

**Testimony of Mr. Jeffrey Manber
Managing Director, NanoRacks LLC**

**before the
Senate Committee on Commerce, Science and Transportation
Subcommittee on Science and Space
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Chairman Nelson and Senator Cruz, thank you for the opportunity to speak today. I'm pleased to lead NanoRacks, which is developing a robust customer base for the U.S.' National Laboratory onboard the International Space Station. We regard our growing private business on the station as a stepping stone for commercially undertaking projects beyond low-earth orbit in partnership with NASA and other allied space exploration programs.

Personally, I've spent the last three decades working to bring about a more commercial space marketplace, whether by helping set up the first investment fund on Wall Street for commercial space ventures, working with PanAmSat to break open the Intelsat monopoly on international communications, as well as helping open the door in American-Russian relations on space and later assisting in the marketing of the Russian space station *Mir*. The common thread has been to help realize a human space enterprise that is driven by American-style commercial principles and practices.

NanoRacks has for the past four years worked to realize a truly commercial business onboard the International Space Station, using our own capital and developing our own customer base. Today I'd like to share with you some lessons we've learned about how human spaceflight can be integrated into a commercial environment. In this way, everyone, including NASA, our international space agency partners, private customers and the American taxpayer can all benefit from a new approach to space exploration that harnesses government and commercial resources to achieve our goals in space.

Attempting Traditional Business in Human Spaceflight

Let me start by saying that NanoRacks' business model would be commonplace in any industry other than human spaceflight. We build our own research hardware with our own money. We market these facilities and our services to customers at set prices. To date, we have purchased and modified for use or built microscopes, centrifuges, biopharma hardware and basic research platforms. All normal business. Except our facilities are all located in low-earth orbit onboard the space station.

We began the company without a NASA contract (and still don't have a traditional one). Instead, we did negotiate access to real-estate onboard the space station and access to the NASA launch manifest, literally first to the empty nooks and crannies on cargo vehicles

headed to ISS . We flew our first equipment with no guarantee that anyone, let alone NASA, would make use of our facilities. And there had never been a proven commercial market for space station facilities, so we couldn't forecast a market based on real world data. Given these realities, we didn't even bother with traditional investors. We say at NanoRacks that our first two investors were MasterCard and Visa.

But we believed passionately that given a permanent presence in low earth orbit, the robust transportation to and from the space station, and NASA's willingness to let us attempt a new way of adding services and facilities to ISS, that we would be successful. Rare, if ever, does a market fail to develop when commercial practices are allowed to thrive.

Placing our own hardware aboard a government facility is a critical part of our success, as it allows us to use commercial practices to design, manufacture and sell the facilities in what is still an immature market. I applaud Mr. Gerstenmaier and professionals in the Space Station Program office, from Mike Suffredini down to the working level, for allowing a private company to attempt this new role. I think their view when we offered to build and market our own equipment with no NASA funding was "let's take a shot and see if these guys can produce."

At NanoRacks, we are very much aware that we may lose our money. We may fail in the marketplace to continue attracting customers. Our equipment may not always work. But these risks are not borne by the taxpayer but by our investors. That is how business works in the real world and should also work in outer space.

A Pioneering and Growing Success

So how are we doing? NanoRacks has flown 150 payloads to date, we have a hundred more in the pipeline, and are averaging just nine months through the NASA safety and payload integration process, a tiny fraction of the usual wait. Our prices are transparent and start low enough to allow parents in school districts to pool their money to fund a genuine space station project, and our facilities robust enough to attract serious academic and industrial researchers. All without NASA funding. When we do receive federal dollars it's because NASA or another agency is buying our services just like any other customer.

And today, I can tell you that every single day NanoRacks is showing that more and more consumers, teachers, researchers, companies and organizations around the world see a value in paying for station utilization.



A final thought on the LEO market today. Just as NanoRacks has customers that are commercial organizations as well as space agencies, it also has space agencies that are competitors. One prime example is the Chinese Space Agency, which is today marketing its space station services to the international community, including my customers. One international client was just about ready to 'jump ship' to work with China on a multi-year program. What stopped this client was the U.S. commitment to operate the ISS until at least 2024.

But the Chinese space station program is already today a formidable competitor for NanoRacks, and we are committed to assuring prices low-enough, and services good enough, to thwart their efforts, not because they are Chinese but because that is the nature of commercial competition.

NanoRacks' progress in attracting customers and helping build up the capabilities of space station is being noticed. For example, Aviation Week recently described the growing commercial utilization of the ISS as transforming the station from a marvel of engineering construction into a thriving entrepreneurial marketplace. Music to my ears.

