PRESENTER: Ladies and gentlemen, please welcome Roman Mars.

[MUSIC PLAYING]

[APPLAUSE]

ROMAN MARS: Good morning. Beautiful nerds. Good morning, beautiful nerds. I slept about this much last night. I don't know about you. I'll probably sleep about this much tonight. Welcome to the Innovation Forums. This is where we talk about cool stuff.

Express, test, and cycle. This is the fundamental process of design. It's our central dogma. Express, test, and cycle. You express the design in a prototype form, and then you test that prototype in a lab or in the real world. And then you cycle. You take what information that you learn and you do it all again. And you do it again and again and again.

This has been the process of design since there have been humans to make things. They probably didn't call it this. They probably called it ug or something. But that's what they did. For most of human history, the design cycle took a really long time. And the result was a unique object that was made by hand.

And it didn't have to be perfect. It just had to do the job well enough. The things we made were not perfectly reproducible until the industrial age. And that's when the job of the designer and the job of the manufacturer, they separated.

So at this point, though, humans were still more adaptive than the things we made, or the tools we used to make them. So one of the first mass produced designed objects was the Darby cooking pot. And it might not be perfect for you. It might be too big for some meals. It might not hang straight in your hearth. But it was affordable and it did the basic job. And you could work around any of its shortcomings.

That's the way it's been for hundreds of years. But now we're entering another age where the tools to design things are more adaptive and robust than we are as humans. And new methods of intellectual productions are changing the ways we collaborate and design.

So the process is still this. It's still express, test, and cycle. But now we have another member

on the team. It's a new kid. It's called the computer. And a computer with pretty much infinite computing power, through brute force, can explore all options. The design process explodes. And we don't have to compromise by expressing, testing, and cycling only one or two options. We can do thousands.

And we get thousands of unique results that can be produced at scale to match individual needs. And we're kind of going back to that dawn of man thing where there's every tool is slightly different to fit needs. And for the first time, we can really break open this cycle of express, test, and cycle. This process to include ideas from outside the company, by crowd sourcing ideas, by gathering data in the real world to improve things so that the cycle never really ends after the product is manufactured.

So these new design tools are the reason that we have the innovators who are presenting here today. We have a couple of young guys who are just out of grad school using 3D scanning and algorithmic design and 3D printing to design and manufacture personalized shoes. I gave them an impression of my feet. I'm getting a pair of personalized shoes.

We have a group of architects forging new ground in the use of digital design and fabrication tools in the realm of architectural design. We have big, established, incumbent companies with appliances in millions of homes who are embracing new ways to foster innovation by engaging the creativity of the crowd. We have a big software company from the Pacific Northwest-- you can guess who that is probably-- blurring the lines between hardware and software.

We have a small company from Liverpool disrupting the sports car market through personalization and beautiful design. And finally, we have a media and entertainment juggernaut from a galaxy far, far away revolutionizing the way we tell stories. It's a killer line up. I hope you're taking notes. I hope you enjoy this session. Please welcome our first speaker.

PRESENTER: Please welcome Matthew Flail and Timothy Ganter.

[MUSIC PLAYING]

MATTHEW FLAIL: So I'm Matt.

TIMOTHY GANTER: And I'm Tim.

MATTHEW FLAIL: We are the co-founders of FOOTPRINT. The mission of FOOTPRINT is to solve the age old problem of improper fit in mass manufactured footwear. We want to take the theme of the market of one to the consumer level by utilizing a combination of 3D scanning, generative modeling, and rapid manufacturing. Otherwise known as 3D printing.

As a couple of guys straight out of graduate school, the formation of a company like this would never have been possible without some fantastic innovations from companies like Autodesk. Today, we want to tell you a little bit about our story and what the future of product design and custom manufacturing will hold.

TIMOTHY GANTER: So as Matt said, we're fresh out of graduate school. We graduated last May with MS degrees in industrial design from Philadelphia University. And FOOTPRINT began as our graduate thesis project. We had this collaborative vision to develop a truly customized and personal footwear experience.

Matt has what others have termed as hobbit feet, so his wide, flat feet never fit any shoes properly. And myself, I've always been a sneaker head at heart, and had a passion for design. So we were a good fit from the start, and here we are today.

MATTHEW FLAIL: So when we began, we realized that there were a multitude of problems with the way current footwear is constructed. And there are some really great technologies out there that aren't really being utilized to their fullest potential, especially when it comes to footwear development.

TIMOTHY GANTER: So one of the biggest problems with how footwear's currently made is all the waste that's created during the process. 20 billion pairs of shoes are produced annually. And each year, about 300 million pairs are thrown away.

MATTHEW FLAIL: On the topic of EVA foam, the most common foam found in sneakers, it can last up to 1,000 years in a landfill and is not recyclable. All this trash doesn't even account for the factory waste during the manufacturing process, from excess molds, tooling, and scrap materials. Through our process, we begin to consider the sustainable aspects of 3D printing and how we can incorporate that into our design process.

TIMOTHY GANTER: Another huge problem is that no two feet are alike, not even your own. The industry's still using a standardized sizing system that's been around since the 1600's. In fact, the original unit of measurement was a single barleycorn. So most people fit between a range of shoe sizes. Even within the same brand, I fit a different size each time. This makes the shoe buying

experience extremely frustrating, especially someone like Matt and his hobbit feet.

MATTHEW FLAIL: So during our research, we spoke with a number of podiatrists and pedorthists to gain some insight. We wanted to develop a footwear solution, and we were torn between orthotics and fully functioning footwear. The most important info that was given to us was that even though an orthotic might fit your foot correctly, if it doesn't fit into the shoe, you're actually doing yourself more harm than good. So that helped make our direction clear as we set out to design our solution.

TIMOTHY GANTER: So our process begins with 3D scanning of the user's foot. We've experimented with a number of different 3D scanning techniques, as well as photogrammetry software, such as Autodesk 123D Catch. With apps like this, it seems increasingly likely that we'll be able to get the data we need directly from your smartphone. And even without a smartphone, 3D scanning for feet is already being implemented into the retail space as a matchmaking service.

So once we acquire this 3D scan data, as you see here, or the mesh, as it's known in the CAD community, we import that into Fusion 360. At times, we also make use of Autodesk MeshMixer to clean up or touch up these super large files. The tools infusion allow us to streamline the process of creating our foot beds. In this modeling environment, we can create organic forms with infinite possibilities.

Here we develop our basic midsole shapes, mapping them to the user's foot, creating a customized midsole that is specific just to you. When switching between workspaces, we can add the final touches, accessorizing and readying the file for its next destination.

TIMOTHY GANTER: And then once we develop this basic shape, we take these solid midsoles into generative modeling software. And here it uses algorithms to transform the solid into a network of support structures. There are two specific processes we use, both that have their own unique looks. Our first process creates a cellular structure where we can manipulate the size and position of the cells. This allows us to create multiple density midsoles that move with your foot.

Our alternate process creates a similar cell structure, but uses what is essentially the inverse of our first process, and creates wireframe supports. by altering these thicknesses, we can accomplish the same results.

