DEFENSE THREAT REDUCTION AGENCY
BROAD AGENCY ANNOUNCEMENT
HDTRA1-14-24-FRCWMD-BAA
Amendment 17
December 2022

Research and Development Directorate (RD)
Enabling Capabilities Department (RD-EC)

Fundamental Research to Counter Weapons of Mass Destruction (C-WMD)

Original Posting Date: March 2015

TABLE OF CONTENTS

SECTION NO. **PAGE NO.**

OVERVIEW INFORMATION 3
1. FUNDING OPPORTUNITY DESCRIPTION 5
2. AWARD INFORMATION 10
3. ELIGIBILITY INFORMATION 12
4. APPLICATION AND SUBMISSION INFORMATION 13
5. APPLICATION REVIEW INFORMATION 30
6. AWARD ADMINISTRATION INFORMATION 32
7. AGENCY CONTACTS 41
8. OTHER INFORMATION 41

ATTACHMENT 1: SPECIFIC TOPICS 43
ATTACHMENT 2: INTELLECTUAL PROPERTY 45

OVERVIEW INFORMATION

Agency Name:

Defense Threat Reduction Agency (DTRA)
Research and Development (RD) Directorate
Enabling Capabilities Department (EC)
8725 John J. Kingman Road, MS 6201
Fort Belvoir, VA 22060-6201

Funding Opportunity Title: Fundamental Research to Counter Weapons of Mass Destruction (FRCWMD) Broad Agency Announcement (BAA)

Announcement Type: This is an amended announcement of this funding opportunity. This BAA is in effect from March 2015 through September 2024. It is anticipated that a majority of the actions funded from this announcement will be in the form of grants; however, other instruments such as contracts, cooperative agreements (CAs) or other transactions agreements (OTAs) may also be awarded from this announcement. Submissions for this BAA may occur in two ways: 1) in response to the published topics detailed in Attachment 1 or 2) to a general thrust area as described in Section 1.5.

In general, all topic-specific and general thrust area submissions require pre-coordination in accordance with the guidelines in Section 1.5 and Section 4.2.1. DTRA reserves the right to waive the pre-coordination requirement for topics on a case-by-case basis; and will state the waiver applies within the individual topic description. If a pre-application white paper is received without prior coordination, DTRA may not review it. From the date of the disposition email the applicant has 63 days to submit the pre-application white paper. If the submission is not feasible within this 63-day window, the abstract must be coordinated again to ensure the interest in the white paper remains.

The evaluation of all submissions will be conducted in two phases. Phase I is for receipt and evaluation of pre-application white papers in direct response to a published topic or by invitation based on the assessment of the idea by the Technical POC. Phase II is for receipt and evaluation of invited proposal applications. Invitation to the Phase II, invited proposal submission, will be based on the evaluation results of the Phase I pre-application white paper.

Funding Opportunity Number: HDTRA1-14-24-FRCWMD-BAA

Catalog of Federal Domestic Assistance (CFDA) Number: 12.351

Dates: This BAA is open continuously from March 2015 through September 2024. Published topics will include instructions on any topic-specific opening and closing dates as well as any topic-specific limitations on award types, dollar values, and eligibility. Submissions to a general thrust area may occur at any time this BAA is in effect. Applicants should take care to note requirements for pre-coordination of an abstract.

ADDITIONAL OVERVIEW CONTENT

Research, educational program, or other effort proposals are sought from accredited degree-granting colleges and universities. Research, educational program, or other effort proposals are also sought from industrial, commercial (including small businesses), and not-for-profit research entities. DTRA strongly encourages and may give preference to pre-application white papers and proposals that demonstrate a significant contribution (significant is defined as a minimum of

30% of total value) by one (1) or more universities.

All submissions (pre-application white papers and invited proposals) must be made in accordance with the submission instructions in this BAA through www.grants.gov using the application packages linked with this BAA (under the "Package" tab) on www.grants.gov. Applicants are responsible for ensuring compliant and final submission of their pre-application white papers and proposal applications. Any submission that does not conform to the requirements outlined in the BAA and in the invitation for proposal may not be reviewed or considered further at the discretion of DTRA.

Pre-application white papers may be evaluated any time after receipt. Invitations for full proposal submission may occur any time after the pre-application white paper evaluation and will be limited to available program funds.

Efforts may be proposed for up to five (5) years. Awards may be for a base period of one (1) year with four (4) additional years as possible options, a base period of two (2) years with three (3) additional years as possible options, or a base period of three (3) years with two (2) additional years as possible options. Applicants should take care to propose the most logical mix of base and option years for the scope of work. Further, the base period should yield a logical completion point for the work. In cases where option years are proposed, decisions regarding exercising those options will be based on the evaluation of the work accomplished in the base period. Pre-application white papers and proposals that outline scope and effort for only the base period and do not propose options are also acceptable; however, the Government reserves the right to invite option years for awards that originally only included a base period.

Grants may range from small dollar value (e.g., $25K) up to $1M annually (total, including both direct and indirect costs) depending on the nature and the scope of work. Payments on grants will be made in advance, subject to the conditions described in 2 CFR 200.305. Funding amounts for contracts, CAs, and other procurement instruments will be considered on a case-by-case basis. Thirty (30)-60 individual awards are anticipated each year.

Any assistance instrument awarded under this announcement will be governed by the award terms and conditions, which conform to DoD's implementation of OMB circulars applicable to financial assistance. This includes DoD implementation of OMB guidance in 2 CFR part 200, "Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards."

1. FUNDING OPPORTUNITY DESCRIPTION

1.1. DTRA safeguards America and its allies from weapons of mass destruction (WMD) and provides capabilities to reduce, eliminate, and counter the threat and effects from chemical, biological, radiological, nuclear, and high yield explosives. DTRA seeks to identify, adopt, and adapt emerging, existing and revolutionary sciences that may demonstrate high payoff potential to Counter-WMD (C-WMD) threats. This BAA is an extramural endeavor that combines the fundamental research, educational program, or other effort needs appropriate for basic or applied research funding of DTRA and other DoD interests.

This announcement solicits ideas and topic-based pre-application white papers for long-term challenges that offer a significant contribution: to the current body of knowledge, to the understanding of phenomena and observable facts, to significantly advance revolutionary technology, to new concepts for technology application, or that may have impact on future C-WMD threat reduction, expertise, or capabilities.

A portion of this effort is expected to be devoted to awards for science, technology, engineering and mathematics education programs with a C-WMD focus; such as, but not limited to postdoctoral fellowships, stipends, degrees, visiting scientist programs, student exchange programs, and development of accredited C-WMD curricula.

1.2. Fundamental research means basic and applied research in science and engineering, the results of which ordinarily are published and shared broadly within the scientific community, as distinguished from proprietary research and from industrial development, design, production, and product utilization, the results of which ordinarily are restricted for proprietary or national security reasons.

Contracted Fundamental Research includes research performed under grants, contracts (awards), or OTAs that are (a) funded by budget Category 6.1 (Basic Research), whether performed by universities or industry or (b) funded by budget Category 6.2 (Applied Research) performed on-campus at a university. Fundamental research provides for science and technology (S&T) research and early applied development. It seeks to lower performance risk to a manageable level and facilitate transition and funding to capability end-state programs.

1.3. Technology Readiness Levels (TRLs) provide a systematic metric/measurement system that supports assessments of the maturity of a particular technology and the consistent comparison of maturity between different types of technology. Fundamental research may be defined within the first four (4) TRLs.

1.4. This BAA seeks optimum approaches to meet DTRA fundamental research objectives. The Government encourages pre-application white papers and proposals that span a wide spectrum of research to expand fundamental scientific knowledge in response to specific topics and to the more general thrust areas. The Government reserves the right to award any combination of approaches which offer the best overall value to the Government and to oversee any and all processes and approaches once ongoing.

1.5. Thrust Areas 1-7 are described below. When a specific set of topics has been identified, these detailed needs will be described in Attachment 1 along with any topic-specific submission instructions, deadlines, anticipated award structure, and funding requirements. Otherwise, pre-application white papers and proposals may be written against one of the general thrust area descriptions.

DTRA may not review any pre-application white papers without prior coordination of the idea with the appropriate thrust area- e-mail address (Section 7). Applicants should note that there is extremely limited funding available for many of the thrust areas; Thrust Areas 1-5 are not currently accepting abstracts for pre-coordination. Pre-application white papers will only be accepted from the coordinated abstracts under limited circumstances.

1.5.1. **Thrust Area 1—*Science of WMD Sensing and Recognition:*** The science of WMD sensing and recognition investigates the fundamental understanding of materials that demonstrate measurable changes when stimulated by radiation or particles from WMD in the environment. This involves the exploration and exploitation of interactions between materials and various electromagnetic phenomena, molecules, nuclear radiation, and particles. Furthermore, these interactions and the specific form of recognition they offer are used for the subsequent generation of information, providing knowledge of the presence, identity, and quantity of material or energy in the environment that may be significant. The goal of this thrust area's portfolio is to advance the following capabilities: location, identification and characterization of radiological-nuclear (RN) materials; detection of RN materials at significant stand-off distances; and the reduction of the technical nuclear forensics timeline. Thrust Area 1 is currently not interested in research focusing on the sensing of explosives or the detection of Improvised Explosive Devices (IEDs). **Thrust Area 1 is NOT currently accepting abstracts for pre-coordination.**

1.5.2. **Thrust Area 2—*Network Sciences:*** The fundamental science of network sciences includes advancing knowledge of complex disparate but interdependent networks critical to military operations where WMD-related robustness, resiliency, recovery of, and informational and operational utility is required. It includes response, resilience, and recovery of interdependent, multi-layered physical networks after exposure from electromagnetic pulse and other nuclear weapons effects, rapid discovery and analyzing low-observable WMD-related information from large, disparate WMD-related data sets from multiple types of networks, and to develop theories and representations for low observable WMD-related radical ideation from social networks. **Thrust Area 2 is NOT currently accepting abstracts for pre-coordination.**

1.5.3. **Thrust Area 3—*Science for Protection:*** Fundamental science for protection involves advancing knowledge in physical, biological, and engineering sciences to protect personnel, sensitive electronic systems, and structural infrastructure from the effects of weapons of mass destruction. Protection includes both passive and active defense against threats. Approaches include advanced highly-ordered materials and nanomaterials to hardening infrastructure and facilities against blast, nuclear events, or other CBRNE effects; exploring new methods to experimentally and computationally simulate the effects of a nuclear event; investigations of the interaction of radiation with sensitive electronics and systems as well as development of novel materials and methods that are robust against radiation effects; novel methods to protect personnel from the physical, radiological, and nuclear effects of WMDs; and the study of biological systems, including intact structures, metabolic products, or discrete components and pathways, as applied to protection of U.S. Forces during operations in areas actually or potentially contaminated by radiation. For protection of personnel the areas of interest include development of radiation countermeasures to prevent biological damage associated with exposure to ionizing radiation and development of novel biologically-based or -produced detection systems for wide area surveillance to determine the nature, extent, and distribution of contamination. **Thrust Area 3 is NOT currently accepting abstracts for pre-coordination.**

1.5.4. **Thrust Area 4—*Science to Defeat WMD:*** Fundamental science for significantly improving energetic materials for use against WMD facilities and systems with minimal collateral effects from post-blast WMD release, for deeper penetration to deny the adversary sanctuary of WMD, and for predictable modeling of counter-WMD munitions and simulation of in-theater scenarios with accurate lethality calculations. **Thrust Area 4 is NOT currently accepting abstracts for pre-coordination.**

1.5.5. **Thrust Area 5—*Science to Secure WMDs:*** Fundamental science to support securing WMD includes: revolutionary means to safely handle, transport, control access, or eliminate WMD components and weapons; new physical or other methods to monitor compliance to support future agreements or treaties; and, exploring phenomena and means that facilitate reduction of nuclear or non-nuclear WMD proliferation pathways. This includes focus on: science principles to assist tagging, tracking, location to secure WMD; novel means to mark and read objects in order to secure inventories; remote or unattended monitoring to understand the nature of objects (e.g., is it nuclear, biological, chemical or conventional?); monitoring to detect intrusion, diversion or substitution, tampering, and other adverse activity; and, understanding of both physical and life science environmental signatures as witnesses of WMD-related activity. The ability to secure WMD may impact either verification of treaties, or control of WMD outside treaty regimes. **Thrust Area 5 is NOT currently accepting abstracts for pre-coordination.**

1.5.6. **Thrust Area 6—*Cooperative Counter WMD Research with Global Partners:*** Cooperative fundamental research to reduce the global threat of WMD in collaboration with a broad range of global research partners. This thrust area involves exploratory basic and applied research that will address opportunities to reduce, eliminate, and counter WMD across the Chemical, Biological, Radiological, Nuclear, and High Explosive (CBRNE) spectrum. Efforts in this area will develop strong international relationships which will foster a smooth transition of program ownership to the partnering country. The goal is to improve international collaboration to detect, characterize, and report WMD, and to advance partner nation sustainment through a culture of long-term cooperation and scientific responsibility for such programs. Multi-disciplinary, multinational research in science, technology, engineering, and mathematics development will be conducted to promote transparency through quality research publications and continual dialogue between scientists/engineers and young researchers.

The Cooperative Biological Engagement Program (CBEP), a component of the DoD Cooperative Threat Reduction (CTR) Program, recognizes the danger to U.S. and global health security posed by the risk of outbreaks of dangerous infectious diseases, whether natural or manmade. Consistent with the national and departmental strategies, CBEP strives to address this risk by promoting best practices in biological safety and security, improving partner country capability to safely and rapidly detect and report dangerous diseases, and establish and enhance international research partnerships that focus on informing the disease surveillance network. The desired end state for CBEP engagements is the development of sustainable partner country capabilities to:

- Employ responsible bio-risk management best practices and principles,
- Conduct a modern and effective disease surveillance mission,
- Independently sustain engagement with, and effectively compete for funding within, the international scientific community,

- Comply with World Health Organization (WHO) International Health Regulations (IHR) and World Organization for Animal Health (OIE)/U.N. Food and Agriculture Organization (FAO) reporting guidelines, and
- Promote the One Health Concept.

The goals and objectives of CBEP international research partnerships are to:

- Goal 1: Support Biosurveillance, Biosafety and Biosecurity (BS&S) Capability Building Efforts
    - Objective 1: Inform and enhance operational biosurveillance strategies and implementation through improved understanding of endemic disease burden and pathogen biology.
    - Objective 2: Institutionalize responsible biorisk management best practices with partner country scientists.
- Goal 2: Engage Partner Country Scientists in Hypothesis-Driven Research
    - Objective 1: Support local, national, and regional priorities for understanding and mitigating human and animal disease risk (e.g., small, focused projects within individual countries linked by broad, integrating projects that include regional partners).
    - Objective 2: Improve international collaborations to survey, detect, characterize, and report disease.
- Goal 3: Promote One Health Initiative
    - Objective 1: Emphasize the nexus of human health, animal health, and the environment, and seek to further understand the mechanisms and factors involved in disease transmission.
    - Objective 2: Advance partner country sustainment of global health security initiatives.
- Goal 4: Foster an International Culture of Responsible and Ethical Conduct in Biological Research
    - Objective 1: Transition to a culture of responsibility and ethical conduct in biological research through thoughtful experimental design and good laboratory practices that result in high-quality data, and active participation in professional societies and the peer-review process.
    - Objective 2: Train partner country researchers to think critically in the pursuit of ethical research and to be competitive in soliciting funding from the international scientific community.

Ultimately, the techniques, procedures, and approaches must be sustainable for the partner country and linked with appropriate training in order to promote global health security, reinforce norms of safe and responsible conduct, obtain timely and accurate insight on current and emerging infectious disease risks, and transform the international dialogue on biological threats.

CBEP research projects are not determined by or limited to specific biological agents, but must be plausibly linked to pathogens of security concern and aimed at measurably supporting threat reduction objectives that:

- Enhance partner country's/region's capability to identify, consolidate, and secure collections of pathogens and diseases of security concern in order to prevent the sale, theft, diversion, or accidental release of such pathogens and diseases.
- Enhance partner country's/region's capability to rapidly and accurately survey, detect, diagnose, and report biological terrorism and outbreaks of pathogens and diseases of security concern in accordance with international reporting requirements.

Region-specific areas of interest are described in CBEP Regional Science Plans. Examples of general CBEP research areas of interest include: Epidemiology (e.g. studies measuring disease prevalence and incidence), Pathogen Biology, Pathogen Characterization, Assay Adaptation and Optimization, Microbial Ecology within a Public Health Context, and Preventative Strategies and Countermeasures. For clarification, medical countermeasure development (i.e., development of diagnostic tools, vaccines, therapeutics) is supported by many other U.S. Government or international agencies and is generally not supported by CBEP; however, research projects may inform medical countermeasure development and support validation and verification testing (e.g., as part of proficiency testing, pilot studies/testing, or exercises, etc.). Additionally, CBEP does ***not*** generally support research with common disease agents such as HIV/AIDS, malaria, and tuberculosis where other U.S. agencies have dedicated missions to do so; however, the program may choose to capitalize on opportunities to leverage research on these diseases to further CBEP goals, for example by testing samples collected under the auspices of other programs. CBEP also **will not** support research which poses risks to the overall threat reduction mission of CBEP, Dual-Use Research of Concern, or related activities (i.e., *in vivo* pathogenicity studies, virulence studies, animal passaging, etc.).

CBEP is interested in collaborative research engagements with foreign partners in any one of the following regions: Countries of the Former Soviet Union (FSU) (specifically, Armenia, Azerbaijan, Georgia, Kazakhstan, and Ukraine), Africa (including, but not limited to, Kenya, Tanzania Uganda, South Africa), Southeast Asia (including, but not limited to, Cambodia, Indonesia, Laos, Malaysia, Philippines, Thailand), and Middle Eastern /South Asian countries (including, but not limited to, Afghanistan, Iraq, India and Pakistan). CBEP encourages proposers to develop projects in conjunction with foreign institutions in CBEP-engaged countries.

1.5.7. **Thrust Area 7—*Fundamental Science for Chemical and Biological Defense:*** Fundamental science for chemical and biological (CB) defense includes science and technology research that advances knowledge in physical and life sciences to defend and counter chemical and biological WMD that could be used against our Nation's warfighters. Fundamental research efforts enable capabilities such as development of improved detection devices for traditional and nontraditional chemical agents; development of diagnostics for existing and emerging infectious disease threats; increasing knowledge and improved capabilities for development of new or improved medical and material countermeasures to CB threats for both pre- and post-exposure scenarios; enhanced personal protection against, modeling of, prevention of, or decontamination of CB threats; and providing effective elimination strategies via non-kinetic approaches for threat agent destruction, neutralization and/or sequestration.

1.6. This BAA, in addition to any amendments issued in conjunction with this BAA, will be posted to the Grant Opportunities Website (https://www.grants.gov), the System for Award Management website (https://sam.gov/), and the DTRA website (https://www.dtra.mil). The

DTRA website is not the official sites; applicants are responsible for monitoring both sam.gov and www.grants.gov. Posted amendments supersede all previous versions of the BAA. Note that topics will be listed in Attachment 1 and will be added/closed with Amendments to this BAA.

1.7. All coordination and communication between applicants and the Government will be conducted using the e-mail address associated with this BAA, specified in Section 7. Applicants should include both the administrative email and the relevant thrust area email address. DTRA will not release employee personal contact information.

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2. AWARD INFORMATION

2.1. Award Types. The full range of flexible procurement instruments available to DTRA are possible results from this announcement, including but not limited to contracts, grants, CAs, and OTAs; however, grants will likely be the predominant procurement instrument. Each of the applicable procurement instruments offer different advantages, liabilities and responsibilities for applicants and the Government.

Applicants must specify in their submittal their recommended approach (e.g. contract, grant, CA, or OTA); however, the Government reserves the right to negotiate and award the types of procurement instruments determined most appropriate under the circumstances. If warranted, portions of resulting awards may be segregated into pre-priced options.

Except for OTAs, the Government actions under this BAA shall adhere to the requirements of the Federal Acquisition Regulation (FAR), Defense Federal Acquisition Regulation Supplement (DFARS) and/or DoD Grant and Agreement Regulations (DoDGARS), as appropriate for the type of instrument. DoDGARs can be accessed online at http://www.ecfr.gov/cgi-bin/text-idx?SID=e5d686f6760f3274b3368f36723fbb7e&mc=true&tpl=/ecfrbrowse/Title32/32CIsubchapC.tpl . See also 32 Code of Federal Regulations (CFR) 22, which can be accessed online at http://www.ecfr.gov/cgi-bin/text-idx?rgn=div5;node=32%3A1.1.1.3.16 . Any assistance instrument awarded under this announcement will be governed by the award terms and conditions, which conform to DoD's implementation of OMB circulars applicable to financial assistance.

