

THE GATEWAY TO SPACE

Seattle has a big stake in the new
space era's satellite race

BY BILL CONROY





THE NEXT FRONTIER.

The new space race is focused on deploying multiple satellite constellations to move huge quantities of data, including internet traffic, on a global scale. That will entail the launching of thousands of small satellites into Earth's orbit over the next decade — and Seattle companies are expected to play a major role in that endeavor.

CURT BLAKE, dressed casually in jeans and a button-down shirt, is seated in a conference room in Spaceflight Industries' Seattle headquarters building, which overlooks a serene Lake Union that has taken on the heather-gray hue of the sky above. Blake pauses for a moment as he considers a question about the nature of "new space" and Seattle's role in that expanding business landscape.

"So, there were all these people trying to strike it rich during the [Klondike] Gold Rush more than a century ago, all these miners, and they would come through Seattle and buy clothing, tents, picks and all the things you need to go gold mining, including a ticket to get up north," says Blake, who is the chief executive officer of Spaceflight — a Spaceflight Industries subsidiary that provides rocket-launching, mission-control and payload-ridesharing services to companies around the world.

"That's pretty close to what we do here in Seattle," Blake adds. "There's a bunch of people who want to make a lot of money in space, and we're like the supplier, helping them to get there."

The gold-rush analogy laid out by Blake is not comparing the faraway past to some distant future. The space-age gold rush he describes is playing out right now, and Seattle is squarely in the thick of it.

In today's still-unfolding new space era — defined as an emerging, global private spaceflight industry — we don't yet have colonies on distant satellites like the moon. Rather, space-focused companies across the globe in coming years plan to launch thousands of fast-moving, man-made small satellites into Earth's orbit to serve as relay points for immense streams of data that will feed information-hungry industries and consumers here on our home planet.

For that to work, someone needs to make and launch the satellites, and someone needs to move, manage and analyze the huge quantities of data. That takes aerospace-hardware genius and software-development brilliance. Seattle has both in spades.

Potential uses for small-satellite constellations, or space-belts, are numerous, including Earth observation, geospatial intelligence, communications, navigation, science, weather observation and far more — with many future uses yet to be conceived and brought to market. But what's captured the attention of the big guns in the space business today is the potential for establishing space-based internet service that can provide connectivity across the planet, opening up vast new business and consumer markets, both in the U.S. and abroad, in regions that currently don't have access to reliable, affordable terrestrial internet service.

“We are on the cusp of a global boom in the commercial space sector,” says Josh Brown, executive director of the Puget Sound Regional Council (PSRC), which last year sponsored a detailed study of the Puget Sound region’s space economy. “Companies and people in the [Seattle] region are in a great position to lead. A lot of that growth will be in the booming satellite sector, which is the biggest player in in the overall space economy.”

The greater Seattle area has the “largest concentration of aerospace manufacturing employment of any identified [space-business] competitor region,” according to the PSRC report. “This is true in absolute terms, with employment in the aerospace industry estimated at 88,000 jobs in the region, significantly outpacing other jurisdictions.”

The study reveals that in the Puget Sound region, the space-business sector — a blend of the aerospace and information technology industries — has an estimated \$1.8 billion economic impact and supports some 6,200 jobs. The study lists more than 65 companies in the Puget Sound region that are involved in the space economy as suppliers, manufacturers, service providers or users of space-related goods and services, and that is likely an undercount — given new companies are starting up or moving into the space sector on a regular basis.

Brown says the greater Seattle area’s leadership in the new space era is built on its long-time strengths in software and aerospace. He says many of the future opportunities in the sector will be open to small businesses and startups that manufacture satellites or their components or provide related services — such as satellite-launch and mission-control management, or sophisticated software and data-analytics platforms and applications.

“One of the big reasons why the space sector is so valuable to our overall economy is the relatively higher overall wages [paid to the highly skilled workers],” Brown says. “It’s diversifying our traditional strengths. And it’s also a major talent attractor that adds to our overall innovative strength and competitiveness.”

A MAJOR PLAYER in Seattle’s space-business market and a good example of the nexus between the aerospace and software worlds is Spaceflight Industries. The holding company is the parent of Spaceflight, Seattle-based BlackSky and is a joint-venture partner with Thales Alenia Space (Europe’s largest satellite-maker) in a

startup small-satellite manufacturer based in Tukwila, called LeoStella.

