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MS: All of you with me, you probably could recite this intro I'm about to make since you've heard it so many times, but I have to do it as a matter of record, so just bear with me for a moment now. I would like to call this meeting of the National Science Board's Commission on 21st Century Education in Science, Technology Engineering and Mathematics to order. Please turn off all of your cell phones and other electronic noise making devices and I'm looking directly across at Bill Noxin right now to encourage him to do that.

My name is Michael Crosby and I'm the Executive Director of the National Science Board. I just want to take a few minutes to ensure that everyone realizes that this board commission is a chartered federal advisory committee and as such, must comply with the Federal Advisory Committee Act, or the FACA act of 1972. For the purpose of this commission, I will serve as the designated federal officer according to FACA regulations.

Dr. Elizabeth Strickland serves as the Executive Secretary for the Commission. Without going into any great detail, the purpose of the act is to ensure that all FACA

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committees provide advice to the federal government that is relevant, objective and open to the public. Simply put, this means that the deliberations of this commission must, with very few exceptions, be made in a public forum. If anyone has any questions regarding how FACA regulations and guidelines apply specifically to this commission, please ask me at a later time and I will be happy to discuss it with you.

Any members of the general public or any special interest groups who are attending the meeting today are requested to register with us by providing your name and contact information to Dr. Strickland. Any members of the general public or any special interest groups who would like to provide comments to the commission may do so later during this telecon. We ask that you please let Elizabeth know.

If you do want to make those comments, you will be restricted to just a couple of minutes, but you will be afforded that opportunity. If we have more individuals wishing to comment than we have time for or you would prefer to provide your input in writing, we would welcome written comments to the commission by sending an email to the following address: NSBEDCOM@nsf.gov.

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Now for the purpose of this call, the agenda is rather general. The commission leadership has requested that you all discuss those items first that time did not allow you to discuss during your last call. The focus of your attention for this call, at least for the first portion of this call, will be the revised draft action plan section of the developing report and I believe it's dated 1/8/07 that Dr. Strickland had mailed to the commission members, emailed to you all. Members of the public here today and the press also have a copy of that before them.

Although there has been some rearrangement of the action plan portion of the report since the earlier December 20 draft that you all saw. I believe the items that you previously did not have an opportunity to discuss are now in Goal I, I believe, particularly items A and B. This, I think, deals with the adoption of national content standards in STEM and the linkages of student assessment to these content standards.

Another issue that was raised by the leadership of the commission that they would like the full commission to discuss is the format of the report. There seems to be a

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general comfort level with the action plan section at your last telecon, but we do need a little bit more guidance at a staff level as to the format. Then as Dr. Vasquez has suggested, if there is some time at the end of this call, you may have other items that you want to bring up and discuss.

Before I would turn it over to Dr. Vasquez, the vice-chair of the commission, for her opening comments, I would like to suggest that we proceed as we did last time after Dr. Vasquez' comments. That we simply proceed in alphabetical fashion by last name down the list of commission members to ensure that everyone has a few minutes on each of the topics to discuss. But we are at the direction of you all and how you want to handle this, so Dr. Vasquez, do you have some opening comments?

FS: Yes, I do and thank you, Dr. Crosby. Good morning, everyone and thank you for giving of your time this morning. I think that one of the things that we do know is that there is a light at the end of this tunnel because we do have and are on now a timeline whereas when we finish our conversation today and whoever has not joined us. But we get the other comments that the staff will do under Elizabeth's guidance, another draft. And that draft will

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then go out to us again and that will be the draft that we will discuss here at the Phoenix meeting.

So what we have today and what we do at the Phoenix meeting will essentially be with modifications, the draft that then goes to the national science board for their first preview to start getting some input and feedback from them. I also had and directed Elizabeth to send out the charge to the commission, the original charge, only because I want to make sure that as we look back over the charge, that we look at the specific role in each of these actions that NSF can play.

That was one of the directions from the congressional staff to us and how NSF can play and be a person or an entity within the STEM education system within our nation. So that said, I think that we are ready to get started.

Michael, I will turn it over to you to moderate.

MS: Okay, very good. We just had someone else come on.

FS: This is Maritza, I'm sorry.

MS: Your timing is impeccable and we're just about to start the conversation. If everyone is in agreement, as you may recall at your last telecon, I believe at that time, it was action item number three and you did not have time to get

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to. It's my understanding that most of the subject matter from that action item had now been moved into major goal number one, particularly items A and B. I wonder if you all are in agreement since that got kind of short shrift not he last call that we begin by asking you all for your feedback on that section. Does that make sense?

FS: You are wanting to start with action item three, is that correct?

MS: No, no - number one on the new document that you all have dated 1/8/07.

FS: I think that is the way to go.

MS: Yes, this focuses on the adoption of national content standards in STEM and the linkages of student assessment on those content standards. You all didn't have a chance to talk about that last time. We just had someone join -

FS: This is Maria, and I apologize for being late.

MS: Okay, I believe that we now have a quorum as well, so we will go ahead and go down the list in alphabetical order. Dr. Boggs, that means you are up first.

MS: Now thank you - we are just commenting on major goal one, is that correct?

MS: Major goal one at this time, and then we will go down the list and then come back and go through the other items.

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MS: Okay. Well, I think that the whole document is much tighter written and much better written, so congratulations to those who are involved in doing that. I don't have a lot of concerns about major goal one and I'm very supportive of this. I know we did have some dialogue about uniform standards, but I think as long as they have some voluntary aspect, that should take care of the concern about federal control of the curriculums. So basically, I am supportive of what we have written here under major goal one.

MS: Okay, thank you very much. Dr. Gallagher?

FS: I would agree with Dr. Boggs that I think this version is much tighter. I like the format, so in general, I think that it's obviously the specifics that we can now concentrate on. I think the notion of horizontal coordination of the STEM education is critical. I have a couple of questions - are we assuming that the national science ed standards that were developed in the '90s are out of date? When we talk about developing national content standards, they may not have gone as far.

So I'm wondering how far back do we want to go? I don't think that we are starting at ground zero. They were developed by the National Academies, I believe. My

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suggestion is that the National Academies might, in fact, be the lead - or should be at least considered as one of the lead federal agencies and professional organization - well, we have that, pardon me, on number two.

