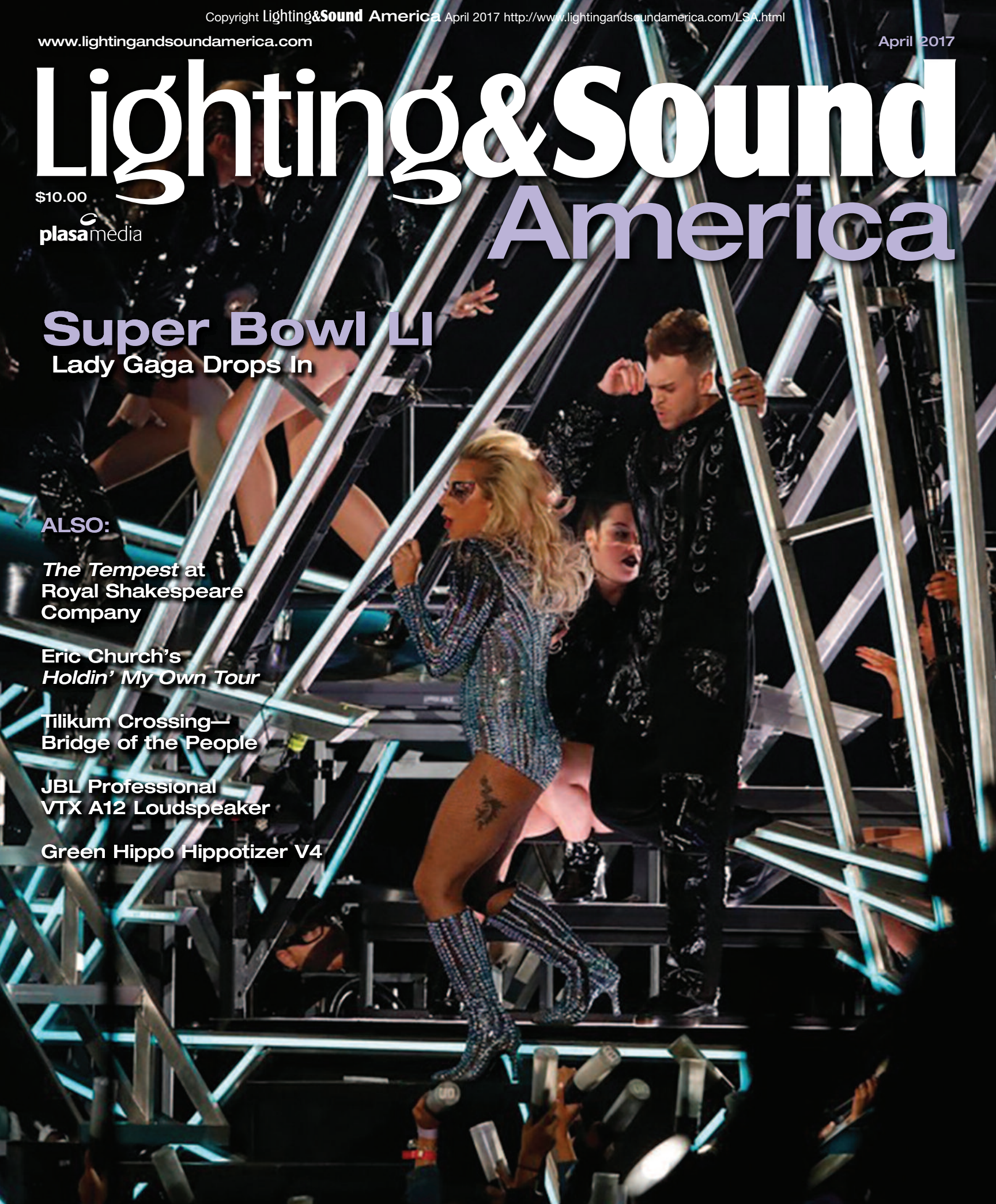
www.lightingandsoundamerica.com

April 2017

# Lighting&Sound America

$10.00

plasamedia



## Super Bowl LI
### Lady Gaga Drops In

ALSO:

*The Tempest* at Royal Shakespeare Company

Eric Church's *Holdin' My Own Tour*

Tilikum Crossing—Bridge of the People

JBL Professional VTX A12 Loudspeaker

Green Hippo Hippotizer V4

# GOING GAGA

## Inside the most spectacular Super Bowl halftime show ever

By: Alan Hardiman

Lady Gaga crafted her performance as a message of unity, delivered against a chaotic backdrop, the production design and staging creating an intentionally ambiguous counterpoint.

Left photo: Michael Zagaris / Getty Images; Above photo: Kevin Mazur / Getty Images

Super Bowl LI, between the New England Patriots and Atlanta Falcons, has been hailed as the best Super Bowl game ever, largely due to New England's unprecedented come-from-behind victory in the championship's first-ever overtime game.

Not one to take a back seat to anybody, Lady Gaga headlined a halftime show that was easily up to the standard set by the game. Kicking it off with a sublime 60-second overture—the strains of "God Bless America" ringing out from a single, solitary voice atop Houston's NRG Stadium against the backdrop of a celestial interplay of 300 Intel Shooting Star drones twinkling in the evening sky—the singer segued from a pastoral portrait of "night with the light from above," into two lines from Woody Guthrie's "This Land Is Your Land" as the flittering stars burst into color, regrouping into two opposing factions in the darkness, one red, the other blue.