Between 2016 and 2018, Spaceflight, through its rideshare and mission control services, has put into orbit some 133 satellites via 11 launches — with a total of 93 additional satellites via 15 launches slated to be sent into space at various launch sites across four continents in 2019.

BlackSky is developing a 60-satellite Earth-observation constellation that will fly over most of Earth’s major cities dozens of times daily, capturing real-time imaging data that will be combined with live news and social media feeds and sold as a service to organizations seeking to make informed decisions

“SEATTLE HAS A UNIQUE CONFLUENCE OF TALENT FROM THE SOFTWARE INDUSTRY AND FROM AEROSPACE. YOU DON’T OFTEN FIND THAT, SO IT MAKES SENSE TO DESIGN AND BUILD SATELLITES HERE.”

CURT BLAKE, CEO OF SPACEFLIGHT

about global operations and assets. BlackSky by year-end plans to have in orbit eight satellites and more than 16 satellites by the end of next year — making it possible for the constellation to cover 95% of the Earth’s population and provide hourly monitoring services over many sites of interest.

LeoStella has an agreement to manufacture 20 satellites for BlackSky at its 20,000-square-foot expandable manufacturing facility in Tukwila. This past May, LeoStella also inked a deal to manufacture 10 small satellites for a Los Angeles space company called Cloud Constellation Corp., which plans to provide space-based secure data storage for a range of clients.

The Spaceflight Industries affiliates employ a mix of aerospace and software experts and are on the cutting edge of the new space era, which is driven by a rapidly expanding small-satellite market and the big data those orbiting spacecraft can channel to Earth-based companies and consumers.

“Seattle has a unique confluence of talent from the software industry and from aerospace,” Blake says. “You don’t often find that, so it makes sense to design and build satellites here.”

And for those satellite constellations to communicate with Earth-bound clients, the industry also needs what are known as ground stations, which are connected by terrestrial pipelines to the internet and communicate with orbiting satellites. Redmond-based RBC Signals, another emerging player in the Seattle-area’s space-business sector, has tapped into that market, providing satellite ground-station access as a service through a network of some 40 ground-station locations around the world.

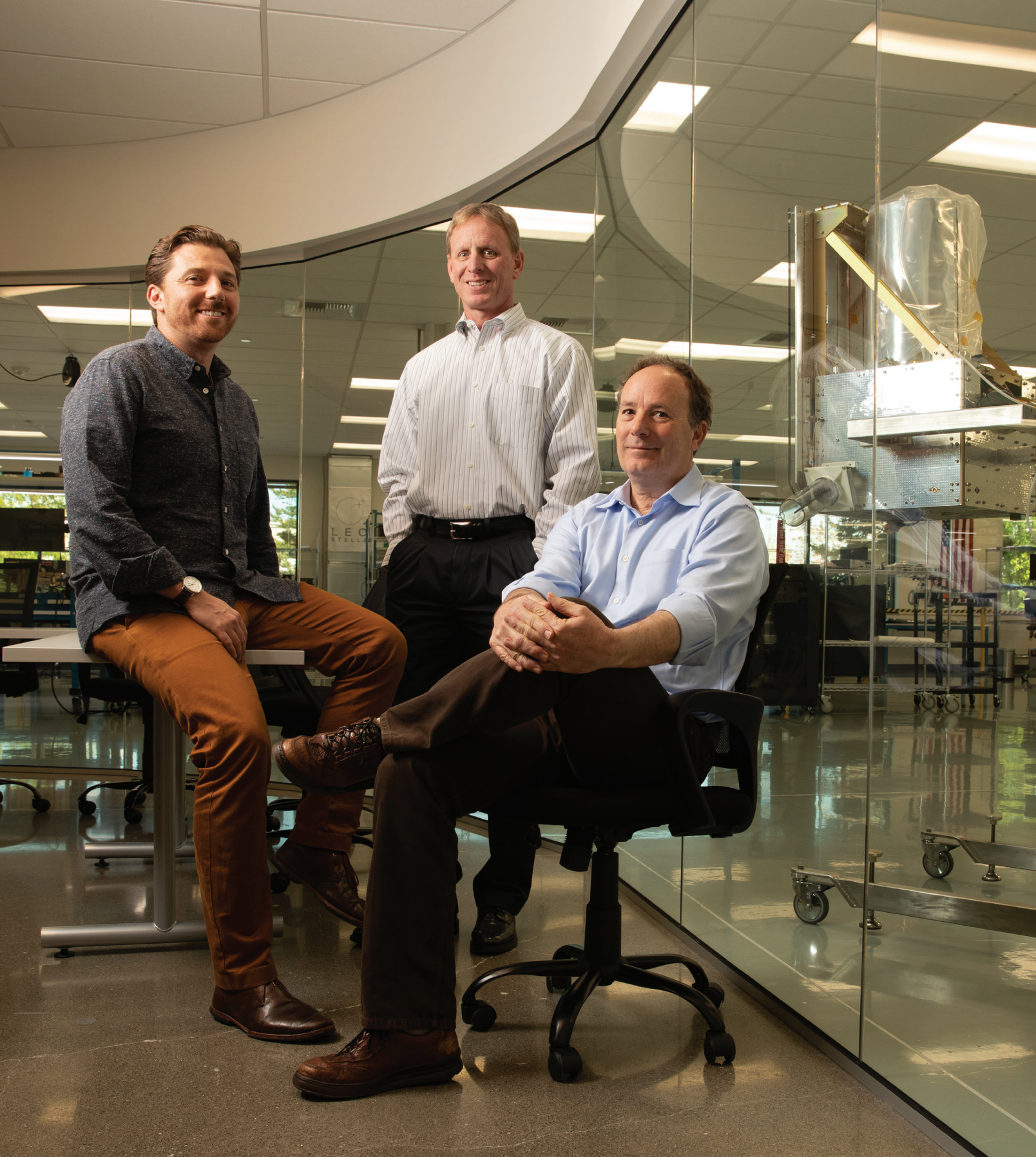
“The value being created in space now is not in the hardware,” says RBC founder and CEO Christopher Richins. “It’s in the data and what you do with it. How do you get that data to the ground, and how do you monetize that data and the services that come from that?”

