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COMMERCIAL CREW & CARGO PROGRAM OFFICE
ORAL HISTORY TRANSCRIPT

HANS KOENIGSMANN
INTERVIEWED BY REBECCA HACKLER
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[The opinions given in this transcript are the opinions of the person interviewed and do not necessarily reflect the official opinions of SpaceX.]

HACKLER: Today is January 15, 2013. This oral history interview is being conducted with Dr. Hans Koenigsmann at the Headquarters of the Space Exploration Technologies Corp., or SpaceX, in Hawthorne, California, for the Commercial Crew & Cargo Program Office History Project. Interviewer is Rebecca Hackler, assisted by Rebecca Wright.

We read from your biography online that you were responsible for the space technology division at the Zentrum für Angewandte Raumfahrttechnologie und Mikrogravitation [ZARM] in Bremen [Germany] prior to coming to California. Can you briefly describe your background before you moved to California, and what motivated you to join SpaceX?

KOENIGSMANN: At ZARM, or the Center for Applied [Space Technology and] Microgravity, I started as a young aerospace engineer, and worked on a satellite project that was supposed to fly with the [Space] Shuttle. It was called BremSat, and it flew on STS-60. This was the flight that the Russian cosmonaut was on the Shuttle, [Sergei K.] Krikalev. The interesting part is Charlie [Charles F.] Bolden [Jr., NASA Administrator] was on that Shuttle too. He deployed BremSat. I actually talked to him a couple months ago, and he remembered BremSat.

On BremSat I started as an attitude control engineer, because that's what I liked working on, guidance and control, attitude control. After a while I became the Technical Program Manager, so I ran the technical aspects of the program. We divided it between the technical and the financial part. Today I would probably say Chief Engineer of the program, but at the time it was called program management.

We launched the satellite on the Shuttle in '94. It flew a year, and we actually operated it for a year from that place. The place was a really good research institute, associated with the University of Bremen. Since I was employed there as a research assistant, I kind of had to do my PhD [Doctor of Philosophy] in the end. Otherwise you go other places and people ask, "What did you do seven years at that university, and you don't even have an advanced degree?"

I did my PhD, and then I worked a little bit with people from California. They asked me at one point in time if I would like to come over for two years, just on a visa. It was not SpaceX at the time, it was a different company [Microcosm, Inc.]. I came over on the visa, and it was more like an adventure, just checking out how this works. I continued working on satellites, and my specialty was magnetic control, using the earth's magnetic field to control the satellite. I actually worked with a lot of companies as a consultant from that company.

Two years became five years, the visa became a green card [U.S. permanent residency], and eventually I ran across Elon Musk [SpaceX founder and CEO (Chief Executive Officer)]. I think it was some rocket launch in Mojave [California] where we met, and we just talked a little bit, and then I invited him to my company at the time. We met, talked a little bit about projects, and then I didn't hear anything for maybe a month or two. Then he called me up and asked if I'm interested, and I was interested.

He came by my house for the interview, because we had no office, nothing. We did the interview in my living room mostly, which I thought was really ingenious because it tells you so much more if you go to somebody's house. You can look at the pictures, the books, everything. SpaceX started right around the same time, and I was the fourth technical employee of SpaceX. Since there were a couple other people that he employed—pilot, driver, cook—I was technically their number seven. I was in there pretty early.

HACKLER: It sounds like you experienced a lot of cultural changes. Not only national cultures, but working at ZARM, then working with NASA, and then SpaceX.

KOENIGSMANN: I must say the ZARM, the place in Germany, was actually not that different from SpaceX in the early years. It was a research institute—young people, we had good money for big projects, we did new stuff. It wasn't that different actually, and that's kind of what I liked. Trying to set a really high goal, and then march towards it and try to get it.

HACKLER: Do you feel like you used your experience from Germany in helping found SpaceX, and set the organizational culture since it was so new?

KOENIGSMANN: Well I think I have a diverse background, and so yes, it certainly it helped me. I think you've got to get used to working here when you're coming from some other place, but that's just natural. It's nothing unusual there. My German accent helps in presentations. Funny as it is, but I've used it. When I say, "This will work," it is more convincing than other accents for some reason.