So my big question is there are standards that have been developed for K-12, what is our assessment of what is there and I think that we need to address it. And the other is something that I mentioned the last time, is we still are letting higher ed off the hook here. We are saying that it is basically okay; it is everything that happens before.

MS: Okay, thank you very much, Dr. Gallagher. You raised a question, are there any very direct responses or comments related to the question that Dr. Gallagher raised?

FS: Yes, and thank you, Dr. Gallagher, for pointing that out. I think the mathematics group has gone through and they've actually identified what they call focal points within the continuum that the students - that the students need to know and understand in order to move on to the next grade level.

I agree with you that what the national science standards and the benchmarks have been developed already, I think that maybe if we put in there or how we can stake that so

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that we go back and have them re-examine the national science education standards. To perhaps bring them in line where they are stated as a grade level specific standard or focal point, whatever they want to call that.

So that there is no question when the states usually base their documents off of the national standards, so that there is no question that says that in second grade or fourth grade or fifth grade, this is what we would like the students to be able to know and understand. So I think that you have really illuminated that, and we need to pull that out and state that very clearly, if everyone is in agreement.

FS: Yes, because their science content standards weren't be grade level, they were by like primary, they were K-4, intermediate, 5-8 and then 9-12 around physical science, life science. So if we want something more, that is individual grade level yes, they would have to go back and address that.

FS: And I think that you are exactly right. Being able to - in my experience, what I have seen is that you've got that great 1-4 grade span and in one state, it may be in third grade. But if the student moves to another state, that may have been covered in second grade and so the student never

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gets that fundamental development block that they need in order to understand that concept. So we need to specifically state that in a way that is very clear.

FS: I think that right now, it reads - one interpretation could be we don't have any standards out there. I know we don't mean that.

FS: This is Maritza and I would just like to add on the question of the higher ed. Because we talk about the standards, but if we have to somehow address that the standards that exist need to be known K-12 the 20th. The teachers that teach teachers, the faculty, many times have no clue of the standards and say they are not part of what we do. So how do we encourage that these standards be known and used to prepare the teachers and to really be part of faculty development.

I am sure that Dr. Gallagher can help me in this a little bit more and I am talking from my teacher ed piece. But that is where it falls apart, in the higher ed is that the schools can have all of these standards, but it's not necessarily what the teachers get helped in understanding. That is just my response in relation to the higher ed. And in relation to the other question related to Joanne's comment, I think that when the national standards came out,

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I think that the benchmarks document was what helped break it down into what is more specific to grades. So we might want to look at the standards and the benchmarks - that is all that I have to say.

MS: Thank you. I know that we are in the midst of going through this first item, but I think I heard our esteemed co-chair, Dr. Letterman?

MS: Our esteemed and late.

MS: If I could just offer, Dr. Letterman, we have just begun the discussion. We are going down through the order of the commission members who are on the call discussing major goal number one. What I would only suggest to you is that we - I think if we are about halfway through and if we could finish that and then perhaps offer you an opportunity to make some opening comments, Dr. Letterman, at that time?

MS: Yes, let me just comment on standards. My strong impression for many, many schools when I visited yesterday is that the trouble with the standards is that they are so vague. Unless we can sharpen the standards, they are not going to perform what we want them to, especially if we head towards, as I seem to think we are, towards a more national, coherent set of standards. We've got to work them so that they are more useful in the schools.

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MS: Thank you, Dr. Letterman. We had another commission member come on board?

MS: Yes, Jim Gentile.

MS: Thank you, Jim.

MS: I am at Georgetown University so I apologize for the echo.

MS: You sound so far away. We will come back to you, Jim, so that you don't get thrown right into this. You would be up right now to comment on major goal number one, but if you want, I will wait until the end of the list to come back to you.

MS: That will be fine.

MS: Okay, then Miss Lopez-Freeman, your comments on major goal number one?

FS: Yes - well, first of all, I want to say I like the strengthening of the overall documents this time around. I think it has more punch than the previous document and then clearly a statement is made in the preface about the recommendations. A couple of comments, and it had to do with Dr. Gallagher's comments on the teacher preparation part of this. I am concerned that or I would say that there are, right now, accrediting agencies for higher education and that is NKAY (ph.) and ENTASK (ph.).

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My recommendation is how do you bring those to be part of this effort? In other words, align them so that you are not putting out a new set of guidelines or a new set of protocols to be followed. But rather that you capture what is out there and to strengthen what is out there, so that STEM education becomes much more focal as schools begin to look at their overall preparation programs. As Maritza said, the teacher providers in such instances are much more aware of what is actually used and needed in schools. So that is one comment. I would like to reconsider the notion of just beefing up the national standards.

The question that I have is how current and appropriate are the standards and the benchmarks as they stand right now and in light of Dr. Letterman's comment right now, to where we want to be 2040 or 2050? Are those the right set of understandings and will they put us or are we in need of understandings that are foundational that include some of them, but not all of them.

So my recommendation or my thinking is that yet again - I'm not saying throw out what we have, but let's take a long, hard look at what we do have, what the academies are calling for. Not only with just the professional

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disciplinary societies, but also with some of the current issues that have come about in competitiveness and to come up with what that content should be and then be very specific about it. I think that is what Dr. Letterman is calling for, specificity that has much more teeth in it for schools and instructional materials developers.

MS: Okay, thank you very much. Dr. McDonald?

MS: I think that I made my comments.

MS: Mr. McCollum?

MS: Just a few comments. One, it is clearly stated there an important point that we are talking about national content standards and not a national curriculum. I think that's clear of what we have here. One of the things that seems to continue to come up in so many of the reports that it seems that we have too many standards.

So if it's a matter of rewriting these standards, who would be doing that, and to shrinking these down to really the big ideas. Or what in the Dot Aylor (ph.) bill as, they refer to it as the core, the real core standards, the most important ones. And then finally, looking ahead to the impact of No Child Left Behind and the possibility of science also being brought in under AYP, that then indeed we would need to be looking at standards at each grade

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level and not just the grades grouped, middle school standards, elementary standards, or early elementary, upper elementary and so on. That concludes my comment.

MS: Thank you very much. Dr. Moss?

FS: To follow-up on what Mr. McCollum said, if we go back on page two under national content standards and do as Joanne and Tim had suggested and put in that we need them to be grade specific. Then maybe on page three under student assessment, we need to talk about suggesting some assessments that are grade specific for those core content standards.

