

**INTERNATIONAL SPACE STATION PROGRAM
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JEFFREY MANBER
INTERVIEWED BY SANDRA JOHNSON
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JOHNSON: Today is August 4, 2015. This oral history session with Jeffrey Manber is being conducted in Houston, Texas, at the Johnson Space Center, as part of the International Space Station Program Oral History Project. Interviewer is Sandra Johnson.

Thank you again for taking the time to be with us today. I want to start by asking you to briefly talk about your background and how you first became interested in the commercialization and utilization of Space Station.

MANBER: Well, it is not a simple answer. I'm part of that generation that believed NASA when they said we're going to open up the frontier of space to commercial companies. It was the start of the [President Ronald W.] Reagan administration. It was the dawn of a new era, and *Time* magazine had the brand new Space Shuttle on the cover. There was [Donald K.] Deke Slayton, the former astronaut, with his Conestoga I [rocket]. There were others, like [Russell J.] Russ Ramsland studying manufacturing in space, and other entrepreneurs.

At that point in my life, I was not sure what I wanted to do. I could go back to graduate school or continue as a writer. Caught up in the excitement, I decided to write about this whole commercial frontier as no one was really doing that. Within six months, I was writing for business publications. I had some pieces published in *The New York Times* [newspaper], and pretty soon I was the go-to reporter and writer for commercial space. Equally important, not

only did it pay the rent, but I got to meet everybody in the industry and the community. This is in the mid-1980s, so that's how I got involved. I should add that entrepreneurs who were attracted early on were fascinating people.

JOHNSON: I read that you established the first commercial space investment fund for the Lehman Brothers [Holdings Inc.].

MANBER: Yes. Really, I was much younger, so I was sort of the assistant, but it was a gentleman named Jim [James P.] Samuels, and it was Shearson Lehman/American Express. The fund was set up when there was still that burst of excitement in the marketplace. The excitement was happening in the entrepreneurial side, and Wall Street [financial district in New York City, New York] was responding. The fund raised \$10 million, and we invested in several ventures. The investment I remember best was American Rocket [Company], which was run by George [A.] Koopman. The CTO [Chief Technology Officer] was [Michael D.] Mike Griffin, who later became NASA Administrator. We invested in other space projects, all of which failed. We lost every penny of the fund, and yet I continued in the industry for reasons that to this day are obscure to me.

JOHNSON: When you went to Washington [DC] and set up the U.S. Commerce Department Office of State and Commerce, how did that happen?

MANBER: You are giving me far too much credit. After Jim Samuels had invited me down to Wall Street, I continued to stay in touch with that first generation of commercial space entrepreneurs.

One of them, [Russell] Russ Ramsland out of west Texas, knew the Bushes [Vice President George H. W. Bush]. The Reagan administration was setting up a new policy shop in the Commerce Department under Secretary of Commerce [H. Malcolm] Baldrige [Jr.]. It was to be the first administration voice for the space business community that didn't involve NASA. NASA always spoke for everybody on space. The space agency spoke for the [presidential] administration, spoke for Congress, and spoke for the business community. Untenable. There was just too many conflicts there.

So, Secretary Baldrige and a gentleman named [Robert H.] Bob Brumley set out to create a more normal situation in the federal government. First, they pushed through a regulatory oversight shop in the Department of Transportation [Office of Commercial Space Transportation (AST), now in the Federal Aviation Administration (FAA)]. The intent, again, was to remove NASA from all things space and allow them to focus on exploration. The Department of Transportation was chosen since it regulates airplanes—now it was to also regulate launch vehicles. And the FAA oversight in the industry has worked out very well, by the way.

In the Commerce Department, Secretary Baldrige and Bob Brumley wanted to set up an office to speak for the business community. Via an introduction from Russ Ramsland, I was the first person they brought in from the outside. We were located in the Secretary's office in order to protect us from Congressional oversight. NASA supporters in Congress would have cut our budget. Many in the building viewed us as a bunch of rebels. There was very strong pressure brought by NASA to preserve their monopoly within the government.

I was only there for a year—last year of the Reagan administration—but we had three goals. The first was to seek to either end Space Station Freedom or at least narrow the costs down. The second was to help a company called PanAmSat [Pan American Satellite Corporation], which was to break up the INTELSAT [International Telecommunications Satellite Organization] monopoly. The third was—it turned out, just happenstance that friends of mine had negotiated a secret commercial contract with the Soviets to use the brand new Space Station Mir.

We took on all those projects, and we lost on Freedom. We won on PanAmSat, and it changed the world. Before that, you could not own a satellite where the transmission went from one country down to another country. International satellite communications were the domain of Intelsat, the organization created by President [John F.] Kennedy. But as one can imagine for an organization with multiple governmental overseers, the operating costs were prohibitive. Rene [Reynolds V.] Anselmo, the head of PanAmSat, a Mexican-American businessman, wanted to broadcast soap operas from one country to the other, so he launched his first satellite with no permission to use it. The first government to agree to break the Intelsat monopoly was West Germany; next was the United Kingdom and to my embarrassment, we were third. By the time he was successful, it changed the world as we know it. That's how CNN [Cable News Network] came about. That's how all this low-cost, international, live television came about.

The other success we had was in helping Payload Systems [Incorporated], a company in Boston, undertake the first commercial mission between a U.S. company and the Soviet space station Mir. We were successful with getting the commercial contract approved, which changed my life, because then I spent a long time working with the Russians, and that started in that office. It was also my introduction to a situation where normal business practices flourished in a

space program and sadly and ironically, it was via the Russians. The Payload Systems' contract for drug research was confidential; it had a set price; the intellectual property remained with the customer; there would be no public release of the results—all of which were not possible with the NASA of 1990.

The Commerce office did not really prosper after the Reagan administration, but those two steps—first setting up the shop in the Department of Transportation, and one in the Department of Commerce—were very important. First time in the United States government, around the White House, the Cabinet, there were multiple agency voices for the space community—it wasn't only NASA and its focus on the aerospace contractors.

JOHNSON: You mentioned Mir. You assisted in that first commercial contract between Mir and a U.S. company for doing pharmaceutical research. You also, after that, became managing director of—

MANBER: [RKK, Russian Space Corporation] Energia.

JOHNSON: Yes. You supported the first contract between NASA and the Russian space program. If you want, talk about that early point and Mir.

MANBER: I don't mean to plug here, but there is a great description in my book, *Selling Peace [Inside the Soviet Conspiracy That Transformed the U.S. Space Program]*. My friend, Dr. Anthony Arrott, walked into my office at the Office of Space Commerce and said, "Close the

door.” I closed the door. He said, “We’ve just negotiated a contract with the Soviets to use the Mir for pharmaceutical drug research.” Where did this come from?

