NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
COMMERCIAL CREW & CARGO PROGRAM OFFICE
ORAL HISTORY TRANSCRIPT

ALAN MARTY
INTERVIEWED BY REBECCA HACKLER
PALO ALTO, CALIFORNIA – 18 JANUARY 2013

This oral history interview was conducted with Alan Marty on January 18, 2013, at the offices of Legacy Venture in Palo Alto, California for the Commercial Crew & Cargo Program Office History Project. Interviewer was Rebecca Hackler, assisted by Rebecca Wright. Marty began the session by sharing his view of the broader national significance of the Commercial Orbital Transportation Services (COTS) Program.

MARTY: We're in a time right now when social need in our country is greater than ever, and yet government resources are more restricted than ever. In that kind of an environment, innovative ways to approach really significant social challenges are critical. COTS is one of those really interesting examples of how a very small team, germinated out of a nucleus of three or four people, used a very innovative approach in order to save the United States taxpayers $100 billion, $200 billion. Even in the federal scope of the budget, that's a material amount of money for a small team.

But COTS is more than just success, it is also a wonderful story to tell. Plenty of challenges, with dead ends and surprising turns in the plot. Colorful characters who bonded in a common effort. And a mission to have the very first private rocket berth with the International Space Station in only six years. Yes, it is a rocket science story, and most experts at the time said it could not be done.

HACKLER: We understand that you had previously worked with NASA at the Ames Research Center [Moffett Field, California]. Can you talk a little bit about your background working with NASA previously, and then how you became involved with the COTS team?

MARTY: I will. Let me frame it a little bit bigger than that if I can. I was a scientist. I was a physics prof [professor], which always helps at NASA, because if you're strictly a business person and you come into NASA, people sometimes look at you a little skeptically. It does help to have a science and engineering background.

I'd also been a White House Fellow. I don't know if you're familiar with the White House Fellow Program.

HACKLER: It would be great if you could explain what you did.

MARTY: The White House Fellows Program was started in the [President Lyndon B.] Johnson administration, and it still exists today. Its objective was to take people early in their career—for me I was in my early 30s—and allow them to see how the federal government works at the highest levels. They pick about 12 people every year, and they allow you to work directly for one of the cabinet members. At the time I was working for the Secretary of Defense. It was in the [Ronald W.] Reagan administration and then the first [George H. W.] Bush administration.

For a physics professor, business-type of person to get a chance to go in and see how the government works at the highest levels is very unusual. I spent a year in [Washington] DC as a White House Fellow, and I came away with some really strong feelings. The Defense

Department at that time had 4.5 million people in it. How do you solve problems with a team that large? What kind of leadership challenges do you have, what kind of communication challenges do you have? When you've got 20, 25 levels of management, how do you communicate with people? How do you get stuff done?

My White House Fellow perspective was really useful to the COTS program, because interestingly, when you're working with the President and with the Secretary of Defense, you don't think very much about NASA. NASA is small. It was a big deal in the '50s and the '60s, but most people don't think about NASA that often. But for a person who has spent their whole life working in NASA, and when your career is determined on how well you perform in the NASA structure, you have to buy in to the NASA culture to succeed.

At NASA, the way to do things well is to dot the I's, cross the T's. Don't make a big mistake, communicate really well. Eventually you'll get a bigger budget and eventually you'll get a lot more people reporting to you. That'll be your career. On a broader scale, that's how the Defense Department works. You do things really well, you don't make any mistakes, you work really hard, and eventually you get a bigger budget and you get a lot more people reporting to you. That's exactly the opposite of how things work in Silicon Valley [high-technology region around San Francisco, California].

The steps to success in the NASA environment or in the Defense Department environment are turned upside down in Silicon Valley. Nobody thinks that way. You don't think about getting a bigger budget, you never would think about getting more people. It's not about that. It's a completely different culture of risk and reward. Failure in Silicon Valley is just an opportunity to learn. But failure in NASA means the [Space] Shuttle blows up, and then the

Shuttle is put on hold for two or three years, and the NASA brand gets tarnished, you have a whole bunch of hearings in front of Congress.

Just a completely different mentality. When you write a contract in the NASA or the DoD [Department of Defense] context, everything is risk averse. Usually we don't even have contracts in the Silicon Valley environment. But when we do, they're very simple, and they're very fluid. They're very asynchronous, which means you don't plan ten years in advance. You plan a month or two months, and then you see what things look like and you adapt. People realize that if you don't keep up, if you don't adapt, it's over. Again, very different culture.

The other thing I learned when I was a White House Fellow was that you can toil away working really hard and really smart 15 levels down in the organization and never make a difference. I was coming into this NASA project with a mentality that if I'm going to take a chapter of my life and work on this, I'm only going to do it if it can make a difference. This is not my whole career, this is simply a chapter.

The primary reason I got interested in working with COTS was to be able to tell the story to my grandkids. People at NASA have heard me say that so many times. My primary motivation for doing this was to be able to tell a good story to my grandkids. That's a very different motivation than trying to dot the I's, cross the T's, and build a career and build a bigger budget. It's just a different mentality.

The White House Fellows Program was very significant because it allowed me to say, "This is how the president thinks, this is how the vice president thinks. This is how the cabinet thinks, this is how budgets get done."

The other thing to realize is that if you're only working at high levels in an organization, a lot of times you can't make the significant change that you want. Conversely, if you work only

at low levels, a lot of times you can't make the significant change. You can toil forever, and a lot of times it doesn't even get seen up on high. The question was—and I'm getting a little bit ahead of myself here—if you're really going to try and make a difference, what's the right way to come into the government so that you can work at the highest levels and at the nitty-gritty levels in such a way that you can actually see it all the way through to making a multi-hundred-billion-dollar difference. That was my mentality going in.

So I brought the perspective of a scientist and the perspective of a White House Fellow and the perspective of an investor. But I also brought a memory of a meeting I attended somewhere between 2000 and 2002 with Sean O'Keefe, who was the NASA Administrator at that time. Sean made a trip to NASA Ames to meet with Henry "Harry" McDonald, the Ames Center Director, and Sean asked to meet with a couple of leaders in Silicon Valley to figure out how NASA could become more innovative. Which is really interesting, because most people think of the NASA brand as the innovation center. But Sean was coming out to Silicon Valley to say, "Actually the innovation center is really Silicon Valley. Ames is in the middle of Silicon Valley, what can we learn from Silicon Valley?"

