

UNITED STATES OF AMERICA

DEPARTMENT OF COMMERCE

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SUMMIT ON THE USE OF ADVANCED

TECHNOLOGIES IN EDUCATION AND TRAINING

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FRIDAY

SEPTEMBER 27, 2002

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The Summit was held in Room 4813 of the Department of Commerce Building at 14<sup>th</sup> Street and Constitution Avenue, Washington, D.C. at 11:00 a.m., Irving Wladawsky-Berger and Henry Kelly presiding.

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1 P-R-O-C-E-E-D-I-N-G-S

2 11:07 a.m.

3 MR. KELLY: First of all, there are a few  
4 announcements. First of all, we have to be done here, as I  
5 understand it to give a read-out at 1:30 because this is  
6 connected directly to the missed standard clock that we'll know  
7 exactly when we're going to be done. So, we obviously will try  
8 to hold to that.

9 Since there are so many people here, we decided  
10 we would not ask everyone to introduce themselves at the  
11 beginning here, but we do ask that when you comment that you do  
12 introduce yourself and say what your organization is.

13 And this will be recorded, so the other request  
14 is that if you speak, try to shout so that it can be picked up  
15 by one of the microphones in the room and they're scattered  
16 throughout here. A final mechanical issue is that I guess lunch  
17 is now available so as I understand the ground rules, anybody  
18 who gets hungry or bored or whatever who wanders out, it's now  
19 available.

20 So, with that we can turn to the charge we've  
21 been given and we've been asked to look at research and  
22 development which plainly is one of the major themes that we're

1 trying to pursue here and we've been asked to look at technology  
2 outlook, technology gaps, technical deployment issues,  
3 partnership models, and next steps.

4 This is too many people and not enough time to do  
5 all of that. I think we can touch on a lot of it briefly, but  
6 what I think we really owe the Department of Commerce here is a  
7 set of action steps, something that can actually happen here,  
8 some practical recommendations that they can follow through on,  
9 that we can all help them execute.

10 And, one of the things that is powerful about the  
11 people who have been brought together here is that I think we  
12 represent a very interesting constituency for change here, and  
13 if we can agree on at least the rough outlines of the principles  
14 of action here, I think that this can be helpful on many  
15 different levels.

16 So, what our proposal is, is that we work briefly  
17 through the initial questions, which is looking at technology  
18 goals, and spend most of our time focusing on how do we actually  
19 - what are the principles on which you would design an effective  
20 R & D plan and specifically what kind of model works, and I  
21 don't know, Irving, if you want to say a few words.

22 MR. WLADAWSKY-BERGER: Yes, just that I think, you

1 know, based on the talks this morning and I'm sure the people  
2 here arriving at something close to a consensus on what has to  
3 be done from a technology and strategy point of view will be the  
4 easy part.

5 The hard part is what's the management mechanism  
6 for coordinating it, and there are multiple models and we should  
7 spend quite a bit of time discussing that, and then since we  
8 really want to get it done, then there should be some concrete  
9 next steps. So what do we think should happen next, by when, et  
10 cetera, and that also will take more of the work.

11 MR. KELLY: And with that, I've just been given  
12 one more pressing issue. Somebody left a key and a cell phone  
13 at the guard's desk at the front, so if anybody is missing that,  
14 they're down at the inspection tunnel.

15 What I propose to do here is at least begin by  
16 spending two minutes writing down at least what we have heard  
17 about what we mean by research, just sort of define the  
18 territory that we're talking about here and have a brief  
19 discussion on that, and then that will at least help us move  
20 forward and say how can we get it done?

21 And I'm about to violate the rule here. I don't  
22 know if anyone can hear me. Is this being picked up? Is this

1 violating the rules? Can anybody hear me? Yes, you guys can  
2 hear me.

3 MR. WLADAWSKY-BERGER: How about if we put it  
4 here?

5 MR. KELLY: I'll tell you what, Kay can you --  
6 maybe you can write and I can talk. This is Kay Howell who is  
7 from the Federation of American Scientists, a learning  
8 federation, the brains behind most of what we're going to be  
9 saying here. But, I mean just to -- the best thing for me to do  
10 is shut up and let her write I think here.

11 But basically just to come up with some taxonomy,  
12 one of the things that we have struggled with here is that this  
13 is a huge research problem and the dilemma here has been trying  
14 to give an individual faculty member the responsibility of  
15 solving all research problems simultaneously. So, we're trying  
16 to figure out how to basically just do a crude taxonomy.

17 Let me propose four or five categories. One of  
18 them is simply basic learning science, the kinds of things that  
19 Bransford was talking about, and this means if you're going to  
20 use discovery-based learning, what does that mean? What works?  
21 What doesn't work? When should you learn it? When should you  
22 use it? When shouldn't you? How do people learn? How do we

1 understand how you build expertise to find expertise and advance  
2 it and measure it? And how do you, if you're actually going to  
3 adapt instruction to different people for different subjects,  
4 what's the research base on which you do this? How do you  
5 understand that?

6           The rest of this largely falls in the tool  
7 building category, which is more of applied research and one  
8 category here is basically building simulations, embedding  
9 knowledge or content into tools and this involves things like  
10 building simulations with open architectures.

11           How do you move simulations out of the research  
12 and engineering field into the instructional environment? How  
13 do you collaborate on building these things? How do you peer  
14 review them? How do you share them? If you're going to build  
15 avatars are there interoperability standards so that you can  
16 program these things and make them draw on common databases?  
17 How do you navigate virtual environments, and this is partly a  
18 hardware issue and partly a software issue and the interface  
19 tools are quite important.

20           Then there's a category that, for the lack of a  
21 better word, I would call interactivity design, which involves  
22 things like how do you make sure that you insert questions

1 efficiently? How do you manage dialogues involving -- how do  
2 you -- a crucial question here is when do you use real people?  
3 What's the highest and best use of people and when do you want  
4 to try to do things automatically?

5 I guess this is the best form of blending but  
6 there's I think an interesting research challenge here. What is  
7 it that you want people to do? What is their highest and best  
8 use? How do you provide decision support for people who are  
9 building systems, integrating tools, and managing these systems?

10 And then there's a set of tools for user modeling  
11 and assessment, and John talked about formative assessment,  
12 something that allows you to continuously model students'  
13 approach to expertise. Chatham talked about modeling interest  
14 as something gamers do very well where you want to keep them at  
15 the edge of excitement. If they're too excited, they get  
16 frustrated. If they know it too well, they're bored. There  
17 are lots of way of measuring student state, what they know.

18 One of the big controversial issues is learning  
19 styles, whether there is such a thing and whether it matters.  
20 And, but part of this is to say you really want to have a very  
21 powerful continuous way of measuring what it is that the student  
22 does know and their interest state that you can use both for

1 real teachers and for any kind of artificial system you put  
2 together.

3 So, this is just a quick snapshot of the kinds of  
4 things we're talking about. Accompanying this there are a bunch  
5 of hardware issues. Largely, these tend to be specialized  
6 things for input/output tools, which would be either high-tech  
7 screens or goggles or haptic devices or things -- Chatham has  
8 some interesting ideas for measuring anxiety levels, but there  
9 are lots of things that fall into this IO tool.

10 So let me just stop there. I wanted to put a  
11 straw man on the table.

12 MR. WLADAWSKY-BERGER: Let me just add two things.

13 One is infrastructure requirements. It would be really nice if  
14 the massive investments, not massive but large investments we're  
15 making like in TeraGrid and all these other things are a very  
16 good base to support educational needs but that needs to be  
17 assessed and tested.

18 A second thing is a little hard to say it so  
19 don't write anything down but let me say it first. It would be  
20 wonderful if all the great stuff that you do in DARPA for  
21 simulations and so on just over time percolates and in  
22 supporting little four-year-olds. We have no idea, at least I

1 have no idea to what extent these technologies and applications  
2 can trickle down.

3 In super-computing we use that term. You start  
4 here and eventually, you know, you have a much more mass market.

5 So I don't know quite how to call that, but there are these  
6 various different constituencies and I don't know to what extent  
7 things are common and therefore you can start where it's easiest  
8 to do the work. Let's say DARPA and it is easier, I think, that  
9 every school district in the country, and then over time and so  
10 everywhere else.

11 So how would you call that?

12 MR. KELLY: Well, part of that is standardization,  
13 right, so you can get things that are built. You want to have a  
14 broad and open market is what you're talking about there.

15 MR. WLADAWSKY-BERGER: No.

16 MR. KELLY: Except that I keep hearing that the  
17 four-year-olds may know more than me.

18 MR. WLADAWSKY-BERGER: I really think it's more  
19 the research on do these applications that work for the pilot  
20 and then applications that work for, you know, training doctors.

21 UNIDENTIFIED AUDIENCE MEMBER: Technology  
22 transfer.

1 MR. WLADAWSKY-BERGER: Yes, that's a very good  
2 term.

3 MS. RENDER: That's a piece of it, but then  
4 there's also the deployment issue as well.

5 MR. KELLY: Can you identify yourself, I'm sorry.

6 MS. RENDER: I'm sorry, I'm Robyn Render and I'm  
7 from the University of North Carolina. It's hard to talk. But  
8 the point is I think there is a technology transfer piece of  
9 that, but somehow in your taxonomy and the things that we talked  
10 about, I guess I'm struggling with where the gap analysis  
11 activities take place, and I guess, I feel a gap analysis in  
12 your trickle down question, you know, about the applicability of  
13 a DARPA game and application to a K-12 mass question or  
14 challenge. That's one gap analysis.

15 But then on the tool side, I think we all  
16 recognize there are tremendous gaps relative to just kind of the  
17 basic components of tools and to go from where we're talking  
18 today to something that you're talking about a national strategy  
19 without some significant work being done, and I don't know that  
20 it's all research, but significant work being done and how do  
21 you move from here to there, is kind of hard to figure out how  
22 we're going to have action steps.

1 MR. WLADAWSKY-BERGER: In business, you would use  
2 the term, I think market segmentation to decide what are the  
3 different markets to address and what are their needs so that we  
4 can address them, and that's really a lot of what goes through  
5 my head, the DOD, the private sector, et cetera, then getting  
6 down to college and universities and so on.

7 So isn't there a kind of application segmentation  
8 here. You know these are the customers of the research that we  
9 recommend doing and what are the key constituencies?

10 MR. ZYDA: Mike Zyda, from the Moves Institute.  
11 One of the things that just struck me is watching the DARWARS  
12 presentation and discussing that building DARWARS for senior  
13 military officers, I actually looked at it and said gee, the  
14 first thing -- if you really want to understand multi-player  
15 gaming is to build something for the K-12 guys and then push it  
16 out to the military officers, because what I find is when having  
17 built it is that you get immense feedback from young adults as  
18 to how to do things better, faster, and I think then you can  
19 push that out.

20 MS. VANDERPUTTEN: Elizabeth Vanderputten, NSF.  
21 And, in fact, we are supporting some of the research that John  
22 is, actually. He has DARWARS for education. We're trying to

1 develop teachable agents and having teachers teach these agents.

2 It could be anytime, anywhere, focusing on cognitive  
3 development for teachers and there are other things like that.

4 So, I don't think it's trickle down but I think  
5 there are perhaps horizontally but also looking at learning-  
6 based things you have to also say what grades may be somewhat  
7 different than adults in their learning needs and cognitive  
8 abilities but there are things we can learn from each other.

9 MR. KELLY: A couple people I want to comment here  
10 but I want to separate this into a couple of problems just  
11 toward the respondent. First is technical interoperability.  
12 You know if I build a simulated human body, I mean you could  
13 teach third grade with it as well as brain surgeons in principle  
14 if you could scale it.

15 But second, there is the question of cognitive  
16 science, how do you learn? And, I guess one of the questions is  
17 how much of how people learn stuff that applies, is universal  
18 and applies to all age groups and how much has to be market  
19 segmentation.

20 MR. WLADAWSKY-BERGER: That's really the key  
21 question. I think they're both important so maybe we can go  
22 through both.

1 MR. KELLY: So we have John and Ralph.

2 MR. CHATHAM: Responding or bouncing off of what  
3 you said, one of the things that I didn't explain in my program  
4 is I'm building or hope to build six different technical tutors  
5 and they are spread out from flying airplanes in formation to  
6 learning language to information technology.