I would not argue that a purely commercial approach should be the only path to ISS utilization. There is always the more traditional, public sector approach, using taxpayer funds, via NASA or CASIS. Typically this involves peer review, with the highest priority given to projects of agreed-on national priority. Our way allows a researcher or entrepreneur who believes in their idea to avoid waiting and try an experiment as quickly as they can develop their hardware.

For us, for our customers, for the space station and for the intent of Congress, the payoff has been dramatic: we estimate that today there is close to \$150 million in private capital, from venture capital firms and personal investors, now supporting NanoRacks and our customers. The resulting economic valuation is estimated to be much higher, with significant job creation in California, Florida, Texas and elsewhere. If you add to this the private investment in commercial cargo vehicles from SpaceX and Orbital, and resulting value of their future launch markets, and the economic value of the International Space Station ecosystem already totals several billion dollars.

By creating and realizing commercial value in human spaceflight I believe we are dramatically increasing spaceflight's economic return to our nation and the world overall. And I am sure that our success in using private capital to leverage government space efforts is transferable not only to other human space stations in Earth orbit but beyond Earth orbit as well.

The global recognition of the power of American-style open markets is perhaps the single most enduring result of the end of the Cold War, whether in former Communist nations, now in low earth orbit and yes, I am sure, one day on the Moon and Mars. Because of the success of companies like NanoRacks working on the International Space Station, I believe the viability of market economics in outer space is finally coming of age.

The Synergy of Commercial and International Cooperation

NanoRacks' experience is showing that there is little difference between a government organization here or abroad and a non-governmental institution. To us they are all customers, and our transactions are fundamentally commercial in nature: a voluntary exchange of reciprocal value. Whether it's a U.S. government R&D agency like DARPA or a privately funded research foundation or a startup company in Silicon Valley or a school in Colorado, our relationship is based on the commercial contract. Just like in any business on the ground that books a government customer for a plane ticket or purchasing software.

NanoRacks has already shown that the divisions and tensions that have sometimes characterized the government vs commercial debate in our industry are becoming outdated. Working together, we can assure human spaceflight operations are undertaken in a commercially efficient manner and reach out to the widest customer base possible, both domestically and internationally, while accepting that much of the space utilization market still requires some public support, especially the first time we seek to go to Mars, or undertake an asteroid mission or permanently colonize the Moon.

Our low costs, state of the art facilities, and speedy commercial practices are just as appreciated by our international government customers as by our private domestic ones. The internationals appreciate our 'business as usual' approach, or as we say: "no flags, just results."

I have no doubt that the next chapter in space exploration must involve a wide range of contributions from international partners, just as any large commercial enterprise already does, from the automobile to telecommunications sectors. On the space station, we have learned without a doubt that other nations have no hesitation to work with a US company like NanoRacks for access to the International Space Station. Our current customer list includes the German Space Agency DLR, the Romanian Space Agency, parts of ESA, and companies and institutions from Israel, Japan, UK, Ireland, Peru, Lithuania, Vietnam and Saudi Arabia. In short, commercial space is another powerful form of international cooperation, and we appreciate NASA's flexibility to allow this new form of space diplomacy to flourish.

Allow me to add another valuable lesson we are learning from ISS operations. And this is the value of the InterGovernmental Agreement (IGA) which is the legal and regulatory framework for managing space station operations among the ISS partners. This document, in my view, provides a solid legal foundation for future international exploration programs. There are certainly improvements to be made as we proceed outward from Earth orbit, but the basic framework and principles of the IGA have withstood many challenges over the past three decades and are extremely sound.

Our commercial utilization of ISS is changing not just the perception of commercial markets in low-earth orbit, but the very behavior of NASA and the other ISS agencies. Skepticism

and confrontation towards working side by side with a commercial company's self funded hardware and services has given way to commercial cooperation and shared resources.

To cite just one example, earlier this year we sought permission from NASA to replace the Japanese Space Agency (JAXA) small satellite deployers with our own, which are larger. We didn't ask NASA for funding. We were willing to take the risk that we could find customers if the deployers could hold bigger and more satellites. And we offered slots for NASA use at no cost.

The result? In just seven months we designed the hardware, had it manufactured, passed the NASA and JAXA safety gauntlet, launched it on an Orbital Sciences Cygnus vehicle. With our space agency colleagues we just deployed 33 CubeSats, providing market leadership for three American companies and also introducing two nations, Peru and Lithuania, to the space station. All with no taxpayer funding in that project.