Five people were at this meeting. [E.] Floyd Kvamme from Kleiner Perkins [Caufield & Byers]; an iconic venture capital investor, John [A.] Young, who was the former CEO [Chief Executive Officer] of Hewlett-Packard [Company]; and me, with McDonald and O'Keefe. We sat for half a day in the big conference room in the Ames center. We spent that time talking about innovation, and if there was a way Silicon Valley could have any useful influence on the way things were done at NASA so that NASA could be more innovative.

Then I filed that meeting experience away, didn't really think about it all that much. But as I look back, I realize it was a pretty interesting and significant conversation, because even

though NASA Ames is right here in the middle of Silicon Valley, at the time there really was very little interaction with the rest of Silicon Valley. And certainly very little interaction between Silicon Valley and Johnson Space Center or [NASA] Kennedy Space Center [Florida] or [NASA Headquarters, Washington] DC. Those just seemed so disparate.

Then I guess because of that meeting, the people at NASA would reach out to me occasionally. For example, while I was a venture capitalist at J. P. Morgan Partners [LLC], I helped NASA produce a DVD video on innovation. It wasn't my job but it was interesting to me, because it seemed like an interesting challenge to see how Silicon Valley could work with NASA in order to do good in the world of some kind. I didn't know exactly what that was going to look like, either do it better or do it cheaper or do it faster, but to make life better somehow.

Innovation is at the core of me. I've got seven patents, I care about innovation a lot. It resonated with me. In 2005 I gave a speech at NASA's request. The transcript is online somewhere. I look back on it and go, "Well, a lot of what eventually played out at COTS was touched in this speech." This is before COTS had really happened, although my guess is that it was bouncing around in [NASA Administrator] Mike [Michael D.] Griffin's mind. As these things converge it's very interesting, because he'd done In-Q-Tel [CIA (Central Intelligence Agency) venture capital firm]. He was the president of In-Q-Tel, so even though he hadn't lived in Silicon Valley he knew something about venture capital.

I gave this speech in 2005, and I basically talked about the challenges of doing innovation at NASA. The challenges of getting the commercial world to care about doing anything with NASA or in space, and sometimes how NASA was its own biggest problem in terms of thinking they were helping but in fact oftentimes getting in the way. Not trying to, it's just that the cultures were so different that in trying to help you can create your own set of problems.

That was in June of 2005, and interestingly, in October of 2005 I was at a reception in the White House, and Mike Griffin was there. I'd done enough with NASA to know who he was, and so I just went up and started talking. As you would expect, if you're at a reception in the White House, you get certain credibility just because you're there. We had this really interesting conversation.

I learned more from him about this idea that he had of maybe doing something venture capital-ish within NASA as a way to deal with what he considered, as he voiced it to me, his biggest challenge. It'd be interesting to know how he would reflect back on this conversation, but the way I recall it was in a highly simplified form.

He said, "I've got an International Space Station. I'm responsible because of international agreements for going up and down to support the International Space Station, I have a Shuttle that's going to retire in 2010, and I've got an Orion [Crew Exploration Vehicle] project that's going to cost hundreds of billions of dollars. It's at best going to be available by 2013 or '14, probably will be delayed, which means I've got this big gap where I'm going to be dependent on the Russians. Who knows if that'll even be possible? Boy, wouldn't it be nice if we could find an innovative way to come up with a commercial way to service the Space Station?"

Now that's a project. That's a really interesting project. I remember telling him at the time, "If you try to do that out of Johnson Space Center it will surely fail, because you're trying to do the most innovative thing out of the deep core of the NASA culture." Remember, I'm not saying anything bad about the NASA culture. The NASA culture is amazing and it's great for what it does really well. But it's very different than the Silicon Valley culture. My suggestion to him was if you really want this idea to go somewhere, you need to move it to NASA Ames.

He said, "Not going to do it. Too far along, not going to do it. But Alan, you should get involved. If you feel this strongly about it, you should get involved." I was really intrigued, so I decide to respond to the COTS formal Request [for Proposals] for venture capital services, and I was selected.

But COTS was starting to move pretty quickly. My contract wasn't supposed to be in place until January of '06, and they were looking to put out the COTS procurement contract in December of '05 or early January of '06. I was well aware that if that procurement went out and I hadn't looked at it, it was going to go out with a NASA approach to innovation and solving a problem. Which again is not a bad thing, but if you're trying to do something really different in a Silicon Valley-style, it's not going to lead to that kind of an outcome.

COTS ended up doing a short-term temporary contract for me so I could read this procurement in its late stages. What I recall is that I marked it up severely, with all the best intentions of my heart. You've got two people who I really came to appreciate. Dennis [A.] Stone [Commercial Crew & Cargo Program Office (C3PO) Assistant Program Integration Manager], who I'd gotten to know a little bit, was highly committed to the commercial space sector for a long time. Knew a lot of people, and his heart was really into trying to get this commercial space thing done—not just checking the boxes, not just worrying about his career, but actually trying to get commercial space off the ground. It was really at his core. Then Alan [J.] Lindenmoyer [C3PO Manager] was also so amazing to work with.

I hadn't met Alan until December of '05 when I first went down there [to JSC]. Both Dennis and Alan were just steeped in the NASA culture. They knew people, they knew how to get things done within NASA. Yet, they were also very good listeners and learners. You don't usually find that openness in people who have a lot of experience and are really successful in

their culture. It's not common for somebody to be able to say, "Oh okay, well let me really listen carefully to a different perspective." That's hard for people to do, no matter where you are. It'd be like somebody in Silicon Valley saying, "Well, let me just listen really carefully to the way they do it in the government."

That's hard. That's hard, because you've spent your whole life thinking that your way is the only way, the best way. I've got to give a whole lot of credit as this thing is kicking off to Mike Griffin, who had this concept, and his experience allowed him to generate it. And to Alan Lindenmoyer and to Dennis Stone, who had this experience that allowed them to be in this place at this time, but also had this personality that allowed them to be really genuine listeners. Without those three people, this would have gone nowhere. It just would have gone nowhere. They, in my mind, were just absolutely stars.

I did the markup of the COTS contract. There were four changes that were really significant. A lot of the logic behind my changes goes back to a particular book. You may or you may not have heard of this before, but it was a very significant book in the world of business innovation. It's a book by Clayton [M.] Christensen called *The Innovator's Dilemma*.

HACKLER: I've read it.

MARTY: You've read it. It's a good one.

HACKLER: It is good, a lot of good insights.

