DEPARTMENT OF ENERGY

HYDROGEN PROGRAM

MANUFACTURING R&D

PRE-SOLICITATION MEETING

FRIDAY, MAY 18, 2007

CRYSTAL GATEWAY MARRIOTT

1700 JEFFERSON DAVIS HIGHWAY

SALONS 5 AND 6

ARLINGTON, VA. 22202

A G E N D A

1:00 p.m.	Welcome and Opening Remarks JoAnn Milliken, Chief Engineer, U.S. DOE Hydrogen Program
1:05 p.m.	FOA Application Process and Anticipated Timeline Jill Gruber, Project Officer, U.S. DOE Hydrogen Program, Golden Field Office
1:30 p.m.	Manufacturing FOA Proposed Scope and Topics Pete Devlin, Manager, Manufacturing R&D And Market Transformation, U.S. DOE Hydrogen Program
1:50 p.m.	Break for Comment and Question Submission and DOE Review
2:30 p.m.	Reconvene to Discuss Comments and Provide Responses to Questions
3:30 p.m.	Closing Remarks/Adjourn

P R O C E E D I N G S

[Time Noted 1:30 p.m.]

[Slide shown.]

MR. DEVLIN: Okay. I've got 1:00 so let's get started.

Welcome to the Pre-Solicitation Meeting for Manufacturing R&D for the DOE Hydrogen Program. My name is Pete Devlin. I'm the Manufacturing R&D and Market Transformation Manager. The meeting's purpose today is to get your input in the most effective way for an anticipated solicitation on manufacturing R&D for hydrogen and fuel cell technologies.

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MR. DEVLIN: The meeting agenda, we will start out with JoAnn Milliken, our chief engineer on the program, who will provide some opening remarks and an overview of how we came to this meeting. Then Jill Gruber from the Golden Field Office will describe the FOA application process and our expected timeline. I will provide the draft topics that we've come up with for the solicitation and some particulars about how we would like to conduct each of the projects. And at this point we would like to have your verbal questions

and we want to answer those for the process.

So Jill will be up here. And we think this is probably the smoothest way to handle it. The general process questions could be answered at this point, 1:50. Then we are going to hand out these note cards and have you fill out the note cards with a comment or input or even a question on the topics themselves. Then turn those in to us and you can take a little break, go for a walk or something, while we sort them out and collect them. Then we come back here at 2:30 and we go through what our responses to your comments, questions, input or what have you. So that's how we want to work it. We think that's the best way to get your specific comments addressed and get on with the solicitation as quickly as possible.

A couple other things. This is a public meeting. It was registered in a Federal Register Notice and also it's our procedure to record these meetings. So there is a recorder over here, Cindy Thomas, who is going to be transcribing all the questions on a non-attributed basis. Your names will not be included in transcription. And the handout we are going to give you with the topics, the proceedings

here as well as the transcript of the questions and answers will be posted on the web, probably next Wednesday or Thursday. So that's how we want to handle it in terms of how to run this meeting.

Any questions so far?

[No response.]

MR. DEVLIN: Okay. All right. Let's go ahead and get started. I would like to introduce JoAnn Milliken our chief engineer to welcome you.

MS. MILLIKEN: Good afternoon. We've been planning this manufacturing initiative for -- this manufacturing effort for about two years. This effort is at the intersection of two Presidential initiatives, the Hydrogen Fuel Initiative which is spearheaded by the Department of Energy and the goal of which is to develop commercially-viable hydrogen and fuel cell technologies by 2015 and the President's Manufacturing Initiative which is spearheaded by the Department of Commerce and the goal of that is to enhance manufacturing in the U.S.

In July of 2005 we held a workshop to begin the process of identifying the R&D priorities for this manufacturing effort and since that time we have been

talking to a lot of companies to refine those R&D priorities. And so the solicitation topics that Pete is going to present will be a reflection of that activity over the past two years. There are really two major objectives for this effort.

First of all to reduce the cost of hydrogen and fuel cell technologies by enabling high volume manufacturing processes and number two, to develop a domestic supplier base. And as I see it, we have two major challenges for this effort. Making this a value-added effort while the technologies are still developing, the fuel cells of today, the designs for the fuel cells today may not be the fuel cells that ultimately end up in the cars in the showroom. And it's really, really challenging to address manufacturing when we really don't know what the end point is, what the fuel cell or the MEA is going to look like.

Then the other challenge is to make this a value-added activity for most of the community, the majority of the community rather than individual developers. So we have struggled with those two challenges over the past two years and we think we've

come up with something that addresses those and makes the most sense. So that's what Pete is going to present. We've spent a long time getting feedback. This is another feedback process because we see those as two difficult challenges. So, with that, I'm going to turn it over to Pete so that he can get into the nitty-gritty here.

MR. DEVLIN: Next is Jill.

MS. GRUBER: Oh, sorry, Jill is going to get into nitty-gritty.

[Slide shown.]

MS. GRUBER: I am Jill Gruber with the Golden Field Office. For those of you who don't know much about the Golden Office, it is located in Colorado and it is the Project Management Center for the DOE Office of Energy Efficiency and Renewable Energy. Besides providing technical field project management, we also provide for administration of EERE awards.

The DOE points of contact for the manufacturing funding opportunity announcement will be myself as the project officer, Bob Kingsley as the contract specialist, Stephanie Carabajal is the contracting officer, and Pete Devlin is the

headquarters contact.

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MS. GRUBER: The information that I am presenting today is an outline of how the funding opportunity announcement may be structured. It can change, so please be sure to carefully check the funding opportunity requirements once it is posted.