7 And, I call them because my boss did, bait. If I  
8 can build one or two of them, then I can -- and someone will say  
9 gee, you did that wound care thing, can I do something like that  
10 for cardiology? And, I'll say sure, here's 100 contractors.  
11 And so, the transition from wild-eyed research to reality that  
12 I'm focusing on is to produce a spectrum of different kinds of  
13 training devices that have some of these characteristics I'd  
14 like that will then be so obvious that the next one will create  
15 another.

16 The other thing while I have the floor for a  
17 second is there is -- I've identified myself. I'm Ralph Chatham  
18 from DARPA. One thing that's not here is knowledge capture, is  
19 how do we get this huge body of declarative and procedural and  
20 whatever words you want to use knowledge that's in the head of  
21 someone that would ordinarily be taught into those titanium  
22 boxes with the apples on them, or the network, and that's a huge

1 piece of the problem?

2 MR. KELLY: John. You need to identify yourself.

3 MR. BRANSFORD: John Bransford from Vanderbilt.

4 Yes, this one thing about learning science and then the tools,  
5 one of the things we found that can be really useful is to try  
6 to have a set of people with different expertise for any kind of  
7 project you might do. So with our bioengineering or actually  
8 Bob and I are part of the Center for Innovative Learning  
9 Technologies too, for any project we do have the content  
10 expertise, so it might be bioengineering and we have to have the  
11 knowledge capture.

12 We have learning scientists. We have assessment  
13 experts, and then we also have people that know how to do the  
14 professional development, the change management, and I think  
15 trying to set up some kind of idea for that would be powerful.

16 And then, if we could -- even if we decided in K-  
17 12 education to say we're going to do teachable agents so kids  
18 teach other kids how to do math or something, there's still the  
19 conceptual idea of DARWARS, which I think is very powerful which  
20 is you get to come into an ongoing world, rather than some  
21 static thing, and you get to be part of it and at first kind of  
22 on the outside and you learn to interact.

1                   That's really powerful.       But now from my  
2 perspective, I would love to have access to the expertise of  
3 people in DARPA who know how to do simulations, you know, a  
4 thousand times better than I do. But that would really help, so  
5 to get that kind of cross-talk going would be very useful.

6                   MR. EDELSON: My name is Daniel Edelson. I'm at  
7 Northwestern University in the School of Education and Computer  
8 Science Department. Something that John said that isn't up  
9 there which is turning out to be essential in our research is  
10 research in the educational system. In my case, that's the K-12  
11 system but in other cases there are lots of others.

12                   We don't understand very well how to change the  
13 practices of teachers. John described it as research on  
14 organizational change in leadership. It's absolutely essential  
15 if any of these technology tools that we're picking up are  
16 actually going to spread and be useful in any way.

17                   MS. BAJCSY: Ruzena Bajcsy. I am Director of  
18 Institute for Information Technology and Service to Society at  
19 the University of California. Three things, three points that I  
20 haven't heard them mentioned. One is that most of what you  
21 folks have talked about is how to teach science and engineering  
22 physical and mathematical which are structured as a pyramid.

1 If you don't know this, you cannot go further, et cetera, et  
2 cetera.

3 I have been sponsoring some work in the  
4 humanities, in particular in Asian studies because I have access  
5 to that, and these folks have a tremendous World Wide Web. They  
6 call it Electronic Cultural Atlas, digitized data of various  
7 kinds, three-dimensional, sculptures, two-dimensional pictures,  
8 et cetera. What they are saying to me is that they are still --  
9 whoever is using this data is using it as books, page by page.

10 MR. KELLY: Yes, exactly.

11 MS. BAJCSY: Wrong. They want tools that would  
12 truly use it as a data structure to look for trends. For  
13 example, they access them through GIS, Geographic Information  
14 Systems data, so you can ask questions what happened daily in  
15 the 19<sup>th</sup> Century and pop up all the answers. And so, they  
16 really need those tools.

17 Second, they really fear authentication because  
18 you can falsify change data so easily and you see unlike in  
19 physical sciences, you can go to the real experiment or the  
20 simulation. They fear that you have made from a sculpture of a  
21 woman to a man and we have technologies that can do that.

22 So authentication is a big deal for them and this

1 is also in English. I have been told, for example, that false  
2 information gets propagated such as that Aristotle stole  
3 everything that was in the Alexandria Library when we know who  
4 was first and who was second. And so, they fear even the usage  
5 of this information to give to the students. Okay, so that's  
6 Point 1.

7 Now, Point 2 is that in terms of infrastructure,  
8 I haven't heard including parents. Now in an undergraduate  
9 context, this is not so important, although sometimes it might  
10 be. But in the K-12 this is very important to really make it  
11 integrated and that really points to infrastructure, that the  
12 parents, the working parents in particular have to have access  
13 to the same data of homework in progress and so forth. Thank  
14 you.

15 MR. KELLY: Somebody in the back had a comment.

16 MR. MASKEK: Yes, I'm Ray Maskel of Think Learning  
17 Solutions. At a conference that Business Week hosted the past  
18 two days, there was a consensus among a bunch of corporate CEOs  
19 that technology has now outpaced corporate management's ability  
20 to assimilate it in the organization.

21 So, from a strategic perspective and the  
22 execution of that strategy, we talked a lot about four-year-olds

1 and eight-year-olds and 12-year-olds but it seems that we would  
2 need a repeatable process to continue to assimilate the  
3 technology amongst the current workforce and not just wait for  
4 the future workforce.

5 MR. KELLY: Andy.

6 MR. VAN DAM: We're waging a multi -

7 MR. KELLY: Would you identify yourself?

8 MR. VAN DAM: Sorry, Andy van Dam, Brown  
9 University. We have to realize that we're waging a multi-front  
10 war here and one front is assimilating the current technology,  
11 which is a very hard war and there are any number of issues that  
12 pertain to that. I'm hoping that we will focus not on that very  
13 important problem, but on what we need to do to get to the  
14 visions of 2020, and those are fierce research problems in their  
15 own right that are multi-disciplinary, interdisciplinary, and  
16 not even well understood yet.

17 We can sit around the table and articulate a  
18 number of them but the bulk of them remain to be discovered.  
19 It's a boot strap process. Only by getting started will you  
20 discover what the real problems are, and I'm hoping that our  
21 session will focus on that category of problems.

22 AUDIENCE MEMBER: That means you focus on the

1 young of the future instead of trying to fix things for us.

2 MR. NEUMANN: Ulrich Neumann, USC. I read Andy's  
3 comment a little differently and it mirrors something that I'm  
4 thinking is also a little overlooked and that is there's this  
5 problem of you have to do it first to understand what all the  
6 necessary problems that come up are.

7 So the test bed for an ability to create  
8 instances of a full case, end-to-end, you know, all the way to  
9 the children, all the way to the adults, whoever it is, whatever  
10 that test case is from authoring, planning, designing,  
11 implementing everything, those kind of test cases have to exist  
12 or you run into gaps all along the way.

13 MR. TINKER: Rob Tinker, the Concord Consortium.  
14 I'd like to collapse a number of these comments into a different  
15 kind of research that we don't hear enough of, which I call  
16 applied research, that you have to be consumer-oriented is the  
17 way Karen Billings would call it. You have to listen to  
18 teachers and classrooms as you were saying.

19 Applied research also would create these test  
20 beds. Implicit in it is thinking about curriculum. I think a  
21 lot of people forget, you just don't take a little of this and a  
22 little of that and mix it up and have kids learn. Any textbook

1 writer will tell you that you spend an enormous amount of time  
2 figuring out what you teach, when you teach it, and what the  
3 sequence is; and, although we're not saying we make textbooks,  
4 we still have to think about the learner in the context.

5 And, it means large trials; some people have  
6 compared this IERI Program to the very beginnings of the  
7 equivalent of medical trials for education. There is good and  
8 bad things about that analogy but the scale is right. Medical  
9 trials are very expensive. It's the only way you really know if  
10 medicine works.

11 And, it suggests a different kind of technology.  
12 Maybe some of the things, Irving, that you're getting to. It's  
13 when you get to these large scale trials that you have to think  
14 much more deeply about the infrastructure and the servers and  
15 the delivery system, the data collection, the integrity of that  
16 data collection and so forth.

17 MR. KELLY: Joe.

18 MR. BORDOGNA: Joe Bordogna, National Science  
19 Foundation. I wanted to do something here that is partly to  
20 make the community aware of it but it's connected well, I think,  
21 with everything that's been said so far this morning.

22 During this morning's presentations you saw some

1 examples of engine research center outcomes and ongoing things,  
2 and NSF has a couple premiere centers investments that are  
3 intended to break the frontier. The Science and Technology  
4 Center is an engine research center and you know about them.

5 We're going to launch very soon a new kind of  
6 centers investment of that kind of magnitude and quality. These  
7 are going to be called Science of Learning Centers, which is the  
8 first issue there, learning science. We've been preparing this  
9 for at least five years. It's a long time. As you know, NSF  
10 their workshops and their solicitations like intelligent systems  
11 and things like that, it's all been a plan to get to this point.

12 We have the management team in place. We have  
13 the intellectual group in place, and these are going to be  
14 called Science of Learning Centers. They will be centers that  
15 are expressed like the other two. There will be key features  
16 and then we're going to have the whole country go at submitting  
17 proposals and banging each other's heads and inventing the  
18 different kinds, the eclectic kinds of ways to proceed here.

19 We're going to start off with four of them.  
20 These will be \$3-\$5 million per annum. They will be ten year  
21 kind of things. As always, they'll end at ten years and one of  
22 you will act as the frontier, put that in because people want to

1 keep them going all the time.

2           They are, I don't want to say principal features,  
3 but we're talking here on a table that technology is so  
4 important to all of this. That's a big feature of it. But  
5 technology, not just IT, I want to emphasize that. We get tied  
6 into tech is IT. Tech is everything so we must keep that in  
7 mind. So, technology that's one big driver that we know about.

8           There may be other drivers that people will invent as they  
9 submit the proposals. That's the crucial piece of this.

10           Another big driver is, in the last 15 years,  
11 linguists, psychologists, philosophers, computer scientists, and  
12 now more recently MRE device guys and so on, neuro scientists,  
13 have been developing a more and more credible knowledge base  
14 about how people think and learn, which by the way is a subtitle  
15 to the Science of Learning Centers, how people think and learn.

16           I should modify that, how animals learn too.  
17 It's a very broad kind of key feature here. How does something  
18 or somebody or some entity learn here? How do machines learn,  
19 for example? So, that cognitive science base that we have a lot  
20 of. You need that. It's credible. It's building. A lot of  
21 people get into it. It's very integrated, very multi-  
22 disciplinary to do it.

1                   So, keep that in mind as you go ahead because  
2                   that's an infrastructure thing. If this works well, and we  
3                   think it will, it's very exciting, we'll get the 20 or so  
4                   centers going like we have the 20 or so ERCs and STCs, and this  
5                   I can see coupling also with the ERCs and the STCs. It's a very  
6                   robust kind of thing.

7                   A final word again just to emphasize the key  
8                   features and the community will invent these, so you ought to  
9                   take advantage of all the eclectic kind of ways that are going  
10                  on. One other thing, there are a finite set of things that  
11                  NSF's invested in which come to fruition here maybe in an  
12                  integrative way. I hear around the table, integrate these  
13                  things. Put them together. Get something done.

14                 The math and science partnership of the No Child  
15                 Left Behind, NSF was assigned a math and science part of that,  
16                 the president doing a partnership with the Department of  
17                 Education. We're about to announce the first set of awards  
18                 there. We've had the competition. We learned a lot from this,  
19                 so the next announcement is going to go out soon which will  
20                 reveal what we learned on the first set.

21                 These math and science partnerships again are  
22                 open. We're getting all kinds of ways to pursue this, but the

1 basic bottom line is the partnership between academe and local  
2 school districts, the partners are robust again, industry, state  
3 people who deal with standards and all kinds of things.

4 But, of course, teachers, high schools,  
5 universities, but this partnership academe and K-12 school  
6 districts, actually local ones, that's the big focus, enabling  
7 teachers with all this stuff that's going on, but a format for  
8 doing all of it together. So, there's a base of these that are  
9 going to be put around the country, and again you've got to  
10 integrate with them because that's maybe how you get to the  
11 four-year-olds and the five-year-olds and the six-year-olds.  
12 So, I just want to make everybody aware of that. There's money  
13 going to pour into this and we'd like to see real interest in  
14 it.