MARTY: I actually handed it out to everybody within COTS, in DC and at the Johnson Space Center, and at Ames. Because the whole point is that—I'm trying to simplify the book, which is a tough thing to do—but if you try and innovate something dramatically new within an established organization, and within an established culture, you surely fail.

This was the genesis of my very first conversation with Mike Griffin. If you try to do this innovation in the bowels of Johnson you will surely fail. Even though COTS was based at Johnson now, and I was just skipping in and out of JSC, my point for the people who were closely tied to COTS was to say, "We've got to take this *Innovator's Dilemma* book seriously, we've got to take it really seriously. Unless you separate yourself mentally from the way you've always done things at NASA and really try to embrace and adapt, you will never pull off the huge success required from COTS."

The Innovator's Dilemma is a big idea. In fact, I remember Alan Lindenmoyer didn't have time to read the book. He was still trying to figure out who Alan Marty was. I actually wrote him a book report, a two pager. I said, "Here, read this. You've got to get this." I think he eventually went back and read the book.

I just wanted to make sure people understood what we were trying to accomplish, that we had to do something with a different culture and a different mentality than NASA had done before if we wanted to do something truly great, and if we wanted to take it all the way to the end. Not just pretend we were doing a program and going through the motions, but actually really do something that would make a difference that would allow me to tell grandkid stories. That was my objective, my grandkids.

HACKLER: Were there any specific principles from the book that you applied to your work in the COTS program?

MARTY: Yes, I probably have the principles on the top of my head. Some of those basic principles were that you want to move the organization to a different place, you want to have a different team, and you want to have a different mentality towards risk. You want to do things that may look totally illogical to people who are in the space business or the steel business or the disk drive business, or whatever business you're talking about, but if you do a lot of learning cycles and you move really fast, you can get on a steeper learning curve. And doing so with the expectation that within a matter of just a few years you can actually have a product that is far superior, far less expensive, and far more reliable.

That's what we were trying to do. We were trying to break the culture, break the paradigm so that we could create a new space vehicle within a very short time—remember, this was 2006. The Shuttle was retiring in 2010. Instead of a couple hundred billion dollars, we had $500 million. Instead of ten years we had four. For three orders of magnitude less money and half the time, we were trying to replace the Shuttle, the task that Orion was supposed to do.

That's big. You can't just do that by doing the same-old, same-old and making a few small modifications. You really have to do a Clayton Christensen sort of an approach. You've got to say, "Let's embrace something really different." Those would be a few of the principles.

As I read the contract, the very first COTS procurement, the kinds of things that stood out, just to give you a few examples—1) If you're NASA and you're giving somebody money, you assume that any of the intellectual property that is generated by the person you gave money to, that intellectual property should belong to NASA. Seems logical. 2) You would assume that

if you want them to be successful that you would take all of the learning that NASA had, and you would share it with that organization in the hopes that they would be able to do their job better. You'd put some people on site, you'd put an organization together in order to share your learning. Seems logical.

3) You would expect that if you were going to give somebody money that you'd give them as much of a runway as possible. You basically say, "I know it's going to take you four years. Let's lay out the whole four-year schedule. You can count on that money being available to you as you go through." And 4) if you give somebody money you expect that you should get some equity. If you're giving to a private company, you should get some equity.

I was looking at this COTS procurement contract from a different perspective, though. I knew we would need private investment to successfully complete the rocket development, but attracting private investment to a COTS rocket company was going to be difficult, so I proposed four guiding concepts. First, we should take no IP [intellectual property] at NASA. Second, we should only share NASA knowledge when it was requested by the company, and put no NASA people on site at the company. Elon [Musk, founder and CEO (Chief Executive Officer) of Space Exploration Technologies Corp. (SpaceX)] later on completely reinforced that second guiding concept by saying something like, "For every NASA person you put on my site, I'm going to double the price." Reinforcing what I was saying.

Third, from a schedule perspective we basically said, "We're not going to make a commitment to you that you're going to get any more money unless you perform at a certain level. If you don't perform at that level we're going to have very clear provisions so that we can wash our hands of you and go to somebody else." From a NASA perspective that sounded just crazy. "How are you ever going to develop a partnership if you're not in it with them? What's

this wash your hands and you can go on to the next one?" Which ended up being extraordinarily important because we did have one of the early COTS choices that was not able to do their financing round, and so we had to move on to the next one.

Fourth, we took no equity. The reason the decision was to take no equity was that in the world of venture capital, sometimes you make poor investment decisions and you get no money back. Sometimes you make really good investment decisions, and you get five times your money back or ten times your money back. But you almost never get one time your money back.

I knew enough about the federal government to know that if you invested money and you got none of your money back, everybody would get angry. But it also turns out that if you invest money and you get five times your money back, everybody gets angry too, because then you're competing with the private sector. There's no way that when you're doing innovation like this you could expect that you were going to get one times your money back. That's just silly. It was better to take no equity at all.

No IP, don't put any NASA people there, don't try and share your basic NASA technology with the people, let them develop it on their own unless they ask you for help. Only give them that money as they earn it, and don't take any equity. Different than a typical NASA approach to having a partnership than they had done before with [The] Boeing [Company] or all the others, which were really big long contracts, very tight. If they missed the schedule, they just slipped the schedule a little bit. They did a change order.

So we were breaking these NASA beliefs about how to set up a successful contract. This was really a very significant change—even for Alan Lindenmoyer and for Valin [B.] Thorn [C3PO Deputy Program Manager]. As we were making our decision on who to fund, the most important objective was who could get the next funding round from the private sector. Because

you can't build a rocket for $200 million, you had to get private funding. We looked at, I don't know, 30-some different companies.

Usually when the government gets involved in a project, all the private funders run away. They don't want to be involved with a project with the government, it slows things down. You have all this bureaucracy, people start worrying about IP. These basic principles that I just laid out with you—about the IP and having people not there, not taking equity, and an asynchronous schedule—was basically because our primary objective was to hire a team with a plan that could get their next round of financing. They wouldn't need additional money from NASA, they could get it from somebody else.

HACKLER: Did you work with the NASA legal team in developing this [COTS] Announcement?

MARTY: On the COTS team we had a legal representative, he was a great guy.

HACKLER: Jon [Jonathan A.] Arena?

MARTY: Yes, Jon. Great guy, very innovative. But his job was to be the legal guy. I would say things and he would go, "We've got to check on that." That was a very common response. But everything we did was completely within the bounds. In most cases it was a cultural challenge more than it was a challenge to do something that was constrained legally. It's just we were doing it in such a different way.

