MEREDITH: Ladies and gentlemen, we are going to begin in just a moment. So in the meantime, we’ve got our last series of success stories from DOE to share with you today on how we are solving industry’s energy storage challenges.

So welcome back to our final session of the Long Duration Storage Summit. This is Lab-Embedded Entrepreneurship Programs. And I am pleased to introduce you to Joe Cresko, who will moderate the session. Joe, I will turn it over to you.

JOE: Thanks so much, Meredith, and welcome, folks. Today, we’ve got something really interesting to talk to you guys about. The Lab-Embedded Entrepreneurship Program, this session will cover a really interesting and unique program that we’ve developed over the last number of years at the Department of Energy coming out of the Advanced Manufacturing Office. And it’s a program that looks for some of the most creative and innovative minds in the country through a competitive process, brings them, and partners them with our national labs with the goal of some great outcomes.

So today, we are—we’ve got a great group of folks that will talk a bit about the program and some of the innovators that are involved in our three nodes that are part of the Lab-Embedded Entrepreneurship Program. Next slide, please. So I’ll start, my name is Joe Cresko, I’m the Chief Engineer in the Advanced Manufacturing Office. And I’ll just give a couple of slides to introduce what this program is, and then I’ll turn it over to some of the really interesting talks that we have lined up, and then we’ll have a panel discussion where we will dive in a little bit more and look for some questions from you. Please enter those into the chat function at any time.

So, as I mentioned, this program really seeks to recruit the best innovators from across the country. It’s a highly competitive process. We currently have three, what we refer to as nodes, set up around the country. Cyclotron Road at Berkeley Lab is the first node that we set up about the better part of eight years ago.

We also have Chain Reaction Innovations, that’s located at Argonne National Lab, and the Innovation Crossroads node at Oak Ridge National Lab.

The goal of this program is to drive ideas and people to their highest benefit outcome and performance, and that means we’re taking ideas and really trying to convert those ideas and companies into successful commercialized products. And by taking a two-year partnership with these fellows, funding them for that period of time, and really driving the acceleration of the technology development, we want to accelerate access to follow-on funding that will lead to commercialization. That is, positioning people and technology into the marketplace. Next slide.

So what does that sort of look like? We really start with an idea. Innovators pitch their ideas to this program. If they’re accepted into the program, they receive a monthly stipend, health insurance, and travel funds. They also have a CRADA, Cooperative Research and Development Agreement, that allows them to really utilize capabilities at the National Labs. It connects them, it allows access to resources. It might be equipment, people, staff. And with that as a foundation, including mentoring, business training, commercialization work, and coupling and teaming people with investors in the outside world, bringing in that private investment, we really want to try to drive an accelerated pathway into the marketplace. Next slide.

So in the few years that the program has been going, we have a very interesting and high-performing set of success metrics. We’ve got a greater than 95% success rate for the companies that are continuing to operate after they graduate from the program. In fact, a dozen innovators have been recognized in the Forbes 30 under 30, and more than 11 companies are now selling commercial products, and that is increasing quite rapidly.

In fact, we have demonstrated over $520 million dollars of follow-on funding, which correlates to approximately more than 8 to 1 return on our DOE investment. So we’re seeing some really amazing outcomes from this program. Next slide, please. With that, I’ll turn this over to my colleague, Paul Syers, who is a Technology Manager in the Advanced Manufacturing Office. He will lead a session after we have some presentations by each of the three nodes.

So we’re going to see a 10-minute presentation from Chain Reaction Innovations, Tom Guarr at Jolt. Dan DeRosa will be introduced by the Director of the Innovation Crossroads node. Rachel Slaybaugh at Cyclotron Road will, we hope, introduce Dan Bierman. who I believe is trying to get access to our session as well.

So I’m going to turn this right over directly to John, and we’ll dive in and go through a little bit of background on each of these companies that has graduated from each of the respective nodes and is really kind of making a dent out in the energy storage world. So, John, let me turn that over to you.

JOHN: Thank you so much, Joe. Thanks, Joe and Paul, for inviting all of us. Always great to see my fellow directors at the other programs, especially the innovators in those programs. A real kick. A couple of quick things that I wanted to say about CRI before I introduce Tom and let him talk about his project he’s been doing the last couple of years in Jolt Technologies. One is you might sense a very unique focus on people in the LEAP program. We don’t talk a lot about the startups. We talk about the people.

