MISSILE DEFENSE AGENCY (MDA)
SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM
STTR 10.B Supplemental Proposal Submission Instructions

INTRODUCTION

The MDA SBIR/STTR Program is implemented, administrated and managed by the MDA SBIR/STTR Program Management Office, located within the Advanced Technology (DV) Directorate. Specific questions pertaining to the MDA SBIR Program should be submitted to:

Dr. Douglas Deason
Director, SBIR/STTR Programs
sbirsttr@mda.mil

MDA/DV
Bldg 5222, Martin Road
Redstone Arsenal, AL 35898
FAX: (256) 955-2968

If you have any questions regarding the administration of the MDA SBIR/STTR Program please call (256) 955-2020 or e-mail: sbirsttr@mda.mil.

Additional information on the MDA SBIR/STTR Program can be found on the MDA SBIR/STTR home page at http://www.mdasbir.com/. Information regarding the MDA mission and programs can be found at http://www.mda.mil.

MDA participates in one DoD STTR Solicitation each year (x.B). Proposals not conforming to the terms of this Solicitation will not be considered. MDA reserves the right to limit awards under any topic, and only those proposals of superior scientific and technical quality will be funded. Only Government personnel will evaluate proposals.

Questions about SBIR and Solicitation Topics

For general inquiries or problems with the electronic submission, contact the DoD Help Desk at 1-866-724-7457 (1-866-SBIRHLP) (8:00 am to 5:00 pm EDT). For technical questions about the topic during the pre-solicitation period (20 July 2010 through 16 Aug 2010), contact the Topic Authors listed under each topic on the http://www.dodsbir.net Web site by 16 Aug 2010. Please Note: During the pre-release period, you may talk directly with the Topic Authors to ask technical questions about the topics. Their names, phone numbers, and e-mail addresses are listed within each solicitation topic. For reasons of competitive fairness, direct communication between proposers and topic authors is not allowed when DoD begins accepting proposals for each solicitation. However, proposers may still submit written questions about solicitation topics through the SBIR/STTR Interactive Topic Information System (SITIS), in which the questioner and respondent remain anonymous and all questions and answers are posted electronically for general viewing until the solicitation closes. All proposers are advised to monitor SITIS during the solicitation period for questions and answers, and other significant information, relevant to the SBIR/STTR topic under which they are proposing.

Federally Funded Research and Development Centers (FFRDCs) and Support Contractors:

Only Government personnel will evaluate proposals. In some circumstances, non-government, technical personnel from the following Federally Funded Research and Development Centers (FFRDCs) and support contractors will provide advisory and assistance services to MDA, including providing technical analyses of proposals submitted against MDA topics and of applications submitted to the MDA Phase II Transition Program.

FFRDCs: The Aerospace Corporation, Massachusetts Institute of Technology Lincoln Laboratory, Oak Ridge National Laboratory.

Universities / Non-Profit Organizations: Draper Laboratory, Institute of Defense Analyses, Johns Hopkins University Applied Physics Laboratory (JHU/APL,), Utah State University Space Dynamics Laboratory, Aerospace Corporation, MITRE Corporation, University of Connecticut, Sandia National Laboratory.

Support Contractor Organizations: BAE Systems, The Boeing Company, Booz Allen Hamilton, Cobham Analytic Services (Sparta, Inc), CACI International, Inc., Computer Sciences Corporation (CSC), deciBel Research, Inc., Dynamic Research Corporation, Inc., ERC, Inc., General Dynamics Information Technology, L-3 Communications Corporation, Lockheed Martin, MacAulay Brown, Inc., Millennium Engineering and Integration, Inc., Modern Technology Solutions, Inc., Northrop Grumman, Paradigm Technologies, Photon Research Associates, Inc. (Raytheon), QuinetiQ North America, Radiance Technology, Raytheon Company, Schafer Corporation, Science Applications International Corporation (SAIC), SYColeman Corporation, United International Engineering, Universal Technology Corporation.

Individual support contractors from these organizations will be authorized access to only those portions of the proposal data and discussions that are necessary to enable them to perform their respective duties. These organizations are expressly prohibited from rating proposals or making recommendations for award selection. In accomplishing their duties related to the source selection process, employees of the aforementioned organizations may require access to proprietary information contained in the offerors' proposals.

Pursuant to FAR 9.505-4, the MDA contracts with these support contractors include a clause which requires them to (1) protect the offerors' information from unauthorized use or disclosure for as long as it remains proprietary and (2) refrain from using the information for any purpose other than that for which it was furnished. In addition, MDA requires the employees of those support contractors that provide technical analysis to the SBIR/STTR Program to execute non-disclosure agreements. These agreements will remain on file with the MDA SBIR/STTR PMO.