I know that people still don't want to talk about a national test, but I feel like as a practitioner in the field, unless we have a test that really tests those core standards, we are not going to get students to the proficiencies that we really expect from them in STEM. So that is all I have to really say.

MS: Okay, thank you very much. Mr. Pritchard?

MS: Yes, Mr. McCollum is 100 percent right in taking the standards down to a manageable number. But that is not my big concern - I have two or three big concerns. The first one is, in dealing with horizontal, vertical alignment, we had done a thing here in Kentucky called mapping the

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curriculum. That basically this says in grade level two, this is what is going to be taught and when it's going to be taught and the sequence and so forth. In level three, this is what it is going to be and for level four, level five and then right on up.

And it goes right into the middle school and we have now got, in my district, when I left we had done it and we now have a K-12 mapped curriculum, so we know what teachers are going to teach. It keeps a very uniform flow of standards. The problem is that they are so broad. We have discovered that they are a mile wide and an inch deep and we need to do something about that.

The other thing is that I'm hearing here and becoming more concerned with is holding higher education to a more accountable standard, but how do we do that when all of them are like little empires? They have their own little - well, they are just little empires and I don't know how else to say that. When you dig into that and you get into any college inside the university that is not educational, then they basically tell you to butt out, because that is not your business. So we've had that issue many, many times, but that has to happen.

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Let me give you an example of what is happening in Kentucky and I just read this yesterday, that we had 33 percent of our students who were going into college this year will have to take remedial math. That amounts to about \$5.6 to \$6.2 million being spent by parents to get their children up to par with non credit hours before they can actually become available in the universities. If they raise the ACT test, which they plan on doing.

The standards is one of the things that our CPE, the Council for Post-secondary Education plans on doing, if they raise that to 22, that is on an 18 on the ACT, so you folks who understand the ACT know what I'm talking about. Then that would make it about 63 to 65 percent of our students in Kentucky - just in Kentucky - that would be in remedial classes. That is math. My goodness, they don't even want to attack science, because they realize how far. I think, if my comments mean anything - and Elizabeth, I think that my former secretary is emailing you today my document, okay?

FS: Okay.

MS: That should come to you today. If we don't do anything, we've got to have an entrance exam or an entrance way into

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college that is high, but it is uniform across the nation. That is going to take a lot of work. I guess my comments are that I see this as a real, real problem for us and I hope that we can get that worked out in a way without fracturing relationships with the universities. That is basically what I will say.

MS: Okay, thank you, Mr. Pritchard. And now we are back to you, Jim - Dr. Gentile. Do you have some comments on major goal number one? Jim? Oh, we may have lost Jim. So we've gone through the list and as we had discussed, we will come back now to Dr. Letterman. If you had any opening comments as co-chair, now is the time.

MS: Okay, I think I already noted that I felt that the latest version was a big improvement. I think that we are close to something which is meaningful. My comment on the standards is that it is a major problem, especially the comment most recently made by Mr. Pritchard in the remediation problem. The remediation problem is going to be with us and it is the major problem that we see in our dichotomy between closing the achievement gap and taking care of the more capable students in the nation.

The achievement gap is crucial, looming more and more as our workforce depends more and more on minorities. We've

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got to organize that and it's all a package of how we begin to install coherence in the national educational system. The remediation, I've seen that. I worked about that in Chicago where the high schools are not preparing kids for college. How we urge and manage that is again, I think, going to be a crucial issue.

So I keep coming back and this, I guess, is a broken record to the fact that we've got to, I think, set up a new mechanism. I mean, it's going to take a long time before all of our high schools are producing students who when they graduate can make a choice of what they want to do afterwards, they can get to college. By now, though, we know that so many - huge numbers of so-called minority, but really majority students graduate from high school, do what they were supposed to do, and cannot do college work. It is a major, major problem.

So we can't solve the problem in detail, but I am strongly urging the notion of a mechanism by which the problem will be solved in this nation. I just went through a whole history of the sputnik and when sputnik came, it was such an enormous shock to the nation. Laws that were attempted and couldn't pass. The nation knew about what to do in

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education before 1957 in October, but they could not get the majorities in the Congress to pass the laws that would allow the federal government to help.

There was a willingness of the federal government to support teachers' salaries, building constructions, equipment for schools, all of the things that were thought to be a no-no. But when sputnik came, then all of those, the National Defense Education Act was passed and that was seminal. So we have to look, I think - and then NASA was created and Dolpa (ph.) was created. Systems were created that were needed to solve the problem, and that is what we need now. We need to not only make all of these suggestions because things change, standards will change as we learn more about science.

So I am stressing the overall notion that came up moderately well and it requires, I think, wording, but wording that we can do to stress the fact that this government does not have yet a mechanism whereby all of these good ideas that you've been discussing on the standards can be implemented. We need a mechanism for implementation. That is the kind of main stress, I think, that if we as a group can set up mechanisms for the

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continuous improvement of STEM education, we will have done something brand new.

MS: Okay, thank you Dr. Letterman. Dr. Vasquez, I think that we started with you on major goal one, is that correct?

FS: No, you did not.

MS: Okay, you are the final one, then.

FS: Just a couple of comments. First of all, I would like to agree with what Maria was saying about looking at the standards as not just the core knowledge or the knowledge, but -

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FS: To include that, because I think that you hit on a key feeling that all of us know right now and understand. The other thing that I wanted to say is I would like to withdraw. I had put under major goal one, I had put a D, my big concern about K-6, preparation of teachers and their content knowledge. But I do think with just a little bit of strengthening within the C and the alignment and the preparation there with institutions of higher ed. I think with a little bit of stronger emphasis on that language there, I think that we can cover that within that. So I would like to respectfully just withdraw my suggestion for D.

MS: Okay, very good. Before we move to the next major goal, may I just raise one issue and make a request of the commission? One item that was raised by several of you, I think that Dr. Gallagher referred to it as letting higher education off the hook a little too easy. Is there someone in particular that might like to look at that, that is major goal one, item C, action three, teacher preparation, lead entity, institutes of higher education. Is that the area that was thought that we were letting them off the hook on?

