23, 2018, <http://spaceflight.com/>.
- ¹⁴⁴ Spaceflight Industries, "Spaceflight Industries - About," *spaceflight.com*. Accessed February 23, 2018, <http://spaceflight.com/>.
- ¹⁴⁵ Spaceflight Industries, "News" <http://spaceflight.com/spaceflight-industries-wins-puget-sound-business-journal-innovation-award/>.
- ¹⁴⁶ Alan Boyle, (2017, August 29), "Spaceflight's BlackSky wins \$16.4M Air Force contract for geospatial data platform", *GeekWire.com*. Accessed Feb 14 2018. <https://www.geekwire.com/2017/spaceflights-blacksky-wins-16-4m-air-force-contract-provide-geospatial-data-platform/>.
- ¹⁴⁷ "BlackSky Global", *Crunchbase*, <https://www.crunchbase.com/organization/blacksky-global>; Alan Boyle, (2017, April 5), "Spaceflight Industries unveils BlackSky Spectra for multispectral stellite imaging", *GeekWire*. Accessed February 26 2018. <https://www.geekwire.com/2017/spaceflight-blacksky-spectra-satellite/>
- ¹⁴⁸ Alan Boyle, (2017, August 29), "Spaceflight's BlackSky wins \$16.4M Air Force contract for geospatial data platform", *GeekWire.com*. Accessed Feb 14 2018. <https://www.geekwire.com/2017/spaceflights-blacksky-wins-16-4m-air-force-contract-provide-geospatial-data-platform/>.
- ¹⁴⁹ Alan Boyle, (2017, August 29), "Spaceflight's BlackSky wins \$16.4M Air Force contract for geospatial data platform", *GeekWire.com*. Accessed February 14 2018. <https://www.geekwire.com/2017/spaceflights-blacksky-wins-16-4m-air-force-contract-provide-geospatial-data-platform/>.
- ¹⁵⁰ (2016, April 28), "BlackSky Inks Partnership with United Nations to Enhance Global Decision-Making", *BlackSky*. Accessed February 26 2018. <https://www.blacksky.com/2016/04/28/blacksky-inks-partnership-with-united-nations-to-enhance-global-decision-making/>
- ¹⁵¹ Alan Boyle, (2016, December 29), "Syria crisis tests BlackSky Satellite data Portal", *cosmiclog.com* Accessed Feb 21 2018. <https://cosmiclog.com/2016/12/14/syria-crisis-tests-blacksky-satellite-data-portal/>.
- ¹⁵² Dave Mosher, (2017, May 2), "Jeff Bezos has job openings for nearly 100 people at Blue Origin --here's who his rocket company is hiring", *Business Insider*. Accessed February 14 2018. <http://www.businessinsider.com/open-positions-blue-origin-2017-5>.
- ¹⁵³ Alan Boyle, (2017 September 7), "Jeff Bezos' Blue Origin makes its pitch to Congress for delivering cargo to the moon", *GeekWire*. Accessed February 26 2018. <https://www.geekwire.com/2017/jeff-bezos-blue-origin-makes-pitch-congress-delivering-cargo-moon/amp/>
- ¹⁵⁴ Darrell Etherington, (2017, December 13), "Blue Origin flies its Crew Capsule 2.0 for the first time", *Techcrunch.com*, Accessed February 14, 2018,

<https://techcrunch.com/2017/12/13/blue-origin-flies-its-crew-capsule-2-0-for-the-first-time/>.

¹⁵⁵ Chris Gebhardt, (2017, November 10), "Blue Origin remains on course for 2020 debut of New Glenn heavy lift rocket", *NASA Spaceflight*. Accessed February 28, 2018.

<https://www.nasaspaceflight.com/2017/11/blue-origin-2020-debut-new-glenn-rocket/>

¹⁵⁶ Bryce, 2017.

¹⁵⁷ The Tauri Group, 2016.

¹⁵⁸ Samantha Masunaga, (2016, July 26). "Angels sending money into space." *Los Angeles Times*.

<http://www.providencejournal.com/news/20160714/angels-sending-money-into-space>. Accessed February 13, 2017.

¹⁵⁹ Masunaga, 2016.

¹⁶⁰ Sarah Cruddas, (2015, August 11). "Rocketing prices: the investors eyeing the riches of space." *BBC News*.

Retrieved February 13, 2018. <http://www.bbc.com/future/story/20150810-rocketing-prices-the-investors-eyeing-the-riches-of-space>.

¹⁶¹ "Space Angels Network | Crunchbase." www.crunchbase.com. Retrieved February 13, 2018.

https://www.crunchbase.com/organization/space-angels/investments/investments_list.

¹⁶² Masunaga, 2016.

¹⁶³ Masunaga, 2016.

¹⁶⁴ (2016, June 29). "The Space Economy - Space Angels Network." *Space Angels*. Retrieved February 13, 2017.

<https://www.spaceangels.com/post/the-space-economy>.

¹⁶⁵ (2016, June 29). "The Space Economy - Space Angels Network."

¹⁶⁶ Mark Boucher, (2016, March 4). "Coalition of 13 Space Organizations Release Space Policy White Paper." *NASA Wah*. Retrieved February 13, 2018. <http://nasawatch.com/archives/2016/03/coalition-of-13.html>.

¹⁶⁷

¹⁶⁸ Lee Moriwaki, "Business - Paul Allen To Move Headquarters Of Vulcan Northwest Downtown - Seattle Times Newspaper," *The Seattle Times*. Accessed February 23, 2018,

<http://community.seattletimes.nwsourc.com/archive/?date=19980313&slug=2739413>.

¹⁶⁹ Todd Bishop, (2013, April 1), "Paul Allen's Vulcan Capital expanding to Silicon Valley". *geekwire.com*. Accessed February 23, 2018, <http://www.geekwire.com/2013/paul-allens-vulcan-capital-expanding-silicon-valley/>.

¹⁷⁰ Julie Johnsson, (2015, April 13), "Paul Allen Wants Path to Space to Start on World's Biggest Plane," *Bloomberg*. Accessed February 27, 2018, <https://www.bloomberg.com/news/articles/2015-04-13/paul-allen-wants-path-to-space-to-start-on-world-s-biggest-plane>.

