Dr. Tony Tether
2001- 2009

This interview is presented in two parts
Part one was filmed May 1, 2007
Part two was filmed February 13, 2009.
Part two was filmed 7 days prior to Dr. Tether's departure.

Interview: May 1, 2007

Interviewer: Please tell me your name and the dates of your tenure.
Tether: My name is Tony Tether, and I started at DARPA in June 18, 2001.

I: I want to go back and set the context politically, socially, in terms of security needs. What was the world like when you took over?
Tether: Well, at that time, the world was mixed up. There were obviously hot spots in the world, with Al-Qaeda, but it was still pretty calm. I mean, it was really an *almost* normal world, it wasn't a hostile world- -- it wasn't a violently hostile world, but there clearly were people who didn't like us—which is not unusual. But it was a pretty normal world.

9-11 came just three months later, and it changed the world. It totally changed the whole world.

I: How did that change not only the world, but what impact did that have on DARPA?
Tether: Well, the impact on DARPA, first of all, it was a major impact on *everybody*. I can remember—I was having a meeting that morning. I had gotten an e-mail message from one of the people that a small plane had crashed into the—hit one of the towers in New York City. I got an e-mail message on my BlackBerry. And I thought, "Oh, that's interesting."

And then a little bit later in this meeting, I got this other message saying, "Hey, looks like *another* plane has crashed into the towers."

And I said, "Does anybody know anything about"—this was in a

conference room. Nobody—"Nah," you know, "It's nothing."

My secretary came out, and she opened the door, and she sort of fingered to me to come out, like this.

And I came out, and she brought me around the corner. Didn't say a word to me, and she pointed out the window, and there's all this black smoke coming from the area of the Pentagon.

And then she said, you know, there was a plane flying around here. They saw a plane flying around.

And then we realized that the Pentagon had been hit.

We had a TV, turned it on, and basically we're watching the towers burn, and then we watched the towers collapse. I mean it was just the darnedest thing—I mean I can't really describe it.

I sent everybody home. I closed down the Agency. I stayed, but I got everybody else out, and I stayed and basically had all the phones come to my phone. And during the course of the day, I would pick up phone calls coming in, usually from news people. And they didn't know who I was. I would just say, "Hello," and, you know, they wanted to know the people who were there. You know, I was new enough, they didn't know me—didn't know who the director was.

And I would say, "No, they're not here," and then they'd say, "Well, what are you doing there?"

I'd say, "Well, I was probably—(chuckles)—the last one out the door. I had to stay," you know, or something like that.

But it really changed. I mean it—we went into worrying about detection. We went up several notches in protection. The whole attitude of the world changed, and—and I knew when I was watching it—you know, I had been around for a while, even at that time—that at the end of the day, we were going to find out that we had all the data. It's just that we weren't able to put it together. But it wasn't going to be for a lack of information that something like this was going to occur. It was just that it was just impossible to integrate it together.

So, the world really did change.

I: DARPA has a reputation of being pretty quick on its feet. Were there changes in any "Thrust" areas? Was DARPA called on to respond?

Tether: Well, both, actually. There was a program that was roaming around. DARPA had been looking at how does one pull together disparate pieces of information and try to make sense out of them. The person who was doing that no longer was at DARPA, but he called me up and said, "Look. There's a program that you ought to hear about that we were trying to start a couple of years ago."

So, I went and met with him, and basically it was a great program. You know, I asked him if he would come back and run it, and it's a program that we really wouldn't have started, except for 9-11. I asked him if he were willing to come back and run it, and he said, "Gee, he really couldn't," but he had a person that he thought would really be ideal to come back and do that.

And I said, "Well, who is that person?"

And he said it was John Poindexter.

So, I got a hold of John. John came in and talked to me on a Saturday and went over what he thought was a program that, if we had had this program in place, something like 9-11 would not have occurred without our knowledge.

I agreed with him, and I took John down to the Pentagon with me to see at that time the under secretary, who was Pete Aldridge. I did this because I knew I was starting a program that was really a new thrust area, and there was a sensitivity, in my mind. Not so much because of the program; it was because of John Poindexter.

But I had John come with me, and we briefed Pete Aldridge on it, and I said, "Pete, I want to start this and get this going."

And Pete said, "Yes, that was great."

He thought it was a good thing to do, and so we did. And that program, of course, was called the Total Information Awareness Program, TIA, which really was the right response to 9-11, but itself got, caught up in *all* kinds of political morasses.

You know, I was under the assumption that we were at war, and that turned out to be a good assumption in some quarters, but a—(chuckles)—bad assumption in—in others.

But really, TIA was in response to 9-11.

I: What was it like going to the Pentagon at that time?
Tether: Yes, part of it was gone. This all happened pretty rapidly after 9-11. Within a week that this program got started.

You know, it was a very emotional time. Those of us in Defense, we knew we were at war. Especially since the building itself was hit. It was really obvious that we were at war. Didn't quite know who the enemy really was. Well, we thought we knew who the enemy was. We just didn't know where they were.

I'm backing up a little bit. DARPA in the middle nineties had been working on countering a threat called the "transnational threat," the threat without a country. So, we had been developing technology all along against that threat, but it was 9-11 that focused all that technology into this thrust area called TIA.

And, Pete Aldridge was a very astute person. It didn't take him very long to understand what we wanted to do, and he said, "Go ahead and do it."

I: I'm sorry. His role was?
Tether: He was the Under Secretary of Defense for Acquisition, Technology and Logistics.

I: That was the new title for DDR&E?
Tether: That's what the old DDR&E had become—exactly. Exactly.

I: Stepping back a little bit, I want to get back to how you became director. Can you fill us in a little bit about getting the call, and what that was like?
Tether: Well, first of all, I've been in DARPA twice. This is my second time. I was in DARPA in the early eighties. I ran an office called the Strategic

Technology Office. And at that time, Bob Cooper was the Director of DARPA, and Larry Lynn was the Deputy Director. I've forgotten exactly when Bob and Larry left, but they left around '85 or something like that.

And I made a run to become the next director, and failed. It was an interesting experience; however, because I did learn a lot, and I hadn't really been involved in the politics, especially in the White House; political appointees and things like that.

And basically, I was finally told, "Tether, hey, look, you're our second choice, but the fact is we own you now. We don't need to bring you in. You're already in, and we have this other fellow that we kind of owe a debt to."

Well, it turned out that he was a good guy, by the way, Cliff Duncan, who became the director, and he was a good guy.

Well, it was time for me to leave. I was at that point where either I became the director of DARPA or I left, and so I left.

One other attempt to bring me back into the government occurred in the nineties. It was really right after Craig Fields left. John Betti at that time was the under secretary of defense, and I knew John from Ford. I had gone to Ford when I left the government, and John came in from Ford. And John actually tried to get me to come into—and I was never sure which job it was, whether it was the DDR&E job—which is not the same DDR&E that Johnny Foster was, for example—or the director of DARPA.

I came in and talked to some people, but I was under some restrictions where I just couldn't make a move. I was actually not all that interested, quite frankly, on coming back into the government at that point. So, it went away.

In fact, Vic Reese, who became the director of DARPA—I know he didn't tell you this, but he told me that, you know, he was sort of in the wings. He was being told, "Hey, Tony Tether's coming, and we just want you to be in a holding pattern here until we get him in here," and, of course, I didn't show up, and Vic became the director of DARPA. So, that was 1990 or something like that—'91.

Time moves on, and over the years, I had been on the various science boards and things like that and met a lot of people, but—and that really is—(chuckles)—that was how it came about. These people—and I won't mention their names, but they were on the transition team for Bush—for Rumsfeld—the Bush administration, but working in the Department of Defense. And I was called and asked to send in my resume, and this was in, oh, I don't know, January of '01.

Well, I said, "Sure," and I ignored him. I absolutely ignored him.

Then about two, three weeks later, I get this other call. "Hey, listen. We haven't gotten your resume yet." You know, "How 'bout sending in your resume?"

I said, "Oh, yes. I forgot." "I forgot."

And I ignored him again. Figured they'd go away.

But then around March, I get this call, and I just happened to be at my computer, and I get this call. They said, "Hey, listen. *Send us your resume*—(chuckles)—right *now*."

Well, I just happened to be at my computer, so I said, "Sure. Give me an

e-mail address," and I sent him my resume, figuring, "Well, okay. There. I got rid of that." Right?

Well, the next thing I knew, I'm being called in for interviews. And I didn't want anything. I didn't want to go—(chuckles)—back into government. I really did not want to go. So, I think, "Well, okay. I guess I'll go. Maybe I can get consulting work out of this." You know, because I was going to meet all of the "to-be's". Nobody had really been selected. They'd been selected, but they weren't confirmed—all the Secretaries of the Services, in fact, even the Under Secretary.

Then I went out and I met with Gordon England first, and I knew Gordon from a long time ago, and I spent an hour with Gordon, trying to convince him that I wasn't the guy for this job. You know? I mean I *did*. I said, "No, you don't want me," And I went through a whole litany why it wasn't me.

And Gordon was getting frustrated because he didn't he didn't like having somebody tell him what his job was. He was trying to convince me it was me. I said, "No. It's not me, Gordon. Go find somebody who really knows the Hill and all of that."

And he says, "Okay. All right, Tether. Well, what about the director of DARPA job? You can't tell me that you're not perfectly qualified for that."

I said, "Eh, I guess you're right."

But then I figure he was being there, as the Secretary of the Navy. I mean what the hell? So, I wasn't worried about it.

He says, "Well, okay. I'm going to call up Pete Aldridge," who was the Under Secretary to-be—"and tell Pete that, hey, you know, you're the right guy for the director of DARPA job."

I said, "Okay." Right?

So, I went around, and I met with the other Secretaries—the "to-be's"—and I didn't say anything to them. They all had a job in mind that—and I'd said, "No, no. It's not me." And I did my thing of convincing him that—thinking I was convincing him that, no, I was not the right person.

By the time I got back down to the transition room, you know, the guys down there said, "What did you do?"

I said, "I don't know. What do you mean?"

He said, "They all called down here and said to tell you that you were full of crap."

So, Christ, they didn't even *know* me yet, you know? How can they say that?

And they said, "No, no, no. They said to tell you that you're—(chuckles)—w*rong*! You're the perfect guy for these jobs."

I said, "But I'm not."

Well, eventually Pete Aldridge came in, who was the Under Secretary of Defense to-be. Now, I knew Pete also. Not only did I know Gordon, I knew Pete from the last time I was in the government—which was, you know, 20 years before. And so Pete comes in, and he says, "Hey, Tony. How you doin'?" He says, "Gee, I heard from Gordon."

I thought—"Uh-oh," you know? And I'm looking at this paper. He said,

"Tell you what. I've got a meeting to go to. You're the director of DARPA. I'll see you when you get in," and he left. That was it.

So, I sat there, thinking, "Ho-oly cow. *N*ow what do I do?" A fellow I knew on the transition team came in. I said, "Look. Let me tell you what he just said."

He said, "Oh, he shouldn't have told you that," He goes, "There's a whole bunch of other things you have to go through. He really can't make you an offer."

So, I said—"Well, okay.

But then I got into this competitive spirit, you know, and I had to go and meet the White House people. This is a political appointment, so I had to go and meet with the White House people, and I did all that. And then by that time I was getting revved up. I guess at that point, I probably still wasn't sure I'd take it, but I didn't want them to say I couldn't have it. You know what I mean? It was one of those things.

And then, finally, after the White House interviews, they said, "Well, your last interview—you'll meet with the Secretary."

Well, I didn't know that. I really didn't realize that the secretary picked the director of DARPA.

So, I had this interview set up, and I go to the Secretary's office. And I also didn't think Pete Aldridge knew this, because just, ironically, when I'm in the Secretary's anteroom, here's Pete Aldridge. And he says, "What are *you* doing here?"

I said, "What do you *mean* what am I doing here? I'm"—(chuckles)—you know, "I'm talking to the secretary about that job."

He says—(chuckles)—"You *are*?" He didn't know about it either, you know?

Rumsfeld was a very hands-on person.

So, I went in, and it was supposed to be like 15 minutes. It went for 45 minutes, almost an hour, with Rumsfeld, really just talking about his problems and what he was trying to do, never mentioning DARPA or anything. And I thought, "My God. He doesn't know why I'm here." Because *I* didn't really know why I was there.

And near the end of the time, it was kind of time to leave, you know. And he says, "Oh, yes. DARPA, DARPA. Let me tell you." He said, "You know, I'm in this business of transforming the military to a more modern force." He says, "But on DARPA," he said, "I don't want you to change it into anything new. I want you to make it like it was. I want you to change it back to the way it was 20 years ago, when the DARPA director on the verge of being fired."

That was about the only conversation we had on DARPA.

On the way out the door, he said one, more thing, too. "Oh, yes, yes. There's this commission report on space." Because, you know, it was the Rumsfeld Commission. He ran it before he became Secretary. He says, "Here. Read it. It's important," you know.

And that was it.

Then I was told I was the director of DARPA, and nobody asked me. I mean it was like, "Well, it's too late now." "You're in."

So—my God, it was *terrible*. I had to close down my business. I had a

pretty good consulting business going on, a lot of money. But I closed it all down, and on January 18th, 2001, I became the director of DARPA.

I: When you walked in, what kind of a DARPA did you find?
Tether: Well, I had stayed in contact with the organization. Of course, you know, staying in contact on the outside is different than being inside. What I found was an organization where I didn't sense any real excitement. They were all doing good work. Don't misunderstand me. They were doing good work, but I didn't sense any real excitement.

Frank had left six months before. They were kind of drifting. Frank's style was totally different than mine. Frank basically allocated a *lot of* control to the offices. I mean in some cases, he gave; total control to the offices, and that wasn't my style.

So, DARPA really was run by separate fiefdoms and office directors, who were all good people, but they all were doing, you know, kind of a more narrow type of scope. And I changed that. It wasn't done without a lot of fuss, by the way. I took the control of allocation of funds back out of the offices into the Director's office. Some of the office directors coped with it. Some didn't, and left, there were no hard feelings on any part.

But the idea was to do just what Rumsfeld said. You know, "Let's get in there and start doing some crazy things." We started SPACE, because remember I had the Commission Report.

But I wasn't there more than two weeks when Scooter Libby, who was—at that time was Cheney's Chief of Staff, called me up. And he said, "Hey, look. The Vice President wants to come over"—and I've forgotten the date, July something; it was only about three weeks in the future—to get a briefing. He wants to know if you can accommodate him.

Well, I said, "Well, I don't know. We're busy." You know. (Laughs.)

That actually turned out to be really a great thing for DARPA. And they also said, "By the way, you can tell the guys in the Pentagon that he's coming, and they don't have to bother to come if they don't want to come."

I told Aldridge—"Hey, listen. They're coming, but they all said you don't have to come."

He says, "Yes, well, I'll be there."

And, of course, the Secretary came. And that was really a tough test, because I had all these office directors, had no idea whether they could brief; I really had no idea what they thought was important, and in about three weeks I had to put together a briefing, for the Vice President, which was going to make or break us. I mean I knew that this was really a turning point.

