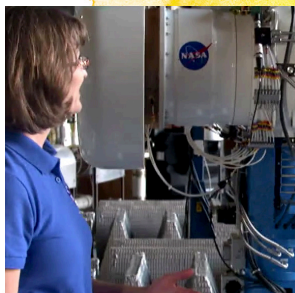




DANIELLE KOCH

AEROSPACE ENGINEER



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Level 1: Less than 810

Level 2: 810-1000L

Level 3: 1010-1200L

Level 4: 1210-1400L

Level
3

NASA's Danielle Koch is wired for sound – and finding ways to make things quieter.

No matter where she is, Danielle is tuned in to the sounds that surround her. Whether that is from a gentle breeze at the top of a mountain or the roar of an airliner's jet engines during takeoff from an airport, she has always been intrigued by the sounds she hears.

Take a moment right now and just listen. What do you hear? Is the room quiet, or noisy? Are you noticing any sounds you would not normally hear unless you were listening for them, just like you are doing now? Whether you live in the city, suburbs, or out in the country, sounds of all kinds surround you.

What if you live near a big airport? If you love airplanes you may think the sound of a jumbo jet flying overhead or racing down a runway is music to your ears. But for most everyone else, that sound is considered noise pollution and they would like it to go away, or at least be quieted as much as possible.

As a researcher who works for NASA, that is what Danielle does. She leads a team of engineers who study ways to reduce engine noise by designing, building, and testing new parts that can be installed in an airplane's engine.

She calls her work "an engineering journey," and it's a journey that has taken her from the top of a mountain range in rural Oregon, to sitting surrounded by tall wetland reeds, to conducting research at a NASA sound laboratory in Ohio that looks like a futuristic igloo with

a big door.

That facility is officially known as the Aero-Acoustic Propulsion Laboratory. It is in Cleveland at a NASA research field center named for John Glenn, who in 1962 became the first American to orbit Earth.

The dome-shaped building is 65 feet high and 130 feet in diameter at its base. That is as tall as a six-story office building and just a little bit wider than the distance the Wright Brothers flew on their first history-making flight in 1903.



Inside, 17,000 custom-designed fiberglass wedges are mounted on the dome's walls and floor. These wedges keep sounds from echoing in the dome, which allow researchers to more precisely study engine noise or whatever sound-making device is being tested at the time.

So, how do you make a jet engine quieter? Turns out there are several ways it can be done, but it took research over many years to come up with some ideas that would



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work. That work is not finished, either. Danielle and her team constantly look for new ways that work even better.

During Danielle's search for ways to reduce engine noise, she realized that nature was full of possible solutions. She noticed that when out in nature, away from traffic and the louder noises so many of us typically hear every day, the sounds we hear change and are often quieter. Strolling deep in the forest, for example, wind blowing through the trees can easily be heard.

This gave Danielle the idea to take a close look at the different materials and structures found in nature to best understand which ones were best at absorbing noise. She hoped to adapt what she found to airplane engines.

One example of something from nature she thought would work was honeycomb. Humans have found ways to use the honeybee-invented structure made up of hexagonal (six-sided) sections for centuries because it is strong and light weight.

Danielle and other researchers who have studied honeycombs found they also work quite well as noise insulators. After much testing and years of experimentation, they came up with a way to put a layer of honeycomb material inside a jet engine. This layer is called an acoustic liner because it surrounds the loud rotating machinery inside a typical jet engine and absorbs the intense sound. This reduces the airplane's

noise level heard on the ground. It also makes the flight quieter for passengers inside the airplane.

Although these liners are effective at noise reduction and help the airlines comply with rules about how loud a jet engine can be, Danielle and her team are not satisfied. They believe it is possible to create acoustic liners that will work even better than using honeycomb.

To do this, Danielle is once again turning to nature for inspiration and her time among the tall grass reeds common in wetlands. Experiments have shown that bundles of reeds are good at absorbing sounds, but there is one big problem. Natural grass reeds are not durable enough to withstand the super-hot, high-pressure environment inside a jet engine. Danielle and her team are working to get the same effects as grass reeds, but with materials that can withstand the heat of an engine.



She is not giving up though. Trying new things, even when success is not guaranteed, is an important part of being an aerospace engineer. It is a job that requires her to be part-scientist, part-inventor, and part-problem solver. Sometimes failure is an option.

When things are not working as hoped, Danielle takes inspiration from the famous pilot Amelia Earhart.

Amelia often tried new things during the early days of aviation, many of them risky. She once wrote a letter to her husband, saying “Please know I am aware of the hazards. I want to do it because I want to do it. Women must try to do things as men have tried. When they fail, their failure must be a challenge to others.”

So, how did Danielle start her engineering journey? When she was younger, she enjoyed math and science and wanted to know how things worked. This led her to study fluid and thermal engineering sciences in college. Now, as a NASA engineer, she gets to do what she loves every day.

Danielle enjoys being an engineer, so much so that she shares her passion with others. She acts as a mentor helping students of all ages learn about engineering careers. She hopes students will realize how rewarding a career as an engineer can be.

So, the next time a jet airplane flies overhead, and the



Another way NASA has reduced jet engine noise, which Danielle helped research, is seen on this Boeing 787. The saw-toothed cuts at the back of the engine change how the jet’s hot exhaust mixes with cold outside air. That makes the engine quieter.

Credits: The Boeing Company/Bob Ferguson

noise does not interrupt your conversation, give a shout out to Danielle and her colleagues who have worked to keep things in the air as quiet as possible. And consider the possibility that one day you could be part of a team at NASA, working alongside Danielle hunting for the next big idea in noise abatement.

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