INTRODUCTION

Responsibility for the implementation, administration, and management of the Department of the Navy (DoN) SBIR Program is with the Office of Naval Research (ONR). The Director of the DoN SBIR Program is Mr. Robert Smith, robert.l.smith6@navy.mil. For program and administrative questions, please contact the Program Managers listed in Table 1; do not contact them for technical questions. For technical questions about the topic, contact the Topic Authors listed for each topic during the period 27 August 2015 through 27 September 2015. Beginning 28 September 2015, the SBIR/STTR Interactive Technical Information System (SITIS) (https://sbir.defensebusiness.org/) listed in Section 4.15.d of the DoD SBIR Program Solicitation must be used for any technical inquiry. For inquiries or problems with electronic submission, contact the DoD SBIR/STTR Help Desk at 1-800-348-0787 (9:00 a.m. to 6:00 p.m. ET).

TABLE 1: DoN SYSTEMS COMMANDS (SYSCOM) SBIR PROGRAM MANAGERS

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<tr>
<td>N153-124 to N153-129</td>
<td>Ms. Elizabeth Madden</td>
<td>MARCOR</td>
<td><a href="mailto:elizabeth.madden@navy.mil">elizabeth.madden@navy.mil</a></td>
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<tr>
<td>N153-130</td>
<td>Mr. John Keiran</td>
<td>NSMA</td>
<td><a href="mailto:john.keiran@navy.mil">john.keiran@navy.mil</a></td>
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<tr>
<td>N153-131 to N153-133</td>
<td>Mr. Mark Hrbacek</td>
<td>SSP</td>
<td><a href="mailto:mark.hrbacek@navy.mil">mark.hrbacek@navy.mil</a></td>
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The DoN’s SBIR Program is a mission oriented program that integrates the needs and requirements of the DoN’s Fleet through R&D topics that have dual-use potential, but primarily address the needs of the DoN. Companies are encouraged to address the manufacturing needs of the Defense Sector in their proposals. Information on the DoN SBIR Program can be found on the DoN SBIR/STTR website at www.navysbir.com. Additional information pertaining to the DoN’s mission can be obtained from the DoN website at www.navy.mil.

PHASE I GUIDELINES

Follow the instructions in the DoD SBIR Program Solicitation at https://sbir.defensebusiness.org/ for program requirements and proposal submission guidelines. Please keep in mind that Phase I should address the feasibility of a solution to the topic. It is highly recommended that proposers follow the DoN proposal template located at www.navysbir.com/submission.htm as a guide for structuring proposals. Inclusion of cost estimates for travel to the sponsoring SYSCOM’s facility for one day of meetings is recommended for all proposals.

Technical Volumes that exceed the 20 page limit will be reviewed only to the last word on the 20th page. Information beyond the 20th page will not be reviewed or considered in evaluating the proposal. To the extent that mandatory technical content is not contained in the first 20 pages of the proposal, evaluators may deem the proposal as non-responsive and score it accordingly.

The DoN requires proposers to include, within the 20-page limit, an option that furthers the effort and will bridge the funding gap between Phase I and the Phase II start. Phase I options are typically exercised
upon the decision to fund the Phase II. The Phase I base amount and Period of Performance shall not exceed $80,000 and six months; the Phase I option amount and Period of Performance shall not exceed $70,000 and six months.

PHASE I PROPOSAL SUBMISSION CHECKLIST:

The following criteria must be met or the proposal will be REJECTED.

_____1. Include a header with company name, DoD proposal number, and DoD topic number on each page of your Technical Volume.

_____2. Include tasks (separately) to be completed during the option period in the 20-page Technical Volume and include the costs as a separate section in the Cost Volume. Costs for the base and option should be clearly separate, and identified on the Proposal Cover Sheet, in the Cost Volume, and in the work plan section of the proposal.

_____3. BREAK OUT SUBCONTRACTOR, MATERIAL AND TRAVEL COSTS IN DETAIL. In the Cost Volume, it is important to provide sufficient detail for the subcontract, material and travel costs. Subcontractor costs should be detailed at the same level as the prime to include at a minimum personnel names, rate per hour, number of hours, material costs (if any), and travel costs (if any). Material costs should include at a minimum listing of items and cost per item. Travel costs should include at a minimum the purpose of the trip, number of trips, location, length of trip, and number of personnel. Use the “Explanatory Material Field” in the DoD Cost Volume worksheet for this information.

_____4. If Discretionary Technical Assistance (DTA) is proposed, add information required to support DTA in the “Explanatory Material Field” in the DoD Cost Volume worksheet.

_____5. The Phase I base amount and Period of Performance shall not exceed $80,000 and six months and the option amount and Period of Performance shall not exceed $70,000 and six months. The costs for the base and option periods are clearly separate, and identified on the Proposal Cover Sheet, in the Cost Volume, and in the Technical Volume. If proposing direct DTA, a total of up to $5,000 combined may be added to the Base or Option periods.


_____7. After uploading the file on the DoD SBIR/STTR submission site, review it to ensure that it appears correctly. Contact the DoD SBIR/STTR Help Desk immediately with any problems.

PHASE II GUIDELINES

All Phase I awardees will be allowed to submit an Initial Phase II proposal for evaluation and selection. The Phase I Final Report, Initial Phase II Proposal, and Transition Outbrief (as applicable), will be used to evaluate the offeror’s potential to progress to a workable prototype in Phase II and transition technology in Phase III. Details on the due date, content, and submission requirements of the Initial Phase II Proposal will be provided by the awarding SYSCOM either in the Phase I award or by subsequent notification. NOTE: All SBIR/STTR Phase II awards made on topics from solicitations prior to
FY13 will be conducted in accordance with the procedures specified in those solicitations (for all DoN topics, this means by invitation only).

Section 4(b)(1)(ii) of the SBIR Policy Directive permits the Department of Defense and by extension the DoN, during fiscal years 2012 through 2017, to issue a Phase II award to a small business concern that did not receive a Phase I award for that R/R&D. **NOTE:** The DoN will NOT be exercising this authority for SBIR Phase II awards. Therefore, in order for any small business firm to receive a Phase II award, the firm must be a recipient of a Phase I award under that topic and submit an Initial Phase II proposal.

The DoN typically awards a cost plus fixed fee contract for Phase II. The Phase II contracts can be structured in a way that allows for increased funding levels based on the project’s transition potential. To accelerate the transition of SBIR-funded technologies to Phase III, especially those that lead to Programs of Record and fielded systems, the Commercialization Readiness Program was authorized and created as part of section 252 of the National Defense Authorization Act of Fiscal Year 2006. The statute set-aside is 1% of the available SBIR funding to be used for administrative support to accelerate transition of SBIR-developed technologies and provide non-financial resources for the firms (e.g. the DoN’s SBIR/STTR Transition Program).

**DISCRETIONARY TECHNICAL ASSISTANCE**

The SBIR Policy Directive section 9(b), allows the DoN to provide discretionary technical assistance (DTA) to its awardees to assist in minimizing the technical risks associated with SBIR projects and commercializing products and processes. Firms may request, in their Phase I and Phase II proposals, to contract these services themselves in an amount not to exceed $5,000 per year. This amount is in addition to the award amount for the Phase I or Phase II project.

Phase I awardees that propose more than $150,000 in total funding (Base, Option and DTA) may not receive a purchase order. Purchase orders are a type of Simplified Acquisition Procedure (SAP) intended to reduce administrative costs, promote efficiency and economy in contracting, and avoid unnecessary burdens for agencies and contractors. The need to issue a Firm Fixed Price (FFP) contract may result in contract delays if the SYSCOM normally issues purchase orders for Phase I awards. FOR ONR TOPICS ONLY: The total Phase I award amount, including DTA, cannot exceed $150K under a purchase order.