On average, DTRA expects to award 30-60 individual awards each year. The predominance of awards will be grants. Payments on grants will be made in advance, subject to the conditions described in 2 CFR 200.305.

2.2. Scope of Awards. Awards may range from focused, exploratory projects with a high risk approach in innovative research in subjects with potential for high impact to C-WMD science to comprehensive programs of innovative research in an interdisciplinary area with potential for high impact.

Awards may have multiple Co-Principal Investigators (Co-PIs) and subawards. Authors of pre-application white papers and proposals should detail the contribution of all Co-PIs and any subawards to the C-WMD scientific impact.

Preference will be given to projects where undergraduate and/or graduate students, and/or postgraduate students are supported by the awards. Details regarding the participation of the students and the value of the research to the students as part of the pre-application white paper

and full proposal are expected. Additional guidance regarding student and/or postgraduate student participation may be provided in the published topics or in communications with the applicant to include the coordination of the abstract or in the debrief summary of the pre-application white paper. Any specific guidance provided in a topic or to an applicant supersedes the information provided herein.

2.3. Subawards. Subawards (subgrants and/or subcontracts) are permitted. Subawards may be used to carry out a portion of the research or efforts. Awards may have multiple subawards. Awards will be made by a single award, e.g., grant or contract, to the lead organization. All subawards are the responsibility of the award recipient; exceptions will not be made.

For submissions made to Thrust Area 6 and associated topics, there is no limitation on subawards. DTRA will review and consider the proposed subawards for all pre-application white papers and proposals on a case-by-case basis. The prime awardee will be responsible for transferring funds to the subawardee. Applicants are reminded that priority is given to projects with the main locus of activity in the region-of-interest, so budgets should be allocated accordingly. Preference will be given to proposals where the subaward component to the region-of-interest partner(s) represents more than half of the award value (as measured in U.S. dollars).

2.4. Award Values. Grants resulting from submissions to Thrust Areas 1-7, including topics associated with these thrust areas, may range from small dollar value (e.g., $25K) up to $1M annually (total, including both direct and indirect costs) depending on the nature and the scope of work. Contracts, CAs, and OTAs will be considered on a case-by-case basis. All awards are subject to the availability of funds. Additional guidance regarding award values may be provided in the published topics or in communications with the applicant to include the coordination of the abstract or in the debrief summary of the pre-application white paper. Any specific guidance provided in a topic or to an applicant supersedes the information provided herein. Funding for participation in this program is highly competitive and the cost of proposed research should strictly be maintained as detailed herein or as indicated in the invitation instructions.

2.5. Period of Performance and Award Structure. Efforts for Thrust Areas 1-7, including topics associated with these thrust areas, may be proposed for up to five (5) years. Awards may be for a base period of one (1) year with four (4) additional years as possible options, a base period of two (2) years with three (3) additional years as possible options, or a base period of three (3) years with two (2) additional years as possible options. Additional guidance regarding award structure may be provided in the published topics or in communications with the applicant to include the coordination of the abstract or in the debrief summary of the pre-application white paper. Any specific guidance provided in a topic or to an applicant supersedes the information provided herein.

Applicants should take care to propose the most logical mix of base and option years for the scope of work. Further, the base period should yield a logical completion point for the work. In cases where option years are proposed, decisions regarding exercising those options will be based on the evaluation of the work accomplished in the base period.

DTRA is flexible on the award structure unless otherwise specified in the published topics or in communications with the applicant to include the coordination of the abstract or in the debrief summary of the pre-application white paper. Applicants should take care to clearly label the tasks and anticipated outcomes for the base and option years in the pre-application white papers

and the proposals. Pre-application white papers and proposals that outline scope and effort for only the base period and do not propose options are also acceptable; however, the Government reserves the right to invite option years for awards that were originally awarded with only a base period.

2.6. The Government Accountability Office, in its report GAO-16-14, WOMEN IN STEM RESEARCH: Better Data and Information Sharing Could Improve Oversight of Federal Grant-making and Title IX Compliance, December 3, 2015, recommended that the DoD collect certain demographic and career information to be able to assess the success rates of women who are proposed for key roles in applications in science, technology, engineering, or mathematics disciplines. To enable this assessment, DTRA will include with each Phase II application package the Research and Related Senior/Key Person Profile (Expanded) form and the Research and Related Personal Data form.

2.7. The Government does not anticipate the need to provide any hardware or software to execute the proposed research. However, DTRA will review and consider any hardware/software requests for all pre-application white papers and proposals on a case-by-case basis.

2.8. The Government reserves the right to fund all, some, or none of the proposals submitted; may elect to fund only part of any or all proposals; and may incrementally fund any or all awards under this BAA. The Government also reserves the right to request applicants make any changes necessary to submitted full proposals to increase the feasibility of making the proposal fundable. Applicants may decline to participate in any revisions to application packages requested by DTRA.

2.9. The Government may offer funding for any full proposals or portions of proposals at any time during the lifetime of this BAA.

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3. ELIGIBILITY INFORMATION

3.1. Pre-application white papers and proposals submitted for this BAA will be considered from the following U.S. and Foreign Institutions as follows:

- Accredited degree-granting colleges, universities, and academic institutions.
- Industrial and commercial entities, including small businesses.
- Not-for-profit entities with a portfolio predominantly in research and foreign government laboratories. Proof of 501(c)(3) status from the Internal Revenue Service may be required. For foreign-based establishments entirely based outside the U.S. and/or its territories, proof of not-for-profit status may be required. Foreign based government laboratory equivalents include those residing in the Ministry of Defense, Ministry of Health, Ministry of Agriculture, Ministry of Education and Science and Food Safety Agencies.

DTRA strongly encourages and may give preference to pre-application white papers and proposals that demonstrate a significant contribution (significant is defined as a minimum of 30% of total value) by one (1) or more universities. Applicants should note that university participation may be mandatory for some published topics. Additional guidance regarding university participation may be provided in the published topics or in communications with the

applicant to include the coordination of the abstract or in the debrief summary of the pre-application white paper. Any specific guidance provided in a topic or to an applicant supersedes the information provided herein.

The following entities may not participate as prime awardees nor furnish Principal Investigators (PIs) in awards made under this BAA but may act as collaborators, including as Co-PIs, and/or subawardees:

- Federal Academic organizations (e.g., Naval Postgraduate School).
- Federal laboratories (including DoD and Department of Energy (DOE)).
- U.S. Government agencies.
- DoD-sponsored Federally Funded Research and Development Centers (FFRDCs) specified in the Defense Federal Acquisition Regulation Supplement (DFARS) 235.017-1 (http://farsite.hill.af.mil/VFDFARA.HTM) and click on 'DFARS Part 35'.
- DOE-sponsored FFRDCs.

Note: Federal laboratories (including DoD and DOE) and FFRDCs are eligible to submit abstracts (when required), pre-application white papers, and proposals in response to the Government Call (HDTRA1-16-24-FRCWMD-Call). However, a FFRDC (other than the DoD FFRDCs specified in DFARS 235.017-1) must have authorization from its sponsoring agency in accordance with FAR 35.017-1. Eligibility requirements under the Call are subject to change. See http://www.dtrasubmission.net and after logging in, follow the link to the 'FY16-24 Fundamental Research to Counter Weapons of Mass Destruction (C-WMD) Government Call'.

3.2. Cost Sharing or Matching. In general, cost sharing or matching is not required for applications to this announcement. However, DTRA reserves the right to require cost sharing or matching on a case-by-case basis. Such instances will be specifically detailed in the published topics or in communications with the applicant to include the coordination of the abstract or in the debrief summary of the pre-application white paper.

3.3. Other. DTRA uses the System for Award Management (SAM) to exclude recipients ineligible to receive Federal awards. SAM can be accessed online at http://sam.gov (Reference 2 CFR 1125).

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4. APPLICATION AND SUBMISSION INFORMATION

4.1. Address to Request Application Package. This announcement contains all information required to submit a pre-application white paper and invited proposal.

4.1.1. The required application packages for the pre-application white papers and for the invited proposals are posted with this announcement. Note that each thrust area (as outlined in Section 1.6) and each topic (as outlined in Attachment 1) has a unique application package posted with this BAA. The application package corresponding to both: a.) the thrust area or topic of interest and b.) the phase, should be used for submission of pre-application white papers and invited full proposals.

4.1.2. The application packages posted to www.grants.gov consist of the forms as detailed in

Table 2.

Form Name	Phase I Pre-Application White Paper	Phase II Invited Proposal
SF-424 (R&R) Application for Federal Assistance Form	Required	Required
RR Budget Form	N/A	Required
R&R Subaward Budget Attachment(s) Form(s)	N/A	If Applicable
Research & Related Senior/Key Person Profile Form (Expanded)	N/A	Required
RR Personal Data	N/A	Required
Research & Related Other Project Information	N/A	Required
Disclosure of Lobbying Activities (SF-LLL)	N/A	If Applicable
Attachments Form	N/A	Required

Table 2: Forms. The instructions for completing each of these forms may be found online at the following web link: http://www.grants.gov/web/grants/form-instructions.html.

4.2. Content and Form of Application Submission. Submissions for this BAA will be conducted in two phases. Phase I is for receipt of pre-application white papers. Phase II is for receipt of invited proposal applications. Invitation to the Phase II proposal submission will be based on the evaluation results of the Phase I pre-application white paper.

4.2.1. The predominance of efforts, including all submissions to the thrust areas and some submissions to topics posted in Attachment 1, as noted within the topic, **must be** coordinated with the relevant technical point of contact (POC) for the appropriate thrust area prior to submission of a pre-application white paper; an e-mail for the DTRA technical POCs for Thrust Areas 1-7 are provided in Section 7. Applicants should note that Thrust Areas 1-5 are not currently accepting abstracts for pre-coordination. Coordination of research ideas and efforts must be accomplished via these email addresses, except in cases where a topic specifically states that pre-coordination is not required, and includes submission of an abstract (recommend less than 250 words) of the proposed project/effort or a paragraph description of the proposed project/effort to the email address in Section 7 and a reply email from the relevant email address in Section 7 with the disposition to the applicant. Pre-coordination may not be accomplished with email addresses other than those listed in Section 7. DTRA will not review white papers without prior coordination. Please note that attachments to e-mails may not be reviewed.

Applicants should note that there is extremely limited funding available for the general thrust areas. Pre-application white papers will only be accepted from the coordinated abstracts under very limited circumstances.

Topics may be posted in Attachment 1 of this announcement that may not require pre-coordination of an abstract. Please review the topics carefully.

4.2.2. Pre-application white papers and invited proposals **must be** submitted electronically

using www.grants.gov and the corresponding application packages linked with this BAA on www.grants.gov (under the "Packages" tab). All applications, including all supporting documents, must be submitted in the English language.

Applicants are responsible for ensuring compliant and final submission of their Phase I pre-application white paper and Phase II invited proposal application. Note that this also applies to applicants using third party systems to submit application packages and attachments. Any submission that does not conform to the requirements outlined in the BAA and in the invitation for proposal may not be reviewed or considered further at the discretion of DTRA.

4.2.3. DTRA will not review any of the following:

- Pre-application white papers that are not pre-coordinated as required
- Pre-application white papers and proposals that are not submitted in the English language.
- Pre-application white papers that are submitted to topics that have been previously closed via an amendment to the BAA.
- Application packages and proposals for Phase II submissions that were not invited.

Exceptions WILL NOT be made under any circumstances.

4.2.4. Phase I Pre-Application White Paper Submission and Content. Each pre-application white paper must address only one thrust area or topic. Each pre-application white paper must use the corresponding thrust area or topic application package.

Each Phase I application package contains the following forms:

Form	Attachment	Action
SF-424 (R&R) Application for Federal Assistance Form	Up to four (4) page white paper	Enter the appropriate information in data fields

Table 3: Phase I Pre-Application White Paper Package Chart.

Each Phase I application package contains the SF 424 (R&R) Application for Federal Assistance. To be considered a complete package, an up to four (4) page white paper is required to be uploaded as an attachment to the SF 424 (R&R).

DTRA-specific instructions for completing the SF 424 (R&R) Application for Federal Assistance are below, general application instructions can be found on www.grants.gov:

- Block 1 – Type of Submission. Applicants should indicate the Phase I submission is a "Pre-Application."
- Block 2.1 – Applicant Identifier. Not applicable.
- Block 3 – Date Received by State. Not applicable.
- Block 3.1 – State Application Identifier. Not applicable.
- Block 5 – Applicant Information. You must provide a Business Office Point of Contact (BPOC) with an e-mail address.
- Block 19 – Authorized Representative. The "signature of AOR" is not an actual signature and is automatically completed upon submission of the electronic application package. Hard copies or email attachments of applications will not be accepted.

- Block 20 – Pre-application. Must be used to attach an up to four (4) page white paper. The white paper itself should provide sufficient information on the research being proposed (e.g., the hypothesis, theories, concepts, approaches, data measurements and analysis, etc.) to allow for an assessment by a technical expert.

Any pages submitted for the white paper that exceed the limit of four pages will not be read or evaluated. A page is defined as 8 ½ x 11 inches, single-spaced, with one-inch margins in type not smaller than 12 point Times New Roman font. The white paper must be provided in portrait layout.

At minimum, the white paper should address the following:

- A project abstract, which should be concise (less than 250 words), provide a summary of the proposed work, and demonstrate relevance to the topic being addressed. The abstract should not contain any proprietary data or markings.
- Potential scientific impact to provide greater knowledge or understanding of the fundamental aspects of phenomena and of observable facts, including how the research contributes to the C-WMD science needs outlined in the thrust area or topic.
- The impact of the research on C-WMD science must be clearly delineated.
- Cost estimate by year and total dollars required to accomplish the research as presented in the white paper (no details or breakout of costs is required).
- Potential team and management plan, including details on student involvement.
- Multidisciplinary white papers should carefully detail each of the institutions/departments involved and the contribution that will be made by each of the investigators.
- Do NOT include corporate or personnel qualifications, past experience, or any supplemental information with the white paper. References may be included within the 4-page limit at the discretion of the applicant; however, extensive references are not required.
- Thrust Area 6 pre-application white papers must also include a description of the extent and duration of the relationship/collaboration between the universities/institutes/entities and/or scientists.
- The thrust area or the topic should be included as a header on the white paper attachment and referenced in the text of the white paper.

4.2.5. Phase I Pre-Application White Paper Re-Submission and Content. On a limited basis a second pre-application white paper may be submitted without pre-coordination of an abstract. These re-submissions will be based on the review of the original pre-application white paper and will be allowed when changes to the project scope, technical approach, and/or cost are envisioned for any potential full proposals. Revised pre-application white papers must conform to the standards for the pre-application white papers detailed in Section 4.2.4.

All submissions should be made with the appropriate Phase I application package which contains the following form:

Form	Attachment	Action
SF-424 (R&R) Application for Federal Assistance Form	Up to four (4) page white paper	Enter the appropriate information in data fields

Table 4: Phase I Pre-Application White Paper Package Chart.

Each Phase I application package contains the SF 424 (R&R) Application for Federal Assistance. To be considered a complete package, an up to four (4) page white paper is required to be uploaded as an attachment to the SF 424 (R&R).

The DTRA-specific instructions for completing the SF 424 (R&R) Application for Federal Assistance are the same as for the original pre-application white paper submission except for the following:

- Block 1 – Type of Submission. Applicants should indicate the Phase I re-submission is a "Changed/Corrected Application."
- Block 4c – Previous Grants.gov Tracking ID. Enter the Phase I Grant ID for the original submission.

At minimum, the revised white paper should address the issues and questions detailed in the debrief summary.

4.2.6. Phase II - Invited Proposal Submission and Content. Each proposal must address only the thrust area or topic for which it was invited. The application package corresponding to the thrust area or topic of interest should be used for submission of invited full proposals.

Each Phase II application package contains the following forms and attachments:

Form	Attachment	Action
SF-424 (R&R) Application for Federal Assistance Form	*N/A*	Enter the appropriate information in data fields
RR Budget Form	Budget Justification for entire performance period	Attach to Section K in budget period one
RR Sub-award Budget Attachment(s) Form (*if applicable*)	Individual sub-award budgets	Attach a separate budget with justification for each sub-award
Research & Related Senior/Key Person Profile Form	PI Biographical Sketch	Attach to Biographical Sketch field
	PI Current/Pending Support	Attach to Current & Pending Support field
	Key Personnel Biographical Sketches	Attach to Biographical Sketch field for each senior/key person
	Key Personnel Current/Pending Support	Attach to Current & Pending Support field for each senior/key person
RR Personal Data Form	*N/A*	Enter the appropriate information in data fields
Research & Related Other Project Information Form	Publically Releasable Proposal Summary/ Abstract	Attach to Block 7 Project Summary/ Abstract

	Project Narrative/Technical Proposal	Attach to Block 8 Project Narrative
Disclosure of Lobbying Activities (SF-LLL) *(if applicable)*	*N/A*	Enter the appropriate information
Attachments Form	Attachment 1 – SOW	Upload as Attachment 1
	Attachment 2 – Quad Chart	Upload as Attachment 2
	Attachment 3 – Supporting Documentation (Thrust Area 6 submissions only)	Upload as Attachment 3

Table 5: Phase II Proposal Package Forms and Attachments.

DTRA reserves the right to consider incomplete application packages and required attachments and to request any missing information via email. Should the applicant fail to provide all the requested information either as part of the www.grants.gov submission or in response to email requests from DTRA, at their discretion, DTRA may not consider the proposal further.

SF 424 (R&R) Application for Federal Assistance: DTRA-specific instructions for completing the SF 424 (R&R) are below. General application instructions can be found on www.grants.gov:

Block 1 – Type of Submission. Applicants should indicate the Phase II submission is an "Application."

Block 2.1 – Applicant Identifier. Not applicable.

Block 3 – Date Received by State. Not applicable.

Block 3.1 – State Application Identifier. Not applicable.

Block 4b – Agency Routing Identifier. Enter the corresponding Phase I Grant ID. If resubmissions were involved, enter the Grant ID for the last submission.

Block 5 – Applicant Information. You must provide a Business Office Point of Contact (BPOC) with an e-mail address.

Block 17 – Regarding Disclosure of Funding Sources. By checking "I Agree" you agree to abide by the following statement: "By signing this application, I certify the proposing entity is in compliance with Section 223(a) of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 which requires that: (a) the PI and other key personnel certify that the current and pending support provided on the proposal is current, accurate and complete; (B) agree to update such disclosure at the request of the agency prior to the award of support and at any subsequent time the agency determines appropriate during the term of the award; and (c) the PI and other key personnel have been made aware of the requirements under Section 223(a)(1) of this Act. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. code, Title 18, Section 1001)."

Block 19 – Authorized Representative. The "signature of AOR" is not an actual signature and is automatically completed upon submission of the electronic application package.

RR Budget Form: The Research and Related Budget Form provided as part of the application package for the Phase II submission should be filled out in its entirety for each project year proposed. Applicants are responsible for ensuring appropriate, approved rates are used in their budget forms. When notified of selection applicants will be requested to provide their current

rate agreement and the rate agreement of their subcontractor(s), if applicable. Applicants should note that in accordance with 32 CFR 22.205(b), grants shall not provide for the payment of fee or profit to the recipient. Applicants should also carefully review Section 4.5.4 to appropriately evaluate inclusion of Value Added Tax (VAT) or other taxes for assistance awards.

Applicants should plan and budget for travel to accommodate the two meetings outlined below:

- National Conferences/Workshops/Symposia: Applicants are strongly encouraged to attend a nationally recognized conference, workshop, or symposium in the field of research each calendar year (1 at minimum). Research should be presented as soon as adequate data are available to support posters and presentations. Conferences/workshops/symposia should be attended by the PI and students supporting the research, as appropriate.
- Annual Technical Review: Applicants should plan to attend an annual technical program review meeting. For planning purposes the review will be for five days and will be held in Northern Virginia.