[Slide shown.]

MS. GRUBER: The manufacturing funding opportunity announcement will have multiple topics in the hydrogen storage and fuel cell areas. Preliminary applications will be required which will be reviewed and evaluated to narrow down the number of final applicants. If an applicant is applying for multiple topics then separate applications will need to be submitted for each topic. The preliminary application will consist of the Standard Form 424 which provides business and budget information and a project narrative that will be limited to seven pages.

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MS. GRUBER: It includes a cover page, technical summary and technical proposal. The technical proposal will need to address the evaluation

criteria within the funding opportunity announcement and needs to include information on a pre-design analysis. The pre-design analysis should examine the cost reduction that will result from the proposed technology compared to current manufacturing technologies. If the pre-design analysis is completed prior to the application submission, then the results of this should be included in the application. However, if this has not been completed then a phase one should be included in the application. During the phase one the pre-design analysis will need to be completed with a go/no-go decision point based on the results of the analysis.

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MS. GRUBER: The final applications will be by invitation only. They should also identify the topic area within the title and they will include budget information, a project summary and a project narrative with certifications and other business forms.

[Slide shown.]

MS. GRUBER: The project narrative should provide a clear description of the technical concept and how the work will be accomplished and needs to

address the criteria that will be used by the reviewers. There will be a 20-page limit on the length of the narrative. The statement of project objectives, work plan, and schedule will be included in the application as attachments to the narrative. They should include at least one go/no-go decision point. And if the pre-design analysis is being conducted as phase one a second go/no-go point may be necessary to evaluate the progress of the project.

[Slide shown.]

MS. GRUBER: The applicant should also include information on the project's participants, facilities, and equipment. These will be included as appendices to the project narrative.

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MS. GRUBER: There will be three evaluation criteria that will be used by the reviewers. The technical concept will be weighted by 50 percent. The work planning statement of project objectives will be 30 percent and qualifications and facilities will be 20 percent.

[Slide shown.]

MS. GRUBER: The first criterion technical

concept will evaluate the perceived value of the project in advancing manufacturing technologies. The clarity of understanding by the applicant of fundamental principles and limitations and the degree to which barriers are identified and addressed within the proposed work. The likelihood of overall success will also be evaluated.

[Slide shown.]

MS. GRUBER: The second criterion is project work plan and statement of project objectives. The reviewers will evaluate the clarity and completeness of these documents including the task structure and schedule and appropriateness of go/no-go decision points as well as the criteria that they are based on.

[Slide shown.]

MS. GRUBER: The third criterion is qualifications and facilities. The reviewers will evaluate the experience of the proposed project participants and their ability to perform the work as well as the adequacy of the proposed participation by team members and use of their facilities. The reasonableness of any requests for new equipment or facilities will also be evaluated.

[Slide shown.]

MS. GRUBER: All individuals who are involved in the evaluation process must sign confidentiality and conflict of interest certifications. This includes DOE and Lab personnel as well as any other people who will read or review the applications. Proprietary information can be included in the proposal, but should be clearly marked.

[Slide shown.]

MS. GRUBER: All applications will go through an initial compliance review to ensure that the required materials have been submitted and that they do not exceed the page limits. If any of the submissions do exceed the page limits they will be truncated at that page limit and additional pages will not be reviewed. All applications that pass the initial review are evaluated by at least three independent reviewers who provide written strengths and weaknesses and score each application according to the evaluation criteria.

[Slide shown.]

MS. GRUBER: The score strength and weaknesses from the reviewers are compiled and the

merit review committee meets to develop consensus scores, strengths and weaknesses. The merit review committee establishes the selection range and recommends applicants in their report.

[Slide shown.]

MS. GRUBER: Selections are made by the DOE selection official who factors in program policy factors as appropriate. The program policy factors are not mandatory, but they can be used by the selection official as necessary to advise the project rankings. The program policy factors will include past performance, topic and technology diversity, best value to the program, and the proposed cost share being above the minimum required.

[Slide shown.]

MS. GRUBER: We are planning on issuing the funding opportunity announcement in July with preliminary applications due in October and final applications due in January. Of course, the schedule is dependent on future appropriations and may be delayed if there's a continuing resolution at the beginning of next fiscal year.

[Slide shown.]

MS. GRUBER: Barring these circumstances, award selection would be complete in March with negotiations taking place in April. When the manufacturing funding opportunity is posted on Grants.gov it will include all the information that I discussed here today. So please be sure to review it there.

[Slide shown.]

PARTICIPANT: Do you mean January 2008?

MS. GRUBER: Yes, January 2008 and February 2008. Sorry about that.

Pete, would you like to come up?

MR. DEVLIN: Okay. Now, we get into the real nitty-gritty. I want to talk about the topics. Can our support people start giving the handouts to everybody? The handouts you are getting are the descriptions, the draft descriptions of the topics. They are intended for you to be able to follow along and also facilitate your written comments. With the written comments, if you could -- if it's specific to a topic, if you could identify the topic number, you know, T-1, 2, 3, et cetera. It will make it a lot easier for us to collate everything and formulate a

response in a short amount of time.

[Slide shown.]

MR. DEVLIN: Okay. Hopefully everybody is getting them. The next thing if our support people can hand out index cards. And I hope you all brought pens. We have some spares around here. If you don't, you can just come up here and grab one of those pens. So, I'm going to go over the specific scope and topics and basically lay out the kinds of projects that we would like to have proposals on. Then we are going to try this. We will try for verbal Q&A on the process that Jill just described and any particulars you have on that, and written questions for the topics that I'm about to go over. Everybody with me?

