

TECHNOLOGY SOLUTION

Power Generation and Storage

Next Generation “Closed Strayton” Engine Design

Genset Delivers Compact, High-Efficiency Power for the Future

NASA’s Glenn Research Center introduces the “Closed Strayton” generator design to efficiently deliver lightweight and sustainable electric power for clean energy applications. Optimized for hydrogen-based, zero-emission electrified aircraft propulsion from kW to MW range, the design builds on the core “Strayton” engine technology, which combines both Stirling and Brayton cycle elements to overcome the size and performance limitations of conventional turbines and heat engines.

In its closed-cycle configuration, the design provides fuel-source agnostic, maintenance-free, quiet power generation for applications with challenging footprint and noise constraints. With additional support for open-cycle and combined-cycle implementations, as well as the capability to scale to higher power outputs, this early-stage technology offers broad applicability for both today and tomorrow’s clean energy and power systems.

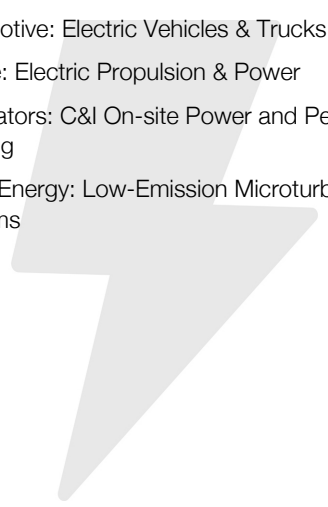
BENEFITS

- High Efficiency: Over 60% system efficiency with zero-emission option
- Long-Lasting Performance: Sealed system engine uses inert gas bearings for quiet, low maintenance operation
- Compact Power: Shaft-embedded Stirling engine saves weight and size over existing closed-cycle designs
- Versatility: Closed-cycle application supports a wide range of heat sources without the need for advanced alloys
- Low Emissions: Increased performance at lower combustion temperatures reduce NOx emissions

APPLICATIONS

The technology has several potential applications:

- Aerospace: Electric Aircraft
- Automotive: Electric Vehicles & Trucks
- Marine: Electric Propulsion & Power
- Generators: C&I On-site Power and Peak Shaving
- Clean Energy: Low-Emission Microturbine Systems



THE TECHNOLOGY

The core “Strayton” generator technology consists of a gas turbine engine with short, axial pistons installed inside the hollow turbine shaft. These pistons form a Stirling engine that cycles via thermo-acoustic waves, transferring heat from the turbine blades to the compressor stage, which improves overall engine performance. Power to an alternator is, thus, delivered from both turbine shaft rotation and the oscillation of the internal pistons.

This synergistic relationship is markedly enhanced in a closed-cycle system, where the sealed turbine engine recirculates a working fluid heated via an external source, such as a hydrogen fuel cell and combustor. This system supports higher compression ratios, reduces the turbine diameter to less than 4”, and eliminates the need for large recuperators. Operational efficiency is projected to extend into the low temperature range (750° C), reducing the need for advanced materials and providing cleaner combustion for hydrogen-based applications. Pressurized, inert working fluids also replace mechanical bearings and gearboxes, enabling years of maintenance-free operation.

The fuel cell and Stirling cycle produce 10% of the total system energy, while the Brayton cycle produces 90%. Other external heat sources could include nuclear, solar, or biogas. Conservative estimates for the hydrogen fuel-cell configuration lifetime are in the 100,000 hour range.

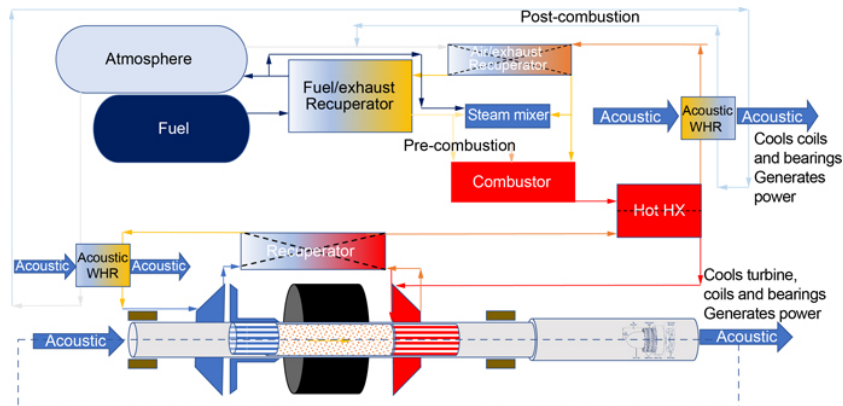
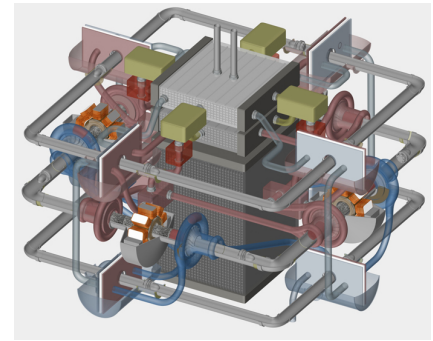


Diagram of the Strayton engine.



3 dimensional model of the closed Strayton system.

PUBLICATIONS

Patent Pending

Dyson, R. W. (2023, April 26). True zero emission electric aircraft propulsion transport technology. [Conference Paper] AIAA/IEEE Electric Aircraft Technologies Symposium (EATS) <https://ntrs.nasa.gov/citations/20230006407>

Dyson, R. (2023, June 14). True zero emission electric aircraft propulsion transport technology [PowerPoint Slides]. American Institute of Aeronautics and Astronautics, Inc. <https://ntrs.nasa.gov/citations/20230006821>

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More Information

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