Chris Doyle is head of our infrastructure geophysical division, and we've heard a lot again today about the importance of critical infrastructure, the resiliency of society and how we can have enhanced consequence management recovery, and a lot of this fits squarely onto Chris's portfolio. So I think you'll be very pleased to hear about some of his thoughts following this.

MR. CHRIS DOYLE: Okay, thank you, Starnes.

First I'd like to thank my friends from the Swedish Fortifications Agency for this wonderful red tie they supplied me with before I came up today. I appreciate that. Actually, many of you have probably seen them already around the conference, but they say CIP at the bottom, which of course can only stand for critical infrastructure protection, to a civil engineer at least.

But I'm glad to be here to talk about what keeps me up at night. There are lots of things that keep me up at night, but none probably more important than the subject we're here to talk about today, and I can tell you that in my world where I'm dealing with infrastructure

protection and emergency preparedness and response, the thought of an event that could have vast geographical impacts and affect multiple critical infrastructure assets and lots and lots of people in one way or another is really I think what keeps me awake at night and kind of drives my R&D agenda. And it certainly keeps my customers inside the Department of Homeland Security up at night, and I think they do a good job of dealing with it on a day-to-day basis. But our role is to develop technologies to help them get a little bit more sleep. So on the preparedness and response side, I think you have to look at it from a couple of standpoints, and we've heard a little bit of discussion about this this morning. Certainly the Defense Minister was talking about this as well. And that's how you're able to share information, because I think one of the keys to a successful response, and again talking about a large geographical area where you're involving multiple jurisdictions or multiple agencies at various levels of government, one of the critical aspects or features that you're looking for is the ability to share information seamlessly. And we've been spending a great deal of time on that over the past several years, and it's a very tough problem to address, particularly where you're looking at potentially in the United States we're

talking about 38,000 separate jurisdictions and many of them are using their own proprietary software applications that we then are trying to find a common ground, a standard, if you will, that will allow for this seamless exchange of data at the emergency operations center, from the state to the local level, from the state to the federal level. And that is a tough, tough problem to try to address. I'm going to deal with one microcosm of that, which is logistics and trying to allocate resources across very broad areas. There are lots of private vendors that are very anxious to get engaged in the disaster response, and we saw this -- really in every hurricane season we see this with big corporations in the United States like Wal-Mart and Home Depot where -- to name just a few. They're willing to supply U.S. with information about their inventories so that the federal government, the state government have situational awareness, they have transparency and understand where various types of materials are located for distribution. However, right now the level of sophistication for exchanging that information involves printing it out and faxing it back and forth to one another. So one of the areas that we're looking at is using this overall standardization of data exchanges to account for that. And one of the

other peculiarities when you're dealing with Wal-Mart or Home Depot or the UPS, Brown, you all may have seen the commercials, I don't know, maybe it's just a U.S. thing. I guess it is, judging from the reaction. It's not. But, you know, all of these private corporations have proprietary packages that they use for allocating their own resources, and the last thing that they want to do is pry them open and allow the federal government to take a look at how their code was put together, because, frankly, there's just not a high level of confidence in the U.S. that the government can take care of and protect that information. That's why personally identifiable information is such a big deal in the United States. But, by seeking a standard through which this data can be exchanged, we think we can get around that issue and still provide a workable solution. And right now we have one that we think is about 35 to 40 percent effective right now, and we're continuing to pursue that. So from an incident management standpoint, I think being able to manage people and resources across multiple jurisdictions, but also providing tools that are going to protect responders, because what we're really interested in is protecting people, and that includes the people who are going in to save other people. So we spend a lot of time developing

technologies that are going to help responders be safer with what they do and more effective with what they do. And I think one of the flag ship programs that I'm proud to have in my portfolio we call a three-dimensional locator or tracker for firefighters, and I'm sure many of you are aware that GPS is denied inside of a structure. You lose it at the front door of a building. So our hope is to develop a solution that is going to work in three dimensions, provide that altitude, and work in skyscrapers in an urban environment where you have lots of steel reinforcement in concrete or you have lots of iron that's been welded or riveted to build the frame of the building itself, and lots of glass. So all these things can contribute to obstructing transmission of signal. So we're working on developing a solution that's going to get around that. We actually have a prototype that's good to about three meters or so already that we're continuing to refine. I think I can say that the three meters is repeatable approximately 50 percent of the time or so. And the program manager is actually here with me this week. Jalal Mapar is somewhere out there. These lights are pretty bright so I can't see where he is, but I brought him with me to talk more to our international friends about that particular product and a few of the other training

things that we're working on.