Budget Justification: Applicants are required to submit a budget justification. The budget justification should be prepared as outlined in the instructions for the Research and Related Budget and uploaded as an attachment to Section K "Budget Justification" of the Research and Related Budget Form. The budget justification does not have a page limit, but should include sufficiently detailed information for meaningful evaluation. In addition, the budget justification must specifically address subaward costs and type to include the portion of work to be subawarded with a supporting rationale. The budget justification should include a discussion of how the subawardee(s) cost was determined to be fair and reasonable. The budget justification must specifically address VAT and other taxes in accordance with Section 4.5.4.

RR Subaward Budget Attachment(s) Form (if applicable): Detailed cost estimates are required for each proposed subaward. The cost estimate for the subawards should include sufficiently detailed information for meaningful evaluation, including labor rates and indirect cost rates.

Research and Related Senior/Key Person Profile Form (Expanded): The Research and Related Senior/Key Person Profile Form (Expanded) should be completed in its entirety for each of the PIs and Co-PIs on the project. The inclusion of additional personnel is at the discretion of the PI. The Degree Type and Degree Year fields will be used by DoD as the source for career information to assess the success rates of women. In addition to the required fields on the form, applicants should complete these two fields for all individuals that are identified as senior or key persons. For Thrust Area 6 submissions, the PI (and Co-PIs) in the region-of-interest should be included as key personnel.

A biographical sketch is required for each PI and Co-PI on the project. DTRA does not have a preference for the format of the biographical sketch; however, it should be limited to 1 page per person. The biographical sketch should be uploaded as an attachment to the corresponding field on the Research and Related Senior/Key Person Profile Form.

Additionally, a statement of current and pending support must be provided for each of the key personnel (e.g., PI and Co-PI) on the project. This statement must include the following items and requires disclosure of all grants and contracts through which each of the key personnel is currently receiving or may potentially receive financial support:

- A list of all current projects the individual is working on, in addition to any future support the

individual has applied to receive, regardless of the source.

- Title and objectives of the other research projects.
- The percentage per year to be devoted to the other projects.
- The total amount of support the individual is receiving in connection to each of the other research projects or will receive if other proposals are awarded.
- Name and address of the agencies and/or other parties supporting the other research projects.
- Period of performance for the other research projects.

Applicants should note that in accordance with the instructions for completion of the SF 424, checking of Block 17 is required. Further, applicants should note that by checking block 17 and submitting an application package, you agree to abide by the following statement: "By signing this application, I certify the proposing entity is in compliance with Section 223(a) of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 which requires that: (a) the PI and other key personnel certify that the current and pending support provided on the proposal is current, accurate and complete; (B) agree to update such disclosure at the request of the agency prior to the award of support and at any subsequent time the agency determines appropriate during the term of the award; and (c) the PI and other key personnel have been made aware of the requirements under Section 223(a)(1) of this Act. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. code, Title 18, Section 1001)."

RR Personal Data Form: This form will be used by DoD as the source of demographic information, such as gender, race, ethnicity, and disability information for the PI and Co-PI(s). Each application must include this form with the name fields of the PI and any Co-PI(s) completed; however, provision of the demographic information in the form is voluntary. The demographic information, if provided, will be used for statistical purposes only and will not be made available to merit reviewers. Applicants who do not wish to provide some or all of the information should check or select the "Do not wish to provide" option.

Research and Related Other Project Information Form:

Block 7 – Project Summary/Abstract. To fulfill the requirements of Section 8123 of the Defense Appropriations Act, which states: "The Secretary of Defense shall post grant awards on a public Web site in a searchable format," DTRA will collect and post via the Defense Technical Information Center (DTIC) basic information about all awards made under this BAA. The information posted will include the abstract submitted to Block 7 of this form.

The uploaded project abstract should be less than one page and provide a summary of the proposed work and demonstrate relevance to the topic being addressed. Most importantly, the abstract **must be** written such that the general public may easily understand the potential scientific contribution and the impact of the research. The header of this uploaded document must contain the following statement:

> *"This publically releasable abstract is provided to DTRA for use in fulfillment of Section 8123 of the Defense Appropriations Act and future versions of the same."*

The abstract absolutely must not contain any proprietary data or markings.

Block 8 – Project Narrative (Technical Proposal). The uploaded technical proposal must not exceed 20 pages (including references). If the proposal exceeds 20 pages, only the first 20 pages will be reviewed. A page is defined as 8 ½ x 11 inches, single-spaced, with one-inch margins in type not smaller than 12 point Times New Roman font. The technical proposal must be provided in portrait layout.

The project narrative (technical proposal) must include the following components:

- ***Abstract.*** Should be a technical project abstract that is distinct from the Project Summary/Abstract that is attached to Block 7.
- ***Scope.***
- ***Objective.*** A clear and concise objective of the proposed project.
- ***Background.*** Provide the necessary technical and scientific background to support the scientific and/or technical merit of the proposed project.
- ***Programmatics.*** Describe your organization's management plan for the proposed project; list supporting and collaborating centers, and the roles/responsibilities of each identified academic and/or industrial subcontractor supporting the project. Authors of multidisciplinary proposals must take great care to clearly outline the impact to C-WMD science that is to be gained from the investment and justify the scientific contribution from each investigator.

  Thrust Area 6 narratives must also describe of the extent and duration of the relationship/collaboration between the universities/institutes/entities and/or scientists. Teams with pre-existing collaborative research relationships and those which propose to establish new collaborations will be considered, provided teams can supply documentation to demonstrate that an operational framework exists to support the proposed work. Please see Attachment 3 below for information on the submission of this documentation.
- ***Relevance.*** Describe the relevance of the proposed project in terms of advancing the state of the science and the anticipated scientific impact on capabilities to potentially reduce, eliminate, counter, provide greater knowledge or understanding of the threat, and mitigate the effects of WMD fundamental aspects of phenomena and of observable facts.
- ***Credentials.*** Describe the PI's qualifications and the organization's qualifications to perform the proposed work. Summarize the credentials of the primary performing center, and supporting academic and industrial partners to perform the work. Describe specific examples of equipment and/or facilities available to perform the proposed work. Focus on information directly relevant to the proposed work.
- ***Work to be Performed.*** Provide details of the work to be performed by task and subtask. Tasks must be grouped by project year; base and option years should be clearly labeled. Additional details that are required include the following:
  - ***Sample Repository.*** Thrust Area 6 narratives must also clearly identify how the applicant plans to maintain samples collected during the proposed research effort, along with relevant metadata, for at least 12 months after the project end date. Note that annual sample repository information must be submitted using a DTRA-specified format that will be made available to awardees.
  - ***Protection of Human Subjects.*** For full discussion, see Section 6.2.2. If the proposed

work involves human subjects or the use of human anatomical substances (e.g., biospecimens, blood, tissue, cell lines), either living or post-mortem, applicants are required to: a) justify and b) outline the use, and c) include the source of the human subjects, human biospecimens and/or human data involved in the research. The DTRA Research Oversight Board (ROB) will provide ongoing oversight throughout the duration of the effort to ensure proper approvals are in place. Further information will be required if the proposal is selected for award.

- ***Animal Use.*** For full discussion, see Section 6.2.3. If the proposed work involves the use of animals, applicants are required to: a) justify and b) include detailed information on the use of animals, and c) include the location(s) of where the animal work is to be performed. The DTRA Research Oversight Board (ROB) will provide ongoing oversight throughout the duration of the effort to ensure proper approvals are in place. Further information will be required if the proposal is selected for award.

- ***Performance Schedule.*** Provide a table of tasks and sub-tasks and the duration of performance of each in a Gantt or other suitably formatted chart.
- ***References.*** List any relevant documents referenced.

Disclosure of Lobbying Activities (SF-LLL) Form: The Disclosure of Lobbying Activities Standard Form-LLL, if applicable, should be completed.

Attachments Form: The attachments form should be used to include the following three items with the application:

Attachment 1 – SOW. The SOW does not have a page limit, but should be approximately 3-5 pages in length for incorporation into an award document. The SOW should not contain any proprietary data or markings. Pages should be numbered and the initial page should have a date (document date) shown under the title (the title of the SOW should match that of the proposal).

The proposed SOW must accurately describe the research to be performed. The proposed SOW must also contain a summary description of the technical methodology as well as the task description, but not in so much detail as to make the SOW inflexible. The SOW format/guidance is as follows:

- ***Objective:*** Brief overview of the specialty area. Describe why the research is being pursued and what knowledge is being sought.
- ***Scope:*** Include a statement of what the SOW covers including the research area to be investigated, objectives/goals, and major milestones and schedule for the effort.
- ***Background:*** The applicant must identify appropriate documents, including publications that are applicable to the research to be performed. This section includes any information, explanations, or constraints that are necessary in order to understand the hypothesis and scientific impact on capabilities needed to reduce, eliminate, and counter the threat, and also mitigate the effects of WMD. It may also include previously performed relevant research and preliminary data.
- ***Tasks/Scientific Goals:*** This section contains the detailed description of tasks which represent the research to be performed that are contractually binding. Thus, this portion of the SOW should be developed in an orderly progression and presented in sufficient detail to

establish the methodology and feasibility of accomplishing the overall program goals. The work effort should be segregated by performance period for all tasks to be performed and anticipated milestones realized in that year (e.g., Year 1, Year 2, etc., should be detailed separately). Identify the major tasks in separately numbered sub-paragraphs. Each major task should delineate, by subtask, the research to be performed by year and number each task using the decimal system (e.g., 4.1, 4.1.1, 4.1.1.1, 4.2, etc.). The sequence of performance of tasks and achievement of milestones must be presented by project year and task in the same sequence as in the Project Narrative/Technical Proposal. The SOW must contain every task to be accomplished to include a detailed schedule.

- The tasks must be definite, realistic, and clearly stated. Use "the awardee shall" whenever the work statement expresses a provision that is binding. Use "should" or "may" whenever it is necessary to express a declaration of purpose. Use active voice in describing work to be performed. Do not use acronyms or abbreviations without spelling out acronyms and abbreviations at the first use; place the abbreviation in parenthesis immediately following a spelled-out phrase. If presentations/meetings are identified in your schedule, include the following statement in your SOW: "Conduct presentations/meetings at times and places specified in the grant schedule."
- ***Deliverables:*** Thrust Area 6 **requires** several additional items be included in the SOW. These items are as follows:
    - Submission of annual sample repository information using a DTRA-specified format.
    - Access to all samples collected and data generated during the course of the project, up to and including at least 12 months after the project end date.

Attachment 2 – Quad Chart. The quad chart must be presented on one (1) page. The quad chart must not contain any proprietary data or markings. The quad chart must be provided in landscape layout. The quad chart should be uploaded as "Attachment 2" of the Attachments Form.

Attachment 3 – Supporting Documentation. For Thrust Area 6 proposals ONLY. Thrust Area 6 narratives must also describe an operational framework to support the proposed work. This includes, but is not limited to the following: the extent and duration of the relationship/collaboration between the universities/institutes/entities and/or scientists. Teams with pre-existing collaborative research relationships and those which propose to establish new collaborations will be considered, provided teams can supply documentation to demonstrate that an operational framework exists to support the proposed work. Each of the following should be concatenated into a single document, in the order specified:

- Specific identification of foreign Principal Investigators (PIs) and number of/job title for other members of the foreign research team.
- Detailed description of the relationship between the proposed research project and current research efforts at the foreign institution.
- Description of facilities and any other evidence of suitability of foreign collaborators and sites. In the event that the foreign research component will involve human or other vertebrate animal use, appropriate facilities compliance and certifications documents must be provided. Refer to Section 6.2.2 and Section 6.2.3 for specific information on required

approvals and documentation.

- Foreign PI letter of collaboration describing, at minimum, the suitability of the proposed work with respect to ongoing research efforts at the foreign institution, merit of the proposed collaboration, and the expected mutual benefits.

Protocol Risk Assessment Tool (PRAT). For Thrust Area 6 proposals ONLY. Applicants will be provided a copy of the PRAT file following their invitation to submit a Phase II full proposal and complete it in its entirety for **each** foreign institution participating in the project. Additional instructions for completing the PRAT may be found within the file. The completed PRAT file(s) should be emailed as a Portable Document File (PDF) format to HDTRA1-FRCWMD-A@mail.mil within two (2) weeks of the full proposal submission. **DO NOT** attempt to attach the PRAT(s) to the www.grants.gov submission.

4.2.7. Phase II - Additional Information Requests by DTRA. A revised proposal may be requested based on the review of the original proposal. Revised proposals will be requested when changes to the project scope, technical approach, and/or cost are required before the proposal could be further considered for an award. Applicants whose proposals are of interest to DTRA may be contacted to provide additional information or to make requested revisions prior to the final decision on funding. This request for further information may include revised budgets or budget explanations, revised SOWs, and other information, as applicable, to the proposed award. Additional instructions may be provided in the request for a revised proposal. Applicants who are not responsive to Government requests for information in a timely manner, defined as meeting Government deadlines established and communicated with the request and not making satisfactory updates as requested, may be removed from award consideration. Applicants may also be removed from award consideration if the applicant and the Government fail to negotiate mutually agreeable terms within a reasonable period of time.

Re-submissions should be made with the appropriate Phase II application package for the thrust area or topic of interest and should be completed in accordance with the instructions provided in the notification email.

The DTRA-specific instructions for completing a proposal re-submission are the same as for the original submission, except the SF 424 (R&R) Application for Federal Assistance should be marked as follows:

- Block 1 – Type of Submission. Applicants should indicate the Phase II submission is a "Changed/Corrected Application."
- Block 4b – Agency Routing Identifier. Enter the corresponding Phase I Grant ID.
- Block 4c – Previous Grants.gov Tracking ID. Enter the Phase II Grant ID for the original Phase II submission.

4.2.8. File Format. Documents should be uploaded as a Portable Document File (PDF) format. Perform a virus check before uploading any files to www.grants.gov as part of your application package. If a virus is detected, it may cause rejection of the file.

Do not lock or encrypt any files you upload to www.grants.gov as part of your application package. Movie and sound file attachments will not be accepted.

4.2.9. All submissions must be completely UNRESTRICTED and UNCLASSIFIED;

submissions must not contain Controlled Unclassified Information (CUI), other Proprietary information or export controlled information or be marked as such.

4.2.10. Confirmed Proposal Expiration Date. Applicants requesting contracts must provide written confirmation that holds the proposal, to include proposed costs, firm for 180 days after the submission due date, as included in the invitation to submit a full proposal. This information must be included in the text of the technical proposal.

4.2.11. Withdrawal of Proposals. Proposals may be withdrawn by written notice received at any time before award. Withdrawals are effective upon receipt of notice by the Grants/Contracting Officer via the administrative e-mail address listed in Section 7.

4.3. Submission Dates and Times.

Coordination of abstracts may be accomplished at any time that this BAA is in effect, unless otherwise stated as part of a specific topic. Once an applicant has been notified that a pre-application white paper is welcomed, the white paper should be submitted within 60 days. If the white paper is not submitted within 60 days, DTRA reserves the right to require the applicant to re-initiate the process with another abstract coordination.

Pre-application white papers may be submitted anytime that this BAA is in effect (as long as it occurs within the 60 day window following pre-coordination of the abstract), unless otherwise stated as part of a specific topic. Pre-application white papers may be evaluated at any time after submission and invitations for full proposal submission may occur any time after pre-application white paper evaluation. Note that proposal invitations may be limited to available program funds.

The due date for the Phase II invited proposal submissions will be provided in the letter of invitation. The applicant will not be allowed less than 45 days to prepare a full proposal submission; there is no penalty for early submissions. An extension for submission of the Phase II proposal submission may be requested by emailing the administrative email address in Section 7 prior to the deadline for the proposal submission. Full proposals may be evaluated at any time after submission.

Applicants are responsible for submitting all materials to www.grants.gov. When sending electronic files, the applicant should allow for potential delays in file transfer from the originator's computer server to the www.grants.gov website/computer server, as well as the delay associated with the www.grants.gov validation of applications, which may be up to 48 hours. Applicants are encouraged to submit their proposals early to avoid issues with file transfers, rejection of applications by www.grants.gov, and delays due to high website demand.

Acceptable evidence to establish the time of receipt at the Government office includes documentary and electronic evidence of receipt maintained by DTRA. Applicants should also print, and maintain for their records, the electronic receipt following submission of a proposal to www.grants.gov.

Applicants should note that DTRA uses a system that pulls applications from www.grants.gov en masse, but this system does not mark applications as "retrieved" on www.grants.gov. As a result, when applicants check the status on www.grants.gov the applications will always look like they have not been retrieved by DTRA. Should you require confirmation of receipt by the Agency, you may request such via the administrative email address provided in Section 7. Note that such requests will generally be treated with low priority by the Agency.

Please note 15 U.S.C. 260a establishes daylight saving time as the standard time during the daylight saving period.

If the application package and required attachments are submitted to www.grants.gov after the exact time and date specified in this announcement or in any written communications provided by DTRA, the application may be considered "late" and may not be reviewed.

If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be submitted to www.grants.gov by the exact time specified by DTRA correspondence, the time specified for receipt of applications will be deemed to be extended to the same time of day specified in the BAA or in the letter of invitation on the first work day on which normal Government processes resume.

4.4. Intergovernmental Review. Not Applicable.

4.5. Other Submission Requirements.

4.5.1. Organizations must have an active System for Award Management (SAM) registration, and Grants.gov account to apply for grants. Creating a Grants.gov account can be completed online in minutes, but SAM registrations may take additional time. Therefore, an organization's registration should be done in sufficient time to ensure it does not impact the entity's ability to meet required application submission deadlines.

All organizations applying online through Grants.gov must register with the SAM and will receive a unique entity identifier (UEI) number. Failure to register with SAM will prevent your organization from applying through Grants.gov. SAM registration must be renewed annually. For more detailed instructions for registering with SAM, refer to: https://www.grants.gov/web/grants/applicants/organization-registration/step-2-register-with-sam.html. Additional information may be found on Grants.gov here: https://www.grants.gov/web/grants/applicants/organization-registration.html

4.5.2. Compliance with Appendix A to 32 CFR 28. All awards require certifications of compliance with Appendix A to 32 CFR 28 regarding lobbying. Proposers are certifying compliance with this regulation by submitting the invited proposal. It is not necessary to include the certification text with your invited proposal. If applicable, proposers should submit the Disclosure of Lobbying Activities (SF-LLL) Form in accordance with Section 4.2.6.

4.5.3. Marking Guidance for Pre-Application White Paper and Invited Proposal and Disclosure of Proprietary Information other than to the Government. The pre-application white papers and invited proposals submitted in response to this BAA may contain technical and other data that the applicant does not want disclosed to the public or used by the Government for any purpose other than application evaluation. Public release of information in any pre-application white paper and invited proposal submitted will be subject to existing statutory and regulatory requirements.

If proprietary information which constitutes a trade secret, proprietary commercial or financial information, confidential personal information, or data affecting national security, is provided by an applicant in a pre-application white paper and/or invited proposal, it will be treated in confidence, to the extent permitted by law, provided that the following legend is included on the front page of the pre-application white paper and/or invited proposal:

“For any purpose other than to evaluate the pre-application white paper and/or proposal, this data

shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed in whole or in part, provided that if an award is made to the applicant as a result of or in connection with the submission of this data, the Government shall have the right to duplicate, use or disclose the data to the extent provided in the agreement. This restriction does not limit the right of the Government to use information contained in the data if it is obtained from another source without restriction. The data subject to this restriction is contained in page(s) _____ of this pre-application white paper and/or proposal."

Any other legend may be unacceptable to the Government and may constitute grounds for removing the pre-application white paper and/or invited proposal from further consideration without assuming any liability for inadvertent disclosure.

The Government will limit dissemination of properly marked information to within official channels. In addition, the pages indicated as restricted must be marked with the following legend:

> *"Use or disclosure of the pre-application white paper and/or proposal data on lines specifically identified by asterisk (*) are subject to the restriction on the front page of this pre-application white paper and/or proposal."*

The Government assumes no liability for disclosure or use of unmarked data and may use or disclose such data for any purpose.

In the event that properly marked data contained in a pre-application white paper and/or invited proposal submitted in response to this BAA is requested pursuant to the Freedom of Information Act (FOIA), 5 U.S.C. § 552, the applicant will be advised of such request and prior to such release of information, will be requested to expeditiously submit to DTRA a detailed listing of all information in the pre-application white paper and/or invited proposal which the applicant believes to be exempt from disclosure under the Act. Such action and cooperation on the part of the applicant will ensure that any information released by DTRA pursuant to the Act is properly identified.