To say that we were going to pick these teams mostly around their ability to get the next round of financing, not around their technical prowess—within NASA that's like, "What? Are

you saying we're going to do this led by the business guy?" That's not the NASA culture. It sounds very illogical, unless you take the perspective that you can't build a rocket for $200 million, and there's no more money coming from the government, so your whole mentality has to be how do you get the next round of funding from the private sector.

If you put that frame on it, then all of these things make sense because what you're trying to do is make this into a logical private investment. It's going to be risky for the private sector, they don't do rocket investments. But you had to make it sufficiently interesting that they would go, "It's worth us looking at this and putting in some money, because we could see how this would provide potentially a very nice return for our investors."

Now the technology matters too, and the team really matters. But the fundamental thing was can they get the next funding round. When we wrote the milestone charts, very early on—the two that we chose first were SpaceX and RpK [Rocketplane Kistler], and RpK did not make their funding round. That was the milestone they missed. They had all this great technology but they missed the funding milestone.

I remember Dennis and I flew up to Wisconsin, sat down with their executive team, and really worked. We really wanted them to succeed. But if they couldn't get funding they were not going to succeed. We had to make the choice. The exit ramp if you didn't meet the milestones was very clear. We'd written that very clearly in advance, because we knew this was possible. That's the way things work in Silicon Valley. If it doesn't look attractive, you don't get the next funding round. Everybody just goes their separate ways, and they start a new company. Then we brought in Orbital [Sciences Corporation] as a replacement.

HACKLER: We understand that you also went with NASA and RpK to New York [City, New York] to conduct some financial meetings on Wall Street [financial district] to try to find investors. Can you talk a little bit about that?

MARTY: Yes, a quick tutorial. Again, I'm a professor type, so I like to teach. I think that attribute was actually really important in this arrangement for COTS, because I spent more time teaching people within NASA what it was we were trying to do—hopefully in a humble, engaging, winsome way—than I did actually selecting companies or managing companies. Because a lot of this was *The Innovator's Dilemma* concept. If you're in the Johnson Space Center, how can you learn to act like you're really in Silicon Valley? So for me, a lot of this was the teaching side.

In tutorial mode here—when you raise money, there's generally a couple different ways to raise money for a startup company. One way is through your network in Silicon Valley. The Silicon Valley way is to assure that the company is performing, meeting its milestones. Then you call up people that you know and you say, "You should take a look at this investment, it's doing really well. I think you might want to come in on the next round of funding. Take a look."

That's what Elon did. Elon made progress in developing the rocket, then for the next round of financing he called up his friends. He was PayPal [Inc., online money transfer service]. He called up some of his friends who were then at Founders Fund [venture capital investment firm] and said, "We're actually making some pretty good progress here. I know you've never done a space deal before, but this is a pretty interesting deal that's got some pretty interesting potential."

Founders Fund led that next funding round. That was a really important step. Then SpaceX needed more funding. DFJ [Draper Fisher Jurvetson] came in and led the third round, which is another Silicon Valley [venture capital] entity. By that time SpaceX was off to the races, they got their funding. Elon came out of Silicon Valley, Founders Fund was out of Silicon Valley, DFJ was out of Silicon Valley. The only [NASA] guy that was working really closely with SpaceX on a day-to-day basis was Mike [Michael J.] Horkachuck [NASA COTS Project Executive]. SpaceX was really a Silicon Valley-mindset approach.

If you have to have somebody to help you raise funds, it's a black mark. Rocketplane Kistler was mostly people that were out of the space industry and had a lot of depth in the technology. They were used to bigger programs and bigger iron. Their approach to raising money was to go to New York and hire an investment banker to tutor them on how to make presentations to the big hedge fund and endowment and pension operations within New York. They did a great presentation, but this is a big stretch. They got close, and they might have pulled it off. It just didn't work out. But you could tell from the very beginning that these were two very different cultures in these two different companies.

I was more familiar with the culture that was a Silicon Valley culture. But I was a participant in putting together the RpK presentation, or at least giving my thoughts. It was an RpK presentation, as they prepared to go to present to the New York financiers.

HACKLER: What sort of specific guidance did you give RpK? Can you think of any examples of the advice, or areas where they were having trouble?

MARTY: No, no real specifics come to mind. It was a very capable team with a lot of technology experience. It was not a Silicon Valley company, but there are a lot of great companies that don't come out of Silicon Valley. It was just a different approach.

In the end, it was just a matter of they couldn't get financing. It ended up not being a technical challenge that tripped them up. It was just all about the money, they just couldn't get the money. Dennis and I flew up to an RpK executive offsite [meeting]. We listened, and we may have made a few comments. But we didn't have enough knowledge to run their business. We were trying to be an encouragement and let them know we wanted them to win. We didn't want to lose the time that would have happened by having to switch horses, but if they couldn't get funding then there was no way they were ever going to be able to meet the objective.

But I don't remember—I'm not allowed to keep any of my notes, and it's been six years now. A lot of that is a little bit fuzzy for me. We had the quick ramp up as we were preparing for the procurement and the Space Act Agreement in December of 2005. My work heavily with COTS started then, and most all of the events I just discussed happened in 2006. Visiting people, going down into the bunkers and reviewing all this data.

Part of my challenge was I needed to maintain—it's going to sound funny, but I needed to maintain a little bit of a mystique of the Silicon Valley guy that flies in. The guy that never wears a tie, that dresses differently, that knows the way things get done in the innovation center of the United States, Silicon Valley. When I would go into DC, I would play up that to the max, because it was important that NASA people could trust that something that felt so illogical to most people in the NASA culture was something they would continue to fund. Even though $500 million isn't that much money, there were a lot of people at NASA who wanted to use that

$500 million for something other than COTS. Mike Griffin did a good job of protecting that pool of money, because it could easily have just flowed away to somewhere else.

HACKLER: Can you talk about some of the due diligence meetings with the companies, where you went in and reviewed their financial information?

MARTY: I don't know how much I'm allowed to talk about that.

HACKLER: Not necessarily the specifics. But can you describe the experience of flying in, seeing all these different companies? How did they react to you? What was your impression, if that was a completely foreign concept to them as well to have NASA examining their business?

MARTY: For the most part this was Alan Lindenmoyer's and Dennis Stone's and Valin Thorn's area. They were leading it. My job was to help them lead, taking advantage of my insights and experience at the U.S. cabinet level and at the venture capital level, and put all these pieces together. But my job was not to run their project. They were great leaders and great thinkers.

