Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-4388-18

Topic # N152-118
Ultra High Density Carbon Nanotube (CNT) Based Flywheel Energy Storage for Shipboard Pulse Load Operation
San Diego Composites, Inc.

WHO

SYSCOM: ONR

Sponsoring Program: Code 33

Transition Target: EM Rail Gun

TPOC:
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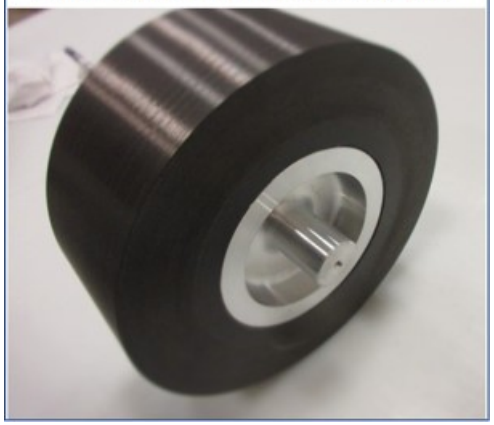
Other transition opportunities:
- Future Navy ships supporting high pulse electrical loads
- Remote construction sites needing power support
- Power grid support for alternative energy (solar, wind, etc.)

Notes: Additional Benefits/Goals:
- TRL/MRL 5 @ 2 Qtr 2019
- TRL 5/MRL 6 @ 2 Qtr 2020

NEFWCF - Nanomaterial Enhanced Filament Wound Composite Flywheel
DOD - Department of Defense
CNT - Carbon Nanotube
FEM - Finite Element Model
INP - Innovative Naval Prototype

Prototype Nanomaterial Enhanced Filament Wound Composite Flywheel



WHAT

Operational Need and Improvement:
The US Navy is looking to develop a composite flywheel energy storage system with improved capacity through CNT material integration for ultra-high density megawatt-scale pulse load power.

SDC's CNT integration manufacturing technique improves the strength of composite flywheel materials by up to 30% to avoid critical failure modes and improve maximum energy storage and power delivery.

Specifications Required:
- Energy storage: 50 MJ
- Power delivery: 5+ MW
- Minimum usage lifetime: 60000 hours, Support >20000 cycles
- Power storage density > 3 MW/m3
- Continuously online charge-discharge of up to 50% duty cycle
- 26" shipboard hatchable design for easy removal or installation of components
- Modular installation and operation capability to multi-MW levels

Technology Developed:
- SDC has designed a NEFWCF rotor that meets all Navy requirements
- Design is scalable for high production rates
- Provides 30% energy storage improvement over current technology

Warfighter Value:
- Improved energy storage/pulse power delivery
- Modular design allows for mission specific configurations
- Easy installation and reconfiguration through hatchable design
- Interference fit design reduces manufacturing cost
- Quick design reconfiguration for new systems through proven and tested FEM

WHEN

Contract Number: N68335-17-C-0135 **Ending on:** April 12, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Preliminary Design Review (PDR)	N/A	Design review with ONR buy off	3	3rd QTR FY18
Initial Test Article Failure Test	N/A	Article performance compared to FEM	4	3rd QTR FY18
Critical Design Review (CDR)	Med	Design review with ONR buy off	4	4th QTR FY18
Prototype Manufacture and Preliminary Testing	High	Successful testing correlated with model	5	2nd QTR FY19
High Acceleration and Cyclical Fatigue Testing	High	Successful testing	6	1st QTR FY20

HOW

Projected Business Model:
- SDC will manufacture NEFWCF composite rotors in our state-of-the-art 70,000 sqft. composite manufacturing production facility
- Production rate is expected to begin at 100 rotors/year for the first year and scale up to 400 rotors/year or market required rate over three years
- SDC will assemble deliverable assemblies at our production facility
- SDC will sell rotor assemblies to the pulse power system prime contractor
- SDC will work with the pulse power system prime to coordinate integration strategies

Company Objectives:
- Integrate ultra-high-speed/acceleration NEFWCF rotor technology into future pulsed power systems

Secondary objective is to identify alternative insertion opportunities including high-speed rotary structures

Potential Commercial Applications:
- Power grid support for alternative power generation (solar, wind, etc.)
- Performance and commercial transport vehicle power and stability
- Construction equipment remote power

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