One last program that I wanted to raise with respect to incident management is a real-time data transmission from aircraft. Surveillance, obviously one of the biggest issues that the European community is dealing with, same with the United States. You might hear more about that from Anh Duong, but certainly from an incident management standpoint and from an infrastructure protection standpoint, we're very interested in surveillance technologies and, particularly following a disaster event, being able to capture the imagery, do some kind of an analysis of what the changes in that area are and get them back to decision-makers as quickly as possible has been a very difficult task to achieve for lots of different reasons. But we have worked a project that we demonstrated about two months ago where we have real-time transmission of that data, of that process data to a ground station using microwave technology. So we're continuing to work on those things. We've not gotten all the way there in terms of incident management, but I think going back to resilience -- and a lot of people think in terms of people's resilience to bounce back from events or a facility's resilience to deal with an event, but I think you also need to think in terms of resilience of

operations and particularly resilience of response. And technology is a key instrument in effecting that kind of resilience and response.

I'll talk about critical infrastructure protection very quickly. I've probably run out of time already, but I just want to impart one thing about infrastructure protection that is key to resilience from my standpoint, and that is materials science. I think that -- and I guess I'll kind of combine this with the last question that you had, Starnes, which was take-aways for this crowd, and that is that I think materials science is really the next frontier for infrastructure protection. The big problem that we're dealing with from an engineering standpoint right now is the existing building stock and the historic fabric associated with much of it. Nowhere is that more prevalent than right here in Europe. We think of old as 200 years or so in the United States. I know that's just an infant over here in Europe. But there's tremendous existing inventory of building stock that needs to be protected, and advanced materials are the way to go because we're never going to move these buildings, we're never going to achieve standoff, we're never going to effect building codes, at least not in the United States, to recognize terrorism restrictions and be prescriptive

against terrorist attacks. So I think that we need to come up with the materials and provide the information to the building designers, the architects and the engineers, so that they can make the decisions on behalf of their clients, the building owners, to make responsible investments in materials to provide this infrastructure protection.

DR. STARNES WALKER: I would make one comment that many in the audience I think would appreciate is that much of the advances we have in society, hundreds of years, has been our understanding of how materials behave in extreme environments -- the physical, the optical, the electronic properties. And I think as Chris has pointed out, as we make advances in materials science and how it ties to resiliency and how to enhance the ability to withstand either a natural disaster or a man-made disaster is really important. So the breakthroughs that are made through Europe, in the Baltic area here and these will have great adaptation to enhancing homeland security, national security interests.

The other, just a question: What's the role of test beds and exercises in looking at the seams of vulnerabilities relative to consequence management recovery? Could you just say a few words, because I think that's something that we saw in the last video

that was very important in terms of how everything worked, but you also want to exercise that to find out where those vulnerabilities are so that you develop programs to address those.

MR. CHRIS DOYLE: Yeah, I think testing and exercising your plans and your ability to respond is a critical feature, and we do that incessantly in the department. We have national level exercises that we conduct within the department that are government wide and also go down to state and local level. And there are also requirements at the state and local level to conduct periodic exercises of their plans for response to ensure that they have all of the right parts in place. In fact, those exercises they conduct locally and at the state level are required in order for them to receive grant funding to carry those out. So our technology part of that is that we watch very closely because we are also building technology enablers, if you will, to help with that training and that simulation, and understanding that the more people that you can get involved in these exercises and the more realistic you can make it, all of these things only go to enhancing the virtual experience of the exercise, if you will, and making it seem realistic and being able to capture data about the decisions that were made by the incident

commanders, by the mayors, et cetera. One of the things that we're striving for is developing a training simulation that will enable U.S. to turn back the hands of time and change the decision and see what the outcome might have been had a different decision been made. And I think that that kind of thing is going to be very critical particularly to elected officials who are constantly struggling with what decisions to make and all of the possible outcomes and consequences.

DR. STARNES WALKER: See, one of the advantages I have in being moderator is I know when to throw a slow pitch. Chris spent years at FEMA before coming to S&T, so I knew that he would be able to answer this very well. Thank you, Chris.