MATTHEW FLAIL: So once we have our midsoles developed and put through the paces in the generative software, we're now ready for manufacturing. 3D printing provides us with fast in-house

production capabilities and eliminates all of the excess waste created in the traditional footwear manufacturing. It also provides us with the opportunity to create complex forms that would never be possible with traditional molding techniques.

TIMOTHY GANTER: So as you can see, we married all these technologies together to make our mission a reality.

MATTHEW FLAIL: So to give you a little bit of an overview on our process, let's bring you back to a little bit about how we came up with these structures, and the evolution of our midsole concepts. When we first decided on 3D printing, we had to do a number of structural tests to find out what provided the best support and compression characteristics. We looked at airless tires at first, and the geometries they use for inspiration.

Then we went to what a traditional foam looks like on a molecular level. We realized that foam gets its variable density from the size and shape of the internal cells. And we tried to mimic that effect in our 3D printing processes. From there, our midsoles evolved.

TIMOTHY GANTER: So this evolution began with our cellular structure mentioned earlier. We started out testing the basic cell systems with evenly spaced, larger cells. From there, we began varying the size, the shape, and the position of all of these cells to achieve variable densities found in traditional footwear midsoles.

We're even looking into using 3D printing as a support structure around the foot, not only underneath. And as we continue to further develop these footbeds, we're looking to generate geometries that work in conjunction with specific printing processes.

MATTHEW FLAIL: So our first wireframe iterations created forms that were entirely too thick to be functional. They made the midsoles too stiff, too heavy, and at times, they were too soft. They just didn't work to wear. As the concept evolved, we began to alter the thickness of the wires. A big part of our current R&D process focuses on maximizing the benefits of the wire frames specific to SLS printing. This includes developing techniques to enclose these open models and ease the marriage of midsole material to knit textile.

TIMOTHY GANTER: So concurrently to developing all of these midsole concepts, we were testing and iterating different 3D processes and materials to determine which would be most successful. We started out with FDM printing, which is the most well known 3D printing process.

FDM melts solid filaments and extrudes it onto the print bed layer by layer. The cost benefits

of FDM printing allow us to quickly iterate most efficiently. And we have tested a number of different flexible materials and had varying success.

We also tested with PolyJet printing, which is similar to inkjet printing, as it uses liquid polymer that's cured by UV rays. While these came out looking really clean and have great detail. They're a little too stiff and too heavy to be used in footwear development. So the most promising process so far has been SLS printing using a few different materials.

So SLS, or selective laser sintering, creates parts using a laser that sinters beds of powder, binding the material together into solid structures. And we have tested a number of thermoplastic elastomers, each with their own benefits unique to our two midsole concepts.

MATTHEW FLAIL: With all of this R&D in mind, we continued to push onward and develop our vision. The speed of growth in the world of software and manufacturing has put FOOTPRINT into a position that would have been impossible to imagine just a few short years ago. We're extremely excited to be part of this new movement, and we look forward to what is yet to come. Thank you all for listening to our story.

[APPLAUSE]

PRESENTER: Please welcome Stephen Van Dyck.

[MUSIC PLAYING]

STEPHEN VAN DYCK: So if architecture is to be an expression of our humanity and our time, our 21st century buildings will require a level of innovation and technological savvy that as an industry we're not yet achieving. This 21st century building is complex, interconnected, and social to accommodate our evolving human networks. It's flexible to respond to our fast changing world. And it must be sustainable beyond traditional metrics.

But the problem is that, for the most part, the supply chain in our industry hasn't changed in over 50 years. We're trying to use 20th century delivery methods to deliver 21st century buildings, and it's not working out so well. Despite many attempts to change this and solve this, mostly through contracts, our industry remains fundamentally still adversarial. This is not the environment which will inspire the innovation required to deliver our 21st century buildings.

But at LMN, we think there's a way. And it involves creative people. It involves our tools. And it

involves getting our hands dirty and making things. So with this in mind, several years ago, we started a research and development group we call Tech Studio. It's an evolving group of individuals with technological curiosities that you wouldn't normally see in an architecture firm.

Their goal is to research, develop, and deploy emerging technologies to our design work in the studio. We've built our own interaction hardware to allow designers to interact with their generative models in new ways. We've built interfaces that link our physical models to our digital simulation tools, and allow for real time feedback while manipulating the model.

And we've built our own CNC tools to begin exploring the role and potential of larger scale digital fabrication to our project work. We've had a lot of fun with all this research over the years, but we've always known that there would be great opportunities in applying this kind of thinking to the realities of our design work and to our profession.

So today I want to share with you a few examples of how Tech Studio is transforming our practice. So in 2009, at the depth of the recession, our industry was in a really desperate state. Architects everywhere were willing to do a lot more for less, and we were no exception. We'd just won a huge project to redesign the civic core of Cleveland, an incredibly prominent site. And this client had very high design aspirations.

But we had a very tight schedule and an even tighter budget. We had only 3 and 1/2 months to develop a facade concept and bring it all the way through to fabrication information, all the way just to the design build team. That's just a quarter of the time that we would normally want to do something like this in.

So at the time, we'd been working on ways of interacting with our generative design models and link them to are simulation tools, so we could rapidly iterate through many options and come to an optimized solution. The problem was that at the time, there was no quick way to get this geometry and data quickly into Revit, which was our collaboration platform.

So we set out and built a plug-in to unite this process. That's right, we the architects had actually become software developers to solve our problems. And it enabled a few amazing things. First, we were able to almost instantaneously give each team member the information that they needed to validate the design. Things as simple as quantity takeoffs, enabled real time pricing by our contractor.

We automated the process of making drawings sheets here to itemize multipanel assemblies

for our concrete fabricator, saving them hours of time every time we decided to work through this iteration. And this same model was pushed forward to develop the surface geometry of the concrete panels. This geometry quickly became so complex that we couldn't actually render the full building in our computers.

So we set out to study it in physical form, and started casting our own. These models are really critical in many ways. They allowed a very high level of detail resolution. And they actually allowed us to realize material savings on the building. But mostly, this method of working generated a huge amount of trust between us and our builders. As a result, our digital models were used to directly fabricate the final building components, completely eliminating the time consuming shop drawing review process.

So this project set a new standard for us at LMN. It enabled team-wide collaboration at a really unprecedented pace. We engaged in a meaningful dialogue with our builders, which led to a better design. But ultimately, it allowed us to build something we could have never built before. To us, this project completely redefined the role of technology in architecture. We weren't just using it to make something look interesting. We were able to use it and leverage it all the way through the delivery process.

So as we emerge from the recession, it had become clear that our industry had fundamentally changed, and so did we. Our clients continued to expect more for less, and one of the best examples was a project that we began in 2013 for the University of Iowa. Their arts campus had been decimated by a flood of the Mississippi. And they needed a new music school. On a very complex site in the heart of Iowa City is a very complicated building type.

But the problem was the agency paying the bills was FEMA. And FEMA required an outdated means of procuring the work, essentially requiring that the lowest bid would win every single one of 13 prime contracts. Now traditionally, this is when architects get really conservative. Clearly, this is not a recipe for innovation.