15 AUDIENCE MEMBER: Joe, what directorate are you  
16 referring to?

17 MR. BORDOGNA: Very good question. This is an NSF  
18 investment, all of NSF, all directorates, and one reason we've  
19 been taking some time this last year is arguing that very issue  
20 because if you put it, you know, the computer directorate owns  
21 it, the education directorate owns it.

22 We also have a behavioral science and cognitive

1 science in the socioeconomic sciences directorate. So, we're  
2 setting up a management structure here that there will be a  
3 person at NSF who will oversee this whole thing so we get the  
4 connections across everything, and that's an excellent question.

5 Every discipline has to be involved in this.

6 MR. WLADAWSKY-BERGER: Probably we should go until  
7 12:00 or so for the research part because the management models  
8 and coordination and then next steps we need some time in the  
9 meantime. You know, we'll get hungry. Is that reasonable?

10 MR. KELLY: Actually, what I suggest is that we  
11 take a five-minute break and let actually everybody go out. I  
12 guess the main purpose here is just so that obviously the goal  
13 here is not to come up with an absolutely perfect research  
14 priority agenda. Developing such a thing is one of the big  
15 problems we all need to face.

16 But before we start designing a management  
17 solution to it, we need to get our heads around the scope of the  
18 problem we're trying to address. So, there's a gentleman in the  
19 far back.

20 MR. KATZ: I wear a couple of hats. My name is  
21 Warren Katz. The first hat is the chairman of the Simulation  
22 Interoperability Standards Organization, otherwise known as

1 SISO. It's a not-for-profit organization, an industry  
2 collaborative that develops the interoperability standards  
3 mostly for the military simulation industry.

4 Just a couple of comments right there. There has  
5 been some talk about necessity for interoperability standards  
6 for piecing these things together. There's already a very  
7 vibrant community in the GFB that is turning out standards by  
8 the boatload for interoperability of simulation products, most  
9 of them military. We are always looking for other application  
10 areas for those standards, medical has dabbled with our  
11 standards successful, NASA, the space industry, as well as  
12 aerospace and some video game industries.

13 The overarching comment I'll say there is we're  
14 relatively standards rich right now as far as interoperability  
15 standards. I would not make that a very high priority in a  
16 research agenda. We just have to access what's going on in the  
17 DOD space, who have the vast bulk of money to do these sort of  
18 things, and there's a whole industry of people who do nothing  
19 all day but come up with interoperability standards, throw them  
20 away, and immediately start the next one before the first one  
21 gets any chance for acceptance. So, Mike can probably confirm  
22 that.

1                   My second hat is I'm the founder of a tool  
2 vendor, a company that sells these interoperability tools to the  
3 military. I'm trying my best to sell to other industries,  
4 however I find no demand. The military seems to be the most  
5 fertile ground for demand of these type of products. We've  
6 tried our best to sell to the entertainment industry. Medical,  
7 space, we always wind up going back to DOD because that's where  
8 the money is for that type of product. So, I would reiterate  
9 there is a vibrant tools industry as well for interoperability  
10 and modeling simulation systems. I would not set that as a very  
11 high research agenda as well.

12                   The one thing I will comment on that the DOD does  
13 very poorly, that the education efforts might also do poorly, I  
14 would warn against this tech transition. The way I define tech  
15 transition is the taking of a viable research product after it's  
16 been successfully proven and somehow put it into the  
17 marketplace, get vendors selling it, and you get people buying  
18 it.

19                   That transition is done extraordinarily poorly  
20 within the DOD, and I'd rate the number one priority as far as R  
21 & D for this community, as Ralph had said earlier in his  
22 briefing, that we have a very thin veneer of training technology

1 on top of a huge bulk of simulation. I believe that is correct.

2 I'm very happy to hear about these learning science centers.  
3 That's a superb idea, sort of a laboratory for education type of  
4 techniques.

5 But if the tech transition of those successful  
6 learning techniques is not correctly pushed into the curriculum  
7 of teachers being trained and accredited for teaching in  
8 schools, you might as well not do it at all.

9 MR. KELLY: Absolutely.

10 MR. KATZ: The military is grappling with this  
11 right now. There's this tremendous mass of money put into R & D  
12 in these battle labs and R & D facilities in the military and  
13 every time a successful R & D project is finished, it gets  
14 thrown in the trash and the investigator goes off onto the next  
15 interesting technological problem. It's not the job of the  
16 researcher in transition.

17 MR. KELLY: Sounds familiar.

18 MR. KATZ: The job of the researcher is to move  
19 on to the next interesting piece of research. So, in summary, I  
20 would say the two most important things are establishing a  
21 feedback process for research into learning techniques and  
22 learning technologies and more important than actually

1 discovering the new technique is having a very definitive tech  
2 transition and commercialization policy for always pushing them  
3 out into a useful marketplace.

4 MR. WLADAWSKY-BERGER: Yes. Let me just point  
5 out one small thing. The DOD had some good examples of success  
6 with tech transfer with the Internet being Exhibit A, so there  
7 are examples. I'm sure there are other not so good examples, so  
8 it's important to know that it has happened very successfully,  
9 and then as far as supercomputing and I don't know who gets  
10 credit for that, but somebody in government, I don't know if  
11 it's NSF or DOD or DOE, but somebody does.

12 MR. KATZ: I think Academia has been wonderfully  
13 successful at transitioning technology to the masses. I think  
14 the number of people who built a piece of interesting software  
15 and put it up on the 'net for other folks to grab is very, very,  
16 very high percentage.

17 MR. BRANSFORD: I think DOD is poor at taking  
18 fundamental technologies that they pay for and transitioning  
19 them into other things. For example, on interoperability,  
20 Warren's comment there is DOD has done much on the  
21 interoperability standards, but frankly those interoperability  
22 standards are so difficult that the entertainment industry --

1 MR. WLADAWSKY-BERGER: So maybe like even the  
2 Internet maybe there were stages and at one point it was DOD,  
3 but then it went into NSF Net and so on, and from there we went  
4 commercial. Actually, that's very reasonable.

5 MR. BRANSFORD: I think the Internet, I mean to me  
6 is when Mosaic was developing, giving out to anybody who wanted  
7 to test --

8 MR. KELLY: Joe.

9 MR. BORDOGNA: I think for a last bit of  
10 discussion, it's imperative that the agencies work together.  
11 All these things that come out of partnerships of the agencies,  
12 the kind you don't hear about because of a certain level down in  
13 the federal government. People are working very hard to couple.

14 There was a formal interagency group dealing with  
15 the Internet and it shifted its focus as the Internet developed  
16 for different kinds of participants. So, in fact, the center's  
17 idea, Science of Learning Centers is one example now, but the  
18 other two that we've had experience with, they require as a key  
19 feature the partnership at the front end of industry, academe,  
20 and so on, so that you don't have to push. It gets pulled as  
21 people grow together. It gets pulled out.

22 MR. KELLY: Well, I guess before we end, we had a

1 very strong statement that the simulation problem is solved and  
2 the only question is adapting it here. The interoperability  
3 problem is solved. Is this a consensus here? I'm surprised.

4 (Chorus of 'No's)

5 MR. KELLY: Okay, well then somebody other than me  
6 should say something.

7 MR. BRANSFORD: The interoperability on some of  
8 the things the Department of Defense has had some wonderful  
9 successes in interoperability. The curse of interoperability  
10 standards in the Department of Defense don't allow for dynamic  
11 sensibility, grade scale ability and interoperability which are  
12 the three key things that you need to put learning and fully  
13 distribute that. So it's very simple. It's not there.

14 MR. KELLY: Andy.

15 MR. VAN DAM: Interoperability of things that you  
16 don't even know exist yet that you can't describe can't be  
17 standardized. That's why the interoperability problem will be a  
18 research problem forever. You can look backwards and  
19 standardize what you know. That's it. So, we just have a  
20 continuing agenda here.

21 MR. KELLY: I'm going to come up with a final list  
22 before lunch, so we have only one finger up, two, okay. That's

1 it, okay.

2 MR. CHATHAM: A very short comment. I'm told that  
3 the reason that the World Wide Web succeeded after they tried  
4 for a long time was that they allowed the 404 error to exist,  
5 that it was impossible, the guys trying it did, for years tried  
6 in DARPA to build the new Internet and it's still going, and his  
7 observation was if you get more than ten people together trying  
8 to build standards, you will fail. It's a social law that it's  
9 not possible. So, interoperability, you are right, it's going  
10 to be there all the time and the only thing we can do is allow  
11 the 404 error to exist. I can't find that one. I'll go on.

12 MS. HAWKINS: Wendy Hawkins from Intel. My  
13 comment is only with the general tenor of conversation about  
14 where the money is for research, where the money has been for  
15 research and how that flows into education.

16 And, the reality, and I think the assumption that  
17 the money is in defense research. The money is in business  
18 research and that the solution is simply to transfer what is  
19 learned there into the context of education, which has been a  
20 tremendous failure and will continue to be a tremendous failure  
21 until we figure out a motivation and a reason to make the  
22 investment in education for the sake of education.

1                   We will simply have very large hammers and be  
2 looking around for many nails to pound with them when, in fact,  
3 what exists in education may be thumbtacks or screws or  
4 something that needs a very different tool.

5                   MR. KELLY: It sounds like a good benediction to  
6 end, so what I suggest is that we try to get back here as soon  
7 as you can but we're going to start talking here in ten minutes.

8                   MR. WLADAWSKY-BERGER: And then we'll approach the  
9 management models and the coordination models and those  
10 questions that come up.

11                   (Whereupon, the above-entitled matter went off  
12 the record at 12:02 p.m. and went back on the record at 12:14  
13 p.m.)

14                   MR. WLADAWSKY-BERGER: Let me give two concrete  
15 models, just to put them out there and then we can discuss a lot  
16 of things.

17                   MR. KELLY: Actually, let me propose something  
18 that we start off by stating the performance objectives that we  
19 want to have this research model form and then spend ten minutes  
20 doing that. So, what do we want to have it -- and then have you  
21 propose a couple of concrete solutions and see whether they meet  
22 the test.

1 MR. WLADAWSKY-BERGER: Okay fair, go ahead.

2 MR. KELLY: But I think that one of the questions  
3 -- I guess Kay is not here but I will be the amenuensis here.  
4 So I guess the question is, if we're going to start off with  
5 this complicated set of research problems we've just talked  
6 about, what are the tests that we would like to apply to  
7 whatever solution you come up with? What are the objective  
8 functions? What are the measures of success here?

9 And, you know, one obvious one is you want to  
10 have some kind of balance between basic and applied but what are  
11 the other things that we ought to put in here and I'm just going  
12 to -- I will do the writing if you will do the chairing.

13 MR. WLADAWSKY-BERGER: Okay.

14 MR. ZYDA: I think the key words we use here is  
15 interdisciplinary, and I think the NSF has set about building an  
16 interdisciplinary research center. So it's right on. I think  
17 this is actually going to a required cultural change. It is a  
18 measure of success.

19 MR. WLADAWSKY-BERGER: Let me put another one able  
20 to transfer to a wider community, so it's the tech transfer but  
21 it's really the ability to become over time ubiquitous in the  
22 way the Internet, World Wide Web and so on have done that.

1 MS. RENDER: I'm sorry to beat a dead horse but  
2 I'd like to somehow stress that one learns a great deal from  
3 looking at the diverse subjects. As I pointed out, there are  
4 very different technological problems and challenges if you want  
5 to teach humanities as opposed to engineering, as opposed to  
6 mathematics, as opposed to even computer science.

7 MR. WLADAWSKY-BERGER: So, interdisciplinary  
8 doesn't quite capture it then?

9 MS. RENDER: Well, yes and no. For example, a  
10 professor from Vanderbilt will tell you he has an  
11 interdisciplinary group because he has people from education  
12 and bioengineering and I don't know what else. I'm finding in  
13 my new job is that there is a tremendous cultural gap between  
14 the humanities and social sciences.

15 MR. WLADAWSKY-BERGER: I understand, so give us a  
16 word that Henry can write that would address what you're saying.  
17 Clearly what you mean is beyond science and math education.

