William Gerstenmaier Video Interview

The Dangers of Complacency

When things are going really well then that's when you need to be really extra vigilant and the Russians tell me this all the time. When little anomalies are occurring, or little problems are occurring, the team is kind of sharp, they're dealing with those problems and they're moving forward, but when everything is going really smooth the human nature and tendency is to kind of relax and things are fine and you kind of lower your attention and your alertness, and then that's when things can creep up on you. Probably the most recent example was last year on our space suits. We had just come off major assembly of space station where we were doing three EVAs on each shuttle flight, sometimes four tremendous amount of EVAs. We used to talk about the wall of EVA that we had to accomplish and these space suits are really performing well and things are going great and now we're done with assembly and now we do EVAs, maybe spacewalks, maybe once a year. So this is fairly easy. This is the lightest EVA workload we've ever had. It's not a big deal. We can go schedule these once we need to. We'll get prepared, go out and do this spacewalk, etc. So I think we may have gotten a little complacent with it. We may have gotten a little relaxed on what was going on with the suits and we didn't see the change in environment. We go from a system where we were exercising the suits routinely on shuttle, they were coming down to the ground to be serviced, training in the pool for station EVAs was really intense and was really rigorous because they had to be choreographed. So those EVAs got done while the shuttle was attached and they had to be perfect. So we really were at this high level of proficiency. Now we're kind of in this slower period and we didn't recognize this change in basic environment and that's a contributor, I believe, to what occurred on the space suit. Then the other thing was that we also kind of lost our inquisitiveness. You hear that talked about in the Apollo I fire, I think by Deke Slayton. We started not questioning. My words are I talk about "staying hungry." We didn't really follow through on the previous EVA. We had a lot of water at the end of the EVA that came out in the space suit on-orbit. We assumed it was a drink bag that had leaked. It had leaked before. So we didn't think that was too big a deal. We went onto the next EVA and low and behold the same failure was present in the EVA and a significant amount of water came out of the suit. The separator was no longer separating water. It was essentially spraying water in the back of the crew member's head. We had also thought that if water came out in the helmet, our past experience is the water adhered to the outside of the helmet. It didn't

adhere to the crew member's head. In this case it actually hit him in the back of the head. It went around, got into his eyes, some of the anti-fog material got in there, which impacted his ability to see. The water also got into his comm cap so he was unable to hear and not communicate. So essentially we had a crew member with water on his face, inability to see, inability to hear, extremely serious situation. This water was coming over his nose and mouth. You can imagine how that sense of not breathing is. It's tough to breathe when your nose is kind of underwater and your mouth is there. It was a really tough situation for our crew member and this had escalated in one EVA to a pretty serious situation where, again, the teams were prepared. It didn't become a casualty, but it was just because of their activity they recognized something was really off-nominal. They didn't fully understand. They terminated the EVA fairly quickly. They happened to be in a region very close to the airlock so it was easy for the crew member to get back. The crew member had adequate training on the ground that he didn't panic when all this started occurring to him. They had the signals between the two crew members. The other crew member could look in his helmet and see that he was okay and they were able to get him in the airlock and everything went fine. So I think the message there is we had indications of this going on on the previous EVA. We had seen this. We kind of ignored that piece a little bit, but then I think the more subtle piece is we didn't recognize the basic environment in which we were operating was dramatically changing. When the suits are not refurbished every time, or familiarity with the suits, or crew training, those kind of things all add up. So it's like they talk about the chain of events that occur in a failure. If you can break any one of those links, the failure doesn't occur. So it turned out if we would have had the cooling button depressed on the suit when the crew member went out, he would have immediately, before he got out of the airlock, recognized that there was water coming in the back of his suit. We probably would have stopped the EVA while he was in the airlock, taken off the helmet and understood what was going on, but we didn't have to do that. We typically had left it up to crew member discretion that when they go ahead and do the pump priming it typically did the pump priming once they got out on the trust. When he needed the cooling, when he did the pump, all of a sudden this separator just saturated, started throwing water out. We had not experienced that before on the ground. Every time we get water in the suit what happened is the fan shut off because the loading of the water in the impellor of the fan actually loads the blades, it gets a high current and shuts down. It turned out again in microgravity the water wicked around the fan, it actually didn't

