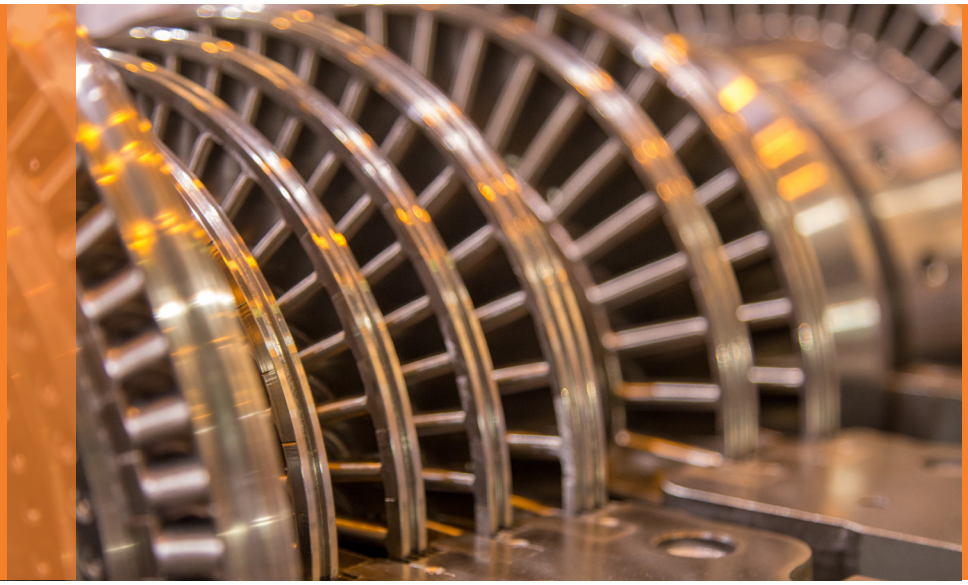
CHAIN REACTION INNOVATIONS
Entrepreneurship at Argonne

Argonne NATIONAL LABORATORY

PLASMA-ASSISTED FUEL INJECTOR CUTS COSTS, ADDS FUEL FLEXIBILITY

Better combustion, better performance



Through the Chain Reaction Innovations startup studio program at Argonne National Laboratory, FGC Plasma Solutions is developing a better fuel injector for jet engines and gas turbines. This injector improves operability and reduces fuel consumption.

fgc plasma SOLUTIONS

Laboratory tests of plasma-assisted combustion show boosts in engine performance compatible with airline jet and micro turbine use.

FGC Plasma Solutions' patented technology can overcome the key challenges that have held back the use of plasma-assisted combustion in real-world engines.

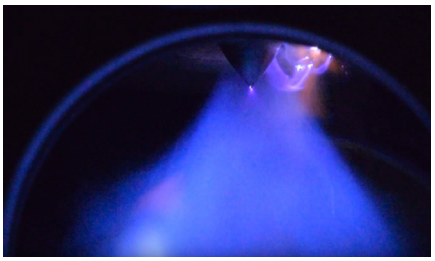
The novel design was demonstrated at NASA Glenn Research Center in realistic jet engine conditions and is undergoing testing on a micro-turbine engine at Argonne National Laboratory in coordination with Capstone Turbines.

FGC Plasma Solutions technology uses plasma to deposit radicals, excited species and intense local heat addition directly into regions of aerodynamic stabilization, thereby enhancing stability. The FGC fuel injector design overcomes technical hurdles that have limited previous adoption of plasma-assisted combustion technologies by minimizing NO_x emissions from the plasma, sustaining durability, and maintaining power consumption. The result is a drop-in injector with a short payback lifetime that reduces fuel consumption, reduces emissions, enables fuel flexibility to improve engine efficiency and durability, and enables the use of low-cost, low calorific value fuels.

FGC Plasma Solutions was accepted into the U.S. Department of Energy's startup funding program, Chain Reaction Innovations, to work with experts at Argonne Laboratory on world-class, multi-million dollar equipment to validate the technology at the full system level and accelerate it into the marketplace. A commercial prototype could be ready 1 to 3 years.

INVEST IN THE NEXT-GENERATION ENGINE

FGC Plasma Solutions is seeking investors and engine manufactures to partner with to develop the leading edge injector to serve the jet engine sector. The combined global micro turbine, power generation turbine and jet engine injector industries are valued at $4 billion annually.



An FGC Plasma Solutions fuel injector in operation at Case Western University test bench demonstrated stabilized combustion and reduced emissions.

U.S. DEPARTMENT OF ENERGY
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ADVANCED MANUFACTURING OFFICE

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Benefits for airlines:

- 2.5 to 4.5 percent reduction in fuel consumption on average annually for airlines
- Up to 20 million metric tons of carbon dioxide emissions avoided annually in the US; equivalent to taking 850,000 cars off the road
- ~3 percent average increase in profits for airlines
- Manufacturing of on-demand changes in fuel injector geometry on a single production line possible because of parts additively manufactured
- Drop-in design works with existing engines
- 2.2 years for injector payback time
- $6.5 million lifecycle savings for average commercial airplane
- Only patented plasma-assisted combustion with targeted radical addition, distributed electrode wear, and spatially uniform discharge

Benefits for gas turbines:

- Use of low-British Thermal Units (BTU) opportunity fuels
- Enables turbines to follow rapid changes in electrical load
- Operation with stability at low powers
- Can burn fuels with low volumetric energy content.
- Potential of 3 to 5 years for injector payback time, depending on operation parameters
- Can run off a gas with less than 300 BTU/SCF while maintaining or improving emissions
- Possibility for compliance with CARB without Heat Recovery or SCR
- No propane needed for startup
- Lower NO_x

An FGC Plasma Solutions plasma-assisted air-blast injector undergoing tests at realistic conditions at NASA Glenn Research Center.

APPLICATIONS

- Aerospace
- Defense
- Aviation
- Power generation
- Micro turbines

FGC PLASMA SOLUTIONS

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