And it turned out to be absolutely fantastic. I had spent a lot of time with him. I mean it, a lot of time was spent putting these briefings together. I knew people. I knew people, and I talked to them about what he liked. But I had also known the Vice President back when he was a congressman.

But he came, and so did Rumsfeld, and so did Aldridge, and they spent five, six hours getting briefed on DARPA. And they were just *absolutely* thrilled. I mean, you can always tell when there's a good briefing. The questions were

great. Interaction was great.

And Rumsfeld, I am told by another person, when he left—they didn't leave until after six o'clock—went to a meeting in the Pentagon, and he walked in the meeting, according to this fellow who was there, and he says, "Look. I know I'm late, but I'm not going to apologize. I just spent the greatest five hours that I've had since I've been Secretary."

Well, that totally armor-proofed us. We not only had the Vice President who was high on us. We had the Secretary who was high on us because originally, he came because of the Vice President. And he saw the Vice President's reaction. And, of course, Aldridge was pleased, -- he was tickled pink. So, we really were armor-proofed, and that really is what gave us the ability to remain DARPA, to do things outside of the bureaucracy. The bureaucracy couldn't get to us, because they had to go through Rumsfeld to get to us.

I: That kind of support is essential, isn't it?
Tether: It *is* essential. It's absolutely essential.

And they knew that. I mean the Comptroller, time and time again, would try to go get money. And, of course, R&D is always an easy hit. And I was told that Rumsfeld always told them, "Hey, look. How many times do I have to tell you people? You leave them alone. They're doing what I want. You just leave him alone."

And that really gave us a lot of ability up through this past November. But that really was a turning point.

Then, of course, 9-11 happened only two months later, and, like I said, the world changed.

And I almost did get fired on TIA. I don't know if you remember. TIA was a, oh wow, I mean holy cow. Did we really get into it. It was hard to believe, but the people, especially people from the western part of the United States, really, I think, believe that the attack on New York was like a movie, "Godzilla Invades," you know, "New York City," or something like that, and didn't really appreciate that *we really were at war*.

But—(chuckles)—Rumsfeld would interact with me through these intermediaries. One was Newt Gingrich. And so Newt came over one day, and he says, "I came over to tell you that the Chief says you're getting close." (Laughs.)

I: A little close to the lightning rod.
Tether: Yes.

I: I guess it helped that Cheney had been Secretary of Defense, because he had a real hands-on understanding of the importance of DARPA.
Tether: Oh, yes. Now, he never went to any other organization in the Department of Defense. We were the only ones that he came to. He visited the CIA, the FBI, NSA and DARPA, and that was it. Now, that may have been because 9-11 distracted him. I mean it may have been that they had other places that he was going to go, but that was it. We were the only people that he

ever really came to see.

I: Did that put you on a fast track to look at existing projects and programs, and try to weed some out.
Tether: It really did. I did in three weeks what I might've taken three months to do. Necessity is the mother of invention, and it was true. In three weeks, I did exactly what I probably would have taken three months to do. And I mean we did it on weekends. We did it on nights. We iterated and iterated it until... These people had a briefing that, one, I felt that they could deliver, and they could deliver it in a way that I felt that Cheney wanted it.

And you had to understand how to "feed" somebody, and he was a person who liked pictures, he is a very visual person. So, having a slide with a whole bunch of words on it was just—oh, wow. You don't ever do that to him. You know, you give him a cartoon, or you give him some visualization of what you're trying to say. And some of these office directors—and forcing him to that was hard, because they would say, "Gee, I"—"I need to remember what to say."

I'd say, "Well, you're just going to have to remember it." You know, "You put a picture down here, and that's all you're going to get." And then he'd talk about it.

And it came off great. I mean they did a great job. We brief a lot of people. I mean we brief *tons* of people, and you got to know how you put the show together. And I call it a show. Because it *is* a show, you know. It *is* a show. And so I always figure out who am I going to have as my lead-off, the warm-up guy. Who warms up the audience is really important for the people following him.

And I always have the Defense Science Office typically lead it off, because they are just interesting. I mean they just have a lot of neat, little things going on, and they always have been good briefers. The first person who was there when I came was this fellow Michael Goldblatt, who was a fantastic briefer. And Michael actually set the stage. I let Michael go first. I was ordering the briefs but thinking, "Okay, if he doesn't stay here for the whole day, who will care if he ever—(chuckles)—hears them?"

But he did stay for everybody—but I believe because the front was so good, you know? And it was really fantastic. It was just absolutely fantastic.

I: Where you able to use the knowledge from past directors at that time?
Tether: Didn't have time. Really did not have time. I tapped into other *people*. And so I was able to get direct information from people who were—Rich Haver was one—one name that you probably don't know, but I would talk to Rich a lot. Because Rich knew Cheney really well. And so I talked to people who knew Cheney, so I could figure out how Cheney liked to be briefed—okay?

And I oriented the briefings for Cheney and just figured, "We'll just see if Rumsfeld and Aldridge like it." But I picked him as the focus. He was the audience, and he was the one that the briefing was made for, and it turned out that it was not only just perfect for him, but it was perfect for Rumsfeld, too.

I: We were talking about how hectic those first few weeks were –
Tether: And it really was. I believe that that was really a turning point for DARPA in that DARPA had become a backwater type of organization in the latter part of the nineties. And it just propelled us into the center stage, because everybody knew that the vice president came and spent all that time with us, and that the secretary was there. And the secretary came back, and as I said, he was he was, extraordinarily pleased at what he had heard.

I: You say your impression is that the Agency is adrift. The Soviet Union had collapsed "Okay, the big enemy's gone. We've slain the dragon. *Now* what do we do?"
Tether: That's right.

Now, DARPA's gone through that several times in its history. I did, by the way, go and then meet with as many of the past DARPA directors as I could, just to find out what happened find out what they thought. I had an appreciation, but—I really did go back. I met Betts, who was the number-two DARPA director, down in San Antonio. Great guy. He told me things about how DARPA almost went away, that he was a caretaker.

I talked to Herzfeld, and I found out what was going on there. And I did know Steve Lukasik quite well, anyway, but I talked to Steve. I got a hold of George.

I created this thing called the Ex Directors, and picked directors. Oh, I picked Johnny Foster, even though he was never a director of DARPA. But Johnny was kind of the person who gave me the flavor of the sixties and the seventies. Then Heilmeier, he was the middle of the seventies; and then Cooper, who was the eighties; Craig Fields, who was the late nineties; then Lynn, who was again back in the middle nineties; and then me.

And we get together. In fact, we're going to get together this afternoon. And I use them to have somebody to talk to who can understand. I did learn as much as I could about the history of the place.

I: Vic Reese told a story that he put together a little video of a tank simulation. And he said it just knocked Cheney's socks off.
Tether: Yes, because he's a visual person.

I am, too, and—(chuckles)—it was really interesting, because there were a lot of mismatches sometimes with program managers trying to brief me who weren't. And I always have a fuss, you know. They would be talking and have these words, and I would be trying to put in the picture, you—(chuckles)—know. We had some times on doing them.

I: Was there a model, or a template, or some sort of management tool, or some sort of evaluation tool that you used in that fast-track three weeks to try to figure out what projects needed amplification and which needed to go?
Tether: It was just *me*. I mean it was making guesses. I was picking programs that were interesting to me, and not only were they interesting to me, but I could see that there was a good story there. I could create the story. The office

director could create the story. So, those were the ones I was picking. I picked them if I thought, "Wow! These are really important, and not only are they important, but they can be briefed in a way to *show* that they're important."

And I just used my own filter. I didn't have time. It was just fortuitous. It was absolutely fortuitous that I guessed right.

I: What were the immediate needs of DARPA after 9-11?
Tether: The response to the immediate need of 9-11 was TIA. A big program. Created a whole office. Really made language prominent. All kinds of things prominent. The major, major response to 9-11 was TIA.

Now, when we got into some of the wars, in Afghanistan and then Iraq, we responded tactically then. TIA was a strategic response. It was definitely a thrust, and—"We'll never let that happen again to us." "We'll never let a situation like that happen again to us and not know that it was going to happen." That was the whole thrust of TIA.

When the wars started, it was solving tactical problems: situational awareness; communication. Remember, we had been working this transnational threat for a while, so we had been actually working the small squad; that it wasn't the—we believed in the nineties from defense science- -- and, in fact, I was involved in it. That was another thing, by the way. I was involved in these studies in the nineties on the fact that the military was not going to be a huge force on force, with a big line. It was going to be small groups of people fighting. And that's really what we were into.

So, we were developing technology to make that force work—networking. And we did—we've done quite well. We really have contributed to the war. It wasn't like we diverted a lot of resources, because a lot of the technology was really developed before I got there, but then it was sort of too early. It was put on the shelf, and then when we started in there, I went back, took it off the shelf and got it out to the forces—for the most part.

It was kind of a real balance. I mean DARPA is an interesting place. We really are always focusing on things that are not validated or requirements, because somebody else should be doing those. We're always looking for what is *going* to be the problem, or what co*uld* be the problem, and trying to develop things to solve that—which always has us out in front of everybody. That's on the one hand. But, that's probably what 75, 80 percent of the organization is really doing.

But you have to have a little bit over here, so people know you're doing something useful—right? And the way you do something—and a lot of it is useful, because the things have started a long time ago, and they just happen to be coming to be useful. You know, it wasn't like you *started* them for this, but you started them a long time ago—in anticipation, just like we were supposed to do.

And we did a lot of it. And we *do* a lot of that.

And that keeps us on the forefront. It allows me to go around and talk to the Secretaries of the Services both the civilian and the military, to tell them, "Hey, you know"—(chuckles)—make sure they know what we're doing, find out

what they want. And surprisingly enough, because we have something going on, we can do most of what they want.

They probably think that we did it deliberately for them. And in some sense, we did. It's just that we didn't *know* it at the time we were doing it.

I: What is your relationship with the Services?
Tether: It's generally good. It's generally good at the senior level—at the Secretary level, and with military and civilian.

As you get down further in the Services, there's undoubtedly and there definitely is a lot of jealousy about our freedom. DARPA people are well known to be arrogant. It's almost not arrogance. It's just that they know they don't have to adhere to these *rules*. There are no laws. And if you got an organization and a guy who says, "We don't have to pay any attention to that," well, they don't.

We don't do anything illegal, you know, at all; but it's amazing what you can do, you know, and still be legal. And we do that. And we do that quite well.

But you can only do that, quite frankly, if you have somebody who's protecting you at the top. If you don't have that, they'll come and get you. They'll come and get you. The villagers will, sooner or later, light their torches and come up the hill after you.

I: The Services' research branches are doing some pretty interesting R and D.
Tether: It's *all* interesting stuff. *It really is*, but it's all about systems and concepts that we *know* about. For the most part, it's all about something that is known. It's a *requirement*. It's a known capabilities gap. It's all of that. And somebody needs to be doing that.

But then you need somebody who says, "Hey, wait a minute. Why are we doing it like that anyway? Maybe we could do this differently, and then we wouldn't have that problem," as opposed to try to fix that problem. "Maybe we can just do it some other way. What technology would allow us to do it differently?"

There were people who were worried about arrows at one time—right? Well, guys with the rifles came around. Took care of *that* problem—right? "Have all the arrows you want. Our bullets can shoot—(chuckles)—further than your arrows can."

And that's sort of the way it goes.

So, we're the people who're looking for that rifle solution against the arrows.

I: Do any transitions come to mind that the Services said, "Gee, we really need this."
Tether: Yes, there is one. I mean there are hundreds of them, actually, but there is one that is so obvious. Again, it comes out of the Defense Science Office, which is surprising, because they were supposed to be a science office, but –

They created a little airplane, a UAV about this big, electrically driven. Flies for over an hour. We put cameras on it; GPS receivers; a data link. Still

flies for an hour. And it turned out to be absolutely perfect. General Mattis is a Marine general. He was the one who was involved with the—the urban battles of Fallujah.

We had him come over. And we do a lot of this, by the way. Come over and tell us, "Hey, what do you think is of importance?"

So, I said, "Well, what do you really think? If you could only have *one thing*, what is it that you really needed in the battle of Fallujah?"

He said, "Situational awareness." He said, "Look. We didn't need to know what was ten miles away. We just needed to know what was on the *next block*."

So, I said, "Well, we can give you 200 of these little airplanes, if you'll use them."

And we have, and they are in use today. The thing is when you give something like this to somebody; they use it in ways you never considered. We made it so that you could have it in a backpack, and anybody, seemingly, can fly one using a PDA.

The way they're doing it now over there is they have what they call a "wasp nest," where the "wasps" are actually flown out of the "nest," and then they pass the control to people along way, so they string it out, and then they fly it back to the wasp nest. So, rather than each of these carrying it by themselves and flying it, which was our original idea, they've learned how to—"Hell, we don't have to do that. You just have this wasp nest, and you fly them." It goes to this next fellow, who turns it over to the next fellow, who turns it over to the next fellow.

And we are saving a lot of lives. A lot of lives, our lives. And we're killing lots of bad guys because of these things.

And I know that because we do get the situational reports.

So, that's one. That's an example of one.

I: It always helps to have something there to show, "We are relevant."

Tether: Yes. And there are tons of other stories like that. I could spend the whole day with you telling you stories of things that are over there right now that—I guess one other is the Striker vehicles. They have a grate around them -- literally a grate. Imagine a vehicle that then has this fence around it. Well, we did that. And the idea was that it was supposed to prevent RPGs from getting to the vehicle by cutting them as they came through.

It works. It didn't work 100 percent, but it worked at a very high percentage—a classified percentage.

But it turns out they found that the vehicles with these grates around them are no longer having RPGs fired at them at *all*, because the insurgents found out, "Hey, don't fire them" because these RPGs are really valuable things to them, and before, it was a probability of one hit, but now the probability was no longer one. It wasn't zero either, but it wasn't one, and so they've just stopped *firing*. "If you got RPGs, don't fire at those guys. Go fire at somebody else."

So, these vehicles with grates around them are now 100 percent effective against RPGs. Just neat, little stories like that.

I: On the other side of the coin, looking back to the Rumsfeld to push DARPA out to the edge, what did you initiate to make sure that you're living up to the Rumsfeld dictate?

Tether: Well, we started major space programs, and, unfortunately, the ones that would prove what I just said are classified. But we did go and create a major space portfolio that was really out on the edge. And some of them are -- on the edge. You know programs that actually got all the way up to the president's attention. So, major programs.

TIA clearly was the one that, you know, really satisfied his itch.

You can go and Google and find really crazy stuff that DARPA's doing. Stuff that only we can do and get away with. Insects that we have learned how to basically take the larva of a moth, and you insert electronics into its body. You literally put it in its body. Then when it grows into the moth, it has these electronics in it already, and the body powers it, and it *flies*, you know. You can put receivers an' things like that—you know?

The Borg. You know, if you remember "Star Trek," the Borg. We're creating the Borg. God, I get all kinds of, you know, hate mail on that one.

