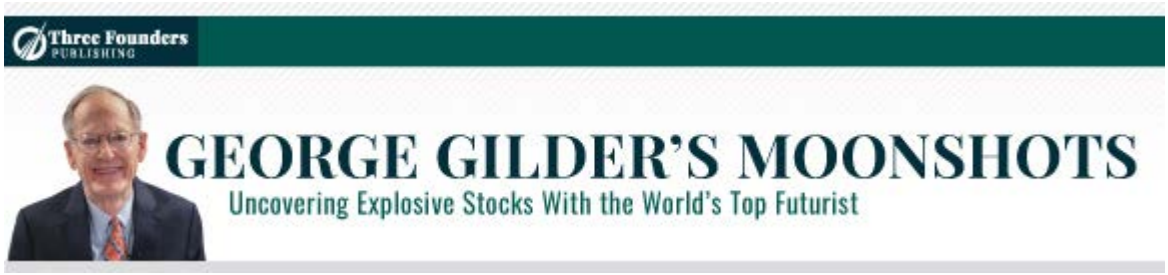

December 04, 2020

[Interview with Paul Stimers] Profiting from the Great Space Reboot

Dear Steve,

Below, you'll find today's *Moonshots* update was written by one of my lead analysts John Schroeter (or Mr. X as I call him), with the help of another analyst on my team, Steve Waite.

These men need no introduction but you can check out the *Prophecy* I wrote a while back where I detail my history with them **here**.

Keep scrolling to read an interview they conducted with Paul Stimers, where he provides insights on Space 2.0.

"We are at an inflection point in human spaceflight. Until recently, space had been the exclusive province of governments and government astronauts, conducting government missions of

exploration and national defense. Now, a new era is underway — one in which citizens, acting in the private sector and for their own reasons, can go to space too. We are moving from a period of exploring space to a period of expanding into space. Like the pioneers before us, we are poised to tame a vast wilderness, using its resources to promote human advancement."

So says **Paul Stimers**, a partner in the public policy and law practice of K&L Gates LLP, a global law firm. Based in Washington, D.C., Paul focuses his policy advocacy efforts on matters related to commercial spaceflight and other emerging technologies.

In this capacity, he serves as policy counsel to several major commercial spaceflight companies and the leading industry association for commercial spaceflight, assisting them in pursuing legislation and representing their interests before Congress and federal agencies.

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It was for his expertise in all things space — and particularly the burgeoning development of Space 2.0 — that I invited Paul to contribute an essay to my book, ***After Shock***, which marked the 50-year anniversary of Alvin Toffler's *Future Shock*. (Many of you will recall that George Gilder

and Alvin Toffler were frequent collaborators, but that's a story for another day!)

The first space age — Space 1.0 — ran roughly from 1957 through 2000. The differentiating factor defining Space 2.0? *Business*.

Exploring Space 2.0

Rod Pyle, writing in his book, *Space 2.0*, explains, "The first space age was born of competition between the United States and the erstwhile Soviet Union for geopolitical influence, and while some of that lingers still in the United States' competition with China, this new space age is increasingly about *commercial* interest — and that's a good thing."

And just what might those commercial interests entail? For starters, consider mining, cargo, space transportation, nanosatellites, terraforming, habitats, spacecraft, manufacturing in space, weapons, space tourism, health, communications, launch systems, in-space services — all manner of gear and support infrastructure.

Indeed, space exploration is rapidly becoming commercialized and privatized, with entrepreneurs building rocket boosters, asteroid probes, prospecting craft, ever-more sophisticated propulsion technologies and life support systems. And opportunities for massive wealth creation.

Look no further than some of the most successful entrepreneurs in history: Jeff Bezos, Richard Branson, Elon Musk — all are heavily invested in Space 2.0. And for good reason.

"We are on the cusp of mining metals, water, and other resources in space," Stimers explains. "This unlocks inconceivably large

reserves of materials that have extensive uses on Earth. The precious platinum group metals, which we use as catalysts, in displays, and for medicine, are abundant in asteroids, and we mine them on Earth from places where asteroids have struck the planet. We have identified asteroids with platinum group deposits whose market values are estimated in the trillions of dollars."

And starry-eyed entrepreneurs are responding in droves.

Chad Anderson, CEO of the investment group Space Angels, points to *hundreds* of companies that have raised money and are executing their business plans. Indeed, this is an industry poised for exponential growth.