On the data front, Seattle-based supercomputer-maker Cray Inc. also sees the potential of the space-business market and a role for high-performance computing.

“I’m very familiar with that environment,” says Cray CEO Peter Ungaro. “What you have is a little bit of computing that happens up in the sky [via the satellites] but most of the data has to be pushed back down to Earth, where you have ground-processing stations that take all that data and do analytics and figure out what it all means. That’s where our Cray [supercomputer] systems would come into play.”

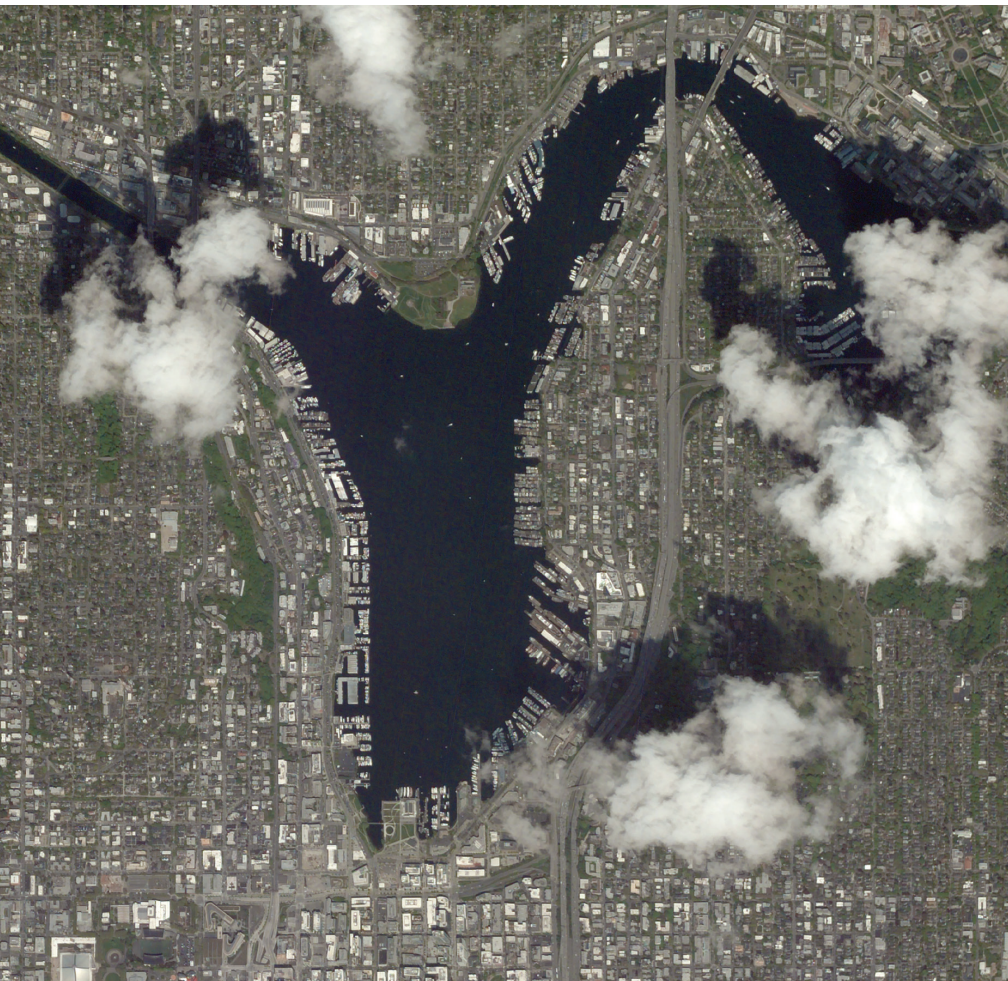
THE LUCRATIVE POTENTIAL of the marriage of data and satellites is illustrated by e-commerce giant Amazon’s plan, announced earlier this year, to launch its own network of some 3,200 small satellites to provide high-speed internet service globally. Separately, the Seattle-based tech behemoth also announced it is partnering with Lockheed Martin to establish a satellite ground-station network.