¹⁷¹ Vulcan Capital, Company Profile - *Bloomberg*. *Bloomberg.com*, Bloomberg, Accessed Feb 12 2018.

<https://www.bloomberg.com/profiles/companies/270128Z:US-vulcan-capital>.

¹⁷² Paul Allen, (2011), "Idea Man: A Memoir by the Cofounder of Microsoft," *Penguin Group*. USA.

¹⁷³ Eric Berger, (2017, May 31), "Paul Allen showed off his new rocket-launching plane today, and it's BIG," *Ars Technica*. Accessed February 23, 2018, <https://arstechnica.com/science/2017/05/paul-allen-showed-off-his-new-rocket-launching-plane-today-it-is-big/>.

¹⁷⁴ Emily Parkhurst, (2016, January 20), "Seattle one of top 10 best educated cities," *Puget Sound Business Journal*. Accessed February 18, 2018, <https://www.bizjournals.com/seattle/blog/techflash/2016/01/seattle-one-of-top-10-most-educated-cities.html>

¹⁷⁵ Kim Vu, (2016), "Washington state's STEM Pipeline in Broken. Here's How to Fix It," *Seattle Business Mag*. Accessed February 18, 2018, <http://www.seattlebusinessmag.com/business-corners/washington-states-stem-pipeline-broken-heres-how-fix-it>

¹⁷⁶ (2016), "A highly skilled, motivated workforce," *Washington state Department of Commerce*. Accessed February 18, 2018, <http://choosewashingtonstate.com/why-washington/our-strengths/highly-skilled-workforce/>

¹⁷⁷ (2016), "A highly skilled, motivated workforce," *Washington state Department of Commerce*. Accessed February 18, 2018, <http://choosewashingtonstate.com/why-washington/our-strengths/highly-skilled-workforce/>

¹⁷⁸ Microsoft Philanthropies, (2017, December 6), "Technical skills training can address the jobs gap in Washington," *Seattle Times*, Accessed February 18, 2018. <https://www.seattletimes.com/sponsored/technical-skills-training-can-address-the-jobs-gap-in-washington/>

¹⁷⁹ Mark Nowlin, (2017, April 12), "UW will let freshmen apply to engineering school in 2018," *Seattle Times*. Accessed February 18, 2018. <https://www.seattletimes.com/education-lab/uw-will-let-freshmen-apply-to-engineering-school-in-2018/>

-
- ¹⁸⁰ Kim Vu, (2016), "Washington state's STEM Pipeline in Broken. Here's How to Fix It," *Seattle Business Mag*. Accessed February 18, 2018. <http://www.seattlebusinessmag.com/business-corners/washington-states-stem-pipeline-broken-heres-how-fix-it>
- ¹⁸¹ Microsoft Philanthropies, (2017, December 8), "Higher education struggling to catch up to tech workforce demand," *Seattle Times*. Accessed February 18, 2018. <https://www.seattletimes.com/sponsored/higher-education-struggling-to-catch-up-to-tech-workforce-demand/>
- ¹⁸² Kim Vu, (2016), "Washington state's STEM Pipeline in Broken. Here's How to Fix It," *Seattle Business Mag*. Accessed February 18, 2018. <http://www.seattlebusinessmag.com/business-corners/washington-states-stem-pipeline-broken-heres-how-fix-it>
- ¹⁸³ (2017, December), "Market Overview: Real Estate," *Zillow.com*. Accessed February 18, 2018. <https://files.zillowstatic.com/research/public/realestate/ZHVI.Seattle.395078.pdf>
- ¹⁸⁴ Mike Rosenburg, (2017, September 26), "Seattle home price growth is nearly double any other U.S. city", *SeattleTimes.com*. Accessed February 13 2018. <https://www.seattletimes.com/business/real-estate/seattle-home-price-growth-is-nearly-double-any-other-u-s-city/>
- ¹⁸⁵ (2017, December), "Market Overview: Real Estate," *Zillow.com*, <https://files.zillowstatic.com/research/public/realestate/ZHVI.Seattle.395078.pdf>
- ¹⁸⁶ (2017, June 20), "Results of SurveyUSA Election Poll #23565," *SurveyUSA.com*. Accessed February 18, 2018. <https://assets.documentcloud.org/documents/3870797/Survey-Results-on-Seattle-Mayoral-Candidates.pdf>
- ¹⁸⁷ Mike Rosenburg, (2017, October 5), "As Seattle-area home prices soar, some would-be buyers are now giving up," *SeattleTimes.com*. Accessed Feb 13 2018. <https://www.seattletimes.com/business/real-estate/as-seattle-area-home-prices-soar-some-would-be-buyers-now-giving-up/>
- ¹⁸⁸ Balk, Gene, (2017, May 25), "Seattle once again nation's fastest growing big city; population exceeds 700,000," *Seattle Times*. Accessed February 18, 2018. <https://www.seattletimes.com/seattle-news/data/seattle-once-again-nations-fastest-growing-big-city-population-exceeds-700000/>
- ¹⁸⁹ Lloyd, Sarah Anne, (2017, October 26), "What states are bringing the most new Seattle-area residents?" *Curbed.com*. Accessed February 18, 2018. <https://seattle.curbed.com/2017/10/26/16554852/seattle-out-of-state-residents-move>
- ¹⁹⁰ Morgan Brasfield, (2017, March 17), "Silicon Valley techies are fleeing to Seattle," *CNBC.com*. Accessed February 18, 2018. <https://www.cnb.com/2017/03/17/silicon-valley-tech-talent-fleeing-to-seattle.html>
- ¹⁹¹ (2018), "San Francisco Home Prices & Values," *Zillow.com*. Accessed February 18, 2018. <https://www.zillow.com/san-francisco-ca/home-values/>
- ¹⁹² Kurt Schlosser, (2017, May 30), "Big demand, little supply: Seattle's hot housing market gets hotter with highest price gains in U.S." *Geekwire.com*. Accessed February 18, 2018. <https://www.geekwire.com/2017/big-demand-little-supply-seattles-hot-housing-market-gets-hotter-highest-price-gains-u-s/>
- ¹⁹³ Mike Rosenburg, (2017, January 5), "Seattle-area home pickings slimmer than ever: high demand, limited supply," *Seattle Times*. Accessed February 18, 2018. <https://www.seattletimes.com/business/real-estate/seattle-area-home-price-gains-slow-a-tad-but-new-low-in-houses-for-sale-is-bad-sign-for-2017/>
- ¹⁹⁴ Mike Rosenburg, (2017, July 20), "Downtown Seattle's construction boom surges to new record, with no end in sight," *Seattle Times*. Accessed February 18, 2018. <https://www.seattletimes.com/business/real-estate/downtown-seattles-construction-boom-surges-to-new-record-with-no-end-in-sight/>
- ¹⁹⁵ Mike Rosenburg, (2017, December 6), "\$500,000 for a 1-bedroom: Condo shortage worse than ever in King County," *Seattle Times*. Accessed February 18, 2018. <https://www.seattletimes.com/business/real-estate/500000-for-a-1-bedroom-condo-shortage-worse-than-ever-in-king-county/>
- ¹⁹⁶ Blanca Torres, (2016, April 30), "Seattle condos: Short supply puts extra squeeze on housing market," *Seattle Times*. Accessed February 18, 2018. <https://www.seattletimes.com/business/economy/condo-conundrum-dealing-with-shortage-might-ease-pressures-on-all-homebuyers/>
- ¹⁹⁷ Charles Mudede, (2017, April 20), "Hot Money and Seattle's Growing Housing Crisis: Part One," *TheStranger.com*. Accessed February 18, 2018. <https://www.thestranger.com/slog/2016/08/08/24442014/hot-money-and-seattles-growing-housing-crisis-part-one>
- ¹⁹⁸ Charles Mudede, (2017, April 20), "Hot Money and Seattle's Growing Housing Crisis: Part One," *TheStranger.com*. Accessed February 18, 2018. <https://www.thestranger.com/slog/2016/08/08/24442014/hot-money-and-seattles-growing-housing-crisis-part-one>

