

## Health-Mor, Brooklyn, Ohio

### PRODUCT: FilterQueen® Defender® Room Air Purifier

The FilterQueen® Defender® is used in homes and hospitals worldwide to filter harmful pollutants such as dust mites, allergens, viruses, mold spores, and bacteria.

"As a small company, we can only afford to do so much research and testing. NASA has so much internal intelligence that can be shared to help us [and it] is much more affordable than us employing an entire R&D team that is going to spend months just learning what NASA engineers already know."

– Dan Duggan, CEO, Health-Mor



### CHALLENGE

Health-Mor needed help with design changes to improve filtration and reduce noise levels. "We needed to make our FilterQueen® Defender® Room Air Purifier even better than it was," said Health-Mor CEO Dan Duggan via email. "Move more air and with less noise." These improvements would help the company meet new European Union regulations to continue selling to their European customers and pursue new international customers. The key to entering these countries with an American-made product, Duggan explained, is a high level of filtration, high-level clean air deliver rates, and the lowest level of noise possible.

#### NASA CONNECTION

The Manufacturing Advocacy and Growth Network (MAGNET) introduced Health-Mor to the Adopt-a-City program, a joint effort of the NASA Glenn Research Center, the city of Cleveland, Cuyahoga County, and MAGNET. Adopt-a-City provided up to 40 hours of pro bono assistance from NASA experts to small and midsized manufacturers to help solve technical challenges with a new or existing product.

Health-Mor was one of eight companies who successfully applied to participate in Adopt-a-City in 2016. Health-Mor representatives were paired with NASA subject matter experts (SMEs) at Glenn Research Center to address their technology challenge.

One of those team members was Research Aerospace Engineer David Elliott of Glenn's Acoustics Branch. Elliott's area of research is the **reduction of propulsion system fan noise.** "All the noise generated by the products of interest is produced by fans," noted Elliott, "which is directly related to the work done by our group."

The SME team also included Research Aerospace Engineers Adam Wroblewski, Sameer Kulkarni, and Vikram Shyam. Their combined **expertise in ideation, compressor aerodynamics, computational fluid dynamics (CFD), and aeroacoustic noise reduction** was exactly what Health-Mor needed to solve their technology challenge.

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#### SOLUTION

Health-Mor provided the NASA team with a sample of their product as well as flow-rate data sets they had generated. After performing several validation tests, the team carried out a number of CFD runs that illustrated the model's flow path.

Explained Wroblewski, "This type of computational prediction allowed our team to identify 'bottleneck' regions in the flow path that cause airflow restrictions and high turbulence, leading to reduced flow rates and increased noise, respectively."

The team was able to help Health-Mor identify options to improve the flow rate and reduce product noise. "Principles that are followed in our propulsion system areas were suggested to help reduce the noise signature," noted Elliott.



FilterQueen® Defender® production line in Brooklyn, Ohio. Courtesy of Health-Mor.



Testing station on the FilterQueen® Defender® production line. Courtesy of Health-Mor.

"We also utilized the computational fluid dynamics work [...] to help with design changes for reduced noise."

Health-Mor CEO Duggan found the SME team's insight into the science of flows particularly helpful. "As you might imagine, NASA engineers are very keen on moving air to power spacecraft and rockets."

#### SUCCESS

As a result of the consultation, Duggan reported, "We switched our entire production worldwide to a single better performing fan blade. This saves on inventory costs [and] makes the FilterQueen® Defender® better by running quieter and with more airflow."



- Helped maintain just over \$2 million in sales
- Allowed the company to add or retain 4 to 5 full-time jobs in their Brooklyn factory
- Positioned the company to begin selling their product in more countries around the world, including some of the most populated areas in Asia, India, and the Middle East

"A lot of what we do at NASA is focused on long-term goals [and] metrics, so being able to successfully assist a local small business with a near-term challenge was very satisfying."

—Sameer Kulkarni, NASA Glenn Research Aerospace Engineer and consultation team member