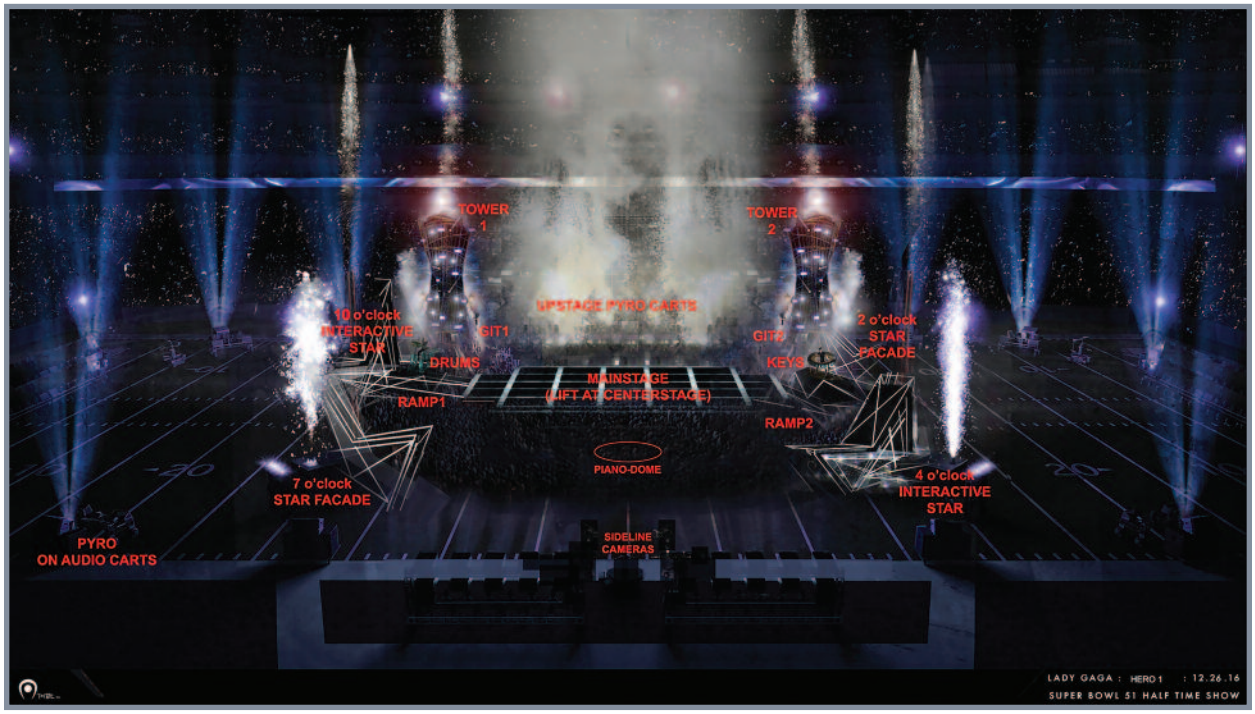
While she recited the Pledge of Allegiance, "One nation, under God, indivisible, with liberty and justice for all," the drones regrouped again, the factions aligning as the stars and stripes in the red, white, and blue of the US flag—the tacit subject of that pledge. It was her cue to leap from the roof edge into the stadium and halftime history.

With no time to unpack what they had just witnessed, more than 71,000 spectators in the stadium and 117 million television viewers attended on a kind of reverse apotheosis as Lady Gaga descended from the heavens—courtesy of Flying By Foy—to a 30'-high platform atop one of two open-frame towers that, along with four oversized fallen stars outlined in neon, flanked the 66' x 40' stage at center-field.

The band immediately launched into the first of seven numbers, a shout-out to Gaga's 2011 hit "The Edge of Glory" introducing "Poker Face" amid a tight sequence of pyrotechnical hits that produced volumes of smoke that sharply defined the beams of a legion of moving lights, the smoke emanating even from slits in the tubular cross-bracing of the stage floor below.

The entire spectacle—reported to have cost upwards of $10 million—could be taken as either glam or post-apocalyptic, depending on your point of view. The production design and staging of the February 5 show, barely two weeks into a presidency that has sharply divided the country along red and blue lines, was intentionally ambiguous.

the impression of a city on fire. "You give people a chance to decide whether it's glam or more kind of aged and broken," Bennett says. "And with the neon-light feel to it, you have a choice of going one way or the other. It's kind of ageless in a certain way, just like *Blade Runner*. Is it post-apocalyptic? You don't quite know what it is. And that's what's kind of magical about it. It was right in the direction that Lady Gaga wanted. Once she has latched onto it, she owns it, and starts to understand what it is and starts to figure out how she's going to work it. She turns elements into certain things that mean something to her, like the dance-platform star turned into a telephone booth for 'Telephone.' She can do it all, she is so multi-faceted. And




The set design, by Bruce Rodgers and LeRoy Bennett, centered on a main stage surrounded by four fallen stars and a pair of towers that evolved from the torch on the Statue of Liberty.

"Some of the elements are nice and shiny, and some are aged and look used," says the production designer Bruce Rodgers of this, his 11th Super Bowl Halftime show, which he designed in concert with Lady Gaga's lighting and production designer LeRoy Bennett. "We wanted all the finishes to be on the darker side. The design was symbolic of the disarray that I think everybody was feeling. Lady Gaga wanted very much to send a message of unity, but I think it would have been boring to put a performance with a message of unity on a stage that also symbolized unity. A phoenix that rises out of ashes is more compelling, so we created this chaotic scene as counterpoint, to render the performance even more powerful."

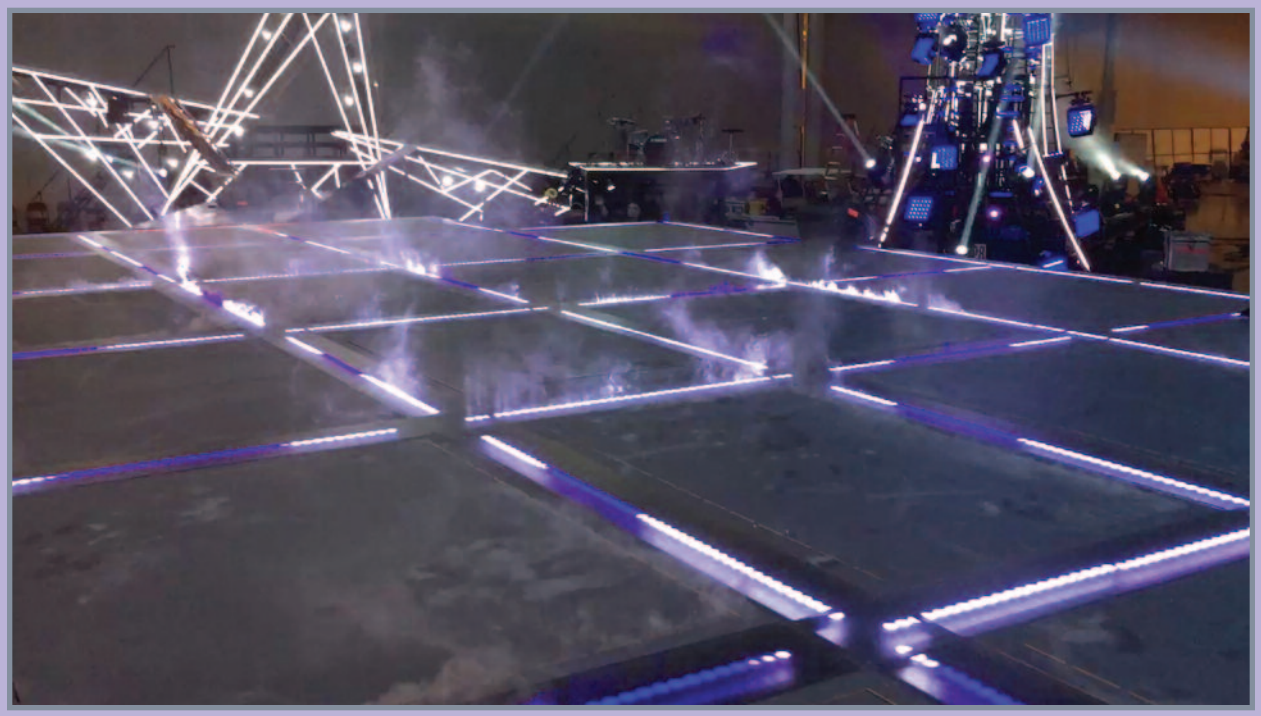
The extensive use of pyro on the towers certainly gave

that's an interesting thing about the set—it was multi-faceted, like she is. There was so much personality about this particular set that it really was true to who she is on many levels."