Conflicts of Interest

You must avoid any actual or potential organizational conflicts of interest (OCI) while participating in any MDA-funded contracts, regardless of whether it was awarded by MDA. You must report to the MDA SBIR/STTR Program Office via e-mail any potential OCI before submitting your proposal or application. The MDA SBIR/STTR Program Office will review and coordinate any possible solutions or mitigation to the potential conflict with the contracting officer. If you do not make a timely and full disclosure and obtain clearance from the contracting officer, MDA may reject your proposal or application, or terminate any awarded contracts for default. See FAR Subpart 9.5 for more information on organizational conflicts of interest.

PHASE I GUIDELINES

MDA intends for the Phase I effort to determine the merit and technical feasibility of the concept. Only UNCLASSIFIED proposals will be entertained. Phase I proposals may be submitted for an amount normally not to exceed $100,000.

A list of the topics currently eligible for proposal submission is included in section 8, below, followed by full topic descriptions. These are the only topics for which proposals will be accepted at this time. The topics originated from the MDA Programs and are directly linked to their core research and development requirements.

Please ensure that your mailing address, e-mail address, and point of contact (Corporate Official) listed in the proposal are current and accurate. MDA cannot be responsible for notification to a company that provides incorrect information or changes such information after proposal submission.

USE OF FOREIGN NATIONALS

A foreign national is any person who is NOT a citizen or national of the United States, a lawful permanent resident, or a protected individual as defined by 8 U.S.C. 1324b(a)(3) – refer to Section 2.15 at the front of this solicitation for definitions of "lawful permanent resident" and "protected individual."

ALL offerors proposing to use foreign nationals MUST disclose this information regardless of whether the topic is subject to ITAR restrictions. If the offeror proposes to use foreign nationals: Identify the foreign national(s) you expect to be involved on this project as a direct employee, subcontractor or consultant and their country of origin. For these individuals, please specify 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 contract issued as a result of this solicitation.

Proposals submitted with a foreign national listed will be subject to security review during the contract negotiation process (if selected for award). If the security review disqualifies a foreign national from participating in the proposed work, the contractor may propose a suitable replacement. In the event a proposed foreign person is found ineligible to perform proposed work, the contracting officer will advise the offeror of any disqualifications but may not disclose the underlying rationale.

ITAR RESTRICTIONS

The technology within some MDA topics is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. You must ensure that your firm complies with all applicable ITAR provisions. Please refer to the following URL for additional information: http://www.pmddtc.state.gov/compliance/index.html.

Proposals submitted to ITAR restricted topics will be subject to security review during the contract negotiation process (if selected for award). 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.

PHASE I PROPOSAL SUBMISSION

The DoD SBIR/STTR Proposal Submission system (available at http://www.dodsbir.net/submission) will lead you through the preparation and submission of your proposal. Read the front section of the DoD solicitation, including Section 3.5, for detailed instructions on proposal format and program requirements. Proposals not conforming to the terms of this solicitation will not be considered.

You must submit the ENTIRE technical proposal, DoD Proposal Cover Sheet, Cost Proposal, and the Company Commercialization Report electronically through the DoD SBIR/STTR Web site at www.dodsbir.net/submission/SignIn.asp. If you have any questions or problems with the electronic proposal submission, contact the DoD SBIR/STTR Helpdesk at 1-866-724-7457. Refer to section 3.0 of the DoD solicitation for complete instructions and requirements.

MAXIMUM PAGE LIMIT FOR MDA IS 20 PAGES

Only proposals submitted via the Submission Web site on or before the deadline of 6:00 a.m. (ET) on 15 September 2010 will be processed. ***Please Note:*** The maximum page limit for your technical proposal is twenty (20) pages. Any pages submitted beyond this, will not be evaluated. Your cost proposal and Company Commercialization Report DO NOT count toward your maximum page limit.

PHASE I OPTION MUST BE INCLUDED AS PART OF PHASE I PROPOSAL

MDA is now implementing the use of a Phase I Option that **may be exercised at MDA'S sole discretion** to fund interim Phase I activities while a Phase II proposal is being evaluated and if selected, the contract is being negotiated. Only Phase I efforts invited to propose for a Phase II award through MDA's competitive process will be eligible for MDA to exercise the Phase I Option, if MDA so chooses. The Phase I Option, which **must** be included as part of the Phase I proposal, covers activities over a period of up to six months, if exercised, and should describe appropriate initial Phase II activities that may lead to the successful demonstration of a product or technology. The Phase I Option must be included within the 20-page limit for the Phase I proposal.