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FS: This is Karen Gallagher. I was actually being broader than just teacher ed, because I thought that we were trying to get more people in the pipeline once they left. That is not just teacher preparation, that is people who might major in the sciences and might go on and do something else, including going on and getting a doctorate. That's what I think we are letting higher ed off the hook.

MS: Across the board.

FS: That includes the teacher preparation.

MS: Okay.

FS: So I would be happy to work with someone, but I would like to get stronger language in there.

MS: Okay - well, perhaps on this next major goal, we can hear some ideas about how we might be able to bolster higher ed in there as well.

FS: Michael, before we lose this, pardon me for interrupting. I don't have down who said about the accreditation agencies.

FS: I did.

FS: Okay, I really think that that language needs to be in there, because - is that Maria?

FS: Yes.

FS: Again, Maria, if you could provide a line or two about those accrediting agencies. I think you are - and quite

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honestly, I had not even thought about it, but I think that that is something that we need to also illuminate within this document.

FS: That is number D or something attached to that, is that how you see that?

FS: It is letter C.

FS: Maybe Maria, you and Karen, if you could email and then work on that piece a little bit?

FS: Can do.

FS: Beef it up.

MS: If I might make one comment on that. Being a practitioner for 34 years and being in spots where I can see the weaknesses here, somewhere we need to be sure that anyone who is teaching in a STEM area needs to major in that area. Now that major needs to be culminated with a master's degree. I propose that this would be the place for me to ask the question.

We have always talked about P-16 and now we are talking about P-20. To me, that is somewhere holding or somehow holding higher education to a little bit more accountability, but let me give you my example of where I'm going. If we are talking about K-6 teachers, and actually we have K-5, but if you are talking about K-6 teachers.

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Mr. McCullum would probably understand where I'm going as a practitioner is teaching now.

If those people in K-6 were required in their preparation to have X amount of hours and X amount of credits and X amount of time spent and mastery of STEM issues and not just methods. Someone gave the example, I believe, in one of the meetings that we were in Chicago where they colored a bunch of bees or something to make counts and they had to color so many red and so many blues and so many greens.

Well, I understand the concept of that with small children, but the point that they were saying was why wasn't that time used for something like taking a science course or a science content course so that they would have a better knowledge of that? Now I will give you an example, one of the things that we have in our elementary schools is we don't have anyone who wants to teach math.

They love teaching English, they love teaching reading, they love teaching art, they love teaching these things. But when it comes to teaching math, it isn't something that they love to do, because they are really ill prepared to teach it. They are even more ill prepared to teach

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science. I think there has got to be some kind of standard at some level that says that if you are going to go into teaching in K-6, this is what you have to have in your preparation.

In 7 through 12, they need to major and they need to be encouraged to have a master's degree in mathematics, a master's degree in science, whatever the science field is. But that is just my, as a practitioner - and I hope that is the direction we are going. The person who said that they wanted to take D out, if you could incorporate it in C, I would agree. But I really believe that has to, I really believe that that is a statement that needs to be made. I think it's a really strong statement and I just think that it needs to stay there or be put somewhere.

FS: This is Maritza, and I just wanted to add a little bit to that. You see, this is where we hit the state differences, because there are some states in the country actually where the results are better. Where the certification for teachers requires that they either get a master's degree or that they come into be certified in the sciences after having had science as an undergraduate.

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And in the states where that does not happen, and we have done the research to look at that, that is where the lower work in students is happening. So that is the linkage, that is the alignment upwards, or the vertical alignment into the higher ed and the certification levels at each of the states.

MS: Thank you - that is exactly what I meant.

FS: And this is Karen Gallagher. Let me just add two things there. Under No Child Left Behind, every state had to come up with standards of what a highly qualified teacher was. That was left to each state to do and in California, you have to have either a major in what you are teaching in, or you have to pass a test that is tied to the K-12 standards here in California. So part of No Child Left Behind turned around and said that you had to be highly qualified, but then left it to each state.

And the second is, when people graduate, whether it's at the undergraduate level or the master's level, to get credentialed, that is something that the state controls. But what the degree is, what it requires to graduate is what the university determines. So we are looking at two different things here, one that the university or the

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college has control over and the other, what the state has control over.

Coming up with language that addresses both has been exceedingly difficult, because there has been lots of groups and organizations that have tried to do that. I'm not saying that we can't take it on, but I'm telling you that it has been done and No Child Left Behind is a good example of where they left it to the states to come up with one standard, because they could not agree in the language at the federal level.

FS: This is Maria. I think that maybe this is where language needs to be inserted in the overall charge to these K-12 councils, because it would be through a state level mechanism that you could bring together some of the credentialing issues that are proprietary to states and make a stronger case for what is needed for the credentials.

The other thing is - here's a reality check. In California, we have a single subject secondary credential that requires a major in the discipline field and a new multiple subject credential that requires a heavy dose of science. And the overall number of candidates applying for

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these are going down now, and it has to do with the burden on students being able to meet the requirements. I think, Karen, that you might add to that, and it is what the statistics are now showing us.

FS: Fewer students are going into education, period.

FS: And part of it is if you were interested in multiple subjects, which was the elementary credential, now the burden of meeting all of the content standards in the state of California because multiple subject teachers - this conversation that we are having about science is the same one that mathematics is having and the same one that English is having and the same one that history is having, and that is discouraging students.

So the tension is how do we get the right level of understanding that we need so that we don't lose our students? And, at the same time, to have the quality that Dr. Pritchard is asking for in terms of a teaching force, and how does that distribute nationally?

MS: Thank you very much for those comments. If I might suggest that - you might want to consider putting major goal number two just to the side for a moment to make sure that you can get to the discussion on major goal three, which I think was a little light at the last telecon, if I am not

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mistaken. Perhaps it would be advisable to now move to the discussion to major goal three, if that is acceptable to everyone.

FS: Yes.

MS: Excuse me, this is Dudley Hirschboch. I have just connected up and I was tied up with PBS interview on science education to this moment.

MS: Well, you should have had them just link into us, that is great.

MS: I did, I urged them to come to Phoenix next week and maybe interview some people on the 19th.

MS: Excellent.

MS: I will email Leon about that, they might want to look into it.

MS: Great. I think that we will go ahead and it sounds like everyone is in agreement and we will start going down the list in alphabetical order again. This time, comments on major goal number three and we will start again with Dr. Boggs.