Amazon top gun Jeff Bezos also is the founder of Blue Origin, a spaceflight-services company based in Kent that expects to have its newest rocket, called the New Glenn,



SATELLITE POWER.

Spaceflight Industries Vice President of Space Operations Nick Merski (left), CEO Mike Hettich of satellite-maker LeoStella (center) and Spaceflight CEO Curt Blake are part of the new space vanguard in Seattle.



NEW SPACE.

A BlackSky satellite captures an image of Seattle from space (left) and a SpaceX Falcon 9 rocket (above) packed with 64 small satellites stands ready to blast off as part of a 2018 rideshare mission managed by Seattle-based Spaceflight.

ready for use by 2021. It includes a reusable first stage that is designed to carry out 25 missions. Blue Origin inked a deal earlier this year with Telesat to launch an unspecified number of satellites using the New Glenn rocket as part of the Canadian company’s plan to create a space-based global-internet service initially involving a constellation of some 117 satellites, according to the Federal Communications Commission.

Telesat is among some nine companies that have received FCC approval during the past two years to launch satellite networks capable of providing high-speed broadband services to users across the U.S., and eventually the planet. Another of those companies is California-based SpaceX, which operates a satellite-development facility in Redmond and plans to put into orbit a space-based internet constellation of up to 12,000 small satellites, called Starlink. SpaceX projected several years ago that the Starlink space-internet service could generate \$30 billion in revenue annually from a potential base of 40 million subscribers

globally once fully operational.

Even aerospace giant Boeing Co. is getting into the small-satellite race, with plans to develop a space-based, satellite-powered internet service. Boeing spokesman Jerry Drelling says the FCC earlier this year placed the Boeing application for authority to launch and operate an initial 147 satellites into the “public notice” phase, adding that “this is a key step toward the eventual grant of Boeing licenses for this system.”

Boeing’s primary satellite operations are based in California, although Boeing’s Space Center in Kent “continues to support Boeing activities related to space-based equipment,” according to the PSRC study.

“Now, we have two planned mega satellite constellations with connections to Seattle [the planned Amazon and SpaceX constellations], as well as the BlackSky constellation,” says Nick Merski, who oversees product development at BlackSky as vice president of space operations for Spaceflight Industries.

Merski adds that a number of compo-

nent manufacturers are located in the Seattle area — such as satellite-parts maker Tethers Unlimited in Bothell and Redmond-based Kymeta Corp., a maker of advanced satellite-communication antennas. “And then,” he says, “you have launch services and rocket-makers” — Seattle-based companies like Spaceflight; Blue Origin; and Stratolaunch Systems Corp., founded by late billionaire and Microsoft co-founder Paul Allen.

“There’s this growing industrial base and owner-operators making the decision to locate here,” Merski says, “so Seattle seems to have all the touchpoints.”