[No response.]

MR. DEVLIN: Okay. I think it will go a lot smoother for everybody. This is, like I said, a public meeting and you can come and go as you please. If you just wanted this for information, feel free to leave after my presentation. You don't have to come back. You could give us the comments and leave too if you have to catch a plane or something. But if you want to have resolution to your comment, you've got to stick

around.

[Slide shown.]

MR. DEVLIN: Okay. We're going to start out with -- first of all, this is all about PEM, let's make that clear, Polymer Electrolyte Membrane fuel cells and the components thereof and how to manufacture them a lot cheaper than they're manufactured today. The current status is around $3,000 to $5,500 per kilowatt. We've had quotes from fuel cell developers for forklift trucks in the $3,000 range and $5,500 for emergency backup power. That's where those numbers came from, those are actual quotes.

We know we've got to get down to something much lower than that. The actual 2015 target is $30 a kilowatt. The current status for those of you were at the annual program review was described as $107 a kilowatt with very high volumes, 500,000 units a year. Well, we all know that the industry is not there, production volume levels are considerably lower than that. Very low volumes and high attrition rates, high defect rates. So this is all about improving the technologies for those very high rates.

I'll just say one thing about rates. If

you're thinking about proposing on a new process, you don't have to say, it's 500,000 units and it will produce this many -- it will result in this many dollars per kilowatt. You could pick an interim volume, that's fine. In fact, we heard a couple of cost estimating discussions about these interim levels being 30,000, being 100,000, being 200,000. So that's perfectly fine.

Anyway, so the whole goal of this is to get closer to that $30 a kilowatt. If we were very successful I would be ecstatic and I think JoAnn would too if we actually had proof positive you can get to $107 a kilowatt and let the material people worry about getting it all the way down to 30.

[Slide shown.]

MR. DEVLIN: Okay. First topic, alternative electrode deposition processes. We are dealing with the CCMs and the GDEs, the Catalyst Coated Membranes and the Gas Diffusion Electrodes. Currently because we are at low volume they are not scaled up. We are not convinced that the current techniques are the best ones for scale-up, high-volume manufacturing. So this is all about novel processes for deposition. Things that

aren't typically done now that are still being looked at in labs like ink jet deposition, liquid ink, maybe even some kind of a novel particulate dispersion technique that none of us are familiar with. The whole idea is to get a better uniformity on the electrode layer and, you know, of course, reduce defect rates and most importantly lower the process time. So that's what this is all about, trying to scale up in any fashion that we can to get close to those targets we need.

[Slide shown.]

MR. DEVLIN: So here's what we're thinking the project ought to include. First of all, an evaluation of alternative processes and the current processes; the recommended alternative process that you would like to develop; design study to determine how feasible that is and are there any manufacturability issues including things like environmental issues, if there are emissions as a result of this process or some wastes that would need to be disposed of. And then lastly manufacturing costs. You will see in your handout, I gave you kind of a summary of the cost elements we think are the most relevant. The most

important thing that I would like to stress there is that those cost elements are consistent with the cost estimates that we're doing for the technology today through TIAX and DTI. So we need some consistency to roll whatever results we get out of this topic, roll those results into our cost estimate.

We're thinking that we want to exclude automated equipment. As JoAnn said, we want to make this kind of a level playing field where everybody gets something and you can pick your automated equipment after your process has proven to work when you decide exactly what product you're going to actually manufacture. So we're thinking automated equipment comes later. This process should precede any selection of robots or any other kind of automated equipment.

Okay. Because we're already doing MEAs out in industry we don't think this should be the rock-bottom cost share, 30 percent. This is a novel approach is what we are after. But there are already processes in place and I'll go through the rest in a summary chart.

[Slide shown.]

MR. DEVLIN: Novel MEA manufacturing. Okay.

What we mean by that is we know how to laminate electrodes onto membranes today for three layers -- three-layer membranes, that's in production or manufacturing volumes now. What we are after is something that nobody has really thought of in terms of how do you actually put together electrodes and membranes in a more effective way to reduce the costs. Are there alternatives that nobody has tried yet? So much like topic one you start out with analysis of current manufacturing processes, the roll to roll kinds of laminated processes that are currently being used would likely be the thing you would want to have as your benchmark and then look at alternatives. And I'm not going to say what those are because I don't know what they are. I'm hoping that you have some ideas to get those, you know, the costs down and the durability up. That's part of this. We want to build products that last for thousands of hours. So if you just had a faster laminated process, you're not doing the technology that much good. You're not doing it any good in fact. So, I want to stress that durability targets that we have in our program are something to be considered in this kind of project.

So, again, a design study of the feasibility and manufacturability of this new concept. Then we want you to figure out how to do some kind of a bench scale test that shows that this would actually work. And much like topic one, we want a cost analysis and it needs to be consistent with the cost elements that are currently in place in the program cost estimates through TIAX and DTI. This is a 20 percent cost share. We don't think -- well, let's put it this way, we don't have a clue what this new process -- what this new approach would be. We know that people put MEAs together every day, but we are looking for something very novel here. It's not just an incremental engineering kind of an effort.

[Slide shown.]

MR. DEVLIN: Okay. Conditioning. It's been identified that conditioning of cell stack that's been assembled is a significant cost driver. We've seen estimates in some of the presentations today in fact of between five and 13 hours for conditioning. If there's anything wrong with one of the cells you've got to take it apart and find out which one it is, put a new one in and try it all again. So it's a very time-consuming

process.