Approval of direct funding for DTA will be evaluated for approval by the DoN SBIR office if the firm’s proposal (1) clearly identifies the need for assistance (purpose and objective of required assistance), (2) provides details on the provider of the assistance (name and point of contact for performer); and unique skills/specific experience to carry out the assistance proposed, and (3) the cost of the required assistance (costs and hours proposed or other details on arrangement that would justify the proposed expense). This information must be included in the firm’s cost proposal specifically identified as “Discretionary Technical Assistance” and cannot be subject to any profit or fee by the requesting SBIR firm. In addition, the provider of the DTA may not be the requesting firm, an affiliate of the requesting firm, an investor of the requesting firm, or a subcontractor or consultant of the requesting firm otherwise required as part of the paid portion of the research effort (e.g. research partner, consultant, tester, or administrative service provider). Failure to include the required information in the proposal will result in the request for DTA being disapproved. Exceeding proposal limits identified for Phase I ($150,000 for Base, Option, and DTA) without including the required identification of DTA will result in the proposal’s REJECTION without evaluation.
If a firm requests and is awarded DTA in a Phase II proposal, it will be eliminated from participating in the DoN SBIR/STTR Transition Program (STP), the DoN Forum for SBIR/STTR Transition (FST), and any other assistance the DoN provides directly to awardees.

All Phase II awardees not receiving funds for DTA in their award must attend a one-day DoN STP meeting during the second year of the Phase II. This meeting is typically held in the summer in the Washington, D.C. area. Information can be obtained at: http://www.navysbir.com/Transition.htm. Awardees will be contacted separately regarding this program. It is recommended that Phase II cost estimates include travel to Washington, D.C. for this event.

PHASE III GUIDELINES

A Phase III SBIR award is any work that derives from, extends, or completes effort(s) performed under prior SBIR funding agreements, but is funded by sources other than the SBIR Program. Thus, any contract or grant where the technology is the same as, derived from, or evolved from a Phase I or a Phase II SBIR/STTR contract and awarded to the company that was awarded the Phase I/II SBIR is a Phase III SBIR contract. This covers any contract/grant issued as a follow-on Phase III SBIR award or any contract/grant award issued as a result of a competitive process where the awardee was an SBIR firm that developed the technology as a result of a Phase I or Phase II SBIR. The DoN will give SBIR Phase III status to any award that falls within the above-mentioned description, which includes assigning SBIR Data Rights to any noncommercial technical data and/or noncommercial computer software delivered in Phase III that was developed under SBIR Phase I/II effort(s). Government prime contractors and/or their subcontractors follow the same guidelines as above and ensure that companies operating on behalf of the DoN protect the rights of the SBIR company.

EVALUATION AND SELECTION

The DoN will evaluate and select Phase I and Phase II proposals using the evaluation criteria in Sections 6.0 and 8.0 of the DoD SBIR Program Solicitation respectively, with technical merit being most important, followed by qualifications of key personnel and commercialization potential of equal importance. Due to limited funding, the DoN reserves the right to limit awards under any topic and only proposals considered to be of superior quality will be funded. NOTE: The DoN does NOT participate in the FAST Track program.

Protests of Phase I and II selections and awards shall be directed to the cognizant Contracting Officer for the DoN Topic Number. Contact information for Contracting Officers may be obtained from the Navy SYSCOM SBIR Program Managers listed in Table 1.

One week after Phase I solicitation closing, e-mail notifications that proposals have been received and processed for evaluation will be sent. Consequently, e-mail addresses on the proposal coversheets must be correct.

The DoN typically awards a Firm Fixed Price (FFP) contract or a small purchase agreement for Phase I.

In accordance with section 4.10 of the DoD Instructions, requests for a debrief must be made within 30 days of non-award notification.

CONTRACT DELIVERABLES

Contract deliverables are typically progress reports and final reports. Deliverables required by the contract, shall be uploaded to https://www.navysbirprogram.com/navydeliverables/.
AWARD AND FUNDING LIMITATIONS

In accordance with SBIR Policy Directive section 4(b)(5), there is a limit of one sequential Phase II award per firm per topic. Additionally in accordance with SBIR Policy Directive section 7(i)(1), each award may not exceed the award guidelines (currently $150,000 for Phase I and $1 million for Phase II, excluding DTA) by more than 50% (SBIR/STTR program funds only) without a specific waiver granted by the SBA.

TOPIC AWARD BY OTHER THAN THE SPONSORING AGENCY

Due to specific limitations on the amount of funding and number of awards that may be awarded to a particular firm per topic using SBIR/STTR program funds (see above), Head of Agency Determinations are now required (for all awards related to topics issued in or after the SBIR 13.1/STTR 13A solicitation) before a different agency may make an award using another agency’s topic. This limitation does not apply to Phase III funding. Please contact the original sponsoring agency before submitting a Phase II proposal to an agency other than the one that sponsored the original topic. (For DoN awardees, this includes other DoN SYSCOMs.)

TRANSFER BETWEEN SBIR AND STTR PROGRAMS

Section 4(b)(1)(i) of the SBIR Policy Directive provides that, at the agency’s discretion, projects awarded a Phase I under a solicitation for SBIR may transition in Phase II to STTR and vice versa. A firm wishing to transfer from one program to another must contact its designated technical monitor to discuss the reasons for the request and the agency’s ability to support the request. The transition may be proposed prior to award or during the performance of the Phase II effort. No transfers will be authorized prior to or during the Phase I award. Agency disapproval of a request to change programs will not be grounds for granting relief from any contractual performance requirement(s) including but not limited to the percentage of effort required to be performed by the small business and the research institution (if applicable). All approved transitions between programs must be noted in the Phase II award or an award modification signed by the contracting officer that indicates the removal or addition of the research institution and the revised percentage of work requirements.

ADDITIONAL NOTES

1. Due to the short timeframe associated with Phase I of the SBIR process, the DoN does not recommend the submission of Phase I proposals that require the use of Human Subjects, Animal Testing, or Recombinant DNA. For example, the ability to obtain Institutional Review Board (IRB) approval for proposals that involve human subjects can take 6-12 months, and that lengthy process can be at odds with the Phase I goal for time to award. Before DoN makes any award that involves an IRB or similar approval requirement, the proposer must demonstrate compliance with relevant regulatory approval requirements that pertain to proposals involving human, animal, or recombinant DNA protocols. It will not impact the DoN’s evaluation, but requiring IRB approval may delay the start time of the Phase I award and if approvals are not obtained within two months of notification of selection, the decision to award may be terminated. If the use of human, animal, and recombinant DNA use is included under a Phase I or Phase II proposal, please carefully review the requirements at: http://www.onr.navy.mil/About-ONR/compliance-protections/Research-Protections/Human-Subject-Research.aspx. This webpage provides guidance and lists approvals that may be required before contract/work can begin.
2. Due to the typical lengthy time for approval to obtain Government Furnished Equipment (GFE), it is recommended that GFE is not proposed as part of the Phase I proposal. If GFE is proposed and is determined during the proposal evaluation process to be unavailable, proposed GFE may be considered a weakness in the proposal.

3. For topics indicating ITAR restrictions or the potential for classified work, there are generally limitations placed on disclosure of information involving topics of a classified nature or those involving export control restrictions, which may curtail or preclude the involvement of universities and certain non-profit institutions beyond the basic research level. Small businesses must structure their proposals to clearly identify the work that will be performed that is of a basic research nature and how it can be segregated from work that falls under the classification and export control restrictions. As a result, information must also be provided on how efforts can be performed in later Phases if the university/research institution is the source of critical knowledge, effort, or infrastructure (facilities and equipment).
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NAVY SBIR 15.3 Topic Descriptions

N153-124 TITLE: Harvestable Energy System for Use in Covered Locations

TECHNOLOGY AREA(S): Materials/Processes

ACQUISITION PROGRAM: PM Combat Support Systems (CSS), PdM Expeditionary Power Systems (EPS)

OBJECTIVE: Develop innovative approaches to enable a Marine unit to harvest energy in locations that are covered with low direct-light levels and low wind levels.

DESCRIPTION: Logistics resupply of power, both fuel and batteries, is a major burden on a Marine Company and can limit their desired operations. The USMC Expeditionary Energy Strategy and Implementation Plan (Ref. 1) states an ultimate goal of eliminating liquid fuel needs except for mobility platforms by 2025. Several renewable energy efforts are underway to get the Marine Corps closer to this goal (Ref. 2); however, most of these efforts are focused on technologies that are most efficient in open sunny locations. With the Marine Corps push to the Pacific and locations where terrain will consist of denser foliage areas, the more standard solar and wind technologies will not be as effective. There is a need for technology that can harvest energy in covered locations which would reduce the Marines total logistical burden of fuel and batteries. Currently all fielded renewable energy systems require open uncovered locations for deployment. Systems such as wind and solar do not perform well near or under covered locations such as in forests or jungles. Known harvesting technology that can be used in covered locations such as waste-to-energy technology is currently too bulky, time consuming to initiate and unreliable for small units of Marines. Other efforts have been looked at such as micro-hydro turbines, hand crank generators, and biomass energy converters. All of these systems have had deficiencies in either size, weight, operational area limitation, or ease of deployment, making them currently unsuitable for wide use. The Marine Corps deploys in a variety of environments and needs advanced technology that will allow for harvesting of available energy in locations that are covered (Ref. 3).