And the reason for that is, as you’ve heard all day today at the summit, if we’re going to address climate change, if we’re going to address the demands of long-term energy storage, we need science-based innovations. We need new discoveries to be the headwaters of that.

And the discovery that has been made over the last several years is, if the scientists that made the discoveries aren’t directly participating in that process, the likelihood of success goes way, way down. So LEAP from its very inception had this focus on nurturing and training STEM-oriented career individuals who made these discoveries, but are not business people, to really understand what it’s like to move a technology to market, informed by interactions with that market.

And that’s one of the things that makes this program really unique. The entrepreneurial fellowship essentially allows us to fully support these individuals for two years. Basically, you get paid full time to be an entrepreneur, to try to de-risk your technology, engage the market, and build a business around it to bring products to market. And that’s number one, that’s unique.

The other thing that’s unique is the National Labs. So this is a program that very uniquely taps in to the facilities and the expertise and the knowledge base at the National Labs. And in the case of energy storage, all three of the National Labs represented here have tremendous strengths.

Argonne has the Joint Center for Energy Storage Research led by George Crabtree. That center’s been in operation for eight, nine years now. It’s actually led to its own startup, Form Energy, which I know many of you probably are aware of that’s actually deploying at scale pilots for demonstration for intermediate duration storage. Tremendous other capabilities at our lab. CAMP cell analysis for modeling and prototyping. So there’s facilities to build cells, test cells. Scientists who know about anodes, cathodes, electrodes, electrolyte chemistries, so on, and so forth.

We’ve had at least one innovator in each one of our five cohorts that specialize in energy storage. And just about every aspect of the problem, from just making it a little bit better, to making them work at low temperature. And in the case of Tom Guarr, you all know, I’ll introduce now, he’s working on a reflow battery technology, a non-aqueous technology, that if it works out of course it might be a 10X improvement on the current state of the art.

The other thing I’ll mention before I truly turn it over to Tom, is inclusive innovation is a really big deal to all of us in the program. Don’t think of this as just the grad student postdoc. We’re really looking for anyone at any stage of their career, who’ve been bitten by the bug of wanting to really see their innovation have an impact on the real world, to join us. We’re really proud jointly of the diversity of the cohorts we’ve had and Tom’s just another great example of that.

So with that, I’d like to introduce Tom Guarr, Dr. Tom Guarr, of Jolt Technologies, and he’s going to tell you about his project over the last years in CRI. And how, with the help of some private-sector funding, is looking to deploy some early-stage prototypes to demonstrate at scale what he’s doing. Tom?

TOM: Thanks, John. I know that that was just a nice way of saying that I’m old. But I do value the diversity in the program as well. And by the way, it’s my birthday today. So it’s great.

JOHN: Congratulations.

TOM: Anyway, thanks, John. As John said, Jolt is interested in developing a non-aqueous redox flow batteries. And we see this route as a potential key to very practical long-duration energy storage. Why organic? Well, we have a long track record in developing organic electric chemical devices. Prior to joining CRI and Jolt, I worked for a company called GenTex Corporation, making electrochromic devices, organic electrochromics.

So we sort of bucked the trend of everybody doing inorganic, and we went with organic materials. Everybody said that we couldn’t make them last long enough for real world applications. We took that as a challenge, developed electrochromic devices. GenTex now has annual sales of nearly $2 billion dollars. So, very successful. I will say that when we started, our estimated field life was about two weeks, and when we finished it was about 40 years. So if I could have the next slide, please.

So the Jolt redox flow battery is different from sort of the traditional vanadium type redox flow batteries. First, we use non-aqueous solvent. We’ve developed a relatively low-cost, high-conductivity, organic solvent mixture, electrolyte mixture.

The other keys to our technology is that first we use organic materials that can exist in stable form in three different redox states. At least three different redox states—in some cases five. And that allows us to use the same material as both the catholyte and anolyte in a redox low battery.

So first of all, we have organic materials that we can make very cheaply, and often from waste materials from other industries. We can use a single material as both anolyte and catholyte. That allows us to replace that expensive ion exchange membrane with a simple porous separator. So the organic solvent gives us higher voltage capability.