When we did these things, yes, they knew that I was along. But Dennis was the guy who was responsible for making the financial determination. Alan Lindenmoyer, he was the leader of COTS. My job was not to do their job. My job was to help to do *The Innovator's Dilemma* part. It was to imbue this COTS organization, that was still physically in Houston, with a Silicon Valley mentality. I was more of a teacher.

But I couldn't have done the teaching unless I was also in the bunker, helping to make the decisions, because it's really easy when you're making those decisions to go, "Why would we

invest in a software guy? We're space people. Why would we ever give any money to Elon Musk who's only done PayPal software? What a silly idea." I had to be in the COTS decision making bunker, because if I wasn't there in the bunker talking about what we were trying to accomplish with this foreign Silicon Valley-type culture while we were evaluating all these different options, it wouldn't make any difference how much pie in the sky stuff we did in DC. I had to be in both places.

Then when we took our recommendations out of the COTS decision making bunker to DC, to [William H.] Gerstenmaier [NASA Associate Administrator for the Space Operations Mission Directorate] and to Griffin and all those folks, there needed to be incredible credibility, because we were recommending things that were way outside the zone of comfort for someone who'd spent their whole life in the NASA world.

As I came into COTS, it was important that I got a chance to be approved to actually be in the bunker, to be part of the decision recommending group, but also that I had a chance to be perceived in NASA DC as someone who was more than just in the bunker, that I was a venture capitalist and a White House Fellow and a physics professor. I could bring a certain gravitas to that part of the decision approval process as well.

HACKLER: What sorts of activities or presentations did you use to imbue the COTS team with that mentality? How did you teach them? Did you have classes, or was it just in the process of working with them that you were able to help them understand an innovator's perspective?

MARTY: They were really good friends. That's where it started. It wasn't about me better than them, them better than me. They were just really good people who really wanted to do good

work. It started with a good friendship. We were completely aligned on what we were trying to accomplish. There was no caring about who got the glory. I left Silicon Valley, Sand Hill Road [road in Menlo Park, California with a high concentration of venture capital companies], and here I am in NASA. I'm buying my own paperclips and making my own travel arrangements. I wasn't doing it for the glamour. It was because we wanted to do something that was really substantial and would really last.

Over margaritas, sitting on the plane, when we were making decisions, "Alan, why would you ever come to that conclusion? Walk me through this again." I was a confidant. Being there to share a different viewpoint, but to share it forcefully, and to be very careful that I didn't overstate anything, because first they were my friends. Again, this was not about me. This was about doing something big. When they asked a question, I was always trying to be a teacher. "Think about it like this, think about it from this perspective. If the key thing is to get the next funding round, then these things make sense. Let's not lose sight of these things." It's really easy.

It's one thing to write it down on a piece of paper, "Don't take the IP, don't put anybody from NASA on site at SpaceX, have a really strong exit plan if somebody can't make their milestones," but when you're actually in the heat of trying to execute something, those are counterintuitive. Most people within any culture will do what's intuitive when the pressure is on. They won't do the counterintuitive. My job was to be a trusted friend who could be the counterintuitive and say, "No, we started down this process the Silicon Valley way with this Silicon Valley mindset. If we break ranks when the pressure is on, it's just going to fall apart. We've got to stay on this track, we've got to see it through. If we see it through, then we can do something really big."

In preparation for this interview, I pulled a few public speeches from my data archives to share with you. One I gave in April 2006, and another I gave in September 2006. You're welcome to take a look at these speeches which were given as COTS was going on. Page 15 for example is a triangle figure which talks about follow-on financing risk. The challenge is if you can't get financed, you can't do anything to completion for this small amount of COTS money. In the end we knew that we were trying to head for a situation where you had received private capital, where private services were provided, and where private customers were using the services [demonstrates triangle chart]. That's what we wanted to achieve.

The challenge was that at the time of this speech all of it was all public in that all the corners of the triangle were controlled by the government. You only had public customers, you only had public rockets, and you only had public funding. Everything was government. The challenge was how do you get from this little triangle in the center, which is all government, to this big triangle where it's all private. Boy, that's a big innovator's dilemma. That's a really big challenge. It would be hard to move from public to private on any of these dimensions, but COTS had to do all three at the same time, otherwise none of it worked.

Intellectually and culturally this was a really interesting challenge to pull off. I think the people within COTS got the energy of what we were trying to accomplish. This was not a trivial program. We were actually trying to do something that really had not been done before on a significant scale.

The other thing that may have gotten lost in the story—this is from slide 5 of the September presentation [demonstrates]. This was at the AIAA, American Institute of Aeronautics and Astronautics conference. I wasn't just doing COTS at this time. I was also founding Red Planet Capital, which was a NASA venture capital effort. Remember we talked

about how Mike Griffin was In-Q-Tel president. There was this idea in 2004 that well, maybe we can do an In-Q-Tel for NASA. A venture capital firm within NASA, which is just another way of creating this innovation culture. Red Planet Capital was going to be based out at Ames, and I got pulled into that too, to try and get that funded.

The whole idea was you've got the traditional government procurement model on the left, and you've got the typical venture capital contract, Silicon Valley style, all private on the right [demonstrates continuum diagram]. Most of the NASA world was contracts or innovative research or even innovative partnerships, but it was all really more towards the traditional government side. What I was trying to drive was COTS and then Red Planet Capital, which were much more on this [private] side, the right side of the chart.

This all goes back to the meeting with Sean many years before, "What can we do to actually make an innovation difference within NASA?" It turned out that [Red Planet Capital] got founded, and then about a month after it got founded it got shut down because it got caught in the grinder of government and people saying, "Well, we shouldn't be competing with the private sector." Which made me even more galvanized to figure out how to enable COTS to really see the light of day and make a difference for the taxpayer. Red Planet Capital went away, and I ended up being focused on COTS.

But it is interesting that I had that perspective, because as we were starting Red Planet Capital, I was in DC a lot. I was the vision guy and the cheerleader. We were picking a set of VCs [venture capitalists] to do the work. But [Red Planet] went away, and that made seeing COTS through that much more important to me.

HACKLER: I think one of the most interesting observations from *The Innovator's Dilemma*—

MARTY: I'm so glad you've read *The Innovator's Dilemma*. That makes all the difference in the world in this conversation.

