Eli Levine: Hello. I'm Eli Levine. I'm with the United States Department of Energy's Better Buildings Initiative. I'd like to welcome you to the February edition of the Better Buildings Webinar Series. In this series, we profile the best practices of Better Plants Better Buildings Challenge of the Better Plants Better Buildings Challenge of alliance partners and other organizations working to improve energy efficiency in buildings and plants all across the country. Next slide, please. So we're really excited to have you today. We have a really great group of panelists here.

We're here to do something a little different here. Rather than typically, these programs offer phenomenal technical assistance and tips and strategies to improve the energy efficiency of your building, and we really want, through the Better Buildings Better Plants Program, to make all of our partners and allies feel like when you're partnering through this program that you have access to all of the great things that the Department of Energy has to offer. So this panel will give us an opportunity to talk about some of those other things, and to talk about some of the real-world applications that inform R&D.

So we're gonna talk about some innovation and some ways to access DOE National Labs, and some of the public/private consortia activities that we have going on, because these are all very exciting, and we're seeing breakthrough technologies every day. Our Secretary calls our National Labs the crown jewels for research and innovation in the country, and we have some great programs to really help you access these resources. So slide three, please; thank you.

I guess before we get started with our presentations, I wanna remind our audience that we'll hold questions until near the end of the hour. Please send in your questions through the chat box on your webinar screen, on my screen up to the right, throughout the section. So send them in as your questions come up, and we'll try to get to as many of them as we can. The session will be archived and posted to the web for your reference as well, should you miss anything as you're taking notes. To start us off, let's hear from Clara Asmail from the Department of Energy.

I'm thrilled to have Clara with me here. She's a close colleague at the Department. She's the Deputy Director for Policy and Practice in the Office of Technology Transitions at the Department of Energy, where she leads coordination among DOE programs and labs to develop apologies and practices that optimize commercialization and the impact of DOE capabilities, facilities, and technologies.

Previously, Clara led the Technology Acceleration Program at the NIST Manufacturing Extension Partnership within the Department of Commerce by building mechanisms to support MEP centers and technology-based engagements with 30,000 manufacturers annually. Prior to 2010, she directed the NIST SBIR program, and at the NIST Technology Partnership's Office, she conducted promotional assessments on invention disclosures, and negotiated cooperative agreements, CRADAs, and licenses.

The first dozen years of her career were as a principle investigator on angularly resolved light scanner from surfaces. She published 20 plus papers and co-invented a method to resolve light scattered from particulate/ microroughness/subsurface defect sources. That patent license earned the historical highest royalty revenue to NIST. So with that, I'll turn this over to Clara. Clara, thank you so much for joining us today.

Clara Asmail: Thank you, Eli. This is great. I'm really glad to be with you and join you and your group there at the Better Buildings. You mentioned that you wanna be able to ensure that your participants feel like they are part of this greater Department of Energy family, where we have these crown jewels at the labs and these tremendous capabilities. I wanna give you just a quick taste and some guidance on how you might access some of that. Can you please flip the slide? Let me – thank you. Okay, that's where we start. May I have the next, please?

The Department of Energy has 17 national laboratories in addition to a few other production facilities. But these are where the bulk of our R&D is conducted and is mainly across the whole country. Many of these facilities you've heard of, and they push out tremendous research results, discoveries, inventions every single year. Twenty thousand scientists who dominate in the R&D 100 Awards, so many Nobel laureates – it's a real powerhouse, something that every American should be very proud of. Next slide, please.

So in these 17 labs – I certainly would never be able to even briefly summarize everything. This is just a very tiny sampling of the kinds of technologies that have come out from the labs. Over on the right-hand side, the modeling simulation that was developed in order to support nuclear weapon production and dismantling at Los Alamos was transferred to a 25-year collaboration between Los

Alamos and Proctor & Gamble so that they can understand how to keep a baby's bottom dry in diapers. On the left-hand side, you see a large area additively manufactured house and other products.

On the bottom left, the vibrant colors that come from Quantum Dots for displays that you have in your everyday computer products. May I have the next slide, please? And while that's flipping, that middle one at the bottom, that was Lawrence Livermore's technology that shows up in your cars and other vehicles when you're getting to close to another object, and it either beeps or automatically stops. That detection comes from Lawrence Livermore. In the middle there, the NETL algorithm to be able to display the error, uncertainty, in data is something that was very useful.

A way to demonstrate – something so simple – once you see it, it's very elegant. But before NETL's invention, it was always very difficult to quantify on 2D the error associated with each of these pixels. And then on the bottom right – I'm not gonna go through all of these – but the bottom right is Ames' very famous lead-free solder that transformed the electronics industry. Next slide, please. And then, of course, our bread-and-butter from the beginning, where we have our radioactivity that is emerging out of from the nuclear weapons research into diagnostics and therapy, as well as imaging for medical science. And the next slide, please.