Now, there are a lot of things about this project that I would love to talk about today, but I'm going to talk specifically about the ceiling system that we developed for the main concert hall. The design of this space involved the input of 15 specialty consultants, all of whom would be critical in the project's success.

So we set out and built a very robust parametric model that allowed their data to drive the geometry of the system. The model gave us the capacity to coordinate a huge amount of data,

resolve the conflicts, and simulate the acoustic performance of this system. All the while optimizing the form as the variables evolved in the design process.

But the problem remained, how would we make this thing? So at the time, we were really interested in a material called composite aluminum panel. This is the stuff that's usually reserved for making gas stations. Needless to say, this is a completely new application for this material type, which meant lots of uncertainty about how it would perform. And the beauty of the material, though, is how easily it can be manipulated to do some really interesting things.

But without construction input on the team, we had to set out and prove it ourselves. So we enlisted the help of our CNC router and got to work making prototypes. And this is where we learned a really valuable lesson. And that is, if you can walk into a conference room full of skeptics and show them this thing that you built on the weekend, nobody can tell you that it can't be done.

Suddenly this idea went from crazy to completely feasible. The prototypes were really critical in other ways. They were allowing us to prove out our details, prove out our documentation, in which we could show the ease of assembly. But to make it truly biddable at an affordable cost, we needed to attract fabricators who would be savvy enough to fabricate directly from our data.

So in an effort to send a smoke signal up over the contract divide, we published the data to fabricate every single panel in our drawing set. And it worked. The winning bidder contacted us immediately upon winning the contract, got our digital model, and fabricated mockups and the final system. Here it is just yesterday. The scaffolding's coming down today.

So what did we learn? Well, that creative thinking with some cheap materials can go a long way when you can self-prototype. The direct to fabrication model is still possible, even in the most stringent of delivery methods. And once again, our technology is allowing us to overcome some of the biggest challenges of our work.

What we've seen so far is the big gains in the back end of projects, where the architect and LMN is becoming absorbed into the building and the making of the project. But we believe that there are some huge gains to be made on the front end of projects as well. Earlier this year, we begin work on a new bridge for the Seattle Department of Transportation.

Now, DOTs are normally very bureaucratic institutions. And these infrastructure projects really

require a layering of public approvals. Both of these can be very big impediments to progressive design and delivery. Not to mention the fact that this is the kind of structure that they usually build for pedestrians.

But we believe that architects are the missing ingredient to this problem. Because we can minimize their risk by enabling the consideration of multiple variables simultaneously. And we can deliver this all with high quality design at a very affordable cost. Our client, KPFF Engineers, believe that too, so they hired us to lead the initial coordination and public process for this new bridge.

Initially, there were huge variables at play. We didn't even know where exactly the bridge would go. So we set out again and built a very robust parametric model that allowed us to study every single permutation of that. So this is where technology is totally transforming the way that we're working on projects in these early phases. In the old days, an engineer would have only been able to study two to three options because the variables are so complicated. But today, we can effectively allow them to study every single configuration possible.

This same model is being pushed forward as the basics of the project's feasibility and cost model. And then into the design phase, this same model is becoming the central point of coordination for the entire design team, allowing us the chance to refine the structural geometry, as well as all the geometric rationalization of that model. And once again, bringing us direct to fabrication. This time for small scale prototypes, which are becoming absolutely critical in the public approval of these projects.

So as a result of all this work, the bridge just received full public funding just last month and will be going out to bid in 2016. But we're finding that our private clients are really benefiting from these ways of working as well. They're coming to us with increasingly complicated projects with multiple layers of negotiations and approvals required. Most recently, for what will be the tallest building west of Chicago, only two blocks from our studio in Seattle.

Our models are becoming the basis of their initial land negotiations. They're the key in developing the basic financial models which are proving the viability of these projects. As in the public work, these same models are becoming key to the public approvals of the project, allowing us to optimize the building form and location and mix for any given site. Here you see an analysis algorithm studying the views of the building and how it might impact those views of the buildings around it.

We're even automating conceptual programming for this building. So when we put all this data together, we're providing a value to the owner that far exceeds anything that we could have done in the past. The architects are now fundamentally informing the financial models of these projects.

So we in the design and construction industry must be the catalysts for positive change and development in our cities. And we believe that the smart and agile use of technology is the only path to getting there. So if technology is allowing us to build better, faster, and more efficiently, why isn't everybody using it in these ways? At LMN, we believe that the key to our success is the key to-- sorry, say that again. We believe that the key to our success depends on the success of our industry as a whole.

So we're committed to making this way of working a new paradigm, which means that we need to quickly disseminate all of our findings amongst our studio and to the profession beyond. And we're doing it. Since we started Tech Studio, we've been sharing both our research and our software developments for free online to anybody who wants it. Finally, for us to make good on our 21st century promise, I believe we must be committed to cross-industry collaboration. Our biggest gains will be made from the insight from people in this room. Thank you.

[APPLAUSE]

PRESENTER: Please welcome Taylor Dawson.

[MUSIC PLAYING]

TAYLOR DAWSON: Good morning. I'm thrilled to have the opportunity this morning to tell you about FirstBuild, and how we, along with GE, are developing a new playbook for product innovation. So what is FirstBuild? Well, FirstBuild is a wholly owned subsidiary of GE Appliances that aims to bring more home appliance innovations to the market. FirstBuild is also a global co-creation community where GE Appliances' engineers team up with enthusiasts to design, build, and sell new appliances.

We have a facility in Louisville, Kentucky, where GE Appliance is headquartered, called a microfactory. And at this facility, we prototype and manufacture sellable product in low volume, all with the goal of scaling them up into the mass market. Anyone and everyone can come,

see what we're working on, share ideas, and develop with us. And all this seems very unconventional. So it's natural to ask a question. GE is a huge company. Why are they getting involved in something like this?

So there are two parts to a company like GE. The first part is the one you see. It's a successful appliance manufacturer. We've brought some of the most important innovations to the home appliance market over the decades. But the story that I want to tell you today is the one that's rarely told. It's the story of all the ideas that haven't surfaced, that haven't made it to market.

And these ideas represent value that designers, engineers, people within the company have seen that they've wanted to bring out to the market. And we've seen them kind of stack up over time. So we've had the question internally, how do we get more of these ideas on the market? It's a world of limited resources, what can we do?

Then we observed something happening on the outside. So Louisville is also home to a hacker space called LVL1. LVL1's a community of hardware and software hackers who are organized around the principle of making and prototyping new things. It's membership's comprised of engineers, entrepreneurs, artists, basically anyone who's genuinely enthusiastic about making new things.

So we ran an experiment. GE and LVL1 co-hosted an open innovation hackathon where GE engineers and makers worked side by side to create new appliances. And after 28 straight hours of prototyping, we had five new appliance prototypes sitting on the floor, communicating a new value that could be created in the marketplace.