A firm-fixed-price Phase I Cost Proposal ($150,000 maximum, including option) must be submitted in detail online. Proposers that participate in this Solicitation must complete the Phase I Cost Proposal not to exceed the maximum dollar amount of $100,000 and a Phase I Option Cost Proposal (if applicable) not to exceed the maximum dollar amount of $50,000. Phase I and Phase I Option costs must be shown separately but may be presented side-by-side on a single Cost Proposal. The Cost Proposal DOES NOT count toward the 20-page Phase I proposal limitation.

PHASE I PROPOSAL SUBMISSION CHECKLIST

All of the following criteria must be met or your proposal will be REJECTED.

____1. The following have been submitted electronically through the DoD submission site by 6:00 a.m. (ET) 15 September 2010.

_____ a. DoD Proposal Cover Sheet

_____ b. Technical Proposal (**DOES NOT EXCEED 20 PAGE**S): *Any pages submitted beyond this will not be evaluated. Your cost proposal and Company Commercialization Report DO NOT count toward your maximum page limit.*

_____ d. Cooperative R&D: For the purposes of the STTR Program this means research and development conducted jointly by a small business concern and a research institution in which not less than 40% of the work is performed by the small business concern, and not less than 30% of the work is performed by the research institution.

_____ e. If proposing to use foreign nationals; identify the foreign national(s) you expect to be involved on this project, country of origin, the type of visa or work permit under which they are performing and level of involvement.

_____ f. DoD Company Commercialization Report (required even if your firm has no prior SBIRs).

_____ g. Cost Proposal **(Online cost proposal form is REQUIRED by MDA)**

____2. The Phase I proposed cost plus option does not exceed $150,000.

MDA PROPOSAL EVALUATIONS

MDA will evaluate and select Phase I proposals using scientific review criteria based upon technical merit and other criteria as discussed in this solicitation document. MDA reserves the right to award no, one, or more than one contract under any topic. MDA is not responsible for any money expended by the proposer before award of any contract. Due to limited funding, MDA reserves the right to limit awards under any topic and only proposals considered to be of superior quality will be funded.

MDA will utilize the Phase I Evaluation criteria in Section 4.2 of the DoD solicitation, including potential benefit to the Ballistic Missile Defense System (BMDS) in assessing and selecting for award those proposals offering the best value to the Government.

MDA will use the Phase II Evaluation criteria in Section 4.3 of the DoD solicitation, including potential benefit to BMDS and ability to transition the technology into an identified BMDS, in inviting, assessing and selecting for award those proposals offering the best value to the Government. In the Phase II Evaluations, Criterion C is more important than Criteria A and B, individually. Criteria A and B are of equal importance.

In Phase I and Phase II, firms with a Commercialization Achievement Index (CAI) at the 20th percentile will be penalized in accordance with DoD Section 3.5d.

Please note that potential benefit to the BMDS will be considered throughout all the evaluation criteria and in the best value trade-off analysis. When combined, the stated evaluation criteria are significantly more important than cost or price. Where technical evaluations are essentially equal in merit, cost or price to the government will be considered in determining the successful offeror.

It cannot be assumed that reviewers are acquainted with the firm or key individuals or any referenced experiments. Technical reviewers will base their conclusions on information contained in the proposal and their personal knowledge. Relevant supporting data such as journal articles, literature, including Government publications, etc., should be contained or referenced in the proposal and will count toward the applicable page limit.

Qualified advocacy letters will count towards the proposal page limit and will be evaluated towards criterion C. Advocacy letters are not required for Phase I or Phase II. Consistent with Section 3-209 of DoD 5500.7-R, Joint Ethics Regulation, which as a general rule prohibits endorsement and preferential treatment of a non-federal entity, product, service or enterprise by DoD or DoD employees in their official capacities, letters from government personnel will NOT be considered during the evaluation process.

A qualified advocacy letter is from a relevant commercial procuring organization(s) working with MDA, articulating their pull for the technology (i.e., what BMDS need the technology supports and why it is

important to fund it), and possible commitment to provide additional funding and/or insert the technology in their acquisition/sustainment program. This letter should be included as the last page of your technical upload. Advocacy letters which are faxed or e-mailed separately will NOT be considered.

INFORMATION ON PROPOSAL STATUS

The Principal Investigator (PI) and Corporate Official (CO) indicated on the Proposal Coversheet will be notified by e-mail regarding proposal selection or non - selection. If your proposal is tentatively selected to receive an MDA award, the PI and CO will receive a single notification. If your proposal is not selected for an MDA award, the PI and CO may receive up to two messages. The first message will provide notification that your proposal has not been selected for an MDA award and provide information regarding the ability to request a proposal debriefing. The second message will contain debrief status information (if requested), or information regarding the debrief request. **Small Businesses will receive a notification for each proposal submitted. Please read each notification carefully and note the proposal number and topic number referenced.**

IMPORTANT: We anticipate having all the proposals evaluated and our Phase I contract decisions in the December 2010 timeframe. All questions concerning the evaluation and selection process should be directed to the MDA SBIR/STTR Program Management Office (PMO).

