April 24, 2024

Tetramer Technologies is seeking university collaborators interested in advancing and commercializing technologies from their labs through the Small Business Innovation Research (SBIR) and Small Technology Transfer Innovation Research (STTR) Department of Defense programs.

To receive updates via email when Tetramer is reviewing future SBIR / STTR opportunities, visit tetramer.com/universities or email info@tetramer.com directly with your information.

SBIR/STTR programs advance high risk, high reward technologies to commercialization by providing funding for entrepreneurship activity. During an SBIR/STTR, a university collaborator can use funds to provide research opportunities for undergraduates, graduates, and post docs. Successful commercialization can result in potential royalty streams for inventors and universities and new jobs for students.

For these programs, university researchers and Tetramer will partner to submit an SBIR or STTR proposal with Tetramer serving as the prime contractor and university collaborators acting as subcontractors and/or consultants. Tetramer has extensive background in contracting and executing these programs and in partnering with universities through the process. At this point, we are identifying university partners with good technical fit from a concept and capabilities perspective.

If you are interested in collaborating with Tetramer on any of the attached topics of interest, please follow the steps below:

- Reach out to the contact listed for the topic of interest no later than **May 10, 2024** to allow adequate time for review.
- Include a **non-proprietary** quad chart of your proposed idea using the template provided.
- Include research capabilities information (i.e. equipment, experience, etc.) and whether there is existing IP which can be licensed.

The Tetramer lead will review all requests and coordinate meetings with researchers. Please reach out with any questions to the individual listed with each topic.

TETRAMER TECHNOLOGIES, LLC
657 S. Mechanic St. | Pendleton, SC 29670 | (864) 646-6282 | Tetramer.com

Tetramer Technologies, LLC

DOD SBIR 24.2 BAA – Tetramer's Topics of Interest

Reach out to the Tetramer PI listed under each title **by May 10, 2024** for collaboration opportunities. Final proposals are due 6/12/2024.

More detailed descriptions are available here:
https://www.dodsbirsttr.mil/submissions/api/public/download?uploadId=MTM3MzQ3MA==&showOnWeb=true&fileName=DOD_SBIR_242_FULL.pdf

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N242-070 Hydrogen Generation Salt-water Electrolysis with Chemical Compression

Tetramer POC: Chris Topping, PhD (chris.topping@tetramer.com)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Materials; Renewable Energy Generation and Storage
OBJECTIVE: Develop a hydrogen generation system that uses salt water to produce one to five kg of hydrogen over a 24-hour period in an austere environment. All components of the system shall be stored, transported, and operated in quad-con ISO containers. The system shall be required to leverage Onboard Vehicle Power (OVP), currently fielded tactical generators, and alternative power sources (e.g., solar or mobile nuclear power generation).
DESCRIPTION: As part of its future force modernization efforts, the Marine Corps seeks to deploy small, disaggregated hydrogen generation units to foreign locations where access to energy sources will be limited or unavailable. These units are to specifically support the U.S. Marine Corps' Expeditionary Advanced Base Operations (EABO), a form of expeditionary warfare that involves the employment of mobile, low-signature, naval expeditionary forces that operate from a series of austere, temporary locations.

N242-082 Selective Stripping of Cadmium and Zinc-Nickel Coatings (MM)

Tetramer POC: Monika Mujkic, PhD (monika.mujkic@tetramer.com)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Materials; Sustainment
OBJECTIVE: Develop a method for selectively stripping cadmium (Cd) and zinc-nickel (Zn-Ni) coatings from small areas (i.e., several square inches/centimeters) on high-strength steel components, without generating dusts that pose an inhalation risk.
DESCRIPTION: Cadmium (Cd) coatings and Zn-Ni coatings are used on many high-strength steel components on aircraft, such as landing gear assemblies on fixed-wing aircraft and the rotor masts of rotary aircraft. These coatings prevent corrosion and protect the integrity of the underlying steel. However, over time as the coating gets damaged or worn, the coating must be removed and repaired. For parts that are overhauled at the depot level (D-level), spent Cd or Zn-Ni coatings can be stripped by immersing the part in a chemical tank. After the coatings are stripped, the underlying metal can be inspected, repaired as necessary, and then recoated with fresh Cd or Zn-Ni coatings. Depot level facilities have chemical processing plants that allow for this type of work to be performed safely.
However, this chemical process is not feasible to perform at intermediate (I-level) or organizational (Olevel) level maintenance facilities. Dozens of I-level and O-level facilities around the world perform touch-up repairs of Cd or Zn-Ni coatings on aircraft components, often to fix localized damage that requires stripping and recoating several square inches (centimeters) of surface area. To remove the old coating when a chemical processing plant is not available, maintainers use methods such as hand sanding, wet sanding, or abrasive blasting to abrade away the Cd or Zn-Ni layer. Unlike with full immersion in a