The Marine Corps is interested in innovative approaches in the development of renewable expeditionary energy systems. Proposed concepts must be able to operate in temperature ranges of -20°F to 125°F in rain, dust, salt conditions and survive transit over rough terrain (Ref. 4). Proposed concept systems must be light and compact allowing a small number of Marines to carry and deploy the system. The objective for an individual component is no more than a 2 person lift (88lbs). To limit deployment area and overall weight, the proposed concepts should be scalable and have energy densities greater than 25W/ft^2 and 5W/lbs. Proposed concepts should have minimal start up time (< 10 minutes for 2 people) allowing the Marines to rapidly set-up and start powering their equipment. It is anticipated that successfully developed energy harvesting concepts would be used in conjunction with the USMC renewable energy and hybrid systems. Therefore, proposed concepts will be required to have either a nominal 24V output which is fairly stable (MIL-STD-1275F) or a 120V AC output (MIL-STD-1332B) (Ref. 5,6).

PHASE I: Develop concepts for harvesting energy in covered locations that meet the requirements described above. The small business will demonstrate the feasibility of the concepts in meeting Marine Corps needs and will establish that the concepts can be developed into a useful product for the Marine Corps. Analytical modeling and simulation may be used to demonstrate feasibility. The small business will also articulate a plan for Phase II development that identifies performance goals, key technical milestones, and, as appropriate, any technical risk reduction strategy(ies).

PHASE II: Based on the results of Phase I and the Phase II development plan, develop and deliver a prototype system for government evaluation. The prototype will be evaluated to determine its capability in meeting the performance goals defined in the Phase II SOW and the Marine Corps requirements for renewable energy systems. System performance will be demonstrated through prototype evaluation and over the required range of parameters as discussed in the Description above. Evaluation results will be used to refine the prototype into a final design. The company will prepare a Phase III development plan to transition the technology for Marine Corps use.

PHASE III DUAL USE APPLICATIONS: If Phase II is successful, the small business will be expected to support the Marine Corps in transitioning the technology for Marine Corps use. The small business will develop a plan to determine the effectiveness of the renewable energy system in an operationally relevant environment. The small
business will support the Marine Corps for test and validation to certify and qualify the system for Marine Corps use. As applicable, the small business will prepare manufacturing plans and develop manufacturing capabilities to produce the product for military and commercial markets.

REFERENCES:
6. MIL-STD-1332 B (Notice-2), Definitions of Tactical, Prime, Precise and Utility Terminologie

KEYWORDS: Renewable energy; energy harvesting; expeditionary energy; expeditionary power; energy strategy

Questions may also be submitted through DoD SBIR/STTR SITIS website.

N153-125 TITLE: Small Arms Fire Location for the Dismounted Marine

TECHNOLOGY AREA(S): Battlespace

ACQUISITION PROGRAM: PMM-113.5, Product Manager Optics and Non-Lethal Systems (ONS), MCPC 240111

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 5.4.c.(8) of the solicitation. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop a system for locating the source of hostile small arms fire without the requirement for direct line of sight to the point of origin. The system shall consist of head, body, and/or hand-held components to provide real-time location data to a dismounted Marine during tactical movement. This topic addresses energy efficiency and operational costs by reducing the power and expense associated with fixed-site and vehicle mounted anti-sniper and counter-fire sensor systems.

DESCRIPTION: Acoustic gunshot detection systems utilizing microphone arrays are capable of establishing the approximate point of origin and trajectory of small arms fire, but are easily confused in multi-path reflection environments, including mountainous regions and urban canyons. The same mountainous and urban environments can constrain the use of line of sight based gunfire location techniques, such as muzzle flash detection, and “pre-shot”
capabilities that actively search for optical augmentation retro-reflections from potential threats, providing little utility to other friendly forces not equipped with their own gunfire or pre-shot sensors. Active illumination pre-shot systems also have the potential to reveal friendly force locations to hostile forces equipped with imaging devices operating within the same wavelengths. Reference 1 provides additional details of these capabilities and their limitations. Dismounted Marines are currently equipped with various direct-view visible light and indirect-view image intensification and thermal imaging systems operating in infrared imaging bands. Under ideal viewing angle (parallel, but not perpendicular, to line of sight) and environmental conditions, some devices are capable of briefly perceiving small arms projectiles in flight, either directly or indirectly via their wake, but without sufficient detail to reliably track to the point of origin.

Prior research (see Ref 2) indicates that small arms projectiles in flight are strong emitters in infrared bands, particularly Mid-Wave Infrared (MWIR). Dismounted Marines typically utilize uncooled Long-wave Infrared (LWIR) imagers, such as the AN/PAS-28 Medium Range Thermal Imager and AN/PAS-30 Mini Thermal Imager (see Ref 3 and 4), due to their low cost (less than $10,000), low power (less than three Watts), and near-instant start-up time, but these systems have only demonstrated reliable imaging of relatively large or slow projectiles, such as grenades. Handheld MWIR imagers are available in the USMC inventory, but their high cost (greater than $20,000) and cooling needs (up to eight Watts and greater as ambient temperature increases, cool-down times measured in minutes) are accepted for only the longest range (over 2,500 meter) imaging applications. The currently fielded AN/PAS-22 Long Range Thermal Imager (see Ref 5) is an MWIR device, but has a restricted field of view, low resolution, and insufficient imaging frame rate to resolve small, high speed projectiles perpendicular to observer.

This topic seeks to explore innovative approaches in the development of a man-portable, battery powered, small-arms fire location system that is handheld, head mounted, and/or body worn for use by an individual dismounted Marine observing from positions of protective cover during tactical movement and, ideally, while also on-the-move. Proposed concepts shall utilize thermal imaging technology to acquire, display, and extrapolate a partial small arms projectile (Russian caliber 5.45mm, US caliber 5.56mm and greater) track, passing at any angle within tactically relevant range (hundreds of meters) of the observer, to the point of origin. Accuracy of points of origin shall (threshold specification) have an average azimuth error of less than five degrees from the observer’s point of view, and an average range estimation error of less than 20%, during conditions of no-obstructing terrain between the source and observer. Accuracy should (objective specification) be less than two degrees average azimuth error, and less than 10% average range error. Thresholds are specifications that meet requirements; while objectives are specifications that exceed minimal requirements and are of a particular interest. Observed tracks shall be graphically distinguishable from extrapolated paths, and overlaid on actual, real-time, terrain scenery to assist observer orientation. Proposed concepts shall have a probability of detection of no less than 70%, day or night and commensurate with the threat weapon capabilities (ex., 500 meters for 5.45mm and 5.56mm caliber rifles; 2,000 meters for 12.7mm caliber heavy machine gun weapon systems). Proposed concepts should not utilize pre-mission terrain maps or other external mapping platforms. Concepts may, but are not required to, include additional electro-optical, acoustic, or other sensors to achieve accuracy requirements or cue other sensors with higher fidelity, but shall remain passive (no deliberate emissions) while in operation. The ability to refine accuracy through networked, open architecture, multi-user observations is desirable; however the system must meet requirements with a, passive, stand-alone capability. Concepts shall be capable of acquiring and temporarily storing (for at least fifteen minutes) the tracks of multiple weapons firing near-simultaneously, including those operating at a high rate of fire (up to 2,000 rounds per minute).

For the purposes of Phase II demonstration, proposed sensor components (including sensor level analog to digital conversion and onboard calibration and image enhancement functions, but not including output capture and projectile track processing hardware) should consume a total of no more than eight Watts of power over an ambient operating temperature range of -40C to +49C. Collected imagery and track analysis should be presented within one minute of firing events (a burst of machine gun fire counts as one event). The goal for Phase III is for collected imagery and track analysis to be presented to the user within 5 seconds or less after firing events. The Phase III system and power supply capacity shall be sufficient for eight hours of continuous surveillance, including no less than 250 distinct firing events detected and correlated to point of origin. The weight of Phase III head-mounted, hand-held, and/or body-worn components (including batteries), shall not exceed 500 grams, two kilograms, and seven kilograms, respectively.