We also have multi-electron capability. We have a system that’s about 2.4 volts at two electrons and we’re actually looking at higher number of electrons in some second-generation materials. We’ve replaced the two most expensive components in a vanadium battery, the vanadium itself and the ion-selective membrane. And this allows us to provide a much higher energy density at a much lower cost. Next slide, please.

So I want to just give a brief history of where we were prior to and after joining CRI. So, like most startups, we started off with a concept, proofed it out with some lab data, and developed the IP. I also worked for Michigan State University, so MSU owned the patents, and we had to license them back to operate. We got some private seed funding, which allowed us to generate early data, that I think was significant to proving the capabilities to CRI.

But when we started CRI, things really accelerated. Through an I-Corps program, we were able to do a lot of customer discovery and refinement of our product. We were able to build our team.

And those, on the timeline, those items after CRI, I think with the possible exception of the SBIR, would not have been possible without CRI and the experience, the validation, and the exposure that we got from that program. So it really is a very valuable program that has led to an increasing number of opportunities for Jolt, culminating in very recently a significant investment from a strategic investor earlier this year.

So I would encourage anybody out there who’s maybe on the fence about applying to a LEAP program, to go ahead and take the jump. I did, I’m happy I did, at a little bit unusual stage in my career, but it’s been a good time. And I would say one of the most valuable parts of the program is learning from the other innovators. Thanks.

JOHN: Thanks, Tom, I think I’ll hand it back to our next speaker who is Dan Miller. Is that correct?

DAN: Yep, thanks. John, thank you very much. And again, thank you for allowing us to be here and talk about the Lab-Embedded Entrepreneurship Program. Joe and John did a really good job of laying the groundwork of and the background of the program. I’d just like to reiterate that the core of this program and what makes it so unique is the collaborative R&D component with the laboratories, with the National Laboratories. And the opportunity it gives for the selected innovators to spend two years collaborating with world-class scientists and getting access to truly unique facilities.

John and Tom did a good job of talking about the Argonne facilities and how they’ve used that. At Oak Ridge, we have a number of facilities that our innovators use and get access to during our program. Several among them are the manufacturing demonstration facility led by Craig Blue and Bill Peter. And specifically to energy storage, our battery-manufacturing facility led by Ilias Filiro.

And the manufacturing demonstration facility and the battery-manufacturing facility are just two of the facilities as part of R&L that are focused on industrial collaboration and commercialization. With that, I’d like to introduce Don DeRosa. Don is founder and CEO of Eonix and he’s part of a diverse group of startups—actually 26 total startups, past and current, that have gone through the Innovation Crossroads Program. And with that, Don, take it away.

DON: Thanks, Dan. I’m going to attempt to share my screen. Hopefully, that’s good for everybody. Okay, well, thank you for the introduction, Dan, and as mentioned, my name is Don DeRosa. I’m co-founder and CEO of Eonix and a graduate of cohort to Innovation Crossroads. Our company focuses on reducing the time and cost it takes to develop new materials for application-specific energy storage products.

So before I get into our company, I’d really like to just outline how profound of an impact this program had on where we were and where we are today. So, in 2018, before we joined Innovation Crossroads, our technology goal was to develop high-voltage electrolytes for ultracapacitors. We were looking to deliver value to this industry by reducing their cost and size of the devices. The market that we were targeting was $400 million dollars.

We were hoping it would grow, but a pretty paltry $400 million dollars direct to electrolyte sales. To date at that point, we had about half a million dollars in non-diluted funding from NYSERDA and I-Corps. And we started building prototypes, so we had a pretty reasonable technology progress at that point. Since graduating Innovation Crossroads, we’ve actually built on that and developed a new core technology, and this is really a testament to having access to Oak Ridge National Lab scientists.

We were able to develop a rapid and automated electrolyte screening system that can be used for both ultracapacitors and lithium-ion batteries. So in terms of value, the system significantly reduces the time and cost it takes us to develop new materials for market-specific applications. And in terms of market that we’re able to target, it’s considerably larger.