All communication from the MDA SBIR/STTR Program management will originate from the sbirsttr@mda.mil e-mail address. Please white-list this address in your company's spam filters to ensure timely receipt of communications from our office.

MDA SUBMISSION OF FINAL REPORTS

All final reports will be submitted in accordance with the Contract Data Requirements List (CDRL) of the resulting contract. Refer to section 5.3 of the DoD Solicitation for additional requirements.

PHASE II GUIDELINES

This Solicitation solicits Phase I proposals. For Phase II, no separate solicitation will be issued and no unsolicited proposals will be accepted. Only those firms that were awarded Phase I contracts, and have successfully completed their Phase I efforts, may be invited to submit a Phase II proposal. MDA makes no commitments to any offeror for the invitation of a Phase II proposal. Phase II is the prototype/demonstration of the technology that was found feasible in Phase I. Only those successful Phase I efforts that are **invited** to submit a Phase II proposal will be eligible to submit a Phase II proposal. MDA does encourage, but does not require, partnership and outside investment as part of discussions with MDA sponsors for potential Phase II invitation. Invitations to submit a Phase II proposal will be made by the MDA SBIR/STTR PMO.

Please Note: You may only propose up to the total cost for which you are invited. Contract structure for the Phase II contract is at the discretion of the contracting officer after negotiations with the small business.

The MDA SBIR/STTR PMO does not provide "debriefs" for firms who were not invited to submit a Phase II proposal.

PHASE II PROPOSAL SUBMISSION

Phase II Proposal Submission is by Invitation Only: *A Phase II proposal can be submitted only by a Phase I awardee and only in response to an invitation by MDA.* Invitations are generally issued at or near the Phase I contract completion, with the Phase II proposals generally due one month later. In accordance with SBA policy, MDA reserves the right to negotiate mutually acceptable Phase II proposal submission dates with individual Phase I awardees, accomplish proposal reviews expeditiously, and proceed with Phase II awards. If you have been invited to submit a Phase II proposal, please see the MDA SBIR/STTR Web site http://www.mdasbir.com/ for further instructions.

Classified proposals are not accepted under the DoD SBIR/STTR Program. Follow Phase II proposal instructions described in Section 3.0 of the program solicitation at www.dodsbir.net/solicitation and specific instructions provided in the Phase II invitation. Each Phase II proposal must contain a proposal cover sheet, technical proposal, cost proposal and a Company Commercialization Report submitted through the DoD Electronic Submission Web site at www.dodsbir.net/submission/SignIn.asp **by the deadline specified in the invitation.**

MDA SBIR/STTR PHASE II TRANSITION PROGRAM

Introduction: To encourage transition of SBIR and STTR projects into the BMDS, the MDA's Phase II Transition Program provides matching SBIR and STTR funds to expand an existing Phase II contract that attracts investment funds from a DoD acquisition program, a non-SBIR/non-STTR government program or private sector investments. The Phase II Transition Program allows for an existing Phase II SBIR or STTR contract to be extended for up to one year per Phase II Transition application, to perform additional research and development. Phase II Transition matching funds will be provided on a one-for-one basis up to a maximum amount of $500,000 of SBIR or STTR funds in accordance with DoD Phase II Enhancement policy at Section 4.6 of the DoD Solicitation. Phase II Transition funding can only be applied to an active DoD Phase II SBIR or STTR contract.

The funds provided by the DoD acquisition program or a non-SBIR/non-STTR government program may be obligated on the Phase II contract as a modification prior to or concurrent with the modification adding MDA SBIR or STTR funds, OR may be obligated under a separate contract. Private sector funds must be from an "outside investor" which may include such entities as another company or an investor. It does not include the owners or family members, or affiliates of the small business (13 CFR 121.103).

Background: It is important that all technology development programs in MDA map to a BMDS improvement and, after a period of development and maturity, are transitionable to targeted BMDS end users. End user is defined as the element, component or product manager to which it is intended to transition the technology. Because of this, it is important that your Phase II contract be at or approaching a Technology Readiness Level of either 5 or 6.

Current guidance and instructions may be found at http://www.mdasbir.com.

