Topic: N132-105

Helicon Chemical Company LLC

Temperature-Insensitive Composite Propellants with Tunable Plateau Burning Using In-Situ Energetic Nanoparticles

Helicon specializes in the research and development of nanostructured composites with superior nanoparticle dispersion properties in a variety of host matrices. Helicon is combining patented nanostructured materials and combustion control additives in a composite solid rocket propellant to match the performance of the fielded double base propellants in ejection seat Cartridge/Propellant Actuated Devices (CAD)/(PAD). The currently fielded propellants have thermal stability problems that limit their service life. Helicon will mitigate safety risks in fielded and future ejection seat energetic components, improve reliability, and reduce lifecycle cost. Initial transition target is the NACES ejection seat, with applicability to a range of aircraft seat systems. Propellants have been tested at relevant temperatures, pressures, and aging conditions with a TRL4 anticipated by Phase II completion.

Technology Category Alignment:

Fixed Wing Vehicles (includes UAS)
Manufacturing Technology for Affordability
Weapons Technologies
Ordnance
Propulsion

Contact:
Dr. David Reid
david.reid@heliconchemical.com
(321) 300-6266
http://heliconchemical.com/
SYSCOM: NAVAIR
Contract: N68335-16-C-0032

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.
NAVAIR 2017-763

Topic # N132-105

Temperature-Insensitive Composite Propellants with Tunable Plateau Burning Using In-Situ Energetic Nanoparticles

Helicon Chemical Company LLC

WHO

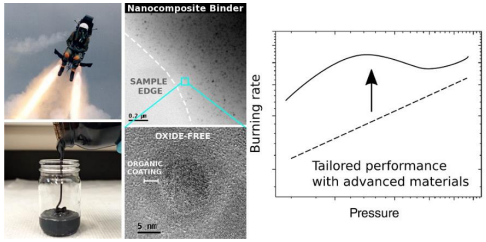
SYSCOM: NAVAIR

Sponsoring Program: PMA 201

Transition Target: WB15 catapult cartridge for the NACES ejection seat, used in F-18 and T-45 aircraft.

TPOC:
(301)744-1520

Other transition opportunities:
The propellants formulated on this Program have applicability across a range of CAD/PAD items and missile systems requiring the replacement of obselete propellants.



Additionally, Helicon is developing multiple energetic systems incorporating its advanced reactive materials. Active programs include an OSD-funded Joint Insensitive Munitions Technology Program (JIMTP) FY16 project on plateau burning high performance propellants, a Navy Phase II SBIR on high performance insensitive solid fuel ramjets, and a collaboration with ARDEC on nano-aluminum based explosives.

Notes:
CAD: Cartridge Actuated Device
PAD: Propellant Actuated Device
IHC: Interim Hazard Classification

WHAT

Operational Need and Improvement:
A double base propellant used in Navy aircraft ejection seats suffers from stabilizer depletion during exposure to high temperature. This issue necessitates periodic replacement of the devices at high cost, to mitigate safety risks. The Navy seeks a thermally stable composite propellant with equivalent performance as a drop-in replacement for the current double base propellant.

Specifications Required:
1. New propellant must provide equivalent performance to the existing propellant
2. Eliminate the thermal stability problem.
3. Consistent performance across operating temperatures from -65 deg F to +200 deg F
4. Nitrate ester free, with no need for stabilizers.

Technology Developed:
1. Standard composite propellants are modified with advanced nanomaterials and additives to match the unique performance requirements of ejection seat systems.
2. Composite propellants are inherently stable, low cost, and manufactured by standard techniques.
3. The enabling technology is a new form of reactive aluminum-polymer nanocomposite, produced by a scalable chemical process, which raises the propellant burning rate and lowers the temperature sensitivity.

Warfighter Value:
1. Longer service life than currently fielded ejection seat propellants
2. Safety improvement by replacement of propellant with thermal stability issue
3. Reduce maintenance requirements and procurement cost
4. Increase aircraft fleet readiness

WHEN

Contract Number: N68335-16-C-0032 **Ending on:** December 1, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Propellant formulation downselect	Med	Ballistic model predicts equivalent performance	3	September 2017
Analog rocket motor tests	Low	Results match small scale test data	4	August 2018
Fully tuned ballistic model developed	Low	Model tuned with motor firing data predicts equivalent performance in end item	4	November 2018
Testing for IHC	Low	DoD IHC obtained to enable shipping of prototypes	4	May 2019

HOW

Projected Business Model:
Helicon will manufacture the advanced materials used in the propellants, and sell to propellant manufacturers. The formulation will be licensed, and materials supplied to an existing propellant manufacturer, who will produce the propellant and sell to the government or the prime contractor for the NACES seat. Helicon is pursuing multiple transition opportunities for its nanocomposites and energetic materials technologies, including missile systems, airbreathing propulsion, and explosives, through leveraging SBIR efforts and other programs. A Navy ManTech project has been proposed. Advanced materials production will be scaled to meet demand.

Company Objectives:
Helicon is situated to be a supplier of advanced materials solutions to the defense and commercial industries. Beginning with energetic materials for weapons systems, Helicon will continue to develop new technologies in partnership with the government and prime contractors. Dual use applications for SBIR funded technology will continue to be identified, and commercialization efforts for multiple product lines will be pursued using a combination of internal and external funding.

Potential Commercial Applications:
Helicon's materials technology has several commercial applications, including:
1. Fuel and propellant for commercial space launch systems
2. Explosives and propellants for oil/gas/mining
3. Thin film technology for electronic systems such as pulsed power, capacitors, and photovoltaics

Contact: Dr. David Reid, President and CEO
david.reid@heliconchemical.com (321)300-6266