

**Testimony of Mr. Jeffrey Manber  
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**before the  
Senate Committee on Commerce, Science and Transportation  
Subcommittee on Space, Science, and Competitiveness**

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Chairman Cruz, Ranking Member Markey, and other distinguished members of the Space, Science, and Competitiveness subcommittee, thank you for giving me the opportunity to return to this room to testify before Congress once again. I look forward to discussing with you the challenges we face at my company NanoRacks, and within the larger commercial space industry, in seeking to develop a robust, American-style, service-based economy in space. We seek a marketplace that will realize multiple commercial space stations, in multiple orbits – within near and deep space, serving both traditional and unique customers from around the world.

Since my visit before this subcommittee in April of 2014, NanoRacks has continued to grow into a commercial space station company via greater utilization of the International Space Station and other platforms. In the past three years we have taken on dozens of new customers, ranging from high schools you represent, to multiple U.S. agencies, other members of the commercial space industry and even foreign governments. To date, NanoRacks has brought over 550 research projects to the Space Station, including approximately 180 satellites, many of which are educational-based experiments representing schools throughout the country. All of this has been done with no direct NASA funding. We are a company that lives on our customers and the revenue generated from our ability to bring payloads and provide services to the Space Station.

How is this all possible? Through a growing number of non-traditional public-private partnerships between my company and NASA. These relationships have grown in time to be more robust, as both organizations learn what works and what doesn't for industry and for government.

As I discussed three years ago before this subcommittee, we at NanoRacks have chosen a business model that is quite normal here on the Earth, but far less common in our space program. Fundamentally, we pay for our own hardware. For example, we have invested \$5 million in our External Platform, over \$4 million in our satellite deployment program, and close to \$1 million in our internal research frames. We are now partnered with Boeing Aerospace and investing \$15 million to manufacture the world's first commercial

space station airlock. This expenditure of at least \$30 million from one company, one small company I would emphasize, has made the International Space Station more robust, asserted American leadership and spurred the growth of new markets.

Why am I not seeking upfront NASA money? Because that's not how the commercial marketplace works. I want to make sure there is no space station gap as there was with shuttle. For a seamless transition, we need the agility of the private sector. I want to squeeze efficiencies where none existed before: efficiencies in cost and efficiencies in use. This is how you build a customer base, and this is how you expand markets - whether on the Earth or in space. This is called capitalism.

For my company, these investments are intended to develop the technical expertise and hardware base to eventually own and operate our own space stations – a realistic goal we've set for ourselves as U.S. policy has matured. Why does this work? Because the growth and development of our public private partnership with NASA allows each of our customers – whether NASA, the European Union, pharmaceutical companies, schools, or industry, to pay fees to use our services – just like any other business here on Earth.

When last here, I ended my talk by stating how we have forged a new, and constantly evolving relationship with NASA. NASA is our landlord, and NASA is our safety official. But every day the agency has become less and less of a competitor. Still true! And today, we work with NASA, not without challenges, but focused on establishing the agency as a facilitator for the private sector building a space economy in low-Earth orbit, and eventually, beyond LEO, that will make all Americans proud.

This is what I would like to briefly talk with you more about today: The changing relationship between NASA, NanoRacks and other members of the industry—and how we together are working to fulfill the wishes of you, in Congress, to inject more commercial practices in the conduct of the American space program. The growing partnership between NASA and NanoRacks adds value to each new program on the space station, and, if utilized to its fullest potential, it can bring about a future in which we can only dream today.

### **Our Evolving Partnership with NASA**

Seven years ago when I first approached NASA, I told the space agency I didn't want their funding. Boy that got their attention. Instead, I wanted the right to put research hardware on the International Space Station and offer services to the public, including NASA, for a fee.

Some at NASA were shocked. How could we charge money for a service onboard the station? Others asked so many questions from their public-sector perspective: Who would set the price? What if there were no customers? What would be the relationship between NASA and the company? Would astronauts work on a commercial service? What services would we offer? How would NASA know if we were successful? By the way, I

told them if we were still in business in five years with customers, we would have been successful!

Both sides survived those initial days. And I applaud the Space Station Program Office for more than once leaving their comfort zone to meet our objectives at least half-way. Today, it is more accepted that companies can utilize the space station for commercial gain. That's great. And NanoRacks has competition - some offering very similar services. That's a sign of policy success. Now comes the hard part. What is the optimal partnership and policy between NASA and private companies to assure a robust commercial marketplace in low-Earth orbit? And, at the same time, is their one type of partnership that is optimal or do different commercial programs, customers, and sectors require differing partnerships?

Permit me to illustrate the landscape as we see it at NanoRacks.

For the past seven years, NanoRacks and NASA have worked together in what has become the first public-private partnership that demonstrates a true path to a commercial marketplace in orbit. Our partnership serves two goals:

1. To unleash the power of the private sector in space services;
2. To assure U.S. leadership and new programs including commercial space station platforms during a time of difficult federal budgets.

