

*Manufacturing
Innovation*
introduces guests
to the conception
of a breakthrough
car model

By Judith Rubin

Ford and the Robot

“The Ford Motor Company had just announced the new F-150 truck and we had an experience we needed to turn over in about nine months,” said John Neilson, senior director, museum and attractions, The Henry Ford, at the 2016 Thea Awards in Anaheim.

Manufacturing Innovation—which opened in February 2015 as the new key attraction of the Ford Rouge Factory Tour at The Henry Ford Museum in Dearborn, Michigan—was being honored by the Themed Entertainment Association with a Thea Award for Outstanding Achievement.

The Ford Rouge Factory Tour is a joint partnership between The Henry Ford and Ford Motor Company. Visitors learn the history of the factory that engendered a long line of famous vehicles, and get to know the modern Rouge facility, where robots and people collaborate to turn out the breakthrough F-150 pickup, the star of *Manufacturing Innovation*. “This is the truck that is going to change the industry, and we needed to have a theatre that would match,” says Cynthia Jones, general manager.

Manufacturing Innovation rehabbed a space originally created in 2004. Facing a warp-speed time line, Neilson, with colleagues Christian Overland (executive VP, The Henry Ford) and Jones, decided things would move most smoothly using BRC Imagination Arts, the same

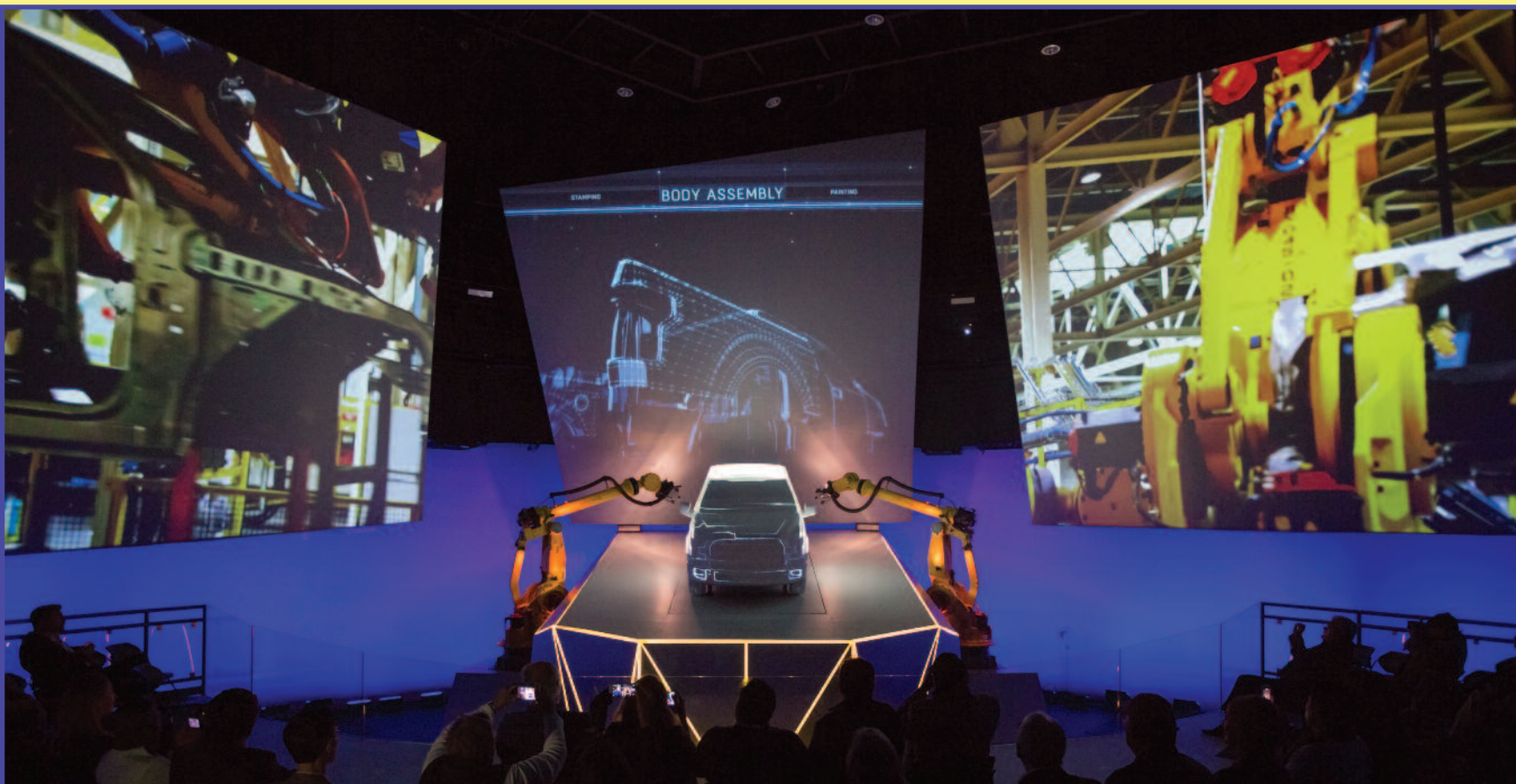
experience design agency that had done the earlier project. BRC’s revamp team was headed by Marci Carlin (executive producer) and Christian Lachel (creative director), who had both worked on the earlier version, and also included Edward Hodge (creative technical director), Philipp Edelmann (project manager), and Chris Pavlica (media director). Others on the external design and production team, brought in by BRC, were NYXdesign (lighting design), TechMD Inc. (AV and control systems), AES (fabrication), and David Kneupper (composer).