-
- ¹⁹⁹ Mike Rosenburg, (2017, July 20), "Downtown Seattle's construction boom surges to new record, with no end in sight," *Seattle Times*. Accessed February 18, 2018. <https://www.seattletimes.com/business/real-estate/downtown-seattles-construction-boom-surges-to-new-record-with-no-end-in-sight/>
- ²⁰⁰ City of Seattle, (2017), "Implementing Mandatory Housing Affordability (MHA) Citywide," City of Seattle. Accessed February 18, 2018. http://www.seattle.gov/Documents/Departments/HALA/Policy/How_MHA_Works.pdf.
- ²⁰¹ Nour Malas, (February 7, 2018), "Tech Wealth Turns Attention to Affordable Housing in Seattle," *WSJ.com*, <https://www.wsj.com/articles/tech-wealth-turns-attention-to-affordable-housing-in-seattle-1518015600>
- ²⁰² The City of Bellevue, (2016), "Bellevue Comprehensive Plan," The City of Redmond. Accessed February 26, 2018. <https://user-ashnxej.cld.bz/Bellevue-Comprehensive-Plan-2015-Volume-1/84>.
- ²⁰³ The City of Redmond, (September 2012), "Redmond 2030," The City of Redmond. Accessed February 26, 2018. <https://cld.bz/fCYgSht#110>.
- ²⁰⁴ KING Staff, (2017, May 25), "Seattle's population growth leads nation: Report." *K5News*. Accessed February 5 2018. <http://www.king5.com/article/news/local/seattle/seattles-population-growth-leads-nation-report/281-442879395>
- ²⁰⁵ Mike Lindblom, (2017, February 21) "Seattle Is a World-Class City — for Traffic Congestion" *The Seattle Times* Accessed February 5 2018. <https://www.seattletimes.com/seattle-news/transportation/seattle-is-a-world-class-city-for-traffic-congestion/>
- ²⁰⁶ Jessica Lee, (2017, July 12), "Study: Here's How Many Hours Seattle Drivers Spend Looking for Parking" *The Seattle Times* Accessed February 5 2018. <https://www.seattletimes.com/seattle-news/transportation/study-heres-how-many-hours-seattle-drivers-spend-looking-for-parking/>
- ²⁰⁷ Census Bureau, (2015), Accessed February 12 2018. https://datausa.io/profile/geo/seattle-wa/#mode_transport
- ²⁰⁸ Anthony Downs, (2004, January 1) "Traffic: Why It's Getting Worse, What Government Can Do." *Brookings* Accessed February 6 2018. <https://www.brookings.edu/research/traffic-why-its-getting-worse-what-government-can-do/>
- ²⁰⁹ Railway Technology, Accessed February 12 2018. <https://www.railway-technology.com/projects/central-link-seattle/>
- ²¹⁰ Mike Lindblom, (2017, January 18), "Sound Transit's cost overruns for first phase hit about 86 percent", *The Seattle Times*, Accessed February 12 2018. <https://www.seattletimes.com/seattle-news/transportation/sound-transits-cost-overruns-for-first-phase-hit-about-86-percent/>
- ²¹¹ Mike Lindblom, "If you think Seattle traffic is bad now, just wait until these projects start", *The Seattle Times*, Accessed February 12 2018. <https://projects.seattletimes.com/2018/one-center-city/>
- ²¹² "Regional Transit Taxes", *Sound Transit*, Accessed February 12 2018. <https://www.soundtransit.org/About-Sound-Transit/Taxing-district>
- ²¹³ David Gutman (2018, February 1) "Republicans in Olympia continue their push to cut Sound Transit car-tab taxes", *The Seattle Times*, Accessed February 12 2018. <https://www.seattletimes.com/seattle-news/transportation/republicans-in-olympia-continue-their-push-to-cut-sound-transit-car-tab-taxes/>
- ²¹⁴ Anthony Downs, (2004, January 1), "Traffic: Why It's Getting Worse, What Government Can Do," *Brookings*. Accessed February 6, 2018, <https://www.brookings.edu/research/traffic-why-its-getting-worse-what-government-can-do/>
- ²¹⁵ Tax Foundation, (2017) "2018 State Business Tax Climate Index." Accessed February 3 2018.
- ²¹⁶ Arthur B. Laffer et al., (2015) *Rich states, poor states*, 8th ed. Accessed February 3 2018.
- ²¹⁷ Arthur B. Laffer et al., (2015) *Rich states, poor states*, 8th ed. Accessed February 3 2018.
- ²¹⁸ Laffer Associates, U.S. Census Bureau, Bureau of Labor Statistics and Bureau of Economic Analysis, Accessed February 3 2018.
- ²¹⁹ Washington (state), House. Committee on Technology & Economic Development, *An act relating to reinstating tax preference for certain high-technology research and development (HB 1894): Report (to Accompany SB 5630)*. Accessed February 4 2018.

