



Recording the Most Powerful Rocket Ever Built in Immersive Audio with Sennheiser and AMBEO's Spatial Audio Technology

Old Lyme, Connecticut, December, 2024 — Earlier this summer, a group calling themselves Birdwatchers gathered in the sand dunes of the western Gulf Coast in South Texas, moments from the US/Mexico border with a handful of Sennheiser microphones to record the latest launch of the most powerful rocket ever built. “These rockets are so loud that they’re tearing the air to shreds, so what we’re trying to capture with these launches is where sound ends,” says Jason Achilles Mezilis, a Los Angeles-based rock musician, producer and extraterrestrial audio engineer.

Mezilis and his fellow Birdwatchers — a group that includes Benny Burt, a sound editor at Skywalker Sound, Justin Foley, system engineer at NASA’s Jet Propulsion Laboratory (JPL), and Andrew Keating, audio engineer with Cosmic Perspective, a company documenting space exploration — have been capturing launch audio and 360-degree video for several years. But this mission, a test flight of SpaceX’s Starship atop Super Heavy, a first stage that develops twice the thrust of the Saturn V that put NASA astronauts into space, was captured and mixed by the group for the first time in immersive audio using Sennheiser’s AMBEO VR ambisonic microphone.

Set and forget with Sennheiser

For this mission, the group positioned a Sennheiser MKH 418-S M-S stereo shotgun microphone and a pair of MKH 8070 long shotgun mics about half a mile south of the launch pad and placed the AMBEO VR mic a mile to the north. The microphones were recorded to Zoom F6 and F3 recorders at 192 kHz, 32 bit, making the most of the machines’ floating-point capabilities to handle the massive dynamic range. The recording machines and microphones are set prior to launch, and because blast-off may be delayed, they must be able to record for 48 hours. “As long as that rocket’s fueled and on the stand it’s basically a giant bomb,” Mezilis points out. “You can’t go back to check your equipment.” The dunes and a concrete pillar on the pad shielded the array of shotgun mics from the rocket blast and much of the dust and debris, he adds.

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Gabe Herman, the Audio Engineering Society's former Regional Vice President of Eastern US and Canada, and former Chair of the Education Committee, recalls his introduction to Mezilis: "Jason emailed me out of the blue and said, 'I helped design a microphone on NASA's Perseverance rover that recorded the first sounds on Mars. I'd love to be able to present something to students about the intersection of science and rock 'n' roll.'" Mezilis and Herman presented "Microphones on Mars" at the 2023 AES Convention in New York.

Recording rocket launches in immersive audio

Herman, an engineer and producer who is also Associate Professor of Music Production and Technology at The Hartt School, The University of Hartford in Connecticut, continues, "Jason shared that he had gained the trust of various launch sites, and they were cool with him showing up and recording rocket launches for fun. I said, 'We should be recording these rockets in immersive audio.'" To assist with that goal, Herman introduced Sennheiser to the Birdwatchers, and they welcomed him into their group.

Accurately capturing a rocket launch trajectory is a challenge, Herman observes, not least because the flight path curves. "We had a theory on the last launch that we needed two shotgun microphones that could be very narrow and focused to track the rocket as it ascended from earth," he explains, so they deployed a pair of Sennheiser MKH 8070 long shotgun mics. "We hoped we could capture the beginning of the launch with one microphone, then the second microphone, angled a little higher in the sky, would catch the second half of that ascent. But those microphones are so good, so narrow, specific and focused, that we didn't capture the arc the way we hoped." That said, Herman notes, "The AMBEO mic was very successful in capturing a very compelling immersive field."

On the recording, Mezilis adds, "The 418-S gave us the meat of everything. That mid-side mic is incredible. The AMBEO VR filled in much of the space behind and around that mic. Because the AMBEO mic is on the other side of the rocket we had to flip the stereo image."

Academic and scientific applications

"There's so much here that's of interest to students and to the scientific community," Herman believes. "For the next launch, we are curious to learn more about how sound behaves at the launch site, which will likely require specialized equipment. Because the air is literally destroyed, it can be difficult to understand the nature of the awesome force taking place at



launch. We hope to build on existing research on this phenomenon and make that more accessible to students.”

Further, Herman says, “There’s no standard method for recording rockets, so we have to keep experimenting with new mic techniques, and continue to be curious about the physical world.” Capturing a launch presents a fixed data set for later study; he says, “This last launch was a scorching success in that we learned so much about what to do for the next one. Every new launch allows us to refine the data set and generate more informed questions.”

Many audio students dream of winning a Grammy award, Herman suggests, but learning about a project like this might inspire some to consider alternative careers. “When you go to audio school you don’t necessarily think that you’re going to end up recording rockets for a living. But it’s all the same physics we experience in the recording studio. This is a way to show a different application of the theoretical concepts covered in the classroom. I think students are excited to learn that there are exciting frontiers in audio that are still being explored.”

Inspiring the next generation of audio engineers

Herman and his fellows have their own vision of presenting these rocket launches as immersive experiences for everyone. “Our dream is to find a way to build a portable dome where we can project 360 video and a 360 audio component so that kids — and adults — who are interested in science can stand next to one of the loudest things on earth and watch it go off into space in a way that you just can’t experience on YouTube.”

Experiencing such a presentation might well inspire the next generation of audio engineers, Mezilis agrees. “When you talk about space, what do kids get excited about? It’s black holes, it’s where physics breaks down, and the end of everything. And what we’re trying to capture is where the air is literally getting shredded and torn apart. This is some of the loudest stuff that there is, and I think that’s appealing to the kid in all of us.”

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About Sennheiser Group

Building the future of audio and creating unique sound experiences for our customers - this is the aspiration that unites the employees of the Sennheiser Group worldwide. The independent family-owned company Sennheiser was founded in 1945. Today, it is managed in the third generation by Dr. Andreas Sennheiser and Daniel Sennheiser, and is one of the leading manufacturers in the field of professional audio technology.



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