We have some intra-markets that represent about $5 billion dollars in initial lithium-ion battery sales, but that’s expected to grow. In terms of funding, since leaving the program, we’ve gotten $3.7 million dollars in non-dilutive grants from a variety of agencies, some of which in the Department of Defense are looking to be our customers, so that’s always good.

And we have three products under development right now. We have the high-voltage ultracapacitor electrolyte that’s drop-in compatible with the existing devices today and that’s actually something we’re in the process of licensing. We’re developing a non-flammable lithium-ion battery chemistry where we have demo devices available for our partners at this stage. And longer term, we are working on energy-dense anode-free lithium-ion batteries.

So essentially, Innovation Crossroads provided us with extensive technical resources. We work with Dr. Jijit Nania’s [phonetic] research group at Oak Ridge National Lab. And when we arrived, we realized that the sensor that we built to develop ultracapacitor electrolytes was actually our core technology.

So it took some collaboration with some scientists on-site and some tweaking to realize that. We had something far more valuable and effective for materials development and product development than just the singular product we were looking to create.

And then second, over the two years that we were with Innovation Crossroads, they provided us with extensive commercialization guidance. We did a pretty big company-wide pivot, you could say. And having their guidance throughout the course of that, making sure that we were evaluating markets correctly. Having a second set of qualified eyes to look over everything and encourage that was instrumental in pushing us to where we are today.

So we’re definitely a far more well-positioned company than we were three years prior, so we really have to thank Dan and the program for that. So with that said, our company is targeting lithium battery markets, predominantly. I think everybody on this call probably knows how compelling of a market that is. It’s expected to be a terawatt in the next five years, which represents a $100 billion dollars in batteries with the market being driven by renewables, grid, automotive, and defense.

But each one of these sectors has different feature needs, different pain points that are driving or inhibiting adoption for lithium-ion batteries. So they all need batteries, but they need a different type of battery, and that’s where R&D and development really becomes a pitfall.

So our solution was to attack the problem of cost, time, and risk associated with product development. We built a high throughput screening system, as I mentioned, at Oak Ridge National Lab. We essentially have an embedded sensor we’re able to put in lithium-ion batteries that monitors the anode and cathode independently. So it allows us to track what’s going on inside of a system in real time electro-chemically.

And then, we paired this with advanced data processing and automated analysis so that we can instantly see where materials are performing successfully, where they’re failing, and then iterate around that. And we have our pilot system now operating at a lab here in Knoxville, Tennessee.

So what does this mean in terms of time and cost to understand novel chemistry? If you’re trying to understand a chemistry, long-term cycling is required, post-mortem analysis, and PhD labor. It’s going to take you about 10 months, and it’s going to cost you a decent amount of money to figure out how a molecule is working inside of a battery.

With our system, we run through a new molecule every eight days with short-term cycling. It’s an in-situ process, so we don't need post-mortem analysis. And it’s semi-autonomous, so we avoid the expensive PhD overhead, and it’s relatively affordable for us. So essentially, we’re able to run through significantly more chemistries and through a product development cycle a lot faster at a much lower cost than any other conventional lithium-ion battery or ultracapacitor lab.

You can consider this as like a product multiplier, a productivity multiplier for energy storage material research. So what have we done with this? We looked for opportunities of value that we could generate. We saw grid storage is expected to grow significantly over the next four years. They have a problem with flammability and safety. New York requires fire suppression systems, Arizona had incidents sending first responders to ICU, and South Korea has had, I think, 23 fires or more since 2018 with grid storage. So our pretty simple solution, carbonate-free electrolyte technical obstacles. Carbonates are required for longevity.

So in terms of value, what can we deliver? A lot of cost stems from energy storage or lithium-ion batteries being dangerous in energy storage. Fire suppression systems, explosive gas ventilation, HVAC, liquid cooling, things like that represent about 25% of the cost. So we set out to develop a carbonate-free electrolyte.

In 2020, we screened 21 chemistries. In 2021, we had 1-amp hour cells that were able to endure higher temperatures and were non-flammable, and they are plug and play with existing electrodes. And we’re currently funded to produce 18650s and 10-amp hour cells. In the next three years, we’re looking to position this for a pilot for grid storage as well. So a safe high-temperature lithium-ion battery that lowers the overall cost of deploying energy storage. So hopefully, I didn’t run over on time, but thank you, and I’m excited for any questions.

