I. INTRODUCTION

The Defense Threat Reduction Agency (DTRA) mission is to enable the DoD, the U.S. Government, and International Partners to counter and deter Weapons of Mass Destruction (WMD – Chemical Biological, Radiological and Nuclear) and Improvised Threat Networks. The DTRA STTR program is consistent with the purpose of the STTR Program – i.e., to stimulate a partnership of ideas and technologies between innovative small business concerns and Research Institutions through Federally-funded research or research and development (R/R&D).

The approved FY20.B list of topics solicited for in the Defense Threat Reduction Agency (DTRA) Small Business Technology Transfer (STTR) Program are included in these instructions followed by full topic descriptions. Offerors responding to this Broad Agency Announcement must follow all general instructions provided in the related Department of Defense Program BAA. Specific DTRA requirements that add to or deviate from the DoD Program BAA instructions are provided below with references to the appropriate section of the DoD document.

The DTRA Small Business Technology Transfer (STTR) Program is implemented, administered, and managed by the DTRA SBIR/STTR Program Office. Specific questions pertaining to the administration of the DTRA STTR Program should be submitted to:

Mr. Mark Flohr
DTRA SBIR/STTR Program Manager
Mark.D.Flohr.civ@mail.mil
Tel: (571) 616-6066
8725 John J. Kingman Road
Stop 6201
Ft. Belvoir, VA 22060-6201

For technical questions about specific topics during the pre-release (6 May 2020 to 3 June 2020) contact the DTRA Technical Point of Contact (TPOC) for that specific topic. To obtain answers to technical questions during the formal BAA open period, visit: https://www.dodsbirsttr.mil.

For general inquiries or problems with the electronic submission, contact the DoD SBIR/STTR Help Desk 1-703-214-1333 or email: dodsbirsupport@reisystems.com (Monday through Friday, 9:00 a.m. to 7:00 p.m.)

Proposals not conforming to the terms of this announcement will not be considered. DTRA reserves the right to limit awards under any topic, and only those proposals of superior scientific and technical quality as determined by DTRA will be funded. DTRA reserves the right to withdraw from negotiations at any time prior to contract award. The Government may withdraw from negotiations at any time for any reason to include matters of national security (foreign persons, foreign influence or ownership, inability to clear the firm or personnel for security clearances, or other related issues).

Please read the entire DoD announcement and DTRA instructions carefully prior to submitting your proposal.

The STTR Policy Directive is available at:
II. OFFEROR SMALL BUSINESS ELIGIBILITY REQUIREMENTS
Each offeror must qualify as a small business at time of award per the Small Business Administration’s (SBA) regulations at 13 CFR 121.701-121.705 and certify to this in the Cover Sheet section of the proposal. Those small businesses selected for award will also be required to submit a Funding Agreement Certification document prior to award.

SBA Company Registry

Per the 2019 SBIR-STTR Policy Directive, all STTR applicants are required to register their firm at SBA’s Company Registry prior to submitting a proposal. Upon registering, each firm will receive a unique control ID to be used for submissions at any of the eleven (11) participating agencies in the STTR program. For more information, please visit the SBA’s Firm Registration Page: https://www.sbir.gov/user/login/.

III. USE OF FOREIGN NATIONALS, GREEN CARD HOLDERS AND DUAL CITIZENS
See the “Foreign Nationals” section of the DoD STTR Broad Agency Announcement for the definition of a Foreign National (also known as Foreign Persons).

ALL offerors proposing to use foreign nationals, green-card holders, or dual citizens, MUST disclose this information regardless of whether the topic is subject to export control restrictions. Offers must identify any foreign nationals or individuals holding dual citizenship expected to be involved on this project as a direct employee, subcontractor, or consultant. For those individuals, please specify their country of origin, the type of visa or work permit under which they are performing and an explanation of their anticipated level of involvement on this project. You may be asked to provide additional information during negotiations in order to verify the foreign citizen’s eligibility to participate on a STTR contract. Supplemental information provided in response to this paragraph will be protected in accordance with the Privacy Act (5 U.S.C. 552a), if applicable, and the Freedom of Information Act (5 U.S.C. 552(b)(6)).