I mean we don't try to make people more than they can be, but we try to make them what they *can* be. And there are a lot of people who don't like that. And I get all kinds of mail on that we're trying to create a super race.

Cognitive computing—making a computer learn you, as opposed to you having to learn it. *Oh*, wow. There's a whole cult out there that thinks, "Wow! This guy's on his way to having computers take over." Imagine computers that can learn.

They *really learn*. "Well, you know, maybe they can learn too much." (Laughs.) I mean *there are really worries.* I have congressmen that write me nasty letters and want me to assure them that while they're developing these computers that can learn or think, that we're also putting in the Asimov—the controls so that they won't hurt us—(chuckles). There are various things like that going on.

I: As Dr. Foster said, DARPA is supposed to stay on the edge. Have you encountered any projects that take DARPA over the edge?

Tether: Well, we've actually done some of them. Of course, it's in the eyes of the beholder. It's a very fine line, because where we are supposed to be is we are supposed to be on that edge. And it's really ticklish sometimes to decide, "Okay, are we over the edge, or..." But we have to *get* to the edge, if we're not on the edge, we're not DARPA.

One program that really a lot of press was this program we had on isomers—hafnium—the golf ball that could be a big bomb and stuff like that. And a woman wrote a book. I forget what she called it. It was something along the lines of *Weird Science*, or, you know, *Fake Science*, or something like that. She argued that we should have known that this couldn't be done.

Well, it turns out that she's wrong, and over time we've shown that it does work. It doesn't work the way we thought it would work, but it does work, and that led us to other situations. But, that was not that bad, quite frankly. There

was a big hoorah—you know, in the press and all of that, but that died down. And her book was interesting, but...

We don't do any offensive bio. Every now and then, I get a proposal which is not for offensive biological warfare, but you see that if you did it, you would actually enable things so that people could go in that direction, and I haven't done those. I've turned those down—just because if we got into playing around with that, they could really do that.

But for the most part, I haven't really found any that I regret. I found there are many that I think we could have packaged it better, but I still don't regret doing them.

I: Have any "wild ideas" come to where maybe they are feasible so maybe you should try them?
Tether: Well, that's usually what we look for. See, DARPA is an organization that bets on an idea. We're different than, really, many other places—or *any* other place in that a person will come in with an idea, with no data. You have to have an idea. "Yes? Well, that's great." With no data at all. And we ask, "Well, gee, is he violating the laws of physics?" You know, do we have to go faster than the speed of light? Obvious things like that.

But we'll fund them to go get the data. And no other place has that nerve to do that. And we *do* do that. And we have done it on—a lot of people trying to exploit dark matter. There are a whole bunch of people out there now who swear they know how to take the energy of this dark matter. And it's very difficult, because there are no physics that explains it—right? Except they have this physics that they believe that was overlooked.

You have to remember all these equations in physics are just models of the world that somebody *thought* was the world, and they have changed over time, as we learn more about *really* what the world was. So, it doesn't bother us that maybe the current equations don't quite explain this fellah, because *it may very well be that they're wrong* when you get to this dark matter area.

So, we fund people to go out and do this, and so far, every one we've funded has proven to not work.

But so what? If it *did* work, "*Ho-oly cow!*" "Ho-oly cow."

I: Well, it's scientific method. You've got to prove...
Tether: Yes, and that's hard. And that's hard.

So, we do things like that. That's what makes us different, and that's what makes us strong. Because, a lot of it is serendipity. I mean a lot of it is *absolute* serendipity if you start something; and, by God, it turns out to be the biggest deal in the world, and, yet, you didn't realize it when you were doing it. And what DARPA's able to do is we are able to do all those things so that when something hits, we can then pounce on it.

People talk about "portfolio management," but I don't think they appreciate what that really means. I mean what it means is you try to really spread your money, but you want to make sure you have enough cash left that if something gets hot; you can really jump on it.

And that's what we do.

I: High risk means high payoff.
Tether: Yes.

I: What is the role of serendipity?
Tether: I tend to always say it in a different way. I firmly believe that strategy is always best written after the fact. After the fact, I can come up with a *great* strategy of how we got there.

But a lot of it is just pure serendipity. And that really was the—(chuckles)—strategy, to make sure that we always turn over enough rocks so that some day one of them will have a diamond underneath it.

I: The panning-for-gold science model...
Tether: Yes.

I: Tell me about the Grand Challenge and how that came about.
Tether: Well, that turns out to be the Grand Challenge and I'll regress a little bit.

The Grand Challenge really saved DARPA. TIA got to the point where, quite frankly, I almost lost the Agency, and that the opposition—I could never really tell whether it was the opposition to TIA, or the opposition to John Poindexter, and it probably was a combination of both. But, really, we almost lost the Agency. I thought there was a war on, but quite a few people who really didn't either believe that, or didn't wan to do all that was necessary to prevent this from ever happening again, even though there was a lot of rhetoric.

But there were people getting poised to just put a lot of controls on us. Like, "Well, God, we can't have these guys over there doing things like this TIA thing, you know, where they're reading all our credit cards," which never was true, but it made for a good story. And once that got in, you couldn't get rid of it. You know, you just couldn't get rid of that image.

That's what finally got me to the point where I just said, "Okay, we've have to stop. We clearly are not going to go any further. It's all counterproductive from this point on," you know.

And even though they were demanding that the organization be disbanded, I did it. I mean I just went and disbanded it.

So, there was a period of time where we had, basically, this aura up on the Hill. Very dangerous. Not in the Pentagon, but up on the Hill, of "these guys are out of control."

The Grand Challenge came around, and the Grand Challenge was one of the—the greatest public relations effort, I mean worldwide, and that instantly changed the whole image of DARPA back to where it was. I mean it was *that close*. It was really that close. I mean I—I don't think anybody in DARPA really understood that, but I knew how close it was.

Even though the Grand Challenge was spectacular, the first Grand Challenge, obviously, didn't get very far—seven, eight miles. Now, from a technical viewpoint, it was a *fantastic* accomplishment, but from a press

viewpoint, it—(chuckles)—really was a bust, you know? But there still were thousands of people—*tens* of thousands of people who were really interested in it.

We did the second Grand Challenge. The first Grand Challenge kind of started to give us this aura of, "Hey, these guys..." I mean people were starting to calm down about the TIA.

The second Grand Challenge, and I never said anything to anybody in DARPA, but I *knew* that we had to get somebody across that finish line, or, at least we had to get them really close.

And to have *four* of them finish under the ten hours, and five of them actually finished the course—I actually got worried. When the first one, Stanley made it across the finish line, I don't think anybody really realized the deep breath that I took and the stress that went away. I knew that, "Holy cow, we *did* it."

There is one thing that we all know is that, while success has many fathers, failure has only one mother. And I knew who they were going to think who the mother was.

So, when Stanley came across, I just said, you know, "Holy cow. We're done. We've made it."

But then we get *another* car makes. And *another* car makes it. And *another*. And I was getting *worried* now. "Ho-oly cow! We can't have a *lot of* these cars make it, because that's even worse on the other—(chuckles)—side!"

But that took all of the previous issues about TIA, except for a few senators. There were a few senators, but even they are somewhat mollified because it was a bigger deal than one really might expect. The Grand Challenge really saved DARPA.

I: Was there a danger in DARPA becoming a little *too* well known? Does it need to stay below the radar?

Tether: There's really no real benefit for DARPA to be very publicly known. I think that's a danger, even with the Grand Challenge, of becoming too publicly known, because then you become a target. In fact, that kind of *happened* to us, in a way. We no longer have the prize authority, which is really strange. Why would you take the prize authority away from an organization that, you know, *used* it? And a lot of it was internal to the department. They saw how the Grand Challenge propelled us, really, to the world map.

I would say there was sort of a jealousy that we were getting too much of the attention. That's not good. That's not good.

So, it doesn't really pay for us to be too visible. Visible enough. You know, we have to be visible enough that people—can appreciate that we are delivering things. And it's really important that the department believe that we are delivering things. That's what we're there for. But it's also important that we reach a little bit of a larger audience so that our constituency is not just limited to the department.

Otherwise, we'd be gone. We're an organization that is unusual, and we have authorities—not that the rest of the people in the Department of Defense

don't have it. It's just that we *use* it. And that is irksome to people who—you know, bureaucracy cannot stand that. Bureaucracies just cannot stand a place like DARPA. Remember, we were created out of a crisis. You *never* would have created a place like that without a crisis.

I: We talked a little bit about the relationship with the Services, and you've been around long enough to see that ebb and flow firsthand. Can you talk a little bit about that?

Tether: Well, for the most part, the Congress is really supportive. I think the only problem we got into was with TIA, and that part of the Congress who were very liberal. I mean extraordinarily liberal in people's rights.

And the impression was that we were developing a technology which could literally mine all the activities. I'd know exactly what you were doing. Then, of course, the movie "Matrix" came out. Didn't help any, you know? And it looked like we were developing technologies which would enable that.

And I would go, and I'd talk to every one of them. And I went over, and, by God, I spent time with every one of these senators. It was mostly all senators that were causing the problems, but—(chuckles)—they were very powerful, because they were very vocal. And I went through what the program was about, and usually they understood.

And I had one tell me, "Well, look. I know you're not doing it for that. I do know that you're not doing it for personal liberties, and that you're doing it for a good cause, but the problem is that if you ever develop those technologies, somebody's going to use it domestically."

And I said, "Well, make laws. Listen, you've got the power here. Just make laws. Make it illegal to be used for anything but in the military."

And they would never do that. They would rather kill the baby in the crib so that they didn't have to worry about it later. If they could prevent the technologies from being developed, then they didn't have to contend with making laws, which they didn't want to do.

I: Did that reaction surprise you?

Tether: It surprised me, yes, it did. And it really surprised me because of the fact of 9-11, you know? It was sort of like they discounted 9-11. I mean they discounted the fact that we had a real threat against us, and they valued personal liberties—a threat against personal liberties, because they didn't want to make laws. I mean that was the thing that really puzzled me—is that, "Okay. Just make the laws." I mean make it so that it's illegal to have AK-47s, which we did.

But that was even a fuss, if you recall.

We had the perfect storm. The people who were very liberal and the far right and the far left came together against TIA. They really did come together. We—we really got into that very sensitive zone, because they, quite frankly, believed that people would not be able to do *anything* without us knowing about it—without the *government*.

They didn't mind if the marketing guys knew about it. I mean usually, in

these conversations: "Well, you know, a lot of what you're talking about is already being done."

And they said, "Yes, that's right. It's already being done. But, it's being done by people who can't take your liberty away."

And that was the issue, is that the government can take your liberty away. Marketers are just a nuisance, but the government can go find out things and take your liberty away—or, just take your liberty away *anyways*.

And that was the *real issue*. The real issue was the *government* was doing this. They didn't care if private companies were doing it for marketing, or knowing what to sell you—that didn't bother them at all. It was the fact that the *government* could have this capability, and, therefore, the government, who has extraordinary power, can take away your liberty. *And that was really the issue.* And both the left and the right got together on that, and it was just *wo-ow*!

I haven't counted it up, but I talked to over 50 Senators—*personally*, one on one—on TIA, and at least a hundred congressmen, to explain. I never had a problem with them, explaining the program. And a lot of them basically said, "Well, now that I understand what you're doing, I guess I don't feel too bad—except that somebody's going to use it domestically."

And I never could counter that except to say, "Make a law." And none of them wanted to make the law.

I: What was the budget hearing like that year?
Tether: Well—these were all private meetings. You get into these hearings, and it's a kabuki dance. It really is a kabuki dance. You know, you do this. I do this. We just go through it. Very seldom do you really get into it on an issue in one of the hearings, where the public's right there with you. So, the hearings were never anywhere near that contentious.

I: Did DARPA's charter change from initially *preventing* technological surprise to *initiating* technological surprise?
Tether: Well, I don't know if it ever changed. Still, the major charter is to prevent technological surprise, but being that agency which basically *looks* for those ideas and concepts that if they could be done, would make a big deal, to make sure that the United States gets them first.

In doing that, however, we get ahead of the pack, right? And so we—(chuckles)—we actually create technological surprise for other people, because we are always looking for those ideas and concepts that—that could make a big deal, making sure that *we* do them first. And then doing them first, we create technological surprise for other people. So, it really is the same charter. I don't think it's really changed.

I: How do you surprise our current enemy, which isn't technologically superior, in current situations?
Tether: Well, uh, that's a hard problem. We are definitely developing technology which will allow us to detect that that person is wearing something strange—at a distance. But when you have somebody who's willing to kill himself, you're really

dealing with a different character. You know, because you have to be prepared to—"Hey, that person's got a bomb on them." Well, *shoot* them. D*o something* to them. You know, don't let them get *near* us.

The problem is that all this technology's not foolproof. You end up with what are called false alarms. And if you're not willing to suffer a few false alarms, like, "Oh, my goodness! Sorry, but he didn't have a bomb on. He—(chuckles)—had some other stupid thing on, you know, that just looked like a bomb. You have a hard problem here of what do you do about it after you detect it?

But we're still working that problem, and we're actually making progress on being able to determine whether somebody's carrying something that—that is unusual.

The real issue is that technical surprise does not necessarily equate to *high* technology. These IEDs are not high technology, but it is a technical surprise. It really is a technology surprise that somebody was able to take a bomb and take a cell phone and hook it up and become very effective. And we're working hard on trying to detect these things to be able to do something about them.

The counter to this problem is a long, long war. I'm not sure whose job this is, but, basically, what we're trying to do is develop technology to contain them, to contain this threat, which is worldwide. We can't go and kill them all, you know. So, we contain them.

While we're containing them, you do need an ability to go in and really start with the three- and four-year-olds to try to get into their minds to basically teach them, "Hey, it isn't a bad thing. It isn't a bad thing to deal with non-Muslims." And in this country, basically programs like "Sesame Street" really went a long ways toward integrating this country, toward our kids growing up, saying, and "Hey, blacks and whites and pinks and everybody—*it's okay*! It's o*kay* to play with them!"

Now, I don't know if anybody really developed those programs with the idea that was the purpose of it; but, by God, they really served that purpose. They really did a great job on getting right down to the kids and at the very early age teaching them that different races—are o*kay*—okay to play with them. They're all people, you know?

We need to find a way to do that to the world. And maybe technology plays a little bit. Rumsfeld, in the early days wanted us to find away to build radios that we could just throw out. I mean that everybody could pick them up and use them. And then he was going to communicate to them.

It was a great idea. We developed a radio; it was the *transmitter* we had problems with.

But that has to be done. While we're containing them, keeping them from coming here, or keeping them from spreading any further in the world, and there is a sort of a belt—we then have to go and figure out how are we going to have a long war, where we go to the three- and four-year-olds and *somehow* change their minds about what is right and what is wrong.

I: Has DARPA expanded into behavioral or anthropological studies?

Tether: Yes, we have a program starting up, and it's one of those programs that worries me. It could easily go south. Not "south" in the technical sense. It could go south in a real political sense. I'm worried about it. Not worried so much I won't do it, but it has the potential to be a TIA, so I'm watching it very carefully, obviously.

