Challenge

USOUND

Having developed an innovative application for MEMS technology in the acoustic market, Austrian start-up USound faces the challenge of a fast market launch while ensuring high quality in design and production.

Sound innovation, sound statistical approach

Engineers at startup USound speed development and production cycles to bring a breakthrough acoustic technology faster to the market.

The advent of silicon in microelectronic and micromechanical devices has transformed modern life. Wireless-enabled devices today allow us to interact with the world in previously unimaginable ways; ask your smart speaker to read you the news or program your refrigerator to order milk when you're out. Many of the most impressive products in this field today, however, still rely on 19th-century electrodynamic speaker technology – a stubborn vestige of the pre-digital era.

But that is about to change. USound, a fast-growing startup founded in 2014 in Graz, Austria, has developed a range of next-generation MEMS (Micro ElectroMechanical Systems) based audio products that promise to transform the possibilities of sound and speaker technology. For one, USound's MEMS microspeakers are small enough to fit within a space of only 50 cubic millimeters. Further, the shock-resistant technology also has an extended bandwidth allowing for HD audio and ultrasound.

Bringing breakthrough technology to market

"We are combining MEMS, a silicon-based process, with typical acoustic components like an acoustic membrane and plate," says Markus Bartek, Director of Audio Industrialization at USound. In essence, he continues, "we're combining two different worlds. If you're working on MEMS, you are doing everything with silicon. We're combining it with standard acoustic components used for electrodynamical devices. This combination is quite unique and has very high potential." USound's flagship speaker is Ganymede, which can be fitted into smartphones, sunglasses and earbuds, among others. The company has already provided reference designs for Fauna audio eyewear with Ganymede speakers in the temples and Megaclite MEMS-based earphones.

Though USound will be the first to market this technology, competitors will inevitably follow. And with them, the pressure to reduce the size of MEMS devices will increase. "There is a lot of potential to make the speakers even smaller and especially even thinner – two qualities which

are in high demand," says Bartek's colleague Florian Iglisch, Product Engineer. "If you look at the applications for this technology – wearables, for example – everything gets smaller and more complex. Our biggest challenge is that we have this innovative technology which is pretty new but still needs time for development."

Getting distinctive sound quality with high levels of energy efficiency requires precise production. That's why reliability and manufacturing are two of the central tenets in USound's value proposition. In order to deliver on the company's quality promise, USound's engineers have taken a scientific approach that applies mathematical precision to move the technology forward.

Shortening production cycles

Bartek and Iglisch are no strangers to quality engineering. Both point to the depth of practical statistical knowledge required at every step in Ganymede's journey from first concept to, eventually, the market. Iglisch now works full-time getting the Ganymede family of microspeakers into production while ensuring components continue to meet the rigid specifications necessary to meet performance standards. "Continuous product improvements related to technology, design and process in parallel to moving the product into the industrialization stage is a challenge," he says.

In Iglisch's day-to-day work, the need to shorten production cycles translates into a need to better prioritize. That means asking questions like "Do we reach customer targets with the development stages we have right now? Is reliability good enough? Can we qualify the product, or do we need to step back and rework it?"

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Markus Bartek, Director of Audio Industrialization

It's in answering these questions that a statistical software package can be absolutely essential. So with USound getting ready to begin full mass production, Iglisch turned to JMP®.

"JMP was new to me when I first joined USound, and the biggest advantage I've found is that it has a very intuitive approach and a very intuitive way to get started," Iglisch says. "You can, for example, just take Graph Builder and play around a little bit and will instantly get a reasonable data representation. Then you can figure out how to use the data best to start problem-solving."

"If we do make changes in the product and in components, we want to get meaningful results in a short amount of time to get to a usable conclusion for a next step, and we definitely saw a big need to use a statistical tool like JMP," Bartek adds.

Monitoring sound performance, building process knowledge

To evaluate Ganymede on a range of performance indicators, USound's engineers measure sound quality over the full range of frequency that can be heard by humans. With this information, they can see a complete vector that can be used to assess performance, improve process control and identify quality parameters.

"We're looking from a performance point of view on the acoustic side," Bartek says. "We try to correlate the soundwaves physically with other physical domains, like component aging and mechanical geometries. In other words, process influences. It's quite important for the speaker area that we correlate between different physical domains, identifying relationships in between to improve the speaker performance in the end."

By loading the data into JMP, Iglisch says it quickly becomes apparent whether fluctuations in quality are signal or noise. In one case, he recalls, "we realized that we didn't have a huge distribution, but we actually had two groups – that came up during one production run where we'd had unstable performance. The second group.... degraded the performance. So we looked at where it came from."

The next step, he says, was to find a correlation. Then, by looking at the process, he could identify and consider possible improvement options depending on whether the source of unstable performance was component variation, for example, or something related to the process.

Depending on what he finds with JMP, Iglisch says, the next action is to "sit down with the manufacturer to look at the process and see what parameters we have and what we can influence. Then we might run some experiments." And by building this knowledge, the team can together control and stabilize the process.

As production continues to ramp up, Iglisch says, the team will be "looking at the process, including all the limits to the user construct and asking, where do we have to improve next? Because there's always room for improvement."

Robust statistics in JMP® help the technology evolve

Because they're able to keep processes in control and stabilize them faster when issues arise, Bartek and Iglisch say JMP has had a real impact – and will play an even more expansive role in future efforts. "I'm currently starting to look deeper into the bigger data sets," Iglisch says. "The database becomes more complex. It becomes interesting to use some kind of scripting approach. And that's something I like about JMP: that you can play around or export scripts – and modify them. That's different from other software where you have to program most of them from scratch."

Iglisch and Bartek will now look to the tool to see how process and product knowledge can help inform technological innovation. Production of Ganymede speakers will most likely trigger new ways to help USound's portfolio evolve and, Iglisch adds, "I think that will be the key part where I will have a focus, where mainly we'll use JMP for the near-term future."

"When you can reach the next level, dig deeper and really know about and use the power of the tools," Iglisch says, "that, in my opinion, is a pretty good approach."

Solution

Adopt robust statistical resources for process control. Use JMP to build process knowledge, assess and monitor performance and refine production quality.

Results

USound is set to bring their first MEMS microspeaker Ganymede, among other products, to market quickly, enabling the company to seize market share for microspeaker technology in wearables, headsets and embedded speakers in various internet-connected devices.

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