By submission of a pre-application white paper and/or invited proposal, the applicant understands that proprietary information may be disclosed outside the Government for the sole purpose of technical evaluation. DTRA will obtain a non-disclosure agreement from the evaluator that proprietary information in the pre-application white paper and/or invited proposal will only be used for evaluation purposes and will not be further disclosed or utilized.

4.5.4. VAT and Other Taxes in Assistance Awards. Prior to proposal submission, the applicant will require any supplier of goods or services to assess and verify potential VAT, excise duties, and other tax implications to avoid the imposition of such charges with respect to the goods and/or services in question to the maximum extent possible.

In instances where the supplier of goods or services is exempt from the VAT, excise duties, or other taxes or is entitled to claim reimbursement thereof, the taxes must not be included in the proposed cost of the award.

In instances where the supplier of goods or services is not exempt from the VAT, excise duties, or other taxes or is not entitled to claim reimbursement thereof, the applicant must itemize the VAT and/or other taxes in the proposal. Further, applicants are advised that prior to the award of any grant or cooperative agreement, DTRA and the recipient will mutually agree upon the use of DTRA funds for the VAT, excise duties, or other taxes, and project activities may be revised

accordingly. All applicants may include costs in their proposal to pay for VAT costs associated with lodging, meals, and transportation for travel.

4.6. Applicants that Propose Use of Contracts or OTAs.

4.6.1. Recommended Procurement Instrument and Pricing Arrangement. Applicants that propose use of contracts or OTAs must provide a summary of their recommended procurement instrument and pricing arrangement as part of the Phase II proposal. However, the Government reserves the right to negotiate and award the types of instruments determined most appropriate under the circumstances. It is anticipated that most instruments will be grants.

4.6.2. Representations and Certifications. Representations and Certifications must be completed at the time of Phase II submission. The applicant must complete the annual representations and certifications electronically via the System for Award Management (SAM) website at https://www.sam.gov/portal/SAM/#1#1. After reviewing their information, the applicant verifies by submission of the application that the representations and certifications currently posted electronically have been entered or updated within the last 12 months.

4.6.3. Organization Conflict of Interest Advisory. Certain post-employment restrictions on former federal officers and employees may exist, including special Government employees (including but not limited to 18 U.S.C § 207, the Procurement Integrity Act, 41 U.S.C. § 2101 *et.seq*). If a prospective applicant believes that a conflict of interest exists, the situation should be raised to the DTRA Contract/Grant Officer before time and effort are expended in preparing a proposal. All applicants and proposed sub-contractors must therefore affirmatively state whether they are providing scientific, engineering and technical assistance (SETA), advisory and assistance services (A&AS) or similar support, through an active contract or subcontract, to any DoD technical office to include, but not limited to, the Joint Program Executive Office (JPEO), the Office of the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs (ASD-NCB), or the Office of the Special Assistant for Chemical and Biological Defense and Chemical Demilitarization Programs (OSA (CBD&CDP)). This information must be included in Technical Proposal of the Phase II full submission. All affirmations must state which office(s) the applicant(s) supports, and identify the prime contract number. Affirmations must be furnished at the time of Phase II full proposal submission. All facts relevant to the existence or potential existence of organizational conflicts of interest, including but not limited to those arising out of activities with the above-referenced organizations, must be disclosed. The disclosure must include a description of the action the applicant has taken or proposes to take to avoid, neutralize, or mitigate such conflict.

4.6.4. Contracts with Subcontracts. Any applicant, other than small businesses, submitting a proposal that exceeds $750,000.00 must submit a subcontracting plan in accordance with FAR 19.704(a) (1) and (2). This information must be included in Technical Proposal of the Phase II full submission. The plan format is outlined in FAR 19.704. Pursuant to Section 8(d) of the Small Business Act (15 U.S.C. § 637(d)), it is the policy of the Government to enable small business and small disadvantaged business concerns to be considered fairly as subcontractors to contractors performing work or rendering services as prime contractors or subcontractors under Government contracts, and to assure that prime contractors and subcontractors carry out this policy.

4.6.5. Limitations on OTAs. Applicants are advised that an Other Transaction for Research Agreement (10 U.S. Code § 2371) or an Other Transaction for Prototype Agreement (10 U.S.

Code § 2371b) will only be awarded if the use of a standard contract or CA is not feasible or appropriate. Applicants are advised that an OTA may only be awarded if there is:

a. At least one nontraditional defense contractor participating to a significant extent in the prototype project, or

b. All significant participants in the transaction other than the Federal Government are small businesses or nontraditional defense contractors; or

c. At least one-third of the total cost of the prototype project is to be paid out of funds provided by the parties to the transaction other than the Federal Government. The cost share should generally consist of labor, materials, equipment, and facilities costs (including allocable indirect costs).

d. Exceptional circumstances justify the use of a transaction that provides for innovative business arrangements or structures that would not be feasible or appropriate under a procurement contract.

e. Although use of one of these options is required to use an Other Transaction for Prototype agreement as the procurement vehicle, no single option is encouraged or desired over the others.

NOTE: For purposes of determining whether or not a participant may be classified as a nontraditional defense contractor or a small business and whether or not such participation is determined to be participating to a significant extent in the prototype project, the following definitions are applicable:

a. "Nontraditional defense contractor" means an entity that is not currently performing or has not performed, for at least the one-year period preceding this solicitation, any of the following for the Department of Defense: any contract or subcontract that is subject to full coverage under the cost accounting standards prescribed pursuant to section 26 of the Office of Federal Procurement Policy Act (41 USCS §§ 1501 et seq.) and the regulations implementing such section; or any other contract in excess of $500,000 under which the contractor is required to submit certified cost or pricing data under section 2306a of this title (10 USCS § 2306a).b. "Small business" means a small business concern as defined under Section 3 of the Small Business Act (15 U.S.C. § 632).

"Participating to a significant extent in the prototype project" means that the nontraditional defense contractor or small business is supplying a new key technology or product, is accomplishing a significant amount of the effort wherein the role played is more than a nominal or token role in the research effort, or in some other way plays a significant part in causing a material reduction in the cost or schedule of the effort or an increase in performance of the prototype in question. NOTE: Applicants are cautioned that if they are classified as a traditional defense contractor, and propose the use of an Other Transaction for Prototype Agreement, the Government will require submittal of both a cost proposal under the guidelines of the FAR/DFARS, and a cost proposal under the proposed Other Transaction for Prototype Agreement, so that an evaluation may be made with respect to the cost tradeoffs applicable under both situations. The Government reserves the right to negotiate either a FAR based procurement contract, or Other Transaction for

Prototype Agreement as it deems is warranted under the circumstances.

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5. APPLICATION REVIEW INFORMATION

5.1. Evaluation Criteria. The four evaluation criteria to be used for responses received to this BAA are as follows:

1. Scientific and Technical Merit. The objective of this criterion is to assess the extent to which the applicant presents ideas that are innovative and/or unique with the potential for high payoff in the science area and details a comprehensive technical approach based on sound scientific principles. Innovation will be judged contextually against the white paper's/proposal's scope, goals, and setting. To the extent possible, the technical risks, including those of biosafety and security, to accomplish the research or project should be identified with appropriate mitigation/management details.

   For Thrust Area 6 white papers/proposals, innovation will also be considered with respect to partner country capabilities.

2. Value to Mission Goals. The objective of this criterion is to assess the extent to which the applicant demonstrates an understanding of the C-WMD research or mission challenges and the contribution to the C-WMD research or mission needs of that thrust area/topic. White papers/proposals must detail research or a project that is responsive to the thrust area/topic as presented in this solicitation. This criterion also addresses the benefit of the proposed effort on enabling knowledge, technology, or capabilities over current methods and/or practices and on the transition potential that is appropriate to the proposed effort. Applicants must also demonstrate an impact of the proposed effort on the institution's ability to perform research relevant to reducing the global WMD threat; and/or to train, through the proposed effort, students and/or partner scientists in science, technology, engineering and/or mathematics.

   Thrust Area 6 white papers/proposals must demonstrate an understanding of the CBEP priorities and mission. As such, the degree to which the proposed collaborations may lead to long-term partner country self-sufficiency and sustainment of the jointly developed capabilities will be considered.

3. Capability of the Personnel and Facilities to Perform the Proposed Effort. The objective of this criterion is to assess the extent to which the applicant's team has the requisite expertise, skills and resources necessary to perform the proposed program. This includes an assessment of the team's management construct, key personnel, facilities and past technical experience in conducting similar efforts of the proposed scope. Applicants must demonstrate that their team has the necessary background and experience to perform this project. Facilities should be detailed with discussion of any unique capabilities pertinent to the research. Subcontractors may include Government facilities or Agencies; however the unique expertise or specialized facilities provided through their inclusion must be clearly presented and the validity of the proposer-Governmental relationship must be clearly documented.

4. Cost Realism Evaluation. The objective of this criterion is to establish that the proposed costs are reasonable, realistic, and justified for the technical approach offered and to assess the applicant's practical understanding of the scope of the proposed effort.

5.2. Review and Selection Process. The pre-application white paper and proposal selection

process will be conducted based upon a technical review as described in the DoDGARs (32 CFR 22.315(c)) and includes the use of non-Government peer-reviewers.

Each pre-application white paper and invited proposal submitted to a general TA will be reviewed on a rolling basis; topic-based submissions will be reviewed as a batch following receipt deadlines. All applications will be reviewed based on the merit and relevance of the specific pre-application white paper/proposal as it relates to the DTRA program, rather than against other pre-application white papers/proposals for research in the same general area.

Pre-application white paper (Phase I) evaluation will be based on the two (2) equally weighted criteria of (1) Technical/Scientific Merit and (2) Value to Mission Goals. The criteria will be scored as Outstanding (O), Good (G), Acceptable (A), Marginal (M) or Unacceptable (U). Any criterion scored as "Unacceptable (U)" will render the pre-application white paper "Not Selectable," and the pre-application white paper will not be considered further.

The full proposal evaluation will be based on the four criteria listed above. Of these, the first two (2) criteria of (1) Technical/Scientific Merit and (2) Value to Mission Goals are equally weighted and more important than the third criterion of (3) Capability of the Personnel and Facilities to Perform the Proposed Effort. These first three criteria will be scored Outstanding (O), Good (G), Acceptable (A), Marginal (M) or Unacceptable (U). The fourth criterion of Cost Realism will be scored as either Acceptable (A) or Unacceptable (U). Any criterion scored as "Unacceptable (U)" will render the proposal "Not Selectable," and the proposal will not be considered further.

Other factors that may be considered are duplication with other research, program balance, past performance and budget limitations. Prior to award, the Government reserves the right to perform a review of past performance. Sources that may be used for past performance review may include the Past Performance Information Retrieval System (PPIRS) and the Federal Awardee Performance and Integrity Information System (FAPIIS). The Government will also evaluate the impact of any proposed limitations to the use of intellectual property (e.g. asserted technical data/computer software restrictions or patents) during the selection and/or negotiation process, and may request additional information from the applicant, as may be necessary, to evaluate the applicant's assertions. Accordingly, proposals may be selected for funding which are not reviewed as highly as others, which are of higher risk and/or which may be of a higher cost.

The Government reserves the right to select all, some, or none of the proposals, or any part of any proposal received in response to this BAA and to make awards without discussions with applicants; however, the Government reserves the right to conduct discussions if determined necessary.

5.3. DTRA anticipates that the total Federal share of awards made under this announcement will be greater than the simplified acquisition threshold over the period of performance (see §200.88 Simplified Acquisition Threshold). Therefore, in accordance with Appendix I to 2 CFR Part 200, Section E.3, this section serves to inform applicant:

i. That DTRA, prior to making a Federal award with a total amount of Federal share greater than the simplified acquisition threshold, is required to review and consider any information about the applicant that is in the designated integrity and performance system accessible through SAM (currently Federal Awardee Performance and Integrity

Information System (FAPIIS)) (see 41 U.S.C. 2313);

ii. That an applicant, at its option, may review information in the designated integrity and performance systems accessible through SAM and comment on any information about itself that a Federal awarding agency previously entered and is currently in the designated integrity and performance system accessible through SAM;

iii. That DTRA will consider any comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of performance under Federal awards when completing the review of risk posed by applicants as described in §200.205 Federal awarding agency review of risk posed by applicants.

iv. For awards that exceed $500,000 over the period of performance, DTRA will employ the additional post-award reporting requirements reflected in Appendix XII—Award Term and Condition for Recipient Integrity and Performance Matters of 2 CFR 200.

5.4. Technical and Administrative Support by Non-Government Personnel. It is the intent of DTRA to use both Government and non-Government personnel to assist with the review and administration of submittals for this BAA. All pre-application white papers and invited proposals may be reviewed by subject matter experts, including, but not limited to, peer reviewers from across the academic and industrial community, as applicable to the research proposed.

Further, participation in this BAA requires DTRA support contractors to have access to pre-application white paper and invited proposal information including information that may be considered proprietary or otherwise marked with restrictive legends Each contract contains organizational conflict of interest provisions and/or includes contractual requirements for non-disclosure of proprietary contractor information or data/software marked with restrictive legends. The applicant, by submitting a white paper or proposal, is deemed to have consented to the disclosure of its information to the aforementioned contractors under the conditions and limitations described herein.

All individuals—including subject matter experts and support contractors—having access to any proprietary data must certify that they will not disclose any information pertaining to this BAA including any submittal, the identity of any submitters, or any other information relevant to this BAA. All applicants to this BAA consent to the disclosure of their information under these conditions.

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6. AWARD ADMINISTRATION INFORMATION

6.1. Award Notices. Applicants will be notified regarding the status of their applications (invitation/non-invitation for full proposals, re-submission of white papers, selection/non-selection for award, etc.) via e-mail to the BPOC listed in Block 5 of the SF-424 and the PI listed in Block 14 of the SF-424 provided at the time of submission. A debrief summary will be provided as part of all notification e-mails.

A notice of selection should not be construed as an obligation on the part of the Government; only duly authorized procurement personnel may commit resources, this will be done by issuing a grant or contract document to the selected applicant. Also, this notification must not be used as

a basis for accruing costs to the Government prior to award. Selected applicants are not authorized to begin work, as any award is subject to successful negotiations (if determined necessary by DTRA) between the DTRA contracting division and the selected organization, and to the availability of funds.

All notifications will be made from notification@dtrasubmission.net. **E-mails to this e-mail address will not be answered or forwarded.**

Applicants must be aware that it is their responsibility to ensure: (1) correct e-mail addresses are provided at the time of submission, (2) this e-mail notification reaches the intended recipient(s), and (3) the e-mail is not blocked by the use of 'spam blocker' software or other means that the recipient's Internet Service Provider may have implemented as a means to block the receipt of certain e-mail messages.

If for any reason there is a delivery failure of these e-mail notices, DTRA will not further attempt to contact the applicants.

6.2. Administrative and National Policy Requirements. All awards require certifications of compliance with national policy requirements. Statutes and Government-wide regulations require some certifications to be submitted at the time of proposal submission. See Section 4.5.2 and Section 4.6.2 for the certification(s) required at the time of submission.

This BAA focuses on fundamental research in a DoD contractual context, which was defined in Section 1.2 of this BAA. Per DoD policy[1], "…products of fundamental research are to remain unrestricted to the maximum extent possible." Furthermore, "The DoD will place no other restrictions on the conduct or reporting of unclassified fundamental research, except as otherwise required by statue [sic], regulation, or Executive Order." As such, fundamental research is normally exempt from controls under the International Traffic in Arms Regulation (ITAR) (22 CFR Parts 120-130) and/or the Department of Commerce regarding the Export Administration Regulations (15 CFR Parts 730-774), but the DoD rule recognizes that there are "rare" situations where export-controlled information or technology may be used in fundamental research that may require a license(s) or restrictions on products.

6.2.1. Export Control Notification. Applicants are responsible for ensuring compliance with any export control laws and regulations that may be applicable to the export of and foreign access to their proposed research. Applicants may consult with the Department of State with any questions regarding the International Traffic in Arms Regulation (ITAR) (22 CFR Parts 120-130) and/or the Department of Commerce regarding the Export Administration Regulations (15 CFR Parts 730-774). Please note that the prime awardee is responsible for monitoring ITAR compliance of all subawardees.

6.2.2. Protection of Human Subjects. If the proposed work involves human subjects or the use of human anatomical substances (e.g., biospecimens, blood, tissue, cell lines), either living or post-mortem, applicants are required to: a) justify and b) outline the use, and c) include the source of the human subjects, human biospecimens and/or human data involved in the research,

[1] Under Secretary of Defense for Acquisition, Technology and Logistics Memorandum, SUBJECT: Contracted Fundamental Research, dated 26 Jun 2008

hereafter referred to as "research."

The DTRA Research Oversight Board (ROB) will provide ongoing oversight throughout the duration of the effort to ensure proper approvals are in place. Further information will be required if the proposal is selected for award. Further information will be required if the proposal is selected for award.

DTRA PMs responsible for the research are required to complete and submit Section A of the DTRA Form 156, available through the DTRA1 Forms Library, to the DTRA Research Oversight Board (ROB) through the ROB Central Mailbox, dtra.belvoir.rd.mbx.research-oversight-board@mail.mil.

Through an Agreement with DTRA and the U.S. Army Medical Research Development Command, Office of Human and Animal Research Oversight(MRDC OHARO), OHARO must review and approve all DTRA funded or supported research prior to the start of the proposed work. This review requirement is in addition to the DTRA ROB review. Therefore, along with the DTRA Form 156, the DTRA PM/STM must complete and submit the MRDC OHARO form titled "USAMRDC_ORP_Proposal Submission_Form" to the DTRA ROB for review of the proposed work. These forms are available through the ROB DTRA1 Sharepoint site, https://dtra1portal.unet.dtra.mil/RD/ROB/default.aspx. Allow up to four months, from date award is submitted to the DTRA ROB, for regulatory review and approval processes. Applicants are to build the review time into their project schedules.

All work under any award made under this BAA involving research must be conducted in accordance with 32 CFR 219, 10 U.S.C. § 980, and DoD Instruction (DoDI) 3216.02, DTRA Instruction (DTRAI) 3216.01, and, as applicable, 21 CFR parts 11, 50, 56, GCP, the International Council for Harmonization (ICH) as well as other applicable federal and state regulations. Contracts must include DFARS clause 252.235-7004 and DTRA Clause 252.223-9002. Other funding vehicles (e.g., grant, OTA) must include similar language. Non-compliance with any provision of this clause may result in withholding of payments under the contract pursuant to the terms and conditions. The Government shall not be responsible for any costs incurred for research involving human subjects prior to protocol approval by the MRDC OHRO and ROB.

It is the responsibility of the PM to ensure performers are cognizant of and abide by the additional restrictions and limitations imposed by the DoD regarding research involving human subjects and human anatomical substances, specifically in regards to vulnerable populations (32 CFR 219 modifications to subparts B-D of 45 CFR 46), recruitment of military research subjects (32 CFR 219), and surrogate consent (10 U.S.C. § 980).

Through the Component Management Plan (CMP), reviewed and approved by USD(R&E), the DTRAI 3216.01 establishes the DTRA Human Research Protection Program (HRPP), and sets forth the policies, defines the applicable terms, and delineates the procedures necessary to ensure DTRA compliance with federal and DoD regulations and legislation governing human subject research, and is managed by the DTRA ROB. The regulations mandate that all DoD activities, components, and agencies protect the rights and welfare of human subjects in DoD funded or supported research, development, test and evaluation, and related activities.

The DTRAI 3216.01 requires that research involving human subjects or human anatomical substances may not begin or continue until the DTRA ROB and MRDC OHRO have reviewed

and approved the proposed work. The requirement to comply with the regulations applies to new starts and continuing research for the life of the project, until closure. The completion of a research project requires closure document (e.g., IRB Final Review submission) submitted to the DTRA ROB and/or the MRDC OHRO.

A study is considered to involve human research subjects if: 1) there is interaction with the subject (even simply talking to the subject qualifies; no needles are required); and 2) if the study involves collection and/or analysis of personal/private information about an individual, or if material used in the study contains links to such information.

A study is considered to use human anatomical substances if it involves human biospecimens such as peripheral blood mononuclear cells, primary cells, blood, saliva, tissue, etc. Commercially available sources (e.g., a vendor, medical facility's discarded materials, research collaborators, biobanks, repositories) of human anatomical substances require review. This includes cadaveric specimens and substances.

Commercially available cell lines are exempt from this definition and do not require review (note: commercially available embryonic cell lines are not exempt, and must be reviewed).

