

# Hydrocarbon Fueled UUVs

## Progress / Status in 2022

### Fuels

- Internally stressed hydrocarbon molecules will increase heats of combustion by 10-15%.
- Heavy hydrocarbons can improve storage density by 10%.

### Oxidizers

- Improved stabilizers will increase commercial grade hydrogen peroxide concentration to 75%.
- Improvements in in-situ oxygen generation will eliminate any need for oxygen storage on support vessels and allow increased vehicle tank pressures.

### Prime Movers

- UUV-sized turbines will have efficiency of 73-75%.
- Foil bearings will provide virtually infinite bearing life.

### Alternator / Gearbox / Power Conditioning

- Very high speed (>500K rpm), very compact alternators and reduced size power conditioning devices will be commercially available.

### Energy Conversion Systems

- Improved turbine efficiency and increased turbine inlet temperature will increase turbine-based system energy conversion efficiency to 33%.
- Reduced size and weight Stirling engine will provide 45-50% energy conversion efficiency.

### Energy Densities and Specific Energies

- The above improvements will increase turbine-based system specific energies to 560 W-hr/kg and 525 W-hr/kg and the energy densities to 660 W-hr/L and 230 W-hr/L for the peroxide and gaseous oxygen based systems, respectively.
- Stirling engine systems may attain specific energies of 750 W-hr/kg.