DAN: Don, awesome stuff and really good to see all the progress you’ve made and continue to make. With that, I’ll turn it over to the final presenting node with Cyclotron Road Director Rachel Slaybaugh.

RACHEL: So great to be here. Thanks for having us. And I’d like to reiterate what everybody has said so far just about the value of the LEAP nodes and the collaboration with the National Labs and how valuable it is for these early-stage companies to be able to access experimental facilities and expertise.

So I’m going to run quickly through some of the numbers of Cyclotron Road and a little bit of some extra take on the value. So, since 2015, we’re the oldest node. We’ve supported 75 fellows from 55 companies and eight of those companies have been storage companies. So we’ve had a pretty strong fraction, about 15% have been in the storage realm. These companies have gone on to raise over $360 million dollars. They’ve built over 25 prototypes, including world record-setting devices. And I’m delighted, for one, Antora Energy will talk to you. They’re one of our record-setting teams. They’ve hired over 360 employees and actually—the storage teams are punching way above their weight here. So they’re 15% of our companies, but 30% of our job creators. So they’ve done above and beyond in job creation, all U.S. jobs.

Our companies have filed 46 patents, 12 of those patents have been joint with the laboratories, so there’s been a great collaboration there. And they’ve worked with at least 70 Berkeley scientists, probably more. And that number will go up once it’s easier to get back in the lab with all the complexities surrounding COVID.

But one of the additional things besides these numbers is we really love that ability to create an environment where innovators can figure out what really works for them. And so pivots, direction changes, all that stuff, and Antora Energy is a particularly interesting example because they actually started out as two different cohort companies who merged to become one. So they’re just an extra example of the kinds of things that can happen in the program. And so with that—oh, and we have so far have had one successful exit. We’ve had a battery team be acquired. So, so far, our one acquisition was a storage team. So really, the storage sector doing well.

So with that, I’d like to introduce David Bierman. He’s one of the co-founders of Antora Energy and was a member of the third cohort of Cyclotron Road. Antora is developing a multi-day energy-storage technology that outputs both power and heat to promote deep levels of renewable penetration. Take it away, David.

DAVID: Awesome—thanks so much, Rachel. Yeah, it’s really wonderful to have the pleasure to chat with you all in this really important workshop. It’s a pleasure to be here. So I’m David, I’m one of the co-founders of Antora Energy. So we’re, like everyone here, an early-stage hardware startup. And I just have to say, we were truly, truly fortunate to have generous early support from the LEAP program. So we’re part of the Cyclotron Road community, and we were able to leverage that in just a number of ways.

One thing that’s been touched on is just the ability to kind of secure follow-on or complimentary public funding. We were able to get grants through RPE, AMO and NSF, and others. And I think that really kind of— if we’re talking about funding, in addition to just the funding that comes through the program through the fellowship, I think we should think about how we leverage that additional support.

So we’re developing a multi-day storage system. The technology aims to provide affordable, firm, zero-emissions power to utility and industrial customers. The system stores electricity in the form of very, very high-temperature heat in a solid storage medium. And then it can efficiently convert that stored energy back into electricity using a solid-state heat engine, known as a thermophotovoltaic device.

So the way we see it, it’s the unique combination of a very low-cost and very energy-dense storage medium with a high-performance, low-cost photovoltaic cell that unlocks all end system costs for multi-based storage that are about 20X lower than incumbent lithium-ion energy storage technologies. Which is, as we’ve seen in the panel and we’ve seen of recent, a very, very important metric to long-duration storage to really enabling multi-day storage comes down to the capital cost of the system.

And so from day one, that sort of thing, our focus, how do we create and configure a system that has kind of to-the-floor capital costs. Before we break into the session, I have to reiterate how critical our experience with Cyclotron Road was to our early success. I mean, both as Rachel mentioned, with getting key pieces of the technology de-risked through pretty deep collaborations with top scientists at the lab, but also by accepting pretty incredible networks and mentorship within the rapidly growing and expanding climate technology space.