This one is kind of out there. If we are really going to compete with internal combustion engines, we would be interested in your ideas on dramatically reducing the conditioning time and obviously the cost of getting through a conditioning step or even eliminating it. If you buy an internal combustion engine there's no conditioning of the engine. They tell you in the warranty, you know, go easy for the first 500 miles or something like that. So we are not looking for that. But we are looking for an approach to possibly even eliminate the need for conditioning as a stack. So, you know, the specifics on this are design concepts that, you know, do what I just said. And each step needs to be explained in exactly how that is going to be done and then there will probably be a go/no-go at that point. Then you go forward with an experiment and provide the test data that shows the reduction in cost of conditioning.

So because conditioning is done a lot and we are just looking at reducing the current process or eliminating the current process, we didn't hit the rock bottom industry cost share. It's 30 percent is what we

think is appropriate.

[Slide shown.]

MR. DEVLIN: Process modeling and stacks -- I mean, process modeling for stacks. I wanted to point out that this is the one that we think really addresses the need to be flexible while the technology is still being developed. We need models that can do DFMs, design for manufacturing, DFA, design for assembly, for this technology that is actually still being developed. What we have today for certain thickness of electrodes on an MEA and our models may not be what we have; in the future it may not be the same material even. So we've got to be pretty flexible in how we go about identifying ways to design for manufacturing knowing that the design and even the research before a design is evolving.

So there are some things out there. We saw that earlier today for anybody who was at the annual program review that are specific for fuel cells and DFM but a lot of things don't really carry over from internal combustion engines. We think there is still a need for working models that demonstrate cost and quality differences when you change different steps or

Comment [MSOffice1]: Aren't we talking about things currently applying to internal combustion engines but needing to carry over to fuel cells?

different designs. And we need to have that kind of model really in the public domain to have everyone get up to speed on what could be done with the technology as it evolves.

So, things that we think -- this is very similar to the other topics -- that are appropriate are, you know, you've got to start out with a benchmark of the current processes and how people are doing it and then look at ways to get this to work in an entire stack. And develop a model that will enable quick changes in the base design that would be appropriate for any new materials that are indtrouced as a result of research or any breakthroughs. We don't know of any specific models that do this, so we're suggesting a minimum cost share of industry at 20 percent.

Comment [MSOffice2]: Shouldn't it be "introduced" instead of "induced?"

[Slide shown.]

MR. DEVLIN: Okay. I guess the next topic is all about building some hardware. And it's really -- it's not a model, it's not a test. We need to have better quality control measuring devices for stacks and really fast leak test equipment developed specifically for PEM MEAs that would be appropriate to substitute for internal combustion engines. This is probably a

good time to bring up that these topics are not solely for automotive. The goal is to compare against internal combustion engines. We all know that they are used for things like GEN sets and smaller power requirements. So it doesn't have to be directly compared to automotive.

Okay. So right now the current state of technology is each one of the stacks is tested manually one at a time and test equipment is expensive and ties up a lot of time and space for performing the test. So we are looking for ideas and designs for equipment that would be low-cost, quality-control measuring devices for the stacks to make sure they're aligned properly and there's no seal issues or what have you; rapid leak test equipment to check the seals and make sure that there aren't any issues after the stack has been assembled. Rather than -- this is one idea we had -- coming up with automated cell stack technology. Well, that should come after this. If we are successful here, there's a lot of people, and some of them are probably sitting here with us right now, that know how to automate a good process. So we're looking for 30 percent cost share from industry on this.

[Slide shown.]

MR. DEVLIN: Okay. The next topic area is on-board storage. So that's what we have for PEM fuel cells. Right now to get the kind of early deployment that we are after and to enable fuel cell companies -- manufacturers -- to get their products faster to market, we really need inexpensive, you know, high-energy density storage systems. And we may even need that for initial conversion of, you know, mobile systems including automotive or light-duty vehicles. There is no system that meets the requirements of this program currently. Although a 10,000 psi gaseous system can come close. Now, you know, we could use the 10,000 psi. I know a lot of industry manufacturers are interested in that. But we went out for a quote and we got $240 to $420 per kilowatt hour. Well, our goal is $2 per kilowatt hour by 2015. So we've got some work to do, to say the least.

This is a technology that's already been commercialized in very low volumes in very small niche markets. But to get anywhere close to that $2 we think it's going to require a lot of manufacturing R&D.

If we got close to the current high volume

number that I heard earlier this week of $18 a kilowatt hour, I think we could call this a complete success.

[Slide shown.]

MR. DEVLIN: Okay. So this topic we are kind of picking a winner here in terms of the technology. And it's just an interim winner. All the low pressure technologies that have a shot are not included. Those are all in research labs. But a composite -- carbon composite storage tank could be made a lot less expensive in a number of different ways. So we are looking for a dramatic reduction in costs and the time necessary for producing these.

One of the things under "to be addressed" that's a little different from this topic is we're also looking for precursor materials. The current precursor material is about 20 or 40 percent higher than what we think it could be if there were some things investigated -- also in very high-strength carbon composites of around 700 ksi.

Then once you get that precursor and you figure out a way to get the carbon in, in a way that doesn't require very much of it as providing that kind of strength, you go to the actual winding and placement

of this material and how can we do it better? Right now it's done on a mandrel, it's done on this little machine that rolls, and rolls, and rolls for hours and hours and days and days. And we think there's got to be a better way to do this. There has to be a better way if you're going to do 500,000 of them a year.