At that time, the Shuttle was grounded after the [STS-51L Space Shuttle] *Challenger* disaster. We had no Shuttle, no access to space, no space station. Yet this small company out of Massachusetts wanted to undertake long-duration microgravity research. The question is, could they get an export license? What we did, to be really blunt, was we sneaked it past NASA and [the U.S. Department of] State.

In our society, in our country, in our government, there is something special about space. It touches all of us in a lot of good ways, and it resonates in some negative ways. We realized early on that if we went to the State Department and said, “We’re Commerce. We have a company that wants to undertake basic research in a Soviet laboratory located 200 kilometers from Moscow [Russia]. The laboratory doesn’t exist in the West. There’ll be technology transfer controls,” it would be approved without any thought.

If instead, we’d go to the State Department and say, “Oh wait, we’re sorry. The laboratory is located 200 kilometers *above* the Earth, on a space station”—no chance of it being approved because space belongs to NASA. We would have heard, “What happens if they get negative results in their drug research? Does that imperil the Space Station Freedom project? Why is a pharmaceutical company able to go to space without NASA?” It’s hard for us to realize today, but at that time the idea of going to space without NASA was too threatening, and so we snuck it through.

We told DoD [Department of Defense], and they thought it was pretty funny. “Let’s test the [Mikhail S.] Gorbachev regime.” We put the fact that it was *in space* on page five or inside the export request. When it landed in State, it didn’t go to its space department; I’m not sure if it

went to NASA. We felt there was no need. The question was, “Is there a transfer of technology?” The relevant question is, “Are the strategic interests of America being served here or not?” We didn’t want NASA answering that question. So, yes, the export request was approved.

For us at Commerce, it was a major policy victory, because we wanted this American company to have access to space, whether through NASA or not, just like any company in a marketplace on the Earth. The story broke in a big way. I’ll confess now, I engineered it with [William J.] Bill Broad to be in *The New York Times*.

I made some novice mistakes early on. Once you win in a policy debate, you should tell the people who lost. It was a great surprise when it broke on page one of *The New York Times* [“American Company and Soviet Agree On Space Venture,” February 21, 1988]. In February of—oh gosh, I don’t remember now—, but boy, they tracked the Secretary of Commerce, then [C. William] Verity [Jr.], to a golf course. Congressman—today he’s a Senator— [Clarence W.] Bill Nelson [II] stood up and said, “This will not be allowed to happen.” NASA was crazed.

But it was okay. Payload Systems did their project. The results are confidential; I never learned. And I should say that another thing, early on, that I learned, I said, “How much are you paying?”

Anthony said, “It’s confidential.” We never heard of that in the industry.

We said, “Who owns the IP [Intellectual Property] rights?”

He said, “Well, we do.” It became clear to me, in the period of the months working with Payload Systems, that the Russians—yes, the Russians—had emerged with a commercial program.

I was in the Reagan administration during its last year. When I left, Payload Systems invited me to the launch of the payload. They were required under the agreement to have a certain amount of American observers, and so they invited me to be an American observer in the Mission Control Room. In '88 that story broke, because in December of '89, I went to Moscow, Soviet Union. It was an epiphany for me. They had a space station.

The launch took place in such heavy fog and snow, we couldn't see the launch on the monitors from Moscow. We [the United States] can't do that. We couldn't do that then, we can't do it today. But, they went to a space station, and I'm not sure, but about two days later, we're in the room, and the cargo is being delivered to the station. Suddenly they hand me the phone, "Speak to the cosmonauts." It was a very life-changing moment.

I went back to the States to Washington DC, and I wrote a piece, published it in a bunch of publications, including *Space News*, saying basically, "I've seen the future, and it's got to involve the Russians. Why don't we use Mir as a stepping stone to Freedom?" Some people in the community embraced that, and some people did not embrace it, which is about standard for my career.

What happened was as the Russians evolved, they remembered me as the guy who had opened the door, who had got the help that allowed the Payload Systems contract to be approved by the administration. Of course, I was not the only one. The company had a law firm, Hogan & Hartson, and there was a woman, Ann [E.] Flowers, who was instrumental in negotiating the contract and other legal issues. The company had others, obviously, but I was the one at the Commerce Department who spearheaded the effort and was also part of the space community. About a year later, after the project had been a commercial success, I met with [Russian Space Corporation] RSC Energia, the Russian organization.

Energia was and remains the most important Russian space organization and one of the most important in the world. Energia undertook the historic Sputnik [first artificial satellite] and Yuri [A.] Gagarin [first manned spaceflight], and the first space station, and the first pictures from the far side of the Moon. For me, they were like the '27 New York Yankees. Any record you could think of, Energia held it. I met them in Montreal [Canada]. An acquaintance, Chris [Christopher J.] Faranetta, introduced me to them. I had met them in Moscow, but he made the reintroduction.

I said to the head guy, Yuri [P.] Semenov, "What do you want to do?"

He said, "I want to be a company like [The] Boeing [Company] and [North American] Rockwell [Corporation]."

I said, "You're willing to privatize?"

"Yes."

I said, "You understand what shareholders are?" I explained.

"Yes, we're willing to do all that. I can't rely on my government for funds any longer." I remember that I made some joke that you want to be a middle-of-the-road Republican, and it was stupid of me. He didn't get the joke. I wasted 10 minutes having to explain what that meant.

Finally I said, "If you're serious about wanting to privatize, and be commercial, I'm willing to consider it." I went to the [George H. W.] Bush White House, and then they had the National Space Council. Mark [J.] Albrecht was the head of it. I went in, and I said, "Hey guys. These Soviets, Russians, want me to be their representative here." At that time, *everybody* was saying they represented the Russians—even relatives in Brooklyn—*everybody* was coming up and saying, "I represent a Russian space organization."

I said, “You know, there could be some value here if Energia is the guys we want to work with.” If they’re bad, I do not want to work with them, but if these are the guys—.

I remember Mark Albrecht hesitating. He wasn’t sure what to say, because I said, “I want a letter. I don’t want in two years things to go south politically with Russia and there I am, having taken money from Russia, and then I’m in front of a Congressional hearing.”

A voice from the other side of the cubicle just said, “We know, Jeff. Better to work with somebody you know than someone you don’t.” It was George [W. S.] Abbey who would later become head of Johnson Space Center. Well-known for his mumbling, this was probably the most articulate sentence I ever heard. One that completely changed my life, and Mark Albright said, “George is right.”

I got a letter. I have it somewhere. They could not endorse my role, but it says something like, “Dear Jeff, how interesting is your new position at Energia. We wish you the best of luck.” At least I had something to show that I had gone, I had spoken, and no one said, “Don’t do it.” Along with Chris Faranetta, who introduced me, we set up Energia USA [LLC], and I was the managing director. We then set about to engage Energia into the family of the space community.