MS: Yes, thank you. I do hope that we have some time for goal two, because I have some comments about that as well. But in terms of three, again I commend the folks who put this together and I think it's wonderful. I didn't note any

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comment about alternative certification of teachers and we may want to have some comments about that.

There are a number of people coming out of science industry and science engineering who may make good teachers, if we have some audited certification programs available for them. I, of course, would like to ensure that we have relationships developed between four-year schools of education and local community colleges. There are a growing number of community colleges across the country that are developing teacher preparation programs.

Of course, they have the greatest diversity of students, a lot of them that we would like to pursue careers in STEM teaching. I would like to see some kind of statement to encourage those kinds of articulation, the relationships between the colleges of education or the schools of education and the local community colleges. Maybe even going down into the K-12 to encourage people to consider careers in STEM teaching.

One thing that we may want to consider is a practice that is developing in some states now for community college faculty members, and that is mentorships. When new faculty

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come into an institution, they are often assigned a mentor, a more senior faculty member to work with that faculty member. So that may be something that we may want to consider as well. But otherwise, I am very supportive of what we have written for major goal three.

MS: Thank you very much. Dr. Gallagher?

FS: Well, I would agree. I am supportive of it. I think that we need to continue to try and attract candidates, well-qualified candidates into teaching. We need that about STEM and we need that in general - we want well-qualified people to look at teaching as a career. I think that there are programs in place in states, from loan forgiveness to there are scholarships.

I think that we need to take a look and probably some coordinated efforts, a clearinghouse or something where people can go to find out how they might pay for their education, because I do think that is one aspect. I do think that, for me, professional development, we have to invest heavily in that because it's the current teaching force that benefits from professional development. That is our main body of teachers, are those that are in the profession.

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And even as we have retirement who still have practicing teachers who, whatever their education was, whether they thought it was good or not, they still need professional development. So I think that for a lot of change to occur more quickly and more readily, it has to be through professional development opportunities for those who are currently teaching.

And that is the part that I hope that we make clear is that we can recruit good students into teaching, we can try and get them, getting their credential into their first years of teaching, we have to support them there. But we also have to pay attention to people who are currently teaching and make sure that they get the professional development that they need.

MS: Thank you. Jim, Dr. Gentile, are you on the phone? Okay, Dr. Hirschboch?

MS: Sorry I couldn't get on earlier. I would agree that there is plenty of nice, good stuff here in the draft under goal three. But for brevity, and since we will meet soon in Phoenix, I will just focus on the thing that I don't see that I think is important. I don't see something here that is going to cause reporters to write articles that see that this is a big bold idea.

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The thing that I would like to urge is the equivalent of the Peace Corps that encourages young people to get involved into something a little like that with STEM teacher recruitment action number two, but it's not stated in a way that I think would really grab people. As I said before, I think our major untapped resource is the bright students we have.

Maybe many of you saw in the New York Times last Sunday, this education part that talked about the zoomers as if they were a problem - they are a resource. We should empower those kids to augment our teaching, because kids are more interested in what other kids are interested in. That connects up with this interstitial thing that I talked about last time. I really think those two things would make a very big impact. Whether they wind up being adopted or not, they might make people think.

Another thing that we ought to be plugging is more informal science exposure. I just came from this PBS thing in which I know the thing that mattered most was showing them a tricycle with square wheels. They were like, "how can you have a tricycle with square wheels?" Well, it shows you

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the essence of science, that you recognize new possibilities. It makes you realize how does an ordinary bicycle work. Well, of course, when the wheel turns, you are always contacting a new part of the wheel with the flat surface.

The square one works fine if you don't have a flat surface and you just have to curve the surface right so that it has little lumps, little bumps along the way that just - the arc of the bump just fits the length of the side of the square. You work along just perfectly - in fact, you can't go off, it's like a train on a track. It's very striking, and I would think that it teaches people who see it and kids who get to ride it something about science. It opens your eyes to new possibilities, and that is what is exciting about it.

That is what you would like them to understand along the lines that Leon wrote about in the science way of thinking. That's what we want the general population to have. And as I told these TV people, the key thing is that it's not so much a question - although it is vital to have a workforce and all, but this business that in the 21st century should be the birthright of everybody to understand enough about

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science and how it works. Because it's really major human adventure that we all are a part of, whether we want to be or not and that so much of our future depends on.

So we have to find ways that allow kids to take ownership of it, and that is why science fairs and this business that I've talked about before, I think are actually at least as important as what we might do in school. That is the key thing that I would like to say. I won't be able to stay too much longer, because I have got to get back to a symposium that I am taking part in and so I look forward to Phoenix.

MS: Very good, thank you. Miss Lopez-Freeman?

FS: Yes, I think that one comment is what I didn't see here is a statement about teachers, that there is such a thing as a professional development contingency teacher and it is analogous to that same kind of continuum that we implicitly accept in terms of doctors. We acknowledge that doctors come out with a certain kind of knowledge out of professional school, but that practical knowledge comes at the clinic and is ongoing through the lifetime of that practice.

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So as we talked about the major goal three and referring back to major goal two, there is no statement - it's about a continuum, but rather about interventions. I would really like that there be much more a language that aligns to the kind of thinking. That you just don't intervene and fix teachers, but rather that teachers have this developmental trajectory.

The other thing is in trying to look at some of the professional development pieces, action number four, I would really go - and this is the one that talks about the National Science Foundation and mentions the MSP partnership program. That those programs that are encouraged to be developed and supported through the NSF be those that are researchable in terms of proof of concept and scaleable.

It is not clear to me that that many of the programs - key programs with highly localized and conceptualized and successful within a given scenario can be scaleable. So I would really go for the recommendation that we made about a road map that has research and part of the foundational issues that is used to think about those kinds of programs

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that could be used across the country. For now I think that is it.

MS: Dr. McDonald?

FS: Well, I am very glad that Dr. Hirschboch was able to kind of join us for a little bit, because I think that is the piece that is missing for me. Is how do we infuse the informal experiences as part of the attraction and the recruitment. And I did send some comments on that, and I will be very happy to work on language. I think that in the part that comes to the NSF where we talk about both professional development, there are some very open spaces there to talk about the partnerships for math and there has been a lot of science.