We would like to see a cost model in any proposal that describes this process in a stepwise fashion that explains how it's better than current stated technology. And any new technologies or processes that would reduce the overall cost of winding and actually putting these tanks together would be appropriate. Then actual lab work -- engineer scaled tests for a storage system to show that it's actually got the kind of pressure that we need.

One thing that -- this was another one that we said, if you figure out the process then somebody -- and maybe it's you -- can figure out what the automated equipment is to enable that to happen. So, you know, you could assume some things in terms of the automated equipment. Just tell us what you're assuming and why in your lab testing, and we'll be satisfied. We are not here to develop products. And we think you cut

across the line when you say, all right, now what are you going to use for the automated system? Well, you've got to have a product designed to really do that. So we are going to stop short there and just you explain to us what kind of automation would be appropriate and how you would proceed and why. And then that's enough, I think, for people to start developing it. And it might be you.

[Slide shown.]

MR. DEVLIN: Here's a summary of the topics in case you weren't following along. But you do have the handout. First of all the total DOE funding is up to $48 million and this project will be three to four years in duration starting next year. And this is just a summary of the total, but if you looked at the cost share, you're up around $61 million total for this solicitation. There are a couple things that are not in this topic. That's it for the topics, there are six of them. One of them is the balance of plant for fuel cells. A lot of people think that's still an issue. I think I agree. But we are seeing some improvement there already without any government support. So we don't see a need for government intervention in

development of balance of plant equipment right now. So our estimators are showing us numbers that the costs are coming down and more specific products are being developed for PEM fuel cells. So that's one thing.

Another one is no production. No hydrogen making technologies. There's a couple reasons for that. First of all that's only going to be required for automotive when you need 1,500 kilograms a day to fill vehicles. And we are still thinking we're a ways away from automotive. It may be appropriate five years or four years from now to do a manufacturing solicitation for a lower-cost natural gas reformer or ethanol reformer, but we are really not there and we only have so much money to work with. In fact, this is kind of stretching it over the four years. So we're going to shy away from that. And also some of the more specific technology like solid oxide APUs, well, that might be an early market. But it's not towards the goal line of what we're trying to do in automotive for the long run so we kind of left that out too. All these things might be in if we had a lot more money. But since we don't, we just picked the stuff that we felt was critical and we absolutely have to have some early

success to help nurture some of these early markets.

Okay. So in summary it's all about reducing the costs, you know, costs, costs, costs, that's it while we're still developing the technology. That's where it gets kind of tricky, how do you do that? We're supposed to wait for the technology. Well, there are products out there, point out some ways you could benchmark or use that as a starting point and to improve that because some of the technology development will result in no change to the current designs that are being manufactured. And all this should lead to a better supplier -- U.S. supplier base. That's a big kind of indirect benefit of this. We want to develop manufacturing capability in this country and to build up the supplier base so that when we're ready for the big applications like automotive we've actually got a base ready to be mobilized.

Okay. I think that's all I had to say. Why don't we ask -- get some questions in terms of the process that Jill described and then does everybody have an index card and something to write on? If you want to ask a question, provide input of any sort like, you know, your cost share is way too low it should be

much higher.

[Laughter.]

MR. DEVLIN: Probably not going to say that.

[Laughter.]

MR. DEVLIN: Whatever it is, put it on the card and please identify the topic. And then, you know, like I said, we'll collate it and figure it out and come back in about 40 minutes and give you a response. And then if you still have a question or an issue or input, you know, give it to us verbally. Are there any general questions?

PARTICIPANT: Yeah. What kind of organizations can apply for these projects?

MR. DEVLIN: We're thinking that it's really up to the proposer which would include, you know, industry, manufacturers. It could be automotive tier one, two. It could be anybody involved with this kind of work. It can be universities and it can be national labs. You could have a nice team of all of those if it makes sense for you.

PARTICIPANT: It was mentioned a couple times [indiscernible].

MR. DEVLIN: Right.

PARTICIPANT: You mentioned earlier not necessarily all automotive.

MR. DEVLIN: Right.

PARTICIPANT: Not necessarily all automotive So it could be for stationary?

MR. DEVLIN: Yes.

PARTICIPANT: The solicitation is just for PEM?

MR. DEVLIN: Yes, it is just for PEM. The question is, is this solicitation just for PEM? And what we are trying to do is get our cake and eat it too. We want to help enable the early markets for PEM to pave the way for the big markets, automotive.

Yeah, solid oxide is done on the SECA program at NETL in the Office of Fossil Energy. So that's an opportunity there.

PARTICIPANT: What responsibility will be in the contracting? And in particular will this be let under OTA (Other Transactional Authority)?

MR. DEVLIN: We're going to leave that open. We're going to say OTA could -- you can use -- you answer that. I think I know the answer, but, Jill, do you want to answer that? I'm going to say, the way we

left that was you could propose to have OTA guidelines.

MS. GRUBER: Yes, that will be described in the follow-up. It will be described in the follow-up when that's issued, but it will probably be both.

PARTICIPANT: It will be what?

MS. GRUBER: Both (types of agreements).

PARTICIPANT: Do you mean TIAs (technology investment agreements) or grants?

MS. GRUBER: Yes, that or a normal cooperative agreement.

PARTICIPANT: What?

MS. GRUBER: Both. Both types (of agreements).

PARTICIPANT: Both.

MS. GRUBER: Yes.

MR. DEVLIN: Okay. It can be either or, I think, or both.