HACKLER: Before we delve into more specific questions, can you briefly describe what your job

is and how your responsibilities have evolved since you started here in 2002?

KOENIGSMANN: When I started, I basically built up avionics. I was VP [Vice President] of

Avionics for the first four years, roughly that timeframe. I'm actually not an avionics person; I

don't have a double-E [electrical engineering] background. I'm an aerospace major, I'm more of

a systems person. I think eventually I ran out of steam on my knowledge in avionics, but I did

continue with Falcon 1 [rocket].

I was part of the launch team, and I worked more and more with Falcon 1. I became the

Launch Chief Engineer, basically. The Launch Chief Engineer is the person that works with the

Launch Director on the technical side—is this rocket okay to launch—and works the operations.

Basically responsible that the launch performs technically. I did all of the Falcon 1 flights, the

last three as Chief Engineer. Then I did all Falcon 9 flights as Launch Chief Engineer since then.

I became VP of Mission Assurance a little over a year ago. To me it's somewhat

transparent, because mission assurance is what I'm trying to do as Launch Chief Engineer. I

have some additional tasks in terms of working with the customer and working with other groups

on the mission assurance side, but I still have the Launch Chief Engineer position and I still do

that. At every launch I go out a couple weeks before, I work along with the team to make sure

the vehicle is good to go, the payload is good to go, and I'm there on launch day.

HACKLER: When did you first become aware that NASA wanted to solicit commercial services,

or cooperate with commercial companies to develop those services?

KOENIGSMANN: I don't think I remember it exactly. Since I go out to these launches, I disappear and then I come back and work a couple months in the main office again. At that time, I do remember I spent a lot of time in Kwajalein [Marshall Islands], where we launched Falcon 1. Those trips were always long. I was there for several weeks, and it must have been in that time frame that it started.

We started working developing and designing Dragon before that; we had an idea of what we wanted to fly in terms of a crew capsule. By the time we started engaging with NASA, the name was a done deal on our side, and many design features were complete. It was more like we built towards that and they say, "Here's an opportunity," and it was worth some adaptations to move this into something that a real big customer actually wants.

It's interesting because I don't recall us analyzing the situation and saying, "Look, the Shuttle goes away, there's no opportunity to launch astronauts from the U.S. at all." This was not what we did. From what I recall, it was the other way around. We had something, and "Oh look, the Shuttle goes away, we can use Dragon there too." I know it's sometimes misrepresented that the rise of Dragon and the Shuttle going away coincide, but from what I recall historically, that is not a correct statement. It was indeed that by the time it was decided that the Shuttle will be retired, Dragon as a design was already there.

HACKLER: Thank you for clarifying that. Were you involved at all in putting together the proposal for the COTS [Commercial Orbital Transportation Services] competition?

KOENIGSMANN: If I was, very little and I don't remember. It's typically not something I do. I may provide a couple pages to proposals, but this is typically not my main job. I may have done a proofread or something like that. I do remember that we worked on a big proposal, and it was a big deal at the time. I can remember that, but I don't remember being actively involved.

HACKLER: Were you involved at all when NASA representatives came to conduct the due diligence sessions?

KOENIGSMANN: Yes, I think I was. I do remember the due diligence on the crew [competition], actually. That was where I was more involved. On this one [COTS] I was more standing on the sidelines, basically still busy on Falcon 1 at the time. My line of work was typically at the end game. To give you an idea, I look at this next vehicle, and I'm looking at the next vehicle after that just barely. By the time we launched it and it's gone, then that's when I look more closely on the next vehicle. It's focusing on the launch.

HACKLER: I found an article online where you were quoted as saying that the Falcon 1 would use just your normal, off-the-shelf Ethernet bus instead of developing specific space hardware. Can you talk a little bit about that philosophy at SpaceX, and how you utilize that?