I would like in there to very clearly make the statement of the informal, especially informals that have a whole research base. For those informal that I am sitting on has just recently been recognized as a degree granting institution, because people for post-docs wanted to come here. So that we are looking for the knowledge and I'm really concerned that it's not just for teachers, but as Dr. Hirschboch said, it is everybody's birthright to understand this. So I would like to figure out how we talk about it. I don't have the exact words.

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I know that in my comments that I had sent them in, but I would like to ask that at some point that we look at the recruitment of teachers and students through programs that have had coaching, that have had extensive - like the ITEPS (ph.) program. That it is really a career ladder, kids that love all of the aspects of science and technology so that that becomes a source for recruitment. That is where you are going to get part of your brightest that are really hooked into this who then can benefit from the incentives at the colleges.

New York City, the same as Chicago, just recently started the academies for recruiting high school graduates into math and science. So we still have to see that. But those are the kinds of things that they are coming here to the museum to recruit kids from 7th grade, having come in here to after-school programs. Because they are the ones who are doing better in science in their schools, are in the competitions, are in the science fairs, are doing the robotics. It is not happening in the schools, it is happening in the informal.

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So I want to make sure that we somehow include where to attract, where to motivate students from these settings. And the last comments I had was in the definition of teaching or how we appreciate teachers. I think that Dr. Letterman's encouraging of us to look at teaching not as STEM teaching alone, but all teachers really need to be appreciated for the work that we do and how this commission might recommend teaching - STEM teachers, but all teachers to be recognized.

I went looking into the international teacher appreciation kind of thing and was very surprised that the 31st Congress in this country created a teacher's day on the second Tuesday in the month of May. Now we could resuscitate some of these things of teacher appreciation to build up the profession, not always saying that - well, you couldn't get a job of industry, therefore, why don't you go into teaching, but actually, the other way around. So those were my two pieces. Teaching on a broader sense and the informals that offer these experiences for kids and for teachers as recruitment mechanisms. I am finished.

MS: Thank you.

MS: Let me jump in there a minute, because I think that is important that STEM tends to alarm our colleagues who are

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teaching in non-STEM fields and we shouldn't do that. We should maybe admit that STEM is a kind of an arrowhead that is pointing towards radical education and reform of science, but that we understand that in geometry and in history and in literature, they have similar problems. We must somehow in our report acknowledge the fact that we are all colleagues and that all of education is at risk in the current 21st century and we have to work together on this.

MS: Very good, I like that statement very much. Mr. McCullum?

MS: I have three comments related to this section. One, looking for perhaps a stronger wording in the area of professional development on how we can use technology to do that. Particularly in an asynchronous manner. It really becomes an agent for the kind of change and improvements that we all seek. I am thinking in things like podcasting, e-mentoring and so on.

Just yesterday at the end of the school day when I once again had a quiet classroom, I took advantage of one hour of professional development by watching a video podcast of a keynote talk in Dallas back in November. I was taking that professional development at the time of the place of my choosing, and that was very, very convenient for me.

Just as convenient as I am gaining my professional

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development through my ipod while I am exercising - again, it's an asynchronous mode and it is something that we really need to tap into.

The second point would be the - I don't know if this would be written into the document itself, but I know that Dr. Hirschboch made reference to this in his contributed comments that were all emailed to us, and I mentioned this in our last conference. The role of the presidential awardees - we have hundreds of presidential awardees in mathematics and science who have been recognized by the White House, and this is a level of recognition, it is bipartisan.

It goes back to the 1980s and there are hundreds of people that are out there that have received these and another batch will go through this summer. This is a group that we really need to capitalize. These are incredible advocates and real recruiters for the best and the brightest teachers that we are all hoping that do come into STEM education. Once that recognition is received, one really warrants the ear of legislators, policymakers, business leaders - they will listen and it will open doors. So we would be remiss to not take advantage of that pool of resources.

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And a third comment, and this has been touched on already a couple of times, and that is I would like to see in there an even stronger mention in terms of the role of informal education. Earlier in our conversation at other meetings, we pointed this out as perhaps being a real major player in what we are proposing. It really needs to be brought out. Some of the finest professional development that I have received has been in conjunction with museums and with education. They really need to be viewed as just more than tourist attractions and sites of informal education, but major players in terms of professional development for teachers. That concludes my comments.

MS: Thank you. Dr. Moss?

FS: First, if we look at how we are attracting the brightest and best, I think this is one of the places that we can add some stronger language under one of the STEM recruitment actions. I would like to see this with the local education agency and the local businesses, some kind of statement about making STEM educators eleven-month employees instead of ten-month employees, and that extra -

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FS: We are talking about teachers being supported with resources, the first teacher support action. I think that we need to add something here about professional development will be provided for principals and other leaders to recognize and support quality STEM education. Because we still have administrators who write teachers up for doing best practices in STEM education. Somehow or another, we need to talk in there that they need some professional development to even know what quality STEM education looks like. And that is it for me.

MS: Thank you. Mr. Pritchard?

MS: Well, she just mentioned the very thing that I was going to say in terms of the thing that I see missing here in this piece is the issue of leadership. Instructional leadership has got to be provided for our principals. Looking at teacher support action number one, lead entity, the local school districts, I wonder if we shouldn't change that to national state and local school districts and just say that that's got to happen.

Because if we looked at our national school board association, and if that word gets out somehow or another that we could get on the agenda there and say this is

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important to board members, the people in the public schools that are making the decisions for who the leadership is. And then if we could get to the National Association of School Superintendents or the National Association of School Administrators and say the same thing, then you are looking at - it just goes on down to the local principal, the local supervisor and so forth.

I think that is a very important piece that needs to be done is the leadership. Until you convince the leadership, it isn't going to happen anyway. The other thing, and very, very quickly, is I agree with whoever said that we definitely need to stress that there needs to be a mechanism for implementation of our plan. That mechanism has got to happen, I think, through a national effort through the Congress.

It has to be something, I think, that is going to say that we need to manage our high schools a little differently, we need to manage our colleges a little differently. And through that, a big part is professional development of our teachers. We talk about recruiting and all of that, but what about the teachers that we have, how do we retain them? Not only do we retain them, how do we make them

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effective. And if we continue to do the same thing that we are doing, we are going to keep getting the same thing that we are getting, which is not satisfactory.