So given that we have such a breadth of capabilities, facilities and expertise across the complex, as we call it, across all these laboratories, how is it that we can expand the commercial impact of our investments in those R&D activities? Well, that's why the Office of Technology Transitions was started up just about three or four years ago. It is a start-up, and we are primarily engaging with stakeholders, we're identifying practices that can be streamlined, and policies so that we can engage more robustly with partners on the outside, whether they be private or public partners.

And then we're sharing best practices among the labs wherever we can find them and elevating the visibility, much like we are doing currently with you right now. May I have the next slide, please. Well, this has to do with much of what I was just saying. We wanna identify barriers that are preventing engagement or causing some friction, either in time or in the way in which industry can engage with our labs, and by doing that, we wanna facilitate the engagement in order to make sure that we can transfer the technologies.

Whether they be technologies that are ready for commercialization or just the expertise to support your own technologies, and the transition of that into practical application. May I have the next slide, please. Some of the activities that we've engaged in so far in our few years of being around, we've helped the labs by giving them a cadre of chosen conditions that they can substitute in their cooperative research and development agreements, CRADA. We're helping them out to figure out what is the best way to develop final reports at the conclusion of a CRADA and understand exactly what should go in there and when it should be submitted so that they're in compliance with the law.

But more importantly than that, so that the public can benefit from each of these investments that are made in each CRADA, 'cause yes, it's a two-way agreement between the lab and this CRADA partner, but because the Federal government is providing some investment in that, we should make sure the taxpayers receive some benefit. So the results of those CRADA projects ought to be made public as quickly as possible, and as completely as reasonable. Likewise, equity on licenses that are negotiated, we're helping labs with that, as well as in general with their practices for licensing.

And this new tool called Agreements for Technology Commercialization, the ACT, which provides a very flexible way for a partner to come in and work with a lab that's not constrained to the terms and conditions of a CRADA or what we call a strategic partnership project, or an SPP. This is really not involving the Department of Energy whatsoever. An outside entity engages with the operator of the laboratory, which is in itself a private entity. Those contractors that operate the labs and an outside partner can then work just like industry would, right, and have industry-friendly terms in those agreements, so that they can get moving at the speed of business. May I have the next slide, please?

Well, these are the kinds of reasons why one would engage in ACT. Why wouldn't you want the CRADA or an SPP? And I'm not trying to be disparaging on CRADAs and SPPs – we negotiate tens of thousands of them – but sometimes, they can be difficult for some partners. If they, for example, cannot provide advance payments, or they're not able to agree with the indemnification, or they need a performance guarantee as opposed to a best effort, an ACT is a terrific route. May I have the next slide, please? And the next. Thank you. I wanna get moving so that you can get on with your other speakers.

The Technology Commercialization Fund is one that is managed out of the Office of Technology Transitions. It's got a budget that is a percentage of the applied energy programs across the entire Department, and it's going toward commercializing or actually advancing – it doesn't have to actually hit the market – but your maturing technologies that have been developed at the labs. That is on its fourth cycle right now, and we're learning from those first three, and we're probably going to be reimagining the way that we execute on that in the fifth cycle. Next slide, please.

This is where you can take note and grab your notebook and your pen and write down that URL at the bottom left-hand side of the screen: https: – it's a secure site – //search.labpartnering.org. This is your portal to the entire DOE complex, where you can identify an expert that might be able to help you with a specific technical problem that you're encountering in your building. Let's say that you can't quite achieve some goal that you have set for yourself, and you don't know where the source of the problem is; you need an expert.

Well, it's tough to find that research that might be exactly pertinent to your problem, so we have a cadre of experts that are available through this portal. And then, of course, it has a very deep directory, if you will, of all of our technologies, that are each researched and are available for licensing, if that's the way that you wanna go, in addition to beta version for how you can access all our facilities. May I have the next slide, please?

This is basically it in a nutshell, where you can connect with an expert, identify licensable intellectual property, and find patents visually to, as we call them, the gems that are the DOE Laboratories. May I have the next slide, please? Energy I-Corps is a training tool that we have been cycling through ten times at the laboratories, that trains the researchers on the bench to engage more with their industry counterparts in a way that their industry counterpart can then inform the research that's going on inside the lab and enable the researcher to understand what industry needs are.

This is a way to make sure that we can be more forward-leaning in our R&D portfolio and increase the stakes for the commercialization prospects of any of our technologies that can be adopted by industry. Can I have the next slide, please? And that's my contact information. I'm sorry that I won't be able to stay for the duration, but Eli will definitely be able to see all of your questions, and thank you very much for your attention.

Eli Levine: So thank you so much, Clara; I greatly appreciate it. I know that she has to jump off, 'cause she was willing to give up her time to be late to a meeting that she has to participate in. By all means, as you have questions, I know we gave a lot of information in a short amount of time there, feel free to ask me. I can field some of the questions and I'm happy to connect you with Clara for any follow-up on any of the resources that she has. So with that, I want to turn it over to Patrick Blanchard from Ford Motor Company.