Proposals submitted to export control-restricted topics and/or those with foreign nationals, dual citizens or green card holders listed will be subject to security review during the contract negotiation process (if selected for award). DTRA reserves the right to vet all uncleared individuals involved in the project, regardless of citizenship, who will have access to Controlled Unclassified Information (CUI) such as export-controlled information. If the security review disqualifies a person from participating in the proposed work, the contractor may propose a suitable replacement. In the event a proposed person is found ineligible by the government to perform proposed work, the contracting officer will advise the offeror of any disqualifications but may not disclose the underlying rationale. In the event a firm is found ineligible to perform proposed work, the contracting officer will advise the offeror of any disqualifications but may not disclose the underlying rationale.

IV. EXPORT CONTROL RESTRICTIONS
The technology within some DTRA topics is restricted under export control regulations including the International Traffic in Arms Regulations (ITAR) and the Export Administration Regulations (EAR). ITAR controls the export and import of listed defense-related material, technical data and services that provide the United States with a critical military advantage. EAR controls military, dual-use and commercial items not listed on the United States Munitions List or any other export control lists. EAR regulates export-controlled items based on user, country, and purpose. The offeror must ensure that their firm complies with all applicable export control regulations.
V. FRAUD, WASTE, and ABUSE

Fraud includes any false representation about a material fact or any intentional deception designed to deprive the United States unlawfully of something of value or to secure from the United States a benefit, privilege, allowance, or consideration to which an individual or business is not entitled.

Waste includes extravagant, careless or needless expenditure of Government funds, or the consumption of Government property, that results from deficient practices, systems, controls, or decisions.

Abuse includes any intentional or improper use of Government resources, such as misuse of rank, position, or authority or resources.

Offerors shall complete the SBIR/STTR Program training related to Fraud, Waste and Abuse and provide documentation of completion with proposal submissions. Training is available at: https://www.sbir.gov/tutorials/fraud-waste-abuse/tutorial-1. Please follow guidance provided on the site to complete the required training.

VI. CYBER SECURITY

Any Small Business Concern receiving a STTR award is required to provide adequate security on all covered contractor information systems. Specific security requirements are listed in DFARS 252.204.7012, and compliance is mandatory.

VII. PROPOSAL FUNDAMENTALS

Proposal Submission

All proposals MUST be submitted online using the DoD SBIR/STTR submission system https://www.dodsbirsttr.mil/submissions/. Any questions pertaining to the DoD SBIR/STTR submission system should be directed to the DoD SBIR/STTR Help Desk: 1-703-214-1333, or email to: dodsbirsupport@reisystems.com.

Classified Proposals

Classified proposal are NOT accepted under the DTRA STTR Program and Phase I contracts are not typically awarded for classified work. However, in some instances, work being performed on Phase II contracts will require security clearances. If a Phase II contract will require classified work, the offeror must have a facility clearance and appropriate personnel clearances in order to perform the classified work.

Proposal Status

The DTRA program office will distribute selection and non-selection email notices to all firms who submit a DTRA STTR proposal. The email will be distributed to the “Corporate Official” and “Principal investigator” listed on the proposal coversheet.

Proposal Feedback

DTRA will provide written feedback to unsuccessful offerors regarding their proposals upon request. Requests for feedback must be submitted in writing to the DTRA SBIR/STTR within 30 calendar days of non-selection notification. Non-selection notifications will provide instructions for requesting proposal feedback.