KOENIGSMANN: Yes, I think to some extent we still do that. We see if there's any other branches in engineering or technology that we can use, and then we make an assessment. In order to fly this in space, you have to make these changes or those changes and see if you can apply it. I think actually it's not as urgent as it used to be ten years ago, but at that point in time I

really felt that space technology fell behind the rest of the world in terms of technology. In particular, when you look at components, or radios—the bottom line is because of the relatively long development times you have in space technology, you don't fly the latest stuff. You fly the stuff that was around by the time you wrote the proposal.

The downside of that is obviously that you're always five years behind, maybe ten years behind, or even more. That is something that we always wanted to avoid. We weren't ashamed to look at other places and look, "What are cars doing, what's done in cell phones, what's the technology in batteries?" and can we use that. I think that's certainly a long-term healthier approach than what has been done in the past, but at the same time I believe we're not the only ones doing this anymore.

HACKLER: Are there any other examples you can think of off the top of your head besides the Ethernet bus, or anything used in the Falcon 9?

KOENIGSMANN: We used a flight computer that was basically what I called the ATM [Automated Teller] Machine, a simple computer that is used for an important task at the end of the day. We build a lot of components now ourselves. The video camera, for example, is still a good old video camera that you can buy. There's probably a couple other examples that we use from commercial technology, but it changed a little bit in the sense that we don't need to do this anymore. We have our own components. We develop them, we tailor them more for our purposes.

Let me give you an example. We had the deploy test for Dragon. Dragon had this nose cone on top of it, and it deploys in flight. For the deploy test, we just bought a children's

[inflatable] bouncer, and we deployed the nosecone into the bouncer, and it worked fine. That is something that I think is SpaceX.

HACKLER: To get the milestone payments from NASA under the terms of the Space Act Agreement, you had to prove that all these components worked in flight. Were you involved at all in the milestone reviews?

KOENIGSMANN: Yes, I was a little bit involved in the milestones to some extent. The milestones were important, but they're almost overly important I would say. They were somewhat artificial at the end of the day. There was a mark on the calendar, at this time these things have to work. Whether this was actually the realistic development time or not, it had to work at the time. It drove the company to prioritize certain work related to milestones as the milestones came closer.

I guess overall that had an impact on the company, which on the good side brought us closer to finishing Dragon on time, and on the bad side may have cost us some extra work occasionally. Overall, I felt that the milestones were almost religiously applied. I wish we would have sat down halfway and said, "You know what, let's look at the milestones again. What makes sense here?"

We did this, in the end, on a very high level. If you remember, C2 and C3 [COTS demonstrations missions] were pooled together, and it was our effort to say, "Look, this mission and that mission are basically identical up to this point. Why don't we combine this?" It took some effort on our side to get this through NASA, but we succeeded in the end, and we had certain conditions which we complied with. Overall, I think it was a really good idea. We knew

this a year ahead of that request that if you look at the two missions, you see they're pretty much the same.

HACKLER: When you proposed the change to the milestones, did you feel that NASA was fairly receptive to that? What was their reaction?

KOENIGSMANN: Actually, I don't even know if combining the mission was a milestone. It may have been more than one milestone, I don't remember. I wasn't there when they proposed it. I believe I got a couple comments from [William H.] Gerstenmaier [NASA Associate Administrator for Human Exploration and Operations]. They were mostly favorable, but skeptical to some extent, "Show us that you can do this." I think that's fair. At the end of the day we combined the missions. We had to show NASA that there was no downside on this.

HACKLER: There was also some additional funding that the COTS office was able to get [fiscal year 2011 budget augmentation], and there were milestones added to the agreements. Do you recall any involvement in that?

KOENIGSMANN: Not a lot, but I do recall that I thought it was really necessary. When you propose these things, it's a fairly large amount of money that you deal with for a small company. But if this company grows, and you look at the tasks, it was not a lot of money. It was actually a small amount of money in the overall scheme of things. I always felt that the adjustment was a fair adjustment.

You're trying to project something over many years, and it's hard to hit the end goal from there. It's nothing that I would consider outrageous or unusual that you renegotiate this, and that's what happened in my opinion. We learned more, we know more now, we had deep negotiations, and we realized we were a little bit short on this and we need more time here, and we need to fix it in order to save the effort. That's what happened.