18 MS. RENDER: Right.

19 MR. WLADAWSKY-BERGER: Is that it? Is that a good  
20 enough word?

21 MR. BRANSFORD: I think the word interdisciplinary  
22 implies, especially for the people in science and engineering,

1 it's okay to couple math, engineering and electrical physics  
2 together, but nobody is thinking about the rest of the world.

3 MR. WLADAWSKY-BERGER: So, it's beyond the usual  
4 suspects is really what you mean.

5 MR. BRANSFORD: To get back to NSF,  
6 interdisciplinary is a word that was an enigma, and now it's  
7 okay. But still, when people say interdisciplinary, they're not  
8 thinking of the social science area.

9 MR. WLADAWSKY-BERGER: I understand.

10 MR. BRANSFORD: So when social science is in at  
11 the front end of an interdisciplinary thought, it's never in, so  
12 that's what really we're saying.

13 MS. RENDER: So maybe I tried to talk about cross-  
14 cultural because it's really almost different cultures,  
15 different training, different thinking.

16 MR. BRANSFORD: I don't know what the right word  
17 is so I'll say interdisciplinary conundrum at NSF.

18 MR. KELLY: There are two things we're talking  
19 about simultaneously. I just want to make sure I'm getting this  
20 straight. One is that whatever it is you want to teach, you  
21 need to bring together an interdisciplinary team in order to  
22 teach it, whatever. And then you say you want to teach many

1 different things. You need to teach humanities and sciences, so  
2 there are two senses in which you're saying you want to --

3 MR. WLADAWSKY-BERGER: Exactly.

4 MR. BRANSFORD: There's something more  
5 fundamental. You size into this measure of organization. So  
6 you save this and you lose some of this. I don't know the right  
7 word yet but it's --

8 MR. WLADAWSKY-BERGER: But very, very specifically  
9 the key concern is beyond the usual math, science, engineering,  
10 even healthcare is included in that and especially reaching  
11 humanities and social sciences. That's an excellent point.

12 MR. BRANSFORD: That was my point.

13 MR. WLADAWSKY-BERGER: Please.

14 MR. HALL: I'm Jason Hall. I'm with the American  
15 Association of Museums. Let me just take that analogy a little  
16 further down the chain. By that I mean let's think a little  
17 more broadly about who would use these technologies and in what  
18 kind of setting? I think it's implicit in some of these new  
19 technologies that they will work not only in the traditional  
20 formal settings, but increasingly in all kinds of informal  
21 settings as well.

22 We know that people use them at home. They're

1 going to be using them in a lot of different kinds of places,  
2 and when we think about testing, therefore, these technologies,  
3 we shouldn't just test them in the formal education settings  
4 with a specific body of K-12 kids or with a specific body of  
5 undergraduates as our test subjects. We should test them more  
6 broadly perhaps with the general public and possibly in  
7 institutions like museums which access the general public and  
8 our educational institutions as well.

9 MR. ZYDA: My children have better computers at  
10 home than they would ever have in school which I think is what  
11 you're saying.

12 MR. HALL: Yes.

13 MR. KELLY: Well we have several people out here  
14 who I know have opinions on the subject that haven't spoken.  
15 Andy, the question on the table is what are the criteria that a  
16 good R & D management plan should meet? What are the features  
17 it should have that we should use? What are the questions?  
18 We're going to get to proposing solutions but what are the  
19 questions we should ask of the proposers? What tests should we  
20 ask for?

21 MR. VAN DAM: Well, in case you think that was a  
22 setup question, I've rehearsed the answer, absolutely not. He's

1 catching me with my mouth full here. Off the top of my head, I  
2 think when you're actuating a research plan, you clearly need to  
3 understand what the general areas in which you want to do  
4 research and what your plan of attack is.

5 What are the barriers that you're going to try to  
6 remove? What sort of machinery can you bring to bear on  
7 removing those barriers, and what are the metrics for success?  
8 So, I think that one of the things that we've struggled with  
9 from the beginning is the metrics for success. How do you know  
10 when you've accomplished something?

11 And, I think the issue of scale, in particular,  
12 is uppermost in all of our minds. We all know about success in  
13 the laboratory and the discussion we had before lunch about  
14 technology transfer. I think it's largely aimed at bridging the  
15 gap between success in the laboratory setting and success on a  
16 large scale setting.

17 So I think fairly standard management issues, but  
18 I think with the proviso that in this area I firmly believe that  
19 the research should go into really unexplored territory so that  
20 it will be difficult to establish what the metrics of success  
21 are when you don't know yet what you're going to be  
22 encountering. It's kind of like trying to say how will Columbus

1 be successful if he does reach India or if he doesn't? Well,  
2 there might be some intermediate stages that could be more  
3 successful even than reaching India.

4 MR. ZYDA: There's a real close point to what  
5 you're making there, which is how long do you wait until you  
6 know that you've succeeded, which is some of what we're  
7 proposing here is actually pretty far beyond the state of the  
8 art, and if you cut this up into 90-day progress reviews, you  
9 would fail, and if you put this out in the long-term, I think  
10 and understand that if you build the learning system in an R & D  
11 mode and then you deploy it, it may take a while to measure  
12 whether or not you're effective.

13 MR. VAN DAM: Yes, I think Mike is dead on on  
14 that. The more adventurous and ambitious we are in our research  
15 agenda, the harder it will be to have quick results that prove  
16 or disprove a particular hypothesis. In this agenda, we have to  
17 be willing to stay the course over a long, sustained period of  
18 time, and have a series of success metrics that evolve as the  
19 research evolves.

20 MR. WLADAWSKY-BERGER: Yes, let me ask a question.  
21 On one end is very basic research. At the other end is very  
22 applied, concrete, let me call it development or deployment.

1 Now where in this spectrum, I mean obviously at some level we  
2 can say we want to cover the spectrum but what is the feeling of  
3 the various proportions, let me say of budget for lack of a  
4 better term that should go in this spectrum?

5 MR. SARGENT: I'm going to make a real brief  
6 statement. I'm going to turn it over to Bill because he's being  
7 way too shy. He's got some very deep thoughts about this and  
8 I'd like to hear it out. We're here at the Commerce Department  
9 today and hopefully what we're bringing from the Commerce  
10 Department is an innovation focus.

11 I've heard a lot today about research and that's  
12 important and you talk about the differentiation, if you will,  
13 between more fundamental and basic research and applied directed  
14 research and I don't think it's an either/or question. I think  
15 what we're talking about is taking advantage of the expertise  
16 and unique capabilities of every one of you that has been  
17 brought together and your organizations and your industries  
18 toward a common goal in a systems approach.

19 I had the pleasure with Henry Kelly of working in  
20 the partnership for a new generation of vehicles, a ten-year R &  
21 D program between the U.S. Federal Government, some federal  
22 agencies, 22 national labs, the big three American auto

1 companies, or they were the big three at the time we started,  
2 hundreds of universities and small businesses all directed  
3 towards the goal of developing a highly fuel efficient --  
4 technologies to enable highly fuel efficient vehicles with the  
5 specific goal of an 80 mile per gallon mid-size passenger sedan.

6 We had basic research. We had applied research.

7 We started with knowing where we wanted to get but not with the  
8 definition of how we were going to get there and so we started  
9 with a broad range of technologies available and we saw what was  
10 most promising. We saw some that were going to be promising in  
11 the time horizon we set for ourselves, which was ten years.  
12 Others, like fuel cells, we recognized had even greater  
13 potential to move past our three times fuel efficiency goal, but  
14 it was going to be down but we continued that work as well.

15 And, I think that's what we're talking about and  
16 I keep hearing the words technology transfer. I hate that word.

17 I hate it for this reason, because if we've done it right, we  
18 don't have to transfer it. We don't throw it over the transom  
19 from the university sector to industry. We're working together  
20 in partnership.

21 Industry is telling the university community what  
22 it needs to achieve its goals, the teaching, education, training

1 communities telling industry the products and services it needs  
2 to reach its goals and there's this constant communication so  
3 that there's not this valley of death or this gap transfer or  
4 whatever and that requires partnership which is why we're here  
5 today. We've got a whole group of people that don't usually  
6 talk to each other here and we need to hear from the whole  
7 group.

8 MR. WLADAWSKY-BERGER: By the way, we will be  
9 discussing exactly those questions in the next step, which  
10 hopefully we'll get to. Since we don't have too much time, we  
11 should probably --

12 MR. KELLY: Yes, I think we should hear a couple  
13 more and --

14 MR. PRATT: Bill Pratt from McGraw Hill.  
15 Obviously the commercial side of this perspective, when we look  
16 at the criteria on this I think we have a unique period of time  
17 with the No Child Left Behind law that's out there in that the  
18 first time we're actually seeing the public sector standing by  
19 it saying we have to have results -- achievable, demonstrable  
20 results coming back from our students and to our teachers.

21 And, I think when we look at these types of  
22 systems, we've got curriculum out there. We've got assessment

1 technology. We've got professional development and these  
2 opportunities of bringing technology as a neighbor to all those  
3 things, that it's the combination of those, but the key metric  
4 and the key criteria has got to be, is it improving student  
5 results? Is it getting us back to actually a better teacher  
6 performance in the classroom? To me, that's the bottom line.  
7 If we don't do that, then we got to go back and do a new -- we  
8 have to do a different type of discovery. We haven't got the  
9 solution right yet.

10 On to the measured side, I think absolutely, and  
11 I'll go back to John's comments, it's going to be a combination  
12 of both. We have to bring in a particular trial of a school  
13 that is in jeopardy, a school that's in pain. Those are the  
14 people who know all of the constraints. They know and you have  
15 the best of the people who are actually desiring a type of  
16 solution, the types of technology.

17 But it's going to require people from academia,  
18 from both the public and the private sector to come together to  
19 actually create a solution that meets the needs of our  
20 communities. I've got a lot of passion in there guys.

21 MR. WLADAWSKY-BERGER: Obviously.

22 MR. PRATT: But we struggle with this on a daily

1 basis with our communities and we hear it right from the  
2 teachers, superintendents and principals.

3 MR. WLADAWSKY-BERGER: Andy.

4 MR. VAN DAM: I agree with that. I agree that  
5 there are a monstrous number of pressing issues that confront  
6 the here and now, but I'm lobbying for a particular point of  
7 view that is probably not shared except by some of you other  
8 French folks out here, which is that we keep saying to  
9 ourselves, it is a multi-front war. It isn't just today or  
10 tomorrow. We have to work both on today's problems, five-year-  
11 out problems, ten-year-out problems, and the 20/20 vision that I  
12 think we were brought here together to discuss.

13 MR. WLADAWSKY-BERGER: No we understand. I think  
14 that's the consensus.

15 MR. VAN DAM: And I think in that vision, now I'm  
16 coming to my point, there may not necessarily be teachers and  
17 schools and students in the traditional recipe that we're all  
18 familiar with. I believe that particularly for post-secondary  
19 education, particularly for life-long learning, some of those  
20 very traditional distinctions are going to be blurred and  
21 potentially deconstructed out of existence, and we need to be  
22 able to think about those kinds of impossible things as well.

1 MR. WLADAWSKY-BERGER: I understand, okay. Okay,  
2 so you had -- just one last to close this part of it.

3 MR. GRIFFIN: Jim Griffin, White House Office of  
4 Science and Technology Policy. I mean, taking the last two  
5 comments, I would say -- I mean they're both right in that, you  
6 know, we need kids who know how to read, do mathematics at a  
7 basic level, science at a basic level, and then choose what they  
8 want to do to achieve in their careers.

9 Now, whether 20 years from now we have school  
10 buildings or not, we have libraries or not, whatever because of  
11 technology, I would say right now, you know, predictions ten  
12 years ago would be you would not have students with backpacks so  
13 full of books that they're falling over backwards, but guess  
14 what? We have students with backpacks so full of books they're  
15 falling over backwards. You know our places in this stand have  
16 not changed, have not moved the earth so to speak.

17 MR. WLADAWSKY-BERGER: No, I understand.

18 MR. GRIFFIN: So, I think we have to focus on the  
19 very near-term and part of it is the fact, and I've worked with  
20 the Interagency Education Research Initiative from the  
21 beginning. One of the things that really, I think the lesson  
22 I've learned from that has been both it's forced us to look at

1 our basic research knowledge and identify gaps so it helps that,  
2 and then for the applied research sometimes the people who are  
3 the ones who know how to do the change are the ones who don't  
4 know the technology. Frankly, some university folks are the  
5 biggest Luddites I've ever come up with. I mean they have their  
6 research intervention but they don't want technology anywhere  
7 near it because that's not where they live.