I: Is there a need to get people from different cultures, even different countries, into the organization to better understand—
Tether: Well, different countries are hard. They have to have a clearance, so we can't get them from different countries.

DARPA is a very interesting organization. I mean people ask me, Is DARPA a bottoms-up organization or a top-down organization?"

Well, actually, it's both.

A new thrust, TIA, comes along. Well, remember DARPA is churning people 25 percent a year and so if you want to do a new thrust, you just hire the next 25 percent to be in that new thrust. So, what you do is you hire—you hire a whole bunch of program managers who are interested in a new thrust. They generate the ideas for the program, so it's really—the ideas for the programs are bottoms-up but the top-down part is that—you hired them to do that. And it was a deliberate thing. It was deliberate, but it's the top-down thrust to create the capability to make it a bottoms-up organization, which is really what it ends up being.

I: Well, I'm interested in DARPA's relationship with the idea factory, the universities, industries and things like that.
Tether: From the industry viewpoint, I think our relationships are constant over time. Industry understands that you really do have to compete and that there's—that they're not entitled to get these funds. They have to put out and think about ideas.

Universities like long-term programs without any real end. I mean even though they like to say they generate a lot of things they *do*, but the generation is almost a serendipitous type of thing, which we are right there all the time, trying to make sure we understand what's coming out. And that's why you need them. I mean that's why you want them. You have to understand that that's the culture you're in, and you want to make sure you feed their culture to make sure that ideas are being generated that you can then pick and choose from.

But it's not a lot of money that it takes to do that. What they've become over the years... I always say, "Well, go to NSF." You know, "They're supposed to do that."

Well, they don't like NSF. Why not? Well, they only get 300 k contracts. Well, that's probably all you *need*, if you're going to just think—right?

They *like* these million-dollar efforts that are really programs.

And I say, "Well, you know, when you get into these programs, we *do* expect a product out." We do have an end-goal here, and we do want to measure—(chuckles)—progress towards that end-goal. And if you're not making progress, we may just stop it.

Well, that's counterculture to them. That's the way we operate with industry, and that's why industry has no problems, but the universities have a problem. They really have become big businesses, and the last 20, 30 years; they found that big business-wise, foreign students were an easy mark. They came in. They didn't have to really do much for them. They came in with money, and so they actually shorted the U.S. kids, because they had all the kids they wanted, foreign.

When 9-11 came and they found people not coming anymore, they got a little panicky. I mean they got really a little panicky, because their source of revenue was going down. Now, I—will tell you this, but this is exactly what was going on. So, that's when you got this hoorah—"Oh, you have to be funded," and where the money's going.

Well, we at DARPA said, "That's great, but what are your ideas?"

And they had for the most part, they had no ideas. "What do we need ideas for? Just give us the money."

They wanted to be given the moneys to go get ideas, which is okay. You do need to do that, but it's not a DARPA thing. It's not what we do. As I like to remind them, we are a *projects* agency. We're not a *research* agency; we are a *projects* agency.

So, we've had this contest, I think, over the years. I don't think it's any different today than it was 25 years ago.

I don't know what Heilmeier told you. He had big fights with them, and so did Foster, you know, back in the 6.1 account, which is the, really, basic research account is, in DOD jargon, defined as "efforts without an application in mind." I mean that's exactly the definition of it.

You know, "Hey, we're doing these. We don't have any idea what—(chuckles)—"what it's going to be good for."

Well, we fund some of that, but the big money is not in DOD. The big money's outside DOD, in NSF and NIH, where it should be, actually.

I: Was it McNamara who came up with those delineations.
Tether: Yes, he did. At least he's given credit for doing it, yes.

I: Is TRP still around?
Tether: No, it's gone.

Actually, it went to NISC. And I think it might still be alive at NISC—ATP I think it's called—I don't know.

I: When you look back to 2001, what was your biggest challenge?
Tether: Well, again, I was lucky. Now, maybe it was deliberate. Cheney, who, by the way, is very good at understanding how to motivate people, did pick us out. It always surprised me. There were people in the Pentagon. I said, "Come on. You called them up and invited them over—didn't you?"

I said, "I didn't do this, they called me." But people still don't believe that, which is okay. It's not bad to let them think I had that much power, which I don't.

As I said, it forced me, in three weeks, to basically do what I would

probably have taken three months to do. And it stepped up the pace of really finding out exactly what was going on in DARPA, exactly what was valuable. I had to choose. I had to listen to it all, and I had to pick. That happened very quickly because of Cheney's visit.

In less than a month. Actually, I came in on the 18th. He was there a month later. So, there were a lot of things that happened because of that that set the tone. I got up to speed extraordinarily quickly.

I: How did you settle on the Grand Challenge?
Tether: First of all, I didn't do it because I needed a counter to TIA. Serendipity once again played.

But we had this prize authority, and none of us had used it in the past. Before I got there, they had a prize authority. And we kept thinking about, "What can we do?" "Gee, can we get this prize authority? Is there anything useful to do?"

And I got all kinds of inputs, you know, from a lot of people what kind of things we could have a prize for, but every time we thought about it: "Hell, we can give a contract for that." We didn't need a prize authority. We could just give a contract—and have somebody *do* it.

The Autonomous Vehicle Race really came about for two reasons. One, it's an important military capability to have convoys that could drive themselves, get the people out of there. If we had convoys that could drive themselves, the IED threat would not be anywhere near it is today. Why? Because they're just blowing down mechanical things. It's really killing people that makes it so effective. So, that was an important military capability.

On the other hand, I *am* worried, and still am worried. I was worried back then, still am worried about the feedstock in this country. I was telling you the schools, the universities, are filled with foreign students and the U.S. kids—there wasn't a value for them to go in engineering and science and technology.

Now, I grew up in the sixties, so I remember the race to the moon and what that did to us. It galvanized us. What a challenge that was. Everybody wanted to get involved.

So, in true DARPA arrogant fashion, I thought, "Well, everybody in this country owns a car. Everybody can buy these computers. The sensors you can buy. The actuators are even available through the handicapped market. So, this is something that has a low hurdle for the average guy, because the only thing left is his imagination to come up with a secret sauce for "how do I take the output to those sensors, come up with the controls, make the car do something, monitor it and close the loop?"

And so I said, "Let's do that, because it's a second reason that we can't put a contract out for."

And it just turned out to be—(chuckles)—gang busters. In fact, far more than I expected. The first program manager, he suffered with me. It was first going to be 250 miles from L.A. to Vegas, and I was really going to start it in Anaheim. I said, "Okay, José. Get out there and find out what highways we can run them down."

He came back and says, "I can't. They won't let us."

I said "Just tell them we'll do it on the weekend. We'll just close them for a little while."

And he finally convinced me that we really couldn't do that, so we started it at Barstow. I didn't want to start at Barstow. I wanted to start right in downtown L.A.

I knew that something was up, though, when we had an Industry Day in L.A. We made an announcement we were going to have an Industry Day, like we normally do, at a car museum. I can't remember the name of the fellow who owns it. It's a famous car museum in Los Angeles.

It was on a Saturday, and I flew in from someplace, and I said, "*God*. I don't know how I ever got talked into this." It was really expensive. We had bought the whole car museum. We had food and everything like that, and I thought, "Gee, probably all the people are going to be our own. If there are five other people there, I'm going to have to go out on the streets of L.A. and get the homeless people to come in to fill this place up to make it look like we have people there.

So, I show up that morning at this Industry Day, and there is a *line* going around the block, of people from all over the country who came to the Industry Day. And at that moment, I thought to myself, "Ho-oly cowl This can really—(chuckles)—turn out to be quite something."

We filled up that Industry Day. The attendance was, like, 7 or 800, people, from all over the *country* to come to hear about this thing, and they wanted to go in.

Even then, I was sort of a little bit in denial, quite frankly. And I thought, "Well, I still have Barstow," because I was still going to take it from L.A.

Then I got to Barstow. "Aw, there'll be about four or five people who'll show up in Barstow. We'll have a pizza and beer party. We'll go to Vegas and see which car makes it."

But the response was *just* absolutely incredible. It really was. Now, again, we only went seven miles, and that was okay. From our viewpoint, it was okay. But, the hype in the world had grown to such proportions that at the second Grand Challenge, one of the guys from the press says, "Well, from the first Grand Challenge, I know you guys were embarrassed."

I said, "Well, *we* weren't embarrassed. I know the *press* was embarrassed. We *knew* what *we* did, but I know you guys built it up so much that it only went seven miles, *you* were embarrassed about it. But don't think we were."

And they said, "Well, how many do you think are going to really make it this time?"

I knew there was at least a couple of cars that I thought could really do it, Stanford being one of them.

But like I say, when that first one came in, -- (chuckles)—Ron Kurjanowicz was the program manager on the second one. Ron, by the way, is a good guy—I couldn't do the job without him. He's the Chief of Staff at DARPA, and he really is the guy who I count on. I mean more than anybody else.

I made him the program manager of the Grand Challenge the second time, because I *knew* just how important it was for us to get this thing done. I didn't tell anybody; but because the last one was sort of a public embarrassment, too. Except that the public reaction of the second one was still good.

But when that first one came across, I thought, "God, we made it."

I: What was the reaction on the Hill?
Tether: Oh, it was fantastic. I mean absolutely fantastic. The first Grand Challenge, the reaction on the Hill was, "Uh, there they go again. Look at this. What an embarrassment." Only seven miles. I mean it really was not that hot. So, I got a lot of heat on that on the Hill.

But they were getting letters from their constituents from all over the country saying what a great thing this was, and that they should do it again. They were getting lots of letters from constituents saying, "This was great, and we want to make sure these guys do this again," you know.

Even though there was this public kind of embarrassment, they were realizing from the constituency of the country, that it was a different viewpoint.

And that was total reversal of TIA where the constituency was the ones that write in saying, "Bad," "bad," "bad." It was totally counter to TIA.

But getting one through was really important.

I: Was the Grand Challenge your most proud moment or were there others?
Tether: There were lots of proud moments. That is my most *relieved* moment—(chuckles). I have to say it was clearly my most relieved moment, because I knew that we were back. Yes. And we were. Yes. All of TIA was totally wiped away. The constituency writing in now was writing very positive things about us.

I: What about some of those proud moments?
Tether: Well, there have been lots of them. Gee, the place does a lot of great things, and a lot of it I can't talk about, unfortunately. But we have provided capability to the war effort which I know has saved a lot of American lives.

I really feel that TIA was probably the greatest strategic thrust we had, and, quite frankly, it's too bad that it didn't happen. But it *did* happen also, because it didn't die. It was just taken away from us, you know. And orchestrating that at the end was really tough, but I had a lot of people who were in the private meetings who were right behind us in the congressional last negotiations. The only thing that happened with TIA was that it went away from DARPA, but it didn't die.

I: Did it impact the clout that you had?
Tether: No. No. And—no, not at all.

In fact, in some sense, it probably enhanced it; because, I did get to—(chuckles)—meet a lot of people. (Laughs.) And I did get to explain DARPA to a lot of people. I really did. And I got to be pretty good at telling that story.

I always say that the best education I ever had—and I do believe this—is that at one time I was a full-time Fuller Brush man. I had to do it for a real living.

When you're a Fuller Brush man and you knock on the door, you only have a second or two to really assess who's answering that door and how are you going to get in that—(chuckles)—house, you know, that is the objective. And all those things that I learned back in those days really came to play, because it was really like people didn't—(chuckles)—want us in the door. We had a good product, but we had to get in there to show it to them.

And going through that, I really thought about every moment. "My God, okay. Here, I've only got a few seconds here, and I have to assess this person right now and find out just how am I going to tell this story." Because I could tell it many different—(chuckles)—ways, like Cheney likes it visual. "Great. We're going to feed it to him visually." And so I learned a lot.

From that viewpoint, I actually think DARPA came out at the end, given the Grand Challenge, to allow the constituency to support us, so now they could support us. There're more people in the Congress that really understand DARPA than there—(chuckles)—ever were in the past. Now, that's good. That's good.

I: Any failures that stand out in your mind?

Tether: Oh, *failures*. (Pause.) Gee, you know, people always ask me that, and the thing about DARPA is that we don't really—(chuckles) –necessarily have failures. Oh, there were programs that were stopped, you know, where it was, "We just can't do this." But those I don't consider failures, because that's really what you're–(chuckles)—supposed to *do*, is to discover those things. So, even the discovery that it *couldn't* be done, to me, is not a failure.

But the DARPA culture is very fast, on their feet. If a person starts a program for this purpose and on the way to that purpose finds out that it can't be really done for that purpose, but—holy cow—there're some other purposes over here, you know—(chuckles)—we just *change*.

So, I'll tell you one story. And, again, this happened when I first came in.

The inspector general sent me a letter. They wanted to investigate DARPA's capability on transitioning technology in the information technology area. I said, "Holy cow. Here I am." It was even before Cheney called—(chuckles)—me. "I'm only just here. I'm going to be out of a job"—(chuckles)—because I figured it was going to really be bad. Because the inspector general's not really somebody you really want to come see.

Well, they came, and they took 20 programs that were information technology-oriented that DARPA had started and was involved in the nineties, and they went off and tracked what happened to those programs.

Well, they wrote a report. They didn't know what to do, because at the end of the day, it turned out that 90 percent of the products that those programs had generated *were in use*. In other words, 90 percent of the products that the programs had generated, somebody was using them.

And I thought, "Holy cow!"

And, of course, in true inspector general, they said, "And they ought to try harder." I mean they couldn't just leave it at that.

But they asked the wrong question. And, of course, I never told them what the right question was. They found that 90 percent of the products that

were produced were being used.

If they had gone back and said, "On these 20 projects, how many of the *original* objectives were being used?" it would've been 5 percent, maybe; because along the way, as people were working those programs, they found that what they originally were trying to do, they either couldn't do it, or it wasn't the right thing to do, and they *changed*. They morphed until they—(chuckles)—until they found a product that somebody wanted.

Again, only at DARPA can this happen because of the culture of the place. If you were in a service lab, in an Army lab, and you were working on a program that was supposed to do something and suddenly you found, "Well, gee, it can't do that; it can do this," chances are you wouldn't be allowed to change it. Because-- who knows? It might be now valuable for the—(chuckles)—Air Force as opposed to for the Army. Or, it might be valuable for some other *part* of the Army, which is even just as bad as it being valuable for the Air Force.

Those poor guys they don't have that ability to be able to change in real time.

I: How can DARPA do that? How come the Department of Energy can't have a DARPA or Homeland Security can't necessarily have a DARPA?

Tether: Because people aren't there very long. That's the one thing that DARPA has that is different than anyplace else. The program managers are only there four to six years, and it's because of that rotation that makes DARPA different, because these programs that were started by somebody—that person left, a new person came in. He got the program. He *changed* it. He had all the authority to change it—until, finally, it got to be something that somebody wanted.

And you can't do that if people are there very long. DARPA's a place where you're not there for a career, so you can't screw up your career. You can't have a failure that can hurt you, because you're not going to be there very long anyways. There is nobody who's going to remember anyways.

