Topic: N152-118

San Diego Composites, Inc.

Ultra High Density Carbon Nanotube (CNT) Based Flywheel Energy Storage for Shipboard Pulse Load Operation
SDC's Nanomaterial Enhanced Filament Wound Composite Flywheel (NEFWCF) rotors are ultra-high speed/acceleration rotors for high density energy storage and pulse power delivery. NEFWCF rotors use a novel manufacturing method and nanomaterial enhanced properties to provide significant improvement over state-of-the-art. SDC's design is modular and reconfigurable to meet a variety of needs for future Navy ship pulse loads. SDC is an aerospace and defense company that specializes in highly engineered composite structures and subsystems as well hybridized material development. Phase II testing has indicated that the desired performance is feasible, and full-scale prototype design is in progress. The goal is to integrate the NEFWCF rotors for future Navy ship pulse loads and become a supplier of this technology to prime contractors.

Technology Category Alignment:

Energy storage
Manufacturing Technology for Affordability
Power and Energy
Structures and Protection

Contact:
Jeremy Senne
jsenne@sdcomposites.com
(858) 751-0450126
http://www.sdcomposites.com
SYSCOM: ONR
Contract: N68335-17-C-0135

Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-4388-18

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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

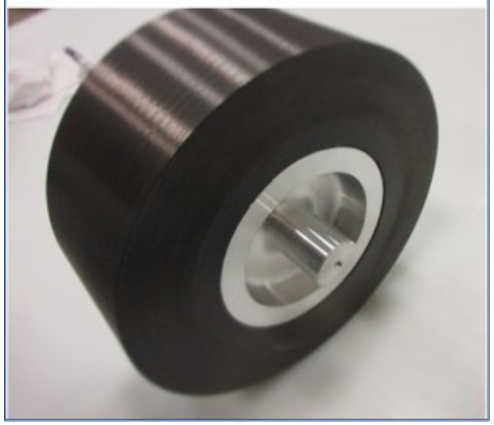
TPOC:
Mr. Donald Hoffman
donald.hoffman@navy.mil

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

Contact: Jeremy Senne, Principal Investigator
jsenne@sdcomposites.com 858-751-0450 x 126