MS: Okay, thank you. Let's see if Dr. Gentile has come back on line. No? So Dr. Letterman, do you have any comments on this.

MS: Well, again, I am very much totally committed to the notion of professional development. The way I see it, especially the collegial part where teachers sit down together and have time to discuss with each other the strategy. Especially in STEM, where there are so many connections between the disciplines that make the education important. One of the things that that brings up, of course, is the cost.

I mean, if we are going to make an action plan, somebody was going to ask us - well, this professional development sounds expensive, and I think it is expensive. It seems to me that if you are going to really take care of current teachers, teachers that may be coming on and keep on stressing the notion that this is a dynamic process. An electrical engineering degree, is well known, is obsolete after three or four years.

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And it's only a kind of professional development, largely self-generated, that keeps electrical engineers viable for the rest of their lives. So I think that this is going to be, if we do it right, a major cost that we haven't discussed at all. I am tending on Phoenix to put in the missing pieces, because somebody is going to say to us - how much is this going to cost?

My guess is that professional development, done correctly, is a very expensive process. It's like adding maybe 15 or 20 percent of the teacher core - a huge cost, but a valuable and, in my view, an essential cost. I keep coming back to again the action plan and how do we generate out of the words we write, and I think that we've gotten all the issues that are fantastically well stated, that how do we get this into implementation. We have to keep that in mind.

MS: Dr. Vasquez, comments on major goal number three?

FS: Yes, I am going to be sort of the task master here as far as - I've been writing down your comments, Natalie and all of you have been right on target. A couple of things - I'm a little bit concerned about professional development of teachers action five. There are two of those, Maria - that

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one and the one on page nine - there is one on page seven and one on page nine.

If you could have your group, working group take a look at that and maybe find some ways of beefing that up in a way that would really help to increase the funding to National Science Foundation for profession development. I think that one of the things that you said was the development of a continuum. I would really appreciate it if you could capture those words and infuse those somewhere in that, because I think that's a way that NSF could play a role in that.

The second thing is Tim, when you mentioned the technology base, I think that is something that has been omitted. If you could look at where that could be the role of technology or alternate ways of receiving professional development could be in there somewhere so you can get a line or two that captures your language. I think that is something that we need to stress. Maritza, I believe truly what you said. I think that somehow, and I don't know where that fits, and you might take a critical eye and look at where it fits in here with the infusion of the informal

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events. And also where they are doing that, the example of teacher recruitment -

FS: Yes, I will do that, Joanne - with pleasure.

FS: Absolutely wonderful. And Dr. Pritchard, the instructional leader piece that you talked about, I think that we have it in there, but it might be sticking out enough that or popping out so that we really see that. So if you could give some guidance to the staff and to Elizabeth on where you think that exact wording might fit within this section. And Cindy, you had comments about - I can't read my writing, this is bad.

You were connecting the recruitment with the lengthening of the school year for professional development, maybe two weeks at the end of the year. I thought that somewhere we had talked about that, but I don't think it got on to paper, but I think that that is a suggestion. That is a bold statement that we could actually come up with. But I don't know how the districts are going to pay for this, but let's just put it there and then maybe we can figure out cost, etc., or whatever later. So those are my comments.

MS: May I make one suggestion? We've let the sun set on Eisenhower money and I know that if you think about the Eisenhower money, it was professional development for

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science and math. Somehow or another, we've got to get that kind of a - and I understand what Dr. Letterman is saying and what you are saying. If we've got some kind of piece like that and show where something like the Appalachian Math and Science Partnership is working in that direction towards professional development, I think those are actually fundable and they are not as expensive as we would think they would be in terms of actually money. But yes, I think that an important piece is to somewhere or another, to mention the Eisenhower Fund and how it worked before.

FS: I think that you are right, and you have also hit on something else that I have been thinking about. And that is getting first of all, some way that the federal government to come back with those Eisenhower funds. If I am not mistaken, I believe that they were sort of resurrected during the time after sputnik, because they had a long length of time. And then there is another pool of money out there, which is the CTE, and I think it's called Continuous - Cindy would probably know what that stands for.

FS: CTE - that is something and Technical Education, Career and Technical Education.

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FS: Right, career and technical education - thank you. Those funds right now are being accessed by several of our high schools here to help with the training of and getting the skills for math and science for the middle level of students. They aren't at the top, so they don't get in the AP course, but it's those middle level of students. Actually, our whole biotech academy here is being funded with those funds. So I don't know enough about that, but that might be something that we could research that even could be put down in here, because there is a lot of money available.

FS: It's the Perkins bill, and that is where all of that money comes from. They are the cash cow in our district and that is who we go to get money.

FS: So it's the Perkins Bill - I will email you, Cindy, and maybe there is something that we can dig out. The last comment, and I'm sorry to be so long here, under D, I think that we need to, we need the support for teachers, adequate support for facilities, etc. I feel this is a little weak. I think it needs to be expanded. So if all of you would just sort of take a look at that and perhaps maybe we could come up with a little more punch to that, and that is it.

MS: I have a comment, and it has to do with technology and about the longevity of our report. We talked about

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podcasts and technology of some kind. There is another feature which was brought out in the New York Times article, someone referred to as schmoozes about the gifted people. Our children are changing as we grow and watch them because of the environment they have based on internet and all of its ramifications. The concept of multi-tasking arises.

I don't know if we have any experts on this, but as our student body evolves in a 21st century environment, they are changing and our methods of teaching have to keep track of that and understand it. I don't see that again anywhere in our report which really has to be forward looking.

MS: Thank you, all. We are rapidly approaching the end of the telecon here and we only have a few moments left. It seems that we are going to have to - we won't have an opportunity to discuss at length number two. But I wonder, Dr. Boggs, you had specifically mentioned - are you still with us?

MS: Yes, I am.

MS: You had specifically mentioned that you really wanted to make some comments in that regard. Would you like to - everybody isn't going to get a chance, but you are first on the list as well. Would you like to have at it?

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MS: Yes, I would - thank you. I think this is, for me, the most important of the areas because we are losing too many students in these transitions. We know a lot of students coming out of high school are just not prepared for success in higher education and then when they transfer between community colleges and universities or from one university to another, they lose credits or they change their majors or they are just not successful in staying in the STEM areas.