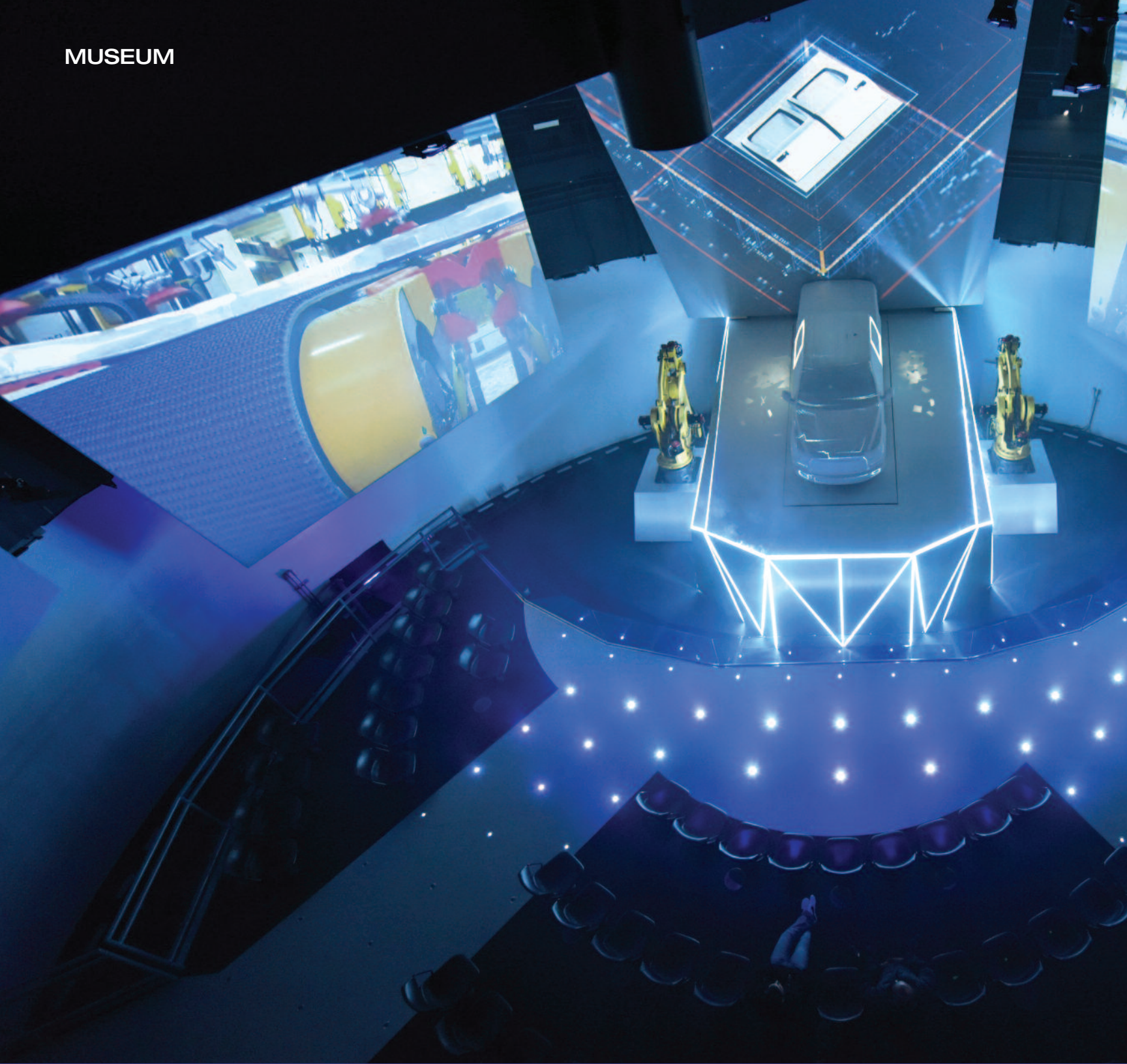
“Let’s do something really magical”