Patrick is the Technical Leader for Lightweight Materials at Ford Research and Advanced Engineering. He completed his graduate studies and Ph.D. in mechanical engineering at the University of Nottingham in the United Kingdom. Since joining Ford in 1999, he's focused on the development of materials and manufacturing technologies for vehicle mass production. This included an emphasis on both polymer composites and magnesium die-casting. From 1999 to 2005, Mr. Blanchard supported Aston Martin during the transition to a more composite-intensive vehicle platform, launching initially on the Vanquish, followed by the DV9 and the V8 Vantage.

Since 2009, he's led an R&D team tasked with the concept design and development of Class A and structural composite components destined for a wide variety of Ford and Lincoln vehicle programs. Patrick, thank you so much, and we're really excited to have you here.

Patrick Blanchard: Well, thank you, Eli, and good afternoon, everyone. Yeah, it's a pleasure to do an overview of a project that's been ongoing for a few years or so between Ford Motor Company and Dow Chemical, and this is for the latest phase, being executed through a new manufacturing institute that was set up in 2015 – I think I'm correct – called the Institute for Advanced Composites Manufacturing Innovation, also known as IACMI. So this is an Advanced Manufacturing Office-funded institute that's being stood up for the last few years. So yeah, if we could go to the next slide.

So affectionally known as Project 3.2, so I'm speaking on behalf of the 3.2 team today. I'll give an overview of the main focus, as well as on carbon fiber concepts development for high-burning automotive applications. Next slide, please. Primary motivator for the program which was kicked off between Ford and Dow was all about fuel economy. As a whole, the industry's been making great strides; however, what's hidden behind here is some of the weight-saving initiatives which are being performed. So go to the next slide.

Key to the ability to have sustained year-over-year improvements in fuel economy is our ability to offset new content which goes on vehicles – the footprint of our vehicles is forever increasing as well, so it's a question of you absolutely add all this functionality and then offset that through various light-weighting initiatives. That's where essentially weight-saving in general becomes one of the key strategies in order to meet our long-term goals. Next slide, please. As I mentioned, the work was performed collaboratively with some other industry partners.

We have Dow Chemical, DowAksa, which is a JV between Dow and another company. We first started discussions back in 2012, but this led in 2015 or actually prior to that to a proposal which was embedded in this new institute, which was a $270 million proposal through Department of Energy. That was successful, and then stood up as part of the initiative of this Ford-Dow program; it was kicked off as one of the marquee programs. Next slide. Now, Eli was talking about leveraging various institutes, so IACMI is just that.

It's embodiment of a number of different national labs and also academic institutes across the country, so from a Ford perspective, we're able to essentially access a very wide network of expertise, ranging from all types of disciplines. It's mainly for us an interest in automotive, but it covers other aspects such as wind or gas as well. So if we go to the next slide. It's not just the core partners within IACMI; it's also the membership. You can see from the pie chart there's over 160 members. They range everything from new start-ups doing high-risk, early-plays technology development, all the way through to your more standard OEMs, such as Ford.

Yes, it gives us a huge breadth of exposure, and particularly at the members' meetings; we have several hundred attend at a time, and it gives great opportunity to seek new opportunities for technology development and do projects, as the one that you're seeing here today. Next slide. So Ford-Dow-DowAksa, we came together, we identified some core disciplines that we needed further support from through IACMI, so we have Michigan State, which we have a SURF Prototype production facility. SURF is Scale-Up Research Facility, so able to do full-size component equivalent to a regular full production facility, so full-size parts.

Purdue was brought on board to assist with a lot of the simulation activities to further develop the analytical tools. University of Tennessee Knoxville for a lot of the characterization. Michigan State again for surface analyses part work, and then Oak Ridge –

clearly, they have a lot of expertise in carbon fiber material development. Okay, shall we go to the next slide? So the project was all about taking aerospace scale technologies and materials and rethinking that and coming up with a new embodiment which allowed us to produce high-volume components or support high-volume production programs.

We were looking to be able to produce at a single to 100,000 parts per year. And then taking that all the way through into a final full-scale demonstrated project. Next slide, please. We had a pretty good target listing of what the material, this carbon fiber material, was needing to be. Our competitor, per se, was light metals such as aluminum and magnesium, and specifically die-castings as well, so we established a set of material parameters that we needed to achieve in order to be able to compete head-on with these other light metal solutions. Next slide.

With the support of I mentioned the SURF, or as I say, IACMI Corktown, so this is the Prepreg machine you see on the right-hand side of the screen, able to produce large quantities of material. On the left-hand side, you've got the carbon fiber, and then the building blocks for the chemistry, and this is really some by Dow in conjunction with some of the academic partners. That was all essentially the material side of things, but the next few slides I'm gonna walk you through is more from the Ford end and is the application validation and prove-out. Next slide, please.

