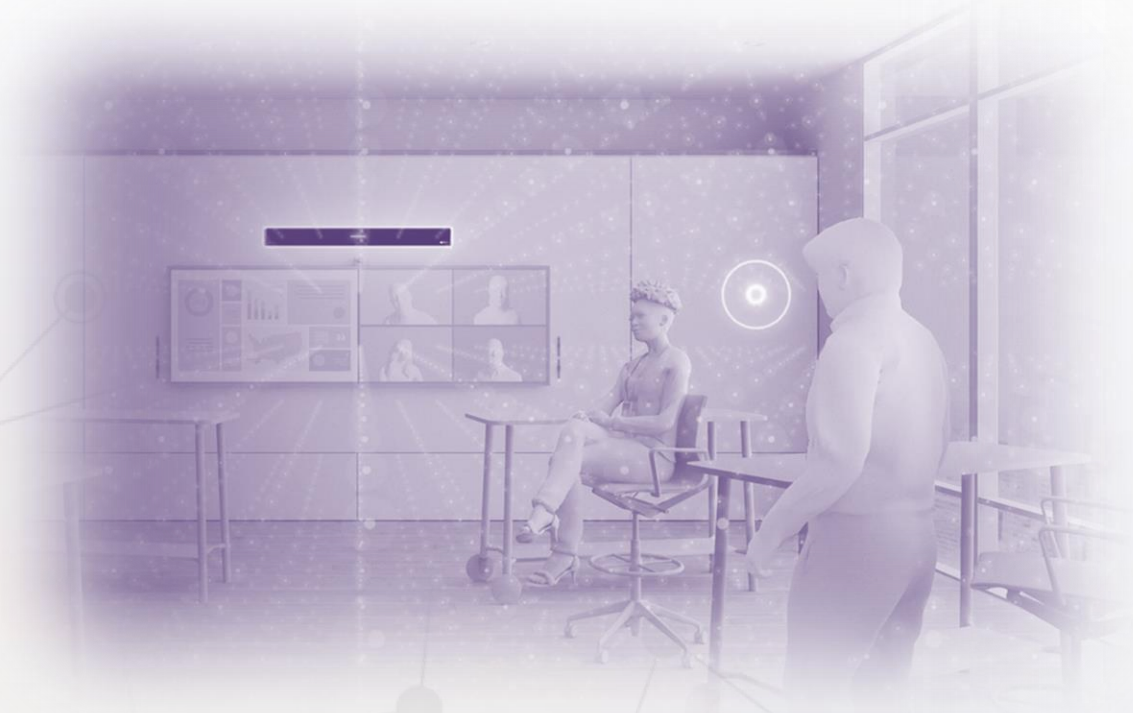
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Quick Take

A Next-Gen Approach to Meeting Room Audio



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RECON RESEARCH

Sponsored by:

nureva

The Meeting Room Audio Challenge

When the pandemic forced everyone to work from home, information workers donned their headsets and joined countless video and audio meetings.



And every day, information workers join millions of audio and video calls using mobile phones. These meeting participants typically hear each other quite well – even though they're in different locations using different devices.

But when people join from a meeting room, the remote participants often can't hear what the local folks have to say.

So, why is meeting room audio so different from personal device (headset or phone) audio? There are many contributing factors, but for simplicity's sake, we'll focus on one - microphone pickup patterns.

A "pickup pattern" is the physical space around a mic where the mic picks up (captures) sound the best.

Some mics pick up sounds in any direction, while others only pick up sounds in front of the mic. Some have a narrow or wide pickup pattern. Some pickup sounds close to or far away from the mic.

Personal device microphones are designed to pick up sounds only a few inches away, so they capture only the talker's voice. These mics essentially can't hear other sounds in the area.



Meeting room mics, however, are made to capture speech audio from several people located a few feet (or more) away. These mics listen for and capture any sound in a section of the room.

Unfortunately, these mics can't easily differentiate between desired sounds (e.g., a person talking) and unwanted sounds (e.g., air conditioning noise or people talking in the hallway).