The cachet for people at DARPA is that they were at *DARPA*. When hiring back on the outside, the cachet that they carry with them is that they were a DARPA program manager—not necessarily what they were doing and whether it was a big failure or not. So, it's a different kind of culture that doesn't exist anyplace.

And I tell all these people, worldwide, who come around and see me, and I say, "This is it. You just have an organization where people don't stay very long."

And I don't mean that you detail them from some other part into here and then send them back there. I mean they come in from industry, universities; give up everything; become a civil servant. And four to six years later, you kick them back out into the industry-university world.

They don't know how to do that.

I: You touched on something that's always intrigued me about DARPA projects, and that is what I call the Law of Unintended Benefits: How does that apply to DARPA projects?

Tether: Yes, and that—a huge number of our transitions are the result of that.

I: We spoke about the 2007 Strategic Plan and I would like to go back and say the project, and then if you could just very briefly talk about it. Let's start with VSO.

Tether: Well, DARPA's been in and out of space many times over the years. We were created because of space and then we got out, because it was taken away from DARPA—"taken away" in the sense other organizations were created. So, see, DARPA from the very beginning started this rotation of people not being there very long where half the Agency went away in 1960. NRO was created—the National Reconnaissance Office was created. Half went away again in 1970, when Defender went away. Half of it went away again in the eighties when SDI was created out of it. So, it's an organization that is used to people not being there very long just by nothing more than they go away for one of those reasons.

So, we're back in space. First, we have a VSO.

That's a Virtual Space Office. Now, I could've created a space office, but I chose not to do that, because one of the only guiding principles of organizations that we have at DARPA is that we physically put people with like interests together. And that's how the offices are formed. Space kind of permeated the whole place. There were people who were interested all aspects of space, so for me to do that, I would've had to really made a very disruptive change to the organization and taken people from a lot of offices, and I didn't want to do that.

So, I created a virtual office, which turned out to be probably the right way to have offices, quite frankly. There's a virtual office. There are virtual people; there are program—(chuckles)—managers in the Virtual Space Office. They all got together by themselves. They have staff meetings—(chuckles)—you know? They've got cups called "VIRTUAL SPACE OFFICE." They've gotten a flag, I hear, and a motto. It's all being run by them. No office director. They've got their office directors in the—where they come from.

I really can't talk about the neat things, though. I mean I *just* can't talk about the neat things. But I'll tell you what. We have got a big program. We went from no money in '01 to over half a billion dollars a year today, and it's really doing some great stuff.

I: Was this in reaction to the idea that the Chinese, in fact, can disrupt our satellite communications?

Tether: No.

Remember, Rumsfeld, as I was walking out the door, said, "Hey, here's the Space Commission report. This is important."

And if you read the Space Commission report, you get a feeling of an organization that is broken in the department, and we fixed it. I mean we executed that, in fact, today we can get out of space now, and we're really thinking about doing that because we really brought everybody else up to the level that Rumsfeld wanted them to be at. And now they actually would like us to go away, because they new feel they can do the things that we were showing them how to do.

I: 50 years from the time that happened initially.
Tether: It's over again—yes. It's all over again. Yes. And it *is* all over again. Not that people at DARPA quite realize that, but it's done. We'll just fade away with the programs we have, and that will be it until the next time.

I: Tell us about, "Newton's Law for Biology."
Tether: You've heard people say, "Gee, you can do anything as long as you don't violate the laws of physics"—right?

Well, the problem with biology is there are no laws. There really are no laws like there's laws of physics. And that bothered me. And it *still* bothers me. And it bothers me because biology and all of the things that we do in biology—it's a descriptive science. In other words, people can tell you what happened after the fact, but they can't predict for you what's going to happen, because they have no equations. They have no fundamental laws that guide them to say, "If I take these things and mix them together, I'm going to get this." They mix them together and they go, "Wow! Look at that! Look at what we got." And then they try to explain it. But they don't have a prediction capability.

Now, that limits that area. We are doing a lot in biology, and we're doing quite a bit, but a lot of it is just still back to throw it in the pot, stir it around, see what comes out.

Now, our instruments are getting tremendously better, so we aren't able to do that, so, I said, "Look. Let's have a major effort on really looking into are there fundamental laws in biology that nobody has bothered to really discover?"

And so we have a major effort. And we have biologists. We have mathematicians. We have physicists. We have them all together, trying to figure out are there laws?

Now, why do I believe that?

Well, if you were to go and look at the ocean and just watch the tides, the ocean—the waves break, you could come up with Newton's law of "F = ma." But it would be a hell of a thing to take all of that data and come up with that simple rule of law, and that's where biology is right now. It's like we're watching the tides and are trying to figure out, "My God. Is there any—(chuckles)—rhyme or reason to this?" Anything driving it? Is there anything driving it?

And so we're trying. And if we can do that, we will absolutely—it will revolutionize the whole biological field.

I believe it's there. And I believe it has something to do with conservation of energy and things like that. And one nice thing about having money is that you can get a lot of people to work hard on these problems.

And they all work hard on it; too, because they know that out of this, there are Nobel Prizes in this area. And we basically are getting papers now of people writing about it.

Let me tell you one thing, just a little bit on DARPA. One thing that strikes me with DARPA is that when we start something, people think we know what the hell we're doing. And so even those people who don't get involved in the program because we started it, they all start doing it, too. So, the leverage that we get

from starting something is *tremendous*. I don't know whether it's ten times, a hundred times. And even though people aren't involved because we're involved, and they think, well, we must know something, they get involved, too. And before you know it, they're starting to make discoveries, too, which we mine and get back into our program.

And this little effort, the fun—we call it "fun bio" for fundamental biology—is really doing that. I mean we started this, and we got people a lot of other people now saying, "Those guys must know"—and they know we're talking Nobel Prize stuff here.

And so we've got people who aren't involved in the program now doing things and then getting involved in the program if they come with anything. And that's really what that's about. It's typical DARPA—absolutely typical DARPA.

I: Real-time, accurate language translation...

Tether: Boy, you want to talk about a major constraint on our ability to interact in the global world. Either we're going to have to teach every kid in the United States 16, different languages because we have become a global world—and while I don't quite understand how it could be; that two tribes less than 20 miles apart, but separated by a mountain, could end up with a spoken language which was so different from each other. I mean you would think, "*How can that be?*" Why didn't we evolve to a common language?" I mean I don't understand that, but that's the way it is.

So, the problem we have is that since it's a global world, we need to be able to communicate with that world if we're going to succeed, either military, or economically, or whatever.

And the out of it is, again, I say either we teach everybody all these languages, or we create the technology which allows this language translation to occur.

Well, our vision, our dream is that you and I, we could have little earphones here. And, of course, computers would be so powerful, that when you talk in your language, it automatically translates it so that I hear it in my language. And then when I go to speak it, I have maybe a little microphone, a speaker here someplace, where when I talk in, out of that speaker comes my words in *your* language. That's real-time—(chuckles)—language translation.

And we are moving towards that goal. We are moving there, slowly, but surely. Maybe not so slowly anymore. Maybe not so slowly. We have one-way translators, two-way translators now, really driven by the war. With a major effort, I believe we're going to get there, because the computers are getting there, and we're understanding how to do this better and better.

I: Prosthetics.

Tether: Wow!

Prosthetics really is understanding the mind, the codes in the mind. And my interest in that goes back a long time ago. When I was in Stanford, I had a scholarship that in order to get the money, I had to take full-time. I had to be a full-time student. And—(chuckles)—after a while, I think I don't know how many

graduate credits I have. I took everything you could think of.

But one course I took, back in, maybe, 1968, was by a fellow called John Bliss, who had a course on the neurons, how the nerves in your body work. We tried to model it from an electrical engineering viewpoint. That really fascinated me.

Well, we skip forward many, many years, and in DARPA we had a fellow who had a monkey down at Duke University. The fellow's name was Nicolelis. With micro technology, electronics technology had gotten to the point we could make probes that were so thin, that we could put them into your brain, and your brain didn't know they were there, so it didn't reject them. So, in this monkey we were able to put hundreds of probes. We were able to monitor her brain signals.

We gave her a test. There was a computer with two balls, and a light would come on, and she had a joystick, and her job was to make these balls come together. And if it worked, she got a treat.

Well, we took the signals out of her head, ran them to a mechanical arm elsewhere and taught that mechanical arm how to move like her arm. Yes. So, she'd move her arm, and that mechanical arm would move, which is fantastic. But then we took the joystick away from her one day. I don't really know where this came about. So, we said, "Let's take the joystick away from her and see what happens."

So, the light comes on. She knows that she has to get those balls together, right, but she doesn't have any joystick.

Out of her mind to that mechanical arm, the mechanical arms moves just like it's supposed to. We thought we had initially hit the motor signal. But we had tapped into the *thought* signal. The thought of moving the joystick is where we had tapped into.

Fantastic! I mean just absolutely fantastic.

So, there are lots of applications for that, but if you go out to Walter Reed, you'll have bad day, because our kids are surviving trauma that they would have died in many wars long ago. Not that long ago. But the extremities are taking a beating. The arm the most complex thing to replace. Legs, we can replace quite easily, actually, you can see people running and doing things like that. But the arm is really a tough thing.

So, I went out there, and I talked to these kids out there, and I said, "Jeeze, I think we can help you, but I might have to put a probe in your brain."

And this one kid told me, he said, "Hey, there's nothing more invasive that's going to happen to me that *you* can do."

And I said, "Well, okay." I said, "But it might take me a long time. It might take me 15, 20 years."

One kid said, "Look, I am 22 years old. If it takes you 20 years, I'm going to be 42. That's okay. I want my arm back."

So, we started the program to take the codes that we had discovered in the brain that have an arm, which we're building, which by itself is a mechanical marvel; but to have it controlled by your brain, and because it's on you, there's a nerve that comes down that we can hook that arm up to, so that we not only have your thoughts controlling it, but we get the sensation back the same way as your

arm does, so that somebody can feel something and actually feel. And we're doing that now.

Now, this fellow, Nicolelis, at Duke, has been invited to give a speech at the Nobel banquet in the fall. They *never* invite a person to give a speech at the banquet unless he's going to get the Nobel Prize, and he's going to get the Nobel Prize for this.

And only at DARPA, because would anybody else have the money to do this and the ability to do it, even though some people might say, "What are you guys doing?" "Isn't that a little bit past that edge that (Johnny) Foster was talking about?"

But success, as I said, has many fathers. (Chuckles.)

I: Alternative energy.

Tether: Big deal. The only way, again, with this problem that we're having—we've have to get oil independence. I really believe that getting oil independence is one of the things that will take the pressure off, maybe give us more time to contain the situation. And the Department of Defense a big consumer of oil. So, we're not looking at it to save the country, although it could obviously be expanded to that, but what we're looking at here is to basically come up with capabilities to provide energy without having to go to oil.

And there are two approaches here. One is very high-efficiency solar cells, where you get 50 percent at the same price point as today's, and the whole world changes from using solar energy. Or, you get fuel from plants. And we have a major program in both areas. And if we can do either of those. I know we're going to do the solar cell, but if we can do the fuel from plants, we will be able to take a small part of Nebraska and basically grow rapeseed out of land that we now pay farmers to not grow corn—to *not* grow corn—and we will be able to satisfy all of the oil requirements of the Department of Defense.

Now, if we go and expand that to maybe take Nebraska and—

It has to be North Dakota. For rapeseed, it really likes colder weather. We could provide fuel for the whole United States—just fuel.

Now, that would just relieve us so greatly of not caring about the Middle East, uh and meanwhile, we're containing it. So, that's why it's a big deal.

I: This one intrigues me. Quantum information science.

Tether: Quantum computing. Quantum computing is like the biology people, that's where they started. If we had started only know in—"quantum" means that something is only probably there. If you measure it, it destroys itself. If we can build a quantum computer, we can have a computer that will operate at capabilities that far exceed anything that we can do today. It'll be an enormously valuable computer. You know, *big* numbers, 10 to the thirtieth, which is a number I can't even think of, 10 to the thirtieth is longer than the universe has been alive, in terms of years. Actually, in terms of seconds.

So, it's a big, big number. But it really is the frontier of computer science.

I: The new architecture they're all looking for.

Tether: The new architecture that everybody's looking for. We don't know how useful it's going to be, but we're going.

I: Networks.
Tether: Big deal. Networks. This country is going toward a network-centric force. Now, what that means is that where before we used to have platforms that had all the capabilities they needed—the weapons they needed, the surveillance they needed were all on that same platform. The problem was they made the platform be 75 tons, which made them not be very mobile.

So, what we did is we basically broke that platform up into little pieces, and they could each be transported quite easily. But then you still needed to have weapons and knowing where you were and all that, and so you had to bring that back together with a network. The reason we can do small units rather than have big, huge divisions of people is that they have information coming to them from all over and can control weapons from all over. So, they really are like a big force, but it all depends upon that network being there.

And we have developed the technology to make that possible. That is real. That is really real, and that's a great attribute. Only DARPA was able to do that. I mean now a lot of people are taking it. They've forgotten we were even involved, but it really was DARPA that made that happen.

I: Air vehicles.
Tether: DARPA's been in and out of air vehicles from the very beginning. Right now, our major themes are air vehicles that might stay up for five years. These are obviously unmanned. But can you imagine if we could have an air vehicle that was like a satellite and just stayed up there? Oh, you'd have to go refuel it, probably but that's one of our space programs, showing how to refuel other satellites. But five-year airplanes is where we're going.

I: Chip-scale atomic clocks.
Tether: Well, if you create these networks, one thing that the networks need to form themselves is they all need to have a common time. They all need to have a common time pack. And right now, we rely on GPS—satellites—to give us that time. However, that makes this network very vulnerable, because if somebody can jam GPS, or get rid of it, your network falls apart.

The network now has become the weapon, because it is the integrating system of your force, and if an enemy can take that away, they actually have taken your capability down to zero. So, keeping that network up is extraordinarily important. And time is the one essence thing that they all need.

Well, we said, "Well, have to solve that problem, so we can take one of these big atomic clocks"—which is huge—"and put it on a chip. Typical DARPA. And, by God, we're *doin'* it. I mean that's the darnedest thing is that we're actually—(chuckles)—*doing* it. We are actually going to have an atomic clock that is oh, about that size. Takes 30 milliwatts of power, on a chip. Every phone will have its own. And all because we have to remove the vulnerability of the network from relying on GPS to be the thing that forms it.

I: What's the key to DARPA's success in the past and continued success in the future?
Tether: I think it's simple. It's program managers, and it is also not keeping them for very long, which is a *really* hard job. Going out and finding the kind of talent that we need to have to make it at DARPA is really hard, because we're after idea people, and idea people are very rare. In fact, maybe we've reached the limit of how many we can really get, especially with the idea of not keeping them there very long.