-
- ²²⁰ Bob Heller, (2015, April), "Washington's High-Tech R&D Credit." *Seattle Business*, Accessed February 4 2018. <http://www.seattlebusinessmag.com/article/washingtonpercent25E2percent2580percent2599s-high-tech-rd-credit>
- ²²¹ Washington state Dep. of Revenue, (2013, December), "High Tech Study: Analysis of High Technology Programs" Accessed February 4 2018.
- ²²² Washington (state), House. Committee on Technology & Economic Development, *An act relating to reinstating tax preference for certain high-technology research and development (HB 1894): Report (to Accompany SB 5630)*. Accessed February 3 2018.
- ²²³ "Business & Occupation Tax", *Washington Department of Revenue*. Accessed February 3 2018. <https://dor.wa.gov/find-taxes-rates/business-occupation-tax>
- ²²⁴ Washington (State), House. Committee on Technology & Economic Development, *An act relating to extending specific aerospace tax preferences to include spacecrafts to encourage the migration of good wage jobs in the state (HB 2226): Report*. Accessed February 3 2018.
- ²²⁵ Washington (State), House. Committee on Technology & Economic Development, *An act relating to extending specific aerospace tax preferences to include spacecrafts to encourage the migration of good wage jobs in the state (HB 2226): Report*. Accessed February 3 2018.
- ²²⁶ "Analysis of Defense and Space Incentives", (2015, December) *Office of Economic & Demographic Research*. Accessed February 4 2018.
- ²²⁷ "Analysis of Defense and Space Incentives", (2015, December) *Office of Economic & Demographic Research*. Accessed February 3 2018.
- ²²⁸ "State Support for Commercial Space Activities", *Federal Aviation Administration*. Accessed February 2 2018.
- ²²⁹ "Analysis of Defense and Space Incentives", (2015, Dec.) *Office of Economic & Demographic Research*
- ²³⁰ "Analysis of Defense and Space Incentives", (2015, Dec.) *Office of Economic & Demographic Research*
- ²³¹ Donna Morris, (2015, August 10), "Helping Our Employees Care for Their Families," *Adobe News*. Accessed February 16, 2018, <http://blogs.adobe.com/conversations/2015/08/donna-morris-enhanced-leave.html>.
- ²³² Julie Kashen, (2015, November 10), "Tech Companies Are Leading the Way on Paid Family Leave," *The Century Foundation*. Accessed February 17, 2018, <https://tcf.org/content/report/tech-companies-paid-leave/>.
- ²³³ Letter from Business School Professors to Congress, September 15, 2015. Accessed February 15, 2018, <http://worklife.wharton.upenn.edu/wp-content/uploads/2012/11/Final-Business-School-Professors-Letter-to-Congress-in-Support-of-the-FAMILY-Act-September-15-2015.pdf>.
- ²³⁴ Jorge Dan Lopez, (2014, May 14), "US, Papua New Guinea, Oman are only nations without paid maternity leave—UN," *Reuters*. Accessed February 18, 2018, <https://www.rt.com/usa/158776-paid-maternity-leave-usa/>. "Key characteristics of parental leave systems," OECD Family database, August 17, 2015, Accessed February 19, 2018, http://www.oecd.org/els/soc/PF2_1_Parental_leave_systems.pdf.
- ²³⁵ "Family and Medical Leave in 2012: Executive Summary," Abt Associates prepared for the U.S. Department of Labor, September 7, 2012; updated September 13, 2013, Accessed February 18, 2018, <http://www.dol.gov/asp/evaluation/fmla/FMLA-2012-Executive-Summary.pdf>.
- ²³⁶ "Family and Medical Leave in 2012: Executive Summary," Abt Associates prepared for the U.S. Department of Labor, September 7, 2012; updated September 13, 2013, Accessed February 18, 2018, <http://www.dol.gov/asp/evaluation/fmla/FMLA-2012-Executive-Summary.pdf>.
- ²³⁷ "Family and Medical Leave in 2012: Executive Summary," Abt Associates prepared for the U.S. Department of Labor, September 7, 2012; updated September 13, 2013, Accessed February 18, 2018, <http://www.dol.gov/asp/evaluation/fmla/FMLA-2012-Executive-Summary.pdf>.
- ²³⁸ "Family and Medical Leave in 2012: Executive Summary," Abt Associates prepared for the U.S. Department of Labor, September 7, 2012; updated September 13, 2013, Accessed February 18, 2018, <http://www.dol.gov/asp/evaluation/fmla/FMLA-2012-Executive-Summary.pdf>.
- ²³⁹ "The Family and Medical Leave Act at 22: 200 Million Reasons to Celebrate and Move Forward," National Partnership for Women & Families, February 2015, <http://www.nationalpartnership.org/research-library/work-family/fmla/the-family-and-medical-leave-at-22.pdf>.
- ²⁴⁰ (2004), "Two in Five Low-Wage Working Parents Receive No Paid Leave," *Urban Institute*. Accessed February 14, 2018, <http://www.urban.org/publications/900701.html>.
- ²⁴¹ Sharon Lerner, (2015, August 18), "The Real War on Families: Why the U.S. Needs Paid Leave Now," *In These Times*. Accessed February 12, 2018, <http://inthesetimes.com/article/18151/the-real-war-on-families>.