Also, these mics capture both direct sound (e.g., a person talking) and reflected sound (e.g., the echo of a person's voice after it bounces off a glass wall or shiny table).

"Capturing speech audio from multiple people in a meeting room is no easy task."

Moreover, the further a person is from the mic, the harder it is for the mic to hear that person's voice above the constant background noise (a.k.a. ambient noise) in the room. In response, audio systems amplify the voices of people far from the mics, but this also amplifies the background noise.

The takeaway is that capturing speech audio from multiple people in a meeting room is no easy task. Capturing high-quality audio in medium and large spaces is an even greater challenge.

A Step in the Right Direction

There are two traditional approaches to improving meeting room microphone audio:

Traditional Approach #1 – Adding Mics

The brute-force approach is to install additional mics in the meeting room, which serves two purposes:

- Reducing the distance between each participant and the closest mic, and
- Decreasing the area of the room that each mic needs to cover

This approach can dramatically improve the quality of the outgoing microphone audio from the room. However, adding mics adds cost (need to buy more mics, mixing equipment, etc.), complexity (wiring, more calibration, etc.), and clutter to the space.

Traditional Approach #2 – Beamforming

Simply stated, beamforming uses multiple mic elements within a single device to create a smaller number of audio pickup zones (beams or lobes) within a space.

The drawing on the right shows a ceiling-mounted audio device using beamforming to create eight fixed beams.

Note how each beam is shaped and positioned to capture the speech audio of one person sitting at the table.

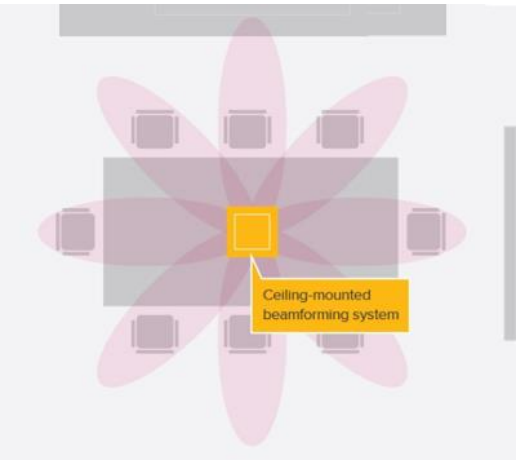


Figure 1 – Ceiling-Mounted Beamforming Device

Beamforming brings several key benefits, including:

- Beamforming is available within various devices (e.g., ceiling mics, video bars, displays, etc.).
- Beamforming allows the mics to be moved off the table (e.g., in a ceiling mic or video bar).
- Beamforming can reduce unwanted noise (if the beams are narrow and properly defined).

Beamforming also brings limitations and weaknesses, such as:

- Beamforming can be complex to set up / configure (depending on the device and meeting room).
- Beamforming only captures the audio in specific parts of the room (e.g., around the table).
- Beamforming sometimes requires large/wide beams causing unwanted noise to be captured.
- Beamforming starts to fail at the edges of the beams or when people move between beams.
- Beamforming uses active interference to electronically cancel out unwanted sound.

The last bullet warrants additional discussion. Beamformers introduce phase-shifted audio signals to cancel out unwanted sounds. As a result, beamforming performance is frequency dependent. Also, the newly added phase-shifted audio may interfere with the desirable speech audio.

What does this mean? Beamforming is an elegant approach that works well in suitable spaces as long as the participants remain in areas covered by a beam. People located outside a beam will not be heard.

We often think of a beam as a flashlight in a dark room. Everyone (and everything) within the flashlight's beam will be easy to see, but anything outside the flashlight's beam will remain unseen.

A Next-Gen Approach to Room Audio

The sponsor of this note, Nureva, has developed a technology called Microphone Mist™ designed to provide the audio performance benefits of beamforming without the limitations and weaknesses.

Unlike beamforming which depends on a limited number of pre-defined beams that cover specific portions of the meeting room, Microphone Mist fills the room with thousands of "virtual microphones."