Discretionary Technical and Business Assistance (TABA)

In accordance with the Small Business Act (15 U.S.C. 632), DTRA will authorize the recipient of a Phase I or Phase II SBIR/STTR award to purchase Discretionary Technical & Business Assistance services, such as access to a network of scientists and engineers engaged in a wide range of technologies, or access to technical and business literature available through on-line data bases, for the purpose of assisting such concerns as:

• making better technical decisions concerning such projects;
• solving technical problems which arise during the conduct of such projects;
• minimizing technical risks associated with such projects; and
• developing and commercializing new commercial products and processes resulting from such projects.
• Meeting cyber security requirements.

If you are proposing use of Discretionary Technical & Business Assistance (TABA), you must provide a cost breakdown in the Cost Volume under “Other Direct Costs (ODCs)” and provide a one-page description of the vendor you will use and the Technical & Business Assistance you will receive. For the Phase I project, the amount for TABA may not exceed $6,500 per award. For the Phase II project, the TABA amount may be less than, equal to, but not more than $50,000 per project. The description should be included in Volume 5 of the proposal.

Approval of technical and business assistance is not guaranteed and is subject to review of the contracting officer.

For Discretionary Business and Technical Assistance, small business concerns may propose one or more vendors. Additionally, business-related services aimed at improving the commercialization success of a small business concern may be obtained from an entity, such as a public or private organization or an agency of or other entity established or funded by a State that facilitates or accelerates the commercialization of technologies or assists in the creation and growth of private enterprises that are commercializing technology.

VIII. PHASE I PROPOSAL GENERAL INFORMATION
Proposal Evaluation

DTRA will evaluate Phase I proposals using the criteria specified in Section 6.0 of the DoD STTR Program BAA during the review and evaluation process. The criteria will be in descending order of importance with technical merit, soundness, and innovation of the proposed approach being the most important, followed by qualifications, and followed by the commercialization potential. With other factors being equal, cost of the proposal may be included in the evaluation. DTRA reserves the right to limit awards under any topic and only proposals considered to be of superior quality will be funded. The Government may withdraw from negotiations at any time for any reason to include matters of national security (foreign persons, foreign influence or ownership, inability to clear the firm or personnel for security clearances, or other related issues). Phase I contracts are limited to a maximum of $167,500 over a period not to exceed seven months. For clarity, the stated maximum dollar amount is exclusive of the Discretionary Technical and Business Assistance (TABA) that firms may request.

DTRA participates in one DoD STTR BAA each year and anticipates funding one or possibly two Phase I contracts to small business concerns for each topic.

DTRA Support Contractors

Select DTRA-employed support contractors may have access to contractor information, technical data or computer software that may be marked as proprietary or otherwise marked with restrictive legends. Each DTRA support contractor performs under a contract that contains organizational conflict of interest provisions and/or includes contractual requirements for nondisclosure of proprietary contractor information or data/software marked with restrictive legends. These contractors require access while providing DTRA such support as advisory and assistance services, contract specialist support, and support of the Defense Threat Reduction Information Analysis Center (DTRIAC). The contractor, by submitting
a proposal or entering into this contract, is deemed to have consented to the disclosure of its information to DTRA’s support contractors.

The following are, at present, the prime contractors anticipated to access such documentation: Cherokee Nation Strategic Programs, LLC (contract specialist support), Kent, Campa, and Kate, Inc. (contract closeout support), Engility Corporation (a company under SAIC, Inc), (advisory and assistance services), Quanterion Solutions, Inc. (DTRIAC), Kforce Government Solutions, Inc. (financial/accounting support), and CACI (contract writing system administration). This list is not all-inclusive (e.g., subcontractors) and is subject to change.

IX. PHASE I PROPOSAL GUIDELINES
The DoD SBIR/STTR Proposal Submission system is available at https://www.dodsbirsttr.mil/submissions/ and will lead you through the preparation and submission of your proposal. Read Section 5.0 of the DoD Announcement for detailed instructions on proposal format and program requirements. You must include a Company Commercialization Report (CCR) as part of each proposal you submit. Proposals not conforming to the terms of this Announcement will not be considered. To be considered for evaluation the proposal package must be formally submitted on the DoD SBIR/STTR submission system by clicking the green “SUBMIT PROPOSAL” button. Proposals addressing the topics will be accepted for consideration if received no later than the specified closing hour and date in the DoD Announcement – 12:00 p.m. Eastern Time, Thursday, 2 July 2020.