Stimers adds, "If these possibilities are measured on a grand scale, the goals of the billionaires driving the commercial spaceflight revolution are grander still. They want to democratize spaceflight. They want to make humanity a multiplanetary species to help ensure our survival. They want to move heavy industry off of Earth and have millions of people living and working in space. They want to end scarcity — to end poverty on Earth and replace it with abundance."

One of those billionaires is Naveen Jain. I met Naveen through an interview I did with him about the company he co-founded, **Moon Express**, for my reboot of the iconic magazine ***Mechanix Illustrated***. I've always been a bit of a space nerd, in no small part because my father was an engineer at JPL during the run-up to the Apollo program. I quite literally grew up with it all, and my fascination has only multiplied over the intervening years. Naveen's venture amplified my fascination all the more.

That interview ultimately blossomed into the book that Naveen and I co-authored, ***Moonshots—Creating a World of Abundance***,

which includes an intriguing foray into the new economics of space, and specifically how — and why — entrepreneurs are leading the way. Consider, for example, that Elon Musk's SpaceX is already responsible for more than half of the launches in the US! It's incredible, really!

And it is still early days for Space 2.0.

Going forward, however, successful space ventures will not only require a good bit of rocket science and investment, but the regulatory frameworks that will make entrepreneurial activity both attractive and economically feasible. It should come as no surprise, then, that we are witnessing the emergence of law firms specializing in the nascent space of space law. Space also happens to be big business right here on Earth!

Which brings us back to Paul Stimers.

My colleague Steve Waite and I recently tapped Paul to share his insights on how Space 2.0 is shaping up. Our wide-ranging conversation follows below. I hope it will inspire you to think about ways you can invest in Space 2.0 (see, for example, the *Moonshots* portfolio company **Maxar (MXR)** **on our website**) or otherwise participate in this exciting and limitless frontier.

You'll find our questions bolded and italicized, with his responses following directly below.

Paul Stimers in the Hot Seat

Thank you, Paul. To paraphrase JFK, today's spacefarers choose to go to the moon not because it is hard, but because it is good business! At least in theory. To what extent is the

2015 SPACE Act actually living up to its name: "Spurring Private Aerospace Competitiveness and Entrepreneurship"?

The SPACE Act has absolutely lived up to its name. It was only one part of the overall legislative package, the Commercial Space Launch Competitiveness Act (CSLCA), which also had three other important parts. The SPACE Act extended and expanded the favorable policy and regulatory foundation on which we have since built a robust and growing US commercial spaceflight industry. We have seen a tremendous number of companies founded and funded, but more important than the number is the diversity.

The second part of CSLCA set up some later work on commercial remote sensing that has been very helpful, and the third part organized the Office of Space Commerce at the Commerce Department, which has already yielded substantial benefits and has the potential to help ensure that space is seen as a place for commerce. But the fourth part of CSLCA is near to my heart, because it is the Space Resource Exploration and Utilization Act. That bill, which I worked on from its earliest stages, says that a US citizen who obtains space resources is entitled to possess, own, transport, use, and sell them. As such, I believe it's the most sweeping recognition of property rights in human history.

A key component of the SPACE Act [CLSCA], of course, is that space entrepreneurs will own anything they bring back from the moon or other celestial bodies. The moon will ultimately be treated no differently than international waters. No one owns the oceans, but those who invest their money and effort to find fish are entitled to profit. Likewise, there is strong legal precedent and consensus around the concept of "finders, keepers" for resources that are liberated through private investment, and the same will be true of space resources. Can

you comment on what you see so far as the consequences of this?

Like all species, humanity is limited by its available resources. We can extend those resources extremely far through the application of ingenuity, and we have, but past a certain point, expansion requires unlocking new resources. Two of the great forces propelling humanity forward are free enterprise and property rights, and the Space Resource Exploration and Utilization Act puts those forces to work for us — and specifically, for the US. I think of it as the Homestead Act for the cosmos. We won't see its full impact anytime soon, but I believe it will come to be seen as a seminal moment in space history.

Naturally, the Space Resource Exploration and Utilization Act caused a stir among those with a different view of property rights — the fans of the Moon Agreement, for example, which purports to collectivize the Moon's resources (and which the US hasn't signed, and opposes). Others thought it violated the Outer Space Treaty (which the US negotiated, signed, and supports) — notwithstanding that the text of the law says it only operates within the limits of US international obligations.