In 2004, the Ford Rouge Factory Tour was one of the very first LEED attractions, and the team wanted to retain and build on the legacy of innovation and sustainability that had initially motivated Ford Motor Co. executive chairman Bill Ford Jr. to engage architect Bill McDonough in re-envisioning the Rouge Center site.

Hodge says, “As we worked closely with Ford marketing and with Ford designers, we had many opportunities to hang out and film, and see how they’re upgrading all of Ford. They opened their doors to us, and that made our show better. The Rouge Factory Tour is a brand home, and it’s really important that, as their marketing and brand shift, the brand home changes to match them.”

All Photos: Courtesy BRC Imagination Arts





Gantom developed custom LED floor “pucks” that provide environmental effects to support the feeling of a high-tech lab.

Manufacturing Innovation is a two-theatre experience. Each theatre has 100 seats. Between 9am and 4pm, shows run every 20 minutes. The preshow in Theatre 1 is a 12-minute, narrated documentary-style movie, on three screens, of Ford and auto manufacturing history through the years. The score was recorded by the Detroit

Symphony Orchestra. It culminates with a message from Bill Ford Jr.).

Ford’s F-150 pickup trucks are its top product line, and the nine-minute show in Theatre 2 is a powerful showcase. It unfolds mostly *sans* spoken word, but begins, in slice-of-life style, with a company innovation rep asking various



truck owners for input about the qualities of a dream pickup—for example, the aluminum body that is a hallmark of the new F-150. This transitions to scenes of the vehicle being designed and engineered and then manufactured in the modernized factory. Next comes the signature sequence Lachel described as “3-D printing the car in the

theatre.” The prop truck rises up from the stage, the circular space comes alive all around the guests with multimedia effects and techno-style music, and the two industrial robots flanking the stage swing into action. The truck passes through the phases of manufacturing and assembly and then goes for a spin. The show ends with a bang and a flash, after which visitors are free to explore the rest of the Ford Rouge facility, which includes a real factory tour and a display of vintage automobiles, including the iconic Mustang and Thunderbird.

Theatre 1 underwent some updates, primarily in terms of media editing, audio retrofitting, and updated, automatic control of visitor flow. But Theatre 2 is where the big changes took place; its new show depends on a tightly integrated blend of custom media, projection mapping, music, lighting, special effects, moving set pieces, and choreographed industrial robots. Existing projectors and screens were kept but reconfigured and updated with new equipment and control systems.

The design envisioned a physical rendition of gaming to connect viscerally with young audiences. “We wanted to meet the audience where they are at, so they’d feel ‘This is my generation’s story,’” Lachel says. “We did that with the media, using a visual language in the film to evoke the wire frames of gaming, and to speak to maker culture, 3-D printing, and coding.”