NASA responded—that’s wrong to say, because NASA’s an institution. Two veteran space officials responded, [Samuel W.] Sam Keller and [Arnold D.] Arnie Aldrich. Arnie, is the quintessential NASA engineer—pocket protector, and everything. They were looking at the design for Space Station Freedom. They were worried about astronaut safety, so we entered into a contract to study whether the [Russian] Soyuz could be used as an escape vehicle for Freedom. It was an important milestone, with the official contract being signed in the National Air &

Space Museum with several congressmen, senators, and the NASA Administrator in attendance. Sam and Arnie asked me to carry that contract on the plane to deliver to Energia.

I speak at universities a fair number of times, and there is always someone who raises a hand and says, “Why did you carry the contract over?” Well, there was no email. You’re not going to put it in the post; you had to carry it. It was a very dramatic moment. It was the first commercial contract between America and the Soviet Union in space.

I walked into the boardroom of Energia, Mr. Semenov’s conference room where the first head of the organization, Sergei [P.] Korolev made the decision to put Gagarin into space. They’re waiting for the contract, the whole upper echelon of Energia. I put the contract on the table, and they start to look at it. That’s when the reality of working with NASA hit everyone—and it was not a happy moment.

First, the contract was in English, no Russian translation. Second, it had FARs, Federal Acquisition Regulations. By the next afternoon, they are asking me questions. “Why do we have to have our bathrooms inspected? Why does it say poultry has to be Grade A poultry? What does this mean about copiers, and we have to print on both sides?”

Then the FAR that really got them—and it took several months to correct—there was a prohibition, buried in there, saying, “You agree you cannot work with Cuba, Libya, North Korea, and the Soviet Union.” I remember Mr. Alexander [G.] Derechin saying, “Jeffery, this is most interesting. How can we not work with ourselves?” That was the first contract.

But, the upshot of all this was a pathway had been established under NASA Administrator [Richard H.] Dick Truly, one which allowed the next NASA Administrator, [Daniel S.] Dan Goldin, to open the door wider to Russian cooperation on the space station

program. For me, I became the only American to ever officially work for the Russian space program. It ended up lasting for nine fascinating years.

During that time, we set up a host of critical international efforts, from the Mir-Shuttle Program, ISS, Sea Launch, ILS, and more. Working with Energia, opposite NASA, gave me a very unique perspective. I used to say at the time, in the '90s, if you wanted to work with the capitalists in space, you had to work with the Russians. If you wanted to work with the socialists, you work for NASA. It was that simple, —and embarrassing.

JOHNSON: You mentioned, as you called it, Mir-Shuttle, and as we say here, Shuttle-Mir.

MANBER: See? Habits die hard.

JOHNSON: It does. Talk about how that came about, or what role you played in that agreement to fly Americans on Russian vehicles and Russians on American vehicles.

MANBER: We like to think in the space community that we are important. The whole Shuttle-Mir Program came about because of foreign policy with India and the Soviet Union. It had very little to do with Mir-Shuttle or NASA needs. What I am about to say, some might dispute, but this is how I recall it.

The Soviet Union had a cryogenic engine deal with India. The United States was deeply disturbed by this transfer of technology and wanted the Russians to end it. Russians refused—both out of pride, national policy, and the money. Finally, as I understood it, I think it was the

[William J.] Clinton White House went in and said, “How about if we get you the money somewhere else?”

Okay. Now, the administration is dangling enhanced U.S.-Russian space cooperation. We’re dangling working together on the Space Station, to the Moon, all sorts of dramatic possibilities with the Russians as almost equal partners, given their knowledge and heritage. And they don’t lose money. That’s how the Shuttle-Mir Program came about. NASA paid about \$500 million, roughly. Gee, that’s about the same amount as the India deal. It took a decade or so for relations between those two nations to recover. It was an egregious step back by a sovereign nation on an agreement, but Russia was weak at that time and it grabbed the chance to work with NASA.

Now that was the motivating factor parallel to the manned space community. Within the space community, totally different. A lot of people in the space community didn’t then, and never had, any idea of what was happening outside, why the White House was endorsing it. Within the space community, there was a quiet euphoria. Goldin had become Administrator. Publicly, he said we, in the United States, do not have the capacity to build our own station. He lashed out at the contractors.

I think it was in Reston, Virginia, where the Space Station Freedom headquarters were. As I’m told, Freedom hardware had been manufactured, but nothing was being assembled. Dan Goldin was horrified. He was looking for a solution, and he also had a flair for drama, shall we say. Now he has the White House saying this whole rapprochement with Russia is cool. This is a new world; Russia can be our friends. The idea developed, “Why not have a Russian cosmonaut onboard the Shuttle?” The Russians refused. They wanted to be paid. From my perspective, the two worlds came together—the old way of doing cooperation in space for

diplomatic reasons and the new, commercial way, where one is paid for space-based goods and services. The result was that the Mir-Shuttle, Shuttle-Mir Program was born.

It was fascinating to be there in the beginning. The Russians—I can only speak for the space Russians—were a little disturbed because they had a space station and crewed transportation system, so why are they going to the Shuttle? “Okay, we need to involve the Americans as equal partners, we get it. So we, the Russians, will use the Shuttle.” At first, the Energia officials wanted the Americans as paying guests to the space station Mir and work instead on a joint Moon program, but NASA was focused only on finally getting their space station. Somehow. Even if it took working with the Russians.

In those early days, there were so many moments of confused feelings. The Americans thought they were doing the Russians a big favor, but the Russians were scared to have the Shuttle dock with the Mir, afraid the Shuttle would cause an accident. No one on the American side could figure out why the Energia officials were so concerned.

Finally, one of my colleagues—and remember, I’m on the Energia side—said to me, “When your people docked with us on the Soyuz-Apollo [1975], it was a hard bump.” You’re like, “Come on guys,” but no, that was the fear. The fear was the Americans were not capable enough; they’d hit the Russian’s precious Mir and there would be damages. NASA officials had forgotten the incident—not so the senior officials from Energia. On the American side, there was resentment that NASA had to pay for the “bankrupt and corrupt Russians.”

It is hard to recount all the many cultural and political issues from those early days, but to cite just one, the Russians had to swallow hard to allow the Expedition 1 mission commander to the International Space Station to be NASA astronaut [William] Bill Shepherd. He was riding up

into space onboard a Russian Soyuz with two Russian cosmonauts. Still, NASA insisted the first commander had to be an American. And it was.

One of the more important takeaways for me of the Shuttle-Mir program is that NASA began to realize how international partners, like the Russians were able to contribute to the program in a meaningful manner. That was driven home after the *Columbia* tragedy, when the Russians stepped up and saved the space station program once the Shuttle Program was grounded.

It also began the transformation of how NASA deals with a whole host of issues, including commercial rights. Allow me to tell one anecdote. Probably for many people, the most striking moment of the Shuttle-Mir program is the iconic picture of the Shuttle docking with the Mir. It is an incredibly beautiful picture, the two huge space vehicles from two national programs, linked together against the blackness of space. Yet, to this day, when I ask people, “How do you think that picture was taken?”—even people in our industry are not sure.