2010 KEY DATES (PROJECTION)

MDA SBIR/STTR Industry Day	July 28-29, 2010	*
Solicitation Pre-release	July 20 – August 16, 2010	
Solicitation Opens	August 17 – September 15, 2010	
Phase I Evaluations	*October – November 2010*	*
Phase I Selections	*December 2010*	*
Letters Distributed	*December 2010*	*

Contract Award Goal	*February 2011*
Phase II Recommendation Period (from 09.B PH I)	*August 2010 **
Phase II Invitations (from 09.B PH I)	*September 2010 **
PH II Proposals Due	*October 2010 **
Phase II Evaluations	*November – December 2010 **
Phase II Selections	*December 2010 **
Letters Distributed	*January 2011 **
Contract Award Goal	*April 2011 **

*This information is listed for GENERAL REFERENCE ONLY at the time of publication of this solicitation. This date is subject to update/change.

MDA STTR 10.B Topic Index

MDA STTR 10.B Topic Descriptions

MDA10-T001 TITLE: Innovative Hardware Technologies for Electromagnetic Attack Rejection in Ballistic Missile Defense System (BMDS) Radars

TECHNOLOGY AREAS: Air Platform, Information Systems, Ground/Sea Vehicles, Biomedical, Sensors, Electronics, Space Platforms, Weapons

ACQUISITION PROGRAM: AN/TPY-2s

The technology within this topic is 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 the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Identify, develop, and demonstrate novel or innovative advances in electromagnetic attack protection hardware technologies that will support existing BMDS X-band, S-band, and other radar systems as well as communication and GPS systems. The focus of this research is to develop and demonstrate hardware technologies that provide protection of the radar from high power microwave (HPM) and ultra wide band (UWB) attacks and with minimal insertion loss.

DESCRIPTION: The BMDS radar threats envisioned for the near- and far-term are a challenging mixture of electromagnetic threats that include jamming, high power microwave attack, and ultra wide band attack, among other countermeasures. These threats will require novel and innovative hardware solutions to protect the front end receivers of radars and communication systems. This technology research effort is focused on developing and demonstrating hardware technologies to defeat evolving advanced high-power (> 10 kW/cm2), fast-rise-time (< 5 ns) HPM and UWB attacks through the radar front end. Currently there is only one limiter that can meet these requirements. This limiter is a waveguide plasma limiter that is not suitable for all radars. Therefore, a limiter that can be mounted onto a circuit board and that can meet the specifications above is needed. Thus, new hardware technologies; e.g., based on new materials, that provide improved protection for existing BMDS radars (SBX, FBX-T, THAAD, and AEGIS) and communication systems are needed. Of particular interest are passive devices capable of providing the required HPM and UWB protection. Proposed approaches should include a preliminary assessment of what impact the proposed technology will have on overall system (radar or communication system) performance.

PHASE I: Develop and demonstrate through proof-of-principle tests the feasibility of the proposed technologies for HMP and UWB protection. Demonstration of the technology with either a brassboard or pre-prototype is preferred.

PHASE II: Refine/update concept(s) based on Phase I results. Evaluate/demonstrate the technology in a realistic laboratory environment to show the enhanced protection and signal-to-noise (SNR) capability provided by the technology. Laboratory demonstrations should be followed by insertion of the technology into an operational radar to further verify the limiter's capabilities and to address integration and radar performance issues.

PHASE III: Demonstrate the new technologies via operation as part of a complete system or operation in a system-level test bed. This demonstration should show near-term application to one or more BMDS radar systems. Partnership with traditional DoD prime contractors will be pursued since the Government applications will receive immediate benefit from a successful program.

COMMERCIALIZATION: The technology is applicable to commercial air traffic control radar and commercial communications systems for protection of commercial equipment from EMP and HPM/UWB by terrorists groups or unintentional electromagnetic sources. There also are numerous military applications outside of missile defense.

REFERENCES:
[1] MIL-STD-188-125-2: http://www.everyspec.com/MIL-STD/MIL-STD+(0100+-+0299)/download.php?spec=MIL-STD-188-125-2.004472.PDF

[2] MIL-HDBK-423: http://www.everyspec.com/MIL-HDBK/MIL-HDBK+(0300+-+0499)/download.php?spec=MIL-HDBK-423_PLACEHOLDER.008045.PDF

[3] MIL-STD-464: http://www.everyspec.com/MIL-STD/MIL-STD+(0300+-+0499)/download.php?spec=MIL-STD-464.003965.PDF

[4] MIL-STD-461: http://www.everyspec.com/MIL-STD/MIL-STD+(0300+-+0499)/download.php?spec=MIL-STD-461_31JUL1967.008678.pdf

[5] J. Benford, J.A. Swegle, and E. Schamiloglu, High Power Microwaves, 2nd Edition, CRC Press (2007).