The Agency requires your entire proposal to be submitted electronically through the DoD Submission Web site https://www.dodsbirsttr.mil/submissions/. A hardcopy is NOT required and will not be accepted. Hand or electronic signature on the proposal is also NOT required.

MAXIMUM PHASE I PAGE LIMIT FOR DTRA IS 20 PAGES FOR VOLUME 2, TECHNICAL VOLUME

Any pages submitted beyond the 20-page limit within the Technical Volume (Volume 2) will not be evaluated. Letters of support and TABA requests should be included as part of Volume 5 so it will not count towards the 20-page Technical Volume (Volume 2) limit. Any technical data/information that should be in the Technical Volume (Volume 2) but is contained in other Volumes will not be considered. DTRA’s objective for the Phase I effort is to determine the merit and technical feasibility of the concept. The contract period of performance for Phase I shall be seven (7) months (approx. 6 months technical work plus 1 month final report preparation) and the award shall not exceed $167,500. A list of topics currently eligible for proposal submission is included in these instructions, followed by full topic descriptions.

Phase I Proposal
A complete Phase I proposal consists of six volumes:

- Volume 1. Proposal Cover Sheet (required) does not count towards the 20-page limit.
- Volume 2. Technical Volume (required). DTRA has established a 20-page limitation for Technical Volumes submitted in response to its topics. The Technical Volume includes, but is not limited to: table of contents, pages left blank, references, appendices, key personnel biographical information.
- Volume 3. Cost Volume (required) does not count towards the 20-page limit. DTRA requires that small business concerns complete the Cost Volume form on the DoD Submission site versus submitting it within the body of the uploaded volume.
- Volume 5. Supporting Documentation Volume (optional) does not count towards the 20-page limit. The Supporting Documentation Volume will be considered part of the evaluation documentation. It
allows for additional specific documents limited to: (a) any additional letters of support, (b) additional cost information, (c) Funding Agreement Certification, (d) Technical Data Rights (Assertions support), (e) TABA, and (f) how you are meeting Cyber Certification requirements.

- Volume 6. Fraud, Waste, and Abuse Training Certification (required) does not count towards the 20-page limit.

Proposal Submittal

Proposals are required to be submitted in Portable Document Format (PDF), and it is the responsibility of submitters to ensure any PDF conversion is accurate and does not cause the Technical Volume portion of the proposal to exceed the 20-page limit. **Any pages submitted beyond the 20-page limit, will not be read or evaluated.** If you experience problems uploading a proposal, call the DoD SBIR/STTR Help Desk from 9:00 a.m. to 5:00 p.m. Eastern Time Monday through Friday at: 1-703-214-1333 or E-mail: dodsbirsupport@reisystems.com

Animal and Human Research

Companies should plan carefully for research involving animal or human subjects, biological agents, etc. (see Sections 4.7 - 4.9 in the DoD Program Announcement). The few months available for a Phase I effort may preclude plans including these elements unless coordinated before a contract is awarded.

X. DECISION and NOTIFICATION

DTRA has a single Evaluation Authority (EA) for all proposals received under this solicitation. The EA either selects or rejects Phase I and Phase II proposals based upon the results of the review and evaluation process plus other considerations including limitation of funds, and investment balance across all the DTRA topics in the solicitation. To provide this balance, a lower rated proposal in one topic could be selected over a higher rated proposal in a different topic. DTRA reserves the right to select all, some, or none of the proposals in a particular topic.