-
- ²⁴² (2015), "Children Benefit When Parents Have Access to Paid Leave," *National Partnership for Women & Families*. Accessed February 18, 2018, <http://www.nationalpartnership.org/research-library/work-family/paid-leave/children-benefit-when-parents.pdf>.
- ²⁴³ (2015, September 4), "The Cost of Doing Nothing: The Price We All Pay without Paid Leave Policies to Support America's 21st Century Working Families," *U.S. Department of Labor*. Accessed February 18, 2018, <https://www.dol.gov/featured/paidleave/cost-of-doing-nothing-summary.pdf>.
- ²⁴⁴ Sharon Lerner, (2005, August 18), "The Real War on Families: Why the U.S. Needs Paid Leave Now," *In These Times*. Accessed February 17, 2018. <http://inthesetimes.com/article/18151/the-real-war-on-families>.
- ²⁴⁵ Jessica Shortall, (2015, November 4), "The American Case for Paid Maternity Leave," *TEDxSMU*, <https://www.youtube.com/watch?v=SJyE40koQyA&list=PLsRNoUx8w3rMwPgmKexZdkPVW0BNk733A&index=1>.
- ²⁴⁶ Sarah Jane Glynn, (June 2014), "Breadwinning Mothers, Then and Now," *Center for American Progress*. Accessed February 18, 2018. <https://cdn.americanprogress.org/wp-content/uploads/2014/06/Glynn-Breadwinners-report-FINAL.pdf>.
- ²⁴⁷ Mike Cassidy, (2015, July 27), "How You Can Make More by Working Less," *The Century Foundation*. Accessed February 18, 2018, <http://www.tcf.org/blog/detail/how-you-can-make-more-by-working-less>.
- ²⁴⁸ Carly Fiorina, (2015, August 13), "The Status Quo Isn't Working for Women in America," *Huffington Post*, http://www.huffingtonpost.com/carly-fiorina/the-status-quo-isnt-working-for-women-in-america_b_7983718.html?ir=Politics&utm_hp_ref=politics.
- ²⁴⁹ (2015), "Paid Leave Works in California, New Jersey and Rhode Island," *National Partnership for Women & Families*. Accessed February 16, 2018, <http://www.nationalpartnership.org/research-library/work-family/paid-leave/paid-leave-works-in-california-new-jersey-and-rhode-island.pdf>.
- ²⁵⁰ Kenneth Matos, (2015), "Modern Families: Same- and different-sex couples negotiating at home," *Families and Work Institute*. Accessed February 16, 2018, <http://www.familiesandwork.org/downloads/modern-families.pdf>.
- ²⁵¹ (2018), "LGBT Data and Demographics: Washington," *The Williams Institute*. Accessed February 15, 2018, <https://williamsinstitute.law.ucla.edu/visualization/lgbt-stats/?topic=LGBT&area=53#density>.
- ²⁵² Heidi Groover, (2017, July 5), "What the New State Paid Family Leave Plan Means for Seattle," *The Stranger*. Accessed February 17, 2018, <https://www.thestranger.com/slog/2017/07/05/25262374/what-the-new-state-paid-family-leave-plan-means-for-seattle>.
- ²⁵³ Claudia Rowe, (2017, July 6), "Washington's new family-leave law is among the most generous in the nation," *The Seattle Times*. Accessed February 18, 2018, <https://www.seattletimes.com/seattle-news/politics/washingtons-new-family-leave-law-is-among-the-most-generous-in-the-nation/>.
- ²⁵⁴ Claudia Rowe, (2017, July 6), "Washington's new family-leave law is among the most generous in the nation," *The Seattle Times*. Accessed February 18, 2018, <https://www.seattletimes.com/seattle-news/politics/washingtons-new-family-leave-law-is-among-the-most-generous-in-the-nation/>.
- ²⁵⁵ Laura Turczanski, Paula Simon, Gillian Murphy, and Angela Vogel, (2017, October 15), "Update on Washington state Paid Sick Leave, Effective January 1, 2018," *Davis Wright Tremaine LLP*. Accessed February 18, 2018, <https://www.dwt.com/New-Details-on-Washington-State-Paid-Sick-Live-Effective-January-1-2018-10-24-2017/>.
- ²⁵⁶ Dana Liebelson, (2013, May 23), "Can Facebook and Reddit Fix America's Maternity Leave Problem?" *Mother Jones*. Accessed February 18, 2018, <http://www.motherjones.com/politics/2013/05/silicon-valley-maternity-leave-paternity-leave>.
- ²⁵⁷ Julie Kashen, (2015, November 10), "Tech Companies Are Leading the Way on Paid Family Leave," *The Century Foundation*. Accessed February 17, 2018, <https://tcf.org/content/report/tech-companies-paid-leave/>.
- ²⁵⁸ The Associated Press, (2017, June 30), "Family-leave measure passed by Washington state legislature," *The Seattle Times*. Accessed February 18, 2018, <https://www.seattletimes.com/seattle-news/politics/washington-legislature-passes-paid-family-leave-measure/>.
- ²⁵⁹ (2014), "The Diversity Gap in Silicon Valley," *Lee and Low Books*. Accessed, February 18, 2018, <http://blog.leeandlow.com/2015/03/12/the-diversity-gap-in-silicon-valley/>.
- ²⁶⁰ (2014), "The Diversity Gap in Silicon Valley," *Lee and Low Books*. Accessed, February 18, 2018, <http://blog.leeandlow.com/2015/03/12/the-diversity-gap-in-silicon-valley/>.
- ²⁶¹ Jessica Guynn, (2017, October 3), "Silicon Valley's race gap is getting worse, not better, new research shows", *USA Today*. Accessed, February 23, 2018, <https://www.usatoday.com/story/tech/news/2017/10/03/diversity-and-silicon-valley-race-not-gender-gap-gets-worse/727240001/>