PHASE I: Develop concepts for an improved approach for locating the source of hostile, small-arms fire without the requirement for direct line of sight to the point of origin that is capable of meeting the requirements stated in the Description above. The company will demonstrate the feasibility of the concepts in meeting Marine Corps needs and will establish that the concepts can be developed into a useful product for the Marine Corps. As applicable, the company will conduct detailed analysis of relevant target sets, concepts of employment, and sensing schemes.
necessary to achieve the desired capability. Where feasible, and within the scope and resources of the Phase I effort, key technical concepts shall be demonstrated. The small business will also articulate a plan for Phase II development that identifies performance goals, key technical milestones, and, as appropriate, any technical risk reduction strategy(ies). The company shall also provide a draft Phase II test and evaluation plan identifying any required resources necessary to acquire data for Phase II prototype design refinement. The plan should include the gathering of live-fire data collection utilizing non-Government resources, should sufficient research literature not be available during Phase I.

PHASE II: Based on the results of Phase I and the Phase II SOW, the small business will gather additional data, via live-fire observations, to refine the design and develop a prototype for evaluation. Access to Government furnished weapons, ammunition, and range facilities may be requested; however, the company shall provide a plan to conduct live-fire data collection utilizing non-Government resources (as part of the company’s Phase II prototype testing and evaluation). At the completion of the Phase II contract, the prototype developed shall have a minimum Technology Readiness Level (TRL) of 5, component and/or breadboard validation in a relevant environment, and demonstrate the ability to meet required capabilities, utilizing critical technology components, such as sensors, representative of Phase III concepts. In Phase II testing and evaluations, low risk technologies (such as image processing electronics) that can be optimally scaled physically and for power consumption with available and proven techniques, may be represented by commercial components (e.g. a tethered general purpose computer with high performance graphics processing units that can be replaced with an embedded field programmable gate array solution in Phase III). Test and evaluation results will be used to refine the prototype into an initial design that will meet Marine Corps requirements for a dismounted Marine platform solution. The company will prepare a Phase III development plan to transition the technology to Marine Corps use.

PHASE III DUAL USE APPLICATIONS: If Phase II is successful, the company will be expected to support the Marine Corps in transitioning the technology for Marine Corps use. The company will develop a self-contained and ruggedized solution and any respective components optimized for evaluation to determine its overall system effectiveness against realistic threats. The company will support the Marine Corps for test and validation to certify and qualify the system for Marine Corps use. As applicable, the company will prepare manufacturing plans and develop manufacturing capabilities to produce the product for military and commercial markets.

REFERENCES:


KEYWORDS: Hostile Fire Indication; Gunshot Detection; Shooter Location; Small Arms Localization; Projectile Tracking; Anti-Sniper

Questions may also be submitted through DoD SBIR/STTR SITIS website.

N153-126 TITLE: High Voltage Antenna Protection for Hand-held and Man-pack Radios

TECHNOLOGY AREA(S): Electronics
OBJECTIVE: Development of innovative approaches to provide high-voltage protection to reduce the risk of electrical shocks from low overhead wires for dismounted radio operators while providing equivalent or better radiation pattern and gain in existing hand-held and man-pack radio antennas.

DESCRIPTION: Marine Corps Systems Command (MARCORSYSCOM) provides radio and antenna material solutions to the Marine Corps. In an operational environment, dismounted Marines can encounter low-hanging wires such as unregulated power distribution lines which present the potential for an electric shock hazard. These lines can be unpredictable in height and voltage. Dismounted Marines operate hand-held or man-pack radios with long collapsible whip (8 to 10 ft.) or blade antennas (3 to 4 ft) (Ref 1 and 2). The configurations allow for the possibility of an electrical shock hazard should direct contact be made with a power line. While whip antennas exhibit good size and weight characteristics for the performance they provide, they pose a shock hazard in these types of environments due to their length and all metal construction. Intermediate length blade antennas are more manageable, but are also not designed for the electrical safety of the operator. The development of technology solutions for this type of environment creates several challenges. Electrical antennas (monopoles) need to be in upright position to perform well and display the appropriate omni-directional pattern. However, doing this increases visual cueing to the enemy. An operator in “prone” position (under fire) could also experience substantial degradation in antenna performance due to reflections off of the ground plane. While higher amplification could facilitate the use of a shorter antenna height, this could in turn negatively impact the available portable battery power carried by each warfighter as higher amplification would require more available power. Wearable antenna solutions (e.g. solution that wraps around the individual) are available; however, they could potentially pose Hazards of Electromagnetic Radiation to Personnel (HERP) concerns. These solutions also are limited by the use of one frequency band and typically have insufficient power for communications. Loop antennas provide a means to reduce the height significantly, but with a cross-looped design (such as an eggbeater), it becomes impractical for an individual to use. Presently, a temporary solution has been deployed but this solution is a simple antenna sheathing that is considered a temporary work around and not integrated with the antenna. At this time, there are no robust, viable technology solutions for this ongoing need in the application cited.

MARCORSYSCOM is looking for non-invasive, innovative approaches that can be installed in the field for our fielded antennas described previously, to reduce the risk to the operator by providing high-voltage protection to 20KV RMS (35KV RMS objective) while also providing equivalent or better radiation pattern omnidirectional gain as well as a solution that is difficult for the enemy to visually detect. The antennas/solutions of most interest are for use with hand-held and man-pack tactical radios in the High Frequency (HF), lower Very High Frequency (VHF) bands (2 to 88 MHz), and 33-88mhz Single Channel Ground and Airborne Radio System (SINCGARS). The following hand-held and man-pack tactical radios use those above mentioned bands: AN/PRC-150, AN/PRC-117F, AN/PRC-117G and AN/PRC-152 (Ref 3 and 4). The radios use N Type and threaded Neill–Concelman (TNC) antenna connectors. Concepts proposed must not negatively impact or damage the high voltage wires encountered and must pass a high voltage performance test. Proposers should be prepared to discuss the level of protection their technology solution(s) provides, the technology used to achieve a proposed level of protection, and any applicable antenna/solution performance information. Proposers should employ open architecture designs principles as much as is practicable. Preference will be given to solutions that do not cause permanent modifications to the current Marine Corps systems. For maximum range and reliability, the dismounted Marine requires the antenna to be light and flexible (Ref 3 and 4). A collapsible design is not required but, if applicable to the proposed concept, would be helpful for storage and transportation.

PHASE I: The company will develop concepts for reducing the risk of electric shock in the event that a hand-held or man-pack radio antenna makes contact with a live power source pursuant to the requirements described above. The
company will demonstrate the feasibility of the concepts in meeting Marine Corps needs and will establish the concepts can be developed into a useful product for the Marine Corps. Feasibility will be established by material testing and analytical modeling, as appropriate. The company will provide a Phase II development plan with performance goals and key technical milestones, and that will address technical risk reduction.

PHASE II: Based on the results of Phase I and the Phase II development plan, the small business will develop a scaled prototype(s) for evaluation. The prototype(s) will be evaluated to determine the capability in meeting the performance goals defined in the Phase II SOW and the Marine Corps requirements as stated in the Description section. System performance will be demonstrated through prototype evaluation and over the required range of parameters as discussed in the Description above. Evaluation results will be used to refine the prototype(s) into a final design. The company will prepare a Phase III development plan to transition the technology for Marine Corps use.

PHASE III DUAL USE APPLICATIONS: If Phase II is successful, the company will be expected to support the Marine Corps in transitioning their technology for Marine Corps use. The company will finalize the design for evaluation to determine effectiveness in an operationally relevant environment. The company will support the Marine Corps for test and validation to certify and qualify the system for Marine Corps use. As applicable, the company will prepare manufacturing plans and develop manufacturing capabilities to produce the product for military and commercial markets.

REFERENCES:
5. Current Exposure Magnitude and Duration, diagrams provided by TPOC on 10/22/15.