overload the fan. The fan kept running. So that provided a mechanism that could then blow the water up into the back of his suit and his helmet. So we didn't fully understand the environment of how this stuff would work. We had seen hundreds of tests on the ground. In fact our procedures were written that water in the suit would not be a problem because it would immediately shut off the fan. When it shuts off the fan you know what to do to come back in. We didn't know that this failure scenario really even existed. So we had gotten comfortable with water in the helmet. Occasionally a drink bag would leak. Occasionally the sublemator would leak a little bit of water and there would be occasional water in the helmet. So we had kind of gotten comfortable with water in the helmet and all these little things add up and we didn't understand how this phenomena occurred in microgravity. So then we ended up with our crew member tremendous risk and we didn't even know we're getting into this risk situation. So the message there is, even though stuff is working right, should we go back and then look at what's going on? So what I asked the team to do is are there any other hazard controls where we rely on maybe a 1G phenomenon? Is there any other places where water could wick around a censor, or wick around a pump, that might behave differently than we had anticipated based on our 1G experience that maybe some of our other hazard controls are not right? Why did it go to his head instead of going around the helmet? What was wrong with our thinking? So, again, we need to learn from these little close calls. I call them gifts when we get these things and extrapolate them out into other systems and see what's going on. So, again, I think you need to be in a posture where you're continually learning. When things are really going smooth and everything looks right, my words are stay hungry, figure out ways to challenge the team, challenge yourself, to look for other stuff. What could really be happening behind the scenes? Or maybe do a test to see just how much margin you have. Take apart the failure. Take a component to failure. Maybe take this fan and try it on a KC135 zero gravity flight to see what this really does. So go back and question some of the data. Things that you never thought about before. On shuttle, many of the systems were designed essentially with very crude math models and sometimes even table lookup stuff. We didn't have computer sims and computer runs. Create something that forces the team to go back and look at using modern tools to go re-look at a situation you fully understood. So things that you think you understand the best, try to understand those and keep that performance level up. So continue to challenge yourselves. Stay hungry. Look at different ways to go moving forward. So that's one way, I think, to prevent this stuff, but again they're going to

occur, but when they occur, if they're small like this and you can learn from them, that's exactly right. So this flight control team, they did exactly the right thing. They made the call. They terminated the EVA probably earlier than would have been naturally anticipated. The crew member was trained enough on the ground to remain calm through this period to understand how to use the tether to get himself back to the airlock. They repressed the airlock in a reasonable manner. All that worked out right. So all the basic parameters were there that kept us safe, but we need to learn from this and we need to not over gain it. So should we give up on some of those other parameters? Don't back off on the training and now spend more time on this other test. So it's that right balance of keeping things moving forward and just recognize that we're operating in a really high-risk environment and recognize that that risk is always there. Don't be paralyzed by it, but keep moving forward. So, again, I think we can continue to keep learning. When things are really going smooth start looking around, start thinking: what else should we be doing? Same thing in development as we're developing the new stuff for Orion and the exploration systems. Continue to challenge ourselves. Sure everything all fits in the schedule, all looks good, but what happens if this test doesn't work? What would we do? Don't build a whole big intricate test procedure, but what if this doesn't work? What is our fall back? So do those simple "what if" things to be prepared and be sharp and be ready to go execute in a whole variety of manners. So, again, it's been fun having this conversation with you. You can feel free to call me or email me at any time with any questions you got. I surely don't know all the answers. I'm still learning. Every day I get new examples of things that I used to think were cut and dry. I used to be very opinionated about things being done a certain way. I continue to challenge myself and I say no there's a subtlety here I kind of missed. So then I'm still learning every day and that's part of what I do every day. So I look forward to any comments or thoughts as we go through this process and hopefully you'll develop and learn new things from what I've said. You'll understand some things that help you build new programs and projects as we move forward. So, again, thanks for this opportunity to talk to you.