-
- ²⁶² Julie Snider, (2014, June 26), "Lack of Diversity could undercut Silicon Valley", *USA Today*. Accessed, February 22, 2018, <https://www.usatoday.com/story/tech/2014/06/26/silicon-valley-tech-diversity-white-asian-black-hispanic-google-facebook-yahoo/11372421/>
- ²⁶³ Clare Mcgrane, (2017, October 15), "The pipeline' isn't causing tech's diversity problem: The workplace is, and here 3 ways to fix it", *The Geek Wire*. Accessed, February 11 2018, <https://www.geekwire.com/2017/pipeline-isnt-causing-techs-diversity-problem-workplace-heres-3-ways-fix/>
- ²⁶⁴ Sarah Kulin, Jessica Rohman,(2017, January 17), " Why Diversity and Innovation Play a Role in Becoming a Great Tech Company", *Fortune*. Accessed January 17 2018, <http://fortune.com/2017/01/17/best-tech-workplaces-innovation-diversity/>
- ²⁶⁵ Rocio Lorenzo and Martin Reeves, (2018, January 30), "How and Where Diversity Drives Financial Performance," *Harvard Business Review*. Accessed, February 1, 2018, <https://hbr.org/2018/01/how-and-where-diversity-drives-financial-performance?autocomplete=true>.
- ²⁶⁶
- ²⁶⁷ Mike Pena, (2016, November 23), "Ignoring Diversity Hurts Tech Products and Ventures," *Ecorner Stanford University*. Accessed, February 26 2018, <https://ecorner.stanford.edu/article/ignoring-diversity-hurts-tech-products-and-ventures/>
- ²⁶⁸ Farah Manjoo, (2014, September 26), "The Business Case for Diversity in the Tech Industry", *The New York Times*. Accessed, February 26 2018, <https://bits.blogs.nytimes.com/2014/09/26/the-business-case-for-diversity-in-the-tech-industry/>
- ²⁶⁹ Farah Manjoo, (2014, September 26), "The Business Case for Diversity in the Tech Industry," *The New York Times*. Accessed, February 26 2018, <https://bits.blogs.nytimes.com/2014/09/26/the-business-case-for-diversity-in-the-tech-industry/>
- ²⁷⁰ Rob Price, (2017, March 12), " Mark Zuckerberg: 'I dont think its a secret' the tech sector has 'an issue with diversity', *The Business Insider*. Accessed, February 26 2018, <http://www.businessinsider.com/facebook-mark-zuckerberg-tech-industry-diversity-issue-2017-3>
- ²⁷¹ Maxine Williams, (2017, August 2), "Facebook Diversity Update: Building a More, Diverse, Inclusive Workforce". *Facebook Newsroom*. Accessed, February 26 2018, <https://newsroom.fb.com/news/2017/08/facebook-diversity-update-building-a-more-diverse-inclusive-workforce/>
- ²⁷² Sarah Kulin, Jessica Rohman,(2017, January 17), " Why Diversity and Innovation Play a Role in Becoming a Great Tech Company", *Fortune*. Accessed, February 22 2018, <http://fortune.com/2017/01/17/best-tech-workplaces-innovation-diversity/>
- ²⁷³ Emily Parkhurst, (2014, August 14), "How do Seattle's tech company demographics compare to Silicon Valley? A bit older and just as white," *Puget Sound Business Journal*. Accessed, February 19 2018, <https://www.bizjournals.com/seattle/blog/techflash/2014/08/how-do-seattles-tech-company-demographics-compare.html>
- ²⁷⁴ Emily Parkhurst, (2014, August 14), "How do Seattle's tech company demographics compare to Silicon Valley? A bit older and just as white," *Puget Sound Business Journal*. Accessed, February 19 2018, <https://www.bizjournals.com/seattle/blog/techflash/2014/08/how-do-seattles-tech-company-demographics-compare.html>
- ²⁷⁵ Anne Seckinger, (2014, August 15), "Why Is Seattle Not Like Silicon Valley", *Crunch Network*. Accessed February 19 2018, <https://techcrunch.com/2014/08/15/why-seattle-is-not-like-silicon-valley/>
- ²⁷⁶ Matt Day, (2016, November 21), "College's computer science diversity a lesson for tech firms", *The Seattle Times*. Accessed, February 19 2018, <https://www.seattletimes.com/business/technology/colleges-computer-science-diversity-a-lesson-for-tech-firms/>
- ²⁷⁷ Nat Levy, (2017, July 18)," Look out, Bay Area: Seattle rises to 2nd best tech city in the U.S, passing Washington D.C", *The Geek Wire*. Accessed, February 18 2018, <https://www.geekwire.com/2017/look-bay-area-seattle-rises-2nd-best-tech-city-u-s-passing-washington-d-c/>
- ²⁷⁸Alaska Aerospace, *Comprehensive Launch Capabilities*. Accessed January 29, 2018. <http://akaerospace.com/comprehensive-launch-capabilities>.