chemical processing tank, using abrasive methods to remove coatings generate inhalation and exposure risks to the maintainer, as well as to the surrounding environment. Particularly with Cd coatings, Cd is carcinogenic and long-term exposure can increase the risk of various cancers and other health effects. There have also been cases where maintainers use an incorrect abrasive that is too aggressive, inadvertently causing damage to the component they are processing. This results in increased rework costs and delays in returning the component to the fleet.
This SBIR topic seeks a method for stripping Cd and Zn-Ni coatings that generate no inhalation exposure risks for maintainers, eliminates the possibility of Cd dust release into the maintenance hangar or surrounding environment, and a method that is repeatable and easy for maintainers to use with no risk of causing inadvertent damage. An ideal solution should be able to remove both Cd and Zn-Ni coatings, be simple and cost-effective, and be easy to deploy to I-level and O-level maintenance sites around the world. The method must selectively strip Cd and Zn-Ni coatings without damaging other coating types, such as primers and topcoats. The method must also not damage the underlying steel component, such as through corrosion or hydrogen embrittlement.

N242-089 Alternative Fabrication Pathways for Complex Alloys

Tetramer POC: Stephen Hudson, PhD (stephen.hudson@tetramer.com)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Materials; Hypersonics;Sustainment
OBJECTIVE: Develop a solid state processing pathway to fabricate refractory high entropy alloys that avoids partitioning (in multi-phase Alloys) seen in melting/solidification processes.
DESCRIPTION: Refractory high-entropy alloys (RHEAs) are considered a new kind of high-temperature materials with great application prospects due to their excellent mechanical properties and have the potential to replace nickel-based superalloy as the next generation of high-temperature materials for gas turbine and hypersonic applications. Currently, the majority of methods for processing of Cantor (3d transition) HEAs and metallic RHEAs are melt derived. This process can be challenging due to the disparate and extremely high melting points of the constituent metals. Moreover, elemental segregation often occurs during the solidification process, resulting in compositional inhomogeneity. In multi-phase alloys, portioning of elements into different phases occurs. This elemental partitioning promotes diverse properties in the different phases of the alloys such differing passivity properties. This SBIR topic seeks to develop a method for Cantor and RHEA production based on the reduction of a mixture of metal oxides, or a mixture of oxides and metallic powders. Processes utilizing non-flammable gas mixtures would be advantageous. The process could be aimed at obtaining (1) RHEA metallic powders (for subsequent solid-state processing) or (2) RHEA bodies (via additive processing of ceramic powders and subsequent reduction heat-treatment). Examples of target RHEAs compositions include MoNbTaW and HfNbTaTiZr.

N242-094 Anti-Corrosion Coating for Gas Turbine Compressor Components Operating in Marine Environments

Tetramer POC: Stephen Hudson, PhD (stephen.hudson@tetramer.com)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Sustainment
OBJECTIVE: Develop and demonstrate a chemically and mechanically robust coating system or other surface treatment for sustained protection of engine compressor components, such as mating compressor stages, cases, and vane tracks, from corrosion in naval aero engine operation.
DESCRIPTION: In naval aviation, aircraft operate in and around marine atmospheric environments often with high humidity and salt content, which accelerates corrosion degradation of aircraft components. High compressor operation temperatures relative to ambient conditions create a cyclic environment within the engine, in which water can evaporate and cool between flight and ground time cycles, leading to the accumulation of salts and other contaminants. This cyclic environment further accelerates corrosion mechanisms. As a consequence of this cyclic, marine atmospheric environment, multiple components throughout military aircraft propulsion systems require frequent repair and/or replacement due to severe corrosion and pitting, which leads to high maintenance costs, increased engine removals, and reduced aircraft readiness.

The Department of the Navy is seeking the development and/or demonstration of a coating system or other surface treatment for sustained protection of compressor components from corrosion in naval aero engine operation. Such a proposed solution must have the mechanical durability to provide corrosion protection along surfaces in contact and under some loading from other components. Specific components of concern are low-pressure and high-pressure compressor stages and cases and are typically composed of martensitic stainless steels (17-4PH and Jethete M152), titanium (Ti-6Al-4V), and Inconels (IN600, IN718, IN909) [Note: specific alloys will be identified upon project award]. Proposed solutions may constitute either the development of a new solution or a demonstration leveraging an existing solution in naval aviation application.

