



TECHNOLOGY SOLUTION

Aerospace

A Method for Reducing Broadband Noise

Thin and lightweight broadband acoustic absorbers inspired by nature

Researchers at NASA's Glenn and Langley Research Centers have developed a groundbreaking bio-mimicking acoustic liner for quieting noisy environments. Conventional approaches have not been able to absorb sound effectively in the 400-3000 Hz range, thereby subjecting humans to excessive noise pollution at the low end of the auditory range. The NASA innovation relies on parallel-stacked tube filters, which improve noise reduction in this range by as much as 25% over conventional melamine or honeycomb solutions. Inspired by the structure of natural reeds, these porous tubes are arranged to maximize acoustic absorption while also realizing significant benefits in weight, size, and extreme-temperature functionality. Since broadband noise represents one of the most significant potential environmental constraints to increasing capacity, efficiency, and flexibility in a host of different arenas, this technology could prove invaluable in multiple applications including aircraft cabin liners, school buses and other vehicles, industrial environments, and building construction.

BENEFITS

- Effective: Proven to reduce noise between 400 and 3000 Hz
- Easily constructed: Manufactured using additive technique with strong, lightweight materials
- Versatile: Suitable for any application in which noise presents a problem
- Durable: Demonstrated to operate effectively in harsh conditions
- Scalable: Modular design for both small and large noise control applications



THE TECHNOLOGY

This NASA technology is ideally suited to absorb sounds below 1000 Hz (at the low end of human auditory range), which commercially available materials have struggled to absorb effectively. NASA innovators designed the acoustic liner to mimic the geometry and the low-frequency acoustic absorption of natural reeds. To provide excellent noise absorption that endures even in a variety of challenging conditions, researchers have created and tested prototypes of acoustic filters using thin and lightweight parallel-stacked tubes one-fourth to three-eighths of an inch in diameter. The assembly can feature a porous or perforated face sheet positioned on one or more sides of the acoustic absorber layer to increase noise-reduction capability as needed. These filters have demonstrated exceptional acoustic absorption coefficients in the frequency range of 400 to 3000 Hz. Results indicate that these assemblies can be additively manufactured from synthetic materials, generally plastic; however, ceramics, metals, or other materials can also be used. The reeds can be narrow or wide, hollow or solid, straight or bent, etc., giving this acoustic liner remarkable flexibility and versatility to meet the needs of virtually any application. This technology effectively demonstrates that a new class of structures can now be considered for a wide range of environments and applications that need durable, lightweight, broadband acoustic absorption that is effective at various frequencies, particularly between 400 and 3000 Hz.



Glenn's novel acoustic liners offer an effective and versatile way to reduce noise in loud environments, including manufacturing settings such as this paper mill



In addition to being used for vehicle or industrial noise control, these acoustic liners can help provide extra-quiet spaces for broadcasting and recording

APPLICATIONS

The technology has several potential applications:

- Aerospace (i.e., cabin, engine)
- Architecture and construction
- Enclosures
- Automotive
- Acoustic insulation (i.e., recording studios, gun ranges, highway barriers)

PUBLICATIONS

Patent No: 10,460,714; 11,532,296

technology.nasa.gov

More Information

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