Following the EA decision, the DTRA SBIR/STTR office will release notification e-mails for each accepted or rejected offer. E-mails will be sent to the addresses provided for the Principal Investigator and Corporate Official. Offerors may request a debriefing of the evaluation of their not selected proposal and should submit this request via email to dtra.belvoir.RD.mbx.sbir@mail.mil and include “STTR 20.B / Topic XX Debriefing Request” in the subject line. Debriefings are provided to help improve the offeror’s potential response to future solicitations. Debriefings do not represent an opportunity to revise or rebut the EA decision.

For selected offers, DTRA will initiate contracting actions which, if successfully completed, will result in contract award. DTRA Phase I awards are issued as fixed-price purchase orders with a maximum period of performance of seven-months. DTRA may complete Phase I awards without additional negotiations by the contracting officer or without opportunity for revision for proposals that are reasonable and complete.

XI. PHASE II PROPOSAL GUIDELINES

Small business concerns awarded a Phase I contract are permitted to submit a Phase II proposal for evaluation and potential award selection. The Phase II proposals are best submitted no later than (NLT) 30 days AFTER the end of the 7 month Phase I period of performance.
All STTR Phase II awards made on topics from solicitations prior to FY13 will be conducted in accordance with the procedures specified in those solicitations.

DTRA is not responsible for any money expended by the proposer prior to contract award.

DTRA has established a **40-page limitation** for the Technical Volume submitted in response to its topics. This does not include the Proposal Cover Sheets (pages 1 and 2, added electronically by the DoD submission site), the Cost Volume, or the Company Commercialization Report. The Technical Volume includes, but is not limited to: table of contents, pages left blank, references and letters of support, appendices, key personnel biographical information, and all attachments.

Further details on the due date, content, and submission requirements of the Phase II proposal will be provided either in the Phase I award or by subsequent notification.

**Phase II Proposal Instructions**

Each Phase II proposal must be submitted through the DoD SBIR/STTR Submission Web site by the deadline as specified in the Phase II Proposal Guidelines, or in the Phase I award or subsequent notification. Each proposal submission must contain a Proposal Cover Sheet, Technical Volume, Cost Volume, a Company Commercialization Report (see Sections 5.4.c. and 5.5 of the BAA Announcement) and Volume 5. The format should be similar to Phase I proposal except the Phase II Technical Proposal is limited to 40 pages. The Commercialization Strategy Volume should more specific than was required for Phase I.

As instructed in Section 5.4.e of the DoD STTR Program BAA, the CCR is generated by the submission website based on information provided by you through the “Company Commercialization Report” tool.

**Commercialization Strategy**

See Section 7.4 of the DoD STTR 20.B BAA.
Phase II Evaluation Criteria

Phase II proposals will be reviewed for overall merit based upon the criteria in Section 8.0 of this Broad Agency Announcement and will be similar to the Phase I process.

XII. PUBLIC RELEASE OF AWARD INFORMATION

If your proposal is selected for award, the technical abstract and discussion of anticipated benefits will be publicly released via the Internet. Therefore, do not include proprietary or classified information in these sections. For examples of past publicly released DoD SBIR/STTR Phase I and II awards, visit https://www.dodsbirsttr.mil.

XIII. PROTESTS

Service of Protest (Sept 2006)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the Government Accountability Office (GAO), shall be served on the Contracting Officer (addressed to Ms. Megan Faherty, Contracting Officer, as follows) by obtaining written and dated acknowledgment of receipt from (if mailed letter) Defense Threat Reduction Agency, ATTN: AL-AC (Ms. Megan Faherty), 8725 John J. Kingman Road, M.S. 6201, Fort Belvoir VA 22060. If Federal Express is used for the transmittal, the appropriate address is: Defense Threat Reduction Agency, ATTN: AL-AC (Ms. Megan Faherty), 6200 Meade Road, Fort Belvoir, VA 22060.

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

(End of provision)
NOTE: The technology within some of the topics may be restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense related material and services. Offerors must disclose any proposed use of Foreign nationals, their country of origin, and what tasks each would accomplish in this statement of work in accordance with section 3.5.b(7) of the solicitation.

