

“WAR OF THE WORLDS”

Case Study



Bexel Achieves Simultaneous Audio Performance Spanning Four Locations



CHALLENGES

Commission an opera spanning four simultaneous performance locations using metal relics from World War II as central set pieces, that could transmit the audio in near real-time, as if the performers and audience were in the same room.

SOLUTION

16 channels of bi-directional audio were configured to each of the four remote locations with only 4.75 milliseconds of latency in each direction. With the help of Bexel, “War of the Worlds” was produced using recommissioned World War II sirens located throughout Los Angeles to broadcast the action live from Walt Disney Concert Hall, and surrounding locations.



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OVERVIEW

The ambitious performance piece **“War of the Worlds”** was Gosfield’s reincarnation of Orson Welles’ famous 1938 fake radio news broadcast about a Martian invasion of Earth performed by the Los Angeles Philharmonic. At the center of the action, World War II air raid sirens refurbished at three outdoor sites transmitted the jarring sounds of aliens, along with instrumental music and news reports back to the Walt Disney Concert Hall, to broadcast to a live audience.



Having supported **The Industry** on special projects previously, Bexel understood that enabling a production of this scope would come with challenges. The challenges centered around three main categories:

1. Research and Technology Development
2. Signal Distribution
3. Package Design and Deployment



Four remote sites had to be seamlessly connected

and conversations with potential technology providers led to roadblocks due to financial, scheduling, or technology limits.

RESEARCH

Since each of the remote sites were city parks or empty parking lots, there were a number of setbacks from the start: (1) pre-existing high-capacity data network connections were not present, (2) the required symmetrical high-speed capability was not available, (3) not even the best codec-based data compression devices could not meet the high audio quality standards. It was becoming apparent that Bexel was going to have to create their own private network that included a combination of traditional copper, fiber optic, and long-range Millimeter wave radio transmitters.

It was a tall task to effortlessly convey audio artistry and ingenuity. Led by the Bexel audio engineering team, Andrew McHaddad (chief audio engineer), Rod Allen (project manager), and Jim Turner (system design and senior engineer) were ready to help make this unconventional production a success.

At first glance, getting 48k/24bit, near-zero latency, multi-channel, bi-directional audio from three remote sites into the concert hall looked like existing solutions could work. However, early research



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	Bi-Directional	Adequate Channel Count	Consistent Latency	Controlled by Bexel	Reasonable Cost
Wireless HD Video Transport					
IP Based Solutions					
ISDN					
Bonded Cellular					

TECHNOLOGY DEVELOPMENT

The key to making this production work was identifying technologies that have synergy – especially when they have never been used together in this manner. The audio networking protocol used was Audinate’s Digital Audio Networking Through Ethernet (Dante) and Multichannel Audio Digital Interface (MADI). This proved to be a winning combination for both latency and audio distribution management. The decisive factor left was to discover if the telecommunications industry could provide off-the-shelf wireless equipment that would support the protocol.

SIGNAL DISTRIBUTION

Although Dante networking was critical for this project to work through the radios, MADI was used as the primary means of signal distribution at each site, and at the Concert Hall.

One of Bexel’s early decisions was to isolate the transmission-path circuits from the onsite audio distribution equipment. Segregating the radio network technology to its own realm was mandatory to keep the project moving, allowing the Bexel team to focus their efforts in two parallel workflows: the transmission path which operated as a “Bexel only” workflow, and the audio distribution where Bexel worked closely with the audio design team to route and manage all the audio and communication sources independent of the transmission path.

Bexel provided the MC-32 from Direct Out Technologies to supply the onsite analog I/O and to get signals in and out of the sound reinforcement system. Additionally, a Direct Out Technologies 2.XT Line Level 32x32 MADI interface was used for the 4-wire communications circuits so the stage managers and technical crew could stay connected to the intercom system at the Concert Hall. To keep all the MADI signals mapped, each site was equipped with Direct Out Technologies M.1K2 MADI router, enabling remote gain control and metering of individual microphones at all locations through the Dante converted MADI stream from its connected interfaces. The live, on-screen metering of the audio interface inputs and outputs proved to be a powerful tool for quality control and signal verification. Additional metering on the Dante side of the system occurred through computers equipped with Audinate’s Virtual Sound Card, and a metering application by Darkwood Designs.