AF242-0009 Graphene CBRN Overgarment (HL)

Tetramer POC: Heather Lange (heather.lange@tetramer.com)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Emerging Threat Reduction; Mission Readiness & Disaster Preparedness; Nuclear; Sustainment & Logistics; Military Infectious Diseases
The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.
OBJECTIVE: By using Graphene, provide a two-part CBRN Protective overgarment with the first part protecting the wearer from most if not all CBRN agents while reducing the weight and thermal load of the overgarment. The second part will be using Graphene to create ballistic plating up to level III+ while weighing a fraction of what current level III+ plates (roughly between 4-11 pounds). With the reduced weight it would allow the wearer to don more protective pieces to areas such as the arms, legs, and other body parts.
DESCRIPTION: Results of breakthrough times for the Graphene suit against CBRN agents and compare them to the current protective overgarment as well as comparing the results to Level B and Level A Chemical suits used in HAZMAT.
Ballistic test results for the lighter weight level III+ plates showing that the Graphene plates can meet or exceed the standard of current plates.

AF242-D018 Development of Advanced Surface Treatments for Astroquartz Fibers

Tetramer POC: Adam Haldeman (adam.haldeman@tetramer.com)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Materials
The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.
OBJECTIVE: The objective of this project is to develop advanced coupling agents and surface treatments for Astroquartz fibers in order to increase the environmental and thermal durability of various Polymer Matrix Composite systems, which include a range of resin matrices from 350 degree Fahrenheit-curing epoxies to advanced polyimides.
DESCRIPTION: Astroquartz-reinforced Polymer Matrix Composites (PMCs) are widely utilized on aircraft in radome applications due to excellent dielectric properties compared to other variants of glass and carbon fiber reinforcements. Although the mechanical performance requirements for these

applications are not as demanding as other structural PMC components that utilize carbon fiber reinforcement, the environmental and thermal durability can limit their service life and significantly impact maintainability. Recent testing performed on various PMC systems with resin matrices ranging from 350 degree Fahrenheit-curing epoxies to advanced polyimides have exhibited extensive disbonds at the fiber-matrix interface after moisture and thermal conditioning. The objective of this project is to develop advanced coupling agents and surface treatments for Astroquartz fibers in order to increase the environmental and thermal durability of various Polymer Matrix Composite systems of interest. This SBIR should seek to identify key contributing factors for the limited durability in PMC systems of interest, develop optimized surface treatment processes for woven Astroquartz reinforcements, and develop tailored coupling agents that offer increased durability over the current state-of-the-art systems.

SF242-0018 Neon recovery and reliquefication for low temperature characterization of infrared focal plane arrays

Tetramer POC: Bogdan Zdyrko, PhD (bogdan.zdyrko@tetramer.com)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Space Technology
The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.
OBJECTIVE: The primary objective is to develop commercial products that specifically permit infrared detector characterization lab users to recover, purify and reliquefy neon gas, at the small scale (<10 liters per day of liquid neon), back into a cryogenic liquid intended for use in pour fill cryogenic dewars, and, thereby, reducing the burden of acquiring additional liquid neon.
DESCRIPTION: Characterizing infrared focal plane arrays is ideally done with the test part in a pour fill dewar that uses liquid cryogens, rather than a closed-cycle system which potentially contributes noise to the test system and limits ones ability to perform focal plane array characterization at a remote facility such as a radiation source. Liquid neon is a near ideal liquid cryogen for this role. It boils at 27.5 K, which is well below liquid nitrogen and, more specifically, below where typical high performance infrared sensors operate, including long wave infrared detectors. Liquid neon also has over 40 times the refrigerant capacity per unit volume than liquid helium.[1] During a detector characterization, these two properties translate into fewer liquid cryogen transfers into the dewar using liquid neon, leaving more time for characterization. This is an absolutely indispensable advantage in the highly unique circumstance of a remote focal plane array radiation tolerance experiment, where access to the radiation source is strictly limited, rarely available and expensive, and the part must be kept cold for over a week at a time. Unfortunately, due to some unusual circumstances, liquid neon is very expensive and difficult to come by. This is because 70% of the neon produced in the world is used in the growing semiconductor chip manufacturing industry, where argon-flourine-neon excimer pulsed lasers are the workhorse source for deep ultraviolet lithography and the ultra-high purity neon (~99.9999%) used in them must be replenished every two weeks. Additionally, neon production occurs mainly as a byproduct of nitrogen generation via cryogenic distillation of air, a technique that happened to be perfected in the Ukraine where grain production requires large amounts of nitrogen for fertilizer. Given the current difficulties in the Ukraine and its diminished production capacity and the growing use of neon in semiconductor manufacturing, the price of liquid neon has risen to roughly $3000/liter, a 600% increase since 2014. Furthermore, there is currently a single domestic distributor of liquid neon, Linde Corp. However, there is a straightforward path to alleviating some of the hardship associated with the use of liquid neon for characterizing focal plane arrays.
The technology to recover and liquefy certain gases, such as helium, at the small scale (~25 liters per day) has been commercially available for nearly a decade and has had a major impact on research and medical institutions ability to experiment, or run their instruments, at cryogenic temperatures. For example, Quantum Design North America, located in San Diego, CA, already offers a complete line of helium