HACKLER: You talked about your work with the Falcon 1. That rocket had three failed launch attempts before it successfully launched. Can you talk about your experiences with that, what sort of effort you put in to make the rocket successful, and meet the milestones and continue the program?

KOENIGSMANN: The first launch failure was heartbreaking, because we were 50, 60 people, maybe more. No more than 200, certainly. A lot of people worked a long time. I spent probably three or four months on the launch site in the middle of the Pacific [Ocean] for that. At the end, it didn't fly very far. We learned a lot of things we did wrong, and learning sometimes hurts.

After that, we looked at it and we decided to learn the lesson and move on. We did this basically three times. The second time didn't feel anywhere as harsh as the first time. The vehicle actually flew very far, and then didn't make orbit, but at least it flew out of sight. It's a difference whether the rocket comes back and hits the launch site and you collect debris, or that it goes away and then disappears somewhere. It doesn't make a difference in the end, but for you personally it's a different feeling. In one case, you collect debris and it's a sad day. In the other case it's still a sad day, but you're not collecting debris.

On the third flight we were a little bit smarter. We had two vehicles actually, so we knew that if something goes wrong we can do this quickly again. Between the third and the fourth flight we changed one number, nothing else. That was the time we needed to separate the two stages. That was another important lesson learned, but I always thought organizations go through this. NASA went through this. NASA had early beginnings where they destroyed a couple rockets along the way, and that helped NASA. Both the experience that comes with that, and I felt that we did this independently on our own.

I don't want to say we replicated exactly what NASA did in the '50s and '60s, but it had a little bit of that flavor. We built a rocket, and then we realized that part does not work, and we have to fix it over here. We did a lot of stuff on our own without anybody telling us at the time. The first five years—what is the date for the first COTS involvement?

HACKLER: The Space Act Agreement was signed in [August] 2006.

KOENIGSMANN: The first four or five years, we were on our own. We learned that lesson on our own. There's nothing better than learning lessons on your own, because you really believe that, and you really know why you're doing this. You really know how to avoid it, and it's the truth that you learned along the way. From my perspective, as bad as it looks losing three vehicles in a row, I feel like we learned that lesson, and that's what makes SpaceX these days.

HACKLER: Did you ever have a moment when you were afraid that NASA would terminate the Space Act Agreement?

KOENIGSMANN: No, never. I never doubted NASA's commitment. The fact that I never doubted it didn't mean that it couldn't have happened, of course. But I never got the sense, from Mike [Michael J.] Horkachuck [NASA COTS Project Executive] and all the other folks, that this was critical and we have to stop it, or we are on the brink of non-performance. I never got that. I always thought we struggled to do our milestones, but not in terms of performance, and not in terms of something that would terminate that contract at all. I never had any doubts on that. Maybe that was naïve.

HACKLER: Can you talk a little bit more about your relationship with the COTS office, working with Mike, and the assistance that you go from NASA?

KOENIGSMANN: At the beginning, NASA was big and a little bit scary I would say because of its size, organization. I had a little bit of experience with JSC, but that was at a time when I was 25, and lots of things changed since then. The COTS team was careful enough to develop a relationship with the engineers, and to build this up slowly. I felt in the end that Mike was just working with us. The fact that he was a NASA employee—I don't know, it wasn't that big a difference. I worked with him like somebody else at SpaceX, I felt they integrated very well.

We also realized we were going through this with them, and they go through this with us. It's a partnership, and we're both in this. If we fail, they fail. If they fail, we fail. I think that sense was definitely there when it came to my job at the launch site. When everybody realized this comes down to pushing that button and having that rocket go successfully all along—not just the rocket with C1, but also the first [Falcon 9 launch] before that.

All these things are so critical for both their success and our success, and making this all close in the end, that I would say it was a really good and close relationship. I almost didn't realize—the COTS program ending and CRS [Commercial Resupply Services contract] beginning, that's the part that I almost missed. I wasn't really aware of the setup from NASA's side at the time.

HACKLER: In your experience working with both the COTS office and the ISS [International Space Station] Program Office, because the vehicle had to meet visiting vehicle requirements—were there any differences working between those two groups?