[Laughter.]

MR. DEVLIN: Either or, is that correct?

MS. GRUBER: Yes, either or.

MR. DEVLIN: Okay. What's the next question?

PARTICIPANT: Can National Labs be partners?

MR. DEVLIN: Sorry, can you say again?

PARTICIPANT: Can National Labs be partners?

MR. DEVLIN: Yes. Again. In the yellow shirt back there.

PARTICIPANT: [Indiscernible].

MR. DEVLIN: Behind you and then you. Okay.

PARTICIPANT: Can cryogenic liquid tanks be proposed or only gaseous tanks like the Livermore approach?

MR. DEVLIN: Yeah, we're after a cheap gaseous tank here of 10,000 psi. We haven't really thought too much about that, to tell you the truth. If you could get to the kind of numbers that we have --

PARTICIPANT: So you can propose cryogenic liquid tanks?

MR. DEVLIN: Yeah. Sorry, give us a -- yeah, we're going to --

MS. MILLIKEN: The solicitation is limited to high pressure storage because we're not doing liquids because of the energy penalty associated with liquefaction. Because of the energy penalty associated with liquefaction. And you mentioned the Livermore approach. The Livermore approach is still too bulky for feasibility. So I would say that until that

technology is reduced in size and weight that it doesn't make much sense to pursue manufacturing at this point. Also, it's not clear if the vehicle manufacturers are interested in the technology enough to justify developing manufacturing for it.

MR. DEVLIN: Okay. Thanks, JoAnn. Just general questions now. The topic questions, put them on your card and we'll answer them in 40 minutes. You were next.

PARTICIPANT: So are you planning on having the final applications due in January?

MS. GRUBER: Right. So that when we receive the preliminary applications we will have to go through the whole process of reviewing the merit view and all that which should take about two months. So, you know, this is an approximate timeline. It really depends on the number of applications that we receive. If we do need more time then it would be fixed in February if needed.

PARTICIPANT: So there will be enough time for applicants to put together their final applications?

MS. GRUBER: Yes, we'll have enough time in

there for people to complete their applications.

MR. DEVLIN: Now, this verbal Q&A is only for the process, not for the topics. I really want to have it done the way we described it where we have them write down on the topics. Go ahead.

PARTICIPANT: Is JoAnn going to hand out what she showed us?

MS. MILLIKEN: No, there's not a handout for that part.

MR. DEVLIN: It will be on the web with the rest of the stuff. Next one.

PARTICIPANT: Can our university be prime?

MR. DEVLIN: Yes.

Any more general questions? Go ahead.

PARTICIPANT: When you put out a solicitation.--

MR. DEVLIN: Tom?

PARTICIPANT: When you put out the solicitation will there be a requirement to have industry be the prime?

MR. DEVLIN: No, there won't be requirements, but we may say something like it will be encouraged to get the best of each type of business or organization.

Okay. We want to do these cards so that we don't -- two things, we don't answer the same question five times and also we want to have time to kind of caucus on it if there's an issue and make sure that we give it proper disposition. So if you could fill out your cards and hand them to Andrea and Joe and then we'll take a 40 -- we were planning on a 40-minute break and then if you care, you can come back, and if you don't, you don't have to. If you want to hear what other people are thinking, you can come back and we'll answer the questions, say what were thinking we're going to do about it and if you have further questions it will be verbal at that point, okay. So why don't you hand them. I guess we're right on schedule. 2:30. Come on back at 2:30 and we'll answer your questions that you wrote. Thanks.

[Recess taken at 1:47 p.m.]

MR. DEVLIN: Okay. Everyone come in who wants to come in as quickly as possible. Some really, really good input. That's my take on it. We are going to go through all of them. There are some general and process ones so Jill is going to cover those. There are some basic program overview ones and JoAnn is going

to cover that and I'll do the nitty-gritty topic by topic. Okay. Go ahead.

MS. GRUBER: Okay. So the first question was will grants.gov be able to handle the volume of proposals? We don't anticipate any problems. Please be sure to submit your applications in plenty of time so if there is any problem we have time to work with you to figure out what's going on. And also, please be sure to print a confirmation once the application has been successfully submitted just so that you do have that.

The second question, is it permitted to use foreign country based suppliers and subcontractors? Yes it is.

And third question, do we qualify if part of the manufacturing is done locally and after some time another part is done overseas? Right now, as of right now you do qualify to apply. This is something if there are any restrictions on the applicant this will be specified when the funding opportunity announcement is issued. So please do be sure to read through that carefully to see if there are any restrictions. And this is also something that might be added into the

program policy factors as a consideration that we'll take.

MR. DEVLIN: Okay. Thanks, Jill. JoAnn has a couple of programmatic questions.

MS. MILLIKEN: The first question is, if the goal is to build supplier base -- it's more of a comment than a question. If the goal is to build supplier base National Labs should not be allowed to lead because National Labs do not manufacture products. To let National Labs lead would be a waste of money.

[Laughter.]

MS. MILLIKEN: Any National Labs want to comment on that?

[Laughter.]

MS. MILLIKEN: Well, you know, we thought about this and remember that I said in my opening remarks that we want this effort to have wide applicability to benefit the community as much as possible rather than specific design -- fuel cell design. So we think we know that National Labs have capability in this area. We know they're not going to build systems or components. But we think they offer capabilities that will be available to the entire

community. And so we are going to allow them to participate in this solicitation.

Second question is, will National Labs be required to provide cost sharing and if so, where do you expect them to get it from?