So let me pause now for a personal anecdote. I was visiting my brother in Arizona, telling the same story I just told you about how GE's interested in working with people from the outside of our company to develop new appliances. And immediately, his eyes light up and he says, I've got to show you my butter conditioner.

So he takes me into his kitchen, shows me his fridge. And on top, there's an industrial grade power supply. He's hacked together an insulated bin within his refrigerator where he stores his butter so he can keep it at his ideal spreading temperature.

So this was a dawn of a new reality for me. I didn't know that my brother was a maker. But it was also a dawn of a new reality for GE appliances. We understood that passion and knowledge for creating new things exists to far be outside the walls of our business. And this

hackathon experience actually guided us to a new set of questions that would culminate in a dramatic shift of our values.

What if everyone could see our products coming to market as they were being developed? What if we could build an organization that would collaborate with makers to build the products they want? Is it possible that we could create a massively open platform for real time co-creation?

So FirstBuild's vision is to invent a new world of home appliances by creating an engaged community of designers, enthusiasts, makers that will share ideas, try them out, and most importantly, build real products that will improve your life. And this vision is specifically designed to revolutionize the way products are brought to market.

This goes against the conventional wisdom in so many ways. In the traditional cycle, business leaders, generally those with a deep insight into the market, establish that there's a need for a product. And they translate that into a technical spec based on the market needs. Hand it over to the engineers, and they are guided by that spec to create what they should deliver to the market. All the while, the business is preparing for a mass launch of the product, including major investments in plant and equipment.

But there's a hard truth about this model. And that is that it takes about four years from the original concept to market of a product. And what happens in that time? Competitive landscape shifts. There's new technologies that emerge. Consumer needs change. And meanwhile, we're spending millions of dollars and years of our lives preparing for a product launch where success is anything but certain.

Make no mistake, launching new products is risky. So with so much at stake, we have this human tendency to look for ways to control the process. The traditional model for product launch applies three values as means of mitigating risk. First, we don't want to share ideas because we don't want to lose our competitive advantage.

Second, the product decisions are left in the hands of a few people at the top. And as such, we expect the product to kind of come out in this linear process. That is to say, we assume that a successful product launch is when we have a physical incarnation of a technical spec. But usually a technical spec that's been written years ago.

And so these values can and have worked in the past, and they work in cases where the

market is stable and understood. Or sometimes where your company is guided by a visionary genius. But there are weaknesses, particularly when we have radically new markets, we're looking at new technologies, or new value propositions that have yet to be tested in the marketplace.

In our increasingly fast changing market, value is not gained by perfecting the known, but by imperfectly seizing the unknown. Value flows from innovation, not from optimization. So when we look to establish a set of values for FirstBuild, we're not looking for greater control. We're looking to create an environment where innovation is given room to flourish.

For decades, we've been applying the values of optimization to the process and practice of innovation. But our new playbook values speed over secrecy. Ideas, prototypes, and product proliferate in an open environment with a making culture. We rely on the passion, interests, and experiences of our community members and employees to guide the development of products. And we aim to get products to market fast to validate consumer interest, all the while reserving the right to pivot in response to market feedback.

So this is FirstBuild's new playbook for product innovation. Design, build, and sell. We design in a co-creative environment, collaborating with a community of makers and consumers. We build in small batches, starting with a prototype. And we sell our products that validate fit for the product in the marketplace.

I'm sure many of you out there have had a great idea for a product and you shared it with your friends. In my experience, 9 times out of 10, when I do that, they give a little nervous chuckle, and then they kind of say, huh? I don't get it. Ideas in and of themselves are limited in their ability to communicate a vision for a new product, so the FirstBuild community members and employees hacked together their first prototype of a product.

In order for our ideas to have life, they need to be experienced. And prototypes are the main currency for communicating value in a design economy. And another thing, prototypes are living, breathing entities, and by the act of creation, engineers and designers enter into a close relationship with the products they're creating. So we believe it's important to empower creators to make product decisions and trade-offs.

The FirstBuild microfactory is a world without barriers. Over the last year, thousands of hackathon participants, students, parents, retirees, and skilled workers have come to our microfactory and contributed on our web platform. By creating an open environment, we

assured ourselves of at least one thing-- every employee, community member, or hackathon participant is there because they want to be there. Openness is a key to igniting passion.

That's why FirstBuild is opening up GE Appliances' firmware to developers. So last year, we launched a product called the Green Bean Maker Kit. It's basically a bridge directly to the brain of your appliances that allows software developers and hackers to access the core functions of GE appliances so they can develop new features for their appliances.

The dream of the smart home has been much discussed, but it has been elusive. And we believe that FirstBuild will help makers develop uses that make sense to them. So for example, this laundry pair, you step outside of your home for an hour and this dryer will notify you when the cycle is done. If you're going to be back in a few minutes, you can activate the fluff cycle through your smart watch by saying, keep my laundry fresh. The smartest ideas in the smart home space may not pass first through the corporate boardroom. They're going to come from people who are passionate about solving problems that they're already experiencing.

So FirstBuild goes well beyond just being an innovation lab. We show that we're serious about product by building sellable units in low volume. As an example, one of GE's industrial designers had a great idea how to improve the usability of this double oven range. The top oven is the one that consumers prefer to use 80% of the time, but it's hard to access the food.

So the novel idea was to design the upper oven door to slide out like a drawer. When we showed this to consumers, the response is uniformly, now, why didn't somebody think of that sooner? Honestly, I don't know. But the hundreds of units that we've made are selling well and now we're making hundreds of more.

This test in the marketplace has also allowed us to establish a demand curve for a future program at GE Appliances. But the most novel and an important part of our approach is that we aim to take products from mind to market in three to six months. When we close the loop quickly, we're able to get a signal from the market that tells us whether to pivot, proceed, or abort.

So one of the most popular ideas on our website was to replace standard crescent-shaped ice cubes with that really beautiful nugget ice. And I know I've met a lot of people here from Texas. Those who are from Texas probably call it sonic ice. For those who don't know yet, it's basically flakes of ice that are compacted into a solid nugget. It makes it crunchy yet also soft and easy to chew.

So we did some quick research and we found that there was a significant preference for nugget ice. And then we launch a challenge to ask our community how to develop a nugget ice maker for the countertop. The winning challenge was a community member named Ismael Ramos from Mexico, and he presented a novel idea of having a removable pitcher that served a double purpose of showing how much ice was left in the bin.

After about three months of design and engineering development, we took this Opal Nugget Ice Maker to Indiegogo, which is a ready made product validation platform. And within 30 days on Indiegogo, it became one of Indiegogo's top campaigns of all time with almost $3 million in crowdfunding. So we got a very strong signal from the market that there is indeed demand for this new style of ice at home.

And we did it all with unprecedented speed and without fronting millions of dollars in product development. Our best ideas have been sparked by anecdotes shared by enthusiasts from outside our business. With Nugget Ice, it was the stories of all the people making weekend trips to buy a bag of nugget ice so that they would have some to last them through the week.