It was an official at Energia who had the idea that the picture should be taken. It went up in that old classic fashion, up the ladder. Got to Mr. Semenov. He thought it was a good idea, and instructed that the cosmonauts were to get in the Soyuz and circle around and take the picture once the Shuttle docked. NASA said, “No way. Absolutely not, you cannot do it.” Semenov did it—it was his station, so he overrode the NASA concerns and so the image was captured.

Energia officials proudly delivered the pictures to us at Energia USA, after personally giving a framed copy to Vice-President [Albert A.] Al Gore. We, in the interest of branding the positives of the Russian capabilities, sell the photo rights to a major New York image house. Within months, the image was published in several high-end business and political magazines.

For all of us, it was not the revenue—it was the fact that we could control the story. Now we could put pictures of the Russians and Americans working together on the publications we chose, rather than the NASA way of just anybody can use it. This way, you are controlling your brand. We were very pleased by this.

Then, unexpectedly, the same images are popping up on bookmarks, mugs in NASA stores, everywhere. We discovered that NASA was releasing the pictures with no restrictions. Why? Because it was space. It never occurred to them that Energia was a private organization that owned the rights—not the American government, not the Russian government. I complained all the way to senior NASA officials to no avail. That was the mindset of NASA in the '90s. Today, there is a shift as NASA comes to understand the role of the private sector and private investment, but not so at that time.

We ran into the same issues over and over again. Let me cite just one more example. Lockheed [Martin Incorporated] was sponsoring the *Mission to the Mir IMAX* film that came out in 1997. Key NASA and Lockheed officials requested personally to the director of Energia, Mr. Semenov, to transport the large camera and allow his cosmonauts to perform a whole range of services, for no fee.

The Russians came to us at Energia USA and asked about the IMAX program. We find out it is a publicly traded company, Canadian. They have stock. We explain the whole thing to the management of Energia, so they ask Lockheed for payment for their services. Lockheed says, “We don’t give money for this. This is to benefit the space program.”

Mr. Semenov correctly says, “But it’s being released by a company that’s going to make lots of money.”

“Oh, you Russians. You’re hungry for money.” On our side, we ended up tracking the stock price of the IMAX Company. We tracked the opening of the movie, the stock price of IMAX. Money was made by the IMAX company but not by Energia.

For us, Energia’s space exploration efforts were a business. Semenov wanted to privatize, and he did with shares of stock. Yuri Pavlovich Semenov should be remembered as a major force responsible for introducing what we call commercial space. And, he was a Soviet appointed by [Leonid I.] Brezhnev. You can debate the reasons why he did it. But, I’m not concerned why Yuri Semenov went to the European Space Agency and said, “This diplomatic stuff is over. You want to take people to my station, you pay me.” The Europeans agreed.

There is another critical moment I’d like to capture here. Having achieved the European acceptance of paying for guest astronaut programs, the Energia delegation returned to Moscow. Next morning, Mr. Semenov meets Dan Goldin and says the same thing to Goldin and others in the administration. Semenov was impatiently waiting for the interpreter to translate and he finally blurted, in English, “We need money.” He then put his hand in his pocket and shows them the change. He’s like, “We need money.”

Dan Goldin was insulted. The Administrator left the Energia office and went across town and met with [Yuri N.] Koptev [Director General of the Russian Federal Space Agency]. Goldin signed a deal with Koptev—head of the three-person Russian space agency—to fly NASA astronauts for nothing, which Mr. Koptev could not do. It was three people and he needed money, and the Americans were the ones who scorned then the idea of paying for goods and services in space. Strange, yes? That agreement did not stick, and in the end, NASA, as I said, did pay for Russian services. The United States refused to recognize that Energia was a private company that controlled its assets. It cost us a lot of lost time and confusion.

Through all my time with RKK Energia, I am proud that I helped NASA and officials in subsequent administrations and in Congress and in the industry come to realize that space can and should be just another place to do business. Today, I'm working as head of NanoRacks [LLC], a company onboard the International Space Station. Probably, we are the single largest commercial aggregator for customers using the Space Station. And ironically, a lot of our success in business development is because of what Energia did building a business on both the Mir and the ISS, and also the relationship they forged with NASA.

Today it's all changed. I'm very proud that America is taking the lead on space commercialization, as we should, as is our wont. Space is becoming a normal place to do business in America, but the first ones to surface and say, "If we provide a service, even if it's for a government, we get paid like any other business," was the Russian company Energia and its leader Mr. Semenov.

JOHNSON: It is very interesting, and especially the time, in Russian history, and what was going on there. As you said, he was a Soviet.

MANBER: Yes, and they are a little embarrassed by that period now. That is wrong of me. If we're going to talk about MirCorp, the Russian space community is, unfortunately, a little embarrassed by that period and the fight to save the Mir space station. It's a shame, because at that time the Bolshoi Ballet was being privatized, Aeroflot [Russian Airlines] was being privatized. Why shouldn't the space program be privatized? I agree wholeheartedly.

JOHNSON: You mentioned MirCorp and your time there, talk about that.

MANBER: Yes. So about '97, '98, I had been working with Energia for quite some time. It just seemed like a break was needed. We always had an agreement, never talk politics. But one evening we were talking politics, and I was expressing that I didn't really like the way the Russian industry was going. One of the guys said, "Well if you don't like where we're going, why are you still working with us?" That was a good question, so I decided to leave. Funny enough, my colleagues then said, "Oh, you have to leave in the correct fashion. You're an authorized officer of the Company." That was true, and I found out what that meant a few years back during the 50th anniversary of Energia.

To commemorate the occasion, Energia published this huge book on the history of the organization, from the original decree from Stalin to once secret programs to the modern era. For the first time ever, they published an organization chart. On the top was a box for the shareholders. They had the board of directors, and then they had the top officer, Mr. Semenov. Just like a Western company, it depicted Mr. Semenov reporting not to the government but shareholders and the board of directors. Very cool, and even cooler was that I was also listed on the organization chart, reporting to Mr. [Alexander] Derechin as head of Energia USA. I am extremely proud to be listed on the organization chart in the 50th anniversary book of Energia.

The ceremony, by the way, was unbelievable to witness. It started at nine in the morning. Hundreds of people, from all parts of the industry, were there. At one point, waves of cosmonauts came marching past us. For a while I was allowed to stand offstage, and these factory leaders would come up, and pronounce to Mr. Semenov something like, "We, from the Urals [mountain range] that have supported the complex—" something like—"for 42 years, and we will support you the next 42 years." Next came waves of supporting scientists, then engineers

and then the politicians. It was an extraordinary moment out of some science-fiction film. Later in a private ceremony, in the private office of Mr. Semenov, he and the other Energia leaders presented me with the anniversary book, signed, and they kept saying, “Look, look.” And there was the organization chart with my name in one of the boxes. Their gift to me.