From a Ford perspective again, we're mostly interested in can we scale these materials, put it onto vehicles, validate it against the whole list of prototypes and load-cases environments and service loads that we see. So we selected a Lincoln MKS and also the deck lid assembly for that vehicle, because it previously had a composite deck lid on a earlier production model. So we redesigned the deck lid inner panel, which you see in green, to be a carbon fiber variant, and then used I would say more of a conventional glass fiber outer panel bonded to that. Next slide.

Actually, we can go to the next one as well. In order to go through the development program – I'm probably not doing justice to the amount of work that was performed. But we would go through some standard load case, such as torsion, corner stiffness, with different stiffness and strength attributes that are first of all analyzed in CAE with the expected material properties, and we're able to achieve all our requirements. And you can see as you go into the carbon fiber, we're over-achieving by a significant amount over the production baseline, in the order of 55 percent improvement in some cases.

So easily passing, and the fact that it's probably still a significant opportunity for optimization. Next slide, please. From the weight saving, going back to the earlier slides, we're mostly interested in what the carbon fiber was offering us over production, from standard to the carbon fiber, through one iteration where it would take 30 percent out in weight, and through another iteration of 35. And again, we think because we're still over-achieving so much, we could take even more; probably close to 45 percent out with a little bit more effort.

So from an analytical standpoint, we're able to validate this and at least give us projections on the mass-production. Next slide, please. Beyond the CAE, we went through a full test program. You can see some of the materials on the left. On the right some of those can be a way to just about make out a deck lid. This is essentially a manufacturing schematic of how we produce the part. But we were able to use production tooling again in a larger manufacturing facility in order to produce full-scale components. Go to the next slide.

This is a build-up of some of the deck lid inners, so you can see the production in the top-right of carbon fiber SMC in a panel, and then going through the various stages, the process as they get painted and primed. Next slide. So we would then build this up through using the standard production process, so inner panel, outer panel, some other hardware for things like attachment of hinges to give us completed assemblies. Next slide. And then we went through a full testing program, again to verify or correlate the CAE vs. the experimental results, and you can see either static fixtures or actually on the vehicle, depending on which type of testing we were doing at the time. Next slide.

So final summary of the testing was that we were able to achieve all the requirements without any issues, and we even went through and did FMVSS 301 rear crash test, which is 55 mile an hour, passing that as well. So very successful in being able to make all the parts to the validation through IACMI, and then also meeting of Ford internal test program as well. So with that, I'll just have one more slide, I think. Yeah, just want to again acknowledge the various partners.

And again, if the audience is not yet reaching out to the various institutes through AMO or other parts of DOE, from a Ford perspective, this gives us direct access to a number of the key facilities that are unique in the U.S., and obviously, a lot of the fundamental research which supports our vehicle programs. So with that, I'll wrap up, and I think we're taking questions at a later time.

Eli Levine: Thanks so much, Patrick. That's great, and I know that folks have been sending their questions in. Please just keep typing them into the chat box, and after this next presentation, we'll take questions for our three panelists. Next, I'm excited to introduce Stan Petrash, Dr. Stan Petrash, to talk, from Henkel Corporation. Stan received his Ph.D. in polymer science from the University of Akron in 1988. Throughout his 20-year career in industrial R&D, his focus was on developing advanced characterization techniques to study industrially relevant materials and processes at micro and nano scale.

His work plays an important role in the development of several new technologies and products for industrial adhesives, metal and polymer coatings, and electronics applications. Stan's main expertise lies in the areas of optical X-ray and electromicroscopy, X-ray scattering diffraction and spectroscopy. Stan's a leader of the Advanced Characterization Group, which has a specific focus on 3D printing and printed electronic applications. As a member of Henkel's Open Innovation Group, Stan is also responsible for creation and management of collaborative partnerships with academic and governmental scientific institutions.

Stan currently holds positions of a visiting researcher at Princeton University, adjunct assistant professor at SUNY Stony Brook, technologist in residence at Brookhaven National Lab, and as a member of the user executive committee for NSLF2, the synchrotron light source, which I know he's going to touch on today as well. So Stan, I greatly appreciate you taking the time to be with us today, and I know I'm excited to hear your presentation.

Stan Petrash: Thank you, Eli. So if you can flip to the next slide, please. So I would like to cover a bit the Department of Energy EERE Technologist-in-Residence Program, which actually is co-managed by the Eli from his office of EERE, and share with you the experiences that we had of working within this program for about two years. First a little bit about our company. We're not as well known as Ford Motor Company – please next slide – but many of you probably heard of it, or if you watch Super Bowl, you probably see our commercials. So I will tell you a little bit about Henkel. Next slide, please.