HACKLER: There's a lot that's very applicable. Especially when you look at SpaceX's model of doing business, it's very very interesting.

Christensen talks about how the problem of disruptive technology is not necessarily a technological one, but a marketing one. The technology for low-Earth orbit space exploration—we've been working on that for 50 years. But what markets do you see opening up for these commercial space enterprises?

MARTY: If you go back to this triangle chart, there are a lot of people that thought low-gravity materials development, biopharma [biopharmaceutical] development things—those would end up being the private demand for space services. The fact that Dennis and the people he's worked with have done such great spadework to develop that was important, but that wasn't my job. My job was to make this little triangle, that's all in the government, become this big triangle which is the private sector.

I didn't really care where the demand came from. I was just convinced that if you got the right teams, like SpaceX, that they would find it. They've dropped the costs so much and they got the reliability up so high, that they actually had way more demand than we ever envisioned that they would be able to have. Which is how the private sector works. You don't exist because you're entitled to exist, you only exist if people will pay you. You end up developing

your product completely differently, because you don't have any entitlement to get paid for anything unless people want your services.

I was not too worried. If we could find people like Elon who were willing to put their hundreds of millions on the line and bring in their friends for follow-on financing—that was only going to happen if they were convinced that there were customers out there that were going to emerge, because they were not depending solely on NASA as their customer. It helped to have NASA as an early customer, but they were not going to write their business plan around NASA as a sole customer. That would have been a problem.

Which leads me to my final chapter. I'm skating a little bit on thin ice here, but I think it has to be said. I ended my contract with NASA 2008 at the time that they were starting to figure out the next round of COTS, which was the manned part. When we did the original COTS, I believe that we had $500 million for cargo and then we had a [Capability] D option for the crew side, which was an addition $200 million if I recall correctly.

By the time we'd taken it through the first three, four years, the team at COTS working on cargo was still just ten people. Not very many people, and the budget was essentially the same at $500 million. The Silicon Valley approach to innovation and successful company creation was working. We never lost the focus that the next round of financing was key. We stayed true to keeping IP open, to keeping the schedule asynchronous, to not taking equity. We stayed true to all four guiding concepts I discussed earlier in this interview. In order to get that next round of financing, the companies funded by COTS knew that they had to have a wide variety of customers, they had to design their rocket around a wide variety of customers.

We knew that COTS couldn't fund more than two serious competitors, because if you've got five competitors trying to split a really small demand pool, all of a sudden none of them can

survive over the long term. They would have invested all this COTS money and private money, but none of the companies would have enough customers. They all go out of business. Disaster.

So you have COTS cargo [C3PO]—very small team, stayed a small team. Very small budget, stayed a small budget. Focused on the next round of financing. Focused on picking companies to work with that were convinced they could get a wide range of demand, a wide range of private customers and public customers.

Compare this with the Commercial Crew Program—I've not been very involved in commercial crew, but as I observe from arm's length, I see the following. Commercial Crew—really big team. I don't know exactly, but hundreds of people. Really big budget. At the beginning, COTS was planning on using $200 million for crew, and I think the current crew budget is something like $6 billion. Really big budget. More than two competitors. I think Commercial Crew is working with six or eight companies. For most of those companies, one primary customer, NASA. It is real easy to say, "Well, COTS cargo worked well. Just think how well it'd work if we gave it a much bigger budget and a much bigger team, and allowed many more people to compete." And that's why it doesn't work!

I'm concerned that we lost *The Innovator's Dilemma* perspective and that we will do less good for $6 billion than we would have done for $200 million. They moved Commercial Crew to Florida [NASA Kennedy Space Center]. It was too easy to fall back into the NASA culture of saying, "I need a big team, I need a big budget. I want to have a lot of people I'm working with my program. That's what success looks like." If you're trying to get to this big triangle [operating in the private sector], that's not what success looks like, because then it becomes all about the government.

It doesn't become all about the private sector, it doesn't become all about private follow-on financing. When it is all about government, then that is a completely different paradigm than what we did in COTS cargo. One of the reasons for telling the story to you is to document why we did what we did in COTS cargo, why it was so unique, and why even within NASA we couldn't stay on script for an additional year. NASA went back to the old NASA way of doing things for Commercial Crew.

I spend a lot of time in the education world. Education is a really really really big problem. We are trying to serve our customers, which are our country's students, and we're letting many of them down every day. We're trying to serve them with an underfunded government-centric model. It may be that there is a COTS *Innovator's Dilemma* kind of a solution that is possible. Don't know what it looks like, but I'm hopeful that it won't just be NASA COTS that learns how to implement the *Innovator's Dilemma* model.

There are other really important significant social issues in our country and our world that we can embrace with an *Innovator's Dilemma* perspective and come up with some really significant innovative solutions that are higher quality, faster to enable, and lower cost.

HACKLER: If you don't mind, I'd like to go back and ask a few more follow-up questions about some things you said.

MARTY: Ask away. None of this is scripted, so I'm winging it here.

HACKLER: A lot of really interesting insights from your experience. You talked about those four guiding concepts you put in the original COTS Announcement: 1) intellectual property, 2) not

so much government supervision, 3) long contract runway, 4) no equity. Did you also work on the [COTS Round 2] Announcement when some of the remaining funding from RpK was eventually awarded to Orbital?

MARTY: I did.

HACKLER: Were there any adjustments that you made to that Announcement based on things you may have learned from that first round?

MARTY: That's a good question. Nothing really jumps out. I really think it was just an opportunity for the COTS team to reinforce the four guiding concepts that we'd previously written down. And when RpK didn't work out —we had to use the planned off ramp. This happens in Silicon Valley all the time. You fund three things and one of them doesn't work. You need to be able to pull that funding. People can't be shocked by that. You need to put the money into a company that is working.

It was a reinforcement for the COTS team that oh, this wasn't just a theoretical situation. That things sometimes fail. It was real, it failed. We had the provision in place to go out and reallocate that money to a different company. We lost nine months or so because we had to go through the re-selection process, but I don't remember that second contract as being that difficult or that much of a change. It was basically just a reinforcement of the four guiding concepts we had the first time around. Again, it's been six years so my memory may not be perfect. I'm happy to have Alan or Valin or Mike or Dennis correct me if I'm remembering wrongly, but that's what I recall.

HACKLER: That's interesting, because in *The Innovator's Dilemma* he talks about having to be willing to accept risk. Invest small amounts, but then have reserves to contribute to the more successful ventures.