I should add one other point worth noting. The Energia stock, when they did go private, created a lot of management uncertainty. Semenov was very scared that someone like Boeing would want to buy them out, secretly, so they only issued like 100,000 shares. Here you have basically the manned Russian space program. We always said it was Boeing, plus Johnson Space Center. If you imagine that with only 100,000 shares—it was not the best strategy.

Another cultural moment came in the mid ‘90s. The company was doing very well; I wanted to sell my stock. My Energia colleagues were horrified. “Jeff, you can’t sell. It’s not loyal. You are a Semenov man. You have to keep it.” I kept it. So, about 1998 I decide to leave Energia and discovered that there’s a proper way to leave. Also a bit of a cultural shock. I was called into Semenov’s office, his inner office, and I explain why I’m leaving. That I was tired, and we’d been together for a while, and I needed a rest. They asked that I keep the Washington office open. It was an official office, signed by the prime minister, hence, it was legal, and they said, “Will you keep it open for some low-level activities?” I said, “Of course.” So my leaving Energia, became a leave of absence. Somewhere, still to this day, in a file cabinet, there’s probably my leave of absence papers.

I leave, and I worked on another project called AstroVision, which was live, moving images of the Earth. Very interesting—NASA administrator Dan Goldin ran into me at one point, and he said, “I hear you’ve left those Russians. I am so happy. I am so happy for you.” I was pretty happy for me, too.

Then one day, I get a call from a guy in the industry, always a radical rebel, Rick Tumlinson. Rick Tumlinson was the voice of a man named [Walter C.] Walt Anderson. Walt Anderson had made his money in telecommunications—he's worth millions and loves space. At that time with NASA's urging, the Russian government announced that the Mir was coming down. At this point, the space station program was no longer *Freedom*, but what became the *International Space Station* in name. It might have been called *Alpha* then. They wanted the Russian Federation to put all its resources into the Space Station, the ISS.

Rick calls me and says, "Walt wants to buy the Mir. Will you help him do it?"

I said, "You can't buy the Mir. Forget it. You can't buy the London Bridge, you can't buy the Mir."

He goes, "No, no. You're the man. No, no, you're the one, they trust you."

I said, "You can't buy the Mir. *But*, you could lease it. I could see you leasing it."

"What do you mean? What do you mean?"

I go, "Well, they're not going to sell the Mir, but they might lease it for a year or two." I fly out to Los Angeles; I meet with Walt Anderson. There was Vladimir Syromytnikov who designed the docking system for Energia. He was echeloned very high at Energia.

I said, "You know, if you have the capital, and you offer to lease, and it's structured correctly, and it's not an American company—Walter, we could do it in Holland."

"Yeah, Holland would be good."

Afterwards, Vladimir said, "Everything Jeff said is accurate. He knows it. He understands us, and this is the way it has to be structured."

Now, I'm on my leave of absence, but I deliver a note to Mr. Semenov, and my old boss, Alexander Derechin and Viktor Legastayev, saying this. They're like, "This is yet another

scheme. People are coming to us all over the world.” The prime minister—I think it was [Yevgeny M.] Primakov—had decreed that the station now belonged to Energia; this is very important as we talk about Dan Goldin. It did not belong to the Russian Space Agency; it did not belong to the Russian Government; under the law of the land, there was a legal chain and the Mir Space Station belonged to RKK Energia.

Very long, story short—Walt comes out and the Energia officials say, “We don’t have time. There’s a Progress [cargo spacecraft] on the launch pad.” That Progress mission was to attach to the Mir and bring it down. Semenov was just beside himself. At one point he said, “Why didn’t you come here sooner?” Walt looks at him and says, “If I came here sooner, the price would be higher.”

Over a period of maybe two months—while the Progress was being readied—we worked in Amsterdam [Netherlands], and in Moscow. We crafted a lease. It was to the first coat of paint. Pretty typical real estate lease, it involved a \$7 million first payment by Walt, but there wasn’t time. We were just running out of time. At the meeting finally, Walt looks at me, and says, “Do we have basically what we need?”

I said, “Yes, we have what we need on paper, about 60 percent, 70 percent, but you have Mr. Semenov’s word.” Walt picks up the phone and verbally wires \$7 million. Just wires it. No contract, no anything.

So we saved the Mir. They launch the Progress but now it boosts the Mir orbit, not pushing it down as planned, and we crafted a deal where we took control of two future Progresses and one manned Soyuz [spacecraft]. The news electrified the space industry, and I think it was a shot heard around the world. A Dutch-American-Russian venture was extending the life of the world’s only space station, over the objections of the United States government.

After this, both parties asked me to head the longer term effort and I agreed to become the CEO of MirCorp.

The initial plan was to raise the Mir using a tether to a higher orbit to give us some time to think through the correct steps. But the State Department refused to let the tether technology be exported to Russia until the day the Mir went in the ocean. The publicity could not have been worse. Dan Goldin testified before Congress that we had taken a Soyuz and Progresses meant for NASA. We tried gamely to tell people that Soyuz and Progresses have a limited lifetime, and without the funding that MirCorp was putting in the Russian system, there would be no more Progresses. The Russians simply had no more money for future ISS cargo vehicles.

Goldin was also upset that we had gotten control of the Mir for \$40 million, but he [NASA] was paying hundreds of millions for the Soyuz and Progress vehicles. I found myself in the strange situation of again explaining how a commercial deal works—it was more than the funds. What made the deal possible was we, Energia partners, owned 49 percent; Energia owned 51 percent. They owned shares of stock in the new venture, not just as a contractor, which was the situation with NASA. The investment company Oppenheimer [Funds] valued the MirCorp stock at about \$200 million. Energia is getting about \$20 million, \$30 million cash, and they have stock valued at about \$100 million. That's a better deal than what Mr. Goldin is offering if it works out. Risk vs reward—that's how markets work.

MirCorp was important, but emotionally it was a rollercoaster ride. Some events are worth noting. The situation with our bank account sheds light on how intense the emotions were from NASA towards our efforts to keep the Mir open for business. We had opened an office in Noordwijk [Netherlands] near ESA [European Space Agency]. On our first day in the new office, we opened a local bank account. Sometime afterwards, the branch manager informed us

the bank account was closed because ESA said we were criminals under the American system. It was a very tough time, the American pressure. The Europeans would take us to dinner saying, “What you are doing is fantastic, but we can’t work with you. Personally, be careful.”

On many levels the Dutch were very supportive. One day there is a knock at the office door; there is a very scholarly looking young man from the Parliament, the Dutch Parliament. They had done a careful reading of the Outer Space [Treaty] of ’67. At one point it states that “a host nation is responsible for third-party liability if one of their citizens owns an asset in space.” Well, under the reading, the fact that we were a Dutch company they were obligated under the treaty to take responsibility for the Mir. The visitor then takes out a newspaper and he says, “You don’t read Dutch, do you?”