And I think one thing, we definitely did a few things wrong, but one thing we really did right was kind of jump on the opportunity to surround ourselves with experts and surround ourselves with people who could help us navigate through all the sorts of mazes that you come across as an early-stage startup. So thanks so much. I look forward to the lively discussion, and, yeah, I can’t recommend enough participation in a LEAP node.

JOE: Fantastic. Thanks David, thanks to all the presenters here. We have about 15 minutes or so to have a little bit of a panel conversation. And just to remind folks who, especially if you came in a little bit late, we’ve got six folks on the panel. And my colleague, Paul Syers, is going to lead the discussion—the discussion—so I’m going to turn it right over to you, Paul, and let’s dive in.

PAUL: Thanks, Joe. So yeah, great opening remarks, everyone. My first question was, I think you’ve kind of already covered in a lot of details one of my first questions, which is how much the program has helped you. And kind of moving forward in time from that, this one is for the innovators, what would you say your current biggest challenges are?

TOM: I think one for us is certainly reducing costs. It’s difficult to take something from the lab to the real world. Proving out durability is certainly a key. But another key is keeping costs low and being very practical in how we approach that.

DON: To kind of piggyback on that, cost of labor right now is really difficult to deal with, so we’re trying to hire. It’s a tough landscape, too, to grow our company. So it’s a good problem to have. Like we need to hire people, we want to grow into larger spaces, but it’s an interesting climate for hiring people in the technical space.

DAVID: Yeah, we have a lot of challenges. I will kind of highlight two. I think one related to what Don just said, as we grow, as we bring new members onto the team, really ensuring that the culture that we wanted to establish from day one is maintained, both the engineering culture, but also just how we treat people and how we operate on a day-to-day basis. That’s certainly something we don't want to overlook.

Another one that’s really interesting in our space is these really powerful, but evolving, market dynamics. So you’ll always hear skate to where the puck is going, not to where the puck is. But there’s a lot of traps that kind of keep you looking at the puck where it is now and not where it’s going. So just really, really focusing and never losing focus on product market fit and understanding how certain policy changes or certain regulations are going to enable applications that today we can’t even fathom. We can’t even do any analysis on because they don't exist. So yeah, definitely a challenge, but also a great opportunity to just where does Antora’s technology fit into the energy landscape of the future, not necessarily of today.

PAUL: Getting back, I guess a bit more, back to your experiences at LEAP. I think a lot of the presentations focused on sort of your technology, where it is today, how you’ve been able to develop it. On the business side, can any of you speak to how your experience was going through LEAP and yeah, how that was?

DAVID: I just had a quick comment. It was completely transformative. I was coming straight from my PhD. I had defended my thesis, I think, one week before I started at Cyclotron Road. And they don't teach you a lot of pretty straightforward and very powerful concepts when you go for your PhD in an engineering or science field. So it was a bit like drinking from a firehose for the first—I’m still drinking, but for the first three or four months really kind of going through some of the programmatic resources at Cyclotron Road.

We had weekly workshop sessions, and you could just talk your fellow cohort members’ ears off or hear what they’re going through. I think—yeah, just the sort of organized programmatic resources were very helpful. And then to something that someone else said earlier, the shared learning was enormous. Just seeing that other people were kind of facing the same problems, but going about them in different ways or they faced those problems a year ago, or two years ago, or whatever it was. That was a level of learning that I never really had previously in any sort of formal training, so very valuable.

DON: I definitely want to go that sentiment because I know that Tom brought it up earlier, and David just mentioned it. But having access to a bunch of other companies that are also in the hard-tech space, which is uniquely different, I think, startup environment-wise than what you see for the most part. There are significant challenges that our companies will face that anyone in like an app in the open space wouldn’t have to tackle.

So having a community where a lot of these challenges have been addressed or different strategies that have kind of been developed or tested is fantastic. And I know with Innovation Crossroads, we try to keep it like a pretty tight community. So from cohort one to cohort five, we’re all discussing, trying to resolve each other’s problems and building kind of a rolodex of solutions. So from a business development perspective, that’s just been instrumental.

TOM: Yeah, definitely the learning from other cohort members has been invaluable. I know also John Carlisle and crew put together a very good program to teach us the basics of entrepreneurial training, customer discovery, product refinement, all of that. I did have industrial experience, actually almost 20 years, in industry prior to this, but very different than a startup. And so I was very much a neophyte, and I learned a lot from the program that John put together, and from the other cohort members.