Were the fallen stars in any way indicative of feelings about the state of the nation? "It wasn't patently symbolic of the flag being shattered or torn up," Rodgers says, "but there was a sense of a broken symbol; not really broken, but more that these powerful stars have fallen from the sky and they are heavy and sharp enough to lodge directly into the grass of the football field. The stars also gave the opening a kind of continuity. We loved how they served as islands of light around the main center stage—you could see through them and they were electric, neon. They might

Images: Tribe Inc.

The set was constructed on 40 carts, including 13 for the main stage, which alone required a fleet of 17 semitrucks for transport.



The floor of the main stage was broken up to allow smoke and light to emanate from its tubular cross-bracing. The smoke was created by 12 Look Solutions Viper NT units, specified by Strictly FX, the show's special effects supplier, and using custom-formulated fog fluid from Master FX, of Plainfield, Illinois.

caption

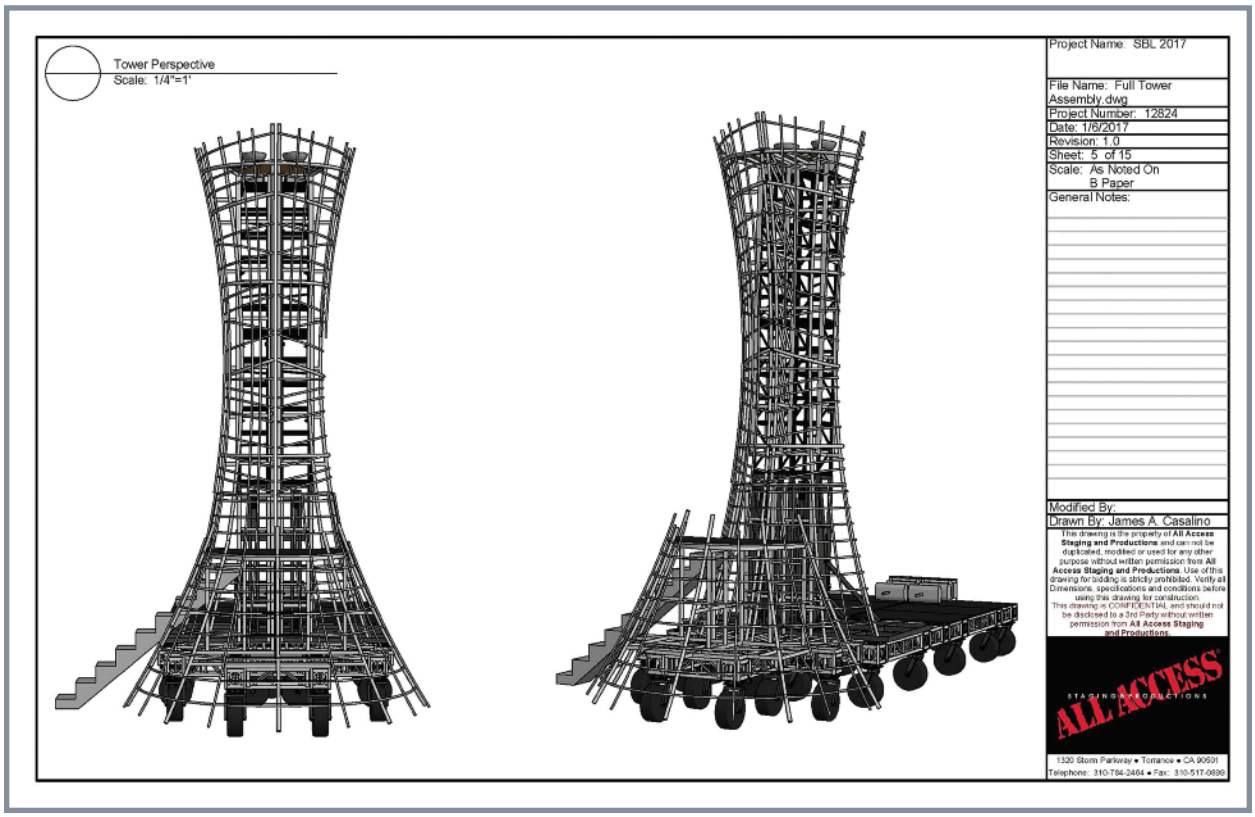
be fallen and lodged in the ground, but they were still completely on fire."

This was Lady Gaga's second Super Bowl appearance; she delivered a memorable rendition of the national anthem during the opening ceremony of Super Bowl 50 last year. Rodgers recalls, "When I first met her at her house in Malibu the day after the election last November, I told her that growing up in West Texas, with marching bands and football games—like [the TV show] *Friday Night Lights*—I had witnessed countless renditions of the national anthem, and hers was the best I had ever heard. I told her, 'You made me listen to it for the first time and told me a story I had never heard.' Our director, Hamish Hamilton, said, 'We should continue that story and start the show off with a continuation of the national anthem somehow, something patriotic'."

Rodgers says that his remarks "set a comfort level for her. She said, 'I'll come onto the field by myself, followed by people who are illuminated red and people who are illuminated blue, and when they join together, they'll all become purple and there will no longer be red and blue people.' And that was just her getting creative.

"Then our lighting designer, Bob Barnhart, of 22 Degrees, came to the table excited by a video he had seen of an event where Intel had flown an array of hundreds of drones," Rodgers continues. "Bob storyboarded the opening segment, and made the suggestion to open with 'God Bless America,' morphing into 'This Land is Your Land.' He developed the concept not only to pitch it to all of us, but also so that he could go and pitch it to Intel. Bob Barnhart drove that completely and is the guy who glued everybody together to make that happen. The whole vibe of the opening is about stars forming an American flag and then going back to being stars, and as sometimes happens in the sky, some stars fall. We thought, 'Let's create this landscape that is not necessarily connected to itself—it's broken apart.' For me that's the simple takeaway, that you create this unity in a performance in the midst of a landscape that isn't unified."

Rodgers and Bennett had been developing this thematic design for some time. "And then here comes Bob with the drone concept, and the drones give you a sky filled with stars," Rodgers notes. "I wish that it had been part of the concept early on, because then people would have said, 'Oh my God, these guys are brilliant!' But, actually, we're not that brilliant. Somehow the stars aligned and the drones ended up supporting the whole vibe. The narrative that we had early on became much more real when we added the drones at the top of the show. It was an opening that you couldn't ignore. It was such a needed statement."




The production design featured a skeletal set that included a pair of 30'-high towers evoking a post-apocalyptic vibe.