Approval to begin research or to subcontract under the proposed protocol will be provided in writing from the MRDC OHRO and the DTRA ROB Executive Secretary (ES) or Program Manager, in absence of the ROB ES. Both the contractor and the Government must maintain a copy of this approval. Any proposed modifications or amendments to the approved research must be submitted to the DTRA ROB and/or the MRDC OHRO for review and approval. Examples of modifications or amendments to the approved work that would require a new review of the project include, but are not limited to:

- a change of the Principal Investigator (PI);
- a change or addition of an institution (note: review and approval of institution is required),
- elimination or alteration of the informed consent process,
- a change in the human subjects study population (e.g., adding children, active duty, etc.) has regulatory implications
- changes in duration or intensity of exposure to some stimulus or agent;
- changes in the information requested of volunteers, or changes to the use of specimens or data collected;
- changes in perceived or measured risks or benefits to volunteers that require changes to the study,
- a change in the IRB of record;
- a change that could potentially increase risk to human subjects
- significant change in study design (i.e., would prompt significant additional scientific review).

Research pursuant to such modifications or amendments must not be initiated without IRB and OHRO approval except when necessary to eliminate apparent and immediate hazards to the subject(s). All unanticipated problems involving risk to subjects or others (UPIRTSOs),

suspensions, clinical holds (voluntary or involuntary), or terminations of the research by the IRB or regulatory agencies, the institution, the sponsor, or any instances of serious or continuing noncompliance with the federal regulation or IRB requirements, must be promptly reported to the DTRA ROB and/or MRDC OHRO.

Greater than minimal risk research projects lasting more than one year require IRB and OHRO review at least every 365 days, or more frequently as required by the responsible IRB. ROB review and approval is required annually from the date of Section A of the DTRA Form 156, through recertification of the DTRA Form 156. The awardee must provide documentation of continued IRB review of protocols for MRDC OHRO review and approval. Research must not continue without renewed OHRO and ROB approval unless necessary to eliminate apparent and immediate hazards to the subject(s).

6.2.3. Animal Use. If the proposed work involves the use of animals, applicants are required to: a) justify and b) include detailed information on the use of animals, and c) include the location(s) of where the animal work is to be performed. The DTRA Research Oversight Board (ROB) will provide ongoing oversight throughout the duration of the effort to ensure proper approvals are in place. . Further information will be required if the proposal is selected for award.

DTRA PMs responsible for the research are required to complete and submit Section A of the DTRA Form 156, available through the DTRA1 Forms Library, to the DTRA Research Oversight Board (ROB) through the ROB Central Mailbox, dtra.belvoir.rd.mbx.research-oversight-board@mail.mil.

Through an Agreement with DTRA, the Animal Care and Use Review Office (ACURO), a component of the USAMRDC Office of Human and Animal Research Oversight (MRDC OHARO) must review and approve all DTRA funded or supported research involving animal use prior to the start of the proposed work. This review requirement is in addition to the DTRA ROB review. Therefore, along with the DTRA Form 156, the DTRA PM must complete and submit the MRDC OHARO form titled "USAMRDC_ORP_Proposal Submission_Form" to the DTRA ROB for review of the proposed work. This form is available through the ROB DTRA1 Sharepoint site, https://dtra1portal.unet.dtra.mil/RD/ROB/default.aspx. Allow up to four months, from date award is submitted to the DTRA ROB, for regulatory review and approval processes. Applicants are to build the review time into their project schedules.

All work under any award made under this BAA involving the use of animals must be conducted in accordance with DoD Instruction (DoDI) 3216.01, DTRA Instruction (DTRAI) 3216.01, and Army Regulation (AR) 40-33. Provisions include rules on animal acquisition, transport, care, handling, and use in: (i) 9 CFR parts 1-4, Department of Agriculture rules that implement the Laboratory Animal Welfare Action of 1966 (U.S.C. 2131-2156); and (ii) the "Guide for the Care and Use of Laboratory Animals," National Institutes of Health Publication No. 86-23. Contracts must include DFARS Clause 252.235-7002 and DTRA Clause 252.235-9001. Other funding vehicles (e.g., grant, OTA) must include similar language. Non-compliance with any provision of this clause may result in withholding of payments under the contract pursuant to the terms and conditions. The Government shall not be responsible for any costs incurred for research involving animal use prior to protocol approval by the MRDC ACURO and ROB. It is the responsibility of the PM to ensure performers are cognizant of and abide by the additional restrictions and limitations imposed by the DoD regarding animal-use research.

The DTRAI 3216.01 requires that research using animals not begin or continue until the DTRA

ROB and MRDC ACURO have reviewed and approved the proposed work.

Through the DTRA Component Animal Use Management Plan (CAUMP), reviewed and approved by the USD(R&E), the DTRAI 3216.01 establishes the DTRA Animal Use Oversight Program (AUOP), and sets forth the policies, defines the applicable terms, and delineates the procedures necessary to ensure DTRA compliance with federal and DoD regulations and legislation governing research involving animal use, and is managed by the DTRA ROB. The regulations mandate that all DoD activities, components, and agencies protect the care and welfare of animals in DoD funded or supported research, development, test and evaluation and training, and related activities. The requirement to comply with the regulations applies to new starts and continuing research for the life of the project, until closure. The completion of a research project requires closure document (e.g., IACUC Final Review submission) submitted to the DTRA ROB and/or the MRDC ACURO.

The DoD definition of animal is "any living or dead vertebrate animal, including birds, cold blooded animals, rats of the genus rattus and mice of the genus mus." "Dead" is defined as animals killed for the direct purpose of conducing RDT&E or training.

Approval to begin research or to subcontract under the proposed protocol will be provided in writing from the MRDC ACURO and the DTRA ROB Executive (ES) Secretary or the ROB PM, in the absence of the ROB ES. Both the awardee and the Government must maintain a copy of this approval. Any proposed modifications or amendments to the approved research must be submitted to the DTRA ROB and/or the MRDC ACURO for review and approval. Examples of modifications or amendments to the approved protocol that would require a new review of the project include, but are not limited to:

- a change of the Principal Investigator (PI),
- a change or addition of an institution (note: review and approval of institutions is required),
- a change in the duration or intensity of exposure to a stimulus or agent,
- a change in the animal model and/or numbers of animals used,
- a change in the IACUC of record, or
- a significant change to in study design (i.e., would prompt significant additional scientific review).

Research pursuant to such modifications or amendments must not be initiated without IACUC and ACURO approvals.

6.2.4. Biological Defense Research Program (BDRP) Requirements: BioSurety and Select Agent Use.

Proposals must specify what Select Agent work will be conducted at the applicant's facility and what Select Agent work will be performed in other facilities. Proposals also must provide the source of the Select Agent(s), any appropriate registration information for the facilities, and specify the Laboratory Bio-safety Level. All Select Agent work is subject to verification of information and certifications. Further information may be required if the proposal is successful.

For those institutions in which PI's are conducting research with Bio-safety Levels 3 and 4 material, a Facility Safety Plan must be prepared and made available during the project award

phase in accordance with 32 CFR 626.18. For grants awarded to foreign institutions, you must follow either local or U.S. laws (as stated above) depending on which laws provide stronger protection. (DTRA requires that research using Select Agents not begin or continue until DTRA has reviewed and approved the proposed agent use. See URL: https://www.gpo.gov/fdsys/pkg/CFR-2002-title32-vol3/pdf/CFR-2002-title32-vol3-sec626-18.pdf for a copy of 32 CFR 626.18, Biological Defense Safety Program.)

For projects that will employ the use of chemical agents, either neat agent or dilute agent, the offeror must provide approved Facility Standard Operating Procedures that conform to Federal, State and local regulations and address the storage, use and disposition of these chemical materials.

6.2.5. Dual-Use Potential. In accordance with National Science Advisory Board for Biosecurity (NSABB) recommendations, DTRA will not support research that, based on current understanding, can reasonably be anticipated to provide knowledge, information, products, or technologies that could be directly misapplied to pose a significant threat with broad potential consequences to public health and safety, agricultural crops and other plants, animals, the environment, materiel, or national security. Research involving select agents and toxins is within scope of the DTRA mission; however, the use of select agents and toxins in certain experimental categories is considered "dual-use research of concern" (DURC) according to U.S. policy. (http://www.phe.gov/s3/dualuse/Documents/us-policy-durc-032812.pdf) Proposals that contain DURC will not be funded. Dual-use potential will be assessed based on application of the following criteria:

- Use of select agents or toxins. This factor evaluates whether the proposed research involves use of one or more select agents or toxins [as identified by the Select Agent Program under Federal Law (7 C.F.R. part 331, 9 C.F.R. part 121, and 42 C.F.R. part 73)] which pose significant risk of deliberate misuse with potential for mass casualties or devastating effects to the economy, critical infrastructure, or public confidence.
- Scope of proposed experiments. This factor evaluates whether the proposed research involves experiments that will produce, aim to produce, or is reasonably anticipated to produce: (a) Enhanced harmful consequences of the agent or toxin; (b) Disruption of immunity or effectiveness of an immunization against the agent or toxin without clinical or agricultural justification; (c) Conferred resistance by the agent or toxin to clinically or agriculturally useful prophylactic or therapeutic interventions against the agent or toxin, or facilitated ability to evade detection methodologies; (d) Increased stability, transmissibility, or dissemination ability of the agent or toxin; (e) Altered host range or tropism of the agent or toxin; (f) Enhanced susceptibility of a host population to the agent or toxin; or (g) Eradicated or extinct select agents or toxins.

6.2.6. Military Recruiting. This is to notify potential applicants that each award under this announcement to an institution of higher education, with exception of any grants awarded to institutions of higher education entirely located outside the United States and/or its territories, must include the following term and condition: "As a condition for receipt of funds available to DoD under this award, the recipient agrees that it is not an institution of higher education (as defined in 32 CFR 216) that has a policy of denying, and that it is not an institution of higher education that effectively prevents, the Secretary of Defense from obtaining the following for military recruiting purposes: (A) entry to campuses or access to students on campuses; or (B)

access to directory information pertaining to students. If the recipient is determined, using procedures in 32 CFR 216 to be such an institution of higher education during the period of performance of this agreement, and therefore to be in breach of this clause, the Government will cease all payments of DoD funds under this agreement and all other DoD grants and CAs, and it may suspend or terminate such grants and agreements unilaterally for material failure to comply with the terms and conditions of award." 32 CFR 216 may be accessed electronically at http://www.ecfr.gov/cgi-bin/text-idx?SID=ee45add5e352854b7089ce420c7fd0a6&mc=true&tpl=/ecfrbrowse/Title32/32cfr216_main_02.tpl . If your institution has been identified under the procedures established by the Secretary of Defense to implement Section 558 of Public Law 103-337, then: (1) no funds available to DoD may be provided to your institution through any grant, including any existing grant; and (2) your institution is not eligible to receive a grant in response to this BAA. This is to notify potential applicants that each award under this announcement to an institution of higher education, with exception of any grants awarded to institutions of higher education entirely located outside the United States and/or its territories, must include the following clause: 32 CFR 22.520 (DoDGARS 22.520), Military Recruiting and Reserve Officer Training Corps Program Access to Institutions of Higher Education.

6.2.7. Combating Trafficking in Persons. The recipient agrees to comply with the trafficking in persons requirement in Section 106(g) of the Trafficking Victims Protection Act of 2000 (TVPA), as amended (22 U.S.C. 7104(g)).

6.2.8. Reporting Subawards and Executive Compensation. The recipient agrees to ensure they have the necessary processes and systems in place to comply with the reporting requirements of the Transparency Act, as defined at 2 CFR 170.320, unless they meet the exception under 2 CFR 170.110(b).

6.2.9. Representation Regarding the Prohibition on Using Funds under Grants and Cooperative Agreements with Entities that Require Certain Internal Confidentiality Agreements. By submission of its proposal or application, the applicant represents that it does not require any of its employees, contractors, or subrecipients seeking to report fraud, waste, or abuse to sign or comply with internal confidentiality agreements or statements prohibiting or otherwise restricting those employees, contractors, or subrecipients from lawfully reporting that waste, fraud, or abuse to a designated investigative or law enforcement representative of a Federal department or agency authorized to receive such information. Note that: (1) the basis for this representation is a prohibition in section 743 of the Financial Services and General Government Appropriations Act, 2015 (Division E of the Consolidated and Further Continuing Appropriations Act, 2015, Pub. L. 113-235) and any successor provision of law on making funds available through grants and cooperative agreements to entities with certain internal confidentiality agreements or statements; and (2) section 743 states that it does not contravene requirements applicable to Standard Form 312, Form 4414, or any other form issued by a Federal department or agency governing the nondisclosure of classified information.

6.2.10. Prohibition on Covered Telecommunications Equipment or Services. Section 889 of the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2019 (Public Law 115-232) prohibits the head of an executive agency from obligating or expending loan or grant funds to procure or obtain, extend, or renew a contract to procure or obtain, or enter into a contract (or extend or renew a contract) to procure or obtain the equipment, services, or systems prohibited systems as identified in section 889 of the NDAA for FY 2019.

(a) In accordance with 2 CFR 200.216 and 200.471, a recipient and subrecipient are prohibited from obligating or expending grant funds to:

1. Procure or obtain;
2. Extend or renew a contract to procure or obtain; or
3. Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that use covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. Covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).
    - For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities);
    - Telecommunications or video surveillance services provided by such entities or using such equipment; or
    - Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

(b) In implementing the prohibition under Public Law 115-232, section 889, subsection (f), paragraph (1), heads of executive agencies administering loan, grant, or subsidy programs shall prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably necessary for those affected entities to transition from covered communications equipment and services, to procure replacement equipment and services, and to ensure that communications service to users and customers is sustained.

(c) See Public Law 115-232, section 889 for additional information.

COVERED FOREIGN COUNTRY means the People's Republic of China.

6.3. Reporting. General requirements are provided below; however, each awardee should check the award agreement and its contract data requirements list (CDRLs) and/or terms and conditions to determine the requirements for that specific award.

6.3.1. Annual Reports. Annual Reports will be due no later than 1 July of each year. Awards effective after 31 January will not require an Annual Report until 1 July of the following year. The Annual Report is *not* a cumulative report.

6.3.2. Final Technical Reports. A comprehensive final technical report is required prior to the end of an effort, due on the date specified in CDRLs and/or the terms and conditions of the award document. The purpose of the Final Report is to document the results of the effort. The Final Report *is* a cumulative report.

The final report will always be sent to the Defense Technical Information Center (DTIC) and reports may be available to the public through the National Technical Information Service (NTIS).

6.3.3. Financial Reports. Federal Financial Reports (SF-425) are due no later than 1 July of each year. Grants effective after 31 January will not require a Federal Financial Report until 1 July of the following year.

6.3.4. Foreign Travel Reports. Within thirty (30) days after returning to the United States from foreign travel, the PI may be required to submit an acceptable trip report summarizing the highlights of the trip. For grants, contracts, or OTAs awarded to institutions entirely located outside the United States and/or its territories, this is not required.

6.4. After-the-Award Requirements for *Grants*. Closeout, subsequent adjustments, continuing responsibilities, and collection of amounts due are subject to requirements found in 32 CFR 32.71 – 73 (Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations) and 32 CFR 34.61 – 63 (For-Profit Organizations).

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7. AGENCY CONTACTS

Administrative Correspondence and Questions	HDTRA1-FRCWMD-A@mail.mil
Thrust Area 1: *Science of WMD Sensing and Recognition*	HDTRA1-FRCWMD-TA1@mail.mil
Thrust Area 2: *Network Sciences*	HDTRA1-FRCWMD-TA2@mail.mil
Thrust Area 3: *Science for Protection*	HDTRA1-FRCWMD-TA3@mail.mil
Thrust Area 4: *Science to Defeat WMD*	HDTRA1-FRCWMD-TA4@mail.mil
Thrust Area 5: *Science to Secure WMD*	HDTRA1-FRCWMD-TA5@mail.mil
Thrust Area 6: *Cooperative Counter WMD Research with Global Partners*	HDTRA1-FRCWMD-TA6@mail.mil
Thrust Area 7: *Fundamental Science for Chemical and Biological Defense*	HDTRA1-FRCWMD-TA7@mail.mil

Table 6: Agency Contacts.

7.1. Questions regarding administrative content of this BAA must be addressed to the administrative e-mail address listed above. Applicants should include the relevant thrust area email address.

7.2. Questions regarding technical content of this BAA must be referred to the thrust area email listed above.

DTRA will not release employee personal contact information.

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8. OTHER INFORMATION

Topics from previous periods may or may not be repeated. DTRA will not provide additional information regarding the posting of future topics, including dates for posting, the potential for a topic to be repeated in out years, the potential for similar topics to be posted, and/or topic details in advance of issuance of an amended BAA.

ATTACHMENT 1: SPECIFIC TOPICS

The Post Doc-Topic B spans the technical areas covered by Thrust Areas 1-7 and is ***NO longer accepting pre-application white paper submission. Submissions to the general thrust area descriptions for Thrust Areas 1-7 are closed; abstracts and pre-application white papers submitted to the general descriptions for Thrust Areas 1-7 will NOT be reviewed.

DTRA anticipates that the award(s) made under Post Doc-Topic B will be contracts. Pre-application white papers and proposals submitted to Post Doc-Topic B must have a single lead organization and single submission for the pre-application white paper and the invited proposal. Awards will be made by a single award to the lead institution. Subawards, including all grants and/or contracts, are the responsibility of the award recipient; exceptions will not be made.

Post Doc-Topic B: Postdoctoral Scholars Program (Thrusts 1-7)

*****PRE-APPLICATION WHITE PAPERS FOR THIS TOPIC ARE NO LONGER BEING ACCEPTED.**

Background: The Defense Threat Reduction Agency (DTRA) Postdoctoral Scholars Program started more than 20 years ago and has a proven track-record of success—measured by program participation by excellent professionals and follow-on career decisions. The future of the Postdoctoral Scholars Program remains consistent with the initial program goals of fostering and strengthening long-term strategic partnerships with the scientific community while leveraging the best and the brightest professionals to address critical science and technology challenges of interest to DTRA. This topic seeks a contracted partner(s) to continue the Postdoctoral Program at DTRA.

The benefits to the contracted partner(s) are that of enhanced institutional ability to effectively combat the threat posed by WMD through strengthened relationships with DTRA as well as workforce development. The benefit for the individual program participants is also tremendous. Each Postdoctoral Scholar is exposed to a breadth of information and gains knowledge of current capabilities, critical national security challenges, and the business of government—areas of skill development that are not readily available through many other early career opportunities.

Impact: The overall purpose of this programmatic initiative is to provide advanced research support, technical expertise, and execution capabilities in scientific, technical, and engineering disciplines relevant to the DTRA mission, specifically those that directly enhance the institutional ability to effectively combat the threat posed by WMD.

Objective: To find a contracted partner(s) organization that is capable of providing up to eight Postdoctoral Scholars (as an initial estimate of the program). The overall program contract period of performance will be 60 months (5 years).

Postdoctoral Scholars will possess doctoral degree credentials. They will be American citizens, capable of obtaining security clearances at the Secret level; clearances at higher levels will be considered on a case-by-case basis. They will exhibit such academic, research, and/or professional credentials as to demonstrate a disciplinary “state of the art” focus, flexibility, and innovation in methodology and approach, which will ultimately enhance the mission capabilities of DTRA.

Requirements and needs for the provision and assignment of such Postdoctoral Scholars, as may be selected to participate under this program, will be defined and prioritized by Agency

leadership, as deemed appropriate. The successful applicant(s) to this topic will provide an appropriate process for the provision of suitable candidates with advanced educational credentials and capabilities responsive to the stated requirements and needs.

Science, technology, engineering, and mathematical skills particularly critical and highly desirable to the enhancement of the Agency mission include: nuclear and radiation physics; weapons engineering; structural, electrical, and mechanical engineering; broad-based nano-technological engineering and applications; weapons effects and system response technologies; physics, chemistry, and biological sciences related to detection, characterization, and destruction of WMD materials; medical and pharmaceutical sciences; information technology, modeling, technical editing and publication, data visualization, data science, and advanced computational sciences; social, adversarial, and behavioral modeling, science, and analysis. This is not an exclusive listing, and DTRA reserves the right to amend this skill list as mission requirements warrant.

Postdoctoral Scholars will be assigned to DTRA functions, missions, and projects according to their respective specialties and at such places and locations determined to be in the best interests of the Agency (taking into practicable account individual career and professional needs). These locations may include DTRA facilities, national and/or DoD laboratories, other government facilities, military facilities, and contractor sites. They will serve as independent technical advisors and professional subject matter experts (SME) on scientific, technical, and engineering issues related to the execution of the DTRA mission.