I said, “No.”

He said, “Well we’re here to inform you that yesterday we took a vote in Parliament and we are taking on the third-party liability. This article explains the situation; you can have it translated. Thank you, have a nice day.” They could have brought us down right there, but they didn’t. There’s a documentary out called *Orphans of Apollo* on the people involved. My book *Selling Peace* goes into details on how the story unfolded. Yes, we failed, but at the end of the day, when the Mir was forced in the ocean, we had \$179 million in customer backlog. That’s pretty good.

Highlights for me were when we signed with [television producer] Mark Burnett and NBC [National Broadcasting Company] to do a game show where the winner would go to space. I signed with Dennis [A.] Tito, the ex-NASA Wall Street executive. He later went to ISS with Space Adventures [Ltd.], but I signed the original contract and later turned his contract over to the Russian Space Agency.

It was a secret at the time, but I'll tell you that we signed with a Western government space agency. The Japanese said if you last a year, we'll go to you. There was a real threat here to the ISS if we fixed up the Mir.

But more than the business, the emotional high point for me was when we sent a crew to the Mir, paid fully by funds from the MirCorp investors and Energia. Still, to this day, the only privately funded manned mission to space. The Mir had been abandoned for months. The day of the launch, I remember well. Strange feeling waking up and thinking that today your company is sending two humans to a space station. I went to Mission Control with Chirinjeev Kathuria, another one of the investors. The Soyuz thankfully launched on time and later they docked with the space station and soon enough, opened the hatch. One of the cosmonauts said, "On behalf of MirCorp, we come to this station." Under the contract, once our crew was in the station, we were the operators of the station. I'm watching from a monitor in the back of Mission Control. I'm in a private room with Valery [V.] Ryumin, the cosmonaut and senior Energia official, and [Pavel M.] Vorobiev, the head of Mission Control in Russia.

The men turn to me and they go, "Sir, what are your orders?"

"What do you mean, what are my orders?"

They said, "It's your space station now."

I had a moment of actual wisdom, and I turned to them and said, "Gentlemen, what do you suggest?"

There had been a leak, a famous leak on the station. The Russians were trying to solve it. One of them said, "We have to find the leak and stop it."

Sounds good to me. "What do you suggest?" I asked the other.

"Let's start doing scientific experiments to show everything's normal."

I go, “Let’s do this. Let’s take a couple of days, look for the leak. Let’s announce that we’re doing the scientific experiments.”

Mr. Semenov’s birthday was coming up. On Mr. Semenov’s birthday, they discovered the leak, and they fixed it. That’s business, old fashioned Russian style.

MirCorp did fine as the business development arm of the Mir space station. We did business—we signed with people, we had backlog, we showed the industry that an orbiting platform could develop commercial business. But the political pressure was too great. About that time the dot-com [internet technology market] crash took place. Walt Anderson suddenly was in fiscal trouble and other investors did not materialize. Meanwhile, the United States was pressuring, and finally, the Russian Federation agreed to deorbit the station. I had to go again to Mr. Semenov’s office and sign documents ending our lease and returning the operations of the space station to Energia, which turned it over to the Russian Federation.

That was the end of a very novel experiment, one which paved the way, I believe, to the boom we are enjoying today. We established a very important data point for the next generation of entrepreneurs. During MirCorp I spoke to Elon [R.] Musk [founder of Space Exploration Technologies Corp. (SpaceX)] and spoke to Sir Richard Branson [founder of Virgin Galactic]. Everybody was watching, and asking, “Could you market space?”

We took an end-of-life station owned by an end-of-life country, and we did pretty well in the marketing and the branding. No regrets. Later, a sad epilogue to this chapter. Walter Anderson was later convicted of tax fraud—sad, but should not detract from his contributions to making space just another place to do business.

JOHNSON: Yes, that's an amazing story. Before you got involved with NanoRacks, during that time after the Mir deorbited, what were you doing?

MANBER: I was too radioactive to get a job in this country, so I was in London [United Kingdom]. I say to people, "Don't cry for me." I spent a lot of time in Sardinia [Italy]. I was in London, I had an internet project. I socially knew Mike Griffin and his wife Rebecca, and I was over at their house and Rebecca was like, "Can't we do something for Jeff?" Mike was like, "No. No. Nope." Burned a lot of bridges. Around the time of the [Barack H.] Obama/[John S.] McCain [2008 presidential] campaign, I began getting emails from both camps saying, "When we win, would you be willing to work with us?"

I say, "Yes, I would like a job."

The Russians were like, "We're sorry, you'll never work again," but, the great thing about America is we forgive, we forget. In this case, they forgave, but didn't forget. People were coming up to me saying, "You were right to push open the door on working with the Russians."

Then *Columbia* [STS-107 Space Shuttle accident] happened. When the *Columbia* tragedy happened, the Russians not only stepped up and saved the International Space Station Program by providing transportation, but they didn't gouge NASA on pricing. They didn't gloat. That also changed the view of a lot of folks that were still against partnering with the Russians.

In space, in my view, the more partners the better. The more vehicles the better. The more space stations, the better. That's how markets develop—with choices and with competition.

Early on, the Obama folks, Lori [B.] Garver, had me doing some international advising. Then people began to realize that I was back and were coming to me with ideas. Some folks came to me with the NanoRacks idea, and I went to NASA, “Are you willing to work with me?” They said, “If you want to help us on Space Station, we could use help on utilization.”

We went to NASA with a unique proposition. We said, “We don’t want your money. What I want is the ability to put my research hardware on the Station. You let me market to whom we please.” They thought about it and first they rejected it. On July 20 [2009], the anniversary of the Apollo [moon landing], they approved it. They said, “Can you get your hardware up there in five months?” We made it on STS-131, then we had more on [STS-] 132.

So I took on NanoRacks. On 9-09-09 [September 9, 2009], we signed the Space Act Agreement. The approval was very quick, but Mr. [William H.] Bill Gerstenmaier, for reasons I’m not sure, said, “Let’s see if they can utilize the space station.”

Our first product was the research platform-1 for use by NanoLabs. These are small containers, mini-laboratories, that measure ten centimeters by ten centimeters by ten centimeters. The idea was hardware focused on miniaturization and open-sourced standardization coupled with commercial type marketing, with people who can speak to customers. My co-partner, [Michael D.] Mike Johnson, developed the hardware. We guessed on the prices. First, we wanted to charge like \$75,000 for a Nanolab for 30 days on the Station. No one bought. We then set a price of \$50,000, and still no customers emerged, so we charged \$30,000 and we finally received customers.

We were losing money but showing, for the first time, that organizations would pay for use of commercial hardware on a space station. Mike Johnson, the Chief Technology Officer, myself—we were paying out of our pocket. We had a warehouse in Houston, down here by

Route 3 [Texas State Highway 3]. It was just a storage facility. Astronauts were coming over to check the hardware before their mission and were a little surprised by our location. They're like, "You're in a storage facility?" And we told them, "It's all we can afford."