Henkel is the world's largest producer and manufacturer of adhesives. We're not very well known as an adhesive manufacturing company, but you heard about the adhesive called Loctite, which is actually a Henkel adhesive. But initially we started 140 years ago; we started as a laundry detergent company. We actually invented the – not we, but our predecessors, our founders have invented laundry detergent, and then in addition to laundry detergent, they also find out that they need adhesive to package the laundry detergent to ship around Europe, so they have to invent better adhesives.

As a result of that, about 60 percent of the company is actually focused on the adhesives applications, as well as in addition to the 40 percent on the laundry. You probably seen the laundry commercial during the Super Bowl for the Persil; I think it was a 30-second spot. But we not gonna be talking about the laundry detergent today. We gonna be talking about the adhesives. And adhesives you will see in pretty much every major area, from industrial applications to electronics to consumers and craftsmen.

You will see our adhesives in packaging of cereal boxes and juices. You will see our adhesives in transport and metal applications, both in automotive – I think the regular car has about 30 kilograms worth of Henkel adhesives in it – as well as in the aerospace, where we provide adhesives and carbon fiber composites for customers such as Boeing and Airbus. We provide electronics materials and adhesives; if you have iPhone or Android phone, you probably have about a dozen of Henkel materials inside the smart phone.

We provide the adhesives for general industry, as well as under the brand Loctite we provide for consumers and craftsmen. The challenge for us as a company, as you can see we have a dramatic range of different applications. Each of them require particular properties, such as strength, conductivity, thermal conductivity, thermal insulation capability, non-toxicity, barrier properties – all of those require a lot of fundamental research that has to be done to find out how the material properties can improve the functionality of our adhesives.

What we realized quite a while ago that we need to move away from traditional Edisonian approach of doing work, where we basically formulate the adhesive, then complete the formulation of it, test the end performance, and then try to by formulating, by basically changing the initial formulating parameters of the adhesive, to get to the final performance. What we needed to really understand is how the materials perform in our industrial applications in order to create the best-performing materials from the fundamental principles. Next slide, please.

The challenge for that is literally bridging the gap – sometimes it's called "valley of death" or "death zone" – it's the gap between the fundamental knowledge about the materials, which is usually concentrated in the universities, where they focus on the early discoveries. They focus on the solutions phase with a lot of fundamental complexity, but relatively smaller technical complexity. On the other hand, we have the industry, which understand very well the market needs, has very good expertise on the end use, but generally lack a bit fundamental knowledge about the materials.

So in the middle, there is this green hump that has to be always bridged when we need to take our material from the fundamental knowledge to the industrial applications. So this is something that our group of adhesives research, and particularly my group of advanced characterization, every time we develop the material, we have to bridge the gap between the fundamental knowledge and the industrial applications. Next slide. As it happens, this is also the major function of the National Lab. National Lab ideally suited to bridge the gap between the fundamental discovery and the market needs.

National Labs, they are indeed the crown jewel of the American society. They're ideally suited for this multi-complexity multi-disciplinary long-time horizon challenges to span fundamentals from the mental R&D to the applied R&D. So basically, the slide that I showed you about the necessity of bridging the gap between the fundamental science and the industrial science, this is actually was borrowed from the DOE Office of Science Presentation, from May 2016. So we were very happy, very excited to find out that the mission of researchers in the industry and the mission of researchers in the National Labs literally coincide.

It was a natural point for us to start partnering with the National Lab to bridge the gap and work on the same function together. Next slide, please. As I already mentioned before, the U.S. Department of Energy has over 17 labs, but to put a bit of the numbers on it, the budget of this Department of Energy Office of Science is over $5 billion, just in 2016, and almost $1 billion they spent just in user facilities' operating budgets. This is basically to help users, such as academic and industrial institution, to take advantage of the capabilities that exist at the National Lab.

Perhaps most importantly, the mission and the research target of the Department of Energy, as well as the industry, almost always coincide. We focus on nano-materials, we focus on the bio-materials, and we focus on self-assembling materials that can help address the next challenges in the technological applications. The focus on the renewable energy applications, which is transportation or energy generation, advanced electronics, optics, and particularly what we're interested in is 3D printing. Most importantly for me as a member of the Advanced Characterization Group is the methods of characterization.

Unlike universities the government labs, the Department of Energy Labs, they focus on in-situ, in-operando, in-vivo method of characterizations, and they also take advantage of the big data. Many of these lab have multi-decades of expertise in computer modeling simulations, and they really bring those capabilities to bear in addressing of these technologies. Next slide, please. Relatively recent programs that help to bridge the gap of knowledge and understanding between the National Labs and the industry was Technologist-in-Residence Program.

And very briefly, this program identifies the individuals in the labs and individuals in the industry, and basically pairs up those individuals almost as a couple. As a couple of Technologists-in-Residence, who can then in their respective institution, identify the need from the industrial standpoint and identify the capability from the Department of Energy standpoint, and really connect those needs in order to solve the technological problems. I've been Technologist-in-Residence at Brookhaven National Lab for almost two years now, with my partner here, Pat Looney, and we were extremely successful in defining those capabilities and pairing up with the needs of the industry. Next slide, please.