Left photo: Icon Sportswire/Getty Images; Right image: Tribe Inc.

## Torch of liberty

The designers wanted a strong vertical element in the set design. “For the past 10 halftime shows, the set has been an open vista to the surrounding stadium audience,” Rodgers says. “With this one, we wanted there to be verticality. In our initial conversations with Lady Gaga, she suggested the idea of getting some sort of projection sphere out on the field. It would have to have been massive in order to pull it off, but we couldn’t rig from the roof. We never know that far in advance if the NFL is going to let the roof open, on account of the weather. But we loved the idea of creating something vertical to fill up a little bit of that space between the artist and the audience, so we came up with some interesting, tilt-up motorized contraptions that looked cool.”

Bennett says, “The verticality allowed us to create depth through light shining through things and the transparency involved in the skeletal feel of all of this stuff. We broke up the stage floor, which would normally be solid, so that light and smoke could emit out of it, to give it life.”

After going through a few conceptual sketches, the designers developed what they call an inspiration board, with images and other things they found. “Roy said that everything needed to be skeletal,” Rodgers recalls. “That gave us an apparatus to mount lighting on, which, in turn, gave an identity to those sculptures—neon, light graphics, a sense of light. So we surrounded the performance space with islands of illuminated and light-emitting sculpture.”

Some of their early inspirations evolved into physical set pieces, “For the first time, we made a 3-D printed 1/8" model,” he says. “It’s interesting the detail that these guys can do on their machines—it almost looks edible.” Robert Sweetnam was the 3-D printed scale model maker.

Other early ideas were realized through choreography with the field cast. The original inspiration for the towers was a single vertical element suggestive of the torch on the Statue of Liberty, Rodgers says: “We cut it in half in order to get it onto the field through the tunnel and then realized that the two halves could provide some symmetry behind the centerline shot. Then they became representative of that post-apocalyptic vibe. The whole thing was very Gotham-like, and Lady Gaga being from New York, that was very fitting for her.

“We didn’t think that anybody was going to be on top, but they wanted her to fly in and land on one of the towers to sing the first song. We had planned to put flame projectors on top of the towers, with a little bit of a foundation up there, so we modified the location of the effects to give her a 4'-deep by 6'-wide landing platform. In a lot of the photographs where she’s posing up at the top, you can see little angled hockey-stick-looking hand rails. Those were modified a week before the show to provide that 3' opening to allow her to fly through or spin. At first, it was going to be more of a cage-type of façade in front of her, but we whittled that away and, sure enough, it’s been in 10 million photographs. It’s almost like it was a design that we had from the very beginning. Then when she flew down to the main stage, the second tower became a useful location from which to emit pyro as her background in the cross-shot. You have to load your smoke-emitting pyro at the beginning of the show, anyway, and later on have less smoke in your effects, because the lingering smoke needs time to dissipate for the third quarter. Her use of the Flying by Foy system, mixed with the pyro and the look of the tower, made the towers more important than I had anticipated.”

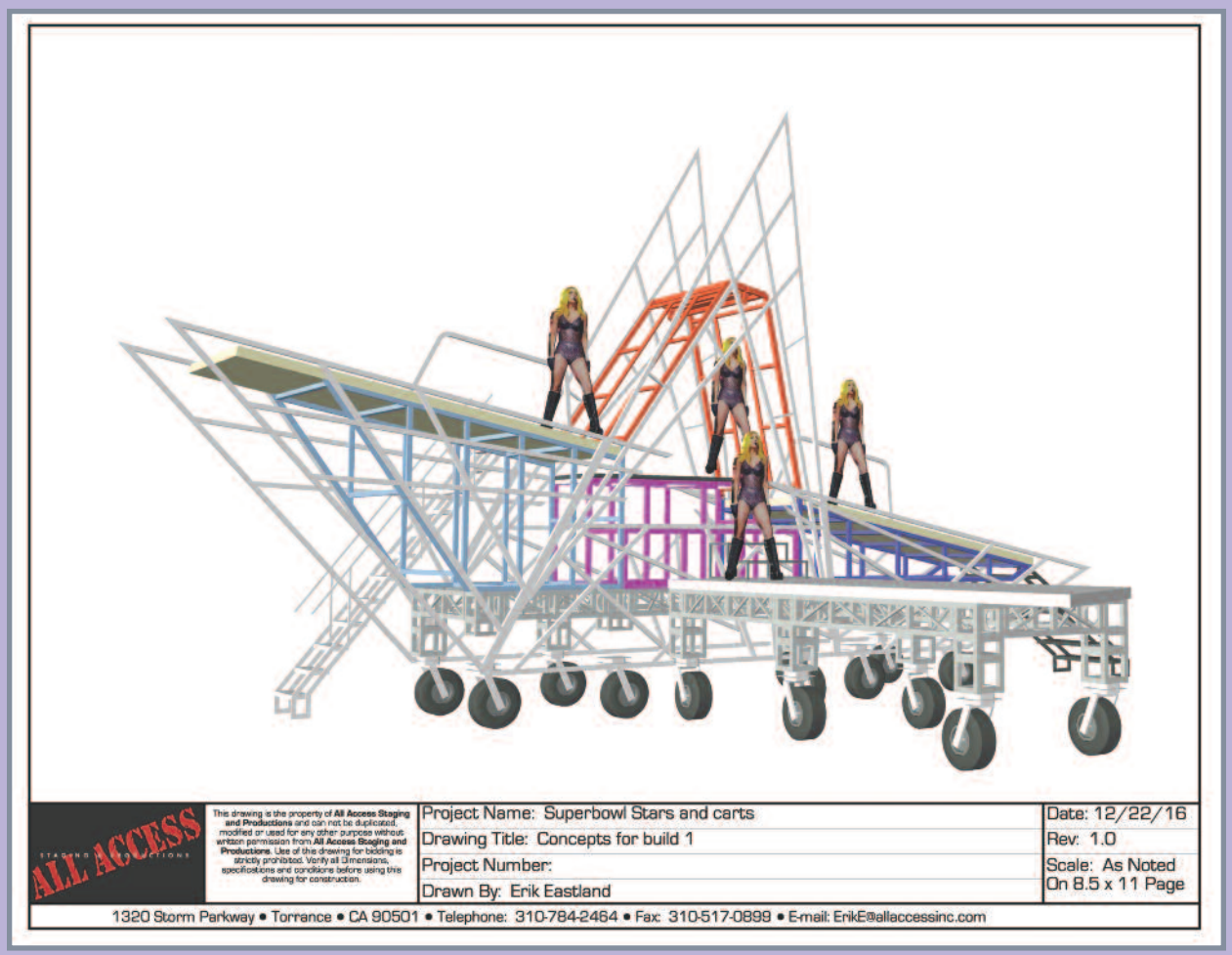
The torch motif was extended down onto the field with each of the 800 field cast members holding a hand-held illuminated baton developed by Glow Motion Technologies that functioned as a 16 million-color pixel in a living LED display. “One thing I found for our inspiration board,” Rodgers says, “was an illustration of a magic carpet of white lights. I thought it would be great to outfit the kids with a prop, like an Olympic torch, so in the wide shots you’d see a moving magic carpet of light, a wave of pixelated color that we could feed imagery through. From this concept, we began to collaborate with the guys at Glow Motion: ‘What are they? Are they mini Olympic torches? What’s their luminosity? How do we put content into them?’ It took a massive effort, with lots of hard work and mental gymnastics, to figure it all out.”