THERE IS A HUGE consumer market for high-speed satellite broadband service that is affordable and global in nature — filling the big gaps in our existing terrestrial internet network. That explains the rush to space to tap into that market. Investors recognize the potential of the expanding satellite market as well. Some \$3 billion of equity capital was invested in

FROM LEFT: COURTESY OF BLACKSKY; COURTESY OF SPACEFLIGHT INDUSTRIES

space companies globally last year, bringing the total since 2009 to \$18 billion, with most of the venture capital funds “focused on satellites and launch,” according to a 2018 year-end report by investment platform Space Angels.

A United Nations report on global internet connectivity indicates that as of year-end 2018, some 51.2% of the world’s population was “using the internet,” meaning nearly half of the world’s population, some 3.7 billion people, are still not online. The digital divide is most pronounced, as might be expected, in the world’s 47 least-developed nations (home to some 880 million people), where 80% of the population doesn’t use the internet.

The U.S. is not immune from the internet-access challenge. In Boeing’s FCC application seeking approval to offer satellite-powered broadband services, the company points out that 39% of rural Americans (23 million people) lack high-speed internet access. In total, some 10% of all Americans, or 34 million people, lack access to high-speed internet, the Boeing application states.

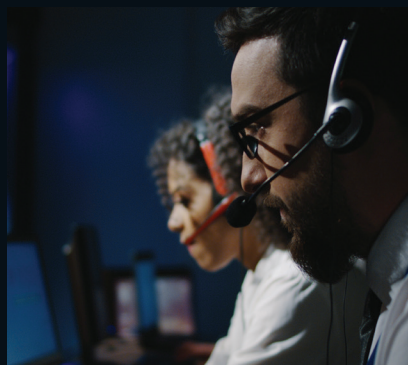
“I imagine Amazon — they’re a public company — that they did the analysis of how customers ordering things throughout the world [via a satellite constellation] increases their [company’s] overall valuation and said, ‘Wow, yeah, we should totally do this,’” Spaceflight’s Blake says.

A recent market study by Morgan Stanley drives the point home further, indicating that “the global space industry could generate revenue of \$1.1 trillion or more by 2040, up from \$350 billion currently.” The study estimates that some \$410 billion of that projected revenue is expected to be linked to internet services. That’s a big pool of forecasted growth.

“Seattle is absolutely a big player in the satellite-constellation business,” says Rhae Adams, vice president of strategy and business development at Seattle-based First Mode — an engineering-services firm that applies deep-space exploration technologies to a variety of industries, both on and off planet Earth. “Once all these ventures play out, you could be creating incumbents [in the industry] that will last for decades.”

Chris Voorhees, president and chief engineer of First Mode who worked previously as a lead engineer for several of NASA’s Mars-rover missions, is a bit measured about the prospects for a space-based internet business model. He says if satellite-powered broadband ends up proving to be a solution that solves a

THE NEW SPACE WAR FOR TALENT



SEATTLE IS A LEADING HUB NATIONALLY for the space-business sector, but it is not alone. Other areas in the U.S. with thriving space-business ecosystems can be found in California, Colorado, Arizona, Texas, Alabama, Florida and the Washington, D.C./Virginia area.

These regional space-business hubs are not competing for business so much as talent, however, according to area experts. Chris Voorhees, president of local space-business firm First Mode, says it makes sense that Seattle, and Washington state in general, want to develop a “strong and vibrant space community” from a regional economic standpoint.

“But from the standpoint of those participating in the space-business sector, it’s decidedly always been parts from many, many places coming together, both nationally and internationally,” he says. “Here in the Puget Sound area, for example, we have LeoStella, [Seattle-based Spaceflight Industries’] venture with [European satellite-maker] Thales Alenia Space. That’s bringing Europe and the states together for mutually beneficial purposes.”

The competition for highly skilled workers, whether it’s on the aerospace or technology side of the business, does exist, but it can be as intense, or more so, within regions as it is between regions, industry observers point out.

“There’s a talent war going on. Yes,” says LeoStella Chief Executive Officer Mike Hettich.

Adds Curt Blake, CEO of Spaceflight Industries’ rideshare and rocket-launch subsidiary Spaceflight:

“On the satellite side, there’s a lot of facilities in San Francisco. There’s also an increasing number here [in Seattle], but we have the wage and cost advantage, which might be fleeting, but for now we do.”