We've also conferred with consumers and chefs who are really interested in making better food through technology. Paragon is a smart induction cooktop. One of the key problems people have when cooking is getting the time and the temperature right. So by pairing this Bluetooth temperature sensor with a cooktop, you can actually dial in the precise temperature and Paragon will control it within one degree Fahrenheit.

And the mobile app actually allows you to do a type of cooking called sous vide, where you can get your steak cooked perfectly, medium rare edge to edge, every single time. So a medium rare steak, tempering chocolate, making candy, holding foods at serving temperature-- these were all applications that we heard first from our community.

Paradoxically, by relinquishing control, we've unleashed an engine that is capable of producing new products at an unprecedented rate. In 16 months since FirstBuild opened, we've actually launched 10 products, and we plan to do another 10 next year. And because we respond to the input of a community, we don't know what every single one of those products will be. But our determination to release new product means that there's always something interesting on the horizon at FirstBuild.

So let's end on a high note. Who likes pizza? Our next big launch is the first pizza oven

designed for a residential kitchen. It can keep deck temperatures of 800 Fahrenheit and dome temperatures of 1,200 Fahrenheit. So it can cook a perfect Neapolitan style pizza in less than 90 seconds. With settings for Neapolitan, Sicilian, New York style, you'll be able to make any pizza you want to pizzeria grade quality with professional results every single time.

So consider this an open invitation. Next time you're in Louisville, come join us for a pizza party. But in the meantime, if you're a designer, an engineer, a builder, an architect, join us on FirstBuild.com and become part of what's next in home appliance innovation. Thank you.

[APPLAUSE]

[MUSIC PLAYING]

[VIDEO PLAYBACK]

-It's human nature to go as fast as you can possibly go. I'm not afraid of dying. I don't want to die, but I'm not afraid of it. This is the first time I've ever had to write a will. I just go, and I don't let up until I have to.

-You're balancing speed against calculated risk.

-Two things that I'm thinking before I take off. Let this be a testament that girls can do anything they set their mind to, and do not wreck this car.

-We're processing over two thousand measurements a second. Enter the Microsoft Cloud. We're able to take the data, automatically process it, and get the results in a time frame that was unimaginable in the past.

-I live for afterburners. It's like turbo boost times a gajillion. The fastest I've driven on four wheels is 440 miles an hour. Now we have one more goal, and that's to be the fastest woman on earth.

[END PLAYBACK]

PRESENTER: Please welcome Ulrich Homann.

[MUSIC PLAYING]

ULRICH HOMANN: In the fall of 2015, Jessi got her wish. A, she didn't die. B, she didn't wreck the car. And C, she actually broke the world record in land speed. She took a-- or the team took a F-104 Star Fighter and put it on land, instrumented it with 2,000 sensors to capture data at the rate of 2,0000 measurements per second. And if you look at the advancements that we have made in terms of moving from a hardware-based focus, then shifting to a software-based focused, we're now at the age of data.

The team at North American Eagle collected so much data that they not only had to have a storage environment that can handle that kind of environment, they also had a compute environment that needed over-- I don't-- I think it's about 10,000 servers to calculate their runs. And every time they wanted to run, they simulated some more data and captured more data to figure out what's going on.

At this point in time, we are collecting data faster every 48 hours than we have until 1960, all up from the beginning of data collection to 1960. Every 48 hours, we collect more data then what we used to do. We're now at zettabytes of data production. And if you think about the data that we are going to produce with all the innovation that you have seen from GE, from the architect people, from the North American Eagle people, you will see that more and more data is being collected. And it's going to be there for you to assemble your solutions and really improve design, construction, and operation of the system.

Now, I am in the platform business, so I don't have cool demos like my friends before. Because normally when you show platform technology, it's like watching grass grow. Because it's like that interesting. However, I do have some friends that we have worked with over the years to effectively help illustrate what can be done and what is being done today.

So if you think a lot of this is future, you actually are wrong. Most of this is happening today, and we will only advance it in the future using tools, technology from partners like Autodesk, but also the Microsoft Cloud, and assets that we are providing in terms of machine learning, big data processing.

Let me talk a little bit about my friends from ThyssenKruppe Elevators. Those guys are a company that operates and maintains 1.2 million elevators across the globe. They're getting paid by uptime. A typical uptime is about 74% of the elevator. And if they get down, they actually get penalties, they get charged by the company or not paid.

So one of their goals is to figure out, how do I make sure that I go into the elevator repair

before it happens, before it goes down. Today, or before this initiative, our friends from ThyssenKruppe had to actually dispatch a field engineer with a laptop, go into a room, and effectively hook up a serial cable onto an RS232 port. And collect the data, analyze it locally on the laptop, figure out what's wrong, and then call somebody with the right part because guaranteed, you picked the wrong part to go and repair this thing.

Now our friends from ThyssenKruppe have worked with Microsoft data scientists, and we did two things. We analyzed 30 years of data that they provided to us. And we effectively looked for patterns of what goes wrong, when does it go wrong, and what are the signs for it. And now ThyssenKruppe effectively is hooking up each elevator, these 1.2 million, with a data box that sends the data continuously into the Microsoft Cloud.

And we are able to process and analyze and look for these patterns. Now I can dispatch a field engineer with the knowledge a priori what's wrong before it goes wrong. I bring the right parts. And as a side benefit, I don't have to necessarily have a 30 year veteran that understands the elevator better than the back of his hand, or her hand, in order to support the production and the maintenance of the system.

This Is going to change their business. And it's moving them from an, OK, we're going to do this service level agreement-based business to an understanding, in-depth, real time, looking at the data, connected product business. And they believe they can now carve costs out of their business and improve the experience for customers. Not sitting in an elevator when it breaks down I think is a nice benefit of what we all would like to experience.

The second one is an interesting shopping experience. How do you go, as a company like Pier 1 Imports, who are importing decorative products for the home, interesting wine products from all over the world at attractive prices, and how do you figure out what is the right product for you, or for me? And not just in mass, but individualizing the purchasing experience.

They work with Microsoft data scientists who effectively analyze the data purchasing behavior. And understanding males, females, white, colored, et cetera, et cetera. And then bringing it into the individual form, meaning provide recommendations for Uli. Uli is not interested in decorative home products, despite my girlfriend's intents of figuring me out there. I just don't do that kind of thing.

But I am interested in wine. And I'm not opposed to buying wine at exorbitant prices. I do like

the occasional bargain as well. And Pier 1 has figured this out. And they've figured out that I'm interested in getting coupons, information, infotainment, and so forth about wine imports, specifically sparkling now that we have the Christmas season going up front.

The next one is something that I think all of us should be concerned about. And it's really exciting to see the application of technology. The US has a really, really big problem in education. I don't know the exact numbers, but a lot of kids don't graduate from high school because they find the curriculum boring. They are not interested and they are not able to find the right courses that keeps them in school.

Using data, using machine learning, using recommendation algorithms, we were able to increase the rate of finishing high school by effectively figuring out, what are you interested in? What is he or she as a student interested in staying, studying, and running the business. Meaning we are able to customize the curriculum to the interests of the individual person.