MARTY: Actually I've seen Clayton a couple times, but I've never told him this story. He was also a White House Fellow. I think he would enjoy hearing how his book was used in a very effective way.

HACKLER: Going back to the question of markets, one of the other things Clayton said was that disruptive technology markets are not only unknown, but unknowable. I'm curious to know more specifically what types of markets have opened up, even some that maybe the companies had no idea others were looking for these types of services.

MARTY: I am certainly not an insider here, so I'm just guessing. But one of the things that Gwynne [E.] Shotwell [SpaceX President and Chief Operating Officer] and Elon always impressed me with early on—which is what we see in Silicon Valley all the time—is they understand markets, but they also understand that they are unknowable, and that if you can do things faster, higher quality and lower cost, you've got a better chance of getting markets to embrace you. If you're low quality and/or high cost and/or the wrong features you don't have a chance.

They did a good job early on at SpaceX of asking for down payments well before the rocket blasted off, and thinking about many customer segments: private satellites, NASA,

defense, CIA, European contracts, Asian contracts. They didn't just pin their hopes on biopharma taking off. They actually had a pretty broad array of potential customers, and they could test it early by asking for deposits before they had the rocket developed.

That takes a little bit of showmanship. It does. But again go back to this triangle. If you're going to jump all three of these at the same time, you need to bet on people that have credibility, that say, "Yes, this is tough but we can do this. We know, we've done this before, we can do this." I think it reinforces Clay Christensen's book again. Markets are unknowable, but that doesn't mean that you can't plan your product to be as high quality, low cost, fast turn as possible, so that you have an opportunity to adjust to marketplaces as they emerge.

HACKLER: On a less financial/investment note, you said you were at the SpaceX COTS demonstration launch. Can you describe that experience?

MARTY: I was at the launch site a few days before, when it didn't happen. I had to come back to my Legacy Venture job, so I missed the actual launch. But I was there the day we expected it to go out. We had a chance for Alan and Dennis and I to just go hang out at the site, take photos, reflect on what we'd been through and why we did it.

Even the fact that it didn't launch on time was fine, because it's commercial now. SpaceX had planned so that if one of the engines wasn't up to full pressure they could shut it down within the last tenth of a second. We knew that that could happen and that it wasn't going to be a tarnishing event for the SpaceX brand. They just want to run a great company, they don't want to ruin payloads. It's more than brand management. It's about running a great company and servicing your customer.

In some ways it was almost a reinforcement of the whole COTS, Silicon Valley model when it failed to launch. But then they launched successfully three days later. I wasn't planning on making it to the aborted launch, but I'm really glad I made the effort. It gave me a chance to reinforce the importance of writing down the story. It was a very warm feeling, these are just really good friends. I really admire what they've done. I was a small player in the overall scheme of things. They did really admirable work.

HACKLER: I'd like to ask Rebecca Wright if she has any questions she'd like to add.

WRIGHT: I've got a couple. Tell us briefly how a physics professor became a venture capitalist.

MARTY: You can read my bio [biography], but I ended up going back to Stanford [Graduate School of] Business for an MBA [Master of Business Administration] and also completed a Master's degree in the Stanford [Graduate School of] Ed [Education, Stanford, California]. This public service side has been a big part of me. Then I worked at a little company at the time called Applied Materials [Inc.], which now is a pretty big company with $8 billion in revenue here in Silicon Valley. Then I went to the White House Fellows Program.

The Stanford business school really opened my eyes in so many different ways, because I was an academic. I came from a family of academics. It gave me a lot of understanding of the broader world. In the same way that Stanford business school really broadened my perspective on different ways to get things done and a wider view, the White House Fellows Program was so significant in doing that as well.

When you sit down every morning with the Secretary of Defense's staff and you're the only 30-year-old in the room with 12 people that are managing about one-third of the federal budget—it was about a $330 billion defense budget in a $1 trillion overall federal budget at the time—you realize the complexity of decision making. They're just normal people in the room trying to do the best they can with limited information. Good people, really good people.

But it also gave me an understanding of how easy it is for federal programs to not ever accomplish their goals, even with the best of intentions, because of just the mass of things that are involved in getting something done, and the necessity for legal rules and Congressional oversight and all those sorts of things. It gave me a better insight of the type of things that you'd ideally want government to do, and the type of things you'd ideally want the private sector to do, and the type of things where you might want to have them work in partnership.

Sometimes, you have to have worked in academia and in big business and in venture capital and in startups and in the federal government and in nonprofits in order to see the best approach to a big problem. If you haven't done all those different things, you lose the perspective on what's possible, and you lose the perspective on what kinds of tradeoffs are killers. Just killers. Which is what *The Innovator's Dilemma* is about.

In some ways my whole career has been to give me enough of a perspective on how things operate across all these different sectors, so that when you have an opportunity like COTS or now Legacy Venture—which is an amazing story itself, where we're sitting right now—to really try to accomplish big things that are good. I have a name for people with this broad range of experiences in many sectors. I call them Bridgers. Bridgers can help bring people together to accomplish big things because they have the necessary cross-sector experiences, stories, perspectives, and empathy.

WRIGHT: Tell us your thoughts about why larger established aerospace companies didn't participate.

MARTY: They did participate, they just didn't get chosen. To me it was very obvious that they wouldn't get chosen, but I'm not sure it was completely obvious to everybody on the COTS team. But that was part of the back-and-forth in the decision process. We wrote up all our recommendations, they were all filtered, and the final decision recommenders were Alan Lindenmoyer, Valin and Dennis. It wasn't Alan Marty. The final decision makers were Gerstenmaier and Mike Griffin.

But to me it seemed pretty clear from the triangle chart—again this is a really key chart in my brain—if you wanted to accomplish the move from the small, government-dominated triangle to the large, private-sector led triangle, you were not going to be able to do it by a small revision on the same-old NASA culture. If you were going to try to get from public customer, public dollars, public contracts to private service providers, private customers, and private financing, it's the same *Innovator's Dilemma* problem. If you're Boeing, you can't think about doing it in a SpaceX way. It just doesn't work in your culture, doesn't work with your overhead, doesn't work with your compensation plans. It just doesn't work. Boeing runs a great business, but it's not a business that can be this kind of a disruption.

WRIGHT: The original conversation between you and Mike Griffin—to me what he was looking for was almost like a two-pronged—he needed a way to get supplies to the Station, but he also

wanted to possibly find a new way of doing that. Do you find that's what he was telling you, or do you feel the emphasis was finding a new way to do business?