A report by the Puget Sound Regional Council (PSRC) points out, however, that the demand for skilled labor by aerospace and technology companies within the greater Seattle area is intense and “may restrict the ability for newer [space-business] firms to access the workers they need.” Adding to the competition for workers is the so-called “silver tsunami” of retiring baby boomers, which is depleting the ranks of the area’s existing skilled labor force, particularly in the aerospace field.

One of the most effective fixes for this regional labor-shortage issue, according to the report, is robust local training and education programs.

“Although larger [space-business] companies such as SpaceX and Blue Origin may have the ability to draw on a national labor pool, many startups and suppliers often rely on local labor to meet their needs,” the PSRC report states. “Providing for a greater availability of skilled labor locally can be an effective strategy in supporting startups and suppliers.”



BOLD VENTURE.

Chris Voorhees (left), president of Seattle-based engineering and space-technology firm First Mode, and the company's vice president of strategy and business development, Rhae Adams, both see the unfolding satellite race as a bold business venture.

problem for people on Earth, “then that’s the thing that’s going to take off.”

“Right now, there’s this soup of new tools — lower-cost satellite platforms, lower-cost access to space and multiple paths to get there,” he adds. “But can you make money with this soup. That’s the experiment, the really big one, right?”

THE RACE TO PUT a space-based internet service in place to reach the huge untapped consumer market is still very much in its infancy, with the various companies pursuing that goal just now beginning the process of building and launching the initial satellites. SpaceX, for example, only this past May launched the first 60 satellites in its planned 12,000-satellite Starlink space-belt. The small satellites in the various planned broadband constellations are, for the most part, destined for lower Earth orbit, or LEO, which ranges from 100 to

1,200 miles above the Earth — where the dishwasher-size-and-smaller satellites must maintain orbital speeds of up to 17,500 miles per hour to remain in orbit.

The lower orbit makes possible faster digital-transmission speeds that are competitive with existing terrestrial broadband services. A major challenge in today’s market, though, is developing viable ground receivers at the consumer level capable of communicating efficiently with the fast-moving LEO satellites.

“In order to do that, you need electronically steered antennas,” RBC’s Richin says. “Right now, that technology is not at a price point that will allow for mass consumption of these data products.”

Kymeta, which is backed by Microsoft founder Bill Gates, does make a steerable antenna for commercial users, but it sells for north of \$35,000. So, the potential economic viability of a satellite-powered broadband

space-belt and how many such constellations could ultimately be supported remain open questions.

In fact, the current race to build a space-based internet is essentially a 2.0 iteration of a business model that played out initially in the 1990s and was largely deemed a failure. In that era, arguably the most notable flop was a company called Teledesic Corp., backed by Microsoft’s Gates, entrepreneur Craig McCaw and Saudi prince Al-Waleed bin Talal.

Teledesic launched an ambitious plan to develop a \$9 billion, 840-satellite constellation to provide global broadband services. Two other companies during that era, Iridium and Globalstar, also attempted to provide global wireless communications services through their own satellite constellations.

Iridium and Globalstar ended up filing for bankruptcy protection as fast-developing Earth-based cellular technology at the time proved to be far more cost-effective than

satellite-based services. Their failures foreshadowed the demise of Teledesic as well, which suspended operations in 2002 and ultimately returned its wireless-spectrum rights to the FCC.

Both Iridium and Globalstar have since emerged from bankruptcy and today are still in operation, though their service base shrank from being the global market to niche groups — primarily government/military and corporate clients that require service in remote areas.

But times have changed. The cost and technology advantages this time favor the satellite industry.

“New production processes and materials have reduced the costs to build and launch satellites and spacecraft,” the PSRC study notes. “Overall, the cost of a launch has been reduced to the tens of millions of dollars. Launching a satellite that is the weight of Sputnik I into low Earth orbit can even be achieved today for less than \$4 million as part of a combined payload.”

LeoStella CEO Mike Hettich agrees that not all the companies competing to establish satellite-based internet service will succeed, but that doesn’t mean they all will fail. “I would compare it to the wireless-phone market,” he says. “Maybe there’s room for three or four or five main internet-in-the-sky-type companies. I don’t know. It’s really up to the individual service providers as to how

they are going to make the business case.”

He adds that the plans being put forth now for the multiple satellite constellations to address the insatiable demand for data are “realistically about setting up the next generation for consumption of whatever those needs are.”