Figure 2 – Virtual Microphones Distributed Throughout a Typical Meeting Room

A virtual microphone is an individual pickup point created using two or more physical microphone elements to focus on a specific location in a meeting room or classroom. Each virtual microphone (see the small blue circles in the image above) behaves like a quasi-physical omnidirectional microphone.

However, there are fundamental differences between Microphone Mist technology and beamforming.

Beamforming	Microphone Mist
Captures audio within its beams only	Captures audio anywhere in the room
Captures desired (speech) and undesired (noise, echo, reflections, etc.) sounds within a relatively large area (each beam) and then works to electronically cancel unwanted sounds.	Blankets the meeting space with small pickup areas (virtual mics) allowing more granular audio capture and reduced need to cancel unwanted audio.
Performance degrades as participants approach the edge of beams and move between beams	Allows participants to move freely around the room with consistent audio capture
May require professional installation and configuration (depending on the device and room)	Can be installed by anyone, and the system calibrates itself automatically

Figure 3 – Comparison of Beamforming vs. Microphone Mist Technology

Nureva has implemented Microphone Mist across its entire USB-microphone product line. The table below shows the supported room sizes and the number of virtual mics each product provides.

Nureva Device	Optimal Room Size	# of Virtual Mics
HDL200	Small – 18’ x 18’ (5.5 x 5.5 m)	Up to 4,096
HDL300	Medium – 25’ x 25’ (7.6 x 7.6 m)	Up to 8,192
HDL310	Medium – 30’ x 30’ (9.1 x 9.1 m)	Up to 8,192
Dual HDL300	Large – 30’ x 50’ (9.1 x 15.2 m)	Up to 16,384
HDL410	Large – 35’ x 55’ (10.7 x 16.8 m)	Up to 16,384

Figure 4 – Nureva Audio Devices (with Room Sizes and Virtual Mics)

The image below shows a large meeting room with an HDL410 system mounted above the display and on the side wall.



Figure 5 – Nureva HDL Devices Installed in a Meeting Room

The thousands of virtual microphones allow the participants to move around the room. They will even capture speech audio from participants facing away from the displays or standing at the whiteboard.

Recon Research has not formally evaluated the Nureva HDL series devices. However, we have used the HDL200 and HDL300 in our lab and can confirm that they are easy-to-install, easy-to-use, well-performing microphone systems.

Summary

For many reasons (noise, distance from the microphones, reflective surface, etc.), capturing speech audio within a meeting room is extremely difficult.

One legacy approach is to install many microphones on the table (and other parts of the room). However, this is expensive, adds complexity, and does not allow people to move around the room.

Another option is beamforming. This approach keeps the microphones off the table and offers strong audio performance – assuming the participants stay within the beams.

Nureva’s Microphone Mist is a next-gen approach that provides similar benefits to beamforming, but requires less time and expertise to install than many beamforming solutions (especially in medium and large spaces) and allows meeting room participants to move freely around the room.

Organizations seeking flexible mic coverage for medium and large rooms should try a Nureva HDL mic. Install it and move around the room. No matter where you hide, the virtual mics have you covered.

About Nureva

(Information below provided by Nureva)

Nureva's line of audio conferencing systems simplify the task of getting great audio performance in meeting and learning spaces from small to extra-large.

Nureva's patented Microphone Mist technology places thousands of virtual microphones throughout a space to pick up sound from any location, ensuring that everyone is clearly heard regardless of where they are in the room or the direction they are facing.

For more information, visit the Nureva website.

About Recon Research

Recon Research (RR) is an analyst/market research firm focused on enterprise communications. Our coverage areas include unified communications (UCaaS), video conferencing (VCaaS), collaboration and ideation platforms, audiovisual (AV) solutions, wireless presentation systems, and more.

RR provides enterprise customers, vendors, channel partners, and investment professionals the information and insight they need to make informed, fact-based decisions.

What makes RR different is the depth of knowledge and experience we bring from our 20 years of company briefings, market analysis, and hands-on testing of products and services in these markets.

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