We started our TiR journey, Technologist-in-Residence journey, by identifying Brookhaven National Lab as a strategic partner. We had the previous connection to this lab because they housed the National Synchrotron Light Source, a very powerful X-ray source that we used previously for our material studies. But then the source was closed, and they built a brand-new one, the latest, the greatest, the best facility in the world for generating X-rays to characterize and study the behavior of the material. Perhaps almost as importantly are the Brookhaven National Labs lies in close proximity to two major Henkel R&D Center located in New Jersey and Connecticut.

Brookhaven National Lab, of course, is located in Long Island, New York. So we started our work with basically participating in the qualification experiments at the NSLS-II second generation X-ray facility, as well as running some proprietary projects with Center for Functional Nano-materials, also located at Brookhaven National Lab. I can't tell much about that, but the Quantum Dot that was mentioned in previous presentation, that was our project; it was focused on the Quantum Dot experimentations. We then expanded the scope of our projects beyond just one particular beamline; beamline is the experimental lab which uses one specific X-ray technique to study the material.

So we are currently using five different X-ray techniques to study our materials, and just to testify to the effectiveness of this program, the presentation that I'm delivering right now, I'm actually right now locating inside the Brookhaven National Lab, inside the National Synchrotron Light Source, getting ready to conduct yet another experiment to study our materials. Our collaboration with them also resulted in me being elected as a User Executive Committee, representing not only the industrial, but all users of the Brookhaven National Lab, to help current and potential users such as you to explore more capabilities of this fantastic network of National Labs in the United States. Next slide, please.

So beyond Brookhaven National Lab, we use the connections of the Technologists-in-Residence to identify other graphs. There is a typo here – it's not EERE, it's the NREL, National Renewable Energy Lab, in Colorado – where I think one year ago there was held Council of Technologies, which I think many of you in the building management community would find absolutely fascinating. The NREL Lab in Colorado, they actually focus on energy efficiency of the building materials and the electrical grid.

And many of those labs there, they literally have mock-ups of the apartment or individual houses, where they identify how the construction of individual house or apartment and the electrical system in there can be used to better save energy in running those houses. So for something that for the building managers, for the developers, this is the NREL Lab, would be a fantastic resource there. We were interested in their capabilities of studying the thermal materials for the automotive electric applications. We also currently have contact with Lawrence Livermore National Labs and Sandia Labs in the area of additive manufacturing.

We actually submitted two joint laboratory-directed R&D proposals to Lawrence Livermore National Lab. Unfortunately, we were unfunded, but we don't give up. At some point we will get funded, and we will also work with the Lawrence Livermore National Lab. And we also collaborated with the Oak Ridge National Lab to take advantage of the fantastic Additive Manufacturing Center. Next slide, please. So currently, we are strengthening our ties with the Brookhaven National Lab. Literally today, we on-boarded a postdoctoral fellow, who's 50-50 funded – 50 percent by Henkel and 50 percent by National Lab – to work with us in the area of additive manufacturing.

And we're currently building instrumentation to study 3D printing additive manufacturing processes and materials for them, in-operando, meaning as the material's being printed. Not before, not after, but during exact industrial processes. As a future plans, we're developing capabilities for joint Government/Industry/Academia Center for Additive Manufacturing located in Brookhaven National Park. And we're exploring potential to actually create a Henkel-run Implant Lab, where Henkel scientists would be working inside the Brookhaven National Lab within the so-called Discovery Park.

The set of offices and lab facilities that are being planned to build here in order to further enhance the cooperation between the industry and academia and National Labs. Next slide, please. So in summary, DOE and National Labs are fantastic resources for industrial partners. They are indeed crown jewels of United States scientific community, and they are not only excellent in the technical terms, but they're also excellent in the cooperation terms. The people here are ready and willing to collaborate with external partners, and the TiR, which we have been participating in, is an excellent step to get to know the capabilities of the DOE.

What we really would like to see from the DOE side is a bit more diverse ways of interactions between them. Currently, CRADA is one of the few mechanisms, but sometimes for other smaller companies, it might not be the best way to go forward. So we're looking to explore these capabilities, and we're also looking – there is currently also looking into the creation of the DOE nonprofit organization. There is currently bipartisan legislation moving in Congress to create this nonprofit organization, similar to the NSF nonprofit, that would allow easier ways to collaborate between the industry and government labs.

So I'd like to thank you for your attention. I really tried to fit into the time allotted and would be happy to answer all of your questions.

Eli Levine: Wonderful. Thanks so much, Stan; that was great. You shared a lot of really good information there. So let's go ahead and take some questions from the audience. Oh, as the slides, I guess we're going back for a second to point out that we have the website for LabPartnering.org, which is more information about the Lab Partnering Service, and then, by all means, should you Google the Office of Technology Transitions or the Technologist-in-Residence Program, or IACMI, the Manufacturing U.S.A. Institute, we are happy to provide more information on any of those resources as well.