DTRA20.B-001  Fast, Radiation Hard Scintillation Materials for Nuclear Battlefield Search and Identification
DTRA20.B-002  Integrated Circuits for Gamma Detector Read Out and/or Gamma Spectral Signal Analysis
DTRA20.B-003  Field Detection of Trace Elements and Chemicals
TITLE: Fast, Radiation Hard Scintillation Materials for Nuclear Battlefield Search and Identification

OBJECTIVE: To investigate and develop fast scintillation materials that can be operated under nuclear battlefields for nuclear search, identification, and dose rate estimation. The new scintillators must have ultra-fast decay time, with very limited to no slower decay components, good luminosity, and capable of radioisotope identification. Demonstrate materials performance in prototype detector and develop a cost model and commercial production path.

DESCRIPTION: Most radiation detection systems utilize scintillators as detectors. However, in high dose rate environment the majority of scintillators are too slow and often subject to radiation damage. Hence, the alternative sensors used under these conditions are often limited to GM-tubes or silicon diodes. While simple and effective, these detectors have their drawbacks: They provide count rates only rather than spectroscopic information which leads to inaccurate isotope identification and dose rate estimation [1]. In addition, the high dead time under high radiation environment will result in the loss of triggers, or lead to detector paralysis. The inoperability of the advanced scintillators at high dose environment has severely limited the mission capabilities in search and identification of radioactive materials in the nuclear battlefield.

In order to improve radioisotope identification and dose rate estimation for very high dose rate environment, new detector materials are sought. Potential solutions include the development of fast and high radiation-tolerant spectroscopic scintillators. Such scintillators shall possess very fast decay time (shorter than 5 ns), very low to absence of slower decay components, high enough light yield (> 1,000 photons/MeV) to allow the detection of photons down to 60 keV, sufficient energy resolution for spectroscopy based dose measurement, and high enough radiation hardness to survive and operate in intense dose rate environment, up to 1,000 cGy/h.

Examples of existing fast scintillators include halide scintillators [2], e.g. BaF2, CLYC, etc. These scintillators decay with < 1 ns time constant and have good luminosity of ~2,000 photons/MeV. However, these scintillators often have slower scintillation decay components that would create significant baseline detrimental for the detector under high radiation fields. In addition, halides are also prone to radiation damage during prolonged exposure to high radiation doses. Oxides, on the other hand, can be radiation hard and provide fast decay time, such as PbWO4 (PWO) commonly used in high energy physics experiments [3]. PWO has high density and fast decay time, but the light yield is not high enough [4]. Even more interesting are the rare earth oxides, such as Lu2O3, have exhibited much higher light yield and faster decay time than PWO. These oxides are often prepared in the form of ceramic scintillators, which makes them more robust and radiation hard than single crystals [5].

To leverage the ongoing research momentum in fast and radiation hard scintillator materials, DTRA seeks innovative ideas for ultra-fast scintillation materials capable of achieving high count rate with sufficient energy resolution for dose evaluation and isotope identification at both low dose rate environments and nuclear battlefield conditions. The materials must be rugged and can operate over DoD’s wide range of environments. Phase I development must demonstrate feasibility of selected materials to provide high count rate, acceptable energy resolution for reliable dose calculation and isotope identification, and adequate radiation hardness. Phase II development will further optimize the down selected materials to achieve the following performance thresholds (objectives):

1) Decay time: < 5 ns (< 1 ns)
2) Light yield: > 1,000 photons/MeV (> 2,000 photons/MeV)
3) FWHM energy resolution at 662 keV: 10-15% {7-10%, or approaching that of NaI:Tl}
4) Capable of operating in high dose rate environment: up to 1,000 cGy/h {3,000 cGy/h}
5) Materials unit cost: less than the cost of PWO {similar to the cost of the NaI:Tl}
6) Materials must be environmentally rugged for DoD applications
7) Neutron detection: optional {required}

The materials performance must be demonstrated in the prototype detector configuration by the end of Phase II program.

