

Topic: N171-060

Lynntech, Inc.

Development of energetic feedstock for COTS additive manufacturing

The Navy utilizes polymer-bound energetic materials for warheads, propellants, and pyrotechnics. Properties like mechanical strength, pot-life, processing, and cure times are either key features or challenging impediments. Advances in additive manufacturing utilizing diverse materials can be leveraged to perform formulation testing and rapid prototyping of unique energetic formulations. This enables potential fast-tracked scale-up processes for the direct manufacture of warheads, propellants, and pyrotechnics. Lynntech has experience developing novel feedstocks for additive manufacturing and working with energetics; we are developing photo-curable and multi-stage cured polymer/binder systems for COTS 3D printer rapid prototyping (print, cure, and testing) of explosive formulations. These unique 3D printable feedstocks can be integrated into development and manufacturing processes utilized by government and prime contractors for testing and production of energetics.

Technology Category Alignment:

Fixed Wing Vehicles (includes UAS)

Ordnance

Propulsion

Propulsion and Extreme Environments

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SYSCOM: NAVSEA

Contract: N68335-19-C-0092

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-19-C-0092

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2019-0589

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WHO

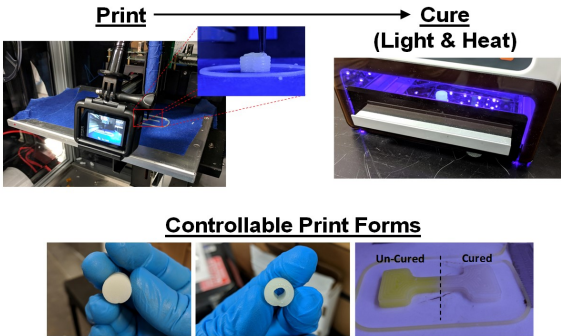
SYSCOM: NAVSEA

Sponsoring Program: Cross Platform Systems Development (CPSD)

Transition Target: Missiles, Rockets, and Customized Munitions

TPOC:
(301)744-4766

Other transition opportunities:
Mortars, bombs, and specialized commercial energetics



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WHAT

Operational Need and Improvement: The US Navy actively utilizes polymer bound energetic materials for warheads, propellants, and pyrotechnic systems. The polymer/binder properties, such as mechanical strength, processing and cure times, as well as pot-life, can be either key features or challenging impediments depending upon the application. Advances in additive manufacturing, which allow for the utilization of diverse materials, are capable of being leveraged to perform formulation testing and rapid prototyping of unique energetic formulations while also enabling the potential for fast-tracked scale-up processes for the direct manufacture of warheads, propellants, and pyrotechnic systems. For modern energetic formulations to be utilized using available and customizable COTS 3D printing systems, new polymer/binder formulations will need to be identified and developed while still meeting the existing criteria for operational testing, safety, and use.

Specifications Required: Usable with existing COTS 3D printing equipment (flowable, extrudable, insensitive to pressure and stirring), fast curing properties (liquid/gel to solid), structural integrity after printing (able to hold form), meet existing safety requirements for energetic materials, meet or exceed current stress/strain and elasticity mechanical properties of current energetic formulations.

Technology Developed: Lynntech's efforts focus on enhancing the properties of polymer/binder materials utilized in energetic mixtures, such as mechanical strength, processing and cure times, as well as pot-life. The goal is to develop photo-curable and multi-stage cured polymer/binder systems capable of being utilized in COTS 3D printer systems for printing of energetic formulations. This technology has the potential to greatly increase the speed of fabrication and testing while lowering the cost and safety risk of energetic formulations development as well as have benefits for manufacturing by leveraging the scale-invariance of 3D printing production.

Warfighter Value: This technology will improve the capabilities of energetics developers and manufacturers by eliminating the need for long-duration thermal curing, reducing waste, improving safety, reducing time required for testing of energetic formulations, enabling fast creation of unique energetic forms, and enhancing manufacturing of novel printed forms by lowering costs and leveraging the scaling potential of 3D printing production.

WHEN

Contract Number: N68335-19-C-0092 Ending on: January 16, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Identify optimal binders for 3D print	Low	Demo 2 binders for >80% solids	3-4	September 2019
identify optimal 3D print methods	Low	Identify COTS hardware & parameters	3-4	January 2020
Optimize formulation chemistry	Med	Demonstrate formulation for multi-stage cure	3-4	August 2020
Enhance binder for latest formulations	Med	Print & cure latest APCP with >88% solids	4	January 2021
Print/Test final energetics	Low	Print, cure, test 2 different energetics	5	January 2022

HOW

Projected Business Model: Lynntech plans to transition this technology to the DoD through prime contractors. Lynntech is currently printing sample energetics with unique, customizable properties for one DoD prime contractor and is negotiating with a second interested party. Lynntech will either sell the formulations and key parameters to them for printing, or will print the required materials for them.

Company Objectives: Lynntech's objective for this project is to develop customizable, printable explosives and energetics that can be light cured. Lynntech Inc, a 2016 Tibbetts Award winner, is a for-profit small business and believes that if the above objectives are met the business opportunity will follow.

Potential Commercial Applications: Customized charges (in shape, burn rate, explosive power) for oil field / mining / and commercial satellite use.