KEYWORDS: antenna; tactical radio; AN/PRC-150; AN/PRC-117F; AN/PRC-117G; AN/PRC-152

Questions may also be submitted through DoD SBIR/STTR SITIS website.
demand processes in water purification systems. Desalination of water obtained from any source to support Squad or Platoon operations remains a significant technical challenge. Commercially available water purification systems operate on a much smaller scale and are only able to handle low-salinity (brackish) sourced water. These systems are not scalable and would require an external generator to provide the power necessary to facilitate the desalination process. Innovative research has been performed in nanophotonic effects allowing for high efficiency direct solar membrane distillation, which could allow desalination of water at resource limited locations (Ref. 3). This process holds the potential to greatly increase typical desalination permeates yields, while decreasing desalinization energy expenditures. This is one example of basic research that could be applied to water purification to increase efficiency of the systems. Successful development of this concept would allow the Squad to facilitate a greater level of self-sufficiency increasing the Commander’s flexibility to deploy this size force. Being able to purify water locally reduces the total cost of supplying water compared to constant resupply of bottled water. In addition, the reduced fuel consumption will reduce the life cycle cost of the water purification system.

The Marine Corps is interested in innovative approaches in the development of a water purification system for Squad sized forces. The Squad sized system should be able to purify 6-10 gallons/hour, weigh no more than 10 lbs, and have a volume of less than 1.5 cubic feet. Of particular interest are approaches which can be scaled to handle Platoon level purification of 12-30 gallons/hour (up to 90 gallons/day) from salt water sources, weigh no more than 84 lbs. and have a volume of less than 15.5 cubic feet. The Marine Corps is required to fight in any location and be highly expeditionary and proposed concepts must be very mobile, surviving transport over rugged terrains (Ref. 2, 4). They must also be usable in any climate the Marines operate in, including desert, jungle and temperate climates as spelled out in MIL-STD-810G (Ref. 4). Concepts proposed must include an automatic water quality test capability and method for providing visual indication (a simple go/no-go indication) as evidence that the water source has been purified to an acceptable level (Ref 1). Concepts should also be operable by a single individual who does not have water quality certification or training. In addition to being able to purify a wide variety of contaminated water sources, proposed concepts must be energy efficient to help reduce the logistical fuel burden on the expeditionary forces while minimizing the need for energy from batteries or other fuel sources (less than 100W during contaminated water purification) and must not require excessive operator mechanical energy for operation.

PHASE I: The small business will develop concepts for an improved water purification system that meets the requirements of the Description section above. The small business will demonstrate the feasibility of the concepts in meeting Marine Corps needs and will establish that the concepts can be developed into a useful product for the Marine Corps. Analytical modeling and simulation may be used to demonstrate feasibility. The small business will also articulate a plan for Phase II development that identifies performance goals, key technical milestones, and, as appropriate, any technical risk reduction strategy(ies).

PHASE II: Based on the results of Phase I and the Phase II contract Statement of Work (SOW), the small business will develop and deliver a prototype water purification system to the USMC for evaluation. The prototype will be evaluated to determine its capability in meeting the performance goals defined in the Phase II SOW and the Marine Corps requirements for water purification as discussed in the Description above. System performance will be demonstrated through prototype evaluation over the required range of parameters as discussed in the Description above. Evaluation results will be used to refine the prototype into a final design. The company will prepare a Phase III development plan to transition the technology to Marine Corps use.

PHASE III DUAL USE APPLICATIONS: If Phase II is successful, the small business will be expected to support the Marine Corps in transitioning the water purification system technology for Marine Corps use. The small business will develop a plan to determine the effectiveness of the new water purification system in an operationally relevant environment. The small business will support the Marine Corps for test and validation to certify and qualify the system for Marine Corps use. As applicable, the small business will prepare manufacturing plans and develop manufacturing capabilities to produce the product for military and commercial markets.

REFERENCES:

NAVY - 14
2. Information on Marine Corps Operating Structure and Battlespace Environments
http://www.marines.com/operating-forces/


KEYWORDS: water purification; desalination; water supply; expeditionary support; disaster relief

Questions may also be submitted through DoD SBIR/STTR SITIS website.

N153-128 TITLE: Light Secure, See-Through Display

TECHNOLOGY AREA(S): Battlespace

ACQUISITION PROGRAM: PMM-113.5, Product Manager Optics and Non-Lethal Systems (ONS), MCPC 240111

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 5.4.c.(8) of the solicitation. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The objective is to develop, demonstrate and manufacture low size, weight, and power (SWaP) display and optical technologies for presentation of enhanced vision system imagery for dismounted Marine mobility (i.e., movement in darkness and degraded visibility environments) and target acquisition, and electronic display symbology for command, control, and navigation applications, while retaining the ability to see the outside world in a manner that does not reveal the operator’s location via stray light emissions. This topic addresses energy efficiency and operational costs by combining the functionality of multiple display devices.

DESCRIPTION: Marines utilize low light imaging sensors in the form of night vision goggles (NVGs) to conduct movement, target acquisition, and manual tasks in conditions of low ambient light. The most commonly utilized NVG is the AN/PVS-14 Monocular Night Vision Device (see Ref 1). The majority of NVGs occlude the eye when in use, and must be rotated over the head or detached when entering environments of high ambient light to allow the Marine to have an unrestricted field of view (FOV). The transition from bright and dark environments and corresponding stowing and re-engagement of NVGs creates periods of vulnerability as the Marine’s attention is temporarily diverted to make the adjustment. Similarly, hand held command, control, and navigation devices, such as Global Positioning System receivers, typically require supplemental illumination to view, such as a backlit display or flashlight. However, this could potentially reveal location at night and inhibit local situational awareness and use of individual weapons when hands and attention are occupied. The predominant example of see-through displays applied to NVGs is the AN/PVS-21 Low Profile Night Vision Goggle (LPNVG) (see Ref 2). The LPNVG optically folds the output of standard night vision image intensifiers, which are offset to the side of the head, to partially transparent display surfaces in front of the operator’s eyes overlaying the images onto the outside world. Visible light emissions are not readily apparent through the display surfaces when observed from in front of the operator. However, the relatively low transparency of LPNVG display surfaces limit the ability to acquire targets when ambient conditions are too bright for night vision sensors and too dark to clearly see through the display. Monochrome head mounted displays (HMDs) developed for pilotage applications are increasingly available, and may be extremely bright (1,500 candelas per square meter or greater) for daytime viewing, but color HMDs utilize broadband light sources with partial reflectance optical
surfaces that allow light to pass out the front. Light emission limitations are not critical for pilotage applications due to the extreme distance of any potential observer; however, light security is essential to dismounted operations to prevent hostile forces from detecting Marines by the illumination from their night vision or other electronic display devices reflecting off their eyes and skin.

The U.S. Marine Corps is interested in innovative approaches in the development of light secure, see-through display technology (ies) amenable to monocular and binocular configurations while providing the ability to view high resolution (described below), full color (red/green/blue - no less than 256 greyscale levels per color) video imagery, while transmitting no less than 50 percent of incoming ambient light (average across visible spectrum) to the operator without noticeable haze, distortion, or optical seam line artifacts. Light security shall be from the perspective of an observer with unaided, dark-adapted eyes standing ten meters in front of the operator and attempting to detect illumination on surfaces (skin, eyes) directly occluded by the transparent display when operating at nighttime brightness settings and clear starlight (0.0007-0.002 lux ambient illuminance). For all proposed concepts the display optics, light engine (light emitting array or illumination source and modulation system), and associated minimal structural framework to maintain alignment and spacing between elements shall be no greater than 250 grams per eye. For the purposes of Phase II demonstration, the weight specification does not include articulating structures for head mounting and optimal positioning of the display in front of the eye(s), or associated application platform electronics, protective enclosures, heat dissipation, cabling, and power sources. Proposed light engine and associated alignment/spacing structures concepts shall not occlude viewing below or to the sides of the display optic. Transparent or wireframe structures concepts that do not significantly occlude vision are acceptable, but shall count toward the total weight. The display shall require no more than 1 Watt of power per eye for the light engine (assumes the use of a Low Voltage Differential Signaling or similar interface for pre-processed video inputs) when operating at moonlight night (0.27-1 lux ambient illuminance) viewing brightness and presenting full resolution imagery (all pixels active at an average of 50 percent peak night viewing brightness) at no less than 60 frames per second. The display should (objective specification) require no more than 1 Watt of power per eye when presenting symbology, such as GPS waypoints, compass headings, and/or target locations, comprising no less than 0.2 percent of active pixels viewable under indoor lighting operating brightness (320-500 lux ambient) conditions. Thresholds are specifications that meet requirements; while objectives are specifications that exceed minimal requirements and are of a particular interest. The display should have a maximum brightness sufficient for viewing symbology outdoors under full daylight (10,000-25,000 lux) conditions. The display active area shall have a horizontal FOV no less than 48 degrees, a vertical FOV no less than 40 degrees, and a resolution of 38 to 50 pixels per degree. Eye relief and viewing offset/angle (eyebox) shall be sufficient to accommodate an operator wearing corrective vision or ballistic eyeglasses while running with the display attached to a ballistic helmet with a three- or four-point suspension system. The combined head-mounted weight of the Phase III demonstrator including optics, display, imaging sensor, display driver electronics, enclosure, and adjustable helmet mounting hardware should not exceed 1 kilogram in either monocular or binocular configurations. Computing elements for symbology generation and sensor image post-processing for display inputs, and battery power supply may be body-worn, and should not exceed 7 kilograms weight.