We began to put more hardware and more hardware, bigger hardware, together. I tell people, "I'm not in the hardware business, but the stuff that's on the International Space Station now is of little use to customers. It's old; it was designed by committee. And perhaps worse of all, it is custom designed, meaning that no researchers are using the same hardware in their own labs. At NanoRacks, we believe that [space-based] research hardware should be the equipment that is on the ground, in the laboratories." For biopharmaceutical, we buy hardware from a Boston company for \$80,000. We got better results in growing crystals than NASA funded hardware, and the researchers on the ground understand the hardware. Off-the-shelf is the only way to go—if hardware in labs is enough to fuel the innovation we see everywhere, it should be good enough for space-based research. I believe this very strongly.

Then we saw that there was a market for CubeSat deployments. The CubeSats are small satellites, no bigger than a loaf of bread. The Japanese had designed a small CubeSat deployer for their KIBO module, and we figured we would deploy one or two a year—couldn't get anybody, not anybody to be a customer. Finally, I'm in Strasbourg, France, and a young man from University of Hanoi in Vietnam [Vietnam National University] says, "I understand I can buy a CubeSat deployment on the International Space Station."

I said, "Yes."

He says, "What's the price?" I tell him. He says, "I'm there."

I say, "You're Vietnam. Where's your money coming from?"

He says, "Microsoft [Corporation]."

That deployment became another iconic picture—the astronauts took a picture of the satellites going out of the station. You are nodding your head; everybody remembers the picture. For the first time, it made the deployment of a satellite a branding or media event. As in the movies, the phone did not stop ringing. We went to NASA—and this is the new NASA. We went to NASA and said once again, “We don’t want your money, but can we build our own CubeSat deployers for the KIBO module, ones bigger and more effective?” NASA and JAXA [Japan Aerospace Exploration Agency] said yes. We spent about \$1 million, which is a lot of money for me and for NanoRacks. To date, we have deployed 90 CubeSats. We have about 150 under order.

We have brought to market companies like Planet Labs [Inc.], Spire [Global, Incorporated]—used to be called Nanosatisfi [Incorporated]. We are working with the U.S. government, different agencies. We have flown satellites from Peru and Lithuania. Today, we’re in an entirely different situation in the commercial space industry than what we have spent time talking about. Today, there are large segments of NASA—not all of NASA—but large segments of NASA that say if commercial can do it, putting your capital at risk, let’s give them a chance.

There are not many companies like NanoRacks. Elon Musk has done miracles for the industry, but it has been launched via a government contract, and there is nothing wrong with that. I wish I had a billion dollar contract [agreement], but we don’t have a contract. NASA is a customer, and NanoRacks lives and dies on every service we undertake for every customer. What we together—NASA and NanoRacks are doing—is totally new territory. We are increasing month by month the customer base of the International Space Station without a NASA contract.

Today, we have reached the point at NanoRacks where NASA is our regulator, it's our landlord. At times, it's our customer—eight percent of my revenue—it's no longer just a competitor. At times; there are certain [NASA] Centers that still compete against us. Basically today, we're moving into the right spot.

For America, how we do things in this society is to allow industry to find the markets and invest. Government can support with infrastructure such as funding the early internet or early aviation. Or today, government funds our airports, government funds the runways and supplies the work force to ensure safety such as the air traffic controllers. In Europe, they are more socialistic with far more cooperation between government and industry, and that's where their space industry is today. Russia's centralized, returning to their roots and losing the imagination of when I worked for Energia and losing their market leadership. China's space program is going to be a weird mix of capitalism and centralization—think of Singapore in space, that is what China is. In short, America, finally, is moving in the direction of allowing space markets to behave like all other American markets. That is what I have spent my entire career trying to get us to—the point where space is just another place to do business and the government is a customer.

Today, NanoRacks is probably one of the largest users of Space Station. We have customers from high schools—we charge \$15,000 for 30 days on the Station—to U.S agencies and foreign space agencies like ESA that pay us for distinct services. At times, they could get it free from NASA, but do you send things to the post office if that shipment is important, or do you send it with FedEx [Corporation]?

We average nine months [getting] through the NASA system; NASA averages three years. Why? Ask them. Same safety, same everything. Some people dislike us very much

because we push the system—always, always pushing the system. For us, what we are doing today has shown Space Station to be important, has shown orbiting platforms to be important. We have learned so much—the secret sauce of how do you get customers, and how do you keep governments happy. We work very closely at NanoRacks with NASA, with JAXA, Roscosmos [Russian Federal Space Agency].

When I walked in to do this interview, the front page of today's *Houston Chronicle* [newspaper] was, "We've just opened the door to China." The U.S. Government, along with the ISS partners, have allowed us to work with the Beijing Institute of Technology, which will be the first commercial research project on ISS from China. Hopefully, that will all go fine. We will see. We have now worked with dozens of nations, all of which require, under the ISS rules, the permission of Russia, Japan, Canada, United States, and the European Union. No one has ever withheld a single request.

At first, the NASA folks were surprised that Russia was so accommodating to NanoRacks and our requests to fly non-ISS customers; the NASA folks did not understand my background with Russia. One day a woman said to me, "You know, the Russians are the toughest on granting these approvals. But yours, they always just grant immediately." I hope they have some nice memories, or they're loyal!

I appreciate the support received from everyone throughout the industry, to see if we can indeed create a commercial customer marketplace in space, starting with low-Earth orbit. And we need the support. For example, when SpaceX Cargo Resupply Service (CRS) mission 7 blew up a couple of weeks ago, NanoRacks lost 1300 kilograms of hardware. That was a tough loss in terms of revenue.

JOHNSON: Yes, and that's a little different. As a commercial company, losing that money. How do you recover? For example, when NASA had accidents, and when things have happened, it's taken so long to recover from that. As you said, it's a different attitude now, and as a commercial company, recovering from an accident like that. Have there been any repercussions from the people who are the entities that had things on that SpaceX mission?

MANBER: Sure, yes. I mean, the projects undertaken by the kids as well as the companies. We had had three failures in a short period of time as we do this interview. When Orbital-3 [Orbital Sciences Corp. CRS-3] failed—that very night, [Michael T.] Mike Suffredini, head of Space Station, calls me and says, “What do you need?”

I said, “I need x amount of kilograms on the next flight.”

He said, “We'll try and get it for you.”

Then when SpaceX blew, I was on vacation. My first vacation in two, three years. When SpaceX-7 failed, NASA was on the phone within 15 minutes, saying, “This one's tough. This one's tough, because we now have two failures and upmass is limited.”

I said, “Well, if I don't get everything I need, I'll have to lay off people. I mean, this is real for us.”

Then Suffredini got to me the next morning, and he said, “What's important for your revenue and your customers? What's the critical items you need flown quickly?” What a change for NASA!