8           So, again getting back to the interdisciplinary  
9 nature of things which shotgun marriages will only take you so  
10 far. I mean there has to be true integration in these areas  
11 and, as I say, I'm a little less -- I think we have to keep our  
12 eye in terms of future sense, obviously, things of that nature,  
13 but going back to the No Child Left Behind Act and things of  
14 that nature we really are trying to look very hard at what has  
15 evidence base behind it and how you can scale it to make  
16 meaningful impact in terms of, you know, kids learning and  
17 achieving.

18           MR. KELLY: Okay, I'm going to end this with my  
19 own little diatribe. Well this is not a good sign here. Well,  
20 I think you know what we're trying to decide as we shift to this  
21 next phase is what do we actually put in place? I think we've  
22 got a sense that this is a gigantic complicated research problem

1 and we heard that it's harder than cosmology. I think that  
2 that's a very fair statement.

3 This is going to be one of the mothers of all  
4 research management problems. We're going to have to go to a  
5 very, very different scale. And what I thought Andy was going  
6 to say if he didn't have his mouth full was that, in fact, what  
7 we ought to look for in this system is something which is able,  
8 in fact, to both balance things which have an immediate impact  
9 but also focus on things that you really need to break through  
10 and get to some of these 20/20 visions.

11 And maybe he didn't want to say nice things about  
12 DARPA in front of DARPA, but in the old days, maybe in the new  
13 days, DARPA had a unique ability to take on a really tough  
14 challenging set of problems, go off in search for expertise  
15 wherever you could find it and sustain a creative effort by  
16 building teams that involved, you know, some of them were maybe  
17 have been forced marriages across boundaries but they were able  
18 to actually pull it off.

19 So at least my criteria would be something that  
20 could actually stimulate a kind of energetic new approach to  
21 some of these very, very tough problems.

22 MR. WLADAWSKY-BERGER: Very good. Now we have two

1 more things we want to do. One is discuss organizational  
2 proposals, management disciplines, and the last one is concrete  
3 next steps. So let me talk a little bit about management  
4 disciplines.

5 Remember it's not enough to have great research  
6 and applied research proposals. We want to get them funded.  
7 Well, it's easier to have proposals that you really want to get  
8 funded, but these ones we want to make sure - we want to  
9 significantly increase the probability that they get funded and  
10 we want to  
11 but these ones we want to make sure - we want to significantly  
12 increase the probability that they get funded and we want to  
13 then make sure that we execute well so the coordination is  
14 extremely important.

15 Now let me talk about two possible models and  
16 then I'm sure there are others. One model I'll refer to as the  
17 FIX ED HPCCI-ITR model, and let me talk about ITR because I was  
18 so involved. You know in PTAC we knew we wanted to recommend  
19 major increases in IT research and that the usual suspects  
20 needed to participate, NSF, DARPA, DOE, NASA, NIST. I don't  
21 remember who.

22 AUDIENCE MEMBER: NIH.

1 MR. WLADAWSKY-BERGER: Yes, NIH and it was clear  
2 that the recommendations had to cover all of them but somebody  
3 had to be the lead agency. That is if it's just well you guys  
4 get together and figure it out that's not as good as there is a  
5 lead agency that coordinates with everybody and the NSF was the  
6 lead agency and naturally run quite a number of meetings and so  
7 forth. So that's one model. FIX ED really had been doing that.  
8 HPCCI had all that.

9 The second model is sort of let me say the  
10 semitic model which is from Day One this has to be a very, very  
11 strong partnership between government and industry and you  
12 create some institution that goes to manage that. I guess in  
13 the case of semitic, was it DARPA that was the lead government  
14 institution and you know there was a dire problem about  
15 semiconductor industry.

16 So I think Intel and Motorola and IBM and the  
17 usual people involved in that were very involved with DARPA and  
18 you can imagine you know some government lead agency not  
19 reaching out to you know business roundtable, CSBP or other  
20 major businesses saying this is a national problem and from Day  
21 One, rather than just government, we need the partnership of  
22 government, business, and maybe foundations.

1                   So those are two possible ones. There might be  
2 others and we need to at least recommend options for how to  
3 organize the research program here, the research and  
4 implementation program, so. Henry, do you have anything?

5                   MR. KELLY: Only to say that the PNGB thing that  
6 John was talking about was in the way of a fixed bottom.

7                   MS. RENDER: Let me share with you a certain model  
8 that I just became aware of a few days ago that is being  
9 organized in Silicon Valley and this is on homeland security.  
10 And, the proposal there is to create a partnership between the  
11 venture capitalists, the government, academia, and industry, so  
12 the industries are IBM, Hewlett Packard, Intel. Venture capital  
13 firms have been including Perkins and there's a Silicon Valley  
14 kind of group of venture capitalists and the universities are  
15 Stanford, Berkeley, and sort of the Silicon area northern  
16 California consortium.

17                   The idea is that the government would supply  
18 funding for research and the venture capitalists together with  
19 industry would supervise or would certainly influence the  
20 research how it is conducted and make sure that through some  
21 organizations like SRI and so forth and so on get created test  
22 beds where some of this technology like large networks where you

1 are taking down and looking at the red team and so forth and so  
2 on can be deployed.

3 MR. WLADAWSKY-BERGER: Any other comments about  
4 what we should recommend? How to organize? Joe.

5 MR. BORDOGNA: I'd just be very, very careful. We  
6 heard it said this way and different ways a number of times  
7 here. What we are trying to do is create a workforce kind of  
8 thing rather than a research frontier if we can find someone in  
9 industry. This is the making of workforce. This is people that  
10 have to be put out here.

11 Second is let's make sure we prepare for things  
12 that are coming and we don't know what they are yet. That's a  
13 big issue. If you go along and are convinced you're going to  
14 find better ways to do it, find something we hadn't realized in  
15 the beginning. Validity is very, very important.

16 The third is don't assume that things that worked  
17 in the past as well apply in this vein. That goes along with  
18 this is the biggest oldest big old thing better than cosmology.

19 They're the very important points here I think ground points to  
20 sit on and we all tend to go do the things we know worked  
21 before. So we have to keep, I mean whatever comes out of here  
22 has to have some fluidity to it. So as you start to put it

1 together, you're not fixed to something that once worked for  
2 some other specialty.

3 MR. WLADAWSKY-BERGER: No, I understand. I think  
4 from the previous discussion it was clear that there should be  
5 recommendations about long term research let's say to implement  
6 the 20/20 visions at one end and then at the other end is very  
7 applied deployment to improve the OD training, workforce  
8 training and the Labor Department kinds of issues and  
9 educational matters, and I think most everybody has said we  
10 should do both.

11 MR. BORDOGNA: We should partner so that there's  
12 also stuff in between.

13 MR. WLADAWSKY-BERGER: And there's stuff in  
14 between.

15 MR. BORDOGNA: Partnership is the principle.

16 MR. WLADAWSKY-BERGER: Yes, partnership - no, no  
17 we understand and maybe also that determines the models in the  
18 sense that a Sematec like thing I don't think is very good at  
19 long term 20/20 vision. That is much more, I mean as we argue  
20 vehemently in the PTAC work, that the federal government the  
21 only one that can do that whereas very applied worker training  
22 and things like that is much more amenable to applied

1 collaborations with business and content providers, venture  
2 capital, I mean McGraw Hill and people like that. I'm sorry;  
3 you had a question?

4 AUDIENCE MEMBER: You sort of took the wind out of  
5 my sail. I think just to paraphrase what you were saying is you  
6 go across the spectrum from pure research to very applied  
7 research. The scale of the work needs to change. And, at the  
8 very pure area, field initiated studies and far out stuff might  
9 be much more appropriate. As you move across the spectrum to  
10 the larger things, clearly you need larger scale operations,  
11 Sematecs and what have you.

12 Let me point out one thing about field initiated  
13 studies. In technology, it always struck me as such a strange  
14 thing that from the time you have a great idea to the time you  
15 get funding, if you're lucky, is two years or a year and a half,  
16 and the technology has totally changed. One of the things we  
17 have to do, and maybe that is what you're thinking about with  
18 the early DARPA model, is to be able to move much more quickly.

19 MR. ZYDA: I think one of the key things that  
20 might have to happen here when I sort of synthesize what people  
21 are saying is if we do write proposals then there should be a  
22 mechanism embedded in the proposal, maybe a tech board from

1 industry and academia and other places besides your own that  
2 watches for things that can be pushed out the door, and maybe  
3 even seed some of those pushes out the door. My institute has  
4 that. I know that our center for research in computer graphics  
5 has that type of door and so it does work.

6 MR. EDELSON: I'd like to point out that we have a  
7 human resources problem here which is that there are plenty of  
8 people who have a lot of technology expertise but the number of  
9 people who have expertise in learning sciences or in educational  
10 systems is relatively small, and not very well respected.

11 I happen to be in a school of education but in  
12 this room I also introduce myself as being a faculty member in  
13 computer science because we don't particularly respect schools  
14 of education in this country, and that's for the most part for  
15 good reason. But, we need as part of this research initiative  
16 to be training people who are qualified to be doing this kind of  
17 work in the future.

18 MR. WLADAWSKY-BERGER: No, I understand. Let me  
19 just say something which I think is a serious problem we need to  
20 address. Let's assume that I was talking about a major program  
21 in CAD/CAM, Computerized Assisted Design, and if we said, and you  
22 know we think the engineering schools don't know anything. Boy

1 do we have a problem because so much of our innovation gets done  
2 by funding, you know, Stanford, MIT, CMU, Illinois, Berkeley,  
3 you know we really trust the engineering schools, the physics  
4 schools.

5 So, the fact that we are worried about the  
6 education departments and universities, I think it's a very  
7 serious problem because they have to be - they are either the  
8 equivalent of the engineering schools or somebody has to play  
9 that role and in all respect, you know, to have computer  
10 scientists say we are the experts in education or physicists  
11 although we're all arrogant enough to say that, that doesn't  
12 feel right.

13 MR. EDELSON: Well, the reality is is that the  
14 schools of education are not as bad as their reputation and that  
15 they're not as good as they ought to be and that we need to be.

16 Somebody said earlier that if you put in money it attracts top  
17 researchers. If education had more money in it and more cache  
18 and people who were interested in technology saw that there was  
19 an opportunity to apply their expertise in those areas, schools  
20 of education would improve and the number and the quality of  
21 people available would.

22 MR. WLADAWSKY-BERGER: Precisely. I mean I feel

1 much more comfortable pointing out how much money we've given  
2 MIT, Stanford, Berkeley, and how much money we've given the  
3 education departments. I'm assume the gap is huge. So, it's  
4 not surprising that if you give one, I don't know, 100 times  
5 more than the other you'll get superb people going to  
6 engineering and it's harder to attract people in education but  
7 let's make that our problem rather than the poor education  
8 schools that have been well underfunded.

9 MS. RENDER: And I was just going to add that I  
10 think -

11 MR. WLADAWSKY-BERGER: I can't hear you, I'm  
12 sorry.

13 MS. RENDER: I just think it might lead to a  
14 model. Again, you kind of talked about a spectrum there and  
15 yes, you know the government funding agencies are going to be  
16 the catalyst for the pure research piece.

17 I think when you get down to apply these, a sub-  
18 model or sub-management structure is critical with this problem  
19 and it has to be built around the entire K-20 education  
20 community and that's who should be in the lead and that's who  
21 should be driving that. That whole boundary question,  
22 interdisciplinary question, is so key to I think some failings

1 with the schools of education and the integration in K-12.

2 And so here's a place where we can create a  
3 laboratory or a test bed that actually brings them together  
4 organizationally in a way that is innovative but with very  
5 specific targeted, you know, objectives and criteria trying to  
6 be achieved in the short run.

7 MR. KELLY: Well, you're on a roll. I mean is  
8 there a model you'd like to see? I mean is there something  
9 that's worked that's supported that kind of thing in any field  
10 that you think we should mimic?