MARTY: I'd really like to ask him that question. I've never sat down with Mike and had the same closure conversation that I'm having right here. I know what I heard, but I don't know what he was trying to tell me. Like I say, it was completely spontaneous, completely unprepared. Neither of us knew the other one was going to be there.

It was a cocktail party in the White House, it was just a conversation. I don't know what it lasted, maybe ten minutes? It wasn't like it was an hour. There were no PowerPoint [presentation] slides or anything like that. Frankly, when I heard his comment about what he was thinking, my first response was, "Don't do it in Johnson Space Center." My guess is that the thing he would remember most about the conversation was me saying, "Don't do it in Johnson. You've got to really think about *The Innovator's Dilemma* stuff." I just remember him saying, "I've got a big problem. I've got to do it in Johnson, it's going to be in Johnson. If you feel like this, you've got to take that given and you've got to bring your insights into it, given that it's going to be in Johnson."

My sense is he's a broad enough thinker that he had both prongs in mind. But he'd have to tell you that, I don't know. I just need to fly down there, spend some time talking to him. It would be great. I've got a nice beautiful plaque and a medal from him hanging on my wall for my contribution, but I've not had this conversation with him. This is an invitation, Mike. I honor you for the vision that you had in taking this on.

WRIGHT: Part of what you were saying earlier was that RpK had great technology.

MARTY: Amazing, and very talented management team.

WRIGHT: Absolutely, with the expertise and the history of the people that were working for them. I'm not a venture capitalist, but how did the fact that that technology could have advanced where NASA wanted to go, to serve the one prong of resupplying the Station—we as NASA, or we as the public lost that ability because the company was not able to gain funds. When you weigh that as a venture capitalist, how does that impact that decision for what could have benefited NASA as a whole?

MARTY: I'm convinced COTS was the only viable answer to the Mike Griffin's problem of replacing the Shuttle in a timely way. For people that are listening to the audio, I'm holding out the triangle chart again. At a broad level, as a policy thinker, in order to do Orion for Space Station resupply, or in order to do RpK, taxpayers were going to need to send a lot of federal government dollars to NASA. But as a country, we have education challenges, we have health care challenges, we have security challenges; we have a myriad of important societal challenges to address.

It's not that NASA is not great. I put a chapter of my life into NASA, I think NASA is fabulous. But in the scheme of the problems that we've got in our country, you couldn't have high confidence that NASA was going to get a doubled budget. There was even some question whether NASA was going to get their budget on an ongoing basis. Orion required them to get significantly larger budgets every year.

To me the key question was, are any of these companies going to get *all* the way to delivering product? It's not about any individual thing. I take you back to the triangle chart. It's not about just getting the funding. If you don't have the technology to build a rocket, who cares if you have the funding? It's not just about the best technology, because if you can't get the funding, who cares? It's not just about technology and funding, because if you don't have any customers, who cares? It's all three. You have to have all three prongs. All three were radically different for NASA.

The context I provided was nobody had framed the challenge that way before: How can NASA go from little, public triangle to big, private triangle? I shouldn't say nobody framed it this way, but in the circle of conversation this framing of the challenge seemed pretty radical. It struck a chord with a lot of people. We were trying to accomplish something that's really challenging and really significant. So I don't think about it as the fact that we lost RpK technology, I think about it as the fact that we got at least one and maybe two companies all the way to the end where they can service the Space Station without a big NASA budge increase. This big triangle is real now, it is real!

We have private customers, we have private supply, we have private capital. It's really cool, it's really cool. These COTS guys got it. They're humble people and they're public servants—Alan, Valin, Mike, Dennis. They don't think necessarily about the importance of telling the story, but they did a really, really significant thing.

WRIGHT: That's my last question. What story are you going to tell your grandchildren?

MARTY: Oh, I will tell them the story you just heard, although you'll probably tell it better than I did. I don't have any grandchildren yet. I don't know when I'll have them, I don't have any married kids yet. I guess this story will have to be a little bit simplified when my grandchildren are young, but I will tell them I had the chance to have a role in taking man to the stars. That's neat. Just a role—it's a big effort of a lot of people—but I got a chance to play a role.

HACKLER: Certainly made a difference. In that role as a venture capitalist embedded with a team of career engineers, what was the biggest challenge in making the COTS program a success?

MARTY: Boy, there were all kinds of challenges. But I felt like Alan and Dennis and Valin were willing to trust me. That was significant, because they are career guys. It's their career. They were doing something that was really pretty radical. If any one of those three people had had a less adventurous personality—and there were some people that came in and out of the COTS program who had that less adventurous personality—COTS would have gone nowhere.

If you didn't have Mike Griffin at the top, who had a sense of venture capital, and a willingness to protect the $500 million when lots of people thought it was really dumb, it never would have worked. There were a lot of people underneath him in the chain of command that thought this was really not wise. And it might not have worked out. It's important to point out that it's not like those people who were skeptical were dummies. We could have spent this $500 million and gotten nothing. That happens in Silicon Valley sometimes. In trying to accomplish something really big, we took some risks. There were a lot of very logical people in NASA that

said, "Wrong risk-return tradeoff. I don't get it, I don't understand, it's a bad use of $500 million."

Having Mike at the top was really a big deal, because it was an idea that was germinated at the very top. I actually think that had Mike and I not had that spontaneous conversation in the White House, COTS would have taken a completely different trajectory. It would have been a nice idea, but I just don't think it would have made it to a successful endpoint. We have no way of knowing.

HACKLER: How did you earn that trust from the COTS team?

MARTY: How do people earn trust? I think it helped a little bit that I was a scientist, and I think it helped a little bit that I'd left a career that was much more financially rewarding to come do something that was not about the money. Clearly was not about the money.

And I just generally liked the COTS team. My first two kids were born in Texas. I just really genuinely liked the team. Really good people. When you genuinely like somebody, there's a reasonable chance that they will genuinely like you back.

HACKLER: Before we end our session for today, are there any final thoughts or reflections or observations you'd like to share for the record?

MARTY: I would say thank you to you for allowing me the opportunity to tell a story that I think is a really good story. It's a little bit about conceptual stuff like public policy and *Innovator's Dilemma*, which from a business side is pretty wonky. But the COTS story was first and

foremost about tackling a big challenge, and trying to do it with really good people that you like to work with. It's really a people story, and those are the best kind of stories.

HACKLER: Thank you very much.

MARTY: Thank you.

WRIGHT: Thank you.

[End of interview]