-
- ²⁷⁹ Michael Sheetz, (2017, September 13), The spaceport industry is booming in every corner of the US, from Alaska to Virginia, *CNBC*. Accessed January 24, 2018. <https://www.cnbc.com/2017/09/13/the-spaceport-industry-is-booming-in-every-corner-of-the-us.html?view=story&percent24DEVICEpercent24=native-android-mobile>
- ²⁸⁰ Post of Moses Lake: Aeronautics. Accessed January 29, 2018. <http://www.portofmoseslake.com/aeronautics/#1477951474319-ad390a9f-8614>
- ²⁸¹ Port of Moses Lake: Aeronautics. Accessed January 29, 2018. <http://www.portofmoseslake.com/aeronautics/#1477951474319-ad390a9f-8614>
- ²⁸² "Data Center," *Grant County Economic Development Council*. Accessed January 29, 2018. <http://www.grantedc.com/grant-county-key-industries/data-centers>
- ²⁸³ Patricia Hynes, (2014, September 8) "Commentary: So You Want to Build a Spaceport," *SpaceNews*. Accessed February 21, 2018.
- ²⁸⁴ "Why is it Better to Launch a Spaceship from Near the Equator," *Northwestern University: Navigation*. Accessed January 29, 2018. <http://www.qrg.northwestern.edu/projects/vss/docs/navigation/2-why-launch-from-equator.html>
- ²⁸⁵ "State Support for Commercial Space Activities," *Federal Aviation Administration*, Accessed January 24, 2018. https://www.faa.gov/about/office_org/headquarters_offices/ast/media/Statepercent20Supportpercent20forpercent20Commercialpercent20Spacepercent20Activities.pdf
- ²⁸⁶ "Frequently Asked Questions," Alaska Aerospace. Accessed January 29, 2018. <http://akaerospace.com/frequently-asked-questions>
- ²⁸⁷ Jeanne Lang Jones, (2017, September), "The Evolution of the Seattle Startup Scene," *Seattle Business Magazine*. Accessed February 2018, <http://seattlebusinessmag.com/business-operations/evolution-seattle-startup-scene>.
- ²⁸⁸ Richard Florida and Karen M. King, (2016, February 22), "Spiky Venture Capital: The Geography of Venture Capital Investment by Metro and Zip Code," *Martin Prosperity Institute*. Accessed February 14, 2018 <http://martinprosperity.org/content/spiky-venture-capital/>; Richard Florida, (2016, January 26), "The Rise of Global City Startups," *City Lab*. Accessed February 14, 2018 <https://www.citylab.com/life/2016/01/the-rise-of-global-startup-cities/426780/>.
- ²⁸⁹ Ed Lazowska, (2013), "STEM Education in Washington: the Facts of the Matter," *UW*. Accessed February 17, 2018, lazowska.cs.washington.edu/STEM.pdf.
- ²⁹⁰ Lazowska, 2013.
- ²⁹¹ Michelle Ranken, (2016, December 12), "Why Tech Companies Aren't Hiring More Local Grads," *Crosscut*. Accessed February 2, 2018, <http://crosscut.com/2016/12/why-tech-companies-arent-hiring-more-local-grads/>.
- ²⁹² Katherine Long, (2017, February 19), "Students Frustrated Trying to get into UW's Strict Engineering Program," *Seattle Times*. Accessed February 22, 2018, <https://www.seattletimes.com/seattle-news/education/students-frustrated-trying-to-get-into-uws-strict-engineering-program/>.
- ²⁹³ Dave Wallace et al., (2015, February), "Aerospace Manufacturing Skills: Supply, Demand, and Outcomes for Washington's Aerospace Training Programs 2014 Annual Report," *Washington Workforce Training Board and State Board for Community and Technical Colleges*. Accessed February 18, 2018, <http://wtb.wa.gov/Documents/AerospaceManufacturingSkills2014.pdf>.
- ²⁹⁴ (2016, January 10), "STEM Education Report Card," *Washington state Achievement Council*. Accessed February 18, 2018, <http://www.wsac.wa.gov/sites/default/files/2016.01.10.STEM.report.cardpdf.pdf>.
- ²⁹⁵ "STEM Education Report Card," 2016.
- ²⁹⁶ "STEM Education Report Card," 2016.
- ²⁹⁷ Taylor Soper, (2016, March 22), "Study: Traffic in Seattle still horrible, ranks 2nd-worst in U.S. for evening rush hour congestion," *GeekWire*. Accessed February 20, 2018, <https://www.geekwire.com/2016/study-traffic-seattle-still-horrible-ranks-2nd-worst-u-s-evening-rush-hour-congestion/>.
- ²⁹⁸ Anthony Downs, (2004, Jan.,1) "Traffic: Why It's Getting Worse, What Government Can Do." *Brookings* <https://www.brookings.edu/research/traffic-why-its-getting-worse-what-government-can-do/>
- ²⁹⁹ Census Bureau, (2015), https://datausa.io/profile/geo/seattle-wa/#mode_transport
- ³⁰⁰ Hayat Norimine, (2017 February), "With Seattle's Housing Crisis, Could Inaction be the Best Action?" *Seattle Met*. Accessed February 14, 2018, <https://www.seattlemet.com/articles/2017/10/18/with-seattles-housing-crisis-could-inaction-be-the-best-action>.

