Science and Technology

INFRASTRUCTURE RESILIENCE & SECURITY

SOUND-FUELED ELECTRICAL AND COOLING SYSTEM

3D-PRINTED ENERGY CONVERTER FOR REMOTE AREAS AND TRANSPORTATION SYSTEMS USING THERMOACOUSTIC TECHNOLOGY TO CONVERT WASTE HEAT TO POWER.

Thermoacoustic heat exchangers use sound waves to cool heat energy and can provide an efficient way to provide refrigeration in loud environments. In the global transition to cleaner energy, thermoacoustics can supplement existing refrigeration and fueling units for aircraft, ships, engine rooms, server farms, and off-grid power stations.

The U.S. Coast Guard (USCG) saw an opportunity to better harness thermoacoustic technology with a precise, 3D-printed, low-heat-conducting stack that allows for sound waves to compress gases and create a cooling system with low-cost additive manufacturing.

KEY BENEFITS

+ Clean energy from waste heat and excess sound
+ Requires little energy and decreases fuel costs
+ Low cost and easy manufacturability with 3D printing
+ Minimal maintenance requirements with only one moving part
+ No emissions of ozone-depleting gases

STAGE OF DEVELOPMENT

Proof of Concept

PARTNERSHIP SOUGHT

Licensing or Collaborative Research and Development Agreement (CRADA)

INVENTORS

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DHS COMPONENT

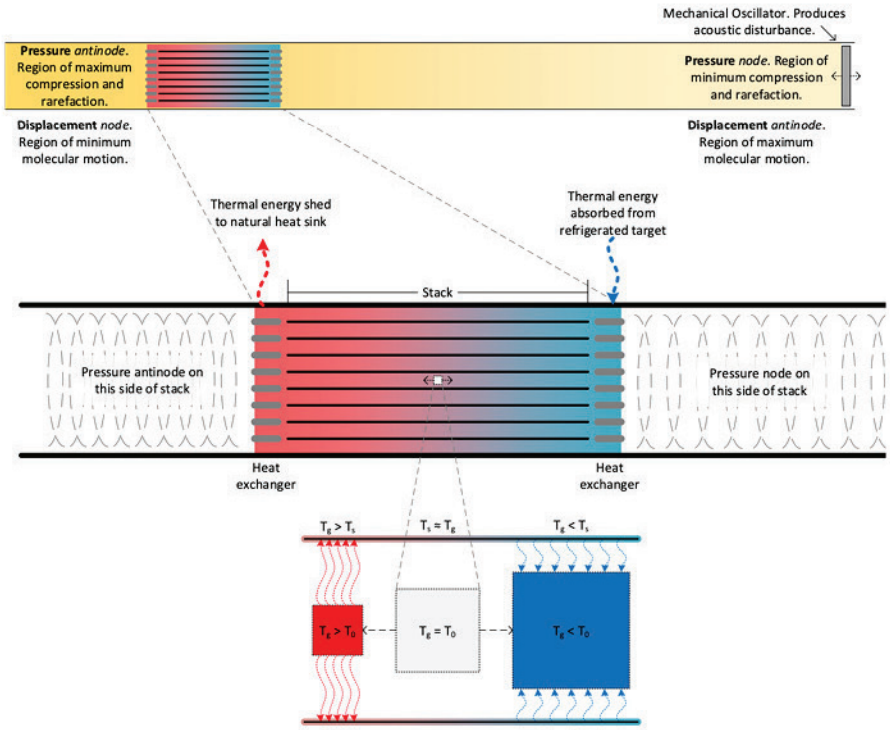
U.S. Coast Guard

The Technology Transfer and Commercialization Branch (T2C) within the Office of Industry Partnerships (OIP) of the Department of Homeland Security (DHS) Science and Technology Directorate (S&T) serves as the centralized point to manage technology transfer activities throughout DHS and the DHS laboratory network. **T2C@hq.dhs.gov**

THE TECHNOLOGY

The device is a thermoacoustic stack using polylactic acid material within a cylinder, which offers high heat capacity and low thermal conductivity to maintain a thermal gradient. Contained within one end of the cylinder is a unit of parallel walls that allow airflow from one end of the cylinder to the other. Heat exchangers sit on either end of the stack. A heat gradient absorbs thermal energy at one end and releases the captured thermal energy at the other end to create refrigeration.

The device can also generate electricity instead of refrigeration when the stack is replaced with a transducer that vibrates from the acoustic sound wave and converts wasted heat into usable power. 3D printing capabilities allow for precise manufacture, higher performance, smaller size, and lower production costs. In addition, the device's only moving part is a loudspeaker cone, allowing for minimal maintenance costs.



Color diagram of the thermoacoustic heat exchanger device from Figure 1 of US Patent Application 17/544,855.

APPLICATIONS

The technology has several potential end-users:

+ Cooling systems
+ Electricity generation

PATENT INFORMATION

US Patent numbers 17/544,855

CONTACT INFORMATION

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TECHNOLOGY SOLUTION

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