KEYWORDS: Electromagnetic Pulse, High Power Microwave, Ultra Wideband, Radar, X-Band, Electronic Countermeasures, Ballistic Missile Defense

MDA10-T002 TITLE: Advanced EO/IR Sensor Components

TECHNOLOGY AREAS: Sensors, Electronics

ACQUISITION PROGRAM: DV, TH, AB, ABIR, PTSS

OBJECTIVE: Improve infrared sensor performance by developing next generation component technologies, including infrared detector materials and architecture, readout electronic circuits, signal processing algorithms, radiation hardening for all components, cryogenic coolers, and sensor optics.

DESCRIPTION: Novel ideas are solicited on all areas of component level technologies pertinent to improving infrared sensor performance for missile defense applications. The current focus is on developing breakthrough technologies to increase the infrared detector performance by an order of magnitude, and to form building blocks for large format dual-band antimonide superlattice focal plane arrays for missile defense applications. The single-band detector performance goals are quantum efficiency exceeding 75% and dark current density less than 50% of that calculated using Rule 07 at long wavelength infrared (LWIR). For dual-band pixel-co-registered detectors at short and long LWIR, the quantum efficiency and dark current density goals for each band is the same as the goals for the corresponding single band detector. For spectral cross talk the goal is less than 10%. Close collaboration between research institutions and small businesses with coherent goals and work plans are strongly encouraged.

To achieve the performance goals as listed above, material defects have to be dramatically reduced and minority carrier lifetimes must be increased one order of magnitude compared to the current state of the art. Novel ideas are solicited for the identification of carrier lifetime limiting defects in superlattice material. Plans for reduction of defect occurrence through new growth technologies or procedures, and ways to mitigate defect influence are requested, with a goal of achieving minority carrier lifetimes in the order of 1μs. Systematic investigations are necessary to reveal the predominant defect types, e.g., point defects, interfaces, and dislocations, and the quantitative contribution from each component. This requires clever use of many semiconductor characterization tools, possibly advanced tools including scanning electron microscopy (SEM), transmission electron microscopy (TEM), cross-sectional scanning tunneling microscopy (XSTM), cross-sectional transmission electron microscopy (XTEM), time-resolved and position-resolved photoluminescence, electron beam induced current (EBIC), and deep level transient spectroscopy (DLTS). Experimental data should be systematically correlated to help gain a complete understanding of material properties and devise ways for their improvement. Novel ideas of inventing new ways and applying cutting edge technologies to characterize superlattice materials are strongly encouraged.

Modeling and theoretical calculations can enhance the understanding of underlying physics that controls superlattice lifetimes and gives good guidance for mitigating lifetime killing sources. The relationship between the lifetimes of a superlattice and its component layers is not clear at the moment: that is, it is not clear how interfaces change the superlattice lifetime characteristics, and other measurable parameters, such as full-width-at-half-maximum (FWHM) of X-ray diffraction. The interface roughness scattering may play an important role on in-plane and vertical direction carrier transport. Substitutional impurities such as Sb-for-As, In-for-Ga, and compositional grading at interfaces

caused by Sb segregation may also have a profound influence that is still to be unveiled. Modeling and theoretical works with a sharp focus on improving detector performance, and with validation by experimental data as an integral part, are strongly encouraged.

Research of epitaxial growth of antimonide superlattice on GaAs substrate is solicited. Although the best performance achieved on superlattice detectors is on materials grown on lattice-matched GaSb substrate, using GaAs substrate may offer the following advantages. High quality GaAs wafers as large as 6 inch in diameter is available at a fraction of the unit area cost of GaSb. This should reduce the development cost as well as the final product cost. GaAs substrate has more desirable physical qualities, i.e., electrically insulating and optically transparent to infrared. This may translate into lower detector dark current and higher quantum efficiency, and eliminate the need for potentially performance degrading substrate removal process. However, the major technical challenge is the larger than 7% lattice mismatch to the superlattice materials. Breakthrough hetero-epitaxial growth and processing technologies need to be invented and implemented to meet the challenge.

Research in the area of detector architecture can lead new ways to suppress various noise sources and further improve detector performance. Ideas for planar detector structure applicable to antimonide superlattice materials are solicited. This approach can be used to mitigate the surface leakage current associated with the commonly used mesa structure. Any proposal on planar detector structure should also address the potential problem of spatial crosstalk, which should not exceed 10%. A mini-array of detectors should be used to demonstrate the effectiveness of the proposed mechanism. Ideas on pixel-co-registered bias-switchable dual-band structure are also requested, with an emphasis on reducing spectral crosstalks between the bands.

PHASE I: Preliminary experimental study or analytical study showing the feasibility of proposed ideas. The small business and the research institution need to demonstrate coherent and mutually supporting goals and plans. A comprehensive study on a selected focus area is expected to show good understanding of the issue and examine it at a single device level. The results from phase I should show strong ability to carry out expansive work in Phase II.