Facilitating the communications for the technical crews from three remote sites was critical, and needed to be near real-time. For this, the data-radio networks were also used to carry the intercom audio circuits to



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create a common channel of communications. Bexel also provided audio technical circuits, a conductor talkback, and a stage-announce to all sites. At the Concert Hall, a Clear-Com Eclipse Pico 36-Port digital matrix was used to merge the signals from each site, and five Clear-Com V-Series key panels were placed at key locations for personnel. For the lead stage manager at the Walt Disney Concert Hall, Bexel used the venue's existing in-house Telex BTR-800 and interfaced it along with the Clear-Com Party-line system into the digital matrix.



PACKAGE DESIGN AND DEPLOYMENT

The overall concept was to have audio routed to and from each of the three sites from the [Walt Disney Concert Hall](#). Additionally, the microphone gain on the preamps at each site needed to be controlled from the Concert Hall, which meant the design would have two parts.

The main system or “hub” was located at the Concert Hall, which included a Yamaha CL5, a Yamaha DM2000, a Direct-Out M.1K2 MADI Router, Focusrite and Yamaha Dante to MADI converters, and Direct-Out MADI I/O.

The Yamaha CL5 was used as the sub-mix/fold-back console. It pre-mixed the elements from the remote sites to feed the Concert Hall's front of house DiGiCo console and created the mix-minus signals sent back to the remote site's performers. Signal transport between the CL5 and the Concert Hall front of house DiGiCo mixer was Dante using Focusrite DN64R Dante/MADI bridges.

At each of the sites, Bexel implemented a racked solution that contained a Yamaha DM1000 for QC, a Direct-Out MADI Router, Focusrite and Yamaha Dante to MADI converters, and a Direct-Out Andiamo MC microphone preamp. To enable communications, Bexel used the Clear-Com Helixnet hardwired intercom paired with a Freespeak II or Tempest wireless intercom system.

The site's systems were configured to allow the local engineer flexibility in the event of a failed link (which was not experienced during the rehearsals or performances). The engineer had the ability to route local signals, manage communications for the site, and QC any audio signals, which could all be done independent of the Concert Hall if needed.

Bexel engineers collaborated with the audio design team and the technical production staff at the Concert Hall to develop a plan that fit both the workflow and the resources available at each site.

Site #1: A parking lot conveniently located across the street from the Walt Disney Concert Hall at 131 South Olive Street. After close inspection, a 2,000 foot fiber path was identified, enabling the use of a standard fiber optic conversion, and eliminating the need for an RF link.

Site #2: A parking lot adjacent to the San Fernando Building at 400 South Main Street. This site became the co-location point supporting Site #2 and the second relay point for Site #3. Each day, a fiber optic cable, a CAT6 cable, and power cable were deployed from the second story of the building. The cable could be left partially installed, reducing deployment time.



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Site #3: A parking lot adjacent to a building at 740 South Olive Street. Site #3 proved to be the most challenging. The first radio link was mounted and aimed at the first radio “hop” location at the One Wilshire building. From there, the second radio link was aimed at Site #2 for its final radio link back to home base, at the Dorothy Chandler Pavilion. Each day, the fiber optic cable and power cable was deployed and retracted using a custom rigged solution that took less than 15 minutes from its location on a 13-story building.

Both radio hops at Site #2 and Site #3 were aimed at the Dorothy Chandler Pavilion since the radio service provider already had a presence on the rooftop that made logistics and permissions easier, and the Pavilion had an existing fiber path (via 4 patch points) that reached the Concert Hall.

SHOW DAY

The other-worldly performance of “War of the Worlds” resulted in a large-scale, city-wide collaborative experience presented by the LA Philharmonic and co-produced by The Industry and NOW Art LA. Bexel’s involvement in this audacious experiment helped bring a notorious radio drama to life by creating a solution for an audio broadcast that had never been done before.



About Bexel

Celebrating more than 35 years of broadcast excellence, Bexel, an NEP Broadcast Services Company, skillfully delivers unparalleled production services and engineering expertise for some of the world’s largest televised events. Bexel has mastered the art of service from concept to completion, and its unique solutions equip broadcasters to capture powerful content anywhere in the world. Bexel’s specialized broadcast offerings include fiber, specialty cameras, 4K solutions, graphics, custom flypacks, and intercom, as well as systems integration, managed services, enterprise solutions, and product sales. Since 1981, Bexel has continually enhanced and evolved the media production experience.