We saw an opportunity for using space station as a small satellite deployer and have invested in the necessary hardware and are finding the customers. Not only is there strong commercial demand for this service but government agencies are now taking advantage of the no-cost slots. That is a win-win for everyone.



A Model for Beyond Earth Exploration

For too long we have considered space exploration as an “either-or” proposition. Either the program is government driven, government operated and government funded, or the program is commercial. NanoRacks has shown on space station that such distinctions are unreasonable and even unproductive. One can well envision a Mars mission which is driven by the space agencies, with basic infrastructure provided by agency funding. The private sector would be invited to risk capital and develop supporting facilities and capabilities which we would then market to space agencies, scientific organizations, and consumers.

The Government can therefore play many different roles in human exploration. It would usually be a facilitator, frequently a landlord, and almost always a customer. Depending on where we are going, the private role could be smaller or greater.

Whether we're reaching for Mars, returning humans to the Moon, exploring Asteroids, or conducting science or business on commercial platforms of the future, a flexible partnership is where and how we should be heading.

Turning to near-term beyond-earth-orbit (BEO) exploration, NanoRacks is committed to using ISS as launch pad for this new chapter in human spaceflight.

We understand NASA is ultimately focused on Mars. At NanoRacks, we too may have Mars in our hearts but our business plan already includes cis-lunar and lunar. We see a commercial market possible with the U.S. government as customer, modeled on the relationship we have developed aboard space station. Other governments could also be commercial customers—or if they want to be political partners, that is fine. But commerce must be allowed to flow among the partners.

We can well see replicating ISS' new commercial environment with a lunar program. Off the shelf hardware. Commercial economic efficiencies. Low cost enough for student participation. American leadership in both technology and market savvy.

For me, the key message here is that ISS is not just a science and technology laboratory, but a powerful management and policy testbed for how the government and private sectors can undertake space exploration together.

And the Moon is not the only possible example. NASA could reach an overarching agreement with ESA on a Congressionally funded, administration approved, asteroid rendezvous program, for example, but DLR and other individual national space agencies in Europe might be pleased to go even further, working commercially with a company like NanoRacks for use of privately-funded exploration hardware for research and utilization aboard the visiting spacecraft. At NanoRacks, we would be willing to self-fund a range of research hardware and services in conjunction with such a mission if we were allowed to market commercially to the user community. As on the space station today, everyone gains. Less government funding and more commercial practices that meet customer expectations, whether the customer is a research organization or a space agency.

Conclusion

In conclusion, Congress has stayed the course on the International Space Station. Your reward, our reward, is a stable beachhead in space, both technically and now commercially. The space station is showing us that incorporating commercial utilization into exploration programs will indeed have huge benefits.

And, as on the space station today, US government strategy should include a way to foster an ecosystem of commercial capabilities that government needs—or very often, the government doesn't know it needs. But given the freedom to operate, commercial will help lower the costs and increase the benefits to government and industry alike of an exploration program.

Finally, I mentioned about our new relationship with NASA. Yes, NASA is our landlord and safety official. But the space agency is every day less and less of a competitor, leaving to the private sector those services we do best.

Taken together, the ISS has emerged as a true laboratory for assuring that our future exploration efforts, like those now on space station, reflect the best values of American leadership and market ingenuity.

Thank you.



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COMMENTARY

Commercial Outpost

Next steps on ISS may include private researchers

The U.S. decision to extend operational funding for the International Space Station (ISS) until 2024 is increasing the odds there will be some significant return on the \$100 billion orbiting investment. So is a growing awareness of its unique utility for industrial and academic research, and some long-delayed traction for the commercial-space incubator NASA set up to promote U.S. National Laboratory assets on the station. While it is still too early to know the precise mix of public discovery and private profits that return on investment will represent, there is growing evidence that the engineering marvel of the age will be more than an impressive showpiece like the great pyramids or Taj Mahal.



NASA JOHNSON SPACE CENTER

As big money for public science on the ISS starts to pay off with enticing results, extension of the station's planned lifetime already has encouraged commercial customers at the other end of the cost scale to plan more missions. Jeff Manber, the commercial-space pioneer who founded the NanoRacks venture, says some of his company's repeat customers were beginning to "hesitate" about buying more time on the station until the life-extension decision was announced.

NanoRacks, which has accommodation and generic equipment for experiments on the station and a team of experts who ensure those experiments meet NASA's safety and other technical requirements, is working with the Center for the Advancement of Science In Space (Casis), a Florida-based non-profit that NASA has mandated to promote the station as a commercial research center in orbit.