KOENIGSMANN: Yes, definitely. The ISS office has a primary objective, and that is keeping the [International Space] Station alive and well. They do need Dragon to transport things up and down, but that is only one aspect of the Station. It's not the main aspect. Versus on COTS, the main object of that program was Dragon.

The ISS office, I've gotten more and more to do with them over the last year, and I must say I'm impressed. It's a huge effort to keep this Station up and going, and the more I learn about it the more interested I am actually. It's certainly different. It's different from the COTS office in the sense that it's more engineering on the NASA side too. The relationship itself was in the beginning slightly different, I would say. In the meantime, it turns more into a working relationship where we work on supplying the Station.

HACKLER: What sorts of changes did you need to make to the vehicles in order to meet those requirements?

KOENIGSMANN: I think it was early enough on the Dragon side to not be a change, but rather maybe a cross-change in design. It wasn't really that we had to throw something out because we went to the Station. I don't think there was anything like that on the Dragon side in terms of hardware. There were some changes more in the way we work, how we document things, and in our processes.

For example, software in particular. I thought that was the biggest change, how we process writing software. How we write software and verify that the software works. On the Falcon 9 side, which was largely my side, there were really not a lot of changes at all. I actually don't remember any actual changes based on that. It was more of an insight, which also is a change.

HACKLER: Were there any changes that you made to the Falcon as a result of the partnership with NASA? Not necessarily for the ISS, but maybe if they had shared lessons learned from their past programs that you were able to apply, or any insights that Mike had?

KOENIGSMANN: I do remember there were a couple things that we got help from NASA with. At the time I was working on flight termination hardware. I do remember that they helped us on a few specific problems that we had with the range, and gave us some hints there. Partly it was documentation that was harder to dig up from our side, that went back 20 or 30 years, and partly it was information that we didn't have access to before. There was definitely help in certain areas that we wouldn't have had without them. It was certainly appreciated on our side, and helped us get over certain problems.

HACKLER: We understand that one of the other federal agencies that was involved was the Federal Aviation Administration [FAA]. Did they have anything to do with your range safety, did you collaborate with them on that?

KOENIGSMANN: The FAA licenses us for the launch. Like they license an airplane for passenger transport, they license rockets for launch. In order to do that, you have to have range safety equipment on board, and you have to have a certain trajectory, done the calculations, and all these things they look at. They do look at it in a parallel effort to what the ranges do at the same time. You compile the same data package for both the range and the FAA, and then you get two approvals back. It's a strange process, but at the end of the day if you've done that a couple times—and I've done it now maybe nine times—it makes sense in the end.

The FAA is also transitioning. Globally, the commercial part on the space industry is growing, so the role of the FAA is more and more important as time goes on. I think we've pretty much worked this out now. We know what to do with them, and we know how to get the data and work with them to get licensed.

HACKLER: In working with the FAA and NASA, did either organization ever express a specific safety concern, for example, that you had to address?

KOENIGSMANN: Oh, all the time. For example, when we flew the second C2/C3 mission, or C2+ as we called it, we overflew Europe. When you overfly Europe, there's risks that something happens and debris comes down. They do some calculations, and out comes the number that's

called the expected casualty. That expected casualty has a certain upper limit, you can go up to

100 people and that's it. We had 120, but we had 120 because our reliability was just following

a prescribed number from them. We couldn't prove that we had a certain lower reliability; we

had to take their number.

The whole thing was just a paper game to some extent, but then we still had to apply for a

waiver, and it was one case where both the range and the FAA actually said, "You need to fill

out this waiver." There were plenty of similar situations. I don't feel that we ever did cause any

public safety concern, in my opinion. The ranges are really safe places. I mean there's miles

between you and the rocket, it's ten miles away from the next road where people move up and

down, there's range safety equipment. I don't think anything could happen, but it certainly

comes with due diligence and some scrutiny.

HACKLER: Can you talk a little bit about how your operations have evolved as a result of the

partnership with NASA?

KOENIGSMANN: There's always two ways to describe these things. You could say you became

more structured, or you could say you became more formal. I see a little bit of that. I had a list

of adverbs here. Systematic—I think we're a little bit more systematic now, we follow a process

when we develop things, we're better in reviewing things. We're also a little bit slower, because

we do review things, and it takes more time to do this.