PHASE I: Identify the scintillator materials and their potential. Demonstrate pathways for meeting the Phase II performance goals through feasibility studies at the end of Phase I. Demonstrate radiation hardness capabilities. By the end of the Phase I, single or multiple candidate materials shall be down selected for further development in Phase II.

PHASE II: Further optimize the selected material(s) to produce detector-size samples at the targeted performance parameters. Demonstrate the performance in prototype detectors that accomplish the goals of reliable gamma-ray (and/or neutron) detection and identification under both low dose rate environments and fallout conditions. The detectors shall demonstrate radioisotope identification capabilities consistent with ANSI N42.34 [6]. Demonstrate ability to measure dose/dose rate under fallout conditions accurate to ±20% or ±15 cGy. Develop manufacturing and commercialization plans for implementing the research in production and dissemination of the scintillators, respectively.

PHASE III DUAL USE APPLICATIONS: Further optimize the selected material(s) to produce detector-size samples at the targeted performance parameters. Demonstrate the performance in prototype detectors that accomplish the goals of reliable gamma-ray (and/or neutron) detection and identification under both low dose rate environments and fallout conditions. The detectors shall demonstrate radioisotope identification capabilities consistent with ANSI N42.34 [6]. Demonstrate ability to measure dose/dose rate under fallout conditions accurate to ±20% or ±15 cGy. Develop manufacturing and commercialization plans for implementing the research in production and dissemination of the scintillators, respectively.

REFERENCES:

KEYWORDS: scintillation materials, high radiation field, dose measurements, gamma-ray detection, radio-isotope identification, RIID

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DTRA - 11
DTRA20B-002  TITLE: Integrated Circuits for Gamma Detector Read Out and/or Gamma Spectral Signal Analysis

RT&L FOCUS AREA(S): Nuclear
TECHNOLOGY AREA(S): Battlespace, Electronics, Materials, Nuclear, Sensors

OBJECTIVE: Improve radiation detector capabilities by reducing the size, weight, and power requirements of the associated electronics. Other performance characteristics may be enhanced.

DESCRIPTION: Over the past decades significant improvements have been made to materials that detect radiation. Over the same time, development with electronics components, circuits, and systems has improved even more dramatically. However, much of the development with electronics has not been successfully applied to radiation detection systems. Just as with consumer applications, these developments have the potential of providing users of radiation detectors with desired system improvements such as lower weight, smaller size, reduced power consumption, and better heat management. Other functional improvements could be improved signal-to-noise and additional computational resources.

This topic seeks the development of integrated circuits (IC) for 1) gamma detector read out and/or 2) gamma spectral signal analysis. The developed solution should not be designed around or for any proprietary system but must be able to integrate with any detector head for the detection material it was designed around using common inputs, outputs, and commands. The deliverables need not be just an IC but could also be the IC integrated into a circuit, however, the IC must be designed such that it could be readily engineered into another system for improved capability. The project must demonstrate the form and/or functional improvement, such as those mentioned above, that would be gained by this effort.

Applications for which this development could be applied include, but are not limited to:

- Front end data acquisition
- Multi-channel analyzer
- Elemental and isotopic identification processing
- Associated detector control circuitry
- Enhanced gain stabilization and calibration
- Pulse shape analysis

PHASE I: Development of the design approach to include risk reduction followed by design. The design should have simulated electrical performance and estimated power consumption by the end of Phase I. This phase should demonstrate the ability to meet the performance goals agreed upon in the Statement of Work (SOW). Consideration should be given to the use of standard practices available for high volume/low cost manufacture. The phase I deliverable is a final report detailing overall system design, circuit level simulation results, and choice of circuit manufacturing process.