“They climbed inside stamping presses,” Jones says. “Things that should never be accessible, they managed to climb inside of—and mount cameras in places I didn’t think were possible. They created new ways to film as they produced the show.”

“The innovation, robotics, lighting, science, and technology of the truck and what’s happening at the plant became our design language for the show,” Lachel says. “Whether you build a show or build a vehicle, today we’re using the same technologies. It’s exciting for all of us—so much change, so much access to tools. It’s like being in Tony Stark’s Iron Man lab.”

Lachel says, “Many of our guests are families and school groups and we know it’s important to have them walk out understanding the importance of science and technology, engineering, art, and mathematics,” otherwise known as STEAM education. Elements of surprise and magic were also important. “From the outset, we were saying, ‘Let’s do something really magical,’” Lachel adds. “The world still needs a bit of surprise and delight.”

Take the truck and stretch it into the room

As is usual in a 4-D theatre, lighting design takes place in an environment where the chief element is video. Manny Treeson, of NYX Design, says, “The film is the principal form of storytelling, along with the projection-mapped truck. There was not a big need for lighting in the absolute

MUSEUM

sense, but it involved cars, robots, and big ideas. They were looking for ways for lighting to take the truck and stretch it into the room. We were to use light as part of that extended canvas that whips around the room and surrounds the audience. I tried to pull colors of the film into the theatre, using one major color saturation tone and one highlight tone.”

Because the robots were constantly moving, it was decided to create attachment points, enabling them to carry their own lights. “Due to the robots’ nature, there are lots of places you can bolt, and weight is not an issue,” Treeson says. “The next challenge was to get control and power.” The quest for a single-cable, low-voltage LED led to the RGBW Gantom DMX floodlight from Gantom Lighting & Controls, 12 per robot. “What’s nice is they mostly disappeared, and the light was really great quality and gave us narrative things to do with the robots,” Treeson says. “Each one of those lights is intelligent, and can articulate, so the light could grow in a sequence. We could use the lights to mimic the laser effects, the flicker of blue-white welding, and all those things robots do in manufacturing the vehicle.”

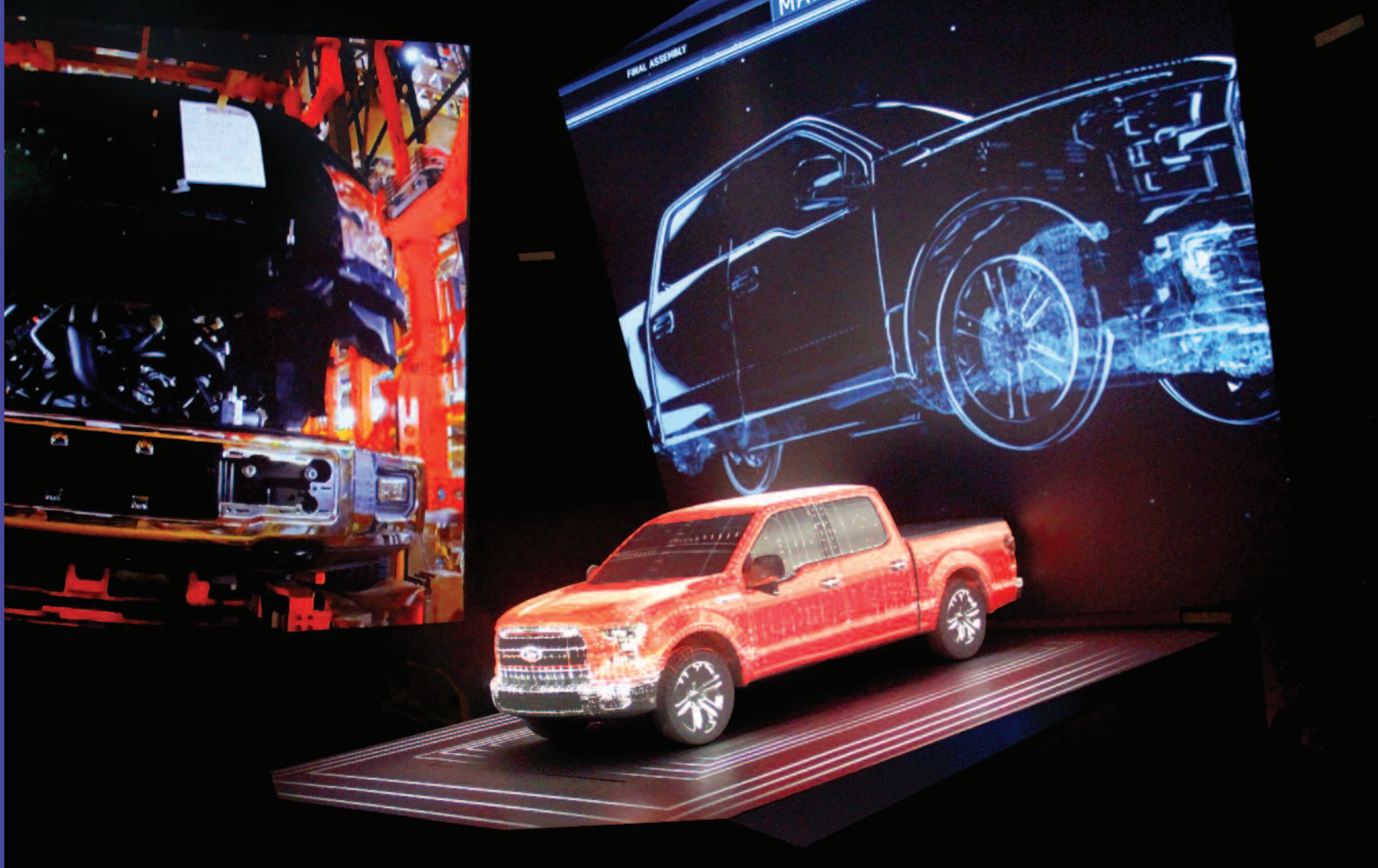
Each robot arm ends in a claw with three lights attached. These can read as a face—and, as such, are key to a final moment of the show, when, having finished “building” the truck, the robots turn these “faces” to the audience and seem to wink.