And in particular, we are losing specific kinds of students or segments of students, minorities and low-income students. So I think this is a very important section. We just concluded some research at AACCC that indicates that 50 percent of the nations' baccalaureate degree students or baccalaureate graduates have taken some coursework at a community college. Here is where I think that we need to not let higher ed off the hook, because there are too many barriers involved in these transfers from one higher ed institution to another, whether it be a community college to a university or just one university to another.

We have to insist upon improved articulation agreements so that credits are not lost from one accredited institution

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to another accredited institution. I think that also we should address scheduling classes in a convenient way for non-traditional students. There are too many higher institutions that are geared towards students who were last century students, the students who come directly out of high school, the young students who can go away to college and take a full-time course load during the day.

Well, that is describing a smaller and smaller percentage of the students in higher ed today. I think that we need to do a few things here. First of all, I think that we need some statements that indicate that articulation agreements need to be improved. We need to break down the barriers to transfer and acceptance of credit. We need to have higher education accept the responsibility for scheduling classes in a manner that allows for the participation of non-traditional students, which describes a lot of our minority students, by the way.

So besides simply strong feelings about this whole issue of transitions, high school to higher ed, from one higher ed institution to another higher ed institution. And I think that also in this section, might be an appropriate place for us to mention remediation. I know that we talked about

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that earlier under the first goal, but it's important here as well. So I think that's about all that I need to say right now.

MS: We affirm that. I think that is extremely important and I agree with Mr. Boggs completely. I think that community colleges are going to have to play a crucial role in this achievement gap problem.

MS: Okay. Unfortunately, by just about any clock here, we're getting close here and we've only got a couple of minutes. We're going to have to adjourn, unfortunately, and we won't get enough time for everyone to go the rounds. But what I'd like to suggest, if Drs. Letterman and Vasquez would agree, is that we use a similar approach as we did last time, that commission members provide comments to Elizabeth and she can coordinate the getting them out to everyone else. But we are under a bit of a timeline here that requires rapid input and responses.

If I can share with you all by Friday, the 12th, at a staff level, we are expecting to be able to provide Malcolm, Letterman and Vasquez a revision of this document based on the discussion that we've heard today. Any specific edits and additional language that you all as commission members can provide to us before that time. They will have a quick

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look at it over the weekend, get it back to us with any last minute changes they would like to have made, we will make those changes.

And then on Monday, the 15th, we will send a revised document out to the full commission. I think Dr. Vasquez has gone over the list of assignments, if you will, but anyone is more than welcome and encouraged to also provide specific input. Track changes, specific insertions, specific language would be most appreciated. Thursday, the 18th is our meeting in Phoenix. The goal/requirement at that time, if you want to stay on the board's timeline with this is that you as a commission, as a body, need to approve at least this action plan section of the report as an initial draft to go to the National Science Board.

That draft has to go to the National Science Board on Monday the 22nd. You all need to approve this as a body, you will be together on the 18th and I would suggest that that is your absolute minimum goal for completion in Phoenix. As Dr. Letterman and others have suggested, there is also a significant need to start working on the remainder of the report, including the introduction, conclusion, all of that kind of sections of the report.

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And that there will be an informal writing team of some subset of the commission that will stay in Phoenix Friday morning the 19th to actually do some writing and discussion, not on this action plan section, but on those other sections.

MS: And everyone is welcome?

MS: Yes, absolutely, everyone is welcome. Elizabeth has done a polling and she might want to get some comments on that.

FS: A few people have let me know that they would like to stay for that and please do let me know if that is the case for you, if I have not heard from you specifically.

MS: Just to continue with the schedule really quickly, the board then meets on February 8th, Thursday and so they will be reviewing this document from Monday the 22nd until they meet on the 8th. Dr. Vasquez, who is the liaison, the official liaison to the board as a board member, will report, provide an update, as she always does to the board. They will have this document, they will discuss it, they will provide comments and feedback to you all, which the board staff will compile together and provide to you all as a commission shortly after that meeting.

I would envision then that we're going to be scheduling a number of telecons similar to this, as well as some

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informal drafting and writing to get the report in a more complete format, with all of the different sections. It has to be approved by you all as a draft, as a full report draft that would go to the board sometime before the 15th of March. The board meets at the end of March and at that time, at least as the schedule goes now, the board would review your draft and if they are comfortable with it, they would approve it for release to the public for review. It would still only be a draft.

There would be a public review and comment period and all of those comments would be compiled here by the board staff and summaries and complete comments would be provide back to you all. There would be another revision and then we would move on with a hopeful May timeline when the board meets in May to approve a final report of this commission. So that is just a general timeline for you all to be thinking about. But other than this immediate action of revisions to this action plan section, Dr. Vasquez, Dr. Letterman, are there any other comments that you would like to make or things that need to be done right now?

FS: I don't think so. I think that you've covered it efficiently and quickly. I think that as everyone knows, we are just on a quick timeline, so if you could get those

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in as quickly as possible, we would appreciate it. I look forward to seeing you in sunny Arizona.

MS: I hope it is sunny in Arizona and no snow, but I think that the Arizona meeting then really is a crucial meeting in getting our ducks in line. Again, making sure that our session, our document is bold and will attract attention. Another report sitting on a shelf is not useful to this nation.

FS: I have a question that I may ask from the leadership in the major goal two? I just had a question because of my conversations with the other people in my group. Could we extend the vertical alignment from pre-K through graduate education and society in general? We can plug in those other informal experiences, NSF, Imex, all of those things that happen to the public, the media, that kind of stuff?

MS: I think that is important. I think that we didn't mention that now, but the media and the public are crucial in this issue. If we don't have them on our side, nothing is going to happen.

FS: And our discussions, and also with Mrs. Baker is that somehow if we put it clearly as part of every goal, but very clearly in major goal two and then it says it is about school and it is about society. I wanted to ask you guys

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if we should continue our thoughts and inject some of those comments in that section.

FS: I think that is very necessary - thank you.

FS: Thank you very much.

MS: We are a bit past the end time. I apologize to you all for keeping you on the line, but I know that at least the staff really appreciates the commitment that you all have made and the input that you are giving us and the guidance as well. We will seek to have this revision to the full commission on Monday so that you all can read, review, mark it up and come to Phoenix with specific edits and modifications that you would like to have made to it. Thank you all very much, and that adjourns the meeting.

END TAPE