[Laughter.]

MS. MILLIKEN: This from National Labs no doubt. But, unfortunately, the National Labs are required by statute to cost share. And there's not -- we don't particularly like it, but there's nothing we can do about it. And as to where we expect you to get it from, well, I'm afraid you're going to have to figure that out. I would think that by teaming with industry you might be able to come up with some innovative approaches.

By the way, we are trying to address that within the Department, but we haven't been successful so far.

How will the number of awards and size of awards be affected by FY08 appropriations; i.e., what is the projected FY08 appropriation and if funding is less will all topics be treated equally, or will some get higher priority?

The FY08 request is $5 million. We don't have an appropriation yet. If we don't get the full request, then we will have to make some hard decisions and won't be able to fund as many projects. And we generally do not cut across the board. We generally prioritize and that's what we are likely to do and we can't say how we will prioritize yet. But we will.

This is actually a topic one question and the only reason that I'm going to read it is because we don't understand it. And so this person should contact us to clarify.

What level of electrochemical testing -- I think it says "testing" it's hard to read -- will be necessary to prove manufacturing method? And we don't understand what that means.

And then there was a topic three question. Who does stack technology? And I mean, we can answer that. There are a lot of stack developers, but we really don't understand what the intent of the question is. And so if this person wants to contact us afterwards we would be happy to help.

MR. DEVLIN: Okay. Thanks, JoAnn. Okay. I'm going to start with the general topic kind of

questions -- general questions on the topics. I'll start with the easy ones.

High temperature MEAs, do they qualify? Yes.

Stationary versus auto MEAs, do they qualify? Yes.

I wish they were all that easy.

[Laughter.]

MR. DEVLIN: Is the technique of rapid prototyping considered an automated process and hence excluded? No. In fact, when we talk about DFM and DFMA that is rapid prototyping, right. So that is included explicitly. What we mean by "automated" is the actual equipment to build the component.

Is the solicitation limited to PEM technology, solid oxide fuel cells? SOFC is a highly viable alternative technology to today's diesel gen sets. We agree. They are. But the SECA program has got the lead in manufacturing research. So you should look to them for any opportunities. However, we've got a request for information out on market transformation and you could respond to that with solid oxide fuel cells and we would really like to hear from you on that.

Okay. At the July 13th and 14th, 2005 manufacturing R&D workshop high-speed forming and joining methods for bipolar plates and subassemblies, plate gasket, and MEA were highlighted as a high priority. Why are components subassemblies of this type not included?

Well, I think I mentioned, we've got a very limited budget and, you know, we may be able to consider some of this type of technology in our SBIR. In fact, that's being discussed now as a topic, bipolar plates and joining methods.

Oh, yeah, sorry. We think the MEA is the critical one that's why there are so many topics that deal with the MEA.

Why is there not a separate topic on novel manufacturing methods for metallic bipolar plates? Well, I think I just answered that one. The same thing.

Will you distribute a contact info list of the attendees in order to help put together teams of companies, labs, and universities?

I'd say that to get a feel for potential candidates for your teams, just go on that web and look

at our Annual Progress Report, you'll get a lot more facts about what each company is doing in this area and you'll be able to approach the most appropriate people for teaming.

How about a topic on systematically quantitatively defined requirements for tolerance in physical and chemical properties? This helps define manufacturing process requirements.

Well, it does. This is true. But we think you kind of crossed over into the specific products at that point. We've heard from people as we were gathering information that that was brought up in the workshop in 2005 and we're kind of -- we're not pursuing this because it's way too specific to products even though it's important.

Okay. This is a general one. Let's see, why break down into unit operations for component parts and why assume DTI and TIAX's approaches?

This is not a requirement. You know, when I mentioned the DTI and TIAX analyses, it was only to serve as a guide for the kinds of things that we're looking for in your cost analysis. You don't have to meet that, you know, cost element definition found in

those estimates. So if you get the impression that we were specifying these estimate component -- estimate elements, no, you don't have to. Just a general guide. In fact, what you see in the write-up is, you know, about the level that we're thinking that you ought to address.

Why are you so attached to plate on frame architecture to the stack?

Well, we're not. We just know about that. So bring it on if you've got something else.

How about single-step integrated approaches like the Japanese are developing?

Yeah. We like that. Please let us understand it better by proposing.

Okay. And the specific topics. Topic one, refresh your memory, alternative electrode deposition processes. How much effort is anticipated for actual manufacture of high-volume equipment?

If I understand it correctly, the answer is none. We are not asking you to put together actual manufacturing equipment. That might not be what you were after there. If it's not, contact me so I can understand it better.

Here's one more general. Will proposals related to direct methanol fuel cells be considered?

We have to consider it. Direct methanol fuel cells are part of our program and that was not specific in here, so that's going to be a change. You know, I said PEM and all that. But direct methanol is part of this program. So that needs to change.

But also they say, as long as there's a clear path applicable to PEM. So, agree with that too. But we will be specific about DFMC.

Topic one or two, electrode deposition and the novel MEA manufacturing. It says, will this topic be limited to conventional stack designs or will jelly roll out-of-box designs be considered for the novel MEAs?

Bring on the jelly rolls, yeah. I mean, it doesn't have to be conventional. We are looking for innovation here.

Topic one or two, is R&D applied to PEM? Is PEM-based electrolysis going to be allowed?

And I'm going to say not on this one. Not at this time. You notice that all the topics deal with very high volume, 500,000 units. And, you know,

electrolyzers are really in the hundreds of units. They're important, but not as important.

