

Topic: N121-095

## PolymerPlus LLC

### Development and Processing of Dielectric Films for Application in Large Wound Capacitors

Railguns, fully electric tanks, electric ships, and airborne pulsed microwave weapons require high energy density, rapid discharge and low loss capacitors. Currently, many fielded-capacitors and railguns utilize metallized biaxially oriented polypropylene (BOPP) film capacitors due to their extremely low loss, stable capacitance, and long life at ambient temperature. However, low energy density and high losses above 85 °C limits are major problems associated with these capacitors. PolymerPlus film based capacitors can eliminate these problems using its high energy density and high temperature films. A two to three times improved energy density and dielectric material stability up to 160°C are demonstrated in PolymerPlus capacitors. Our goal is to fabricate full scale capacitor prototype for pulsed power applications and transition this technology into government and prime contractor energy storage and other relevant systems.

### Technology Category Alignment:

None

None

None

### Contact:

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**SYSCOM:** ONR

**Contract:** N00014-14-C-0096

 Corporate Brochure: [https://navystp.com/vtm/open\\_file?type=brochure&id=N00014-14-C-0096](https://navystp.com/vtm/open_file?type=brochure&id=N00014-14-C-0096)

## Department of the Navy SBIR/STTR Transition Program

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### WHO

**SYSCOM:** ONR

**Sponsoring Program:** ONR Code 33 - Sea Warfare and Weapons

**Transition Target:** Railguns

**TPOC:**

Dr. Paul Armistead

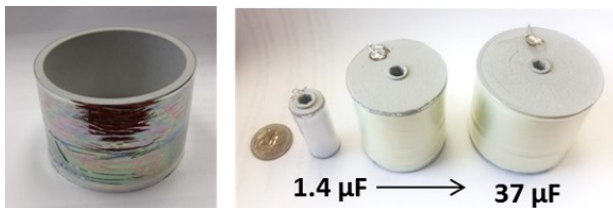
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**Other transition opportunities:**

Pulsed Power Capacitors

Electric Ships

Power Conditioning



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### WHAT

**Operational Need and Improvement:** Develop and process a dielectric film that: has increased energy storage density relative to very thin Biaxially-Oriented PolyPropylene (BOPP); has low dielectric and leakage losses in a wound capacitor; exhibits graceful failure; and retains performance to 125 °C or higher.

**Specifications Required:** 10 joule capacitors with a 1 kHz discharge time, graceful failure, desired temperature performance, and a wound capacitor energy density above 2 J/cc

**Technology Developed:** Multilayer film technology with operational temperature of 160 °C and density of 9 J/cc at film level was demonstrated. 40 µF capacitor prototypes were fabricated and tested at temperatures up to 150 °C.

**Warfighter Value:** Dielectric multilayered films technology enables up to a ½ reduction in capacitor volume by replacing BOPP or Mylar while extending usage temperatures to 160 °C and maintaining similar product price levels.

### WHEN

**Contract Number:** N00014-14-C-0096 **Ending on:** September 30, 2015

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Multilayer film production	Low		TRL 5	November 2012
Material Catalog Development	High		TRL 4	January 2014
Film production scale-up	Med	3000 sq. ft. film rolls	TRL 5	December 2014
Film metallization and prototype fabrication	Med	40 µF prototypes	TRL 6	June 2015

### HOW

**Projected Business Model:** PolymerPlus technology can begin low rate film production on its pilot scale film production line. Currently positioned to fabricate 3000 to 5000 sq. ft samples, PolymerPlus has also identified partners for scaling up film production. It has also identified production equipments necessary for film production scale-up in-house within 6 to 12 months. We will work with commercial capacitor manufacturers to develop capacitor prototypes that meet Navy needs.

**Company Objectives:** The objective of the company is to become a major multilayer dielectric film manufacturer and work with partners to develop metallized films and capacitors.

**Potential Commercial Applications:** \* DC, Pulsed, high frequency AC applications - Examples: DOD railguns, electric ships

\* Vehicles and Electric Vehicles - Examples: DC link, IGBT, power electronics, DC link capacitors for hybrid electric vehicles and inverters for grid-connected photovoltaics.

\* Pulsed power market - Examples: power drilling technology for the oil and gas industry and deep enhanced geothermal power

\* IGBT Power Electronics - Examples: Inverters, Electric vehicles, trains, variable speed refrigerators, lamp ballasts, air-conditioners, alternative Energy power management systems, power supplies, motor controllers

\* Power Factor Correction – Examples: single and three phase power factor correction capacitors

\* Medical Applications –Examples: External defibrillators, ICDs

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