Potential light engine technologies amenable to power efficient low brightness, high pixel count imagery and high brightness, low pixel count symbology include, but are not limited to, organic light emitting diode arrays and micro-electromechanical raster scanning laser systems (see Ref 3 and 4). Examples of lightweight display optics include, but are not limited to, multi-layer holographic waveguides, free-form prisms, and ellipsoidal mirrors (see Ref 5 and 6). Of particular interest are concepts that minimize forward protuberance, maximize airflow to prevent fogging, and prevent pooling of rain or other liquids within the active viewing area while standing or prone. Proposers should be mindful that any proposed display optic materials shall be ballistic polymers or shall incorporate structures that reduce hazardous flying debris when shattered and resistant to abrasion by blowing and hand-wiped sand and dust.

PHASE I: The small business will explore the application of innovative concepts for the development of light secure, see-through display technology (ies) amenable to monocular and binocular configurations that meet(s) the requirements as detailed in the Description above. The small business will demonstrate the feasibility of the concepts in meeting Marine Corps needs and will establish that the concepts can be developed into a useful product for the Marine Corps. As applicable, the company will conduct size, weight, and power analyses, optical modeling and will provide a preliminary design as a means of demonstrating the ability to meet or exceed the stated capabilities. Where feasible, and within the scope and resources of the Phase I effort, key technical concepts shall be demonstrated. The small business will also articulate a plan for Phase II development that identifies performance goals, key technical milestones, and, as appropriate, any technical risk reduction strategy (ies). The small business shall also provide a draft Phase II test and evaluation plan identifying any resources necessary to acquire required data for Phase II
PHASE II: Based on the results of Phase I and the Phase II SOW, the small business will refine their designs and develop scaled prototypes with a minimum Technology Readiness Level (TRL) of 5, component and/or breadboard validation for evaluation in a relevant environment. The prototypes shall demonstrate the ability to meet required capabilities while utilizing optical elements with manufacturing and integration schemes representative of Phase III concepts. Simulated sensor imagery and command and control symbology may be in the form of pre-recorded inputs to the displays. The display mounting scheme shall be amenable to direct viewing of imagery and external scenery by an observer under the specified ambient lighting conditions. Low risk technologies (such as video graphics driver electronics) not part of the developmental effort that can be optimally scaled physically and for power consumption with available and proven techniques, may be represented by commercial components (e.g., a tethered general purpose computer and high performance video graphics driver card that can be replaced with an embedded field programmable gate array solution in Phase III). As applicable, the small business will prepare a Phase III development plan to transition the technology to Marine Corps use.

PHASE III DUAL USE APPLICATIONS: If Phase II is successful the small business will be expected to support the Marine Corps in transitioning the technology for Marine Corps use. The company will fabricate ruggedized systems with a minimum Technology Readiness Level (TRL) of 6 (defined as system/subsystem model or prototype) for demonstration in an operationally relevant environment. Adjustable position helmet mounts will be required for evaluation to determine effectiveness without the demonstrator tethered to a fixed location. In addition to an integrated command and control symbology generator, an imaging sensor capable of demonstrating full resolution and frame rate scene presentation shall be utilized to simulate night vision capability in real-time. This can include low cost (less than $10,000) commercial silicon cameras with near-infrared cut-filters removed to permit non-visible flood illumination operation, and should be of unity magnification and aligned parallel to the display viewing angle. The company will support the Marine Corps for test and validation to certify and qualify the display and optical components for integration into future Marine Corps night vision goggle systems. As applicable, the company will prepare manufacturing plans and develop manufacturing capabilities to produce the product for military and commercial markets.

REFERENCES:

KEYWORDS: Head Mounted Display; See Through Display; Night Vision; Augmented Reality; Command and Control; Light Security

Questions may also be submitted through DoD SBIR/STTR SITIS website.
N153-129  

TITLE: Ultra-lightweight and Compact Hybrid System

TECHNOLOGY AREA(S): Materials/Processes

ACQUISITION PROGRAM: PM Combat Support Systems (CSS), PdM Expeditionary Power Systems (EPS)

OBJECTIVE: Develop a renewable energy hybrid system in the 1kW power range that will reduce the weight and volume by 50% compared to the currently deployed 1kW systems.

DESCRIPTION: During Operation Enduring Freedom, fuel and water accounted for seventy percent of the logistics required to sustain Marine Corps and Army expeditionary forces ashore. A Marine infantry company today uses more fuel than an entire infantry battalion did merely a decade ago. This increase in the demand for “liquid logistics” places a significant risk and strain on the distribution pipeline and increases the overall weight of the Marine Air Ground Task Force (MAGTF). A 2010 study found Marine and Army units in Afghanistan average one casualty for every 50 fuel and water convoys. The demand for fuel, batteries, and bottled water places more Marines on the road and has become the soft underbelly of our forces. To counter this logistical problem the USMC started several initiatives in renewable hybrid systems to reduce fuel consumption on the battle field with an ultimate goal of eliminating liquid fuel needs, except for mobility platforms, by 2025 (USMC Expeditionary Energy Strategy and Implementation Plan). One of these initiatives was the establishment of the Ground Renewable Expeditionary Energy Network System (GREENS) II Program to incorporate current renewable technologies that will provide only limited weight and volume savings for the current deployed systems. More significant weight and volume reductions are needed to increase the deployment options for these systems. Rethinking the construct of renewable hybrid systems may be necessary to achieve this goal.

For these reasons, the Marine Corps seeks the development of technology that can reduce the weight and volume of current deployed renewable hybrid systems. For renewable energy systems to be effective in tactical environments they must be able to reliably provide power no matter the environmental or transportation conditions (MIL-STD-810G, Ref 1). Because of this many of the available renewable systems are required to be hybridized type systems that use energy storage, power management and backup power generation from generators and vehicles. Current state of the art in Marine Corps tactical renewable energy systems in the 1kW sustained power range is GREENS. This system has a total weight of around 700lbs and volume around 44ft^3 once all the components are considered (renewable energy, power electronics, inverter, energy storage, cabling and power manager). Unfortunately, force structures in the 1kW power range are small tactical units, Platoons (43 Marines) and squads (13 Marines) with only human lift capabilities (MIL-STD-1472G, Ref 2) making the current systems useful in limited scenarios. If these systems can see a reduction in weight and volume by at least 50%, then the adoption of these types of systems can be increased greatly. These reductions can potentially be found in the renewable energy technology, electronics technology, packaging technology, and energy storage technology or by completely rethinking the construct of what a hybrid energy harvesting system consist of. To support USMC applications a nominal 24V output (MIL-STD-1275D, Ref 3) or a 120V AC output (MIL-STD-1332B, Ref 4) is required. Proposed system concepts must also be able to provide power both night and day.

PHASE I: The small business will develop concepts for an improved ultra-light weight and compact hybrid system that meets the requirements described in the Description above. The small business will demonstrate the feasibility of the concepts in meeting Marine Corps needs and will establish that the concepts can be developed into a useful product for the Marine Corps. Feasibility will be established by material testing and analytical modeling, as appropriate. The small business will also provide a Phase II development plan with performance goals, key technical milestones, and a technical risk reduction strategy.