liquifiers and helium recovery, storage and purification systems, which allows users to recover and liquefy the exhausted helium gas currently being lost from the normal boil off and helium transfers to cryogenic instruments.[2] This technology alleviates the user's dependence on cryogen suppliers and lessens the impact of rising costs and undependable supply, as well as helps preserve a precious natural resource which is vital to scientific research and medical treatment. With some modification, a similar approach can now likely be adopted for the small scale (<10 liters per day) recovery and reliquefication of neon used in scientific research. In fact, reliquefication of exhausted neon gas was already demonstrated at the laboratory scale (~3 liters per day) in the early 1990s, but the technique was never adopted, likely due to cost and availability of liquid neon.[3]

DHA242-003 Hydrogel-based Drug Delivery Product(s) for Traumatic Brain Injury

Tetramer POC: Heather Lange (heather.lange@tetramer.com)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Combat Casualty Care
OBJECTIVE: To develop and validate a biodegradable hydrogel drug delivery system for open-skull fracture or penetrating traumatic brain injury (TBI) designed to seal the wounded environment and facilitate the controlled, continuous release of hemostatic agents to stop intracerebral hemorrhage, antimicrobials to prevent infection, and drugs to prevent brain swelling and herniation.
DESCRIPTION: Traumatic brain injury (TBI) is a significant health issue affecting military service members during both wartime and peacetime. Care for TBI will be particularly challenging for military medics as it will extend over a prolonged period, in far-forward, austere settings. Yet, this prehospital phase of care is vitally important as the first link in the chain to prevent death and to limit secondary injuries for TBI combatants. Currently, no therapeutic intervention is available as neuroprotective treatment for TBI. In the battlefield, supportive measures usually include restoration of blood pressure and tissue oxygenation through resuscitation or control of intracranial hypertension with hypotonic saline. However, all these measures require skilled paramedics and reasonable medical settings, which are often not feasible during combat. Future improvement in combat casualty outcomes depends on closing the gap in prehospital care. One approach is to develop therapeutic products that can be readily available for administrating by a Combat Medic and/or self or buddy-administration to mitigate morbidity and mortality from TBI during prolonged field and enroute care.
Hydrogels are stable, highly malleable, and easily transportable matrixes that can potentially carry multiple therapeutics. They are easy to apply and offer a promising solution for the point-of-injury care for TBI. Moreover, they are ideal for extended release of drugs directly at the site of injury, bypassing the systemic route and thus limiting potential adverse effects (Fernandez-Serra, Gallego, Lozano, & Gonzalez-Nieto, 2020; Ma et al., 2020). The desired end-product would be a combination (biologic + drug) therapy product utilizing an FDA-approved biodegradable hydrogel combined with an FDAapproved drug that has demonstrated significant evidence of therapeutic benefit in the preclinical TBI literature. The product target should be for TBI patients presenting with skull fracture or penetrating wounds to the brain. This system should be designed to seal the wounded environment and facilitate the controlled, continuous release of individual or multiple therapeutics including antimicrobials to prevent infection, antioxidants, and anti-inflammatory drugs to prevent cellular damage, brain swelling, and herniation. The release of the drug(s) should be unidirectional, facilitating drug infusion into the injured tissue while mitigating any seepage into re-sutured skin and/or gauze bandages. A successful awardee will design, develop, and demonstrate the utility of a hydrogel-embedded drug formulation for TBI in preclinical studies.

More detailed descriptions are available here:
https://www.dodsbirsttr.mil/submissions/api/public/download?uploadId=MTM3MzQ3MA==&showOnWeb=true&fileName=DOD_SBIR_242_FULL.pdf