

# A traveling-wave engine to power deep space travel

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A University of California scientist working at Los Alamos National Laboratory and researchers from Northrop Grumman Space Technology have developed **a novel method for generating electrical power for deep-space travel using sound waves**. The traveling-wave thermoacoustic electric generator has the potential to power [space](#) probes to the furthest reaches of the Universe.

In research reported in a recent issue of the journal Applied Physics Letters, Laboratory scientist Scott Backhaus and his Northrop Grumman colleagues, Emanuel Tward and Mike Petach, describe the design of a thermoacoustic system for the generation of electricity aboard spacecraft. The traveling-wave engine/linear alternator system is similar to the current thermoelectric generators in that it uses heat from the decay of a radioactive fuel to generate electricity, but is more than twice as efficient.

The new design is an improvement over current thermoelectric devices used for the generation of electricity aboard spacecraft. Such devices convert only 7 percent of the heat source energy into electricity. The traveling-wave engine converts 18 percent of the heat source energy into electricity. Since the only moving component in the device besides the helium gas itself is an ambient temperature piston, the device possesses the kind of high-reliability required of deep space probes.

The traveling-wave engine is a modern-day adaptation of the 19th century thermodynamic invention of Robert Stirling — the Stirling

engine — which is similar to a steam engine, but uses heated air instead of steam to drive a piston. The traveling-wave engine works by sending helium gas through a stack of 322 stainless-steel wire-mesh discs called a regenerator. The regenerator is connected to a heat source and a heat sink that causes the helium to expand and contract. This expansion and contraction creates powerful sound waves — in much the same way that lightning in the atmosphere causes the thermal expansion that produces thunder. These oscillating sound waves in the traveling-wave engine drive the piston of a linear alternator that generates electricity.

NASA funded the traveling-wave thermoacoustic electric generator research.

Source: DOE/Los Alamos National Laboratory

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