I felt that overall it forced us to work a little bit slower and be more careful, and at the

time it was probably a good thing. I don't think it completely transformed SpaceX at all. I think

it just added a different perspective. It added another branch to us where we say, "Since we're

going to the Station, we have to verify that everything's okay and in order." And we just do that as part of the job now, something we would not have done, otherwise you wouldn't have gone to the Station. It did change us, but I don't think it changed us dramatically.

HACKLER: In May of last year, the C2+ mission was successful in demonstrating capabilities to Station.

KOENIGSMANN: Absolutely.

HACKLER: What was your feeling when that happened, to see all of your hard work come to fruition?

KOENIGSMANN: It's like climbing a hill or a mountain and being on top of it. It was pretty good. The mission before that, the C1 mission, was already flawless. I've done a lot of missions where little things don't work. That mission was really outstanding in so many aspects. It was near perfect. C2 I was of course worried because it's a much more complex mission, and a lot more can go wrong along the way. There were some little problems that we had to overcome, and we worked it, and it worked beautifully. I was pretty thrilled.

That mission did one thing that we've never done before. Actually, two things we've never done before: we launched at night, and we launched on the second. We've never been able to do this. Every mission before we had issues on the launch, delayed by an hour here, an hour there, and it ended up at the end of the window typically. That mission was just on the second, and worked beautifully. It was brilliant.

HACKLER: You originally launched in the Pacific, and then moved the launch site to Cape Canaveral [Air Force Station, Florida]. Can you talk about the reasoning behind that decision, why it was first on Kwajalein and then moved to the Cape?

KOENIGSMANN: We actually tried to launch from Vandenberg [Air Force Base, California] originally. We gave up on that when we ran into trouble with our neighbor. The range told us to wait until the other rocket launched, and we said that's not acceptable and went out to Kwajalein. In hindsight I thought that was the right decision, because it's a lot safer in Kwajalein. There's nobody around, there's nothing you can hit.

You have a lot more freedom to test vehicles, and I think that's basically what we wanted to do. It's far away from anybody else, nobody knows where it is. Everything that happens at the Cape happens in plain sight, and whether you put the rocket up or down, you read about it on the website ten minutes later. That's not the case in Kwajalein, there's really not a lot of that. I think it's a good sandbox to learn, and to work this out.

I still believe it's a good launch site, because it is so close to the equator. That was the other reason we went there. We had a payload at the time that required us to get closer to the equator, and that launch site was right at the right spot for that. Certain payloads you can't easily do from the Cape. It's harder to do this, and it's easier to do this from Kwajalein.

One of the downsides of Kwajalein is that you have to get stuff there, and it takes four weeks to do this. Everything that's bigger than what you can take on an airplane just takes time, and it's expensive to bring it there, and I think bringing Falcon 9 there, or a vehicle of that size, would have been very difficult. By the time we went to Falcon 9 and Dragon, we had to go on a

big national range and launch from there. In particular, since NASA was our customer, there was never any discussion. It's going to be from the Cape and that's it, because that's where the customer is.

HACKLER: You said that you were out in the Pacific for months at a time during the Falcon 1 development. Can you talk a little bit about your experiences out there? It seems like such an interesting location.

KOENIGSMANN: It's a lot of work. We lived in Kwajalein, but we worked in Omelek [Island], so we would take the boat. My commute was pretty much like here, 20 miles, but the boat is a little bit slower than the car, even in traffic. One of the things that we found is when you take a boat to work and then you take the boat back, you actually talk. The team is very well aligned, because everybody on the team is in the same boat. One effect was that the team itself was a really good team.

Everybody knew each other, and we basically lived together and worked together. There were not a lot of distractions there, there's not a lot you can do. You can dive or swim or do something in the water, and that's it pretty much. I'm not a fisher, but I do like diving, so I did a lot of diving. But that's pretty much all you can do. It gets old after a while, but it is truly a strange place. It's the middle of the ocean, and you're just a tiny little speck in that whole pot of water there. I liked it.