So it's not something where you effectively say, hey, this is the curriculum for everybody. Now I can actually build a curriculum that's not only based upon what you think your interests are, but also what your interests have been over the course of your studying, and patterns from students that have similar interests than you are. Because sometimes you don't know what's good for you.

And so the system is able to help you figuring out who you really are. Sounds really spooky, but it's certainly one of those applications that we will see. I've only brought three of these examples, but there are hundreds more out there that are being explored today. Fraud detection, real time analytics of traffic patterns, parking, and so forth will all be fed by data coming in, being analyzed, and looking for patterns in the system.

Now, what do you need for that kind of solution to be available for you? First of all, you need an environment that doesn't constrain you. You need an environment that's available across the globe. Now, I have one of those. It's called Microsoft Azure. And I run north of one million servers across the globe.

I've laid about 1.5 million miles of cable to effectively connect those computers across the globe. And I effectively run a Microsoft Cloud environment in over 100 data centers, ranging from the US, Europe, Brazil, India, China, Japan, and so forth. So from my perspective, that's number one. You have to have a lot of stuff and a lot of gear to help you make this possible.

The second thing you have to have is a way for you to connect all these things. Now, if you read IDC or any of these other guys, they will tell you that we are going to connect 23 billion devices by 2025. Sometimes it goes up to 50 billion devices. It's really hard for me to tell how you can talk about 50 billion devices when, if you do a desktop deployment in your company, 100,000 desktops is a very big project. You're really trying to figure this out.

Now, we talked casually with a company in Denmark. They are doing pumps, for example. That's a pump company called Grundfos. And they casually informed us that, they said, yep, we want to connect in the first batch 12 million pumps. So 100,000 desktops, huge project. When these guys were saying, yep, easily connecting 12 billion pumps.

I'm not going to go through the details of the Azure IoT technology, but it effectively enables you to connect millions, billions of things, and derive the data through the processing system for real time analytics and so forth. Just to give you one data point, currently one of my event hubs, which is a technology to ingest information into the cloud, can handle a million events per second. One million events. And we're currently working on how do we make that faster, or even faster.

The second technology set you need is analytics. And our product set is effectively talking about the Cortana Analytics Suite. But again, not enough time for details. Just look it up in terms of how are you taking information in, how do you manage information, how do you store information? We always talk about big data, right?

I have a data set that is north of one exabytes of storage, where I use big data sets to drive relevance for search engine called Bing. And it's effectively running north of 100,000 servers as one data mining environment. And while that sounds big, it is effectively something that's coming your way using cloud technology and the intuitive design and capabilities of your creativity.

You can learn more at the InternetOfYourThings.com where we effectively tell you stories, share with you technology, and welcome you to experiment with our technology for your benefits and your customer's benefit. Thank you very much.

[APPLAUSE]

PRESENTER: Please welcome Ian Briggs.

[MUSIC PLAYING]

IAN BRIGGS: Hello, everybody. Briggs Automotive Company, or BAC, grew from a design consultancy that I'd formed with my brother Neill in the early 1990s. We did lots of projects, lots of interesting project for the big OEMs. But in 2007, we decided we wanted to create our own car.

We wanted to show what we could do as a design company if we set the brief, if we decided where the focus should be, where the compromises should be, made the decisions. And we also want to create a high performance car. That's where our interests lay.

So what we did here, if you see on the graph, we created a graph of what we perceive to be our competitors. Along the bottom is cost, and on the left side is lap time. And you can see the established brands as a kind of a relationship between the price you pay and the performance you get. And top left is where we imagined our product would be. Ultimate performance at affordable price, but not cheap.

As you might expect, as normal, we started with mood boards. But you'll probably notice there's no images of cars. We'd sets out to create a different type of a car. We didn't want to create to car as a means of transport. Our car was not going to be anything to do with A to B. It was going to be A to A. So what we actually decided to do was to try and create a piece of sport equipment for the extreme sport of driving.

And as you can imagine, once you start with this different approach, then it becomes obvious to follow that focus all the way through. So very early on, it became clear this car would be a single seater. And this single seater would have influences that would differentiate as a new product in the market.

This was the most influential image for the design team. The idea was organic surfaces stretched over a machine. So as we first started sketching, this was a theme that we adopted all the way through. And we liked this teardrop form, because we felt as the air was broken, it became less and less necessary to cover the machine and to protect it from the wind. And so you'd see less and less body work as you got towards the rear of the car. That's where the aesthetic for Mono began to be developed.

I mentioned earlier about a piece of sports equipment for the extreme sports of driving. If you set out to design something like a snowboard or a mountain bike, we're very aware of the compromise you would make if you made space for an occasional passenger. Imagine a pair

of skis with place for a mate.

So because of this focus, because we were aware of this compromise, it was very obvious to us from the very beginning it would be a single seater. And that allowed us to create this type of package, the most optimized structure which is literally just big enough for a person, an engine, and a gearbox.

We did face lots of challenges though, of course, because one, we're a very small company, and here we're trying to take race car and formula car engineering and apply into road cars. So there's lots of regulations about what you're allowed to do in a road car. And there's lots of safety regulations in motorsport that we were very keen to be mindful of.

So after the first sketches, we started to develop the idea. This idea of organic surfaces stretched over a mechanical lower body developed. We developed the clay model, checking them against our early sketches. And as time goes on, we're checking back into to the physical model as well, sight lines, what feels too close, what feels too narrow, what feels good. And referring that back into the clay model.

And all the time, this dull brown clay, we're having to play around in Photoshop and just try and get some idea of what it's going to look like, and to start to look at some of the functionality of that design. And here you can see us developing this idea of these mechanical elements in the lower body, and the organic surfaces in the upper body.

That's the final chassis. And that's the clay model just before it went off to be digitized. As the digitizing was taking place, we conceptualized the interior. Wanted a really simple interior. We were going to put all of our controls on the steering wheel with minimum controls in the cockpit itself. Here you can see we're sketching over the actual physical model.

And we came up with some unique solutions as well. The cockpit's so narrow that if you try to operate a switch with your right hand on the right-hand side, you physically can't do it. So we decided we would use the opposite hand to control. And the whole layout of the interior and the orientation of important functions was dictated by that.

As a small manufacturer, we can't even begin to think about affording our own lights, so the light design and how we integrated off the shelf lighting into the design of the car was one of the big challenges. And when we referred back to the mood boards, it was clear we couldn't just take some lighting unit from a production car and bolt it onto Mono. So we took off the

shelf lighting units. We completely disassembled them and we created billet surrounds machined from solid aluminium that made a lighter solution, and an aesthetically more appropriate solution.

We used Autodesk CFD software to develop innovative solutions, sometimes solutions that you would not imagine. We have a small wing in the front of the car, and in order to create downforce, because the airflow in that area, the wing actually has a positive angle of attack. Something you would not normally expect.

Other challenges included things like using the software to work out where this 100 millimeter sphere can contact mechanical elements, because of the rule for production cars for pedestrian protection, anything that this sphere can contact has to have a certain size radius. And so the software allowed us to look at where it's possible to contact, and then to change the design.