This year, the designers didn’t want to use conventional video or projection. “It’s been done so many times and I really wanted to step away from that as much as possible,” Bennett says. “The torches gave us a more organic way of doing LED graphics. They gave the show more life than an LED screen, or any kind of projection, would have, and added a human aspect in contrast to the really sharp, hard edges of the stage. They gave it a soul.” Rodgers adds, “Each person holding a baton is a pixel. It ended up being a technical nightmare to feed each torch with a pixel of the video feed we created, knowing that the field cast director, KP Terry, was going to make the kids perform choreographed movement scenes to translate our video content to the field of play. Over the course of the show, each of the kids, representing a pixel, would go to different parts of the field for different scenes. As soon as they were done, they had to return to the main stage area to their exact same individual starting positions, in order for the graphics to key in properly for the next scene.”

“The torches received an RF signal from our lighting console that triggered content held in a small amount of onboard memory,” Barnhart says. “The torches first appeared during the song, ‘Telephone,’ where they created a five-point star of content rolling throughout the entire field cast. Toward the end of the next song, ‘Just Dance,’ the field cast formed two large rectangles out by the 20-yard

Photo: Kelley Coffey / Tribe Inc.

Lighting, from 81 Ayrton MagicDot-XTs arrayed on Lady Gaga's piano dome, was augmented by thousands of cell phone flashlights in an audience-participation segment during the song "Million Reasons."




The dancer platform star, seen in two different renderings above and below, doubled as a phone booth during the song "Telephone." It required some assembly on the field before it could be powered up.

Images: Tribe Inc.

Eight hundred handheld Glow Motion batons, comprising an LED-mapping display, and a record 5,000' of LED tape, outlining the stars, were among the lighting innovations in this year's show.

lines on either side of the stage, with the words JUST and DANCE flashing through the torches. They brought a lot of dimension to the show, and I liked how they brought physical energy to the stage area with that light." The content for the LED mapping display was by Tantrum Content. Thirty illuminated Glow Motion air blades were also used, aptly choreographed in a manner reminiscent of baton-twirling.

"The production was epic in its combination of pyro, lighting, staging, and performance," Rodgers says. "The way each scene was developed between all the departments was dramatic, everybody fighting to help fix each background look to its maximum. Hamish worked to show the TV audience both the epic scale and the detail, spending a good two weeks with Lady Gaga in the rehearsal process, finding ways to click through each camera shot. It's almost like they were preparing a storyboard."

While that was going on, the field crew was loading in the show and rehearsing the logistics and movements necessary to get the set on and off the field in seven minutes or less. "By this time, we had previsualized pyro and special effects here and there—the color and vibe of those effects—and the lighting," Rodgers says. "So when we began to make those storyboards real, subtle details emerged. For example, there were moments in Lady Gaga's dance routines where she'd hit a certain pose and that would be a cue for a pyro hit. In a live show, that pyro hit would be on exactly the same cue, but in a televised show, Hamish would want to see her head-to-toe, or maybe a close-up of her face at that instant. He wouldn't be going wide enough at that moment to get the full sense of the pyro effect, so it would become almost like a stutter cue: Hamish would go to her first, and then go wide right after that, and that's when the pyro cue would happen. For the pyro guys, it was almost anti-instinctual. It was super-tricky, and, because of the scale, it took so long for pyro to get up 300'. If the director had stayed on the tight shot, all you would have seen is a plume of smoke behind her. That sort of subtle detail applied to everybody."

The coordination of Glow Motion's technology with KP Terry's choreography "unified everyone," Rodgers says. "There's something heroic about everybody holding a baton like that. I just cannot imagine the show without them. If we hadn't had the kids illuminated with the batons, we would have lost most of the look of the show. It was beautiful, especially the mix of light and the color choices that Bob and Roy made."

Photo: Icon Sportswire/Getty Images

## Lighting

"The thing about lighting versus video or LEDs is that lighting is more physical," Bennett says. "You get beams of light that have more depth. Lighting extends farther out into the stadium in a physical sense. The whole thing became bigger than it physically was on the field, and helped give a big presence to the show."

The lighting was designed primarily for television. Barnhart adds, "It goes back to the contrast ratio problem. The human eye has got a 2000:1 contrast ratio, but even a really good live broadcast camera has only about a 450:1 contrast ratio. So I have to squeeze the contrast down for television; otherwise, one thing is going to be way too dark and another thing is going to be way too blown-out. For a live audience, you would have your star really pop to the human eye. I'm sure the stadium audience probably didn't notice anything odd. But it is a different way of lighting, and you have to cater to the millions of television sets over the 70,000 people in the stands who will still enjoy the show."

Barnhart's team included the lighting directors Pete Radice, Jason Rudolph, and David Grill. "They have been doing this with me a long time," he says. "They have to take on a lot of the jobs on their own, and then we bring it all together. For example, Jason is over in a rehearsal hall, doing the floor and the piano light, and Pete is in the stadium doing all the interior stadium lights. We hardly ever see the scenic lighting until it actually gets in together, so you're kind of roaming around between all your lighting directors, working on different aspects of the show and trying to see if it's all going to come together. They do such a great job of communicating with each other and getting on the same page. After a pass and after an evening ends, we'll sit down and look at a video. It's amazing how little we need to change, as far as how one lighting director's equipment is matching up with another's. That's hardly ever the conversation, which is always really impressive to me. Obviously, we make a lot of changes, but they're universal changes, not 'Hey, you're in the wrong color palette, what happened'?"