For us, getting what we and our customer needed all hinged on the [Russian] Progress that was launching that Friday. If that Progress had been destroyed, I would have been in serious

trouble—could not have done the upmass, but NASA got everything I needed on the HTV [H-II Transfer Vehicle], the Japanese [cargo spacecraft].

At times they've even sacrificed things that the astronauts have wanted. They've explained to folks here at Johnson Space Center that the astronauts can wait a little bit for this extra this, this, and this, but we've got this company whose revenue is tied to implementing a given project or service. It is hard for me to even put into words just how much the Space Station Program gets what we are trying to do at NanoRacks. Every week we go back and forth on what we need, what they need to get to the space station. No one writes about the good side of how commercial services are maturing on the International Space Station, and that is why some of the folks don't like us, because we have gotten priority over what used to be the priority.

JOHNSON: That's quite a switch in the last 15 years as far as the attitude coming out of NASA.

MANBER: Yes. I think it is because of a group of people who have been working to bring about commercial space. And I think for many in NASA, in Congress, in their hearts—look, they're Americans and deep down, they know that socialized, centralized programs do not work in this country. Why should space be different?

It's very strange to go to [NASA] Marshall [Space Flight Center], Huntsville [Alabama] and come to Johnson [Space Center]. I would dare say most of the people here are probably to the right of the political center, and argue with them that they shouldn't be socialists when it comes to space! So far, I've emerged with my life intact!

JOHNSON: What do you think the legacy of ISS will be when this is all said and done?

MANBER: Oh, great question. They tried to get the ISS program to be awarded the Nobel Peace Prize. At first I thought it was a silly thing. On reflection, it's not silly. Having nations work together peacefully in the pursuit of knowledge is something worth celebrating. In society, I fear it will have very little legacy; it has not really made much of an impact. I fight with NASA to do more emotional things like art and music for this very reason, but NASA's just not geared for doing those sort of things. I fear that in terms of the society, the legacy is not that great, unless some great research breakthrough is indeed finally realized.

The station may be remembered as the starting point for our future journeys beyond low-Earth orbit, back to the Moon and to the asteroids. I hope the first steps are taken from the Space Station. As of today, my feeling is that the legacy will be remembered for the international cooperation. The IGA—the Intergovernmental Agreement that is the operating contract for the space station—I call it the Magna Carta of space. I hope it never goes away. It has worked for 15, 20 years. It has waiver of third-party liability, it has rules that have withstood the test of time, of setbacks, and unexpected developments. If you introduce that the space agencies can buy and sell services worldwide, it works pretty well for me. I think the legacy will be that Russians, and Americans, and Europeans, and Canadians, and Japanese could work together. Why not include a few more nations under the IGA to Mars, or maybe one day we won't have nations, we'll just have companies. The IGA is the legal and operational legacy that the Cold War enemies could work together peacefully.

Largest, I think, international cooperative project in peacetime between Russia and America—that legacy marks the International Space Station in the Clinton, post-Cold War era. It was our most ambitious effort done, most optimistic. By the way, I wish in some way it had

gotten rid of the unbelievably government bland name of ISS. The Mir, for example, is the Russian word for peace.

I think the ISS will stand proudly in its place of what we believed the future could be with Russia. With respect to Canada, Japan, and Europe—they probably share this view—it's really a statement of the two great space powers, Russia and America, working together. And in America, we learned how you run a manned platform for years at a time. I hope we do not forget these lessons and need help yet again decades from now.

JOHNSON: The lifetime [of ISS] was extended to 2024. Do you feel that NanoRacks—and being able to show what the possibilities are, and the science, and now that's it's up and running as a full science station—do you feel like that had anything to do with the extension?

MANBER: We are told that we played a minor role, that there is bipartisan [congressional] support for utilization. A lot of people in Congress like NanoRacks, because we don't ask for money. So yes, I think the fact that NASA was, "finally getting its act together," and showing that they get the future of reduced budget, and entrepreneurial space companies, I think it did play a role.

It was something that the Obama administration wanted to do early on to send a signal. We were on the [Capitol] Hill saying we needed to extend the life of Station. When we started NanoRacks, the Station was to be defunded in '15, I think, and deorbited in '17. Then it was extended to 2020; now it's extended to 2024, so I do believe that utilization and the value of utilization and creating jobs and valuation and showing American leadership did play a role.

JOHNSON: Now as you mentioned, China is a possibility. What do you see as a future for this type of utilization of space as far as other companies forming? Do you think it will take off like a dot-com boom? Do you think this will be something that grows quickly?

MANBER: Yes. We spend enough money on space, but we spend it horribly inefficiently. We don't use consumer practices, business practices. Government is slow on innovation. There sure is the strategic need to keep space safe for use by all of us on Earth.

All this suggest that services in low-Earth orbit may well "take off." I think there's a revolution in Earth observation where we understand everything going on right here on the ground—how many cars are in Walmart [retail store] parking lot?, you can map that. Clearly today, space is both strategically important and of growing importance in our daily lives. NASA has said publicly that this is the last Space Station they will operate in low-Earth orbit, but we're not leaving low-Earth orbit. Ipso facto, therefore commercial companies will have to play a role. I expect that, and I hope to be part of that.

Part of the legacy of ISS is the fact that we showed utilization, and we showed that it can play a role in more than, dare I say this, pure science. There are some who don't like that NanoRacks is doing satellite deployments and Earth observation services for customers, but that's what is going to be needed to keep our presence in low-Earth orbit. We think that there are so many launch vehicle companies coming down the road, we want to be one of the destinations. You have people like Elon Musk saying, "I want to colonize Mars." You have [Jeffrey P.] Jeff Bezos of Amazon [Amazon.com, Incorporated] doing his secretive Blue Origin [aerospace company]. Blue Origin announced two weeks ago, three weeks ago, that NanoRacks—my company—will play a role in their business development and payload integration. Now, if all

goes well with Blue Origin, we will be bringing customers to at least two operating platforms, both for the ISS and now for the suborbital New Shepard.

And I hope we will have other platforms and space stations in the not so distant future.

JOHNSON: I think we are about out of time. Is there anything else that you wanted to mention?

MANBER: It's an evolving story. We are at a tipping point.

If we had done an interview, let's say, in the mid-'80s, it would for me have been one of optimism, but just not sure where it was going. If we spoke in the '90s, the tone of the interview would be one of anger at the intransience and stubbornness of the American view of space, and the fact that I had to work in Russia to undertake commercial services on a manned space station. If you were American of certain means and wanted to personally experience the joy of being in space, you had and still have to work via the Russian space program. This should come to an end in a few years but how strange is that?

Doing this interview today? It is a very exciting time because it seems like the pieces of the jigsaw puzzle are coming together. Let's hope it continues. It will be very interesting to see where we go in the next five years. It will be very interesting.

[End of interview]