So as we get started with questions, I just want to mention as well that as Stan was mentioning, it is a priority here at the Department of Energy to facilitate access to the incredible resources at our National Labs. So to that nature, by all means I'll share my contact information at the end of the webinar. Feel free to reach out if there's something that you're interested in at the National Renewable Energy Lab, at Oak Ridge National Lab, at any of the 17 National Labs. We're happy to facilitate a visit.

On that note as well, the Better Plants Program is hosting – and we've extended an invitation to all of our Better Buildings compadres – what we call Technology Days, which is a two-day event to showcase the resources at the National Lab, allow people to network and make connections with the National Lab scientists to learn about how to partner with the National Lab. So these are held at a National Lab. What we're particularly excited about this year is that this will be held April 9 and 10 in the Bay area, and we're featuring not one, but two National Labs.

Lawrence Livermore National Lab will host our partners for a day, and Lawrence Berkeley National Lab will host our partners for the following day. So if that's something that you're interested in, April 9 and 10, please reach out and we're happy to get you more information about that event. With that, I'll turn it over to some questions. Patrick, if my company was thinking about joining one of these institutes, what would you say are the key advantages and disadvantages of participating, or doing research like this through an Institute?

Patrick Blanchard: I think the key one for Ford is acceleration to market. The accessing of the resources just allows us to move faster, so if we can move faster, that's great. And then secondly, there are some, through IACMI and particularly this Institute, and Oak Ridge in general, there are some unique facilities which just are not available elsewhere, so they allow us to perform our research not only at lab scale, but also at full production scale. So these are I think two key items which *[break in audio]* into the Institute.

Eli Levine: That's great. Thank you, Patrick. Stan, one of the things that someone noted and I certainly liked hearing about was how much you leverage the TiR partnership, not only to develop this great dynamic long-term relationship with Brookhaven National Lab, but also to explore the capabilities across the National Lab enterprise. How did you go about identifying what Lawrence Livermore National Lab had to offer, or why you should be talking to some of the other labs? And then how did you identify who to talk to at that lab?

Stan Petrash: Oh, this is actually probably the biggest strength of the TiR program, because for the outsider, the structure of the Department of Energy National Lab could be a bit overwhelming. These are big labs; these are labs that are the offshoot of the original Manhattan Projects, so for people who have specific questions and specific topics to be addressed, just basically going to one of the scientists and trying to talk to them might be a bit overwhelming. So what we were able to do through the TiR program – remember, TiR partners the contact from the industry with the specific quite high-level scientist and/or manager at the National Lab.

What the manager at the National Lab can do, they can basically go directly to the upper management of the relevant National Lab and say, "Hey, my partner is interested in topic A. Who in your department or any of the other department are the key personnel working on this topic?" So it basically goes, instead of the bottom up, it goes up to the bottom, so they can immediately identify the correct person, the correct contact. And it also helps with a bit of management incentive attached, because when the scientist who is working on this program, he has contact from the director of his division saying, "Hey, here is the guy coming from the company.

"And by the way, this is coming from the management, so could you please pay them a little bit more attention?" this is extremely helpful. It really cuts down through a lot of calling and trying to identify the right person, and maybe trying to figure out the right resource; it basically goes right straight to the point. It goes to the point of contact, the people directly in charge of this particular program. So with both it's happened, at the Lawrence Livermore

National Lab, it happened at the Oak Ridge National Lab. You'll get immediately put in touch with the right individuals working on the research that you would be interested in.

Eli Levine: Thank you, Stan; that's a strong endorsement. Patrick, a related question that you got. How did you go about identifying the partners that you worked with on the project? Had you had relationships with them before the start of the project?

Patrick Blanchard: Yes, in some part; we have existing projects, and we have a university alliance network which has been stood up for many years, and we have ongoing activities there. But I think through the Institute, and also working with their governing body – IACMI HQ, if you want to call it – everyone was able to recommend some other partners that had key infrastructural capabilities that could support the project. So yeah, it opened up doors which we hadn't really contemplated before, and so made us aware of technologies which have complemented some of the other activities we already had ongoing.

It's been a bit of a mix, so (a) yes, there's been relationships, but (b) it's definitely opened up new paths of communication.

Eli Levine: Wonderful. Thank you, Patrick. Stan, how difficult was it to navigate forming relationships and developing projects and proposals at the different National Labs, who oftentimes have their own ways of doing business?

Stan Petrash: Not difficult at all. What we found is that scientists here are extremely talented individuals, and they're extremely focused on unsolved problems. Also, what I found them, because they're scientists they're also extremely curious. If you bring them an interesting scientific program – which in industry basically we're full of the interesting scientific and technological problems – they get excited, they get interested. They said, "I never thought that you guys in industry working on such challenging, such scientifically important topics."

