Ultra Endurance Unmanned Aerial Vehicle – Heavy Fuel Engine Program –

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At a Glance

What is it?

- The Ultra Endurance Unmanned Aerial Vehicle (UE-UAV) Heavy Fuel Engine (HFE) FNC is developing engine component technologies to help extend the endurance of the air vehicle to at least 12 hours and up to 24 hours.

How does it work?

- This effort will develop detailed finite element models and use performance analysis tools and computational fluid dynamics models to improve scavenging, fuel injection, and mixing.
- Component development and selection focuses on minimizing the engine's weight.
- Testing of prototype hardware will evaluate engine performance and durability.

What will it accomplish?

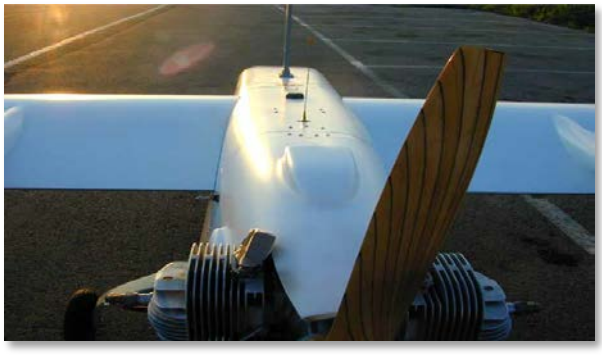
- The UE-UAV will operate on logistically available fuels, allow for extension of the vehicle endurance capabilities and is suitable for military operational environments.
- In addition to small tactical-sized UAS applications (STUAS), the technology developed and demonstrated will also be suitable for other applications such as portable generators, pumps and other applications the warfighter needs to further reduce the use of volatile fuels in combat environments.

Point of Contact

Miss Malinda Pagett, ONR Code 352
malinda.pagett@navy.mil

The need for a small tactical UAS heavy fuel engine still exists due to logistics and operational concerns in both maritime and land operations with gasoline. A production small heavy fuel engine will reduce the need for gasoline procurement and storage, allowing the troops to use fuels that are currently available in the logistics system. Heavy-fuels are defined as Diesel, JP-5, and JP-8.

The technology readiness level (TRL) of current state-of-the-art varies considerably from TRL 2 to 5. The Ultra Endurance Unmanned Aerial Vehicle (UE-UAV) Future Naval Capability (FNC) Product recently developed a true small 12 hp diesel engine. It can operate on a broad range of heavy fuels and has a relatively high power-to-weight ratio of 0.75 hp/lb. The time between overhauls is 250 hours, and the engine's life is 500 hours. The applicable Brake Specific Fuel Consumption (BSFC), a measure of its fuel economy, is 0.44 lb/hp-hr. If only achieved individually; power-to-weight ratio, durability, fuel efficiency, or the ability to run on different fuels; would be considered impressive accomplishments, especially considering the use of direct fuel injection within a cylinder bore measuring only ~2 inches. However, the true technical achievement and challenge is to realize all four in the same engine, which is the goal of UE-UAV. Technical areas being addressed include combustion, cycle analysis, and heat management; fuel delivery, atomization, and fuel-air mixing; intake and exhaust systems; power generation systems; mechanical systems; and lastly, controls and engine health management systems.



Research Challenges and Opportunities:

- Efficient combustion with compression ignition in smaller chambers
- Precise miniaturized fuel injection system components
- Design and construction of strong and lightweight smaller engine components (e.g., crankshaft, crankcase)