PAUL: Excellent, great to hear. This next question for the program directors at all three of the nodes, I know John Carlisle sort of made the statement earlier that it’s about the people. So the question is, what are you looking for in a candidate in an application because there are so many different factors and dimensions one can think about. So yeah, can you elaborate on what you look for?

DAN: I’ll go first. And you’re right, Paul, there’s a lot of things that we look for. I know each of the programs has an extensive review process. And the reason is it’s because we want to create a lot of touchpoints so that we get to know the applicants and the potential innovators along a period of time before we make selections into the program.

You know, I think one of the main things is entrepreneurial passion. And that’s a lot of times hard to quantify, but that’s why we involve a lot of experienced entrepreneurs—each of the programs does in the selection and in the review process. You don't have to say that entrepreneurship requires almost unmatched resourcefulness and relentlessness to persevere. So that’s something that we look for.

And then I’ll just say, there’s a lot of other things—well, maybe one other thing I’ll mention is the innovation that the applicant is looking to bring. And if it’s truly innovative, and if there’s a fit with the lab, and if we think that the lab can really make a step change in a two-year period and put the innovator and hopefully the startup on a path for success. I’m sure I’m forgetting some important things, so I’ll let John and Rachel jump in.

RACHEL: Yeah, I completely agree, and maybe two things I’ll build on. We look for a really solid technical foundation. As I mentioned, sometimes our company’s committed totally pivot. So we look to make sure they have the technical, they’re not like a one-trick pony. They really are technically very strong, so that if they get there and realize oh my gosh, I’m not going to do hydrogen generation, I’m going to do cement, they can.

And we look for coachability because a big piece of a lot of the factors we consider are, are you going to benefit from this program, so you have a great stage, all that stuff. Once you get there, are you open to learning, do you want to learn? You don't have to take all our advice, but are you going to listen to it to see if you want to take it? So coachability is a big consideration for us.

JOHN: Yeah, we’re asking almost the impossible of our innovators, really. We’re asking you to be the CEO, the CTO, and the lab tech at the same time. And so it’s really a special set of skills. The technical foundation has to be there because they’re driving a project, interfacing with some of the leading researchers of the world, National Lab. And they’re going to pivot, they’re going to change, they’re going to evolve their business based on the market discoveries, so on, and so forth.

So they need to be pretty sharp, technically able, coachable, committed, passionate. And willing to persevere through not just the normal challenges of taking a science-based manufacturing innovation to market, but also dealing with COVID. In all three of our programs, I’ve just witnessed astonishing perseverance through just the most unideal situation you can imagine.

You need to get in the lab and do work in order to get this done, and, right now, all the labs are, have been wonderfully supportive of LEAP and giving access of our innovators to all these unique facilities during COVID, during COVID protocols. So it’s a very special type of person that makes it through our selection process.

And all our programs are over-subscribed, by the way. We can’t support all the innovators that we’d like to support. But when you get a few 100 applicants and you get down to the top 10, there are no—there are no A-minus students left; it’s all A-double-plus. That community that each of our programs has built is really one of the biggest values of this program.

PAUL: Yeah, I can definitely echo that. The level of excitement balanced by the level of heartbreak that happens in trying to choose the—make the selections out of the finalists, which are always strong, that of finalists. We’ve got a range of different experiences with technology development here on this panel.

So just throwing out to anyone, thoughts and comments on how much this sort of accelerates the progress of a typical startup. Thinking if you had this idea and did not have two years at Cyclotron Road or Chain Reaction Innovations or Innovation Crossroads, how would that stack up? Does anybody have any rough estimate in the acceleration impact?

JOHN: Paul, our goal is to go from a science fiction project to an investible business in two years. And for deep-tech manufacturing innovation, that’s like all kinds of tough—and, in fact, when I became director, I thought it was practically impossible. Given my own personal experience with a startup, I think typical times are eight, nine years. We’re trying to condense that down to maybe two to three years. So a factor of 2X to 3X acceleration given the intensity of the project, the embedding of the lab, and the ecosystem, by the way.

