

Engineers at Naval Surface Warfare Center Dahlgren Division (NSWCDD) Develop New EPIC Engine

By **DON Innovation**

A Dahlgren lead team of engineers and scientists, which includes partners in industry, academia, and warfare centers, are working on the development of the patented Extreme Power Internal Combustion (EPIC) Engine. Research on the new EPIC concept is currently being funded by the Office of Naval Research (ONR).



The advanced engine could provide substantially higher power-to-weight ratio than a turbine powered engine, while doubling the torque and significantly improving fuel efficiency beyond that of comparably powered systems (especially in off-peak conditions). The engine would accomplish this high power density in a small, lightweight package, with improved stealth (low emissions) and built-in hybrid power or pumping capability (e.g., quick charge, ducted fan, water jet, emergency pump, fast compressor, hydraulics).

The EPIC engine's cycle is a "modified-Otto" cycle in which the power and compression strokes occur simultaneously, followed by the simultaneous occurrence of the intake and exhaust strokes to complete all four strokes of the 'Otto' cycle. It utilizes shared space in a manner such that each piston shares the same area as the previous piston, sequentially. The engine provides maximum leverage, as combustion expansion and piston movement is always perpendicular to the drive shaft moment arm. It conserves momentum by true circular rotation of the pistons (i.e., not wasting energy on piston return strokes) and transitions rapidly from full power to lower powers (e.g., 64 cylinders to one) and back again, near instantaneously.

By combining simultaneous strokes, shared space, maximum leverage, conservation of momentum, and cylinder selection, the EPIC engine is able to produce game-changing power and torque in a revolutionary, small, lightweight, and fuel efficient package. It is scalable from radio control (RC) engines to the main propulsion of a mega ship or jumbo airliner and it can be utilized for heavy lift to high performance in land, sea, and air systems such as:

- Airplanes
- Ships
- Tactical and Logistics Vehicles
- Semis
- Trains
- Vertical/Short Take-off and Landing (V/STOL)
- Amphibious
- Hybrid Submersibles
- Unmanned Vehicles
- All-Terrain Vehicles (ATVs)

- Snow machines
- Personal Watercraft
- Ultralights
- Robots
- Exoskeletons
- Generators
- Pumps
- Towing and Lifting Equipment
- Construction and Earth Moving Equipment