Department of the Navy SBIR/STTR Transition Program

STATEMENT A. Approved for public release; distribution is unlimited.
ONR Approval # 43-2203-16

Topic # N101-081
Thermal/Mechanical Aqueous Chlorate Solution Oxygen Generator
API Engineering, LLC

WHO

SYSCOM: ONR

Sponsoring Program: PEO LCS - PMS 406

Transition Target: Knifefish UUV

TPOC:
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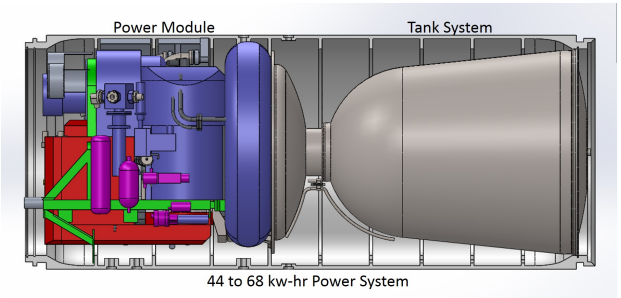
Other transition opportunities:
Small & Large UUVs
Other Surface Mine Countermeasures (SMCM) UUVs
Large Displacement UUV (LDUUV)



Notes:
Above CAD view image depicts API's oxygen source (shown blue) as it fits into the Integrated Power System. Other main elements include hydrogen generator (purple), SOFC Fuel Cell (red), and fuel/reactant tanks (grey).

SYSCOM Oversight: Naval Undersea Warfare Center (NUWC)

Supporting contractors:
- Nexceris LLC - SOFC,
- Advanced Propulsion Inc - Reaction Vessels,
- Applied Design Inc - Test System Controls

WHAT

Operational Need and Improvement: UUV power systems must provide a high level of energy allowing for long term missions. Fuel cells have the potential to meet these power requirements. In air independent operation the most important driver of energy density is the oxygen source. This technology has the potential to SAFELY deliver an oxygen source to UUVs. Without a safe easily handled, power system with a dense oxygen source, fuel cell powered UUVs may not be viable.

Specifications Required:
Gross system power output: 2.5 KW
Envelope: 21 inch hull dia,, 50 inch length
Power system mass: 225 kg
Energy delivery: 42 KWhr
Endurance: 32 hrs

Technology Developed: The power system is built around API's oxygen generator integrated with a solid oxide fuel cell (SOFC) and a hydrogen fuel source. Oxygen is produced from an aqueous chlorate solution by thermal decomposition using SOFC waste heat. The chlorate solution is a safe, stable, room temperature liquid with excellent oxygen storage metrics that are competitive with cryogenic liquid oxygen without its safety and handling concerns The hydrogen fuel is derived from a sodium borohydride solution. The power system can be configured as a fully closed system (lower energy, no effluent) or an open system (higher energy, with effluent)

Warfighter Value: API's air independent power system built around its innovative oxygen source runs on safe room temperature liquid reactants that enable easy refueling of the UUV with minimum shipboard handling equipment.

WHEN

Contract Number: N00014-15-C-0074 **Ending on:** August 1, 2017

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase 1 & Option SBIR	Low	Oxygen generator proof of concept via tests and studies	3	June 2011
Phase 2 Base & Option SBIR	Med	Demonstrated subscale continuous oxygen flow plus integrated power system studies & tests	3/4	October 2014
Subsequent Phase II Base & Option SBIR	Med	Oxygen and fuel cell full scale high fidelity system demonstration plus power system studies	4/5	August 2017
Phase III	Med	Power module packaging & demonstration	6	August 2019
Non SBIR SYSCOM Program	Med	Integrated power system demonstration	7	August 2021

HOW

Projected Business Model: API is currently under contract to perform a high fidelity laboratory demonstration of the full scale oxygen system integrated with an SOFC fuel cell. API is looking to acquire a Phase III partner where this laboratory system is packaged and demonstrated in a simulated environment. Later API would assume a supporting role in the complete integrated power system demonstrator. Final system production would be conducted via technology license or sale.

Company Objectives: Aquire Navy Phase III sponorship and team with a commercial partner interested in the UUV market and interested in purchasing or licensing our technology

Potential Commercial Applications: Fuel cell power systems in air-independent environments: commercial UUV's, scientific UUV's, oil & gas undersea operation support

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