Here we're using the digital data from the clay model and creating the class A surfacing in Alias. Mono has some very complex transitions. Heaven knows how that was done before computers or before God invented Alias in response to every industrial designers' prayer. These kinds of tools are just invaluable.

So what did we create at the end of the project? We'd created 44 carbon fiber parts. We'd chosen a lightweight engine from Cosworth. It was the lightest normally aspirated engine we could find. We'd combined it with a gearbox from motorsport Formula 3, and develop it into a very, very compact package, which you can see here.

And using Showcase software-- this was back in 2010, so we were using Showcase at that time-- we were, for the very first time, able to see how our design-- how these different elements had come to be. Again, as a small company, we'd never had the opportunity to do a full size clay. So this was the first opportunity for us to see really what our creation was going to look like.

The end of 2010, we began the prototype build. It's an exciting moment, as you can imagine. The first carbon fiber parts arriving. And in 2011, we launched the car. It's obviously a bit of a nerve wracking moment when something you've been working on for 3 and 1/2 years behind closed doors is first shown to the public. But as you can see by the reaction there, people seemed to like it. Thank God.

We won all kinds of press awards. And encouragingly, not just in the automotive press, but also *GQ*, *Wired* gave us awards. And we had some fantastic reviews. *Top Gear*, I won't actually bother quoting them, but if you'd care to read them, they all said some very nice things. This was that Steve Sutcliffe from *Autocar*. It's the oldest car magazine in the world. "I think I found my all time favorite car, genuinely." And that's from a road tester with 25 years experience.

The editor of *Evo* magazine, "from now on, any car collection is incomplete without Mono." But our biggest achievement, and our proudest achievement, is *Top Gear* Stig's car of the year. The car was designed to be compromise-free, purest supercar. And for a character who's created in order to do nothing but driving, for them to create that award for us, and they've never given it ever again since, that was a massive pat on the back.

It's the quickest road car on road legal tires ever around the *Top Gear* test track. And in 2012, we started to deliver our first cars. Lots of them in California. Obviously, the climate there is suitable. That was our final solution. The production solution for the driver interface. Every control is on the steering wheel except some controls for brake bias and fire extinguishers, things like that.

This is just some automotive porn. It's only in there because I think it looks good. And ironically, after creating this idea in our heads, and then in the virtual world, and creating it into a real car, the car's been really successful in the virtual world, again being featured in games--*Project Cars, Grid 2,* for which they made a Mono edition. . Sony's *Drive Club*. And very premier automotive model company, AUTOart, did a signature series Mono which has just launched.

But the big challenge for us as a small company and as a design company was to transition into a car manufacturer. That's our manufacturing facility. As designers, we were completely in over our heads. This was our factory when we opened it. Not much going on there. It looks different now.

And we continue to develop the product. In order to open new markets, we've developed emissions compliant versions of the engine. More powerful, but still meeting emissions. And that's opened up mainland Europe, where we're now road legal in Germany, which is one of the most challenging markets.

The continuation of improving the car also, we've developed carbon ceramic brakes. We've

saved 2 and 1/2 kilograms a corner. And it's not just technical innovations that we've come up with. The whole bespoking of the car. So our customers have a seat molded for them. You can see here one of our customers having his seat molded. And that's the final result.

And in the same way, we do made to measure. We believe we're the only company in the world making made to measure steering wheels. And so we mold the grips to the driver's hand. We scan it. We make a 3D model. And then we print it in any sure hard rubber, depending on the customer's preferences. That's the finished result.

Another bespoking thing we do, top left, you can see how we did it in the past. We would come up with color schemes in collaboration with the client. The designers would work on the final iteration and even the actual masking of the final car. And then the customer would get his car.

This is actually the DJ Deadmau5, and he loves his car so much he put a tattoo of the logo on his arm. For which we are eternally grateful. But now with VRED, we're able to do much better visualizations. We're able to show the client a much, much better view, animations, of how his car's going to look. That's a car we did for Goodwood for a client. And there's the finished result.

The bespoking extends also into made to measure race overalls. We have our own design of race overalls. The lightest Formula 1 approved overall on the market with an Italian partner, [INAUDIBLE]. And it's made to measure for the drivers. So you have a made to measure seat, steering wheel, race suit. And we even do that with helmets now. We've just started doing a program with [INAUDIBLE].

Working with Autodesk, we're also trying to take this, the whole configuration of the car to the next level. We want to be able to, in real time, invite customers to an Amazon server and give them the kind of performance they can have in the showroom. And instead of just seeing still images of the cars, they can see the full, real-time animations of the color schemes we've created for them and the various options we've created for the car.

The car continues to get great reviews. It was considered one of the top 10 cars in the world by *Top Gear*. Another amazing compliment to the work that was done by the team. And this is the same graph we showed earlier, but this is what we intend to do. We intend to keep our performance advantage over the competition, and just move more and more premium as we make the product more and more bespoke.

Finally, that's what it's all about. Man, machine, creating a one of a kind experience and a one of a kind product. Thank you very much.

[APPLAUSE]

PRESENTER: Please welcome Vicki Dobbs Beck.

[MUSIC PLAYING]

VICKI DOBBS BECK: So I'd like to start by telling you a story. The story is about Industrial Light & Magic. But first, we need to take a look back at its 40-year history of innovation. And a no to Autodesk who provided tools and support throughout that process, and has helped us be responsible for many of those accomplishments. So this is a piece I call 40 years in 60 seconds.

[VIDEO PLAYBACK]

[MUSIC PLAYING]

[END PLAYBACK]

[APPLAUSE]

VICKI DOBBS BECK: So now back to our story. In classic film structure, it is a story with three acts. In act 1, ILM was the only ship on the ocean. From 1975 to 1995, we created, trained, and inspired the industry. In 1996, things began to change. New competitors entered the scene. Many of these competitors founded companies and they were former ILM-ers.

At the end of this decade, we started seeing the impact of globalization. And in act 3, it's become a bit of a feeding frenzy. Commoditization has taken hold. There are lower barriers to entry, severe pricing pressure, and a proliferation of competing tax incentives. So the question was, could we overcome what seemed like seemingly insurmountable odds?

This brings me to a time when, a few years ago, I was introduced to a book whose metaphor really resonated for me. The book was called *The Blue Ocean Strategy*, by W. Chan Kim and Renee Mauborgne. And the premise of their book was, our aim is not to outperform the competition in the existing industry, but to create new market space, a blue ocean. Fundamentally redefine the competitive landscape, thereby making the competition irrelevant.

So while the end of our story has yet to be written, and the possibility of sequels remains to be seen, we're optimistic.

One blue ocean has come in the form of new and disruptive technologies. Virtual reality, augmented reality, and mobile. These offer new levels of immersion, new opportunities for storytelling. In response to this blue ocean opportunity, we launched ILMxLAB in June of this year. We believe this is our blue ocean.