In our partnerships, NASA is the safety regulator, launch provider, and station resource provider. NanoRacks is the designer and developer of chosen hardware, the funding source for the hardware, and chief marketer of on-orbit services.

Our relationship works because this program is voluntary. The private sector (NanoRacks) can choose which hardware it wishes to develop and market. Consequently, the government can choose whether or not to utilize the hardware. In plain language, NASA acts sometimes as a customer to NanoRacks to use our services, but there is no guarantee they will. And we have to perform the service to be paid by customers. And, in a growing number of cases we "pay" the space agency for use of space station resources via pricing discounts and other tangible advantages.

There is one other implicit understanding: the private sector program can fail – and there may not be customers. NanoRacks assumes this risk.

One of our largest demonstrated successes with this partnership has been the development of our space station satellite deployment program. NanoRacks recognized that American industry wanted to develop sophisticated small satellites, but was stymied by the fact that the only real small satellites launch opportunities were non-domestic. NanoRacks believed the International Space Station could play a pivotal role.

Today, our responsibilities in the public-private partnership have expanded: we are the program originator and program operator related to launching the small satellites of our

customers. The government risk remains confined to the safety of the hardware. And we use the NASA-Japanese space agency (JAXA) barter relationship to utilize the Japanese airlock to deploy the satellites, until the NanoRacks Airlock Module, now under development, is on station in 2019.

As such, I believe this is as pure an example that has ever existed of a public-private partnership between NASA and the private sector. Unlike the Commercial Resupply Mission program (CRS), NASA did not institute our program. NASA did not fund our program, and there was no guarantee that NASA would even use our program. Let me add, however, that CRS has proven to be everything we hoped in allowing a company like SpaceX to leverage NASA as a customer, and truly change space transportation today.

But look at what the NASA-NanoRacks partnership has provided: American leadership in a marketplace for small satellite services.

Today, we are one of the leading American providers of small satellite deployment opportunities in low-Earth orbit. Our experiment has been a wonderful success: our satellite customers range from NASA and other government agencies, the European Commission, private companies, startups, universities, high schools – and yes, even elementary schools. Over 180 small satellites have been deployed from the station. Just as importantly, we have shown that space stations can have several unique roles in satellite deployment. To cite just one example, we have customers who store satellites on the space station to deploy on demand, when necessary. That can't be done from a launch vehicle!

So industry (NanoRacks) suggested a commercial space station program (satellite deployments) to NASA. We fully funded the hardware. We made use of NASA resources. NASA is “paid” via defined deployment opportunities. And the U.S. government has become growing customer as well.

However, an even larger success is that we—NASA and NanoRacks—accelerated the growth of the small satellite market. Without a doubt. Because of our demonstrated success, private capital exists for non-ISS launch services. Companies around the world are able to tap private capital because there is an existing market. There are (literally!) dozens of companies that offer low-cost, efficient CubeSats and SmallSats.

For example, our customer Spire is changing the way we track ship movements and weather from space through their CubeSat constellation. The leadership at Spire tells me that this is causing NOAA to re-look at public-private partnerships for the availability of commercial weather data.

Clearly, our initiative and willingness to take the risk worked. The market is growing and the number of customers is increasing, but the ISS share of the marketplace is dropping, as it should, in a growing competitive marketplace. This is a public-private partnership at its best, whether on the ground or in low-Earth orbit.

## **Partnership Stage Two: Commercial Airlock on Space Station**

As I previously mentioned, NanoRacks is currently manufacturing the world's first commercial Airlock Module onboard the International Space Station. The NanoRacks Airlock Module, which we call our 'Gateway to Space,' will be on the station in 2019. We solicited NASA for the right to build and operate the Airlock. We did not seek NASA funding. We saw a market need and are willing to invest our own capital to increase the capacity of the station as a deployment platform for smaller satellites and for moving larger cargo out of the station.

The advantages for the program are many: the NanoRacks Airlock Module will be five times larger in volume than the current airlock owned and operated by our friends at JAXA. It will be commercially operated, efficient, allow NASA capabilities not possible today, and best of all, at the proper time, the hardware can be removed and mated onto our own future commercial platform. NASA is not funding the Airlock Module. Rather, in an exciting and unique partnership with Boeing, our two organizations are privately funding the hardware. Yet we are aware that the Airlock Module is also utilizing valuable NASA resources, and we have voluntarily entered into negotiations with the space agency to forge a partnership that makes smart sense for both parties.

In this regard, NanoRacks is a commercial space market pioneer. Together with NASA we are forging an even larger partnership than that for the satellite deployment program. At the same time, we have made clear to the Space Station Program Office officials that we expect other companies will also enter into such partnerships. And not just for space station use. Use of taxpayer resources for commercial services should either be at no-cost for all, or some sort of barter arrangement for all.