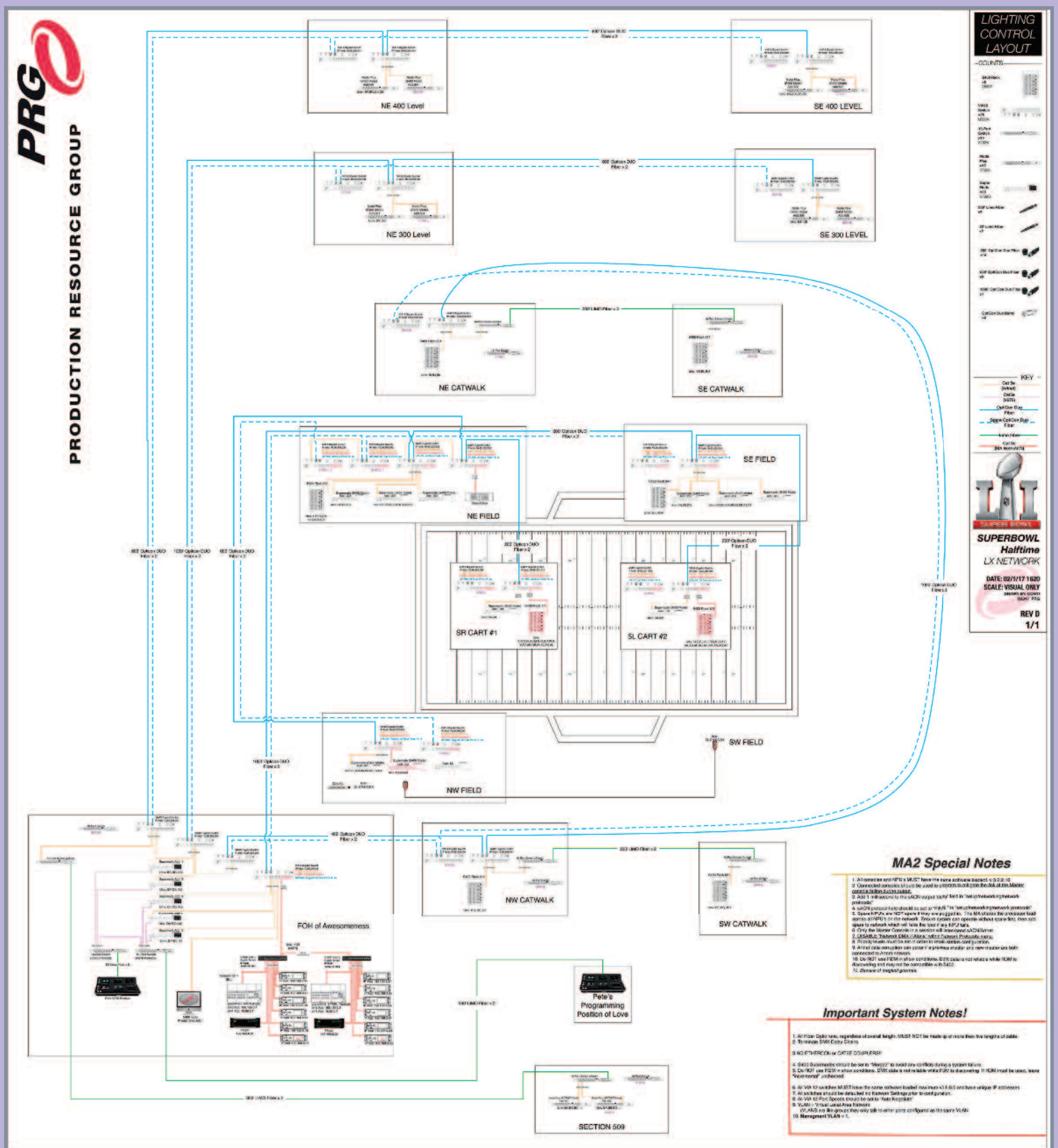
For lighting positions in this, his 19th Super Bowl halftime show, Barnhart used the rails on the 300 and 400 seating levels, end zone trusses, east and west trusses at a trim height of 163', the stadium floor, the set stars and towers, and the loudspeaker carts. His equipment list included 72 Philips Vari*Lite VL4000 BeamWashes, 12 VL6000 Beams, 96 PRG Best Boy Spots, 60 GLP GT-1 luminaires, 14 GLP impression X4 Bar 10 battens, 170 GLP impression X4 Bar 20 battens, 126 Claypaky Sharpy moving lights, 56 Claypaky Mythos moving lights, 81 Ayrton MagicDot-XT moving lights, 40 Ayrton MagicPanel-FX luminaires, one Ayrton CosmoPix-R moving light, 46 TMB Solaris LED Flares, 160 Chauvet Professional COLORdash Accent wash lights, eight Arc Lighting Brite Box medium-throw followspots, and seven Arc Lighting Brite Box long-throw followspots.

Control was via a pair of consoles: one MA Lighting grandMA2 desk provided 55 sACN DMX universes to drive the Glow Motion batons and the pixel-mapped GLP Impression X4 battens beneath the stage, while a PRG V676 console supplied 45 Art-Net DMX universes driving the moving lights, Solaris Flares, COLORdashes, and 5,000' of LED tape, that imparted the neon look to the four stars, a record amount used in any set constructed by All Access Staging and Productions. A single Art-Net universe was allocated for pyro. PRG supplied the lighting, VER provided the LED systems, and the pyro and special effects were supplied by Strictly FX. Chris Conti, of PRG, designed the lighting control network.

"At the outset, you start looking for the places you can rig, which is the outer perimeter of the roof once it's open," Barnhart says. "The outer perimeter has a good capacity, so we earmarked a lot of long-throw fixtures to pick off things like the cast and the scenery, and we put some lighting on the fans in the stadium just to give some depth and dimension to the overall feel. You look for all the things you can do before you even have an artist booked, in the sense of where you can locate tools, including the followspots that you'll probably need around the stadium even without knowing where the show is, whether it's on the 50-yard line or the end zone. You know you're going to need followspots, so you just start allocating positions with the NFL, with the understanding that some positions will probably be given back once the show settles down. The NRG stadium has this fantastic roof with an incredible weight capacity but the NFL wanted the option to have the roof open so we had to count that out.

"Then we start looking at places like the rails of the 300, 400, 500, and 600 levels or whatever the building can give you, so that we can give the wide shots the scale of a Super Bowl halftime show in a stadium, not just a stage show. We had lights bolted to the face of the 300 and 400 levels. The light I would have preferred to use hung down too low and affected the audience visually on the level below, so we did a test in October and showed them a sample, and of course they preferred the smaller light. All of that's just kind of a game that you play to make sure everybody's happy, and we still get something that we can work with, but obviously the game takes precedence."

Once an artist is chosen and the field of play is defined for the show, the key lighting positions can be selected and locked in. Compared to previous years, Barnhart says this year's show was more tightly focused: "Two years ago, for example, Katy Perry went from end zone to end zone twice, facing in major different directions in terms of good key light. This one was a little bit more focused in the sense of how it was performed more in a proscenium




Control network for the lighting design that comprised 55 sACN DMX universes, 45 Art-Net DMX universes, and a pair of consoles. An additional Art-Net universe was allocated for pyro.

Each Glow Motion baton received an RF signal from the MA Lighting grandMA2 console that triggered content held in a small amount of onboard memory, transforming it into a pixel in a living LED display.

style for the most part. It's not our show; it's Lady Gaga's show. It would have been a totally different show with any other artist, and it will always be that way."