Gantom developed custom LED floor “pucks” that provide environmental effects to support the feeling of a high-tech lab. They embed 65 RGBW Gantom DMX floodlights into the floor, where they can be walked on. “I wanted a polished, stepover puck,” Treeson says. “Gantom came up with one in a very short time: a beautiful, milled aluminum unit with a fixed piece of glass,” he adds, praising Gantom’s Quan Gan and Landin Fusman for their service. “This gave us a grid of lights that are individually controlled, with which we could make a pixel map of the floor and program in sequences, with the full palette of colors available. At one point in the show—depicting the sheet metal stamping—music and audio and edge lighting come together in pulses to dramatize the impact of each stamp. The light flows like water across the audience with each effect. Everything revolves around the crown jewel of the F-150. It was really great fun.” The programmer was Josh Selander.

The Theatre 2 lighting system was a complete retrofit using the existing grid from 2004, integrated with the existing ETC Paradigm system, and adding an ETC Eos control console. “This allowed me to leave all the programming in place that already existed for the rest of the building,” Treeson says. “Working with ETC is always a pleasure—they never disappoint. In this particular case, Ted Ozimek [Western region project manager, ETC] made a visit to the facility because it had an old ETC Unison



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controller still on a floppy drive, from which we needed the cue information for the new Paradigm processor. That was probably the hardest thing we did, getting the old programming transferred. It was hard to parse that file after 10-plus years—we had to reconstruct things and keep the legacy information because it's a working museum and we didn't touch Theatre 1, the factory tour, or most of the exhibits."

Barbizon Lighting supplied fixtures that, in addition to the Gantoms, include ETC LED Lustr+ units, Chroma-Q Color Force 12s in a circular array, and 350' of LiteGear Chroma LiteRibbon LED RGBW tape. "LiteGear products don't flicker, and are very high-quality, a great fit for themed entertainment," Treeson says. "I used the ribbon inside the stage itself for a fractured kind of vibe, lighting multiple panels that we articulate throughout the show." There are also three Philips Showline Nitro 510 strobes. ETC LED Source Four Lustr+ units overhead (48 of them) are used mostly for house lights and the stamping sequence. A Rosco three-head IFS (Intelligent Fog System) fog/haze system provides smoke and haze effects. Laser effects are emitted from gear supplied by LumaLaser.