PHASE II: Based on the results of Phase I and the Phase II SOW, the small business will develop and deliver to a renewable energy hybrid system prototype for government evaluation. The prototype will be evaluated to determine its capability in meeting the performance goals defined in the Phase II SOW and the Marine Corps requirements for hybrid systems. System performance will be demonstrated through prototype evaluation and over the required range of parameters as discussed in the Description above. Evaluation results will be used to refine the prototype into a final design. The company will prepare a Phase III development plan to transition the technology for Marine Corps use.
PHASE III DUAL USE APPLICATIONS: If Phase II is successful, the small business will be expected to support the Marine Corps in transitioning the Ultra-lightweight and Compact Energy Hybrid System for Marine Corps use. The small business will develop a plan to determine the effectiveness of the new hybrid system in an operationally relevant environment. The small business will support the Marine Corps for test and validation to certify and qualify the system for Marine Corps use. If applicable, the small business will prepare manufacturing plans and develop manufacturing capabilities to produce the product for military and commercial markets.

REFERENCES:


5. USMC Expeditionary Energy S

KEYWORDS: Hybrid; renewable energy; remote power; light-weight packaging, light-weight electronics; high-energy density batteries

Questions may also be submitted through DoD SBIR/STTR SITIS website.

Title: Three-Dimensional (3D) Interconnect Technology to Improve Size, Weight, Power, and Cost (SWAP-C) of Current and Future Electronic Systems

TECHNOLOGY AREA(S): Electronics

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 5.4.c.(8) of the solicitation. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Fabricate and demonstrate three-dimensional (3D) interconnect technology between heterogeneous wafers in an effort to significantly reduce the Size, Weight, Power, and Cost (SWAP-C) of current and future systems.

DESCRIPTION: As 2.5D/3D technology starts to reach mainstream production in the electronics industry, opportunities exist to develop this technology for use in many defense applications. Dense levels of integration at the wafer interconnect level and potentially the device level would significantly reduce the SWaP (Size, Weight and Power) of current and future systems. Oftentimes, in both military and commercial systems, requirements exist for a non-standard reticle size or interconnect technology to meet custom application needs. This solicitation will explore the ability of the current industry wafer fabrication base to create custom wafer stacks with a large number of interconnects in the vertical (via) and horizontal (trace) dimensions across an entire wafer and wafer stack.
It is desired to fabricate, at the end of Phase II, a five layer wafer stack that consists of wafers at least 150mm in
diameter, with each wafer containing a minimum of 500,000 interconnects to the wafer above and/or below it. The
topmost and bottommost wafers are excluded from this requirement and need only demonstrate interconnects to the
wafer above or below. The interconnect density should be evenly spread across, to the extent possible, the entire
150mm wafer stack. Current IC technology has high interconnect density in the chip itself but interconnect
technology to the circuitry above or below, for example in a wafer stack, is typically much less.

A methodology to test every connection from a DC perspective is required to obtain yield data. The wafer stack must
contain at least one Silicon wafer, and may contain more than one, but it is ultimately desired for the wafer stack to
contain other substrate materials. Sapphire, Gallium Arsenide, Silicon Dioxide, Gallium Nitride (GaN), and Indium
Phosphide are potential candidates, and may be integrated with other materials, for example GaN on diamond. Other
material or combinations thereof may be submitted for consideration. The bonding and interconnect methodology is
not defined and up to the performer to determine. The performer must show that any bonding techniques do not cause
detrimental effects, for example too high of a coefficient of thermal expansion (CTE) mismatch causing structural
damage, to any potential active devices contained within any of the candidate substrates. The desired interconnect
metal is copper to maintain maximum compatibility with current industry fabrication techniques, however other
interconnect metallurgy will be considered if appropriate. If required, a handle wafer may be counted as one of the
mandatory wafers.

PHASE I: Phase I is a technology feasibility phase and will determine the best fabrication processes and
methodologies to design, fabricate, and test a wafer stack meeting previously discussed requirements. A report
detailing the outcome of Phase I is required. The report should describe the approach to be used to demonstrate 3D
interconnect between wafers if awarded the Phase II effort.

PHASE II: Phase II will require the successful bonding of at least three wafers, one of which must be Silicon and one
of which must be another dissimilar material, having at least one million measurable connections between the wafers,
with greater than 99% yield.

PHASE III DUAL USE APPLICATIONS: If Phase II is successful, the small business will provide support in
transitioning the technology for Navy use, with a focus on scaling manufacturing capabilities and commercialization
plans.

REFERENCES:
Technologies", John Wiley & Sons Ltd, Chichester, United Kingdom, DOI: 10.1002/9781118760475.ch06
Weinheim, Germany, ISBN:978-3-527-33466-7

KEYWORDS: Three-Dimensional (3D); Wafer scale; Three-Dimensional (3D) Interconnect; Wafer stacking; Vias;
Yield; Heterogeneous

Questions may also be submitted through DoD SBIR/STTR SITIS website.
multi-species, highly turbulent, supersonic flow through a short, thick-wall, curved steel pipe, without any element of the sensor suite permanently altering or physically crossing the pipe boundary.

DESCRIPTION: A novel approach to collecting flow performance data (i.e., pressure, temperature, density, void-fraction, and velocity) is needed to support routine performance assessments of Navy hardware systems and needs to be demonstrated in a test environment. To minimize the high cost and safety impacts associated with hardware modifications and test conduct, a portable, non-invasive sensor suite is needed. The non-invasive sensors must collect data by instrumenting the outer surface of a pipe. Permanent modifications to the pipe structure are prohibited due to safety, cost, and logistical concerns. Legacy data do not provide the level of understanding desired to assess system performance and to support validation and eventual use of newly developed computational fluid dynamics (CFD) based modeling and simulation (M&S) tools because no solution currently exists to capture this data. New spatially resolved, time-dependent flow data will provide an improved understanding of the underlying physics within the flow phenomena, and also support flow performance assessments and predictions with the CFD M&S tools.

The current hardware under test consists of an upstream high pressure inlet mixing with a reservoir connected to a short, curved, thick steel pipe that flows the mixture of steam, water (from the reservoir), gas and pressure inlet by-products into a larger chamber. The pipe is the area of measurement interest and is approximately 19-inches in diameter, has a 2-inch thick steel wall structure, contains one bend of less than 90 degrees and has an available straight pipe length of less than 5-inches. The environment to be measured during hardware tests is a high-pressure, high temperature mixture containing at least water/gas/steam created by igniting a double-based grain solid propellant (inlet pressure) into a water-filled reservoir. As the solid propellant expends itself, the mixture combines with propellant particulates. The noise generated by the solid propellant combusting has a broadband acoustic signature that is in the order of hundreds of decibels. The high-level, broadband acoustic noise environment may corrupt acquired data, particularly if the sensing method is ultrasonic in nature. The total duration, from ignition to propellant expended, lasts approximately 1 second.

The flow through the curved pipe can be characterized as multi-phase (i.e., water, steam, and propellant gases), compressible, nonhomogeneous, turbulent, and highly transient with the potential presence of shock waves within the pipe. During the ~1 s duration test event, the pressure in the pipe is expected to rise to ~600 psia; the temperature is expected to rise to ~400 °F; and flow is expected to have a mean motion velocity of ~800 ft/sec may exist.

Through industry searches, it has been determined that current commercially available technologies' response times and sampling rates are insufficient to non-invasively collect sufficient data. Additionally, any invasive sensor suite would be exposed to the harsh environments and would need to withstand the high temperatures, high velocities and high pressures. Historically, there have been difficulties with sensor survivability, which can result in loss of valuable data.

An innovative, non-invasive, prototype sensor is needed to obtain some, if not all, of the following short duration (~5 ms) time-average, spatial and temporal resolved data:

1) Pressure
2) Temperature
3) Density
4) Multi-phase void fraction (i.e., ratio of liquid to gas/steam/propellant mixture)
5) Velocity

PHASE I: Determine technical feasibility and develop a non-invasive, portable sensing system that can discern the presence of water, gas, and/or steam flowing within a 19-in. diameter, short (< 5-in. of straight length), curved, 2-in. thick steel pipe at flow speeds of up to 800 ft/s. Perform analysis, modeling and simulation, and/or laboratory investigations/demonstrations to provide initial assessment of approach. The size of the sensor suite is of less concern during the Phase I effort, as long as it is shown that the physical foot print of the sensor suite can be reduced in later phases.

PHASE II: Based on Phase I effort, further develop and demonstrate a non-invasive and portable sensing system that can measure and accurately quantify (to within 10%) the flow characteristics (i.e., pressure, temperature, density, void-fraction, and/or velocity) of a multi-phase fluid that is multi-species, compressible, and highly turbulent. This sensing system should be capable of being sized appropriately to fit within an approximately 3’x3’x3’ volume.
Performance of a demonstration to prove capabilities of the new system will be required. It can be expected that the government will provide the hardware under test in order to simulate the environment that needs to be measured.