PHASE II: Phase II projects should develop a prototype device. At least one IC fabrication should be performed, although more may be required to reduce development risk. The prototype should be characterized and tested in a laboratory environment. The prototype should demonstrate the capabilities as agreed upon in the SOW. The phase II deliverable is a final report. Samples for delivery to the Government for internal testing or integration into systems may be negotiated.

PHASE III DUAL USE APPLICATIONS: The ICs developed would have wide commercial applications including for power plant, environmental, and incident management monitoring. Finalize and commercialize IC for use by customers (e.g. DTRA, industry). Although additional funding may be
provided through DoD sources, the awardee should look to other public or private sector funding sources for assistance with transition and commercialization.

REFERENCES:

KEYWORDS: Integrated Circuit, ASIC, Gamma, Detector

TPOC-1: Thomas McKnight
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Email: thomas.k.mcknight.civ@mail.mil
TITLE: Field Detection of Trace Elements and Chemicals

RT&L FOCUS AREA(S): Nuclear
TECHNOLOGY AREA(S): Battlespace, Bio Medical, Nuclear, Sensors

OBJECTIVE: Develop a capability to collect and provide immediate presumptive analysis of radiological/nuclear samples of concern in field environments.

DESCRIPTION: The Defense Threat Reduction Agency seeks technologies that can detect and identify trace quantities of elements and/or chemicals with a preference for both. Target elements and chemicals must include those containing plutonium and uranium. Of interest are chemicals specific to the nuclear fuel cycle. Current capabilities require samples to be sent to a location other than the location of collection requiring more time than is desired. This topic seeks to allow for presumptive analysis to be obtained at the source of collection.

Samples, which could include swipes, must be obtained from solid surfaces; air sampling is not sought. The prototyped device must be compact and able to demonstrate that a commercialized version could be carried by one person. It must also be able to operate for 4-6 hours on battery power. The resulting analysis must provide quantitative measurements. The threshold sensitivity for the detection and identification of uranium and plutonium should be 1 part per million (or 5 nanograms for uranium). Isotopic identification is required while the determination of isotopic ratios is desired. Minimal sample preparation and time is required with no more than single-step wet chemistry allowed. The process should not contain harsh separation/dissolution chemicals, such as perchloric acid. Sample analysis from dry surfaces is required with analysis from wet surfaces desired. The analysis should be non-destructive such that samples, or a portion of the original sample, could be retained for further analysis. The operator must be able to collect and prepare samples with nitrile gloves.

A commercialized version must be able to operate in a “hot zone” without concern of internal contamination while the exterior could be decontaminated following use. The prototype system must provide an analysis of the sample within 5 minutes and allow for an immediate follow on analysis. The system should have a volume <0.1 m³ and a mass <15 kg. The prototype should require only minimal, low-cost consumables, which can be packaged with the system.

PHASE I: A trade study should be conducted to assess the possible methods for sample analysis. Although a full prototype is not necessary, the work should demonstrate the necessary basic physical principles for meeting performance goals in Phase II. Consideration should be given to the analytical accuracy and precision of the system, the ease of measuring samples in the field, and the portability of the system. Phase I proposals should indicate the need for and planned access to characterization samples (e.g., uranium, plutonium, etc.) under a Phase II development.

PHASE II: Phase II projects should develop a prototype device. The prototype should be man-portable and capable of being used in a field test. The prototype should demonstrate accurate elemental and/or chemical analysis of samples containing plutonium and uranium for the requirements listed in the topic description. The Government will not provide characterization samples (e.g., uranium, plutonium, etc.). The proposal should indicate the need for and access to such samples.

PHASE III DUAL USE APPLICATIONS: DUAL USE APPLICATIONS: A field-deployable trace element and chemical analyzer would have wide commercial applications including for environmental
and industrial sampling. Although additional funding may be provided through DoD sources, the awardee should look to other public or private sector funding sources for assistance with transition and commercialization.

REFERENCES:

KEYWORDS: Trace element, presumptive analysis, surface sampling, in-field analysis

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