And it was, I dunno, maybe it just happened, I lucked out on interested good people. But everybody was nothing but extremely helpful in solving our issues. As I said, if you manage to strike up the curiosity, the scientific curiosity in the scientists, then basically all the work is done. They would do a lot of work for you. They would explore the capabilities, as Patrick said, that we haven't even probably contemplated before. So Oak Ridge National Labs, Lawrence Livermore, and specifically Brookhaven, never had any problems with lack of interest, lack of enthusiasm; extremely helpful.

Dramatic contrast from, for example, interacting with the academia, where sometimes, as I said, academia is a little bit of conflict of interest. They interested in publishing papers, they interesting in educating people, but industry and National Labs, they interested in the same thing. They interested in commercializing the technology, and this is, I think, the key point there.

Eli Levine: Thank you. That's really helpful, Stan. So there was a question that was posed to Patrick, but I'll open it to both of you, and with that, after this question I think we'll probably wrap up. For both of you, the title of this panel was Lessons from the Field: Real World Applications that Inform R&D. So the question that we got was, Patrick, how often does Ford's research team look to folks on the factory floor for feedback about opportunities for innovation or to save energy?

How often are you hearing from folks who are manufacturing every day about the challenges they're facing, or areas where they think, "If we dedicated some time and money to research and development, that it could have a big impact?"

Patrick Blanchard: I would say that under typical circumstances, our projects reach out way beyond our research facility into the plants, because ultimately, these folks are responsible for execution and delivery on the vehicle programs. So I think over the years – and it does take time – you build up a very strong relationship all the way down the pipeline. And so after one or two instances, that becomes a bit of a two-way street. It is all about networking and people, but I'd like to think that we do receive constant feedback from our plants, regardless of the types of projects and the types of things we could be doing, as well as oversee coming up with our own ideas as well. So it's a constant quest, and I think nothing's perfect, but it's definitely something which features in all our programs.

Eli Levine: Perfect. Wonderful. Thanks, Patrick. Stan, anything to add from your perspective?

Stan Petrash: Very similar. It's nice to know that our big companies operate very similarly. Patrick mentioned the word pipeline, and that's exactly what we have at Henkel. We recently several years ago instituted a formal – it's called ATD, Adhesives Technology Development – program, where we have actually two processes happening at the same time. We have technology development going on in the more research centers, and then the product development going on in the more production end and plant centers, and those two processes, they literally form a pipeline.

When technology is being developed, it has to come up pipeline into the product, as well as when the product needs to be developed, it creates a request for the sort of technology to support this product to be developed. And we also have formal structure of individuals who actually oversee this pipeline to make sure that the processes there happens relatively – as said, it's not perfect – but relatively smoothly and efficiently. So it's a specific structure that was created to align the needs of the plants and the product development people with the technology development, so the future directions in which technology is moving.

It is not only nice to have, it's an absolute requirement to have people in the plants and product development being aligned with the technology development organizations.

Eli Levine: Wonderful. Thank you both so, so much; really informative answers. I know I benefitted a lot from this. So with that, I think I'm going to wrap up. We hope you enjoy the remainder of the Better Buildings Webinar Series, where we're taking on the most pressing topics facing energy professionals with new experts leading the conversation on proven best practices, cost-effective strategies and innovative new ways to approach sustainability and energy performance. I believe next slide? So additionally, we hope you'll plan to attend the next Better Buildings webinar on Tuesday, March 5, from 3:00 to 4:00 PM, titled Better Buildings, Better Bodies: Strategies for Health and Wellness.

Meet Beter Buildings partners who are implementing design strategies and benchmarks in their buildings and sustainability plans that focus on the wellness, health and productivity of the people inside them. Speakers will highlight the Fitwel certifications, WELL Standard, and more. Lastly, and next slide – so that was, sorry about that. Registration is open for the Better Buildings Better Plants Summit, which will take place on July 10 and 11 in Arlington, Virginia, in the D.C. metro area. Pre-conference activities will take place on July 9.

I know for us, that includes a lot of exciting tour opportunities; tours and training opportunities. To find out more information and to browse the agenda, visit the Better Buildings Solution Center link in the slide. We hope to see you all there. With that, I guess next slide for the close. With that, here's all of our contact information. I'd like to thank our panelists very, very much for taking the time to be with us today. Feel free to contact our presenters directly with additional questions or if we weren't able to get to your question during the Q&A period.

If you'd like to learn more about Better Plants, the Better Buildings Challenge or Alliance, please check out our website, or feel free to contact my colleague, Kendall Sanderson, directly at the email, or feel free to contact myself. I hope you'll follow the Better Buildings Initiative on Twitter for all the latest. You will receive an email notice when the archive of this session is available online. Thank you, everyone, and I hope you got as much out of this as I did. I look forward to the next webinar. And with that, that wraps up this webinar.

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