PHASE II: Design and implement comprehensive and systematic scientific investigation on the proposed research topic. Various sources of experimental data and modeling data should be analyzed and correlated in order to establish links to detector performance. Methods for improving detector performance should be derived and subsequently executed, preferably demonstrated at a FPA level.

PHASE III: Marketing technologies developed under this solicitation to relevant missile defense elements directly, or transition them through infrared sensor vendors.

COMMERCIALIZATION: The contractor will pursue commercialization of the various technologies and EO/IR components developed in Phase II for potential commercial uses in many areas, including semiconductor manufacturing, scientific and educational instrumentation, and infrared detection and imaging.

REFERENCES:
1. W. Tennant, D. Lee, M. Zandian, E. Piquette, M. Carmody, MBE HgCdTe Technology: A Very General Solution to IR Detection, Described by ‘‘Rule 07’’, a Very Convenient Heuristic, J. of Electronic Materials 37, 1406 (2008); W. Tennant, “Rule 07” revisited...still a good heuristic predictor of HgCdTe performance? To be published in J. Electronic Materials.

2. John Ayers, Heteroepitaxy of Semiconductors – Theory, Growth, and Characterization, Taylor & Francis Group LLC (2007). 3. SPIE Conference Proceedings on Infrared Technology and Applications XXXVI, volume 7660 (2010).

KEYWORDS: lifetime measurement, minority carrier lifetimes, semiconductor characterization, Rule 07, superlattice interfaces, antimonide superlattice, semiconductor defects

MDA10-T003 TITLE: Fast Algorithms for Generating Hardbody Thermal Histories

TECHNOLOGY AREAS: Sensors, Battlespace

The technology within this topic is 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 the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop an innovative thermal solver capability to operate at real-time rates to support in-the-loop operation.

DESCRIPTION: A creative simulation solution is needed to accurately model in real-time the changing thermal characteristics and evolving nature of responsive threats and other associated objects. Historically, tools for providing high fidelity thermal histories of hardbodies such the Optical Signatures Code (OSC) have been operated in an off-line manner, i.e. they have run as stand-alone programs generating databases that are later used in larger scale simulations. This current solution is not adequate for the new closed-loop real-time system simulations that are currently being developed by MDA. These simulations are being developed to integrate the various potential sensors, space platforms, and weapons to examine complete system effectiveness.

Target objects can change temperatures dramatically throughout the flight due to altitude changes, internal heating, interaction with the environment, and dynamic events. An innovative thermal solver solution is needed to capture these changes to support high fidelity multi-spectral integrated scene generation for real time or near-real time data rates. It is desired that the thermal solver solution be capable of integrating (i.e. with an Application Programmers Interface (API)) into existing and future MDA high fidelity digital simulations to allow multi-spectral scene generation models to create real-time in-band signatures. MDA scene generation models, for example the Fast Line-of-sight Imagery for Target and Exhaust-plume Signatures (FLITES)1 code, will use the new thermal solvers to compute battlespace imagery for surveillance sensors and interceptor seekers viewing threat hardbody components. The thermal solver capability should enable real time or near-real time thermal solutions to be computed for complex multi-layered materials and paint coatings for environments from sea-level to space environments with environment data provided by the higher level simulator.

PHASE I: Provide an assessment of potential thermal modeling solutions for suitability for real time operation. Approaches for code development should be clearly laid out, along with anticipated hardware requirements. Develop a detailed verification and validation plan to show how the codes accuracy will satisfy the requirements in a similar manner that the legacy code bases have fulfilled during their operational history.

PHASE II: Provide a prototype real time thermal solver capability. In addition to demonstrating real time rates for MDA class targets, the data generated should be validated against existing MDA tools such as OSC, as well as measured data where possible.

PHASE III: Provide an operational package of hardware and software that operates against a specified set of targets in a real-time fashion. Thermals solutions should be verified against existing thermal modes and validated against government provided target data.

COMMERCIALIZATION: Techniques, processes and hardware developed in this effort will have broad application across the DOD and Homeland defense simulation community, including hardware and software in the loop test and evaluation, signal processing algorithm and software design and development and sensor design and development.

REFERENCES:
1. D. Crow, C. Coker, W. Keen, “Fast Line-of-sight Imagery for Target and Exhaust-plume Signatures (FLITES) scene generation program”, Technologies For Synthetic Environments, Hardware-in-the-loop Testing XI, Proc. of SPIE Vol 6208.