We haven't mentioned probably enough how all our programs lean on the ecosystems we’re in for the business and the manufacturing acumen. But there is a significant acceleration, mostly driven by the fact that you get paid full time for a couple of years. That full-time dedication of A-plus people is a really big mover here. So just my quick thoughts.

RACHEL: I’d add for some folks, it’s infinite acceleration. Because without that two years of salary and health insurance, they might not be able to start a company. And one of the real strengths of the LEAP program is that it enables people who don't have the ability to raise a friends and family round or are independently wealthy to go pursue this really hard thing. So in that way, the acceleration is infinite.

DAN: Yeah, and just to quickly add, also not to be discounted is the—as a part of embedding really incredibly talented entrepreneurs coming in from the outside from working with the laboratory, those relationships don't end when the program ends. And so I know across all programs, there’s continued collaboration that just kind of continues the acceleration and the really innovative R&D. So yeah, it’s hard to say. And I agree with—definitely I think John did a good job of quantifying, and Rachel, yeah, absolutely. There’s a lot of projects and a lot of startups that would not have happened.

TOM: Yeah, those are really good points. Looking on time, I don't want the session to end without mentioning that we’re getting around to sort of the application period. Application portals are open at Innovation Crossroads and Chain Reaction Innovations, and they will be open soon at Cyclotron Road. So definitely keep on top of Cyclotron Road’s website to be aware of when theirs open up as well.

I think we might, one last question, it’s a bit more sort of technical from the Q and A box. But you know, these innovators come in with ideas, and there’s a lot of research done during these two years. Intellectual property is probably generated. What’s the ownership situation, what’s the split on that of IP?

RACHEL: It depends on how it was generated. If it’s generated with—so, for example, the ones I said are joined with the lab, that IP was generated with the CRADA funds they have to spend at the lab. And then there’s joint ownership, and there’s a pre-determined agreement about how the companies are able to access the IP, and they work out some sort of licensing.

So it’s usually owned by the lab and licensed to the company. When I mentioned all of those patents, I just meant those are the ones that companies have done in general. Much of that has been with their own non-government funding. But any IP generated with government funding is subject to an IP agreement that’s mostly—the terms are kind of set ahead of time, and then it’s specifically negotiated, but owned by the government or the labs.

JOHN: The most important aspect of this is the engagement of the innovators with the labs to suit their startup companies. So they’re not employees of the lab. The lab’s not getting a piece of the action. They’re not getting a royalty stream, they’re not getting equity in the company. And the IP that’s generated by the innovators accrues to their startup company.

Any form of government support for projects, typically the government has government rights to the IP. But these companies have access and ownership to the IP that allows them to represent to the private sector that they have the rights to the technology, and they can make and ship products based on those innovations. And that’s as disruptive as any other thing about this program, actually. Because they’re coming into the National Lab and working, but the intellectual property accrues to their startup, to their business benefit.

TOM: And as I understand it, they are interacting with the lab much in the same way that any private company would be interacting with the lab that has CRADA fund. This is in no way unusual to how the labs operate.

JOHN: Right, yep.

TOM: Well, I would like to thank all of our panelists for your time. Thank you so much for taking time out of, I know, all of your busy schedules. Some of you I know directly you have busy schedules and for those running startups, you definitely also have very busy schedules. And I would also like to thank Joe Cresko for kicking off this panel.

ALL: Thanks, everybody.

MEREDITH: Thanks to our speakers for your time and energy throughout the summit. We have had a fantastic Storage Shot Summit. For more information about today’s materials, including the flow battery manufacturing awards and the energy storage for social equity initiative, that will be posted on the Long-Duration Storage Summit website.

To all of our attendees, thank you so much for joining us yesterday and today. We appreciate your questions, your interest, following up with all of our speakers. And while this ends the summit for today, there is a lot more for us to discuss and many upcoming storage events, and we’re going to put that up on the screen now.

Please keep these events in mind as you plan out the rest of the year. More information will be available on the DOE website. If you have any feedback about today’s event, please send it to [esgc@hq.doe.gov](mailto:esgc@hq.doe.gov). Again, that’s [esgc@hq.doe.gov](mailto:esgc@hq.doe.gov). We’ll put that in the chat for you. And thank you again and have a wonderful day.

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