Each Postdoctoral Scholar will be assigned a DTRA Mentor to guide, lead, and ensure the optimal utilization of each participant, ensuring that all assigned Postdoctoral Scholars' duties maximize individual intellectual contributions to the overall enhancement of the Agency's capabilities. The Postdoctoral Scholars will report to these individuals on a regular basis to provide informal status reports, to present feedback, and to obtain guidance on current and future activities. Institutionally provided online library services is an important aspect to the success of the Postdoctoral Scholar.

To ensure the goals of the program are met to the maximum extent possible, as well as minimize disruption on academic and professional careers, a minimum commitment of one calendar year of effort per Scholar appointment is required. Two additional one calendar year extensions may be made available as determined by the DTRA manager and on the desire of the Postdoctoral Scholar to extend.

Postdoctoral Scholars will be expected to perform some travel (both local and non-local) approximately once a month during their assignment to DTRA to maintain their technical proficiency. This travel will include, but is not limited to, national conferences, symposia, workshops, interfacing with their home organizations, and site visits for outreach. Travel may also include, but is not required, one or more international conferences.

Thrust Area 7 has ten (10) topics —Topics M1-M10 —detailed below. Submissions to the general thrust area descriptions for this thrust area in accordance with the requirements detailed in this BAA are also welcome.

- If NOT submitting to one of the specific topic numbers detailed below, use one of the **Thrust Area NO TOPIC** application packages
- If you ARE submitting to one of the specific topic numbers detailed below, use the applicable **Basic Research-Thrust Area 7-Topic M1 to M10** application package

Great care must be taken to use the appropriate application package on www.grants.gov, as the package selection dictates how each submission will be reviewed:

*****BASIC RESEARCH TOPICS M1-M10*****

In accordance with Section 4.2.1, the requirement for abstract pre-coordination is waived for Topics M1-M10; these topics do NOT require pre-coordination of an abstract prior to the submission of pre-application white papers. All other pre-coordination requirements remain in effect.

The pre-application white paper deadline for Topics M1-M10 is 3 February 2023. **PRE-APPLICATION WHITE PAPERS FOR THESE TOPICS MUST BE SUBMITTED BY 11:59 PM (MIDNIGHT) EST ON 3 February 2023.** White papers submitted to Topics M1-M10 may not be considered if they are received after this deadline.

Topics M1-M10 are interested in research projects that span from those that focus on exploratory aspects of a unique problem or approaches to those that involve a comprehensive program with interdisciplinary areas. Consistent across all proposals should be the focus on innovative research with the potential for high impact to C-WMD science.

The following topics are Basic Research topics, and proposals should not be solely written with or marketed to a DoD centric application; the offerer should also present a description of the broader implications of their work to our Nation and the whole of society.

DTRA anticipates that the predominance of awards made under Topics MI-M10 will be grants. Pre-application white papers and proposals submitted to Topics M1-M10 must have a single lead organization and single submission for the pre-application white paper and the invited proposal. Awards will be made by a single award to the lead institution. Sub-awards, including all grants and/or contracts, are the responsibility of the award recipient; exceptions will not be made.

Thrust Area 7, Topic M1: Host Response to Emerging Viral Threats: Discovery of Common Mechanisms for Therapeutic Intervention

Award Amounts for this topic are anticipated to be up to $500,000 per year (total dollar value = direct and indirect costs). In all cases, the proposed award value should be clearly substantiated by the scope of the effort. Further guidance on scope and cost may be provided in each full proposal invitation.

The preferred award structure for this topic is a base period of two (2) years with up to three (3) additional years as possible options. However, pre-application white papers and proposals that outline scope and effort for only the base period and do not propose options are also acceptable. Pre-application white papers and proposals that outline scope and effort for different base period and option combinations may also be considered; however, note that pre-application white

papers and proposals that outline scope and effort that exceed a total of five (5) years will not be considered.

Background: Direct acting antivirals deployed during the COVID-19 pandemic have helped mitigate the effects of the viral infection when administered early in the course of disease; however, the disease processes targeted and induced by SARS-COV2 have been persistent and have contributed to long periods of morbidity in several subsets of the population. The COVID-19 pandemic highlights the need for additional therapeutic strategies, such as host-targeted therapeutics, that are effective in mitigating or reversing symptoms caused by viral infection.

This solicitation seeks research to understand host processes and mechanisms involved in viral infection, replication and disease progression for members of viral families Filoviridae (e.g. Sudan, Marburg, Ebola), Hantaviridae (e.g. Hantaan), Arenaviridae (e.g. Lassa, Machupo), and/or Togaviridae (e.g. VEEV, EEV), which can leveraged to identify common host targets for broad-spectrum (i.e., multi-pathogen) therapeutic intervention.

Impact: If successful, this effort will result in the discovery and validation of host processes and mechanisms common among/within viral families that can be targeted to develop broad-spectrum, host-directed therapeutic medical countermeasures for emerging threats.

Objective: Pre-application white papers and proposals will describe technical approaches to characterize and identify host processes and mechanisms common among/within viral families of interest to the ChemBio Defense Program that are involved in the propagation of viral pathogens and/or are linked to the progression of disease in an infected patient. The approach proposed must include methods for confirming the role of identified targets in viral infection or pathogenesis in more than one orthogonal assay. Experimental methods may include cell cultures, micro-physiological systems, *ex-vivo* systems, and small animal models of disease. The data collected must be documented and formatted such that it can be used by potential collaborators for future development of therapeutic medical countermeasures.

References:

1. Geraghty RJ, Aliota MT, Bonnac LF (2021) Broad-Spectrum Antiviral Strategies and Nucleoside Analogues, Viruses, 13(4):667. doi: 10.3390/v13040667.
2. Lu L, Su S, Haitao Yang H, Shibo Jiang S. (2021) Antivirals with common targets against highly pathogenic viruses, Cell 184(6):1604-1620.
3. García-Cárceles J, Caballero E, Carmen Gil C, Martínez A,(2022) Kinase Inhibitors as Underexplored Antiviral Agents J. Med Chem 65(2):935-954

Thrust Area 7, Topic M2: Exploration of Consumer Non-invasive Brain-Computer Interface (BCI) Technologies for Chemical and Biological Defense (CBD) Applications

Award Amounts for this topic are anticipated to be up to $500,000 per year (total dollar value = direct and indirect costs). In all cases, the proposed award value should be clearly substantiated by the scope of the effort. Further guidance on scope and cost may be provided in each full proposal invitation. Award amounts for this topic are anticipated to be commensurate with the

proposed work involved in exploring consumer non-invasive brain-computer interface for CBD applications, evaluating materials, and other aspects of this program outlined in the metrics below. It is anticipated that teams with varying expertise are required to meet the metrics outlined below.

The preferred award structure for this topic is a base period of one (1) years with up to four (4) additional years as possible options. However, pre-application white papers and proposals that outline scope and effort for only the base period and do not propose options are also acceptable. Pre-application white papers and proposals that outline scope and effort for different base period and option combinations may also be considered; however, note that pre-application white papers and proposals that outline scope and effort that exceed a total of five (5) years will not be considered.

Note: For this topic, awardees will be required to grant the US Government a licensing agreement to all software and or hardware in perpetuity for all Chemical and Biological Defense Program (CBDP) uses.

Background: The battlespace is a complex environment with the six fundamental variables of combat represented by the military acronym METT-TC (Mission, Enemy, Troops, Terrain and weather, Time available, and Civilian considerations). For CBRN operators, the operation variables are further complicated by the threat of operating in contaminated environments. To protect our Warfighters, Mission Oriented Protective Posture (MOPP) is the standard protective gear used when operating in contaminated environments. However, it is known that wearing MOPP gear can cause physical and mental stress as well as reduction in mobility, sensory awareness, attention, alertness, and both gross and fine dexterity [1-3]. The situational uncertainties, physical limitations, and the associated risks can impact awareness of the situation while operating in such a complex and dynamic environment. Yet, effective decision making is built off of situational awareness and the ability to recognize the essence of a given problem and the creative ability to devise a practical solution. These abilities are the products of experience, education, and intelligence [4]. Therefore, the Joint Science and Technology Office Digital Battlespace Management Division (JSTO CBI) is seeking methods that can allow easier access to information while operating to enable comprehensive decision making, and promote the inheritance of knowledge and experience.

JSTO CBI has identified brain-computer interface and the related neurotechnologies as the potential solution. The human brain, formed by nearly 100 billion neurons and 100 trillion connections, is one of the greatest mysteries in science. With the dedication of neuroscientists, it is now common knowledge that these neurons and connections work to process and transmit electrophysiological signals. Jacque Vidal asked in his publication Toward Direct Brain-computer Communication nearly half a century ago [5], “Can these observable electrical brain signals be put to work as carriers of information in man-computer communication or for the purpose of controlling such external apparatus as prosthetic devices or spaceships?”. In this topic, JSTO CBI would like to ask a similar question—can these observable electrical brain

signals be put to use in order to serve our Warfighters in Chem/Bio defense missions and tasks.

A brain-computer interface (BCI) is a communication system that allows human interactions with surroundings without the involvement of peripheral nerves and muscles. Such interaction is achieved by leveraging control signals generated from electroencephalographic activity [6]. BCI can serve to record data from the brain for further decoding to transform the data into meaningful outputs for purposes such as control of external devices (e.g., robotic limb) [7]. Because of the possible external device control, BCI applications in medical fields for restoration purposes are often seen. However, the advancements in neuroscience and BCI is shining light on other applications. This expansion toward other applications is evident with an unprecedented amount of corporate investments in neurotechnologies, such as Nissan's brain-to-vehicle [8], Valve Software's focus on BCI for virtual reality (VR) interaction [9], Facebook's optical BCI investment [10], and Neuralink's focus of bringing neurotechnology to the mass market. Although nascent, this trend is expanding toward applications other than restoration of physical functions.

The combination of BCI, Team Awareness Kit (TAK), and heads-up display technologies are potential tools that can provide enhanced situational awareness to the Warfighters while operating in highly dynamic and hazardous environment as an alternative to commonly seen hand gesture, eye-tracking, or voice controls, allowing Warfighters to have hands on tasks, eyes on target, and minimal risk of exposing their locations. It is desired to explore whether consumer non-invasive BCI can be exploited for human interest detection (HID) [11] and decision making [12, 13] to support CBD situational awareness and mission readiness. JSTO CBI is seeking to investigate the possibility of leveraging consumer non-invasive BCI for human interest detection (HID) in combination with artificial intelligence (AI) or machine learning (ML) models to help reduce cognitive load by reducing amount of information to be projected on head-up displays (HUD). It is also of interest to explore if and how the detected interest can be leveraged to enhance or facilitate decision making. Additionally, we seek to answer the question whether consumer non-invasive BCI can assist understanding the key responses that lead to successful completion of tasks in hazardous and dynamic environments.

Impact: The research in this topic seeks to explore the potential and possibilities of leveraging signals from consumer non-invasive BCI for detecting human interest toward the applications of HUD content control, CBD knowledge inheritance, and decision making. The results of the studies are envisioned to reduce cognitive load and enhance decision making when operating in high-stress, dynamic, and hazardous environments as well as to promote the preservation of critical CBD operational knowledge.

Objective: Pre-application white papers and proposals should describe the development and demonstration of the potential to leverage signals from consumer non-invasive BCI to detect human interest for the purposes of HUD content control to reduce cognitive load, enhance decision making, and preserve and extract critical knowledge or responses from experienced

CBD operators.

Applicants should consider methods that leverage consumer non-invasive BCI and related neurotechnologies for the above mentioned 3 areas. Proposed work focusing on selecting any number of the above listed areas will be considered. Proposed work should employ a phased approach with the following recommended stages of applications:

- Demonstrate capabilities in controlled indoor settings to allow explorations and baselining
- Demonstrate capabilities in controlled outdoor settings to explore influences from outdoor environment
- Demonstrate capabilities in a stressed outdoor environment that simulates a dynamically changing battlefield
- Demonstrate capabilities in a stressed outdoor environment with tasks to simulate the level of complexity to carry out a mission in dynamically changing battlefield

The order and stages of milestones are open to modifications that best support the proposed studies. The number of subjects to be involved in phases should be considered. Applicant should consider IRB and HRPO processes when proposing the research schedule.

Research areas may include, but are not limited to:

- Exploration of applicability of one or multiple consumer non-invasive BCIs for signal extraction
- Exploration of different modalities of consumer non-invasive BCI (e.g. EEG-based, in-ear BCI)
- Development of necessary AI/ML algorithms or models to achieve the goals of HID for HUD content control, achieve enhanced decision making, or preserve critical CDB knowledge

Proposed work may leverage a combination of multiple consumer non-invasive BCI devices. It should be noted that minimum modifications to consumer non-invasive BCI devices are acceptable. However, this topic is not aimed at hardware development and should focus on making use of signals available from consumer non-invasive BCI devices. Applicants are encouraged to consider leveraging TAK variants when reasonable.

It is anticipated that this topic will require teams of researchers with different expertise in brain-computer interface, neurotechnologies, AI/ML, computer science modeling, and extended reality. A justification of the budget will need to be provided to supplement the costs proposed for this effort.

References:

1. FM 3-4. NBC Protection. Department of Army. US Marine Corps. Washington D.C. 29 May 1992.
2. Headley, D.B. et. al., (1997). The Impact of Chemical ProtectiveClothing on Military OperationalPerformanc Military Psychology, 9(4), 359-374
3. Giat, R. H., 2014, Thickness of Butyl Gloves Significantly Impacts Gross and Fine Dexterity—A Randomized Controlles Crossover Trial. Worldwide Military-Medicine.com. https://military-medicine.com/article/2387-thickness-of-butyl-gloves-

significantly-impacts-gross-and-fine-dexterity-a-randomized-controlles-crossover-trial.html
4. U.S. Marine Corps (1997). MCDP 1: Warfighting. PCN 142 000006 00
5. Vidal, J. J. (1973). Toward direct brain-computer communication. Annual Review of Biophysics and Bioengineering, 2, 157–180. https://doi.org/10.1146/annurev.bb.02.060173.001105
6. Nicolas-Alonso, L. F. and Gomez-Gil, J. (2012). Brain Computer Interfaces, a Review. Sensors, 12, 1211-1279. https://doi.org/10.3390%2Fs120201211
7. Osborn, L. E., Betthauser, J. L. and Thakor, N. V. (2019). Neural Prostheses. In J. G. Webster (Ed.), Wiley Encyclopedia of Electrical and Electronics Engineering, 1–20. John Wiley & Sons. https://doi.org/10.1002/047134608X.W1424.pub2
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Thrust Area 7, Topic M3: Leveraging quantum effects to improve diagnostic and detection capabilities for threat agents

Award Amounts for this topic are anticipated to be up to $500,000 per year (total dollar value = direct and indirect costs). In all cases, the proposed award value should be clearly substantiated by the scope of the effort. Further guidance on scope and cost may be provided in each full proposal invitation. Award amounts for this topic are anticipated to be commensurate with proposed research seeking to characterize, control, or exploit quantum mechanical effects and properties involved in biological interactions for the purpose of improving detection and diagnostic tools. It is anticipated that teams with varying expertise are required to meet the metrics outlined below.

The preferred award structure for this topic is a base period of two (2) years with up to three (3) additional years as possible options. However, pre-application white papers and proposals that outline scope and effort for only the base period and do not propose options are also acceptable.

Pre-application white papers and proposals that outline scope and effort for different base period and option combinations may also be considered; however, note that pre-application white papers and proposals that outline scope and effort that exceed a total of five (5) years will not be considered.

Background: Current diagnostic and detection technologies are largely based on our understanding of biological processes at the macromolecular scale. In order to develop transformative solutions that improve our ability to identify threats and approach the ultimate limit of single cell and single molecule detection in handheld assays, we must seek to understand and leverage knowledge of the processes that occur in the quantum realm. There are numerous ways quantum mechanics can be exploited to improve portable, handheld diagnostic and detection assays including leveraging knowledge gained through quantum biological processes, exploitation of quantum light properties, and the use of quantum materials that interact with biological molecules.

The burgeoning field of Quantum biology seeks to achieve a better understanding of quantum mechanics in biological processes. It involves the study of the influence of non-trivial quantum phenomena which can be explained by reducing the biological process to fundamental physics. Quantum measurements in noisy biological environments pose a formidable challenge, but work in this field has already begun leveraging higher resolution tools and even synthetic biology methodologies to elucidate biological activities that involve quantum effects such as tunneling, coherence, and entanglement. Is it possible that knowledge gained from this work could be leveraged to increased signal amplification or reaction speeds for biological assays?

Diagnostic and detection technologies could also be improved by exploiting the quantum properties of light. Many biological assays, such as optical microscopy, cellular histology, and fluorescence immunoassays use classical light for detection/readout. In contrast to classical light, quantum light can have unique properties, such as temporal/spatial coherence or entanglement that can provide unique advantages, including increased sensitivity, lower light dose, superior spatial resolution, or wider and novel spectral windows of observation. Recent work has brought together quantum physics and biology to show that quantum light can be used to track enzyme reactions in real time. This made it possible to use low illumination without disrupting the enzymes, with the potential to achieve a better sensitivity. This type of work is an important step toward development of quantum sensors for biomedical applications.

Another potential area of exploration is the use of quantum materials to improve sensitivity of assay read out. Here, we define quantum materials as systems where key material properties (such as discrete and quantized fluorescence emission or altered/enhanced electrical conductivity properties) stem from quantum effects such as quantum confinement. This confinement may come in zero dimensional materials (e.g. quantum dots or vacancy centers), 1D materials (such as carbon nanotubes or nanowires) or 2D quantum materials such as graphene. The small and reduced dimension of these materials generally makes them sensitive to their local nano-environments, which have the potential to be used as ultra-sensitive reporters of chem/bio agents and their effects on cellular and human health.

This topic seeks to leverage quantum mechanics to gain better understanding of biological processes and to exploit quantum mechanical effects or properties to develop transformative

solutions for the diagnosis of disease and detection of threat agents.

Impact: This topic encompasses broad topics related to applying quantum mechanics and quantum tools and materials, as well as exploitation of quantum effects to improve diagnostic and detection capabilities for chemical/biological threats. Successful efforts from this topic will provide novel solutions for improving the sensitivity or specificity of diagnostic and detection capabilities.

Objective: Proposals for this topic should address the broad objective of using quantum mechanics to improve diagnostic and detection capabilities. Quantum material proposals for this call should focus on novel materials and synthesis methods, therefore, proposals including established commercial off-the-shelf (COTS) materials will not be considered. Examples of specific research questions that may be addressed include but are not limited to the following:

- What quantum effects play a non-trivial role in biological processes and how can these effects be exploited to improve point of care diagnostic and detection capabilities?
- Can quantum mechanical effects or properties be used to enhance the sensitivity, resolution, or specificity of biological assays in areas important to biological health or chemical/biological agent detection?
- Can quantum mechanical effects or properties be used to extend bio-imaging and sensing to important novel spectral windows difficult to obtain via classical methods?
- Can quantum mechanical effects or properties be used to extend the observation period or increase the spatial resolution of visualizing host-pathogen or host-agent interactions and interventions?
- Can quantum mechanical effects or properties be used to reduce the cost or SWAP (Size, Weight, and Power) requirements for standard biological assays, chemical/biological agent detection, or imaging methods?
- Are there key biological molecule and quantum materials interactions of relevance to chemical and biological agent interactions that could be shaped/manipulated/detected because of quantum interactions?
- Can new quantum materials be developed and exploited to measure parameters of interest to biological health in response to chemical/biological agents?
- Can new quantum materials be developed for chem/bio detection and sensing, measuring key biomolecular properties on spatial or temporal scales un-obtainable via classical methods?

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Thrust Area 7, Topic M4: Let's Get Moving: Surface Agitation and Self-propellant Materials in Liquid Films for Decontamination

Award Amounts for this topic are anticipated to be up to $500,000 per year (total dollar value = direct and indirect costs). Award Amounts for this topic are anticipated to be indicative of the amount of work involved to comprehensively address the objectives of this program outlined below. It is anticipated based on this topic that there will be teams with varying expertise that is required. In all cases, the proposed award value should be clearly substantiated by the scope of the effort. Further guidance on scope and cost may be provided in each full proposal invitation.