11 MR. WLADAWSKY-BERGER: I think -

12 MR. KELLY: I didn't mean to put you on the spot.

13 MR. WLADAWSKY-BERGER: Let me mention one and see  
14 if the people who did it agree. The NSF Supercomputing Centers  
15 starting in '85 were an answer to a dire problem and there is no  
16 question in my mind they changed the landscape.

17 I mean obviously DOD and you know everybody else  
18 contributed but boy supercomputing research in this country was  
19 very different or the use of supercomputers in research is what  
20 I mean, not the hardware but the applications, totally changed  
21 after the NSF Center started. It transformed everything and,  
22 you know, it continued with the PAC east and so on. Is that an

1 example?

2 MS. RENDER: I represent the North Carolina system  
3 not the university, so I'm talking about 16 campuses with a  
4 continuum of campuses that run from top research ones to great  
5 liberal arts and specialized schools, and thinking about that  
6 content we have 15 schools of ed. We have some serious K-12  
7 issues, okay, and we have a serious responsibility as a  
8 university to be a part of the solution there and statutorily  
9 and all kinds of other places. There's tremendous pressure in  
10 that particular model to address something in this.

11 Parallel to that, on the technology side we're  
12 doing some pretty innovative things in the area of marine  
13 technology focusing on the bio-informatics part because that's  
14 an important part in our state. But we recognized very early  
15 that the applicability of that, something like what we're called  
16 the edge of great concept that could be instrumental to the  
17 comprehensive schools in our system.

18 And so I'm saying kind of based on that  
19 foundation of perhaps a fairly at least defined technological  
20 infrastructure laying on top of that a true K-20 applied test  
21 bed, that's pretty much as far as I can go without coming up  
22 with a model.

1 MR. WLADAWSKY-BERGER: No, that's perfect. Yes,  
2 Joe.

3 MR. HALL: I'd just like to describe this  
4 conundrum in reverse. No Child Left Behind, NSF gets assigned  
5 the math and science part of it and you put together a  
6 math/science partnership in the title of it, and there you have  
7 a focus in gee, K-12 No Child Left Behind, that's the school's  
8 education, but a key feature of the math/science partnership,  
9 you must have in the partnership or it doesn't even get past the  
10 first filter in the step, mathematicians, mathematics  
11 professors, engineering professors, science professors and so  
12 on.

13 So, the case like here that we sort of have the  
14 reverse and we want to make sure the schools of education are  
15 pulled in in some visible way.

16 MR. WLADAWSKY-BERGER: I understand. By the way,  
17 who got assigned humanities and social sciences and history and  
18 all that?

19 MR. HALL: Who got assigned that?

20 MR. WLADAWSKY-BERGER: You said you had only math  
21 and science and as Ruzena said -

22 MR. HALL: The Department of Education NSF is

1 doing this math and science thing together.

2 MR. WLADAWSKY-BERGER: But every other, history,  
3 how about history?

4 MR. HALL: It just depends on the school education  
5 there. They're attending to that. We're not. Jim, I'm sort of  
6 waving to you.

7 MR. GRIFFIN: I think - okay in the No Child Left  
8 Behind Act there were specific things targeting read, math and  
9 science.

10 MR. WLADAWSKY-BERGER: I understand.

11 MR. GRIFFIN: Okay, so they were not specifically  
12 addressing the humanities.

13 MR. WLADAWSKY-BERGER: Okay, so it didn't aim  
14 beyond, it didn't aim at the whole curriculum?

15 MR. GRIFFIN: Well, the reading, language arts. I  
16 mean I don't know how far you want to go.

17 MR. WLADAWSKY-BERGER: Do you have the lead for  
18 reading also?

19 MR. BORDOGNA: No, no.

20 MR. WLADAWSKY-BERGER: Who does, Education  
21 Department?

22 MR. HALL: That's the Department of Education but

1 with the National Institute of Health as well because they do a  
2 lot of reading there.

3 AUDIENCE MEMBER: Two points. One of my favorite  
4 analogies, I'm a physicist by training and I have to confess,  
5 the -

6 MR. KELLY: But not a cosmologist.

7 AUDIENCE MEMBER: But not a cosmologist, no. The  
8 particle accelerator labs create an interesting model and so  
9 I've been saying we should have a set of education accelerators.

10 MR. KELLY: Yes, that's a good analogy.

11 AUDIENCE MEMBER: One of the things it does is it  
12 allows a physics teacher in Yellow Springs, Ohio to participate  
13 in current high-level research and get academic credit for it  
14 and I think where you get your academic credit and what have you  
15 makes a lot of difference and it's one of the reasons schools of  
16 ed haven't really been able to participate.

17 The model comes from the social sciences with the  
18 individual professor and their students. So, I think we have to  
19 break that down. The first grade example of that was the  
20 development of the bomb where initial research was done in  
21 individual labs around until they brought everybody together on  
22 a plateau in New Mexico.

1 MR. WLADAWSKY-BERGER: Yes, let me point out to  
2 your point that it's probably then not an accident that let's  
3 say the whole notion of URLs came out of the energy physics  
4 community because they needed to share documents and then more  
5 recently they all say, you know, this computer stuff is too  
6 difficult.

7 Let's virtualize it so let's do something called  
8 grid, so they've been driving this stuff and the driving need is  
9 the need to collaborate around the world. So that's a very good  
10 example how a need to collaborate is driving incredibly advanced  
11 technologies which then have a life of their own beyond their  
12 initial thing.

13 MR. KELLY: Irving, this gentleman.

14 MR. WLADAWSKY-BERGER: Yes.

15 MR. MACLENNAN: Malcolm MacleNNan from Computer  
16 Associates and I think it's interesting that we are sitting in  
17 the Department of Commerce and I'd like to feed on something  
18 that John - he is not in the room right now. But in our  
19 company, the only way we get to move ahead on a project with a  
20 client is if we can prove return on investment, reduction on  
21 total cost of ownership.

22 If there's a business application that we could

1 seek to derive success with and have that as a model, would it  
2 not take away some of the issues of trying to get two years of  
3 research applications behind us, that type of thing? And once  
4 we have the business model returning significant investments, I  
5 mean Bill's comment about being part of the 20 organization of  
6 the largest corporations in America consortium.

7 If that consortium was to use some of the outcome  
8 of the spirit of this room, we could then drill that down into  
9 the K-12 markets, which funding may have been more difficult at  
10 times to derive. So, I'd put a different spin on it. Could we  
11 get a business focus on this that may to the justification of  
12 large corporate America using the concepts that drills down much  
13 more readily into the K-12 and into the academic world? I don't  
14 know how that will be received.

15 MR. WLADAWSKY-BERGER: But I thought that's a  
16 little bit the Sematec model I believe that the businesses Intel  
17 and Motorola and so on felt it was very difficult to do the  
18 advanced research one company at a time so resources were pooled  
19 and then DARPA helped incredibly with 50 percent matching?

20 MR. KELLY: Yes, right.

21 MR. WLADAWSKY-BERGER: And so, I don't know if  
22 that would cover what you are saying.

1                   MACLENNAN: But I've seen nothing put up on the  
2 white boards or in this discussion today that we don't do in our  
3 organization. There's nothing. There's no tools. I mean we are  
4 very proud to be a very significant player in the infrastructure  
5 management space which says that if the degree of readiness  
6 through an assessment and an analysis of the front end says we  
7 can't put files that size down that pike, we don't build it that  
8 way.

9                   In other words, if the organization has to make a  
10 \$150 million investment to push JPEG files, we don't build a  
11 JPEG. So, again from a very high level of looking at all the  
12 concepts that are put on the white board, there's nothing that  
13 we don't do today that couldn't be done. There's nothing  
14 stopping us. We can deliver it now.

15                   MR. WLADAWSKY-BERGER: I understand. Please. Oh,  
16 I'm sorry.

17                   MACLENNAN: With corporate America, I mean if we  
18 do a \$300,000 project but it would turn \$1.5 million, I mean if  
19 you don't do that, if a corporation decides not to do it,  
20 something is fundamentally wrong in their thinking and we'll go  
21 to another organization

22                   If we are to make progress, we have to find ways

1 to make it exciting. I hate that, because I hate the guy who  
2 says, "Learning should be fun."

3 Well hell, learning is not always fun. Learning  
4 is hard and difficult and sometimes it's rewarding and sometimes  
5 it isn't. So there is a culture that we are facing which says,  
6 schools of education are second rate. There's a culture that  
7 says, training in course rooms are boring things. And if we're  
8 to get anywhere, we've got to find tricks to change that view --

9 MR. WLADAWSKY-BERGER: I understand.

10 MR. CHATHAM: -- in the minds of the people who  
11 might give us the money.

12 MR. WLADAWSKY-BERGER: No question.

13 MR. CHATHAM: The entertainment industry should  
14 be glued right to this, education, learning centers. All the  
15 work we do is with Hollywood people --

16 MR. WLADAWSKY-BERGER: For the gaming, the people  
17 who do the X-Box.

18 MR. CHATHAM: There's no research in those  
19 industries.

20 MR. KELLY: Yes, they don't any research.

21 MR. CHATHAM: They have no idea why this stuff  
22 works.

1                   MR. KELLY:    So let me be the bad cop here --  
2                   Irving is going to be the polite cop.   We've got to walk into  
3                   this room in a half hour, and the Department of Commerce --  
4                   within a week.   Irving is going to walk into the room in half an  
5                   hour and explain.

6                   The challenge we've got here is that we've come  
7                   over this very rich set of complicated problems here, and we've  
8                   got the Department of Commerce saying, you look across the  
9                   entire federal government.   Look at everything we've ever tried  
10                  to do to manage research in the past.   Look at the way  
11                  corporations have partnered in the past.

12                  What do we do?   You know, if supposedly actually  
13                  they're refreshing things, that they have said that they are  
14                  seriously interested in solving this problem.   They want to do  
15                  the right thing.   They want to support basic research, applied  
16                  research.   They want to move stuff out quickly.

17                  We've got a bunch of interesting stuff on the  
18                  table.   We have the NSF, Science of Learning Centers.   Is that  
19                  enough?   Do we need to do something in addition?   How do we  
20                  manage it?   What do we actually go back and say?   You know, if  
21                  you were going to advise, you know, you have your ten minutes in  
22                  the Oval -- with the President, what do you tell him that he

1 ought to do? And, we have Andy, who is --

2 MR. VAN DAM: Well, this is a setup.

3 MR. KELLY: Is it a setup?

4 MR. VAN DAM: It's a setup.

5 MR. KELLY: I'm bracing myself.

6 MR. VAN DAM: I think first of all it's premature  
7 to select a single model. We're going into an unknown area, and  
8 we should be studying various models that make sense. To answer  
9 your rhetorical question, do I think NSF's program is sufficient  
10 by itself? I personally do not, no matter how great it's going  
11 to be.

12 No one agency, no one outfit will be able to  
13 sponsor what in effect has to be viewed, ladies and gentlemen,  
14 as a grand challenge project, the size of putting man on the  
15 moon, the Manhattan Project, and all those other good examples  
16 of grand challenges.

17 It takes that degree of commitment and turning it  
18 into a national priority to energize the right kind of  
19 interdisciplinary folks to come together and bite off pieces of  
20 this huge problem, and work over a sustained period of time  
21 towards a solution.

22 I think it's harder than man on the moon. That

1 only took a decade.

2 This is going to take our lifetimes and the  
3 lifetimes of those who come behind us. And we should just own  
4 up to that and put machinery into place that allows for a  
5 sustained effort that is funded at an adequate level. So, I  
6 love what NSF is doing. I'm very happy to hear from Ruzena that  
7 there may be another model solving another problem in Silicon  
8 Valley.

9 Let's work over a period of time to build the  
10 research agenda, to try to identify what the things are that  
11 need solving, what the barrier issues are, and let's also during  
12 that same time put together some pictures of funding models and  
13 management models.

14 MR. WLADAWSKY-BERGER: Yes, good.

15 MR. VAN DAM: And metrics.

16 MR. WLADAWSKY-BERGER: Yes.

17 MR. VAN DAM: We are not ready to propose any  
18 single solution at this point.

19 MR. WLADAWSKY-BERGER: You're right there.

20 MR. VAN DAM: And by the way, you know that I'm  
21 passionately committed -- as is Henry, as is Randy Heinlich and  
22 other people -- to establishing the learning federation. Lest

1 you think that that is a canned solution, it is not. It is a  
2 concept for systematically evolving a process to tackle some of  
3 these problems.