"We're trying to commercialize the station and inspire the nation by using a minimum of 50 percent of upmass and downmass and astronaut time for the benefit of mankind here on Earth,"

says Greg Johnson, a former space shuttle pilot who visited the ISS twice and has taken over the Casis helm after a series of false starts slowed its start-up (*AW&ST* June 25, 2012, p. 45). "It's a great value proposition, where NASA is paying for [transport] to and from the [ISS] and we have that astronaut time for free—upmass, downmass for free. We do have to pay for the implementation piece, but we're looking for commercial entities to make a business proposition of the [station]."

Casis has revived the old "space is in it" branding concept for companies that bring products to market that are derived from ISS research. A likely first user is Puma, which has conducted research in orbit that may find its way into golf clubs and other sporting goods. Because of the effects of the station's microgravity environment on microorganisms, pharmaceutical research there has been particularly promising, and Casis has focused early outreach work in Texas, Boston and other biotechnology centers to promote the ISS National Lab capabilities. Now it is moving into Silicon Valley in search of

both researchers and venture capital.

Both should be easier to find with the station life extension, said government and private-sector participants in a Space Transportation Association (STA) panel on the ISS status held in Washington March 14. Also boosting the prospects for more commercial work on the station are bandwidth upgrades for data links to station experiments and steps NASA is taking to increase average utilization of the U.S.-controlled station assets to 70% from about 50%.

The latest Orbital Sciences Corp. Cygnus capsule to arrive at the station was unberthed last month using the robotic controls in the station cupola by Koichi Wakata, now the station commander, and NASA's Mike Hopkins, who returned to Earth March 10 (see photo). Developed with \$500 million in NASA seed money, both the Cygnus and the SpaceX Dragon can accommodate more cargo than is being carried, Manber says, and the Dragon can bring payloads back to Earth.

In the longer term, it is starting to seem at least possible that someone will adopt the evolving commercial-spacecraft model NASA has promoted to orbit a commercial replacement for the ISS. Orbital Sciences has some concepts in mind for using Cygnus as a free-flyer, and SpaceX has proposed a "DragonLab" version of its capsule, which it is also adapting as a contender in NASA's commercial crew development competition.

But for now the transportation, crew time and other support Congress is funding to spark commercial activities in space is essential, say those who are using it. "That's one of the advantages that we have" Johnson argues. "I know SpaceX, with the DragonLab concept—that's a real challenge for them because they don't have that help from the government."

Ultimately, it may also be possible for industrial or academic researchers to spend time on the ISS without being selected as NASA astronauts, perhaps on the model of the industrial and military payload specialists who flew on the space shuttle, according to Sam Scimemi, the ISS director at NASA headquarters. "One model may be to have private astronauts doing private research," he says. ☺

**Jeffrey Manber
Chief Executive Officer
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Jeff Manber brings together three decades of experience in realizing a more robust commercial space marketplace.

Currently, as Managing Director of NanoRacks from 2009 onwards, Manber has steered the growth of the first company to own and market its own hardware and services onboard the International Space Station. NanoRacks enjoys a customer pipeline of over 100 payloads from both domestic organizations and foreign governments, has flown over 150 payloads in the last two years and is a recognized leader in commercial space services from sub-orbital to low-earth orbit and beyond.

Previous to NanoRacks, Jeff's accomplishments include:

--adviser to the chairman of PanAmSat, the first privately owned international satellite venture that ended the Intelsat monopoly on international satellite communications and enjoyed a billion dollar IPO;

--co-developer of the first Wall Street fund dedicated solely to commercial space (Shearson Lehman);

--helping create the Office of Space Commerce at U.S Department of Commerce in the Reagan administration;

--Managing Director of the American office for the Russian space company RKK Energia. Jeff facilitated the current cooperation between the Russian and American space programs. Participant in formation of Energia-Lockheed (ILS), Energia-Boeing (Sea Launch) and other key U.S.-Russian space ventures;

--CEO of MirCorp. While leading MirCorp, Manber signed media and entertainment deals with space tourist Dennis Tito, Survivor television producer Mark Burnett and movie producer James Cameron;

The author of numerous articles and several books, including "Selling Peace," which chronicles Jeff's time working with the Russian space program. Jeff was also the recipient of the American Astronautical Society's 2011 Lloyd V. Berkner Award and NASA's Exceptional Achievement Medal in 2012.