So, recruiting is a major job. It's a major job. That's probably my biggest job. And it would be easy, quite frankly, just to go hire people. If I wanted to just fill up the building with program managers I could do that tomorrow. It's filling it up with the *right* program managers that is really hard. Sometimes, what happens with these people rotating is that when a person leaves, the office directors get nervous, because they've got these programs—right? And this guy's leaving. The program is not *done*, you know. They never are done. So, the office director has to figure out, "Well, who on earth is going to run this program now that this guy is gone?"

I say, "Well, we can just let it die. It doesn't bother me. We can just let it go away. It can just go away."

Well, they don't want to do that. So, they have great pressure on me to "just hire anybody to run this program."

Well, I told them, "Hey, look. We don't *want to* hire people to run programs. We don't want to have people as DARPA program managers run programs. We hire *industry* to do that for us."

And so I resist that. I strongly resist that.

But on the other hand, it's very hard to find the right people, and that's the problem with DARPA, program managers, that's the secret of DARPA. The right program managers and then not keeping them very long.

I don't know what the other directors told you, but I think that turnover has been a theme since the very beginning. It's become a theme, at the least.

I: I was really impressed. I went back to a couple of Dr. Fernandez's speeches and looked at them, and they really are recruitment speeches.
Tether: Oh, yes. We are recruiting all the time. Yes. We recruit *all* the time—constantly. Boy, we're really pounding it. It's a problem. It really is what limits us.

But I don't think just go around hiring people because we got money to spend is the right answer.

I: Can DARPA survive the next 25 years?
Tether: Well, I don't see why not. I really don't see why not. It just is a great place for people to come. The question, I think, is how big will it be. And having a lot of money, which we have, is not necessarily the right answer. And a lot of people think I'm nuts because I would rather not spend it if we didn't have "DARPA-like" ideas to work on. And the only way we're going to get DARPA

ideas—(chuckles) idea—is to program managers—right?

The worst thing that could happen to DARPA is just fill it up with people who manage things, as opposed to create things. Then we'd become like everybody else.

I: Will it outlive its usefulness?
Tether: No, I don't think so. I really don't think so. I really believe that there always will be a frontier. Teleportation is still there, still unsolved. *That* is a DARPA program.

I: Thank you.
Tether: Thank you.

Interview: February 13, 2009

Interviewer: I always like to start with the tough questions, and that's what's your name and what's your title?
Tether: My name is Tony Tether. I'm the director of DARPA.

I: Now, last time we talked was May 2007. A lot has happened.
Tether: It really has. Remember, the purpose of this is to get all of the previous directors to provide a history, so that the future DARPA directors could read and understand what happened to this organization over 50 years.

When I was here before, I knew that I was not quite at the end of my term, and so that's why I'm back. I'm back to close the story. And it's hard to believe it's been 2 years. A quarter of the time I've been at DARPA since we were last here, and the last time I talked about a lot of things: how we got to where we were, some of the dangers that DARPA went through, how we almost went away.

Many things have happened since May 2007 – a lot of which are really good, some of which are not so good – that I want to get on the record, so that whoever's reading this, and I hope they do, will get an appreciation for what happened at the end of this term.

I: Okay. Well, let's start with the Urban Challenge.
Tether: If you recall, the last time, I talked about the first two Challenges and, how in fact, how important they were to get us to overcome a program that we had, called TIA, which really almost brought the Agency down, but the Challenges made us a household name back in the U.S. in a very positive way.

Quite frankly, I did not want to do another Challenge after the second Challenge, that was so successful. You know, we had five cars finish. It was great. And, you now, you always want to know when *not* to do something. Knowing when to "hold 'em or fold 'em" is always something that people should know.

But I was talked into it. I was talked into it by Ron Kurjanowicz and Art Bruckheim, that I really needed to do another Challenge. I tried to avoid it. I said, "Oh, we've done it all. What else could we do?"

And they said, "Listen, we have not done it in traffic. All the challenges to date have been just vehicles on their own, going on a path, avoiding fixed obstacles, but we haven't shown that you can do it with obstacles that are moving, other cars."

So, I agreed that, yes that would be a good finish to the whole series of the Challenges. Now, I was worried, because we were going to have on a course not only a single car, but we were going to have other cars being driven by people.

The way we had arranged it was in a small town in Victorville, California, at George Air Force Base, where they had a housing part, that is no longer in use. We were going to evaluate it by having people write tickets, which means we were going to have people out on the track.

There was a great danger here that something bad could happen, that somebody could really get hurt. And as the time came closer, I really was wishing that I hadn't done this. All I could see was the downside of this and I couldn't see much upside.

But it turned out really great. We had 20+ cars start. They had to go through a qualifying test, which was very hard. Not only did they have to be good technically, they had to prove to us that they were safe – because of the way the event was going to go. Eleven made the finals.

Within *minutes* after the event started, the nightmare happened. What would happen when robotic vehicles came to a four-way stop at the same time? It turned out there was no problem. They each knew who got there first and, in California, the rules are that the one who gets to the stop sign first has the right of way, and they just worked perfectly. It was the *people* driving the cars that we were having trouble with, because they would come, and they would not obey the California driving laws.

It was a spectacular finish. We had six cars finish. We gave away more than $3 million. $2 million dollars first place, $1 million second place, and $500,000 for third place.

But the response from the country was fantastic. We had done what we had wanted to do: We wanted to show it could be done in an almost real environment. But more importantly, we had changed the lives of tens of thousands of kids, who might never have gone into science and engineering, but they got involved with the Challenge, and they learned how much fun it is to do things like that.

Basically, when I was a kid, ham radio was the thing that kids went into. Ham radio is a thing of the past, almost. In fact, the involvement in ham radio is really going down. And this really did provide another vehicle for kids to be involved. Really great.

I am glad I did it after the fact. I really didn't want to do it, but I was glad I was pushed into doing it.

I: I wasn't there. I saw the tapes. They were *amazing*.
Tether: Absolutely amazing. We did have two cars hit each other. But for the most part, it was very safe. All of the robotic vehicles did a really good job. They all obeyed California driving laws. We really had no great violations to speak of, and it was really a great activity.

I: Have you seen any kind of payoffs yet from that?
Tether: Lots of payoffs. The thing that DARPA does, and DARPA does well, is we show that something can be done. We typically never really finish anything. We never really take something to a final product. But our role is showing that it *can* be done. And once you show somebody that it can be done, it's amazing how many people suddenly are brave enough to go and try it.

General Motors really got heavily involved and were using the technology. Of course, the financial issues that they have now have put a damper on that.

Caterpillar, however, is making autonomous tractors. In Europe,

autonomous cars are coming in. If you read the press, they all cite the DARPA Challenge series, and in particular, the Urban Challenge, that makes them believe that all of this can be done.

And even in the services, for whom we really *did* the job, they are picking up the fact that we can have autonomous vehicles. And we will have convoys not being driven by people in not the too-distant future – 5 to 10 years.

I: I wanted to talk a little bit about the progress made in prosthetics.
Tether: Yes.

I: Now, I understand they're actually going into the field right now.
Tether: Well, they're not going into the field, but they're being put onto *people*.

I: That's what I meant.
Tether: I mean, we have gone away from the monkeys. We're past the monkeys, and we're putting these arms on many people. Right now, the arms are mind-controlled, but indirectly. I mean a person could think of twitching a muscle on his chest, and then a circuit would pick up that twitch, and the arm would move in a special, learned way.

We have people who lost their arms when they were 18 years old; a lineman, who basically lost both of his arms when he was 18 years old, who now has arms. He's able to pick up things. He's able to feed himself. He used to have to, when he want to open a door throw, himself on the floor and use his feet to open up the door.

He complains now to us. He says his wife is making him do work around the house, where before, he didn't have to. Now that he can do things, his wife is making him do things.

We have a young lady, a Marine, who lost her arm in a motorcycle accident. And what we've done with her is that she has a left arm, and we've been able to hook up the arm to the nerve that goes back to her brain, and she actually has had feeling in her fingers. She could *feel her finger* touching something.

In about two years, we will be going to clinical trials on people with a chip in their head – a computer chip – and it will be a wireless control to an arm, and that arm will also have a feedback path back to their brain. And our promise to these kids is that if they could play the piano before, they will be able to play the piano again.

And we are going to see that done a lot faster than I thought. I think the last time we talked about this, I told you I thought it might take 20 years. Now, the program's been going on for 10 years. DARPA does a lot of long-term research, and people don't quite realize that, because when they start seeing the results of the research, they are seeing it when it starts to get to be near the end, and they sometimes think we just started that effort.

But this has been going on for 10 years, and we'll have people with real arms within the next 5 years.

I: Did that short time surprise you?
Tether: You know, it really did, but it really shouldn't have. The way we do projects is we provide mini-challenges. We call them "go/no-gos," because it sounds more draconian. But these are really milestones, and they are mini-challenges. And what it does is gives people not only a focus, but a feeling of accomplishment as they move through each of these waypoints. We set out the waypoints of things that have to happen in order for this end result to be there.

The first one was could we really read the code, break the codes of the brain, because if we couldn't do that, there was no sense fooling around with anything else. The fellow that was doing that, he groused that he had to get through this gate in order to get any more money, but I'm sure he worked day and night and had his students work day and night – more than they might have, probably, because they had to get through that gate. And when they did, they had an enormous party down at Duke.

And that gave them a great sense of accomplishment of a waypoint that was the second year of the program.

So, having those mini-challenges, I think, are really what really forced it to go faster than it might, because people knew the path. People had their Mapquest and knew what they had to get through to get to the end. And, usually, if you give people that, they will go faster than you ever could've thought.

I: I had a past director tell me that he thought that it was going to be one of the biggest things that DARPA has done, this idea of controlling machines right from your mind.
Tether: I don't know if it will be the biggest thing. It most certainly will be like the Internet in that it will be the thing that the public will know the most about. It will be a big thing, but I don't know if it will really be, or *should* be, the biggest thing that we've done, but it will be in the top ten. It will be definitely in the top ten.

I: Let's talk a little bit about DARPATech 2007.
Tether: DARPATech 2007 was the fourth DARPATech, and by the time we got to the fourth DARPA Tech – that I'd been involved with – we had this down to a science. First of all, we used the same hotel, the Marriott in Anaheim, because there's Disneyland. And where else would you have a DARPA conference? It's the perfect place to have a DARPA conference!

We had 3,000 people come. Filled the place up. We learned how to have exhibits, and by now we'd also learned how the speeches had to be put together. Remember, these are all teleprompter speeches. We had to do the teleprompters, because we had to control what these people were going to say, because the *world* was there. There was no restriction on attendance.

And that all just came together. It was one of those things that's remarkable. It all came together. The speeches were fantastic. The exhibits were really fantastic. In fact, the people were there with their prosthetic arms. The indirect-controlled arms, showing how they worked. It did everything that we wanted to do. We got our message across on what we want to do in the future. That's the purpose of DARPATech. We also were able to show people what we

were doing today.

We also have sidebars, where people can come and have a 15-20-minute private conversation with a program manager, and we had on the order of a thousand of these. We froze out the big companies from that. We put the front-of-the-line, small companies, you know, with maybe seven, five people, because they were the ones that we knew had a tougher time getting to the program managers than, like, Boeing. And the big companies understood that, so it was really no real problem.

I: You also, during your tenure, had the 50th celebration.

Tether: I think I mentioned the last time that when I came into DARPA, I really only intended to be at DARPA for the normal amount of time for a DARPA director, on the order of 2 to 3 years. 9-11 really did change all that. I just got heavily involved, and before you knew it, before *I* knew it, you know, 7 years had passed. 5 years, 6 years had passed.

Then I was thinking, "Well, maybe it's time to leave," but on the other hand, we had just finished DARPATech and the Grand Challeng, and then we had the 50th coming up. And I knew that, by God, I'd been there so long, that I was going to stay for the 50th anniversary.

I'm glad I did. We had a dinner-type meeting here in town. It turned out to be a black-tie type of dinner. Many alumni came. In fact, quite a few alumni came. The Vice President came and gave a *great* talk. Gordon England, the Deputy Secretary of Defense came, and he gave a great talk.

The Vice President's talk was *really* exceptional, and let me tell you how that came about. I knew that if we could only ask him, that he would want to come. Vice President Cheney has been a fan of DARPA's back when he was a junior congressman back in the late 1970s.

It took a little while for us to get his staff to ask him. We finally pestered them enough they said, "Okay, we'll ask him, but we don't have any confidence that he's going to say yes."

Well, not only did he say yes, you know, he really got involved, and that kind of surprised me.

His speech writer got involved and was going to write him a speech. I sent him some material, and spent about 20 minutes, maybe 30 minutes with him, answering his questions. Then he went off, and Cheney got involved in actually putting on his own touches. The speech writer sent me the speech about a week before, and he said, "The Vice President wants you to look at this speech and tell us if anything should be changed."

So, I read the speech, and it was incredible, so the only thing I told him when I called him back, I said, "Don't change a word." And not only did he not change a word, but his delivery – ah! If you've ever known him, he's a great, great speaker. You know, he just is a great communicator.

He did a great job, with jokes. You know, one of the things that we always say at DARPA is that the one thing that makes DARPA great is that nobody's there for very long. You hire the smartest program managers and you don't keep them very long. When they come in the door, their last day is on their badge.

So, there's this constant push, "Hey, time is of the essence. We can't fool around. Let's get this going."

And Cheney went through it, and he gave that line, and then he said, "Oh, by the way, my last day's on my badge, too." You know, it was a great, great day.

I: And he also visited DARPA again, didn't he?
Tether: Yes, he did, right after that. You know he had visited us in July of '01, right after I first got there.

During the 50th anniversary conference, we had a chance to go back and talk with him and when he first came in, he spent time with the office directors and deputy office directors. We were still waiting, we had a chance to talk to him. Ron and I stayed behind.

We said, "Hey, you know, you really should come again, if you can."

He said, "I'll do that."

And he turned to his Chief of Staff, whose name I can't remember and he said, "Make this happen."

And it did. And in May of that year, just a few months later, he came back to DARPA. He spent 6 hours at DARPA, going through everything. Great guy. Very great guy.

I: We talked earlier about the Rumsfeld report.
Tether: Right.

I: "Get DARPA back into space." Well, tell me a little bit about Orbital Express, for example.
Tether: Well, Orbital Express was a program that was going to prove you could have one satellite, all by itself, refuel another satellite and actually change out equipment. It was kind of the Grand Challenge in space. You know, where in the Grand Challenge, where autonomous vehicles are on their own on the ground. This one was a satellite, on its own, in space, that was going to do similar things, go up, find another satellite and rendezvous with it; come up with it, come in and "mate" with it, and pass gas, or, pass fluids, change out batteries.

It worked extraordinarily well. Now, that was one of our programs where we don't have any direct transition, but what we're hoping is that, once we've shown that something could be done again, that people will go and pick it up. *And they are.* People who make spacecraft, who are the most conservative people in the world, are starting to put more and more autonomy into their spacecraft.