KEYWORDS: Thermal solver, signature, simulation

MDA10-T004 TITLE: Modeling of Lithium-Ion Cell Performance

TECHNOLOGY AREAS: Materials/Processes, Space Platforms

ACQUISITION PROGRAM: PTSS, ABIR, SM-3 Variants

The technology within this topic is 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 the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop, from first principles, advanced mathematical modeling of lithium-ion cell and battery performance.

DESCRIPTION: One area of interest for mathematical modeling in lithium-ion technology will involve the development of mathematical approaches to LEO and MEO performance of new cathode and anode material chemistries, including advancements currently underway in government and academic laboratories. The new chemistries under development are desired to accommodate calendar life coupled with active life in LEO and MEO satellite applications which may include potential pulse power requirements and variable DoD's. A second area of interest is in development of modeling coupled with laboratory cycling to provide verification data, to fully understand whether accelerated life testing can be utilized to characterize LEO and MEO orbital missions, because of the long term bench testing required to qualify a chemistry in real time, before insertion into actual satellite missions.

In the first Topic area, for new chemistries, optimal performance with respect to a mission profile is necessary and requires predictive modeling in advance of selection of appropriate chemistries. In this respect, failure to understand the degradation processes which occur in these new materials during potentially abusive use of the cells such as pulse loads and variable DoD's means that their availability for insertion in satellite applications will be problematic. In the second Topic area, accelerated life testing for LEO has been a significant problem area for many years in Li-ion chemistry because the processes that occur at the anode and cathode at high DoD's (60+%) are poorly understood as to how they relate to low DoD's (30% and lower), and yet accelerated life tests to speed up qualification processes are critically needed. In order to fully understand the impact of both of these research areas on performance capabilities and eventual cycle life, it is important that mathematical models be developed which accurately describe the processes which occur as a function of the performance requirements, to provide for modifications to manufacturing and testing procedures to accommodate the needed performance.

PHASE I: Design and develop representative proof of concept software supported by data from appropriate hardware for lithium-ion cell technology. The modeling should be evaluated against actual cell performance data to characterize performance and to assist in developing a Phase II design strategy. The software should be functionally tested in operationally driven modes and analyzed for a path to representative environments. The contractor will identify key technical challenges and establish a plan to address and overcome those challenges. The contractor will also develop a Phase II program plan, including (but not limited to) a development strategy appropriate to application to several battery designs, program schedule, and estimated costs. Proposing firms are strongly encouraged to work with MDA satellite payload and system contractors to understand the requirements, to help ensure applicability of their efforts, and to begin work toward technology transition.

PHASE II: Using the lessons learned from developing and testing the prototype modeling software in Phase I, design and develop prototype modeling concepts that can be integrated into an MDA requirement/system. The prototype software will be tested in accordance with MDA/SS operational and environmental parameters. The contractor should keep in mind the goal of commercialization of the innovation for the Phase III effort, to which end they should have working relationships with, and support of, system and payload contractors.

PHASE III: The modeling technologies developed as a result of the Phase II contract(s) will be applicable to many other military and commercial satellite applications that can benefit from the enhanced capabilities, as well as cost savings associated with the new technology. One of the first uses of the modeling technologies is envisioned for application to a space tracking and surveillance satellite.

COMMERCIALIZATION: The commercial potential for increased performance of satellite batteries is high. Commercial satellite providers are a significant fraction of the space market and are continually looking for ways to reduce system mass, decrease costs, and increase spacecraft reliability and lifetime. Rechargeable batteries are used in commercial aerospace applications for on-board power and innovations developed under this topic are likely to benefit various commercial spacecraft applications.

REFERENCES:

1. http://www.acq.osd.mil/mda/mdalink/html/mdalink.html - provides an overview of MDA platforms.

2. http://www.electrochem.org - provides detailed information on current state-of-the-art advances and research of interest to MDA rechargeable batteries.

3. Handbook of Batteries, 3rd Edition, McGraw-Hill, provides detailed information regarding the design and construction of lithium-ion rechargeable batteries.

4. http://www.eaglepicher.com/EaglePicherInternet/Power_Group/Defense_Applications - provides documents describing MDA-interest batteries and related technology.

5. http://www.lithion.com/lithion/index.html - provides links to various documents describing MDA-interest rechargeable lithium battery technology.

6. Q. Zhang, R.E. White, and B.N. Popov, Capacity fade analysis of a lithium ion cell, J. Power Sources, dol:10.1016/j.powsour.2008.01.028.

7. P. Ramadass, B. Haran, R.E. White, and B.N. Popov, Mathematical modeling of the capacity fade of lithium ion cells, J. Power Sources, 123 (2003), 230-240.

KEYWORDS: Lithium, Battery, Rechargeable, Modeling Software, Cycle life, Space Power