Meanwhile, the US government is negotiating a series of bilateral agreements for space exploration — the Artemis Accords — that include a principle on resource utilization consistent with current law. NASA has also set in motion plans to purchase lunar regolith *in situ*, partly in order to set the precedent. So the US is moving ahead, with its partners.

Let's switch gears to how we'll get to and from the moon… Water, it is said, is the oil of the solar system and the key to developing a colonizing presence on the moon, as it is also the

key ingredient in fuel. It's also one of the key challenges to be addressed. What's your view?

Water is vital to a sustainable human lunar presence. It's also difficult to bring from Earth, because it is heavy and cannot be compressed. Fortunately, we have recently discovered vast quantities of water ice on the moon. That water ice is not evenly distributed, however; much of it is in craters near the poles, where sunlight never reaches. These regions are also important because the rims of the craters near the poles have very extended periods of exposure to sunlight. The existence of relativity high-value areas on the moon increases the likelihood of near-term competition for access to those areas, notwithstanding the Outer Space Treaty's prohibition on the claiming of territory.

The cost of accessing space has plummeted in recent years, thanks to the efforts of entrepreneurs like Elon Musk and the folks at Rocket Lab, for example. This will have the effect of lowering the bar, creating a kind of land grab for space. What is your outlook based on these dynamics?

The cost of accessing space needed to drop drastically, and it is. When Blue Origin launched, landed, and reused the *New Shepard*, it heralded the start of a new era in space access. Moving beyond disposable rockets was the first big step. In-space manufacturing and assembly will be one of the next. As the cost of accessing space drops, and as we develop the capability to design and build for the space environment rather than the launch environment, we should expect to see much more activity in space, and on celestial bodies. If history is any guide, we will not be very good at predicting what applications will emerge, or how those applications will interact with each other. What we can say with reasonable certainty is that we will need a framework for promoting the development of space that is based on the rule of

law, without being too proscriptive. The US is following this path, having started with the Outer Space Treaty and followed with the Commercial Space Launch Competitiveness Act, the Executive Order on Encouraging International Support for the Recovery and Use of Space Resources, and the Artemis Accords.

Both China and Russia are also seeking a stake in space. How would you compare their efforts and capabilities relative to each other and to the US? Should we be concerned?

Like the US, China and Russia have strong, active space programs with a variety of goals, including scientific, exploratory, economic, diplomatic, and military. We have cooperated with Russia throughout the construction and operation of the International Space Station, as we have on a number of other space missions. Certainly both countries' contributions to science — when shared — are welcome. But we must keep a close eye on the national security aspects of both countries' space efforts. Space is critical both to the US economy and to the nation's ability to project power around the world. Russia and China both know this. They are developing assets to disrupt and destroy our space capabilities in order to degrade our military advantage in the event of a conflict. We must therefore continue to innovate and to defend those space assets in depth — by hardening them, distributing them, and being prepared to repair, upgrade, replace, or do without them as needed. Ideally, our space assets would be so well-defended that no adversary would seriously consider attacking them in the first place.

Manufacturing in space, via 3D printing, is also a revolutionary enabler of establishing more functional outposts in space. How do you see this sector shaping up?

Imagine not having to design payloads under the constraints of the launch environment — the temperature extremes, pressure changes, G-forces, vibration, and fairing size — all of which cease to be relevant after the payload has reached space. The implications are staggering, especially when coupled with space resource mining. On the surface (or interior) of the moon, Mars, or another celestial body, or on long-duration spaceflights, 3D printing is crucial. Rather than trying to predict and pack everything that it will need, an expedition will be able to make what it needs on the spot, with plans beamed from Earth if necessary. A 3D printer would have sucked all of the drama out of *Apollo 13* and *The Martian* — which is excellent news for space explorers.

There are indeed, many independent components, like propulsion, 3D printing, robotics, etc. that must come together and converge to enable more ambitious and cost-effective missions. Where do you see the greatest risks, and which of these pieces do you consider to be the most critical, and hence, of greatest value to investors and entrepreneurs drafting business plans? How would you direct them?

In many ways, the greatest risks have to do with law and regulation. A number of companies have told us that potential investors have confidence in their technology, but not in the legal or regulatory regime they have to navigate. If the government is not going to let you operate, it doesn't matter how good your technology is. We work to remove barriers to innovation, streamline regulations, and help create an environment in which commercial spaceflight companies have the freedom to compete in the global marketplace.