In fact, it led to another program of ours, where we asked the questions, "Why do you have to launch a satellite all in one piece? Why can't you break it up into little pieces and launch each peace by itself and then have it form itself in space?" And that would solve a lot of problems. First of all, if a booster blew up, you didn't blow up the whole satellite. You only blew up part of it. If over time you wanted to change out the payload, you could send up another little satellite that would move in and kick the other one out, or just leave them both there.

And so we're in the process of doing that, and that is a direct result of Orbital Express, but it will change the way we build satellites. And I know that is going to be a big impact.

Rumsfeld was a great supporter of DARPA, absolutely a great supporter of DARPA. And, in fact, he was so much of a supporter of DARPA, that while he was there as the Secretary, we really were, as we like to call it, "armorproof." Nobody could get to DARPA without going through Rumsfeld, and he made that very clear, but nobody was going to get through him to come and get to DARPA.

We always do things legal, but we get right up against it. You know, we *do* get right up against it. And there were people who wanted to put restraints on us or wanted to take some of our money away because they felt we had too much, and Rumsfeld always stopped that.

When you have somebody who's that strong, there was a lot of pent-up pressure within the Pentagon. DARPA became this sacred cow that nobody could touch, and the bureaucracies do not like that. So, there was a great, pent-up pressure to get at DARPA.

Recall, Rumsfeld left suddenly. The day after he left, maybe it was the second day after he left, the OSD comptroller, who never could come and touch us before, put out what they call a "decision memorandum" to take $800 million of DARPA money out that year, to literally drop our budget by $800 million. It clearly was something that they were aching to do, and they couldn't get it done before because Rumsfeld was there. And by two days after he left, we were suddenly facing the possibility of having that money removed.

Luckily, Gordon England, who was the Deputy Secretary of Defense, also was a very strong supporter of DARPA. Rumsfeld was never a subtle person. You know, he was not subtle about what he did. Gordon is more of a gentleman, and he tried to reason with them. And I told Gordon, "You can't reason with the comptroller." "You just can't *reason* with a comptroller."

And Gordon finally had to tell them, "Hey, you just leave those guys alone."

But there was that time during the transition between Rumsfeld and when it got back to a little bit more normal, they *really did come after us*. I always used to say that I knew Rumsfeld was protecting us, and what I wanted was a two-minute warning that when Rumsfeld left, because I knew that when he left, the villagers were going to come up the hill after me. I just *knew* they were going to come up the hill after me. What I wanted was enough time to get down to my car in the garage and out of there.

But I didn't have enough time. He left, and, boy, they really hammered us right away.

I: That's funny. Did things stabilize when Gates came in?

Tether: Gates' whole focus is on the war, and Gates really never did get involved with DARPA. Which was a surprise, quite frankly, a surprise that I still really don't understand. But he had apparently has no interest in ever coming over to DARPA, finding out what we do. Even when the Vice President came, Gates didn't bother to come, which was a surprise. You had the Vice President

there, and the Secretary doesn't come.

A lot of that may have been that it was last May, and everybody knew that they were on their way out. So, it may have been a little bit of that. I don't know. But he hasn't shown the same interest in DARPA. Quite frankly, if it hadn't been for Gordon England's protection, we really could have been in a world of hurt since Rumsfeld left.

I: I was going to ask – I might as well ask it now. Not only after 9-11, now we have two wars going on during your tenure at that point and time. Did that impact DARPA at all?

Tether: It impacted us in that we had a place that we could go try out things. Necessity still is the mother of invention and, because of that, some of the technology that we had developed a long time ago for that kind of a war, which the Services did not want – suddenly, they were willing to go and try it out.

The two wars have gotten an enormous influx of technology into the Services that would not have happened, if it hadn't been for the wars. I mean that's an upside to the war. That really is the only upside I can think of.

We didn't stop and then focus all our money on the war. We kept doing technologies that really weren't going to pay off for, still, tens of years. But, remember, we had been doing that for a long time. The people before me, the DARPA directors before me, had been doing technology that suddenly was now at that point of coming to be real, of which I took full advantage of to get out into the war.

When the Services saw that we were really producing things, they, in turn, protected our budget, when people came after us. They, in turn, would stop the OSD civilians from taking money from us, because they knew that we were providing stuff that was really valuable. They may have thought we were doing it as new efforts, but this was stuff that we had done in the past. The only money we were spending was money to finish it off, if you will, to get it out into the force.

I: Were there changes in the Secretaries of the Army too?

Tether: Let's see. The Secretary of the Army that I started with, he got fired. The Secretary of the Navy changed because, remember, Gordon England was the Secretary of the Navy. He went over to Department of Homeland Security. Then he came back as the Deputy Secretary in DoD, and Don Winter became Secretary of the Navy.

Now, that was great. Don Winter is an ex-DARPA program manager. In fact, I knew Don from when we were both there 25 years ago. So, that was great. We had a really good relationship right away with the Secretary of the Navy, who knew us, because he was one of us.

The Secretary of the Air Force, Mike Wynne, a great guy, he was also from OSD, and he really liked DARPA. He got fired. He got fired over just a nuclear flap a little over a year ago. That hurt, because we had plans that we were plotting together. It was only his vision that was driving the Air Force to do them, as opposed to the Air Force wanting to do them. And when he got fired, they really went away.

So, there's been a turnover in the Secretaries. But the new Secretaries, we've developed great relationships with them as well.

I: Have you been able to manage the projects and the people in this changing landscape not only in the Pentagon, but also in Congress?
Tether: Well, I'm not sure if I know what you mean by "managed."

I: Relationships?
Tether: Oh, relationships. Well, we work hard at it. We work hard. Let me take the DoD part first.

We work hard to get them to come over to our place, and we brief them 4 or 5 hours on what we're doing. And usually, if we can do that, they leave as a convert, because we tell them that the reason that we want them there is that to learn what we want their opinion as to what we're doing. Is it good? Is there something we're doing that they don't like? But more importantly, is there something that they want us to do that we're not doing?

So, we get them to be part of the process. That has worked *really* well. One person in particular, General Cartwright, who has had several jobs. His current job is the Vice Chairman of the Joint Chiefs of Staff and as the Vice Chief, he runs a group that's called the JROC, the Joint Requirements Oversight Council. And these are the people who basically look at, determine if this is really something that the DoD should do.

Now, what he did is he made them all come to DARPA. You know, he was a fan of DARPA because of his time at STRATCOM, the Strategic Command, and where we had established a great relationship with him. So, he made them all come to DARPA. When we went through the briefing with them, they were all stunned at the things that were going on. And the reason he wanted them to come and listen to what we were doing is that he wanted them to see what was possible and what was coming, so they would not be so closed in their thinking about what could be done.

In DoD, these things are called "validated requirements" that they come up with. But the facts are that they don't really validate requirements; they validate programs. A program can do something. Suddenly they validate what the program can do and then call it a "validated "requirement."

So, he wanted them to come so they wouldn't be so near-term-oriented.

Now, in fact, when he heard that I might be leaving on the 20th, and I didn't, this is January 20th, he came by. He wanted to come by himself before I left to get another briefing. He did this before January 20th and then he wanted to bring the JROC back again to get another, you know, taste of what could be done.

And at that time, it looked like I was going to be around until May or June, because the first input I got was that they asked me to stay until I was replaced.

Well, that turned out to not be the case. I think I mentioned, maybe I didn't, that last week, I got a call saying, "The Obama administration has changed its mind. They want you to leave now, and we'll give you 2 weeks," and that's where February 20th comes up.

So, Cartwright learned about that. Cartwright took the time to schedule an immediate visit. Remember, these are four-star generals with other jobs. He's forcing them to come back to DARPA next Thursday – *next Thursday* – to get a last briefing while I'm around, on what DARPA does. But that shows you the kind of relationships that we have built up in the DoD.

Now, you take all that activity, you go to the Congress. We have not treated the Congress any differently. We have tried hard to get the congressmen and senators to either come to our place to be briefed or we go to them, and we make sure that they understand what we're doing. We make a huge effort trying to figure out how to explain what we're doing in their language.

We have done extraordinarily well on the Hill. We have lots of friends on the Hill because of that, lots of people who protect us on the Hill. I can't say I can think of anybody on the Hill who's ever gotten briefed by us who is not an absolute fan of DARPA.

I: Was that hard to turn around after the Poindexter incident
Tether: The silver lining in the Terrorist Information Awareness (TIA) program was that I spent an inordinate amount of time on the Hill explaining to people what TIA really was trying to do and that it really wasn't doing what they were reading about in the papers.

In doing so, I probably personally met with maybe 60 senators, I don't know a couple hundred, maybe 300 congressmen, where I went and explained DARPA. Without the Poindexter affair, that would never have happened if it hadn't been for TIA, because these people were only going to let me in the room because I was coming to talk about TIA, and they wanted to beat on me, you know.

TIA got me into the room with them and allowed me to spend time explaining to them what DARPA was all about and what TIA was all about, and they became fans. I mean we created a fantastic relationship that would not have been created if it hadn't been for the Poindexter topic. And it was one of those events where you couldn't have planned it.

But like I always tell the people at DARPA, strategy is always best written after the fact. *Always*, it's best written after. It comes out better that way. I can create a story that this is all a big strategy of how to get on the Hill, by having a bad thing happen, where they had to listen to me because they were interested in what going on.

I: It's gone from ARPA to DARPA to ARPA to DARPA, and I've heard that there's been some movement to get it back to ARPA again.
Tether: Well, the changes have usually occurred during Democratic administrations. The Republicans like to call it "DARPA," because they like the "D" in DARPA. It's "Defense," and they want it to focus on defense.

What has happened in my term is that we have done some fantastically *incredible* things over a broad, broad spectrum, ranging from prosthetics to new foods, to new medicine, to new energy sources, but all with the Department of Defense in mind.

So, what happens is that people have said, "My goodness! Look at this place called DARPA!" You know, "Why can't we take some place like that and focus them on domestic issues, too?"

That's what you're hearing. We've been *so* successful providing things, that people want us to provide those same things domestically. That's why we have copycat organizations: ARPA-E, ARPA Energy. I was a proponent and spent time with Senator Alexander to get that started. I-ARPA, Intelligence Advanced Research Projects Activity, same thing. I spent a lot of time trying to get that started, and that's started and doing well.

It was not totally altruistic, because I knew if I didn't get those things started, they were going to come and try to make *this* little organization do those jobs, too, because of the fact that we've been extraordinarily successful.

So, I think what the danger is, and it's a danger. Hopefully, the next director, he or she has to realize that these are really dangerous times. It's easy for an organization like DARPA to survive in the Department of Defense because the problems tend to be sterile, analytical. You know, you can actually sit down and figure out what the problem is and what the solutions would be.

Once you get outside of that and you get into the commercial world, it's not so analytical anymore, because now you're dealing with the marketplace and, really, like the stimulus package. What is it that you do that makes somebody go and want to spend their money, or borrow money, to do the things that you're developing? It's not as easy. And the people who typically come into DARPA aren't trained for that world.

So, it's a great danger to take that and have that happen. It happened in the '90s. The last time that DARPA went to ARPA, they created a program called the TRP, the Technology Reinvestment Program, with the objective being, again, "Hey, we got a bunch of smart guys that have really done great in the '80s. Let's have them do venture capital types of things – commercially."

It was an absolute disaster because the place wasn't set up for that.

But there is that danger. Whoever is the DARPA director, if they really want to make this change, but maybe they are the DARPA Director because, quite frankly, he or she probably said that they wanted to do that. So, I may be giving a warning to somebody who really came in on that carpet of having DARPA become an ARPA. And if that's the case, all I want to say is, "Be very careful." This is a fragile organization. You could do something that destroys it and, like Humpty Dumpty, you'll never put it back together again.

I: How could DARPA break?

Tether: Well DARPA is about its program managers, and you really have to get the right program managers in there. We have such a reputation as a place that really does crazy things and actually does more than a few of them very well, that they *want to* come to a place like DARPA.

If you start this, you know, so in order to move the place over to being ARPA, you have to be going after different types of people. And the type of people that you're going after may not really be very well suited for the environment. Plus, I don't believe that they will be very successful, trying to be a

commercial venture capitalist from the Department of Defense. When that happens, the reputation of DARPA for these really great things starts to diminish.

Now, this almost happened in the '90s. I mean it's based upon observations and experience.

DARPA is the epitome of the revolving door because DARPA's strength is that we bring smart people in, and we only keep them 4 to 6 years, and we throw them out. So, 25 percent of our population is leaving every year. Not voluntarily, necessarily, but they're leaving because their time is up.

So we're constantly having to get another 25 percent. So, it doesn't take too long, if your reputation is that, of a place that is not doing very well, for you to suddenly, in order to keep the people in, your standards for selection of people starts to decrease. And then you're on the slippery slope, you know. You're not picking the smartest and the brightest.

So, what happens is that they're not doing the real wild, out things, which means that the reputation is decreasing, which means that, yes, you're having to reduce your standards even further to get people to come in. And you really are on a slippery slope, until you finally become like everybody else. And that would be the end of the place.

I: Let me ask you a little bit about recruiting. I've heard that you were looking at international programs.

Tether: We're not looking at international programs to bring people in. We're looking at funding things internationally, so we know what's going on internationally. I remember when we were created to never let the United States be surprised again by a third-world country, like what the Soviets did at the time.

So, but in order to do that, you have to know what they're doing, and one way to know what they're doing is you go to them and give them a little money. We fund them. We fund universities and we fund companies. We fund them in the category of what we call "basic science," which is defined as research without an application in mind, which is not sensitive. But we get to know what's going on at the research level.

And if you know what's going on at that level, then you know what's going to be coming out later on. So we do that deliberately, and whoever comes in next really needs to keep that going. It's really far more important than they might think. It doesn't cost much money. It does take up time, but it doesn't cost a lot of money. Because otherwise, you really don't know what's going on in the world.

So, every year we would go to, uh, two or three major trips, to South America, to India, to Sweden, Finland, Russia, just to make sure, to find out what was going on and, with a few dollars, have them interested in telling us what's going on.

But we keep it at the basic research level, because that's where it all starts. And if you know that, what's going on there, you know what's going to be going on 15 years from now. And that, of course, is what we want to know.

I: Do you find an increase of talent coming internationally?

Tether: Well, in some countries, the answer is yes. Israel has always been the case. They've always got very, very smart people, very aggressive people. You know, they really do have first-class people who are smart and entrepreneurial.

Singapore comes second. You know, very smart people – smart, strategic country. They're only 20 miles by 20 miles. They really have no natural resource, except for a deepwater port, which they've made great use of. So, they're spending money on trying to become preeminent in biology, things that don't require big acreage. You know, biology, semiconductors things like that. And they're doing quite well.

And, again, they're very, very good businessmen, so they're very entrepreneurial.

I worry about the Chinese. The Chinese are putting on the order of 5 million kids a year into school, into college. *Five million kids a year into college.* And most of them are doing engineering, science, and technology.

Even if you were to assume that the distribution of genius-level people is independent, you know, a genius-level person being, like, 1 percent or less of the of the population, you take 1.4 billion people – or a billion people – it's a big number compared to us. Well, in fact, it's four or five times bigger.