For us, our Airlock Module is a stepping-stone to the goal of working with NASA on commercial habitats in an equitable manner.

## **From Airlock to Commercial Space Stations beyond ISS**

NASA has a unique opportunity, one previously only dreamed about: fostering U.S. leadership in opening the door for commercial space stations in low-Earth orbit and beyond. I have spent the last three decades working to bring about a more commercial space marketplace, including helping set up the first investment fund for commercial space ventures on Wall Street and commercially marketing the Russian space station *Mir*.

My time at NanoRacks has been focused on our long-term goal: owning and operating commercial space stations, all while democratizing access to space. One where NASA is a customer; where the capital is commercial, and the operating system onboard the station is one based on American-style free markets.

There are a number of approaches companies can take as we look to a future beyond the International Space Station. Some of our colleagues in the industry seek to realize the

commercial habitats after the ISS by constructing new platforms and stations on the ground, and launching them into orbit. That's one way. And that's the expensive way.

Let's consider another strategy: the re-use of in-space hardware. We have seen recently the value of re-using the first stage of launch vehicles, as shown by both Elon Musk's SpaceX and Jeff Bezos' Blue Origin. At NanoRacks, we are focused on re-using the second stage, not for use in another rocket, but as the shells of commercial habitats. I'm pleased to report that NASA has given us a chance to prove the value of using re-purposed in-space hardware for commercial habitats in low-Earth orbit.

Over fifty years ago, NASA's Marshall Space Flight Director Werner von Braun proposed the idea of re-using the spent upper stage of a rocket and converting it into an orbiting platform. From this concept came America's first space station, Skylab, which was a re-purposed second stage of a Saturn 5—the vehicle that took America to the Moon.

We are 'back to the future' now at NanoRacks. We have been awarded funding through the NASA NextSTEP Phase II program for the "Ixion Initiative," a concept study for re-using in-space hardware and converting upper stages of rockets into commercial habitats in low-Earth orbit and deep space. Specifically, NanoRacks, along with Space Systems Loral (SSL), is studying the re-use of upper stages, including that of United Launch Alliance's (ULA) Atlas 5, for use as a low-Earth commercial habitat.

This pathway is made possible because of the growing maturity of the partnership between NASA and NanoRacks. From NASA's acceptance of our first self-funded research platforms to our satellite deployers to the commercial Airlock, we together have paved a partnership where the gravity pull is mutual: both sides contribute what it does best. In NASA's case, that is resources and hardware already paid for by the taxpayer and available for further utilization. In NanoRacks' case, that is capital and the expertise in attracting and working with customers in a cost-efficient manner.

Let me add, if I may, one key point necessary to make our program a success: The announcement of a firm date for the end of the current mode of ISS operations. I respectfully ask that by 2019 we know the end date for station services. Additionally, let me compliment this committee's work on the ISS Transition Plan and specifically addressing this issue in the NASA Transition Authorization Act of 2017.

No matter the end of operations date, the private sector needs to hear what that date is, rather than keeping it ambiguous – and we seek for this committee to emphasize this with the next NASA Administrator. Also key is to understand the requirements of the U.S. Federal Government as a customer, post-ISS. Keep in mind, this is not only about creating a robust economy in space, but also assuring we do not leave this territory to foreign governments.

The Ixion Initiative team and NanoRacks look forward to being part of this discussion on the proper ISS transition.

However, some key questions still remain: How does NASA determine the merits of a commercially funded program? How much should a company be expected to contribute? How does NASA protect this emerging marketplace from foreign government competition dumping at arbitrary prices or zero cost? And how do we assure America's continued leadership in near space in the event of commercial setbacks?

In short, what is the policy that will enable flexible, optimal, public private partnerships between NASA and industry? We are far closer than three years ago, and I'm confident with your continued leadership we are close enough to imagine commercial habitats and commercial in-space servicing in partnership with NASA. Close enough for us to be confident enough to continue investing private capital.

### **Conclusion**

We are in a new space race, one where to the winner belongs the most robust use of the new frontier by all segments of our society. NASA is ready, industry is ready, and I'm ready, to focus on our return to the Moon and the human exploration of Mars. But I am sure that this can only be done once we have freed up our national resources from low-Earth orbit by creating a sustainable market economy in near space.

Whether we're reaching for Mars, returning humans to the Moon, exploring asteroids, or conducting science and business on commercial platforms, flexible partnerships constitute the direction we should be heading, and the methodology we should be using. The International Space Station has served as a powerful management and policy test bed for how the government and private sector can undertake space exploration together – and that has been proven by seven years (and counting) of customer growth at NanoRacks.

I'm confident we are on the right pathway even though there is no precedent to guide us. There is no proven formula to understand how to make space just another place to do business, one where America will excel. We are venturing into the unknown.

However, we will be successful in this venture because creating new markets and tapping the next frontier is what America does best, whether on the Earth, or for the benefit of those of us on Earth.

Thank you. I will look forward to answering your questions.