Okay. Topic one, focus on electrode MEA fabrication is good, however, the gas diffusion layer has been shown up to represent significant costs. I recommend adding a topic for gas diffusion layer manufacturing.

We had a lot of discussion on that. We are going to have some more discussion. We might agree with you after more discussion. We will take this under consideration and decide whether or not a GDL topic should be in.

This is a general one. Sorry. Why are the budgets different from topic to topic and the cost share different?

Okay. I guess the reason why the cost share is different is because we perceived the risk is different. If it's a 20 percent cost share we think that's high-risk, long-term and, you know, we can't expect a high cost share from industry if there's a chance that it won't go anywhere. And a 30 percent or more of an incremental leap of technology rather than come up with something totally new that's the cost

share part. The money part, I tried to make the distinction between when you're analyzing something with a guy sitting in front of a PC or something versus you're actually developing and testing a prototype in a laboratory. So the latter of those two have got more money associated with them. That's the way we usually do these kinds of solicitations.

Topic one, MEA conditioning and electrode deposition has almost the same funding; is that appropriate?

The challenges of electrode deposition is much higher than MEA conditioning and we -- I think we agree with you on that. There is a lot more challenges in electrode deposition. So we're going to take this under consideration and maybe make some changes -- appropriate changes.

Topic two, this is the novel MEAs should also cover five and seven layer MEA production.

Yeah, that could be a novel MEA. And we're not saying no. We didn't want to prescribe that. We started out by prescribing that and we took it out because we didn't want to say, here's the answer, go do it. So, yeah, that might be something that you could

propose and that would be included. It's in the scope.

I think we answered this one. Okay. Topic three and four. Should not topic three and four meld together?

Let me refresh your memory on that one. Three is rapid MEA conditioning and four is process models. And yeah, maybe. That's a good point. You could see it either way and we're going to talk some more about it. You know, they maybe should be together on that.

What drove the funding allocation -- I think I answered that already on how I allocated the money on that.

Topic four, process modeling. It will be extremely difficult and likely not possible to collect accurate, i.e., honest and current benchmark costs of manufacturing. The industry will not divulge real costs.

Okay. That is a challenge. We think that we've got a pretty good start with some of our estimates. And if you talk to our PIs that are associated with fuel cells they can give you some more insight on that. There was quite a bit of data

provided this past week. So somebody is giving to them.

Process modeling, topic four. Will modeling include life-cycle energy requirements and environmental effects?

Well, we think it probably should. So the answer is, yes.

See we had to think about that because you guys are asking questions that we haven't thought about and so that's good.

Topic five. Okay. Topic five is cost effective testing cell stacks. Does this include online quality control processes and methods and tools for MEAs and CCMs?

The answer is definitely yes.

Topic six is the tanks. What about high pressure hybrid tanks containing metal hydride and chemical hydride media and the tanks are around 100 bar in pressure?

Well, we're going to consider that. We are going to think about that. We don't want to rule that out. We might widen that topic to allow that. It's a good idea.

Topic six. Allowed to propose fibers that are not carbon but can meet the tensile strength in costs?

Yes, absolutely. So we need to take out the part about it's just carbon. Because if you've got something that meets the strength requirements, that's what we're after.

Topic six again. This is -- caught me on this one. I meant to get this out. Conformal tanks introduced domestically are the most expensive methods; is that an issue? If this is an issue shouldn't conformal tanks -- should this not include other than conformal tanks?

The answer is yes. So we will take out the "conformal" words in that topic.

Topic six. Cost model component is that model development only for fiber placement and winding or is it for the broader model of the whole tank?

It's for the broader model, but we want to focus on the windings and how to get the fiber processing done to get the costs down. So we don't want a lot of cost modeling on the valves and all the ancillary components associated with a high pressure

tank.

This is the last one. This is good because we can say yes to all these. Explicitly state that fibers other than carbon should be considered. I already said yes to that. Material and design requirements of tanks must be stated? Strength. I think I did state that one.

Toughness, if you could tell me what you mean by that. I think you're maybe talking about tensile strength. But, I'd like to know what exactly you mean.

And long-term durability. Yes, we will add that. So that's good.

Any target cost reduction you need to state the benchmark and then the percent reduction. Absolutely. Thank you for that comment. We will be more explicit. And that's where we are. I hope this has been useful for you, it certainly has for us.

We are going to make some changes. We hope to have the transcript of this meeting's proceedings, that handout we gave you, the slides, all on our web site by the middle of next week; right? Okay.

And it is --

PARTICIPANT: Which web site?

MS. CHEW: There should be a link from hydrogen.energy.gov. We'll post a news link so that it's easy to find. Does that clarify the question?

MR. DEVLIN: Okay. So anything else?

PARTICIPANT: Quick question. Actually I just wonder if this solicitation is about developing new manufacturing and assembly processes or developing prototypes that are cost effective? Like, do you want it to generate new manufacturing and assembly cost-effective processes, or you want to develop prototypes that are cost effective?

MR. DEVLIN: Thanks. That's a very, very good question and we probably should have started out with that.

We are really after the processes. And when I said "rapid prototyping models" it's the process to do rapid prototyping models, not the prototypes themselves. So it's all about faster, more effective processes. Does that answer your question?

PARTICIPANT: Yes.

MR. DEVLIN: All right. Well, thank you very much. Look for our proceedings on the web site and hopefully look for our solicitation very soon. Thanks

a lot.

[Whereupon, at 3:00 p.m., the meeting was adjourned.]