So, you have that many more genius-like people who are now, with the economy in China getting better, who are making sure that they get into schools, and they're learning engineering and science. And these people are very entrepreneurial. If you know a lot of Chinese people, you know they *love* making a buck. Not so much for the money, but for the game, for the game of it all.

And so that's a worry. That's really a worry. And so we're monitoring that as carefully as we can. But all I can say is, as of today, I'm comfortable that we're well ahead.

I've had many countries come to me and ask me how can they form a DARPA. They *want* to form a DARPA. We've become so recognized in the world as the place that's very small, that somehow throws these things out of fantastic impact.

And I tell them, "It's very simple. You just go hire the brightest kids you can and you just don't keep them very long. Four to six years, and you kick them out." And it's not like you detail them from within the government to you and then detail them back. You take them from the *outside* and then kick them back outside. That gives you constantly fresh blood and it also means fresh industry with very, very bright people who have had, you know, an exposure.

None of them are able to do that. None of them have been able to really get into that model - it's *tough*. We weren't born that way. Again, you know, strategy is best written after the fact. I could tell you that, "Hey, this what we had planned, intended to do from the very beginning," but it was something that evolved over time.

Whoever is reading this section, hopefully, has already read the interviews that you've had with the other DARPA directors. And if they have, the one signal that comes through from them all is that what made DARPA different, in their mind, was the fact that the people were not there very long, but were very, very bright.

I: Is there a tendency in DARPA to find a balance between basic and applied research? We've talked about that before.
Tether: It ebbs and changes over time. We're now into a stage where over the last 8 years, we really have milked a lot of our strategic thrusts to the point where it's time for us to get out of them. Now, because we're doing product improvement things, as opposed to DARPA things, showing it can be done. Now we're taking things that we showed could be done and making them better.

What we do is show it can be done is our major thing. So, if I were to stay around, I would right now be looking at these thrusts that we have accomplished and I wouldn't be giving the money back, but I would be taking that money and putting it into our core technology just out there experimenting. I mean just doing all kinds of technological things, not sure where it's going to go, but then monitoring it to see when the next thrust could be pulled out and give us another brand new capability.

And I think we're in that stage, of going back more into core technology, and then after a while, we will have developed technology that somebody will say, "Hey, you know what? We can now do this, if we want to, we think."

And so we'll all go off and show that it can be done. Maybe it'll wind up being that we'll really do teleportation someday. Who knows?

I: You keep going back to that, don't you? You *want* that – don't you?
Tether: I really want that. Solve a lot of problems.

I: So, emphasis sometimes peaks in some ways. I'm thinking, in particular, maybe biology; some of the things that were being done in biology, because we talked about that last time.
Tether: Yeah, we're at the end of the road in biology. DARPA didn't have any biology programs until around 1994. And the reason we went into biology is that we were fighting a threat which at that time, we called a transnational threat – the threat without a country. Or, it's become known as terrorism.

And the question was being asked, "Well, hey, listen. If you have a threat without a country, what kind of really mass destruction kinds of things could they do?"

And the answer was biowarfare, because you don't need big infrastructure to cook these bugs up. If you want to make a nuclear bomb, you need big infrastructure. That's why only countries can do that.

But if you're a rich terrorist, you might be able to buy one.

So, that meant that the bugs they were going to come up with were bugs that we didn't know about because they were going to engineer them. You might ask, "Well, would they ever come into the United States?"

That was a worry. But our soldiers go overseas. So, they're going to be first exposed to all of that, and you look at the timeline. At that time it took to identify a bug, learn what it was, come up with treatments, testing the treatment, making enough of it to have any impact on the people, it was *years – 16, 20 years*. You couldn't tolerate that, because the people making bugs can make

new bugs at a very fast rate.

So, that's why we went into biology. Today, we have almost accomplished everything on that roadmap, ranging from being able to detect pathogens and identify them, and read their DNA, come up with therapeutics to candidates to conquer them, or vaccines, test them out, and then be able to make millions and millions of doses in a rapid time.

Now, we haven't finished it all, but we're now into making the millions and millions of doses part of it. But when you stop and think about it, what's left, what else is there to do? Now, we can still work on it, but we've transitioned it. We've shown it can be done, so other people are now doing it.

If it wasn't for the fact that we turn over people, there would be a great pressure in DARPA to keep it going. But remember, we're the easiest place in the world to stop doing things or to start doing new things. *You just don't hire the people in the future*. And every year, you lose 25 percent of them, so it doesn't take long for those people who are working on the biology to all be gone. So, they're not clamoring to keep it going, and you can be off doing something else.

So, I believe we're at the end of the trail on bio. Not that we'll ever go to zero, now, but I think as far as being a major thrust, its day probably has come.

I: There's been some barking from computer research people, too.
Tether: Oh, yeah.

Actually, it's been three localized schools: Stanford, Berkley, and MIT. And, again, through the '90s, they were being funded quite well. They were being funded mostly on reputations. Well, first of all, they'd been funded, really, to work really neat problems. They had neat ideas, and they were working real problems.

And then after time, they got to the point where they got used to this funding, but they really had kind of lost generating ideas. They just got used to the entitlement on this.

And it just went away. I mean, if you looked at the funding of these three schools, it dropped dramatically. Now, it didn't drop because we said we weren't going to fund them anymore. It dropped because they weren't *applying* for efforts anymore. They weren't sending us proposals, or ideas. Well, we can't fund them if they don't send proposals. But they got used to being funded just because of their reputations, and before they knew it, they were back into a competitive situation, which they haven't done very well in.

I don't know if you have any kids or not, but if you remember back to when you were a kid, you know, if the teacher gave you a bad grade, sometimes the kid will say, "Well, that's because she doesn't like me. That's why it has nothing to do with me. It's because she doesn't like me." That's kind of what you're hearing.

I: I like one of your responses: I read, "Well, we don't fund institutions. We fund ideas."
Tether: Yeah, we don't fund *entitlements*. We only fund ideas.

I: I did want to talk about the Wireless Network After Next (WNAN) radio.
Tether: That's another area that maybe has come to the end of its trail – for now. In all of these, I mean, it's for now. I mean what'll happen is that we'll go out, and we'll develop core technology, and before you know it, we will be able to come back in these areas and, rather than making incremental improvements, we'll do something *totally* brand new – you know, make a *big jump*.

And that's what we did in radios back in the late '90s. And that – at that time, again, we were back with our forces going overseas and really going overseas in small numbers. And that meant we had gotten to the point where we became a network-centric type of force, but in order for that to be true, they needed a network, and that network couldn't wait for people to go put up towers. It had to form itself as they flowed into the area.

And we have shown that you can do it. Never was thought of being able to do it. One of the things was spectrum, that when it flowed into an area, it needed to know what frequencies to use. And we didn't have time to go negotiate that, so we asked a question: "All the frequencies in the world are typically -100 percent licensed by someplace – the communication frequencies. And we said, "Gee, I wonder how much of that's being used."

And we took measurements and we found that 5 percent – right now, here, in D.C., at this moment only 5 percent of the available spectrum is being used.

So, we said, "Okay. Can we develop a technology so that when this network comes on, it looks into the spectrum, finds what is not being used, and then goes and forms a network there, such that if somebody comes along, it moves itself to the next white space, knowing there's going to be one?" Because 95 percent of it is not being used in any instant of time.

That is now *real* and will *dramatically* change the communication capability not only in the military, but commercially, where now your cell phone will actually not need a tower, but it will be looking for what frequency's not being used and form it, and the network will be constantly forming and changing frequencies.

A lot of people – if they read from along the 50 years, will have said that differently. They will say most of the good things in DARPA are serendipity – totally serendipity. *Just happened.*

But you can always *explain* how it happened after it happened. But most of them have come from serendipity.

What I have tried to do, and what all the rest of the early DARPA directors have done, is be relaxed about that. We haven't tried to force it; we've just let it happen. And what we've all done is, when it happened, then we were poised and jumped on it and accelerated it. But it wasn't like, you know, there was a real plan for this for the most part, other than the fact, "We're going to go in this area, and we're going to keep doing things until, 'Oh, my *goodness*! Look what happened!'" And then really go accelerate that technology.

I: Let me ask you about cyber threat and cyber security. Is DARPA working in that area at all?
Tether: Yes, we are.

We have a major program in cyber. Again, it goes back to – which really started around 2000, and it goes back, again, to asking the question of, "Hey, What is a threat that doesn't take much infrastructure?" and back to the terrorist type of threat.

And if you think about it, not only is bio one of those, but because of the whole world being in the Internet, which we created, so we kind of created our own threat. You can be halfway around the world, and you can be fooling around with computers here in the United States. Now, these computers can do a lot of things. They can be computers that drive power systems – power plants, so you can turn them off. Computers that are used for airplanes, you can turn them off. Computers that, you know, on and on and on, because they're all now networked. You can get to them without ever having to come here.

So, we realized that, and then we did some things. We looked at how to defend against that, how to defend against people coming in. But the reality is that in order to defend against a threat like that, you really have to be better than the threat, offensively. You really have to know how to do that yourself far more than anybody else, because once you do know that, then you know how to defend against it.

And so we've had a major program over the last 8 years, and as the new DARPA director will find out, we have the world experts in offensive techniques, followed by defensive techniques to prevent that from happening.

As you know, there's this new initiative in the nation called the National Cyber Initiative. In that National Cyber Initiative, DARPA's been given the charge to go and develop a test range that will allow people who are developing offensive techniques and defensive techniques to come and test themselves.

Now, you might ask, "How can we, a little outfit, become so expert and world renowned in this area in such a short period of time?"

The reason is, once again, we laid out these milestones – go/no-gos for people that they had to get through. And when we did it, however, we realized, "Oh, my goodness. If you've got these milestones, somehow you have to be able to measure them."

So, the way we went about measuring is we created our own test ranges, not of the size of the one for the national one, but it's these test ranges that allow people to go and play, try things out, see if it didn't work, find out why it didn't work, correct that.

And the speed of progress in the world has always been limited by our ability to measure. Imagine if we never had oscilloscopes, voltmeters. We wouldn't have gotten *anywhere*. And it's until we have that measurement capability that progress really is not constrained, at least by that.

So, we're off building this National Test Range, and it will change everything. First of all, we will be able to bring people in who don't believe this is a threat, like bankers – of course, maybe they won't be around to be worried about it anymore, and show them, "Watch this. 'Woosh!' Here's your network. You agree that this is your network. Watch us take it down. Watch this."

I mean, we can show it to them and really make them believe that this threat is *real*.

So, cyber is a big deal, and cyber is not at the end of its thrust area. But it's, you know, again, we've done an awful lot over 8 years.

I: This go/no-go in the milestone thing – did you think that up?
Tether: I didn't think it up. It was done to me, and I *hated* it! I *hated* it when it was first done to me, when somebody said, "You're going to have to figure out what the first thing is that needs to be done and lay these things out." I just absolutely hated it. You know, I didn't like it being done to me, and so I'm glad it's not done to me.

But on the other hand, I realized that when it *was* done, the speed of getting through was *tremendous.* You knew what you had to do to get through each gate, and so you worked hard. And you knew when you *accomplished* it. And if the gates were really laid out correctly, I mean if they really were the gates, you just moved right through those at a rate that you never would have if you didn't have them.

So, I've just carried that, you know, even though I *know* that when I imposed them on everybody, I knew that they probably were, like me, saying, "I'll *kill* that son-of-a-bitch," you know, "because I *really* don't like these things!"

But, you know, after a while, people do get used to them. And if you talk to people in industry who *just really* did not like them, if you talk to the managers, they've all come to the conclusion, "Holy cow! This really works!" You know? "I'm really getting these programs through. I'm finding out if I can. And sometimes we fail, but we find out quickly."

If you can't get through a go/no-go, and it really is a go/no-go, if you can't get through it, you *stop*, because it's *over*. And so you find out what you can't do, but you really give people these little challenges. You know, we used to have *parties* – beer parties, pizza parties; I mean – well, it was a long time ago, you know when we got through these go/no-gos. Did all kinds of crazy things that today would be – well, it would be nice to be able to do them again.

And I hope the kids today have as much fun as they go through these go/no-gos, after they've gone through them, as I did when I had to do that. But I didn't like them. I didn't like them at all, but they were really the right way to go.

I: I meant to follow this up when we talked about it earlier; within the Pentagon, DARPA has this reputation of kinda being the cowboys out there, and you said, "We did everything legal. We go right up against it." What did you mean by that?
Tether: This is taxpayer money, so there's lots of constraints that are put on people on what they can do and how they can spend it. And what usually happens is that, when a new regulation comes out, and let's say it's in the Army. Well, somebody in the Army will take that new regulation and will add a buffer to it. You know, rather than saying, "Well, you can do this," they'll say, "Well, locally we won't allow them to do that. We'll allow them to do a little less."

And then that goes off to somebody else, who adds another little buffer to that, until you finally get to the people who are doing the actual operation, and they've got, you know, a thousand times more buffer than is required, which really constrains the speed at which they can *do* things.

And so we basically say, "Here's the regulation. By God, does it say it's illegal?"

"No?"

"Well, then we're going to do it" – as opposed to, you know, worrying about this buffer.

We can do that because we're only a couple hundred people, so I can go and talk to everybody. You know, I can literally talk to everybody and explain things. If you're the Army, Navy, Air Force, where you're tens of thousands of people, they make these buffers because they don't get the chance to go *talk* to these people. So, they put that in as their management technique, where DARPA, because of our size, does not have to do that.

But, consequently, when the bureaucracy looks at us, they say, "How can you guys *do* something like that?"

And I said, "*Because we can*! Because it's *legal*."

They say, "Well, *we* can't do it!"

And I say, "Well, that's only your own, local rule."

And I've had many fights with them. I say tell them, "Well, you go look."

And they come back and say, "Yeah, its been created, you know, it's like Pogo said, "We have met the enemy, and the enemy *really is* us."

I: About talking with people, you talk to the generals in the field, try to, I guess, match their needs, so you're really in tune with what's going on in the field. And I've been told that one of your frustrations was that the general will retire and then have this great epiphany about, "Oh, well here's what I should have done."
Tether: Right.

I: Well, do you have any epiphanies?
Tether: Do I have any epiphanies?

No, I don't, because I think I've done all the epiphanies I could have. There's nothing that I would do that I haven't already done.

To me, the toughest day is going to be February 21st. Now, you might say, "Well, that's a Saturday."

I always go to work on Saturdays.

I: Any final words of wisdom for the next few folks?
Tether: Well, this is the best job you ever had. One thing they have to understand is that it will end. So, what that means is that every day that they go into work, they have to not let anything get in their program managers' way to prevent something from happening, because this is finite. Even for me. It was 8 years. My goodness. Even for me, after 8 years.

Washington is a cruel place. I knew I was leaving, but I've never been given just 2 weeks to clear out in my whole life. And – and that could happen. So, you have to always understand that any day you can get a call that it's over. And when that call comes, you don't want to have any regrets that you haven't done everything you could do and didn't wait for tomorrow. That's what they have to do.