It's our newest endeavor in making things. And consistent with our legacy, bringing story to life is at the heart of everything we do. ILMxLAB builds on the technology foundation of our advanced development group that's been doing pioneering work in high fidelity real-time graphics. We also embrace ILM's R&D in virtual production. And of course, we're leveraging the production talents of ILM and Skywalker Sound. And finally, xLAB roots it's experience design in the creativity of the Lucas Film Story Group.

So what is xLAB doing? Well first, we're enabling filmmakers. ILM has a long history of using virtual production to help filmmakers visualize their stories. But as this new technology has come onto the scene, it has also enabled the development of new kinds of tools. Most recently, we've created something called VScout, short for virtual scout.

Using the Magic Window ability of the iPad, as well as the immersive experience of a VR headset, VScout allows filmmakers to scout virtual locations and review digital assets. They can get a sense of place and scale before any physical sets have been built and any digital sets have been finalized. Filmmakers can now truly step inside the digital worlds of their stories.

So we sent a team recently to London to test this out on set. And here's what the filmmakers and production designers said. They talked about revolutionizing workflows and the limitless potential. But as with so many things, we still have a ways to go.

In addition to enabling filmmakers, we're also weaving story into life. xLAB recently had a unique opportunity to collaborate with a company called Open Bionics. Open Bionics was a part of the Disney Accelerator Program, and Open Bionics creates affordable, 3D printed robotic limbs. Our pro Bono design work around Star Wars and the royalty free license granted by the Walt Disney Company made it possible, not just for kids as well as adults, not to just feel different, but to feel special.

And what was really exciting about this project is not just the integration of story into the design of the limb, but actually into the process of acquiring the limb. The choosing, the fitting, and the training in its use. After all, learning to use the force takes time and patience, so it was a perfect parallel. And this is a photograph of Jedi Logan, the proud recipient of the first Star Wars-inspired Open Bionics limb.

In addition to using this stage to enhance the filmmaking process, we're also using it for another purpose. It gives us an opportunity to imagine what other kinds of experiences are going to be possible in this world of immersive cinema. Imagine live performances driving virtual characters, or remote broadcasts. It also is a surprisingly good proxy for the world of augmented reality. So as that hardware is being refined, and as it comes out on the market, we're trying to anticipate what kind of experiences are going to be possible. And this is a way that we can learn.

On the mobile front, I want to share an early prototype we undertook to understand the balance between story and interactivity. It starts with a short linear piece, and lest anyone think this is from *Episode VII,* this is classic *Star Wars.*

[VIDEO PLAYBACK]

[MUSIC PLAYING]

-Report.

-According to our informants, a pair of rebel droids have attempted to make contact with the local underworld. They describe the droids as a golden protocol unit and a blue and white astromech. They may be attempting a rendezvous here at this outpost. Our ground forces have just engaged a transport that blasted it's way out of Mos Eisley. Proceed but sure the perimeter first. Those droids must not escape. Fan out.

-Wait for me.

-Oh, no. Captain Data, Captain. R2 and I are ready for extraction and heading to the rendezvous point. I repeat, we are ready for extraction-- immediately!

-I've got Imperials all over me, but I'll do what I can. I'm calling in for backup.

-That doesn't sound very reassuring.

[FIGHTER JETS OVERHEAD]

-Oh, my. They're everywhere, R2. R2! Oh, R2, I can't keep up, save yourself. Is this how it all ends? Thanks to Data, we're saved.

-Stop right there.

-Oh, no.

[END PLAYBACK]

VICKI DOBBS BECK: So we started with a linear piece because we wanted to preserve the vision of the master storyteller. But because this was created in real time using a heavily modified game engine, in this case, EA's Frostbite, we were able to allow the viewer new and different ways to immerse themselves in the world of the story. In addition to taking on different points of view of any of the characters, we can also look at different story threads.

[VIDEO PLAYBACK]

-C-3PO, were you robbed?

-And now, an army of stormtroopers is searching for us. It can only be a matter of time before we are blasted into spare parts.

-R2, can you get to the rendevous point?

[R2D2 BEEPING]

-But we have not yet complete the mission.

-You did your best. Captain Data will pick you up as planned.

-R2, wait. Wait for me.

[END PLAYBACK]

VICKI DOBBS BECK: So we knew the linear piece that the storm troopers had been searching for the droids. And we knew that the droids had been hiding in the hut. Well, this provided a way for us to see what was happening on that parallel story thread. In addition, we can do things like change the weather, or the time of day. We're augmenting the story, not fundamentally changing the story flow. In this case, we kicked up a dust storm on Tatooine. So as you can guess, we've only

begun to scratch the surface. The possibilities of cloud stream cinematic experiences are virtually limitless.

And because we had the real time environment, and the real time story, we could also explore what this might look like on other platforms, such as VR. We asked ourselves, what would leverage the capability of VR in a way that the iPad could not? And you can see what the answer we came up with was, riding a speeder bike through Tatooine. As we zip through this environment, that story that we were watching is continuing to unfold beneath us.

So what does it mean to tell stories in a new way? Well first, we have to leave our traditional toolbox behind. This is a new art form. It's going to require a new language for creation, new tools. For example, in VR, pacing is very different. Because it's fully immersive, people actually want to explore, and they want the time to do it. That's very different than in the telling of a linear tail, as in film.

And screenplays can't be written in the same way. There's no such thing as pan and tilt and push in, et cetera. In VR, the camera is no longer subjective, expressing a point of view. It becomes neutral. So in many ways, creating in this environment is much more like a live theater director working in the round.

Secondly, we have to anticipate what consumers will want. We believe they're going to want worlds that are social, persistent, and dynamic. We believe they're going to want to create user-generated content that gets incorporated into that experience. So it's our job to figure out how to make those things happen.

And finally, we have to embrace this phase of learning and discovery. I can honestly say, in my 22 and 1/2 years with Lucas Film, this is the single most exciting moment in my professional career. We are at the beginning of something that could be absolutely amazing. And we're very lucky as storytellers and technologists to be able to participate in it at this very early stage.

So in closing, I wanted to pose a final question. Why does innovation in storytelling matter? In the words of Harold Goddard, "the destiny of the world is determined less by the battles that are lost and won than by the stories it loves and believes in." Thank you very much.

[APPLAUSE]

PRESENTER: Please welcome back Roman Mars.

[MUSIC PLAYING]

Can we have a round of applause for all the people who spoke today? I think they did a fantastic job.

[APPLAUSE]

If you look at your seats, you will find these cards. They have three things on them. Pick me up, fill me out, hand me in. Please do that, because we are designers and we want to learn and do better next year. And this will help us.

So when I opened up, I started with this story about the history of design, which had three points in it. The dawn of humans, the dawn of industrial design, and now, the rest of the history of design is all just noise in comparison. That's how important I think this moment is. And as evidence, there all kinds of companies that we heard today that are part of it.

GE-- 120 plus years old. And a car company that couldn't exist 10 years ago. This is an exciting moment. So I hope you enjoy what's going to happen to you and to the world in this new era of design. Thank you so much. We'll be back at 2:45 here. Please come back for the last innovation forum. Have a good day.

[APPLAUSE]