As far as the current lack of an affordable, consumer-friendly ground-based terminal, or gadget, for communicating with the proposed broadband satellite constellations, Hettich says it’s a bit of a “chicken or egg” scenario. In other words, something must come first, and once the space-based broadband service is available and the benefits understood, the consumer-product innovation will follow.

“I didn’t know I needed a smartphone, until someone actually showed me all the capabilities that it had,” he says. “So, there are needs that we have that we don’t know that we have until someone gives us a solution, like a smartphone.”

Clearly, there is great risk for the companies pursuing grand plans for space-based broadband constellations that can serve the entire planet, but the potential payoff for them, and planet Earth, literally, also is great.

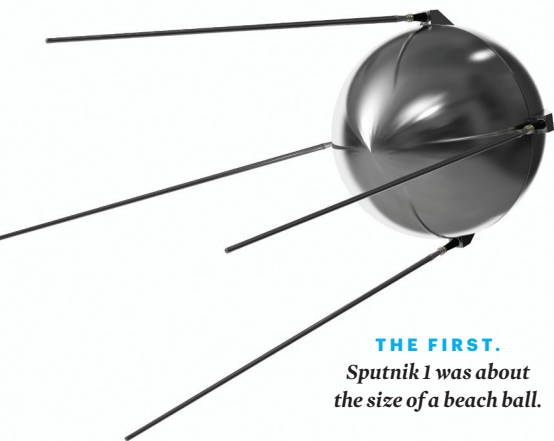
“Universal broadband capability benefits everyone,” Boeing states in its application to the FCC for approval of its proposed satellite-broadband service. “Connectivity in rural areas leads to economic development, an increase in the availability of

news, information gathering, communication, education, and health. Connectivity in harsh environments when health and safety are on the line is essential in our modern society.”

As part of this great generational endeavor, Seattle’s expanding space-business sector may well be in a position like the one the city’s business community played during the Klondike Gold Rush of the late 1800s, as Spaceflight CEO Blake points out. Only today, rather than selling picks, shovels and steamship tickets, Seattle’s space-focused businesses are furnishing the key supplies and services for the new space era’s cosmic prospectors as they venture toward the stars to make their fortunes.

“Everything [in this new space era] trends toward more software,” Blake says. “When companies are deciding where to build their satellites in the future, they are going to go where there is a huge pool of software developers, and if that also happens to be a place where there are a lot of aerospace engineers, like Seattle, that just seals the deal. I can see Seattle becoming just huge in the satellite arena.”

Space is, as the popular TV series “Star Trek” described it, the final frontier. Seattle’s history as the “Gateway to the Gold Fields” of the Yukon Territory may well foreshadow its destiny as a gateway to that final frontier. Time — and space — will tell. **SB**



THE FIRST.
Sputnik 1 was about the size of a beach ball.

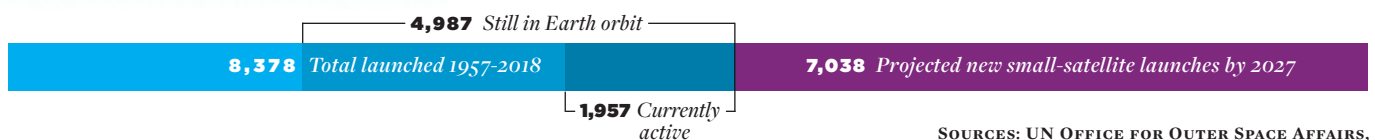
SATELLITES IN ORBIT*

A report by the United Nations’ Office for Outer Space Affairs reveals that as of the start of 2019 a total of 8,378 objects had been launched into space since the Soviet Union’s 1957 launch of the first satellite, Sputnik 1. Of that number, 4,987 satellites are still in orbit, of which only 1,957 are currently active.

By 2027, however, satellite consulting and research firm Euroconsult projects that more than 7,000 new small satellites will be launched into orbit — a figure that is nearly equal to the total number of objects launched into space over the first six decades of human space exploration.

The Satellite Industry Association estimates that the satellite industry accounted for 77% of the global space economy’s 2017 revenue of \$350 billion.

*The difference between satellites launched and those still in orbit is accounted for primarily by orbital decay — which over time results in objects burning up in Earth’s atmosphere.



SOURCES: UN OFFICE FOR OUTER SPACE AFFAIRS, UNION OF CONCERNED SCIENTISTS AND EUROCONSULT