Once the illusory truck has progressed through

stamping, welding, and painting stages all the way to quality control, it goes for a ride on-screen through a range of environments. "We had to help the theatre take that journey with the truck," Treeson says. "For instance, in the city at night, the taillights become red streaks. To mimic that all around the audience, we used the pixel-map engine in Eos, and gave it a rotation 15° around the theatre, fading up and down. We randomized it through the pixel engine."

In terms of work flow, Treeson says, "When the movie got to a certain point in audio structure, and there was enough of an edit in place, we started to talk as a team about the immersive effects. With the first real pass of the movie, I broke things down using Adobe Audition. The sound edit program lets you look at the audio with the video reference in sync. I marked that all up inside the program and created cue points. Then we all could look at it together, see the cues, get feedback, share ideas."

Robot breakthrough

BRC's role as creative producer included, according to Hodge, master planning, design, writing, editing, media production, project management, overall creative direction,



Above: "We were to use light as part of that extended canvas that whips around the room and surrounds the audience," says Treeson. Right: "We like a theatre to meet almost a soundstage rating to allow our sound design to really ring," says Hodge.

and close coordination with the architectural firm (Harley Ellis Devereaux) and general contractor (Baum Construction). The process began with a two-day charrette, and production kicked off about five months prior to opening. "Normally, it would be closer to a year," says Hodge, "but we were able to compress it by having a very solid idea walking in, with storyboards and concepts, bringing in strong tech partners to help determine what could be done within time and budget, and treating the manufacturers like partners. For everything, we had to have a Plan B; there would be no time to scramble and design down the path."

The robots, built by FANUC, were hard to get quickly. "Robots want a six-month delivery window," said Hodge. "They are made to order, usually not in the US." From a list of Ford factory-bound units, "we found the tallest, fastest robots with the largest arm reach we could fit in the building, and asked to have them diverted to us." TechMD Inc. worked with Ford robot programmers to adapt the robots for the show. "These aren't programmers that do a wink and a wave normally," Hodge says. "I sat with the

team for more than 200 hours. We may have ruined an entire generation of robot programmers!"

The robots being huge, heavy, and potentially dangerous, audience safeguards include barriers, touch mats inside the barriers, motion detection, and 25,000 individual fault safes. A PLC computer backstage monitors all life safety systems and can override the show action.

Dave Revel, president of TechMD, says, "They are true industrial robots and their programmers are industrial programmers. They weren't used to the concept of a show, although they were very safety-conscious." The creative breakthrough, he says, came when the robot programmers got on site and saw firsthand what the team was doing: "The process became more visible to them. Our mode of operation for working with systems like that is to allow the programmers to pre-program, and then our show control system cues them in sequence with proper timing. We don't try to micromanage those subsystems. They were more comfortable once they understood that. We had a list of individual movements for them to program, based on the script and choreography."

BRC has a history of transforming industrial robots into characters in visitor attractions. The best known, and the first, was the popular *Bird & the Robot*, which ran for many years at EPCOT and also dealt with auto manufacturing. In 1990, BRC produced *Ballet Robotique* for a world's fair exhibit; the show, which was nominated for an Academy Award, turned robots into expressive musical performers. "They are characters—we know they can be turned into emotional character actors," Lachel says. "This is something BRC is very comfortable with." In *Manufacturing Innovation*, "we don't overuse them—we do it judiciously. You never really find a face on a manufacturing robot, but we added a 'face' to our FANUC robots to help acknowledge that our story is, at heart, a people story. There are always people behind the robots. Robots are a great supporting cast."

Gear-agnostic

TechMD handled the retrofit of the audio and control systems, added projectors and players for projection-mapping the vehicle, and ensured that the original video system was brought up to current standards.

Revel reports that, because media is playing a larger and larger role on projects, project heads are bringing AV integrators into the process sooner, as BRC did here. "Coming in early lets us lay groundwork, minimizes conflict with other disciplines, and ensures we will have the tools to do the job. There's a place for our gear and it fits the

big picture. These days, you've got to be talking about the tech and the content at the same time. We try to be gear-agnostic."