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

WRIGHT: I'm curious—working with NASA in this capacity, as VP of Mission Assurance, what types of challenges did you encounter?

KOENIGSMANN: I work with NASA [Office of Safety and] Mission Assurance, I work with other NASA organizations, and there are more cultural differences than between us and the ISS office for example. We've had an opportunity to grow together with the ISS office and get over those cultural differences, but when I walk into any different NASA organization, then I have to start again basically. That's something I always need to consider.

It's a really simple thing sometimes. I read the NASA document, and it's so full of acronyms I can't understand it. I go, "I have no idea what that means," and I'm working in the same area. It's really frustrating. Elon recognizes those critical issues. If you want to communicate, you must avoid acronyms, or you can't communicate. In my opinion, that is something that I always have trouble with when I talk to other organizations within NASA. Not within SpaceX, because those people know that you're not supposed to use acronyms.

Then of course, we work relatively hard here, and our private lives are not as important. Job comes first, and then we play hard and we work harder. That's not always the case in other places. For other contractors or government organizations, you have to consider that there's no way to call them after Friday 3:00 p.m. There's a lot going on here on Friday at 7:00 p.m. at SpaceX.

WRIGHT: You were, as you mentioned earlier, depending how you count it, the fourth or seventh employee of SpaceX. You've been here all through its growing stages. What kind of impact did this COTS proposal have on SpaceX and its future?

KOENIGSMANN: I would say definitely it was essential. It enabled us to do something that we would not have been able to do for a long time otherwise. Again, I really believe it was not the strategy, that we did not sit around the table and strategize. I think it was either coincidence or just a good nose, but it allowed us to step up to the same level as any other aerospace company in one big step.

If you think about this, from 2008 flying Falcon 1, and launching payloads and going through this learning process, then the next step is docking at the Station basically. That is a huge step. I have friends working this in Europe on ATV [Automated Transfer Vehicle], and they were almost jealous that we would just take these big steps. Not do any of the other things, we would just go straight to the Station. Now it looks pretty natural, but at the time I don't think it was.

It was certainly a risk for the COTS office. I really must say, the COTS office took a risk. There's no other word for it. It was a calculated risk, and I think it paid off. All things considered, not all organizations do that. Even NASA doesn't do that a lot. NASA is not necessarily taking a lot of calculated risk. This particular office certainly did, and I really think it paid off big time.

WRIGHT: Do you consider it was also a risk for SpaceX to enter into that agreement?

KOENIGSMANN: Yes, it was a risk in terms of you become what you eat a little bit, that you would turn into a little NASA. I don't think that happened, frankly. I think we kept the culture,

we kept what makes SpaceX a great place to work. Different from NASA, but perfectly capable

to work with NASA and to do things like service to the Space Station.

At the same time, we also worked with the Air Force, we worked with commercial

customers, and worked with a lot of other customers. That's one of those things that we need to

keep, preserve the ability to work with other customers at the same time. Other customers want

other things. It's certainly different to work with the Air Force, Navy, commercial customers,

and NASA. It's a little bit of adjustment every time.

WRIGHT: Thank you.

HACKLER: You were talking about the other customers that you also work with at SpaceX, and

one of the goals of COTS was to open up commercial space transportation markets. Do you see

a lot of those opening up, or are there any that you have been able to open up as a result of your

work with COTS?

KOENIGSMANN: I think we're halfway there. There's a step missing. You open up commercial

space to people that have a Space Station in orbit, but there's really not too many. That business

is probably limited to the ISS as long as Dragon remains the way it is. However, if you put

people in I think that's a game changer. I think that certainly allows you to possibly have a

commercial space station out there.

I think that it also questioned a little bit how we did aerospace over the last let's say, 20,

30 years. People are now more comfortable with a commercial service, which I think is a good

thing. Competition is a good thing. It will drive the cost down sooner or later, and it will certainly allow us to have more aerospace than before, which is a good thing in my eyes.

HACKLER: All right, thank you very much for your time this afternoon.

KOENIGSMANN: Sure.

WRIGHT: Thank you.

[End of interview]