-
- ³⁰¹ (2015, May 26), "Silicon Valley Exodus is Real, Even Techies Can't Afford the Bay Area Anymore," *CBS BayArea*. Accessed February 14, 2018, <http://sanfrancisco.cbslocal.com/2015/05/26/silicon-valley-exodus-is-real-even-techies-cant-afford-the-bay-area-anymore/>.
- ³⁰² Clare Mcgrane, (2017, October 15), "The pipeline' isn't causing tech's diversity problem: The workplace is, and here 3 ways to fix it," *The Geek Wire*. Accessed, February 11 2018, <https://www.geekwire.com/2017/pipeline-isnt-causing-techs-diversity-problem-workplace-heres-3-ways-fix/>;
- Sheelah Kolhatkar, (2017, November 20), "The Tech Industry's Gender-Discrimination Problem," *The New Yorker*. Accessed, January 25 2018, <https://www.newyorker.com/magazine/2017/11/20/the-tech-industrys-gender-discrimination-problem>
- ³⁰³ Rachel Emma Silverman, (2015, November 2), "Joining Tech Rivals, Amazon Adds Paternity Leave, More Paid Time Off for Mothers," *Wall Street Journal*. Accessed February 20, 2018, <http://www.wsj.com/articles/joining-tech-rivals-amazon-adds-paternity-leave-more-paid-time-off-for-mothers-1446503585?alg=y&cb=logged0.15335040958598256>.
- ³⁰⁴ Kathleen Hogan, (2015, August 5), "The employee experience at Microsoft: Aligning benefits to our culture," *The Official Microsoft Blog*. Accessed February 20, 2018, <https://blogs.microsoft.com/blog/2015/08/05/the-employee-experience-at-microsoft-aligning-benefits-to-our-culture/>.; Rachel Lerman, (2017, October 20), "Washington state's new parental leave law could change workplace for moms — and dads," *The Seattle Times*. Accessed February 20, 2018, <https://www.seattletimes.com/business/encouraging-fathers-to-take-parental-leave-could-give-women-a-boost-in-the-workplace/>.; Rachel Emma Silverman, (2015, November 2), "Joining Tech Rivals, Amazon Adds Paternity Leave, More Paid Time Off for Mothers," *Wall Street Journal*.
- ³⁰⁵ Kathleen Hogan, (2015, August 5), "The employee experience at Microsoft: Aligning benefits to our culture," *The Official Microsoft Blog*.
- ³⁰⁶ Rachel Lerman, (2017, October 20), "Washington state's new parental leave law could change workplace for moms — and dads," *The Seattle Times*.
- ³⁰⁷ Rachel Lerman, (2017, October 20), "Washington state's new parental leave law could change workplace for moms — and dads," *The Seattle Times*.
- ³⁰⁸ Rachel Lerman, (2017, October 20), "Washington state's new parental leave law could change workplace for moms — and dads," *The Seattle Times*.
- ³⁰⁹ Susan Wojcicki, (2014, December 16), "Paid Maternity Leave is Good for Business," *Wall Street Journal*. Accessed February 20, 2018, <http://www.wsj.com/articles/susan-wojcicki-paid-maternity-leave-is-good-for-business-1418773756?alg=y>.
- ³¹⁰ Eileen Appelbaum and Ruth Milkman, (2011), "Leaves that Pay: Employer and Worker Experiences with Paid Family Leave in California," *Center for Economic Policy Research*. Accessed February 20, 2018, <http://www.cepr.net/documents/publications/paid-family-leave-1-2011.pdf>.
- ³¹¹ Asees Sing, (2014, May 1), "The Lost Startup Benefit: Paid Maternity Leave," *Thunder Blog*. Accessed February 20, 2018, <https://www.makethunder.com/blog/maternity-leave-benefit/>.
- ³¹² Asees Sing, (2014, May 1), "The Lost Startup Benefit: Paid Maternity Leave," *Thunder Blog*. Accessed February 20, 2018, <https://www.makethunder.com/blog/maternity-leave-benefit/>.
- ³¹³ John Cook, (2016, March 18), "Company builders wanted: Can you find any Seattle investors on this list of the top 100 venture capitalists?" *GeekWire*. Accessed February 20, 2018, <https://www.geekwire.com/2016/company-builders-wanted-can-find-seattle-investors-list-top-100-venture-capitalists/>.; John Cook, (2013, October 22), "Contrarian view: Entrepreneurs say lack of capital in Seattle is actually a healthy thing," *GeekWire*. Accessed February 20, 2018, <https://www.geekwire.com/2013/contrarian-view-entrepreneurs-lack-capital-seattle-good/>.
- ³¹⁴ Neal Ungerleider, (2018, January 23), "How To Launch a Space Startup," *Fast Company*. Accessed February 23, 2018, <https://www.fastcompany.com/40507858/space-startups-record-investment-rocket-labs-interorbital-phase-four>.
- ³¹⁵ Aime Williams, (2017, March 17), "Space: The final frontier for investors," *The Financial Times*. Accessed February 14, 2018. <https://www.ft.com/content/05f24014-07e1-11e7-97d1-5e720a26771b>.
- ³¹⁶ Jon Talton, (2012, April 30), "What would it take to become the Silicon Valley of Space," *The Seattle Times*. Accessed February 18, 2018. <https://www.seattletimes.com/business/economy/what-would-it-take-to-become-the-silicon-valley-of-space/>.; (2017), "The 2017 Global Startups Ecosystem Report," *Startup Genome*. Accessed February 18, 2018, <https://startupgenome.com/thank-you-enjoy-reading/>.; Taylor Soper, (2016, June 7), "Venture

capitalist Fred Wilson calls Seattle a ‘third-tier’ startup city,” *GeekWire*. Accessed February 18, 2018, <https://www.geekwire.com/2016/venture-capitalist-fred-wilson-calls-seattle-third-tier-startup-city/>.

³¹⁷ John Cook, (2013, October 10), “VC deal activity hits highest mark since dot-com boom,” *GeekWire*. Accessed February 18, 2018, <https://www.geekwire.com/2013/vc-deal-activity-hits-highest-market-dotcom-boom-days/>.

³¹⁸ Bryce 2016.

³¹⁹ Richard Florida. (2016, January 26), “The Global Cities Where Tech Venture Capital Is Concentrated.” *The Atlantic*. Accessed February 14, 2018. <https://www.theatlantic.com/technology/archive/2016/01/global-startup-cities-venture-capital/429255/>.

³²⁰ Joanna Glasner and Gene Teare. (2016, September 7). “Crunchbase sees rise in average seed round in 2016.” *TechCrunch*. Accessed February 14, 2018. <https://techcrunch.com/2016/09/07/crunchbase-sees-rise-in-average-seed-round-in-2016/>.

³²¹ Geoff Ralston. (2017, January 7). “A Guide to Seed Fundraising.” *blog.ycombinator.com*. Accessed February 14, 2018. <http://blog.ycombinator.com/how-to-raise-a-seed-round/>.

³²² See, for instance, Starburst Accelerator, starburst.aero.

³²³ See for instance, Lubna Hamdan. (2018, February 11). “UAE Launches \$545k fund to support space research.” *arabianBusiness.com*. Accessed February 14, 2018. <http://www.arabianbusiness.com/technology/389590-uae-launches-545k-fund-to-support-space-research>.

³²⁴ Tony Romm, (2015, November 6), “Bezos space startups boosts D.C. Game,” *Politico*. Accessed February 18, 2018. <https://www.politico.com/story/2015/11/bezos-space-startup-boosts-dc-game-215596>.

³²⁵ Port of Moses Lake: Aeronautics. Accessed January 29, 2018.

<http://www.portofmoseslake.com/aeronautics/#1477951474319-ad390a9f-8614>

³²⁶ (2017 November) “Labor Force and Industry Employment.” *Port of Moses Lake: Employment Security Department*. Accessed Feb 20 2017. <http://www.portofmoseslake.com/economic-dashboard/labor-market/>

³²⁷³²⁷ Amanda Robert, (June 13, 2017), “States Bet on Spaceports, Future Economic Benefits,” *Forbes.com*. Accessed February 28, 2018. <https://www.forbes.com/sites/legalnewsline/2017/06/13/states-bet-on-spaceports-future-economic-benefits/#5dc57db51639>