The preferred award structure for this topic is a base period of two (2) years with up to three (3) additional years as possible options. However, pre-application white papers and proposals that outline scope and effort for only the base period and do not propose options are also acceptable. Pre-application white papers and proposals that outline scope and effort for different base period and option combinations may also be considered; however, note that pre-application white papers and proposals that outline scope and effort that exceed a total of five (5) years will not be considered.

Background: Decontamination and protection rely on diffusion of toxic chemicals (for example GD, HD, and VX) to active/catalytic sites that will then detoxify those materials. Although highly efficient towards toxic chemical decomposition these active/catalytic materials have the rate limiting step of being controlled by diffusion of the toxic chemical to active sites. Having a reactive or catalytic decontamination technology with the capacity to be "mobile" could impact the ability for the decontaminant to improve efficacy with respect to time (increasing the amount of analyte decontaminated in a specific time) and/or allow for migration of the decontaminant into small spaces where the current dominant mechanism is reliant on chemical diffusion out of these small spaces such as rivets or metal joints on vehicles.

Current research in micromotors, active droplets, small scale/micro-swimmers, and propelled metal organic frameworks (as examples) have explored these "mobile" materials for toxic chemical remediation, detection and neutralization, improved mixing to reduce increase reaction efficiency and also including wastewater remediation of various chemical and biological contaminants. Researchers have also studied mechanisms of particulate self-propellancy and interactions with other particles (e.g. swarm behaviors) and different geometries and chemistries to introduce additional functionalities for detection, monitoring, and decontamination. These technologies have the potential to allow for self-propellancy of the decontamination technology such that the decontaminant could maneuver across surfaces and/or into complex features to allow for self-propellant behavior to/from contaminated areas or surfaces increasing rates of decontamination and getting into complex features where current diffusion based mechanisms

are dominant.

This topic seeks to develop a fundamental understanding of how to develop and integrate components for both self-propellant and decomposition of toxic chemicals (surrogates, simulants or model systems) into one material. Initial studies can be initially demonstrated in solution, with the ultimate goal to minimize the solvent to a liquid film on a surface. This topic also seeks self-propellant behavior through utilizing internal or external stimuli (chemical reactions, attraction/repellency, enzymatic, biologically inspired, light, pH, magnetism, electrostatic, ultrasound, predator/prey relationships or other mechanism) without requiring mechanical stirring or other direct intervention.

Impact: If successful the methods and materials developed during this effort could be developed into a new decontamination technology or integrated with existing platforms to increase rates of surface decontamination and increased diffusion/decontamination rates in areas that are difficult to decontaminate.

Objective: This topic seeks to develop a fundamental understanding of how to develop and integrate components for both self-propellant and decomposition of toxic chemicals (surrogates, simulants or model systems) into one material capable of neutralizing toxic chemicals. Proposals should describe the approach for investigation of the components and integration of these materials for eventual use in or on surfaces or in complex features that will be self-propellant with internal or external additives or other triggers (e.g. chemicals, catalytically propelled, light, pH, magnetic particles, Marangoni effect, thermal, concentration gradients, other particle attraction/repulsion interactions) and reactive or catalytic towards toxic chemicals decomposition/destruction. Proposal designs should include the following:

- Base Period Goals:
    - Proof-of-concept (iterative design, development, fabrication, and characterization) of an active/self-propellant material or self-propellant phase (micromotor, active droplet, etc.) and a catalytic or reactive component for decomposition of surrogates/simulants or a model system for one or more toxic chemicals.
    - Initial studies of mechanisms and kinetics of decomposition with these materials in the model system or for simulants/surrogates including determination of efficacy of static versus self-propellant version of the material in liquid films
    - Initial studies of multiple materials in close proximity (e.g. aggregation potential)
    - Preliminary fundamental studies of self-propellancy and development/use of methods to measure self-propellancy of these materials in liquid films
    - Demonstration of relative efficacy for simulants of static and self-propellant version of the offerors concept and demonstration of self-propellancy of the initial designs in liquid films to adjudicate potential for future work
- Option Period(s) Goals
    - Year 3: Refined studies of mechanisms and kinetics of decomposition with these materials in the model system or for simulants/surrogates ; continued advancement of decontamination rates and improved kinetics of diffusion to/from

these integrated materials on surfaces; continued study of efficacy rates relative to static materials

- Year 4: Determine stability (mechanical, chemical); formal study of behavior of multiple self-propellant materials in close proximity; determination of initial ability for use on actual surface materials or in complex features
- Year 5: Determination of ability to maneuver, traverse longer distances and encounter other materials; determination of efficacy of reaction of simulant/surrogates and efficacy relative to time, determination of chemical decomposition rates relative to static material using DMMP, DIMP, CEES or other simulants.

The selected providers must provide appropriate model systems/reactions for CB defense applications showing promise for compatibility with potential protection and hazard mitigation technologies.

Proposals should focus on one or more toxic chemicals and associated model compounds. It is expected that the awardees will work only with simulant/surrogates and/or model compounds as part of this research. Actual chemical agents should be considered but not proposed as part of this work.

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Thrust Area 7, Topic M5: Medical Countermeasures Against the Aging of Acetylcholinesterase Complexed with Organophosphate Agents

Award Amounts for this topic are anticipated to be up to $500,000 per year (total dollar value = direct and indirect costs). In all cases, the proposed award value should be clearly substantiated by the scope of the effort. Further guidance on scope and cost may be provided in each full proposal invitation. Award amounts for this topic are anticipated to be commensurate with the proposed work involved in developing novel in vitro models. It is anticipated that teams of collaborating organizations with varying expertise maybe required to meet the metrics outlined below.

The preferred award structure for this topic is a base period of three (3) years with up to two (2) additional years as possible options. However, pre-application white papers and proposals that outline scope and effort for only the base period and do not propose options are also acceptable. Pre-application white papers and proposals that outline scope and effort for different base period and option combinations may also be considered; however, note that pre-application white papers and proposals that outline scope and effort that exceed a total of five (5) years will not be considered.

Background: Organophosphate agents (OP) continue to be a threat to the Armed Forces and

agricultural workers, and there are no broad spectrum medical countermeasures for treatment of OP intoxication. The management of OP exposure is further compounded by the phenomenon of "aging," during which the OP-ChE conjugate is dealkylated, and the enzyme inhibition becomes irreversible. Once aging has occurred, existing medical countermeasures become ineffective. The rate of onset of aging is variable **across** OP agents, but can occur fast enough to severely limit treatment options post-exposure.

The structural basis of the aging process for OP-ChE conjugate has been investigated, and protein structural effects seem to be critical to the irreversibility of aging. As early as 2008, X ray diffraction and other analysis have shown that the aging process involves agent O-dealkylation resulting in a negatively charged oxygen "salt bridge" to a proximal histidine in AChE, as well as conformational changes. These insights have not, however led, to progress against the problem of aging.

Since then, there are multiple lines of evidence that the aging phenomenon both is dependent on particular enzyme structural features in order to occur, and imposes structural effects on the enzyme that prevent reactivation. Specifically, aging can be inhibited by both mutations to the AChE and interactions with other molecules that affect protein structural dynamics. On the other hand it is shown that aged OP-AChE conjugate has increased rigidity compared to the native enzyme, which is thought to prevent countermeasure access to the active site and interaction to restore function.

Separately the science of structural biology has advanced significantly since the time of these findings. There are now theoretical and analytical tools for structural analysis that have not yet been fully investigated for their relevance to this problem. Therefore, the intent of this topic is to support novel approaches using emerging structural tools and insights to defeat the problem of OP-AChE aging and to expand the utility of existing OP countermeasures.

Impact: Successful execution of this effort will establish the foundation for novel therapeutic approaches using the prevention of OP-AChE aging as an adjunct or alternative to the standard of care, reactivation of AChE from OP inhibition. As a result, the utility of existing countermeasures will be expanded to a larger therapeutic window after exposure, and exposures to fast-aging OPs that were previously not treatable in practical terms will become more available to medical intervention.

Objective: This program seeks to leverage the known structural aspects of the OP-AChE aging process and the emerging technologies in the prediction, study, and control of protein structure to establish a basis for preventing OP-AChE aging.

Pre-application white papers and proposals should describe the development and demonstration of novel insight into the role of protein structure changes in the OP-AChE aging process as well as approaches to modulating structural effects to prevent or reverse OP-AChE aging.

- Considerations for a responsive proposal can include the following:
- The investigation of a structural basis for restoring catalytic function to aged OP-AChE conjugate.
- The investigation of a structural basis for preventing formation of aged OP-AChE conjugate.
- The targeting of OPs, e.g. with small molecules, to prevent them from being able to age with AChE.

- Mechanistic understanding of any of the above processes.
- Ensuring the mechanisms developed are broadly applicable to a spectrum of OP agents.
- Use of AI/ML and/or microphysiological systems (MPS) (e.g. organ-on-a-chip or human-on-a-chip) to establish and characterize rational approaches to these solutions.
- Integrating the issue of physiological relevance early in the development of these medical solutions, to support their ability to eventually transition to human use.

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Thrust Area 7, Topic M6: In Vitro Model Development of Alphavirus Infection

Award Amounts for this topic are anticipated to be up to $500,000 per year (total dollar value = direct and indirect costs). In all cases, the proposed award value should be clearly substantiated by the scope of the effort. Further guidance on scope and cost may be provided in each full proposal invitation. Award amounts for this topic are anticipated to be commensurate with the proposed work involved in developing novel in vitro models. It is anticipated that teams of collaborating organizations with varying expertise maybe required to meet the metrics outlined below.

The preferred award structure for this topic is a base period of three (3) years with up to two (2) additional years as possible options. However, pre-application white papers and proposals that outline scope and effort for only the base period and do not propose options are also acceptable. Pre-application white papers and proposals that outline scope and effort for different base period and option combinations may also be considered; however, note that pre-application white papers and proposals that outline scope and effort that exceed a total of five (5) years will not be considered.

Background: Neuroinflammation is present in nearly all pathological conditions in the central nervous system (CNS) by either being the primary cause of the condition or as a response to the disruption of homeostasis following disease progression. Microglia and astrocytes become

activated following insult or injury to the CNS. The resulting crosstalk between neurons, astrocytes, and microglia has been shown to play a significant role in the observed neuroinflammatory response including dysregulation of endothelial signaling pathways.

For alphaviruses the pathology surrounding brain inflammation is a significant factor of the disease and is therefore a target for medical countermeasure development. For example, Severe Combined Immunodeficient (SCID) mice survive longer than immune-competent mice suggesting that it is the inflammation that is the major contributor to morbidity, rather than any immune deficiency.

Alphaviruses poorly elicit an innate immune response in cell culture which leads to mischaracterization of in vivo tropisms. In addition, current cell culture models are limited in their ability to observe the effects of membrane-bound or cell proximity-dependent mechanisms and such innate responses. Recent advances in the manipulation of individual cell types and culture systems offers new possibilities to develop cell, tissue, and 3-D models to better represent animal model systems.

Impact: The research explored in this topic seeks to develop new neurotropic cell and tissue based models that better mimic the natural response to infection. Few current neuroinflammatory models are able to capture the important interplay between neurons, astrocytes, and microglia. Thus, there is a need for new, multicellular culture systems that are capable of modeling the impact of crosstalk between different cells in the CNS. This could result in an enhanced understanding of the fundamental regulators of the CNS, increase target identification, better prediction and screening for promising medical countermeasures.

Objective: Pre-application white papers and proposals should describe how their proposal would be used in drug discovery.

Research areas may include, but are not limited to:

- Neurovascular tissues and alphaviruses (VEEV/EEEV/WEEV)
- Characterization of molecular pathways and/or mechanisms of action for alphavirus-induced inflammation.
- Identify common molecular pathways and/or mechanisms of action for alphavirus-induced host response that may be suggestive of novel targets for therapeutic intervention.
- Scaffold based techniques such as hydrogel-based support, polymeric hard material-based support, hydrophilic glass fiber, and organoids
- Scaffold free hanging drop microplates, magnetic levitation, and spheroid microplates with ultra-low attachment coating
- The development of CNS organoids, spheroids, 3D printed microfluidics, methods of improving imaging, automation of liquid handling, and other innovative technologies.

It is anticipated that this topic will require teams of researchers with different expertise in modeling, synthesis and characterization of these materials. A justification of the budget will

need to be provided to supplement the costs proposed for this effort.

Pre-application white papers and proposals may focus on incremental and high risk attempts to develop realistic in vitro models.

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Thrust Area 7, Topic M7: Correlating Multi-omics Changes with Measurable Physiological Responses

Award amounts for this topic are anticipated to be commensurate with the proposed work involved in elucidating the underlying principles for multi-omics and other biomarkers in response to chemical and biological (CB) agent exposure and the ability to use them to quantify human physiological responses. It is anticipated that a multi-disciplinary team is required to meet the metrics outlined below.

The preferred award structure for this topic is a base period of one (1) year with up to two (2) additional years as possible options. However, pre-application white papers and proposals that outline scope and effort for only the base period and do not propose options are also acceptable. Pre-application white papers and proposals that outline scope and effort for different base period and option combinations may also be considered; however, note that pre-application white papers and proposals that outline scope and effort that exceed a total of three (3) years will not be considered.

Background: Infectious disease pathogenesis is often first recognized at the onset of symptoms in an infected individual. A cascade of chemical mediators and cellular pathways trigger the inflammatory response to infection and cause measureable physiological symptoms, such as increased temperature and a change in cardiac rhythms, which are felt by the individual as having a fever and feeling generally unwell.[i] Throughout this response to infection, changes in specific biomarkers have been characterized, to include total white blood cell count (WBC), C-reactive protein (CRP), and procalcitonin (PCT).

Beyond vital signs and biomarkers, multi-omics (transcriptomic, proteomic, and metabolomics) have been increasingly studied to advance the molecular understanding of host-pathogen interactions during viral and bacterial infections. Specifically, multi-omic approaches have been

used to characterize virulence, pathogenicity, and metabolic pathway regulation after infection.[ii]

Similarly, exposure to chemical agents has been shown to cause substantial omics changes, notably significant downregulation of multiple proteins. A proteomic-based study examined the impact of the never agent soman on brain tissue in small animals. The soman-induced proteomic changes impacted key pathways for cell inflammation, metabolism, neurodegeneration, and cell death, among others, and demonstrated that persistent proteomic changes in the brain can cause multiple neurological effects.[iii]

While research on both physiological effects and multi-omics data related to CB agent exposure continue to advance alongside one another, there is limited evidence correlating the two research areas. This topic seeks to determine the feasibility of correlating multi-omics from the course of infection or chemical exposure with specific physiological responses such as *changes* in heart rate, temperature, respiratory rate, and blood pressure.

Impact: DTRA continues to invest in leveraging data collected from wearable devices to provide early warning of CB threat agent exposure[iv], as well as in advancing research on understanding multi-omics effects of CB exposure to aid in improved diagnostics, therapeutics, and medical intervention to minimize warfighter casualties. However, physiological data collected from wearable devices is limited to more common infections, such as influenza and COVID, and does not cover the full breadth of CB threats. By answering fundamental questions on the feasibility of correlating multi-omics data with the physiological response to infection/exposure, it may be possible to extend the current state-of-the-art for wearables-based early warning to encompass additional threat agents. Organ-on-a-chip (OOC) technology provides an opportunity to explore multi-omics changes across a wide array of tissue types in response to different CB threats, which may allow for data collected from multi-omics OOC studies to be leveraged to improve predictive wearable based algorithms specific to CB agents.

Objective: Pre-application white papers and proposals should describe an approach for inferring changes in, and quantifying, if possible, specific physiological responses (e.g., vital signs) as they relate to biomarkers and multi-omics data collected during biological pathogenesis or chemical agent exposure. Applicants should propose access to datasets that include **both** physiological and multi-omics data for the same patient during course of infection or chemical exposure, and may consider leveraging additional Sponsor-provided datasets.

Applicants should demonstrate expertise in the areas below and propose methodology to assess the following:

- Commercial-off-the-shelf (COTS) wearable-based data analysis
    - Understand changes in the physiological response after exposure to CB agents.
    - Propose methodology to compare COTS wearable data with varying temporal resolutions, varying devices, and varying features.
    - Hypothesize key feature importance and probability for correlation to host response to infection.
- Multi-omics data analysis
    - Demonstrate experience with analyzing multi-omics data (e.g., proteomics,

metabalomics, transcriptomics, epigenomics) from blood, serum, interstitial fluid, saliva, or breath for biomarkers in response to disease/infection or exposure to chemical agents
    - Propose methodology for identifying key markers and/or specific cellular pathways following infection or chemical exposures and the intended approach for analyzing the impact of multi-omics changes on physiological response.
- Machine Learning (ML) approaches for analyzing disparate datasets
    - Propose intended ML approaches and demonstrate experience in selecting ideal approaches depending on dataset parameters and intended algorithm development.
- Hypothesis on correlating multi-omics and other biomarkers to vital sign data
    - Propose methodology and anticipated capability to leverage multi-omics data to qualitatively correlate it with changes in physiological responses (e.g., temperature, heart rate).
    - If feasible, expand the qualitative correlation between multi-omics data and the physiological responses to explore if changes in vital signs can be quantified (e.g., actual temperature or heart rate) based on multi-omics data alone.
    - Hypothesize the granularity of any correlation and methodology to assess this.

Final output of this topic should be a report on the feasibility of correlating multi-omics data with the physiological response (e.g., changes in vital signs) to a CB threat exposure. If a qualitative or quantitative correlation can be demonstrated, the methodology and underlying data analysis to support the correlation is an expected deliverable.

Data collections are not a part of this topic, and data proposed must already exist. Responses should discuss availability of or access to in-vivo datasets of omics and vital sign data, and/or expect to be able to Sponsor-provided datasets which include in-vivo omics data and vital sign data for all individuals.

It is anticipated that this topic will require teams of researchers with expertise spanning data analytics, ML and algorithm development, physiology, CB threat agents, and immunology / molecular cell biology. A justification of the budget will need to be provided to supplement the costs proposed for this effort.

1. El-Radhi, A. Sahib (2019). Pathogenesis of Fever. PubMedCentral <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7122269/>
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Thrust Area 7, Topic M8: Project MAGNETO, lowering SWaP for Microsensors

Award Amounts for this topic are anticipated to be up to $500,000 per year (total dollar value = direct and indirect costs). In all cases, the proposed award value should be clearly substantiated by the scope of the effort. Further guidance on scope and cost may be provided in each full proposal invitation. Award amounts for this topic are anticipated to be commensurate with the proposed work involved in elucidating the underlying principles for multiferroic materials, evaluating materials, integrating materials into a sensor prototype, computational models to understand the properties of proposed materials, and other aspects of this program outlined in the metrics below. It is anticipated that teams with varying expertise are required to meet the metrics outlined below.

The preferred award structure for this topic is a base period of three (3) years with up to two (2) additional years as possible options. However, pre-application white papers and proposals that outline scope and effort for only the base period and do not propose options are also acceptable. Pre-application white papers and proposals that outline scope and effort for different base period and option combinations may also be considered; however, note that pre-application white papers and proposals that outline scope and effort that exceed a total of five (5) years will not be considered.

Background: A variety of sensors are being researched and developed to detect chemical and biological (CB) threats in ambient conditions. Recently, there has been a paradigm shift in the field towards developing lower size, weight, and power (SWaP) microsensors to detect CB threats. As sensors are being studied to possibly use for detection applications of CB threats, there is a need to address how to smartly store the data gathered from the sensor. Employing a data storage capability that enables magnetoelectrically-coupled multiferroic materials to write electrically (faster, low power) and read magnetically (nondestructive), this integration into a sensor could provide a means to advance innovation into this area, resulting in a smaller bit size and reducing the applied external fields required within the circuity of the sensor. By having a lower demand on power, this will also help reduce the battery power needed to operate the sensor. Collectively, this could lower SWaP to advance microsensor development, enabling technologies that can operate longer in the battlefield due to lower power consumption and smarter data storage. This would equip the Warfighter with state-of-the-art innovative microsensors to support their mission and increase their situational awareness.

However, the challenge is to find single-phase materials exhibiting multiferroic properties, i.e. more than one type of ferroic property, at room temperature or composites merging ferroelectric and ferromagnetic materials. A major step toward making viable magnetoelectric technology would be the ability to alternate ferroelectric states with relatively minor voltages. The discovery of more magnetoelectrically-coupled materials or composites would help in the potential development of such sensors and modernizing technology.