The folks at Perquin noted recently that VC investment in aerospace rocketed to $3.6bn (see blog post here). What explains the growing interest in this segment from VCs today?

What's new about the commercial spaceflight industry in the last few years is the diversity of the companies participating. We're seeing more companies in more sectors, from launch to on-orbit operations to commercial plays in areas we had previously considered the exclusive province of national space programs. To me, that indicates that a real market is beginning to form. In addition, we're beginning to see exits — mergers, SPAC IPOs, and so forth — that are signaling to VCs that the industry is starting to operate within their time horizon.

We've seen declassification in recent years of technologies that resemble what we see on Star Trek and in other science fiction movies and novels — technologies such as warp drives, antigravity for aerospace, and positron aerospace propulsion. What are some of the most innovative technologies you are seeing in the commercial space sector today?

You might as well ask me to tell you which of my children I prefer! That said, the technologies that I believe will have the greatest impact are those that can change the fundamental economics of space. Reusable rockets are dramatically lowering the cost of access to space. In-space manufacturing and assembly is poised to radically expand the "capability per kilogram" of payload sent into space, as well as the resilience and longevity of those payloads. A solution to orbital debris will be critically important as space gets increasingly congested. Of course, asteroid mining and *in situ* resource utilization has tremendous potential. Because these and other game-changing technologies

are all coming online together, we are in a golden age of space innovation.

We know you are heavily involved in quantum technology through your work with the Quantum Industry Coalition. What kind of convergences do you foresee with commercial space and quantum technology in the years ahead?

It's already happening. The International Space Station has been at the forefront of quantum technology with its Cold Atom Lab, which has produced a Bose-Einstein Condensate in orbit. The microgravity environment aboard the ISS enables longer observation times and is helping advance our understanding of quantum mechanics. NASA is working with commercial partners on quantum computer development. China has demonstrated secure quantum communication via satellite; several companies are working on their own versions of this capability.

What are some of the challenges with creating profitable businesses in the commercial space sector today?

As I mentioned, the legal and regulatory environment can be a major challenge. We have seen a lot of progress over the past few years, and the commercial space sector has demonstrated that with the right legal and regulatory environment, it can out-compete the rest of the world. There is more work to do, including on updating export controls and scaling up regulatory approval processes to accommodate a much higher rate of launches and satellite deployments.

You and your colleagues do a lot of work up on Capitol Hill. What's the stance of the US government with respect to the commercial space sector?

It has been very positive, for the most part, with strong bipartisan support on Capitol Hill and across presidential administrations of both parties. The 2015 Commercial Space Launch Competitiveness Act provided a strong foundation, and the Trump Administration has built on it with a series of Space Policy Directives and agency activities that have been very helpful. NASA, the Department of Defense, and other agencies have acted as customers, which has also been key. Unfortunately, some in Congress see space as a place that should be reserved for research and exploration, not commercialization. Others see regulation as synonymous with safety, which is not true for a nascent industry that is always innovating toward safer vehicles. We must continue to engage and educate, as we have done for years, to maintain bipartisan support for a strong commercial role in space.

What are the potential downsides to the privatization/commercialization of space?

As big as space is (really big), Earth orbits are getting increasingly crowded as space becomes more commercialized. The entire space sector is increasingly concerned about space traffic management, orbital debris, and the potential for collisions. The nightmare scenario is a chain reaction of collisions creating debris that leads to more collisions, severely restricting access to space. Commercial space companies are leading the way in the responsible development of Earth orbits, with debris mitigation and end-of-life solutions. Governments have been the least responsible actors in this area, with India and China having recently created orbital debris fields by destroying satellites (Russia and the US also have anti-satellite capabilities). The United States is taking steps to address space debris, including through international agreements like the Artemis Accords, along

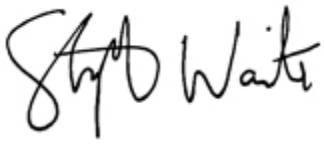
with congressional proposals to provide more authority and resources for space situational awareness.

***You contributed an essay to the book,* After Shock*. If you had to update that essay for a new edition for next year, what would you alter or add*?**

This year, the American commercial spaceflight industry enabled NASA astronauts to reach the International Space Station from American soil twice. By next year, I hope I would be able to point to the first commercial launch of a paying customer as another major, concrete step toward the future we know is on the way.

Regards,

John Schroeter
Lead Analyst, *George Gilder's Moonshots*



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