

# Enabling the Advanced Manufacture of Propellants

A2774 — Additive Manufacturing for Propellants

## Objective

The objective of this Energetics Manufacturing Technology Center (EMTC) effort is to enable the advanced manufacture of Navy/U.S. Marine Corps critical, solid propellant grains for use in cartridge actuated devices (CADs) and propulsion systems. Additive manufacturing (AM) is an advanced manufacturing technology that has the potential to produce lower cost propellant grains with little-to-no induced thermal stress/strain during cure. Under this effort, two types of AM technology will be explored for use in propellant manufacturing: material extrusion and vat photo-polymerization. Adaptation of these AM technologies for energetics will enable both composite and single- and double-base forms of propellants to be manufactured using advanced techniques.

## Payoff

AM has become an attractive technology for low-volume production of specialized parts for as-needed applications. AM has flat cost per part vs. production volume curves, and is far less sensitive to changes in product demand. While the year-to-year demand for the manufacture of new CADs containing HES-5808 is difficult to project, an advanced manufacturing technique like AM will provide increased sustainability and lower costs. Additionally, the implementation of an AM process will likely eliminate “cracking” commonly found during traditional grain manufacturing and will enable consistent CAD performance due to the potential for higher precision printed grains.

## Implementation

The initial focus will be on transitioning AM-produced HES-5808 grains into the M91 Impulse Cartridge utilized on the AV-8, F-15, F-16, and B-52 platforms. Upon completion of this project, the final formulation and technical information will be submitted to the CAD technical agent to determine energetic material qualification requirements and testing. Following this, Naval Ordnance Safety and Security Activity approval will be sought to use the AM-produced grain in the end-item application and validated by a design verification test (DVT). A critical design review (CDR) will analyze the results of the DVT prior to beginning the device qualification process. After the CDR, service release testing (SRT) will be conducted. SRT results will be reviewed to ensure all technical requirements are met, and if found acceptable, a Type III service release will be issued to allow manufacturing of the M91 with the AM grain. In order to achieve implementation of the AM-produced HES-5808 grain, the JPO technical agent, Naval Surface Warfare Center Indian Head Division will conduct the AM HES-5808 and M91 Impulse Cartridge qualification.



**PERIOD OF PERFORMANCE:**  
October 2017 to December 2022

**PLATFORM:**  
Energetics / M91 Impulse Cartridge  
utilized on the AV-8, F-5, F-16 and  
T-38

**CENTER OF EXCELLENCE:**  
EMTC

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**STAKEHOLDER:**  
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**TOTAL MANTECH INVESTMENT:**  
\$1,727,000