This topic seeks to develop a fundamental understanding of multiferroic materials or composites (characterizing bulk materials and thin films), computational models to investigate the structural, magnetic, and electrical properties of materials and to compare to experimental studies, and

integration of the magnetoelectrically-coupled materials or composites into a sensor prototype. This topic also seeks to evaluate these materials integrated into a sensor prototype during year 5, and if milestones are achieved, this technology will be transitioned into a 6.2 program, supporting the Unconventional Detection Modalities Thrust Area listed in Division CBA's portfolio. This project also seeks to potentially develop a microsensor prototype to detect CWAs, emerging threats, and/or simulants of CWAs, and utilize data storage capacity to collect measurements. Measurements collected by the sensor can be AC impedance, infrared, Raman, photovoltaics, but not limited to.

While the ultimate intention is to integrate these materials into suit-based technologies that detect CB threats when exposed to low levels of emerging threats, CWAs, and/or simulants, the basic research should be focused solely on the magnetoelectrically-coupled multiferroic materials or composites to use as data storage for potential optimization and development of the next generation of microsensors.

Impact: The research explored in this topic seeks to develop a fundamental understanding of multiferroic materials (characterizing bulk materials and thin films), computational models to investigate the structural, magnetic, and electrical properties of materials and to compare to experimental studies, and integration of the magnetoelectrically-coupled materials or composites into a sensor prototype. This could be integrated into suit technology for microsensors that could be used to detect agents and other toxic emerging threats, mitigating risk for operational deployment and increasing the Warfighter's situational awareness. Thus, this technology can help unburden the Warfighter and promote integrated layer defense to support the mission.

Objective: Pre-application white papers and proposals should describe the research, development, and demonstration of the technology. Applicants should keep in mind the technology must be operationally relevant to support the Warfighter's mission and ability to tolerate varying environmental conditions in the battlefield.

Applicants should propose magnetoelectrically-coupled multiferroic materials or composites merging ferroelectric and ferromagnetic materials that will be able to have adequate activity to meet metrics including:

- Multiferroic properties –
    - More than one ferroic property: ferromagnetism, ferroelectricity, ferroelasticity, ferrotoroidicity
        - Antiferromagnetism and weak ferroelectricity will also be considered
    - Minimally magnetoelectric materials
- Characterization profile of the structural, magnetic, and electrical properties –
    - X-ray diffraction for crystal structure identification, phase verification, and Rietveld structure refinement
    - Neutron diffraction for crystal structure and magnetic structure identification as well as determining the atomic positions and bond lengths in the unit cell
    - Zero-field and field cooled susceptibility curves and hysteresis loops to provide information about the magnetism
    - Electrical polarization hysteresis loop to monitor the current density and

ferroelectricity
    - Dielectric constant as a function of temperature to provide insights toward the ferroelectric behavior and magnetoelectric coupling
- Fabrication of thin films –
    - Characterization profile of the structural, magnetic, and electrical properties
    - Investigation of films for data storage capability
- Computational models to help understand properties of materials
- Integration of materials into a sensor prototype as an optional year –
    - Demonstration that sensor can operate for at least an hour (threshold) and up to 12 hours (objective) after powered on.
        - Maintain ability to detect emerging threats, CWAs, and/or simulants for 1 to 12 hours but not necessarily continuously monitoring of agents or simulants
        - Ability to operate in varying environmental conditions, such as low and high relative humidity conditions, low and room temperature conditions, and salty, sandy, and smoky conditions
        - Demonstration of threshold metrics (above) within base period (3 years from award) or prove significant progress towards those goals
    - Require little or no external resources required to operate
- Live warfare agent testing should be strongly considered but not limited to as part of this effort or proposed work.

Ultimately, these materials should be cost-realistic and deployment in varying environmental conditions should be strongly considered.
Research areas may include, but are not limited to:

- Determination (theoretical and experimental) of magnetoelectrically-coupled materials or composites that work in ambient conditions, using external fields, that are capable of storing the data over time to allow for measurements to continue for 1 to 12 hrs.
    - Experimental synthesis and characterization of the materials (bulk materials and thin films) and measurements at the laboratory scale
    - Applicants are encouraged to submit magnetoelectrically-coupled materials or composites for data storage capability and will function at ambient conditions.
    - Applicants are encouraged to evaluate technologies including the potential for detection capability of emerging threats, CWAs, and/or simulants (as vapors or aerosols).
    - Applicants should propose determination of environmental conditions (e.g., light, temperature, relative humidity, salty, sandy, smoky), preferably ambient conditions, for operational relevance of technology.
    - Applicants should propose evaluation of emerging threats, CWAs, and/or simulants (as vapors or aerosols) with these magnetoelectrically-coupled materials or composites.

It is anticipated that this topic will require teams of researchers with different expertise in modeling, synthesis, and characterization of these materials (bulk materials and thin films). A justification of the budget will need to be provided to supplement the costs proposed for this

effort.

Pre-application white papers and proposals should focus on a fundamental understanding of research, development, integration, and demonstration of magnetoelectrically-coupled multiferroic materials or composites to use as data storage and integrate these materials into a sensor prototype aimed to detect emerging threats, chemical warfare agent, and/or simulants for potential use with Warfighter suit of technologies.

References:

1. Eerenstrein, W.; Mathur, N.D.; Scott, J.F. Nature 2006, 442, 759-765.
2. Zvezdin, A.K.; Logginov, A.S.; Meshkov, G.A.; Pyatakov, A.P. Bulletin of the Russian Academy of Sciences: Physics 2007, 71, 1561-1562.
3. Spaldin, N.A.; Fiebig, M. Science 2005, 309, 391-392.
4. Du, Y.; Cheng, Z.X.; Dou, S.X.; Wang, X.L.; Zhao, H.Y.; Kimura, H. Applied Physics Letters 2010, 97, 122502.
5. Azuma, M.; Kanda, H.; Belik, A.A.; Shimakawa, Y.; Takano, M. Journal of Magnetism and Magnetic Materials 200

Thrust Area 7, Topic M9: "Next" Next-Generation Material(s) for Chemical and Biological (CB) Protection and Decontamination

Award Amounts for this topic are anticipated to be up to $200,000 (total dollar value = direct and indirect costs) for a maximum of one (1) year effort.

The preferred award structure for this topic is a base period of a maximum of one (1) year with no option years. Phase I white papers and proposals that outline scope and effort for periods beyond the base period will not be considered.

Award Amounts for this topic are anticipated to be indicative of the amount of work involved in demonstrating feasibility of highly innovative basic research areas that may serve as the basis for advancement of new concepts for chemical and biological protection and decontamination, and other aspects of this program outlined below.

Background: DTRA/JSTO's recent basic research investments relevant to chemical and biological (CB) protection and decontamination have identified materials that demonstrate adsorption, reactivity, selective permeability or a combination thereof. Examples include metal-organic frameworks, metal oxide nanoparticles, reactive polymers, and biomimetic and bioengineered systems. While studies with these material classes continue to evolve, new foundational materials research and discoveries are essential to shape future technological capabilities for the Warfighter.

In order to realize new materials with extraordinary function, the exploration of novel scientific opportunities is desired. These studies should seek to identify scientific breakthroughs that may begin to address technical or logistical challenges associated with materials utilized in current

protection and hazard mitigation technologies. For example, conventional adsorbent materials function by means of both physical adsorption and chemisorption; however the lack of selectivity and reactivity limits the chemical protection that can be attained. Elastomers provide excellent barrier properties but at the trade-off of reduced tactility and moisture vapor transport. Polyfluoroalkyl (PFAS)-based coatings provide a high level of surface repellency, but due to environmental and health impacts, efforts are shifting towards non-PFAS material alternatives. Decontaminants have proven to reduce hazard levels, but materials that can turnover agent efficiently and are compatible with complex surfaces are needed.

Impact: This topic will foster innovative ideas to advance the scientific state-of-the-art, with potential of identifying creative material solutions to modernize CB filtration, decontamination, and protective suit technologies.

Objective: This topic seeks short-term, fundamental research investigations focused on proof-of-concept studies and collection of preliminary data of highly innovative research initiatives in support of the "*next"* next-generation material(s) and concepts for CB protection and decontamination. Example research areas *include but are not limited to:*

- Catalysis and reaction engineering to generate concepts that demonstrate rapid, efficient turnover
- Polymer and soft materials to generate concepts that demonstrate stretchable, repellent barriers
- Hybrid or multifunctional materials to generate concepts that demonstrate a combination of adsorptive, catalytic, and/or repellent properties
- Interface and colloid science to generate concepts that demonstrate the ability to enhance reaction rates, diffusion, transport, and/or mechanical properties
- Computational approaches that provide a new means of screening novel materials, developing quantitative structure-activity relationships and other models, predicting the properties of materials, and performing other materials-related studies

Additional considerations:

- Research must be completed within 12 months of award of the agreement.
- No capital equipment may be purchased under this award.
- Due to the relatively small dollar amount and short-term nature of this award, applicants are encouraged to maximize the benefit derived from this funding by prioritizing labor and employing other cost-saving measures in support of the effort. In particular, applicants are strongly encouraged to contribute as a cost-share or significantly reduce the indirect costs associated with the proposed effort.
- The Phase II project narrative (technical proposal) should reflect the level of work to be performed within 12 months, and emphasize the key tasks leading to proof of idea. Due to the short-term nature of this award, the Phase II project narrative (technical proposal) should not exceed 10 pages (including references), and does NOT require the following components/attachments: programmatics, performance schedule, and quad chart. For budgeting purposes, there is no travel requirement for an annual technical review.
- Under this reward, reporting requirements are reduced to a final technical report only.

References:

1. Mondloch, J.E.; Katz,M.J.; Isley, W.C.; Ghosh, P.; Liao,P.; Bury,W.; Wagner, G.W.; Hall, M.G.; DeCoste, J.B.; Peterson, G.W.; Snurr, R.Q.; Cramer, C.J.; Hupp, J.T.; Farha, O.K. Destruction of chemical warfare agents using metal–organic frameworks. *Nat. Mater.* **2015,** *14*, 512-516.
2. Lasseuguette, E.; Malpass-Evans, R.; Casalini, S.; McKeown, N.B.; and Ferrari, M. Optimization of the fabrication of amidoxime modified PIM-1 electrospun fibres for use as breathable and reactive materials. *Polymer* **2021** *213*, 123205.
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4. Tu,Y.; Samineni, L.; Ren, T.; Schantz, A.B.; Song, W.; Sharma, S.; Kumar; M. Prospective applications of nanometer-scale pore size biomimetic and bioinspired membranes. *J. Membr. Sci.* **2021**, *620*, 118968.
5. McEntee, M.; Gordon, W.O.; Balboa, A.; Delia, D.J.; Pitman, C.L.; Pennington, A.M.; Rolison, D.R.; Pietron, J.J.; DeSario, P.A. Mesoporous Copper Nanoparticle/TiO2 Aerogels for Room-Temperature Hydrolytic Decomposition of the Chemical Warfare Simulant Dimethyl Methylphosphonate. *ACS Appl. Nano Mater.* 2020 *3* (4), 3503-3512.
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7. S.1605-117th Congress (2021-2022): National Defense Authorization Act for Fiscal Year 2022, Section 347. (2021, December 27). https://www.congress.gov/bill/117th-congress/senate-bill/1605/text

Thrust Area 7, Topic M10: Leveraging Protein Structure Insights and Allosteric Effectors of MCM Targets

Award Amounts for this topic are anticipated to be up to $500,000 per year (total dollar value = direct and indirect costs). Award amounts for this topic are anticipated to be indicative of the amount of work involved to comprehensively address the objectives of this program outlined below. It is anticipated based on this topic that there will be teams with varying expertise that is required.

The preferred award structure for this topic is a base period of three (3) years with up to two (2) additional years as possible options with options being dependent on meeting benchmarks established in the proposal and statement of work. Phase I white papers and proposals that outline scope and effort for only the base period and do not propose options are acceptable, but note if

option(s) are not proposed they will not be granted at a later date. Note that efforts that propose exceeding a total of five (5) years will not be considered.

Background: Development of safe and effective pre-exposure prophylactic or post-exposure therapeutic medical countermeasures (MCMs) to counter the adverse effects of CWAs (including blister agents, nerve agents, pharmaceutical based agents and other emerging chemical threats) is necessary to protect the warfighter and maintain Force Lethality in CWA-contested environments.

The full complement of protein receptors, metabolic pathways, and tissue distribution of receptor targets of chemicals of concern are not well understood. The improved understanding of the identity, abundance, and tissue-specific distribution of receptors in humans and animal models affected by various chemicals of concern will provide a significantly improved profile to facilitate enhanced medical countermeasure development and identify receptors that are impacted by more than one class of existing and emerging chemical threats.

In order to develop more effective and broadly acting medical countermeasures there is a need to identify host-related biomarkers and biochemical pathways that overlap amongst various threat exposures.

There is also a need to implement a state-of-the-art computational approach, including artificial-intelligence (AI) and machine-learning (ML) based predictive methods that will prioritize specific protein targets for further experimental validation. Use of experimental and/or predicted protein structures to discover novel receptors for CWAs (including blister agents, nerve agents, pharmaceutical based agents and other emerging chemical threats) will help to determine the basis for potential new CWA -protein interactions that can include active sites, ligand binding sites and/ or allosteric sites.

Impact: This approach can leverage protein structure prediction capabilities to identify novel protein targets that are most likely to be functionally impacted by CWA interactions. There are breakthroughs happening in the understanding of protein structure, through both analytical methods and AI- and ML-based predictive methods.

An in-depth understanding of the nature of the molecular recognition/interaction is also of great importance in facilitating the discovery, design, and development of new MCMs.

This approach also enables prioritization of the most biologically meaningful proteins for further study and development of MCMs.

Objective: CWAs continue to be a threat to the warfighter, against which there are no broad spectrum medical countermeasures.

Identification of overlapping biomarkers and biochemical pathways that are affected by exposure to various types of chemical agent threats can help with development of broad-spectrum, potentially cross-toxidromic, medical countermeasures.

The proposal should include one or several of the following approaches, as applicable:

- Enable discovery and quantification of both known and novel (e.g., off-target) receptors of CWAs to allow for development of novel MCMs for broad-spectrum prophylactic and/or therapeutic interventions.

- Use of multi-omic approaches and other pathway analysis to identify nodes of convergence for identifying targets for cross-toxidromic MCM development.
- Use of AI/ML and/or microphysiological systems (MPS) (e.g. organ-on-a-chip or human-on-a-chip) to identify MCMs that can be used to treat multiple chemical toxidromes, allowing for broad-spectrum chemical agent MCMs to enable a suite of MCMs that addresses CWAs (including blister agents, nerve agents, pharmaceutical based agents and other emerging chemical threats).
- Leverage novel protein structure prediction capabilities to identify novel protein targets that are likely to be impacted by CWA interactions to help prioritize specific protein targets for further experimental validation.
- Identify common molecular pathways and/or mechanisms of action for adverse effects resulting from exposure to a broad range of chemicals (e.g., blister agents, organophosphorus compounds, opioids, non-opioid sedatives and other emerging chemical threats) in order to identify new areas for broad-spectrum, cross-toxidromic pre-exposure prophylactic and/or post-exposure therapeutic interventions.
- Include mapping of receptors and enzymes across various CWA-relevant laboratory animal models to allow for more relevant animal model selection in medical countermeasure development.

The CWAs (including blister agents, nerve agents, pharmaceutical based agents and other emerging chemical threats) of interest may include, but are not limited to, organophosphorus compounds, opioids and non-opioid sedatives.

References:

1. Convention on the Prohibition of the Development, Production, Stockpiling and use of Chemical Weapons and Destruction, Technical Secretariat of Organization for Prohibition of Chemical Weapons, The Hague, accessible through internet. 1997, https://www.opcw.org/about-us/history.
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7. Abdel-Magid AF (2015). "Allosteric modulators: an emerging concept in drug discovery". ACS Medicinal Chemistry Letters. 6 (2): 104–7.

ATTACHMENT 2: INTELLECTUAL PROPERTY

(Applies to FAR Contracts & OTAs)

Applicants must describe any limitations on the use of any intellectual property (patents, inventions, trade secrets, copyrights, trademarks, technical data or computer software) that will impact the offeror's performance of the contract or impact the Government's subsequent use of any deliverable under the contract. In particular, the applicant must describe the intellectual property in sufficient detail and describe the limitations on its use (potential patent licenses required by the Government, data assertions of the offeror or any subcontractor, etc.) and describe how the Government can accomplish the stated objectives of this BAA with the limitations described or proposed by the offeror.

Patents. Applicants must list any known patents, patent applications, or inventions which the offeror may be required to license in order to perform the work described in the Applicant's proposal, or which the Government may be required to license to make or use the deliverables of

the contract should the Applicant's proposal be selected for award. For any patent, patent application or invention listed, the Offeror must provide the invention title, a summary of the invention, patent number, patent application publication number, or provisional patent application number, and indicate whether the offeror is the patent or invention owner. If a patent or invention is in-licensed by the offeror, identify the licensor.

If any listed patent, patent application or invention is owned or licensed by the applicant, the applicant must provide a statement, in writing, confirming that it either owns or possesses the appropriate licensing rights to patent, patent application or invention to perform the work described in the proposal and/or to grant the Government a license to make or use the deliverables for this program. If any listed patent, patent application or invention is not owned or licensed by the applicant, then the applicant must explain how it will obtain a license, how the Government may obtain a license and/or whether the offeror plans to obtain these rights on behalf of the Government.

Be advised that no patent, patent application, or invention disclosure will be accepted if identified in the Data Rights Assertion list. **The list of patents, patent applications, and inventions of this section must be a separate list from the Data Rights Assertion list.**

Government rights in any technology that might be invented or reduced to practice under the contract are addressed in the patent rights clause to be included in the contract.

Data Rights. Applications submitted in response to this BAA shall identify, to the extent known at the time an offer is submitted to the Government, the technical , the technical data, or computer software that the Offeror, its subcontractors or suppliers, or potential subcontractors or suppliers assert should be furnished to the Government with restrictions on use, release, or disclosure, in accordance with DFARS 252.227-7017, Identification and Assertion of Use, Release or Disclosure Restrictions, and DFARS 252.227-7028, Technical Data or Computer Software Previously Delivered to the Government. The applicant's assertions, including the assertions of its subcontractors or suppliers, or potential subcontractors or suppliers, shall be submitted in the following format, dated and signed by an official authorized to contractually obligate the applicant. If the applicant will deliver all technical data and computer software to the Government without restrictions, enter "NONE" in this table under the heading "Technical Data or Computer Software to be Furnished with Restrictions."

Identification and Assertion of Restrictions on the Government's Use, Release, or Disclosure of Technical Data or Computer Software.

The applicant asserts for itself, or the persons identified below, that the Government's rights to use, release, or disclose the following technical data or computer software should be restricted:

Technical Data or Computer Software to be Furnished with Restrictions*	Basis for Assertion**	Asserted Rights Category***	Name of Person Asserting Restrictions****
(LIST)*****	(LIST)	(LIST)	(LIST)

*For technical data (other than computer software documentation) pertaining to items,

components, or processes developed at private expense, identify both the deliverable technical data and each such item, component, or process. For computer software or computer software documentation identify the software or documentation.

**Generally, development at private expense, either exclusively or partially, is the only basis for asserting restrictions. For technical data, other than computer software documentation, development refers to development of the item, component, or process to which the data pertain. The Government's rights in computer software documentation generally may not be restricted. For computer software, development refers to the software. Indicate whether development was accomplished exclusively or partially at private expense. If development was not accomplished at private expense, or for computer software documentation, enter the specific basis for asserting restrictions.

***Enter asserted rights category (e.g., government purpose license rights from a prior contract, rights in SBIR data generated under another contract, limited, restricted, or government purpose rights under this or a prior contract, or specially negotiated licenses).

****Corporation, individual, or other person, as appropriate.

*****Enter "none" when all data or software will be submitted without restrictions.

Date	_____
Printed Name	_____
Printed Title	_____
Signature	_____

Applicants responding to this BAA requesting an Other Transaction or Other Transaction for Prototype shall specifically identify any asserted restrictions on the Government's use of intellectual property contemplated under those award instruments. For this purpose, applicants must propose specific Intellectual Property terms and conditions and a data deliverable list. Further, the applicants must explain why an Other Transaction is necessary and, in particular, how the intellectual property terms and conditions proposed will meet the objectives of this BAA.

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[i] El-Radhi, A. Sahib (2019). Pathogenesis of Fever. *PubMedCentral* *<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7122269/>*

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