BRC and Ford asked the team to re-use as much gear as possible. "It was a challenge to match up and document its condition, and, as it had been running several years, to make it work as a system with the new gear." In both theatres, TechMD upgraded playback and control electronics, and added new audio playback, processing (QSC), and video servers (7th Sense). The original acoustics of the space, which BRC had designed 11 years ago, were kept, according to Hodge: "We like a theatre to meet almost a soundstage rating to allow our sound design to really ring." Providing reinforcement is a new JBL system designed by TechMD, with input from composer David Kneupper. (It includes seven AM7215/26, three VP7215/95DP, and two VPSB7118DP boxes.) "It's a round room with a lot of screens—a difficult room to tune," Hodge says. "TechMD spent two days tuning, and David Kneupper spent four days mixing, using Pro Tools software. The result: a lot of fidelity without high volume." Other audio gear includes a variety of QSC amplifiers.

Reusing the existing seven screens took some effort. "We spent two days swapping them around to change the focal point in the room," Hodge says. "The GC were heroes—the screens couldn't touch the ground in the course of moving them. It was a nail-biter."

Theatre 2 has one speaker behind each screen. "The





The main show control panel for the facility lives in the equipment room upstairs.

trick was to get the vertical coverage aiming to focus sound on guests in the audience and avoid bouncing off the wall on the opposite side, because it is a round room,” Revel says. There were many existing transducers under the floor. “We just made sure they were still wired and functioning and added a couple subwoofers for bottom-end, clunky sounds,” he adds.

Of the dozen projectors in Theatre 2, seven are existing, four-year-old Christies (DS+750), mounted around the room. Five new Panasonic (four PT-DZ870ULK units and one PT-DX100) are positioned in the truss work above the prop car.

The building’s existing cable infrastructure needed to support the new, higher-resolution video. “We had to test all cables to all projectors for their ability to pass increased bandwidth,” Revel says. Using new 7th Sense video servers with the older Christies presented its own challenge. The Christies have a 4 x 3 aspect ratio, while the newer projectors are 16 x 9 and 16 x 10. “We had to make sure that the pixels were square, not stretched or squashed,” Revel says. “Sometimes, projectors will try to fit an image in. It was a matter of cropping the image and then making sure the Christies didn’t try to do anything on their own—a case when a smart projector can be too smart. Christie helped us find the hidden menus.”

On the map

In its Burbank shop, TechMD mocked up the projection mapping at roughly 10%. “We mounted projectors in the scale model and were able to give a preview demo to BRC and Ford for approval,” Revel says. “By reducing throw distance in scale, you can make your projector behave



An advanced Medialion show control program was customized by TechMD.

down to about 1/8 scale and scale brightness, lensing, and image size.”