PHASE III DUAL USE APPLICATIONS: The mature sensing system will transition into the program of record and will be used to assess system performance and to support validation and use of newly developed computational fluid dynamics (CFD) based modeling and simulation (M&S) tools. This technology and the data obtained from its use will be used on possible future programs as well.

REFERENCES:


4. L. Barelli, G. Bidini, C. Buratti, R. Mariani, Diagnosis of internal combustion engine through vibration and acoustic pressure non-intrusive measurements, Applied Thermal Engineering, Volume 29, Issues 8–9, June 2009, Pages

KEYWORDS: Non-intrusive; sensor; multi-phase; supersonic; flow; instrumentation

Questions may also be submitted through DoD SBIR/STTR SITIS website.

N153-132  TITLE: High Energy High Flux X-ray Detector

TECHNOLOGY AREA(S): Electronics, Materials/Processes, Sensors

ACQUISITION PROGRAM: D5 Trident II (ACAT IC)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 5.4.c.(8) of the solicitation. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Determine the optimum design concept for a high energy, high flux detector for use with the High Energy Computed Tomography (HECT) that meets our mission goals of both inspection capability and system supportability. Trident II rocket motors are currently inspected using a HECT system to inspect for critical defects that affect motor safety and reliability. Objective is to develop the design concept into a usable x-ray detector for the use with the Varian-supplied K15 Linatron source. Access to a K15 will be made available at the Naval Air Warfare Center China Lake. This will include the x-ray detector, as well as all support electronics and necessary hardware to integrate it into the existing system. The intention is to develop a replacement for the detector, which is a subsystem of the HECT, which must work with the radiation source (The Varian K15).

DESCRIPTION: The current HECT system, used to inspect the D5 Trident II rocket motors, is an old design using outdated technology. As such, it has become expensive to maintain and support. The intention of this effort is to develop a new x-ray detector that is improved for performance (based on bit depth and resolution) and supportability.
(based on ability to procure and maintain hardware), using modern electronics, components, and interfaces. This is a difficult problem as the radiation environment is both high energy and high flux. Radiation hardening impacts detector performance. This program will develop a new detector with modern components and materials that has equal or improved performance and is more supportable for the inspection of these rocket motors.

One of the (non-Navy owned) HECT systems currently in use was updated in the early 1990s and resulted in large improvements in system performance and supportability. This demonstrates that system performance can be greatly improved in all aspects. However, the materials, technology, and design from that upgrade have been made obsolete by improvements in detector technology and electronics, which made huge leaps in capability in the 2000s. A research and development (R&D) effort is necessary to ensure that new detector technology can be modified and/or redesigned to be able to operate in our specific environment (specifically, radiation hardening).

PHASE I: Determine technical feasibility to develop a new High Energy High Flux X-ray Detector as discussed in the Description section. Develop conceptual design and select 2-3 of the most optimum detector design concepts. These concepts will be implemented in a detector that allows performance evaluation (in particular regarding resolution, bit depth, and detector life), with an understanding of the tradeoffs of performance specifications, reliability, and supportability. A technical report will be generated detailing results and tradeoffs between the designs.

PHASE II: Develop and deliver a prototype detector, usable with the K15 on D5 Defect Standards, along with a report containing a full evaluation of its actual performance and capability as used with the K15. Demonstration of improved resolution, bit depth, and detector life will prove out the design and allow progression to Phase III.

PHASE III DUAL USE APPLICATIONS: Based upon Phase I and II effort, fabricate full scale High Energy High Flux X-ray Detector Array and transition to Navy for use in inspecting D5 Trident II rocket motors in the HECT inspection system. Engage in broader commercialization efforts to field this x-ray detector suitable for use in the high energy environment. Possible customers include Army, Navy, Air Force, NASA, large solid rocket motor industry suppliers, Department of Homeland Security, and other countries that use K15 Linatron x-ray sources to inspect rockets for their space program.

REFERENCES:


KEYWORDS: x-ray; high energy; high flux; detector; computed tomography; inspection

Questions may also be submitted through DoD SBIR/STTR SITIS website.

N153-133 TITLE: Re-Entrant Jet Measurement During Large-Scale Gas Bubble Collapse

TECHNOLOGY AREA(S): Ground/Sea Vehicles, Sensors

ACQUISITION PROGRAM: Strategic Systems Programs (SSP), ACAT I

OBJECTIVE: Develop and validate a new instrumentation sensor suite and associated processing techniques to capture the size, shape, composition, and velocity of a re-entrant jet formed during large-scale bubble collapse near a moving boundary. The sensor system must collect spatially resolved, time-dependent void-fraction, density and velocity data.

DESCRIPTION: When a pressurized volume is suddenly opened, such as when a payload exits a launch tube, there is a sudden “uncorking” of pressurized gas that expands out of the volume. If a moving surface (boundary) is what is
initially in place to maintain the pressure in the volume, the gas expands out of the volume and directly behind the moving surface. This "uncorking" event forms a large bubble that expands to a maximum size before collapsing (due to local hydrostatic pressure) and forming a re-entrant jet which then contacts the moving surface. This re-entrant jet presents a threat of damage due to high-speed impact with the moving surface.

Re-entrant jet behavior is observed in various other disciplines, including cavitation research and underwater explosions [UNDEX]. In each of these problems, the jet is formed when the bubble is placed near and allowed to collapse into a solid boundary. In spite of the widespread interest in this problem, the dynamics of large-scale bubble collapse are not well understood. This is due in part to the difficulty of performing direct measurements of the bubble collapse phenomena.

To-date, measurements of the uncorking and re-entrant jet phenomena for a moving plate have been limited to qualitative, underwater video of the bubble and limited pressure and load measurements on the moving surface. Visual methods have provided limited information on the jet due to opacity of the bubble interface.

The objective is to develop a sensor suite to quantitatively measure the size, shape, and velocity of this re-entrant jet throughout its formation and as it impacts/interfaces with the moving surface. In a notional test environment, the bubble is planned to uncork with an overpressure of approximately 20 pounds per square inch differential (psid) (relative to the local hydrostatic pressure), and then expands out to a diameter of approximately 10 feet. The bubble travels upward due to buoyancy and the influence of the moving surface, which is traveling in the same direction. Bubble collapse occurs after 10-15 feet of upward travel. The bubble then continues to oscillate, resulting in multiple re-entrant jet formations during the time that the moving surface moves to the free surface of the water. At the time when the moving surface broaches the water surface, the jet forms one last time, impacting the moving surface with significant force. Another factor making measurements more difficult to collect is the addition of vented gas from the moving surface, which increases the opacity of the environment that a measurement device would need to be able to resolve. The venting results in a steady stream of small bubbles that surround and join the base bubble that is generated, creating a highly opaque and turbulent region.

Market and historical searches have confirmed that instrumentation suites have not been able to view or collect data on this water jet within this region of vented gas.

PHASE I: Define and develop a new instrumentation sensor suite that can provide accurate measurement of the re-entrant jet. Perform analysis, including modeling and simulation and breadboard testing, to ensure concepts can be utilized with major features of the full-scale environment as discussed in the Description section. This environment would include both underwater and surface capture of the phenomena at the described geometries and pressures for this high speed event.

PHASE II: Based on the Phase I effort, develop a large-scale version prototype of the new instrumentation sensor suite for demonstration and validation. The prototype should be delivered at the end of Phase II to be utilized on subscale testing. The large scale version prototype would need to be able to view an approximately 20 ft wide underwater area by 50 feet tall. It would also need to view a 20 ft wide area above water.

PHASE III DUAL USE APPLICATIONS: If Phase II is successful, the small business will provide support in transitioning the technology for Navy use. The small business will develop a plan to determine the effectiveness of the sensing system in an operationally relevant environment. The small business will support the Navy with certifying and qualifying the system for Navy use. As appropriate, the small business will focus on scaling up manufacturing capabilities and commercialization plans. Completed system(s) will be delivered to the Navy for use.

REFERENCES:


KEYWORDS: Sensor; instrumentation; multi-phase; underwater; launch; bubble collapse; re-entrant jet

Questions may also be submitted through DoD SBIR/STTR SITIS website.