The stars, towers, and other set pieces gave Barnhart a lot more to light this year. A small open-frame dome used to house Lady Gaga's piano for the song "A Million Reasons" was alone studded with 81 Ayrton MagicDot XTs. "The major difference from previous shows," he says, "was that there was a lot more scenery than we normally have to deal with; to light that much scenery, in the limited amount of time that we have on the field by the time it's dark, doesn't leave us much time to home in on how we want to light it."

Audience participation has come to be something of a tradition for the halftime show, and this year was no exception, with the crowd contributing to the overall lighting look. They had been instructed to hold up their cell phones with flashlights turned on during the song "Million Reasons;" this provided some continuity of the starry background from the beginning of the show during the slower number. "You never know how that's going to work out, but we got a very large participation, so it was great," Barnhart says.

The field cast's baton torches and the drones brought new dimensions to the lighting. "We've been working with Glow Motion for years on the Super Bowl," Barnhart says. "They offer up some cool things, and ask us if there might be a way to work any of them into a show, and we'll see if it works. Like any major project, if you try to take it all on at once, you will be overwhelmed, but if you just tick off each piece as you go, ultimately you kind of get through it. The drone portion was a completely separate entity. I had been trying to work a drone show into halftime for about three years, but the technology to do a large swarm of drones just wasn't there yet. It's still not where I want it to be in the sense of being able to do an indoor version of it. It turned into a two-month process to pull that off, just because Intel had not done it in such a situation before, and, by the time we got it together, there was no time to really test it beforehand, so it was trial by error on-site. We thought we were going to get nixed months ago with even just the concept of it."

The Federal Aviation Administration announced that as "a designated National Security Special Event, additional unmanned aircraft restrictions will be in place before, during, and after the Super Bowl," declaring the air space within a 34.5 mile radius of NRG Stadium a "no-drone zone" from 4pm to 11:59pm on game day. Rodgers says that this also had to do with the RF control of Intel's drones: "When you're at a Super Bowl, there are so many RF communications going on across the entire campus. Part of what drives a drone is a GPS aspect, and the GPS

Photo: Tribe Inc.

relies on a RF frequency to tell each drone where to go. Even during rehearsals, one might decide to stray off course or start falling like a falling star. With all that RF traffic on game day, they couldn't guarantee full control of the drones."

Due to the FAA restriction, the opening drone segment was prerecorded five days before the show, under a special FAA waiver that allowed them to fly up to 700', the highest they had flown to date. Intel received an additional special waiver to fly its Shooting Star fleet in the more restrictive class B airspace where they are otherwise prohibited. Weighing less than 10oz each, the drones feature built-in LED lights that can create over four billion color combinations in the sky. All 300 drones can be controlled by one computer and one drone pilot. According to information supplied by Intel, however, there is always a second pilot on hand as backup.

"The whole performance, from the time you see her singing 'God Bless America' to the time [Lady Gaga] does her first dive was done in one take," Barnhart says. "It was not edited. We did two passes, and she chose the one she preferred. They cut to live action when you see her flying inside the stadium. The drone show absolutely happened behind her. She was perfect, but you're asking 300 imperfect little drones to handle the wind and the updraft between those two stadiums in order to hold formation as the American flag. Every time I rehearsed it, and then both times that we shot it, I was biting my nails off. That final formation was so hard to hold."

Even though it is always the performer's show, Barnhart notes that the production team's experience with halftime shows can take it to another level, considering that "it's got to be a show that can get on the field in seven or seven-and-a-half minutes. They would all love to do a Super Bowl halftime show where the set would be in there for days, not just minutes."

## A carted show

While the NFL stipulates a 12-minute halftime during the regular season, during the Super Bowl it is typically more than twice that length. To set up the show in seven minutes and strike it in even less time requires a tremendous amount of coordination among hundreds of staff members and volunteers, some of whom plan their annual vacations around the Super Bowl so they can volunteer their services on the field. For logistical reasons, the stage and other set elements are constructed entirely on carts.

The set required 40 carts, including two for each of the towers and 13 for the stage with its central lift, plus several for the ramps and individual carts for each of the stars—a stair-star, dancer platform star, and two façade stars—as well as the piano dome, and the drum and keyboard risers. The carts were brought onto the field through a tunnel behind the goalposts at one end of the field, riding on pneumatic tires to minimize the potential for damage to the turf. All Access constructed the stage set in just a little over four weeks. Cartage of the stage alone required a fleet of 17 semitrucks.

"We had to figure out how to get 40 carts through that center pathway and past the goalposts into position in the six-and-a-half or seven minutes that we have to get everything onto the field. I thought this show would be the most challenging ever in my 11 years and it turns out that our staging guys, led by Cap Spence, Tony Hauser, and Doug Cook, managed to do it in just under seven minutes," Rodgers says. "It was totally insane. They videotaped the rehearsals with GoPros and chest cameras, and at night they had meetings, watching the video with the stagehands, looking for ways to shave time off here and there, finding ways to make it go together a little bit quicker and smarter, and finding ways to have a safe load-in, because a lot of these carts are in the 3,500lb – 4,000lb range. They were teaching the stagehands and the field crew members how to push a cart like that, not only to get it down through the tunnel, but once they get it onto the field, they know that they need to line up each cart in order to marry it up to the next one along one of the yard markers. It can be a dangerous situation without good staging guys."

The large 40'-long x 7'-wide x 22'-high dancer platform star on the 30-yard line, which doubled as a phone booth during the song "Telephone," was rolled in early in the train of carts because it required some assembly of its upper parts on the field before it could be powered up. Other elements were moved during the show itself: the façade star in front of the stage-right corner was moved to make way for the piano dome, initially parked in front of center stage, for the song "Million Reasons."

"Last year, we had 35 carts," Rodgers says. "It was a massive look, but I felt that, scenically, we didn't really challenge ourselves. To me, when you have a staging crew like we've got, you want to really give them something that's seemingly impossible. From the get-go, I was drawing something that I knew would take at least 40 carts. I thought, It's no fun unless there's adrenaline flowing, unless afterwards you're looking at the staging guys and they're feeling good about what they just did. After all, we're all in show business. We all strive to put on a performance on the scale of the Super Bowl, and it's not just Lady Gaga or Coldplay's Chris Martin or Beyoncé who wants to kick everything in the ass, but the guys who were on the staging crew, and everybody involved who don't want to walk away thinking that just anybody could have pulled this off. So here we go on this one, and people are starting to say it's too big, and I'm saying that we've got to go for it. We normally have up to seven-and-a-half or eight minutes to load it in, and they loaded it in in seven min-

utes. Even when I challenged the hell out of these guys, they found ways to improve their performance."