4 MR. WLADAWSKY-BERGER: Okay.

5 MR. VAN DAM: I'm hoping that somehow we can get  
6 Commerce to be a partner in that investigation.

7 MR. WLADAWSKY-BERGER: Okay.

8 MR. VAN DAM: It's a road mapping effort, by the  
9 way, for identification of research issues -- not yet handing  
10 out pots of money to solve these virtualities.

11 MR. WLADAWSKY-BERGER: The road map and very  
12 assumptions that need to be studied so we can come up with a  
13 decision. So, here are the possible models but the decision --

14 Let me just take something that was toward the  
15 end of Andy's comments.

16 If you look at the successful programs, there  
17 was, even though they were inter-government reaching out to  
18 business even, some lead agency, some agency took the lead. I  
19 mean with Sematec, DARPA did with the supercomputing centers.  
20 NSF was putting a man on the moon, and the space platform NASA.

21

22 Is it premature to ask if there is a sense of us

1 of which government agency we recommend taking the lead, so we  
2 can work with them in refining and, you know, putting together  
3 the agenda? What's the feeling on that? Joe?

4 MR. BORDOGNA: I agree with what Andy said. The  
5 Science in Learning Centers is one piece of this. It's to get  
6 at the very frontier of how people think and learn. A lot of  
7 ramifications come out of that. That's not the solution to this  
8 thing we're talking about. I'm not sure what we're talking  
9 about right now. Some grand challenge is a good word.

10 I think it's impossible to come out of this group  
11 right now to what the Commerce Department should do by itself to  
12 take leadership, or what have you. I think the best in a lot of  
13 this, some of these thoughts we're thinking about, some guidance  
14 to Commerce.

15 I think there has to be some way to get an  
16 interagency group together. There's a National Science and  
17 Technology Council. Jim, I think this should go to a science  
18 advisor who is very sensitive about all these issues right now,  
19 including the social science issue. And that's a venue for  
20 bringing together these two parties here that could benefit from  
21 guidance from this group.

22 That's an approach here. No one agency is going

1 to be able to do this. I'm not the sure the interagency could,  
2 so it's a big thing. Also the interagency thing has to be well  
3 aware that it's a national partnership. A learning federation  
4 is another kind of construct that the private sectors are  
5 putting together.

6 MR. WLADAWSKY-BERGER: I understand, Joe, but  
7 some agency has to take the lead; otherwise, like we don't even  
8 know who to follow up with.

9 MR. BORDOGNA: Yes, but I think that's determined  
10 a little later. I don't think we know enough. I think the  
11 concept is correct. But generally what happens, in the NSTC,  
12 that group says "You're the lead" somehow. PTC did it, but it  
13 did it in a lot of argument when the agencies got involved.

14 MR. WLADAWSKY-BERGER: Oh, no. It took us  
15 months.

16 MR. BORDOGNA: Right.

17 MR. WLADAWSKY-BERGER: And we grilled Ruzena to  
18 the wall, and it took us months. I'm sorry.

19 MR. BORDOGNA: And Andy and I used to sit in an  
20 office next to each other too, so there's a plot here.

21 MR. KELLY: But, Joe, Irving suggested, you know,  
22 two approaches. One of which was in effect what you said. You

1 know, with a fix-it. It was the HPPC model which was, in fact,  
2 what PTC built off. So your argument is that that's an  
3 effective and efficient --

4 MR. BORDOGNA: Yes, let's go on a little bit  
5 more, because the HPPC model got converted sort of roughly. I  
6 mean by "rough" it was hard to do, when Ruzena came because the  
7 IT, it was ten years old. It wasn't subsuming itself into the  
8 new thing.

9 MR. KELLY: Right.

10 MR. BORDOGNA: So it took a jerk there -- I mean,  
11 not a person, but that was the next stage of acceleration. See,  
12 that's why this group can be a catalyst in that sense. We're  
13 coming to a point now where there's nothing around that really  
14 is going to do this. So how do you get your arms around it?

15 MR. WLADAWSKY-BERGER: Yes, I understand. There  
16 were a number of people with hands raised. Ruzena, go ahead --  
17 since he may have called you a jerk, you get --

18 MS. BAJCSY: May I a little bit disagree, and I  
19 am truly by heart an engineer, and I like to go into the lab and  
20 build things, so I would like to meet with our great sponsor of  
21 this meeting, the Commerce Department, that perhaps they could  
22 start something, start a lab, you know.

1                   Start something to explore where the hell are we  
2 going? Because otherwise it will be philosophizing, and maybe -  
3 -

4                   MR. KELLY: Years of committee work.

5                   MS. BAJCSY: -- making the white paper after  
6 white paper, we need some data. That's my point.

7                   MR. WLADAWSKY-BERGER: I understand.

8                   MR. BORDOGNA: It's funded in NRC's stead.

9                   MR. WLADAWSKY-BERGER: I'm sorry.

10                  MR. BORDOGNA: I think Commerce should run an NRC  
11 study to define the national agenda.

12                  MR. KELLY: But that will be three years.

13                  MR. WLADAWSKY-BERGER: NRC -- from personal  
14 experience having been there, by the time the study came out, we  
15 had forgotten what the problem was. And I mean that with all  
16 respect. But, I'm sorry.

17                  MR. VAN DAM: May I amplify Ruzena's point with a  
18 concrete suggestion? Learning federation with good advice from  
19 folks like the former CEO of Sematec, and find out what we  
20 should do to get greater clarity and start a year's road mapping  
21 effort to establish a research agenda. I'm proposing that we  
22 get Department of Commerce, NSF, some of our leading industry

1 partners, many of whom are represented at this meeting --

2 MR. WLADAWSKY-BERGER: Plus education.

3 MR. VAN DAM: -- to chip in a relatively small  
4 amount of money, create a pool of somewhere around \$1 million,  
5 which is what Henry and his crew have thought it would take to  
6 conduct such a road- mapping process, and also in parallel get  
7 some other folks thinking about funding and management and  
8 metrics for success models, so that we work in parallel instead  
9 of our eternal sequential way of proceeding, where it takes us  
10 five to ten years to get a good idea consummated.

11 MR. WLADAWSKY-BERGER: Yes.

12 MR. VAN DAM: I agree passionately with Ruzena's  
13 point. It is a way of getting it off the ground and start  
14 studying.

15 MR. WLADAWSKY-BERGER: Yes, let me repeat it  
16 because it's such a concrete proposal, which is that the key  
17 government agencies involved -- Commerce, NSF, Education, Labor,  
18 DOD, NIH -- with the proper business representation, fund a one-  
19 year study that comes back to them -- so we need to get them  
20 here -- an HPCCI kind of thing, to then flush all this out, plus  
21 what our colleagues in the other room might be recommending.  
22 And then after a year, there might be a major report, budget

1 implications, but that's a very concrete thing we would  
2 recommend should happen as soon as possible.

3 Does that capture what you said, Andy?

4 MR. VAN DAM: To a first approximation, yes. We  
5 can refine it.

6 MR. KELLY: That doesn't mean you're going to get  
7 it though.

8 MR. WLADAWSKY-BERGER: They'll take it. You got  
9 it, Kay?

10 MS. HOWELL: I think so.

11 MR. WLADAWSKY-BERGER: Yes, sorry.

12 MR. STREICHENBERGER: I suppose I'm next because  
13 I'm -- sorry, a different role, but --

14 MR. KELLY: Could you introduce yourself, sir?

15 MR. STREICHENBERGER: I'm sorry, my name is Ivan  
16 Streichenberger. I'm with Houghton-Mifflin, publisher. We've  
17 got an immediate issue which is, how can we improve the way we  
18 teach kids, how can we make sure these kids know how to read, to  
19 do math, and so on?

20 And the thing that is an immediate challenge is  
21 what you face now. Obviously there are some long-term research  
22 to do and so on, but one thing we could do right now is to make

1 sure there is a presentation, whatever, of work done by the  
2 different departments, by some of these departments to the  
3 publishers, to us, and so we could learn that from the different  
4 research, practically.

5 What I listened to this morning obviously was  
6 kind of vague as to classified and so on, but I'm sure the  
7 private industry could benefit a lot from this research, and  
8 we've got to deliver within the next few months and few years, a  
9 better result for the kids in school, for math, science,  
10 reading, and so on.

11 This program for me -- again, I'm out of this  
12 world and belong to another country and experience as well. But  
13 it is going to take a long, long time. In the meanwhile you can  
14 tell the kids in school what you learned, and you know, if five  
15 years down the road we're still stressing how we're going to  
16 fund it, we're still going to have a problem with these kids.

17 MR. WLADAWSKY-BERGER: I understand.

18 MR. EDELSON: What I want to say sort of follows  
19 on that. I don't know that much about the learning federation,  
20 so this may already be part of its role, but I've been funded by  
21 NSF to do technology and educational research for at least ten  
22 years.

1 I've never been in a room that had such industry  
2 involvement in it. I think the one thing that the Commerce  
3 Department is offering, an issue coming out of the Commerce  
4 Department, is to go beyond what has been done yet, is bring  
5 together people like John Bransford and Bob Tinker and myself  
6 and lots of others of us who are doing both research and  
7 development that has near-term implications, together with the  
8 representatives of the industry.

9 There's never been, at least I don't know of any  
10 real joint initiative that brought together people from academia  
11 and the real publishing industry in any meaningful way, at least  
12 not in the last 20 years or so. and the Commerce Department is  
13 really the facilitator making that happen.

14 MR. ISRAEL: Chris Israel, actually with the  
15 Commerce Department, with the Technology Administration here. I  
16 apologize that I've been bouncing back and forth between the two  
17 sessions this afternoon. I think there are some ideas for some  
18 interesting collaboration that will be spawned by this initial  
19 collaboration we put together.

20 And to follow up a bit, I think that is a good  
21 point, and I think that's kind of where we see the fit for this  
22 for the Commerce Department, and an interest in trying to

1 figure out where the areas of push and pull exist within the  
2 system for bringing the innovation, bringing the R&D that's out  
3 there, that's been done that has some utilization within the  
4 education context, actually into the classroom.

5 I had a chance a few months ago to spend some  
6 time up at Carnegie Mellon and spoke to a couple professors up  
7 there who have done a lot of research into technology  
8 applications. And they noted the disconnect between the ability  
9 to attract venture capital, the ability to -- you know -- really  
10 look at it as an industry, for lack of a better word, really.

11 There's a large and robust and potentially very  
12 vibrant industry for education technology, and to look at it  
13 that way essentially -- and kind of, what are the value chain  
14 questions that you need to address -- whether it's -- actually I  
15 think transition was a word that was used earlier in this room,  
16 which I think is an appropriate way to look at it.

17 You know, how do you actually transition the  
18 technology into an ongoing successful model that's going to  
19 attract financing, that's going to attract the type of marketing  
20 skill.

21 There was recognition of the entertainment  
22 industry and the gaming industry as two industries that don't do

1 any research and development, but what they do do fantastically  
2 well is to figure out the utility for what they have, what they  
3 know, and what they build -- for their target audience.

4 I think that type of look -- kind of outward from  
5 the target audience towards the R&D and to figure out what it is  
6 that's going to make those innovations, make the technologies  
7 really matter in the marketplace, build that marketplace and  
8 effectively get into the classroom -- is kind of where we see  
9 our ability to help focus some of the debate and some of the  
10 ideas. This is a great setting for getting some initial input  
11 on those types of factors.

12 MR. MASHEL: I would like to clearly echo what  
13 Andy said, and that is it has to start soon. It has to have a  
14 fixed time, and it really does have to be driven by Commerce,  
15 because that's the linchpin to not giving up on the current  
16 workforce, and -- nothing against the other departments but --  
17 if the focus is in other places, then there's a huge portion of  
18 the current workforce that we'll give up on with the results of  
19 whatever we begin to establish on Day 366, which is really when  
20 it begins out of this process.

21 MR. KELLY: Could you introduce yourself to us?

22 MR. MASTEL: I'm sorry.

1                   MR. CHATHAM: Ralph Chatham again. I'm hearing  
2 very contradicting things. Andy has said we need a Manhattan  
3 Project, a thing that's bigger than any of us, any of the rest  
4 of the discussion is talking about. Commerce isn't big enough  
5 to do what you were suggesting.