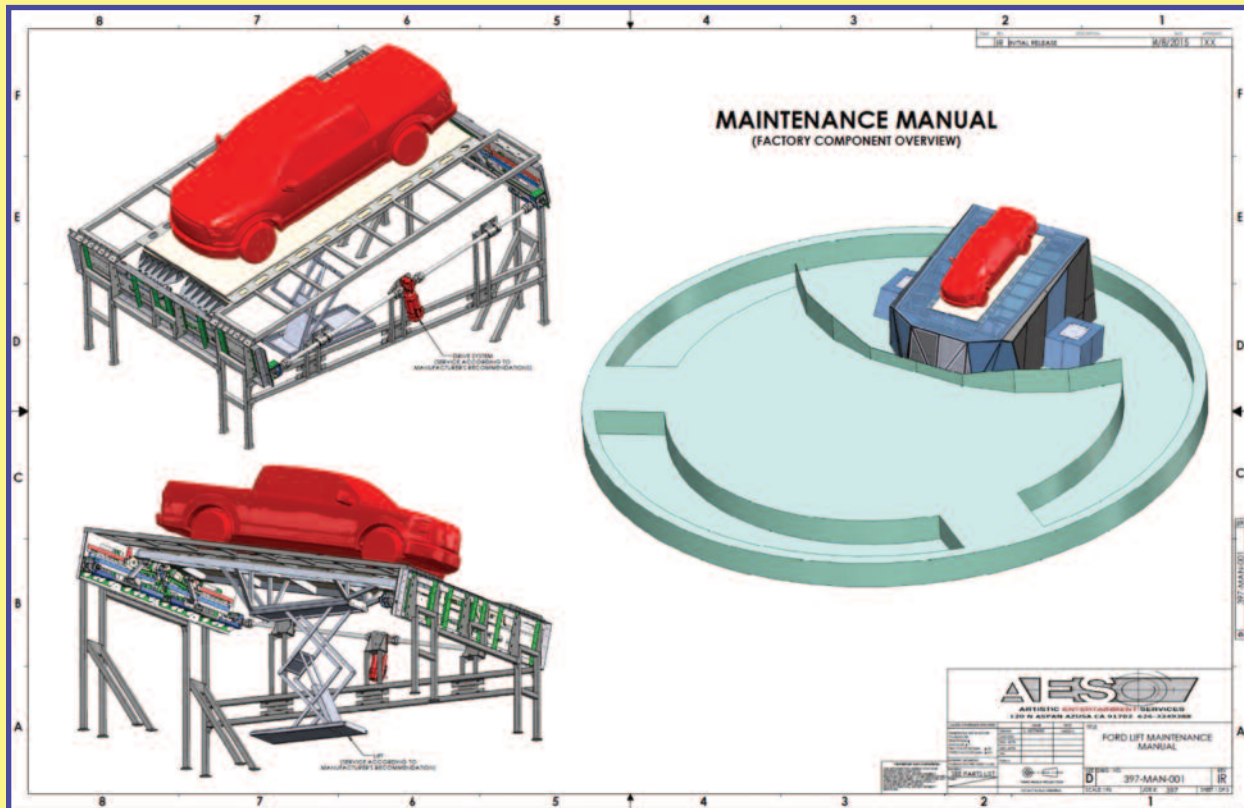
In charge of the building is an advanced Medialon show control program, customized by TechMD. “It constantly monitors the status of all systems, the position of the truck and doors, the robots, and all facility doors,” Hodge says. All theatres have custom touch panels employing what Hodge describes as a “really beautiful custom-designed user interface by us and TechMD.”

The system is also set up to provide remote support over

Amazing times

In the words of Christian Lachel, “We live in an amazing moment in history. What we’re doing in manufacturing and the way we tell stories is coming together.”

Craig Bugaski’s account of how his company, Artistic Entertainment Services (AES), created the truck set piece aptly illustrates Lachel’s statement. “We created a scaled-down digital-file version of a Ford F-150 with low detail for a clean projection surface. It was carved out of urethane foam using a seven-axis Kuka robotic arm, fiberglass-coated,



Artistic Entertainment Services fabricated the prop truck, first creating a scaled-down digital-file version of a Ford F-150 with low detail for a clean projection surface.

a VPN. The main show control panel for the facility lives in the equipment room upstairs. “Our show control talks to all projectors and players, audio and video, and other components, relaying all the cues programmed by the various teams,” Revel says. “When the operator pushes a button at the beginning of the day, safety and performance checks are performed, they get a green light, and the show starts.” The Henry Ford in-house team keeping things humming includes head technology engineer Christos Polymeneas.

TechMD’s team included Tim Brown (lead engineer), Michael Matthews (lead programmer), and Damien Charkiewicz (video engineer).

then mounted to a custom hydraulic lift. [Cynthia Jones reports that the existing lift is shortly to be upgraded to a Serapid model]. The top surface of the housing structure is rigged with custom doors that will track from side to side, as the projection service truck rises from below. Surrounding the mechanisms is an artistically custom-lit brushed aluminum structure.”

A viewer from *The Detroit News* called the theatre experience a “wild ride” reminiscent of a *Fast and Furious* action film. Afterward, guests understand much better what goes into the conception and making of a Ford car, and, if *Manufacturing Innovation* has really done its job, feel a reinforced kinship with the brand. 📶