He adds that if a design ever threatens to run away into over-complexity, there is a strong hand on the tiller at RK Productions to keep everyone on course. "Our executive producer, Ricky Kirshner, is so important. He glues everything together; he's meeting with the NFL and with [the sponsor] Pepsi, talking about the show and why we want to do certain things. He's protecting the integrity of the show, and then he's coming back to us and helping edit it, and saying no to certain things, guiding and protecting the look of the production. Creative people can go too far. You need a guy who is creative and responsible like he is. He can say, 'We've got enough; it's 12 minutes, we've filled it up. We don't need to do any more'."

## Sound

The stadium sound system consisted of eighty-four JBL 4889 large-format three-way line array loudspeakers and thirty-six S28 dual 18" subs, distributed on 18 carts arranged in a large oval around the edge of the field. Every cart carried a pair of subs. Six were loaded with four 4889s each, and 12 with five 4889s. Powersoft K10 two-channel amplifiers powered the system, which was supplied by ATK Audiotek, of Valencia, California.

"This was a good year for us because we had done the 2004 Super Bowl in this stadium and we were quite familiar with it," says ATK's sound system designer Kirk Powell. "We didn't have to knock new core holes around the stadium for cabling; we used our existing ones, which helped us quite a bit. Based on our previous experience there, we decided to design the system differently. This year, our carts did not cover the upper deck, because we wanted to minimize the reflected energy off the upper walls and the roof from coming back onto the field, so we used our cart system up through the 500 level, and the house system for the upper 600 level. We learned before that we didn't want to try to cover all the seats from the field, since that creates far too much reverberant energy for an enjoyable audience experience. This approach worked out well for us this year, and we were very happy with the results."

ATK's Alex Guessard handled the front-of-house mixing duties and Tom Pesa the monitor mix, both using DiGiCo SD5 consoles. Sound Design Corporation's Paul Sandweiss mixed the broadcast mix on the Calrec Apollo console in NEP Broadcast's Denali California truck. The front-of-house mix was also used for radio network distribution around the world.

"The system infrastructure design was very, very similar to last year," Powell says. Performers' mics were split ahead of the consoles via an ATK-designed four-way transformer-based splitter. One split went to the front-of-house console's DiGiRack stage box, and another went to the broadcast truck. The direct feed was to the monitor mixer's DiGiRack. "It's a four-way custom passive splitter-with a high level, very high-quality transformer, but we use only three splits from it," he says.

The front-of-house and monitor consoles were connected to their respective stage boxes via Optocore fiber optic cable. Each console was independent from the other, so there was no requirement for a master clock. The MADI digital audio output from the front-of-house console was distributed in a redundant optical ring to four locations around the field and thence to the Powersoft amps via 16-channel Focusrite RedNet D16R Dante-enabled Ethernet network interfaces.

"I had two remote racks in the front-of-house location, each offering 56 inputs and 56 outputs," Guessard says. "I ran the audio at a 48kHz sample rate because I had inserted a Yamaha QL1 backup console in the Dante loop, and that console can only do 48kHz. There was no additional analog backup system this year, but the Dante is fully redundant. Everything was timed to time code generated from the broadcast network, which was distributed to all locations in order to synchronize the lighting, video, pyro, and special effects with any kind of playback coming out of the broadcast truck.

"Everything that Lady Gaga played and performed onstage was 100% live. The piano was hard-wired, via a Radial DI. Her Keytar was wireless. For mics, the band used what they used for rehearsals and on tour. They brought those with them."

Due to nondisclosure agreements, no one was able to confirm how much of the backing instrumentation was performed live. The band tracks for a show on this scale are usually prerecorded ahead of time, so that the many diverse elements of the show can be repeatedly synchronized with the music during several days of rehearsals and on game day, and to ensure that the show comes in on time. This recording is typically made in a rehearsal studio with the band playing live so that it doesn't come off sounding like a multi-tracked studio master.

"We did 10 or 12 run-throughs with Lady Gaga in rehearsals in the stadium on the Wednesday, Thursday, and Friday before the game," Guessard says.

A second reason for the use of prerecorded tracks is simply that most of the seven-minute setup goes to the load-in and interconnection of all the set elements, leaving precious little time—no more than a minute at best—to connect all the live inputs and perform a sound check. During 2016's halftime show, which featured three distinct acts, 40 channels of prerecorded tracks were replayed from a dual-redundant Pro Tools HD system, including click tracks, band tracks, and backup vocals, in addition to the live wireless microphone signals from the performers.

This year, Lady Gaga herself used three separate wireless mics during the course of her performance, each one

colored differently to match her costume changes. “They were all Sennheiser 5200 systems with 5235 capsules, but on three different frequencies,” Guessard says. “She used the first one up starting up on the tower, and then when she arrived at the piano, a second mic was already set up there. After that, she went to the white mic for the finale. I had to ride those microphones during the performance. I also used a few Waves plug-ins: a C6 helped me to compress, frequency-wise, some parts of the spectrum so that I got in to pretty close to where I need to be. I also used the H-Delay and H-Reverb.” The Waves Live plug-in package developed for DiGiCo uses a dedicated SoundGrid DSP server to power the plug-in processing with low latency, a necessity in live mixing.

says. The decision to use the house sound system to reach the upper seating level meant that there was little real difference in the amount of bounce-back between rehearsals and the game-day performance.

Shure PSM 1000 in-ear monitor systems were selected by Professional Wireless Systems for use by the performers. It was the 20th consecutive Super Bowl for PWS, who coordinated all wireless RF operations for the referee mics, as well as the pregame and halftime events. A total of eight transmit mixes were sent to 32 body-pack receivers used by the musicians and dancers in the show.

At the end of “Bad Romance,” which Lady Gaga performed atop the center-stage lift, she was carried to the base of the stair star positioned downstage left. Climbing the


The lighting crew, including members of IATSE Local 51, flank the lighting designer Bob Barnhart, of 22 Degrees (white shirt, center).

“In the past, we had mixed for the stadium in mono,” Guessard says. “This year, I decided to go with a stereo cart system, with each cart alternating left-right-left-right. There is so much information coming to us in stereo, and if you sum it to mono it doesn’t always work. There can be a lot of phasing issues, so I kept everything in stereo and that really seemed to help with the clarity. The subs, however, were in mono on an aux feed.”

One significant difference between the rehearsals and live performance was that the roof was open during the show, but not during any of the rehearsals. “Because of the helicopters and other aircraft, we were never able to do any rehearsal with the roof open. Every time we opened the roof, we ended up with the press flying above,” he

stairs, she gave a final shout-out to “Super Bowl Fifty-One!” and, dropping her mic, leaped off into empty space, catching a white, diamond-encrusted football mid-air, and fell out of sight into a foam pit concealed below.

“When she jumped off the star and caught the football, everyone in the truck cheered,” Rodgers says. Bennett adds, “That was the most nerve-wracking thing in the whole performance!”

The NFL reports that the Super Bowl LI halftime was the most-watched musical event of all time across all platforms. It was also the most-watched Super Bowl halftime performance in history through broadcast and digital channels. It was also reported that, as per established practice, the headliner was not paid for her performance.