6                   MR. VAN DAM: I agree completely, and that's not  
7 a problem.

8                   MR. CHATHAM: No, but if -- well, all right, as I  
9 was -- and interpret through my ears -- I'm listening to people  
10 talking about low level solutions to a problem that you declare  
11 and that I would agree is very much larger. It has to be a  
12 national priority, if it's to do the kind of things that you  
13 want to do, and I'm not -- we're looking at ourselves from our  
14 inside view of what we are, and we're not looking at ourselves  
15 from what the outside world will see.

16                   If we're going to do what you want, we have to  
17 think a lot bigger than what I've heard.

18                   MR. WLADAWSKY-BERGER: Okay, but let me try to  
19 connect the dots, which is -- we all agree this is perhaps the  
20 hardest problem we have, and that's why we need a Manhattan  
21 style, you know, or let's put a person in the moon project, that  
22 very quickly makes it a national initiative and communicates it.

1                   But then we need to pull it together, and the  
2 recommendation was, so assemble a team of people to pull  
3 together the road map, the agenda, make management  
4 recommendations, and that team of people will report to a  
5 coordinating body that includes the members of the key  
6 government agencies and business and others, you know, not only  
7 federations, foundations.

8                   And I think the sense of the group has been, and  
9 we recommend, that Commerce take the lead for this coordinating  
10 body. It in no way means the execution will only be done by  
11 Commerce.

12                   We just say somebody has to take the lead, and we  
13 are recommending Commerce take the lead for this coordinating  
14 body to help us launch it, pull it together, et cetera, and then  
15 they will recommend -- a year from now roughly -- this is the  
16 Manhattan Project. This is the funding.

17                   You know, HPCCI sort of worked that way. There  
18 wasn't business involved, but it sort of worked that way. To be  
19 honest, PTC very much, the ITR program, worked that way. I  
20 mean, the problem was infinitely simpler, but it was pulling  
21 people together, make recommendations, eventually come out with  
22 concrete budget things, very important, go pound the pavement in

1 Congress to convince the Appropriations Committees to give us  
2 the money.

3 It's not enough to throw it over trenches.  
4 Somebody has to sell it. So, Ralph, that's how I connect the  
5 two sides of what Andy said, the Manhattan Project vision, with:  
6 Let's take a year to define it with a small team. Is that a  
7 correct interpretation to first order? Yes, please.

8 MR. PRATT: Bill Pratt, McGraw-Hill again. I  
9 think that if we use No Child Left Behind though, as basically  
10 that sense of urgency, that there's real targets out there, it's  
11 going to give this group a sense of focus, a sense of time line  
12 and the deliverables that need to get achieved. And I think  
13 that's how you create a real sense of getting something done.

14 And those targets are far enough out so that, in  
15 fact, we can start looking for more far-reaching advanced  
16 technology reply grids, but we have to keep our eye on the ball.

17 There is a mission out there. There is a national mandate  
18 that's been set up by our President. We don't have the means to  
19 get there.

20 And we're already starting to see, with many of  
21 the states backing off of those commitments. They're already  
22 lobbying now to get those deadlines pushed up, because we do not

1 have the mechanism upon which to measure, upon which to change  
2 the curriculum and the pedagogy to achieve those.

3 So, I think the mission is out there. I think  
4 the mandate has been put out there, and it's this kind of group  
5 that's got to actually come together to figure out how we  
6 deliver.

7 MR. WLADAWSKY-BERGER: Joe.

8 MR. BORDOGNA: What I was trying to convey,  
9 building on what Andy said in the beginning in developing this  
10 grand challenge kind of thing, is -- Irving, when you did this  
11 for IT, PTC, the "P" was "Presidential."

12 So I was going, with the NSTC you get the White  
13 House Office to make this a Presidential level thing, not any  
14 particular agency. That's why you succeeded.

15 I mean, that had an undeniable punch to it --  
16 that there was nothing higher than that. So, if you want to do  
17 this thing, I think to begin I would suggest you get through to  
18 the Science Advisor and see what you can do there. Maybe you  
19 can't do it.

20 MR. WLADAWSKY-BERGER: I don't know.

21 AUDIENCE MEMBER: But what's the time line on  
22 PTC?

1 MR. BORDOGNA: PTC was very fast.

2 AUDIENCE MEMBER: Exactly. Presidents last a  
3 maximum of eight years.

4 MR. BORDOGNA: Pardon?

5 AUDIENCE MEMBER: Presidents last for a maximum  
6 of eight years. If we're talking about a 20-year project that  
7 may not be the right place.

8 MR. HALL: We're also doing about doing something  
9 that focuses much more on immediate goals, but also establishes  
10 a time line of 2020 or whatever.

11 But I'll tell you, I mean right now I can't tell  
12 you how many things that come across my desk that have moon  
13 shots, that have Manhattan Project, that have all these things -  
14 - and guess where they go. Because they stay in the ether, and  
15 I mean we heard NRC. No, not NRC. They'll take too long and by  
16 that time, you know.

17 I mean, not to deflate the balloon too much --  
18 because I think there's a lot of positive energy -- and I think  
19 one of the things that can come out of this is bringing the  
20 government, with the publishers, with the tech community  
21 together. That's a tough alliance, and I don't know too many  
22 examples where they've really been brought together for a

1 meaningful collaboration.

2           If you all unite together and say, you know,  
3 we're really -- again, I would use the example of the goals set  
4 out in No Child Left Behind -- that we're going to make a good  
5 faith effort to try to help with the fulfillment of those goals  
6 in the near term, but with the idea being we have this. We need  
7 to go beyond that even, and that we even have this vision out to  
8 2020.

9           That, I mean frankly I could sell. I mean, I  
10 think that's something that makes sense, because it has some  
11 short term applicability, and it has the players at least  
12 potentially involved that need to be there. But it also has  
13 some foresight and some vision to it.

14           AUDIENCE MEMBER: All those are Presidential.

15           MR. HALL: Well, again whether it's Presidential  
16 or not, I think the thing with the Presidential is, if you don't  
17 have the Presidential, you bring it to this group and the other  
18 agencies who aren't sitting around this table, like I don't know  
19 if there's anyone in this group from the Department of Ed or  
20 some of the others. There's nobody here from NIH, I think.

21           I can tell you right now their reaction to this  
22 is going to be, pretty cover, nice graphics, you know -- I'll

1 put that on my desk and get right to it. I mean you really need  
2 to have the people from the ground up. The President's office  
3 has, I mean through the National Science and Technology Council,  
4 I mean we can bring the people to the table. But I mean -- and  
5 again we also have PACAS, President's Advisory Committee on  
6 Science and Technology.

7 I mean, we do have an ability to bring some of  
8 these coordination functions together. But as I say, one of the  
9 reason I haven't been more forceful on this is, I'm also not  
10 trying to take anything away from Commerce, or anyone else,  
11 because again I think obviously they brought this together and  
12 they deserve the credit for that.

13 MR. WLADAWSKY-BERGER: Let me just say, this  
14 stuff is really hard, so at some point whoever puts up their  
15 hand and has passion, you know, we should look at very  
16 seriously. I mean, in the PTC you know, we looked at a number  
17 of options, and NSF fought like crazy that this was their  
18 mission and they wanted to do that. And that was a lot of what  
19 we did.

20 So, you know, I don't know if OSTP feels that  
21 passion to lead this, or if I heard you say we need to convince  
22 them that this is worthwhile -- and it's one of 27 other things

1 they get, and our balloon should be deflated. That's what a  
2 good start to a date.

3 MR. HALL: No, no, no, that's not what I was  
4 trying to say. What I was trying to say is, I think if it's too  
5 diffused, I think it's going to be much harder to get a lot of  
6 excitement. Because, as I say, you know again there is some  
7 truth to the fact that, in politics, your shelf life is only so  
8 long.

9 And I mean -- you can look at some of the things.

10 I mean, everyone probably around here has been involved with  
11 things from previous administrations or whatever and -- think  
12 about it. Where are they right now? Some of them have had  
13 lasting effects. Others have not. We want something that has  
14 lasting effects.

15 MR. WLADAWSKY-BERGER: I understand. Joe and  
16 then Andy.

17 MR. BORDOGNA: I think it's good discussion but -  
18 - how did the ITR get going? There was a meeting, when all this  
19 arguing was going on, of the heads of the agencies which were  
20 listed. They met, with the Science Advisor chairing, and they  
21 all agreed that they would do this together, and they all agreed  
22 to be led by NSF. They all agreed that Ruzena would be the

1 chair. I mean, so what we're trying to do is put it in place,  
2 put it in a place where something like that can happen, hence  
3 the committee and that was done through Neal Lane.

4 MR. WLADAWSKY-BERGER: I understand, so the  
5 equivalent would be?

6 MR. BORDOGNA: The forcing function came from  
7 PTC.

8 MR. WLADAWSKY-BERGER: Yes. So you would say the  
9 equivalent is to do it through Dr. Marberger?

10 MR. BORDOGNA: Well, I'm not sure how to do this.  
11 I mean, we're discussing this now, so we're putting all the  
12 ideas on the table, because we're all interested in this.

13 But we all should be informed about the way  
14 things happen with other things. This may be totally different,  
15 and we could all be thinking about it.

16 MR. KELLY: But if I could just make one brief  
17 statement. In fact, what you know -- this needs to be a  
18 Presidential initiative, no question, that the NSTC, the Science  
19 Advisor -- you know, the President needs to say, this is a great  
20 idea.

21 And then the question is, how do you actually get  
22 it implemented? And what you're talking about is, by the time

1 that meeting with Neil Lane happened, of course, everything had  
2 been wired in. Ruzena had been shanghaied and, you know,  
3 pressed into service and so on.

4 And, in the case of PNGV that John Sargent just  
5 described, you know, Commerce in fact did pick that up. In  
6 fact, even though they had almost none of the money, after --  
7 Well, I don't know how many meetings, but nonetheless -- What  
8 the President can do is empower and bless a process, you know.  
9 Obviously the White House can't operationally run this thing;  
10 the team that you described needs to run it. This one is  
11 really, we keep saying, it is the hardest of anything that we  
12 can imagine.

13 This is really, really very hard, because it does  
14 cross so many different disciplines, so many different agencies,  
15 and you really need somebody that understands innovation to help  
16 process it. So, Professor van Dam?

17 MR. BOND: Yes, since time has got us here, I  
18 want to endorse a couple things that Joe said, and make a couple  
19 of suggestions. I think first of all, the most immediate  
20 concrete step that we can take is for people to re-up, and stay  
21 engaged. There would be a whole host of ways to stay engaged,  
22 and I'm confident that, as this process unfolds, there will be a

1 number of other opportunities.

2           The very first thing -- I would hope we'd go back  
3 to everybody and say, are you going to stay engaged? Are you  
4 going to remain committed? And, at least come out with a list  
5 of folks who want to go forward.

6           Secondly, I think your point, your desire for  
7 leadership, is exactly right because with leadership comes  
8 accountability. But as Joe indicated, that needs to come  
9 through the NSTC. What I would commit Commerce to doing is  
10 taking that piece to NSTC and teeing it up. But that's exactly  
11 right where he's got it coming. Labor isn't here. They have a  
12 21<sup>st</sup> Century Workforce Office. And many other players who would  
13 need to be a part of it. So, I want to endorse that.

14           I think you might want to think -- we could  
15 commit to this too, working with NSF and Education, at least to  
16 start -- which would be to perhaps take that first cut, as staff  
17 always does, at what that road ahead might be -- to disperse for  
18 Commerce and keep going. That might be another concrete step.  
19 Those are just a few thoughts as we get ready to close out.

20           MR. VAN DAM: Am I allowed a postscript? Is  
21 there time?

22           MR. WLADAWSKY-BERGER: Yes, we have one minute.

1                   MR. VAN DAM: I agree with all that. I think  
2 it's great. But at the same time, I believe if we found ten  
3 stakeholders at \$100,000 each, while the heavy machinery was  
4 starting to be engaged, we could start on the first step to this  
5 longest of all journeys. That's what I'm pleading for. Go in  
6 parallel.

7                   MR. KELLY: So we have the unenviable task of  
8 trying to summarize what we've said, but we will do our best and  
9 count on you guys to correct us if we're not doing our job.

10                   (Whereupon, the above-entitled matter was  
11 concluded at 1:33 p.m.)

12

13