NAVY
12.3 Small Business Innovation Research (SBIR)
Proposal Submission Instructions

The responsibility for the implementation, administration and management of the Navy SBIR Program is with the Office of Naval Research (ONR). The Director of the Navy SBIR Program is Mr. John Williams, john.williams6@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 under each topic from **26 July 2012 through 26 August 2012.** Beginning **27 August 2012**, the SITIS system (http://www.dodsbir.net/Sitis/Default.asp) listed in Section 1.5, c of the DoD Program Solicitation must be used for any technical inquiry.

TABLE 1: NAVY SYSCOM SBIR PROGRAM MANAGERS

Topic Numbers	Point of Contact	Activity	Email
N123-152 to N123-156	Mr. Paul Lambert	MARCOR	sbir.admin@usmc.mil
N123-157 to N123-158	Mr. Dean Putnam	NAVSEA	NSSC_SBIR@navy.mil
N123-159 to N123-164	Ms. Elizabeth Altmann	SPAWAR	elizabeth.altmann@navy.mil

The Navy's SBIR Program is a mission oriented program that integrates the needs and requirements of the Navy's Fleet through R&D topics that have dual-use potential, but primarily address the needs of the Navy. Companies are encouraged to address the manufacturing needs of the Defense Sector in their proposals. Information on the Navy SBIR Program can be found on the Navy SBIR website at **http://www.onr.navy.mil/sbir**. Additional information pertaining to the Department of the Navy's mission can be obtained by viewing the website at **http://www.navy.mil**.

PHASE I GUIDELINES

Follow the instructions in the DoD Program Solicitation at **www.dodsbir.net/solicitation** for program requirements and proposal submission. Cost estimates for travel to the sponsoring Syscom's facility for one day of meetings are recommended for all proposals and required for proposals submitted to MARCOR and NAVSEA. For NAVSEA proposals, a recommended proposal template can be found at http://www.navysbir.com/navsea. The Navy encourages proposers to include, within the 25 page limit, an option which 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 base amount of the phase I should not exceed $80,000 and six months; the phase I option should not exceed $70,000 and six months.**

The Navy will evaluate and select Phase I proposals using the evaluation criteria in Section 4.2 of the DoD Program Solicitation in descending order of importance with technical merit being most important, followed by qualifications and commercialization potential of equal importance. Due to limited funding, the Navy reserves the right to limit awards under any topic and only proposals considered to be of superior quality will be funded.

One week after 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 Navy typically awards a firm fixed price contract or a small purchase agreement for Phase I.

PHASE I SUMMARY REPORT

All awardees must submit a non-proprietary summary of their final report (without any proprietary or data rights markings) through the Navy SBIR website. Submit the summary at: **http://www.onr.navy.mil/sbir**, click on "Submission", and then click on "Submit a Phase I or II Summary Report". A template is provided for you to complete. This summary, once approved, may be publicly accessible via the Navy's Search Database.

PHASE II GUIDELINES

Phase II proposal submission is by invitation only. If you have been invited, follow the instructions in the invitation. **Each of the Navy Syscoms has different instructions for Phase II submission. Visit the website cited in the invitation to get specific guidance before submitting the Phase II proposal**.

The Navy will invite, evaluate, and select Phase II proposals using the evaluation criteria in Section 4.3 of the DoD Program Solicitation in descending order of importance with technical merit being most important, followed by qualifications and commercialization potential of equal importance. Due to limited funding, the Navy reserves the right to limit awards under any topic and only proposals considered to be of superior quality will be funded. The Navy does NOT participate in the FAST Track program.

The Navy SBIR Program structures Phase II contracts in a way that allows for increased funding levels based on the project's transition potential. This is called the Phase II.5 and is accomplished through either multiple options that may range from $250,000 to $1,000,000 each, substantial expansions to the existing contract, or a second Phase II award. For existing Phase II contracts, the goals of Phase II.5 can be attained through contract expansions, some of which may exceed the $1,000,000 recommended limits for Phase II awards.

All awardees, during the second year of the Phase II, must attend a one-day Transition Assistance Program (TAP) meeting. This meeting is typically held in the summer in the Washington, D.C. area. Information can be obtained at **http://www.dawnbreaker.com/navytap**. 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.

The Navy typically awards a cost plus fixed fee contract for Phase II.

PHASE II ENHANCEMENT

The Navy has adopted a Phase II Enhancement Plan to encourage transition of Navy SBIR funded technology to the Fleet. Since Phase III awards are permitted during Phase II work, some Navy Syscoms may match on a one-to-four ratio, SBIR funds to funds that the company obtains from an acquisition program, usually up to $250,000. The SBIR enhancement funds may only be provided to the existing Phase II contract. For more information, please contact the Syscom SBIR Program Manager.

PHASE III

A Phase III SBIR award is any work that derives from, extends or logically concludes 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 which 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 Navy **will** give SBIR Phase III status to any award that falls within the above-mentioned description, which includes according 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). The government's prime contractors and/or their subcontractors shall follow the same guidelines as above and ensure that companies operating on behalf of the Navy protect rights of the SBIR company.

ADDITIONAL NOTES

Because of the short timeframe associated with Phase I of the SBIR process, the Navy 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 time to award goals. Before Navy 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 our evaluation, but requiring IRB approval may delay the start time of the Phase I award and if approvals are not obtained within six months of notification of selection, the award may be terminated. If you are proposing human, animal, and recombinant DNA use under a Phase I or Phase II proposal, you should view the requirements http://www.onr.navy.mil/en/About-ONR/compliance-protections/Research-Protections/Human-Subject-Research.aspx. This website provides guidance and notes approvals that may be required before contract/work can begin.

Proposals submitted with Federal Government organizations (including the Naval Academy, Naval Post Graduate School, or any other military academy) as subcontractors will be subject to approval by the Small Business Administration (SBA) after selection and prior to award.

PHASE I PROPOSAL SUBMISSION CHECKLIST:

The following criteria <u>must be met</u> or your proposal will be REJECTED.

____1. Include a header with company name, proposal number and topic number to each page of your technical proposal.

____2. Include tasks to be completed during the option period and include the costs in the cost proposal.

____3. Break out subcontractor, material and travel costs in detail. Use the "Explanatory Material Field" in the DoD cost proposal worksheet for this information, if necessary.

____**4. The base effort does not exceed $80,000 and six months and the option does not exceed $70,000 and six months. The costs for the base and option are clearly separate, and identified on the Proposal Cover Sheet, in the cost proposal, and in the work plan section of the proposal.**

____5. Upload your technical proposal and the DoD Proposal Cover Sheet, the DoD Company Commercialization Report, and Cost Proposal electronically through the DoD submission site by 6:00 am ET, 26 September 2012.

____6. After uploading your file on the DoD submission site, review it to ensure that it appears correctly. Contact the DoD Help Desk immediately with any problems.

NAVY SBIR 12.3 Topic Index

N123-152	Blast dosimeter for monitoring and documenting Blast exposure for Breacher and route clearance personnel
N123-153	Application of a Treatment to the Military Fabrics that is Affordable and Provides Durable Flame Resistant Properties
N123-154	Next Generation Passive Hearing Protection
N123-155	Field Drying System using no power for clothing and boots
N123-156	Post-IED Hull Inspection Tool
N123-157	Efficient, Cost-Effective, Low-Emissions Method to Cutting Nuclear Submarine and Aircraft Carrier Hulls
N123-158	Innovative Approach to Low Cost Shock Testing Fixture for Medium Weight, Shock Isolated Equipment
N123-159	NetOps as a Service - Mission Focused Analytics
N123-160	Querying and Processing Encrypted Databases without Decrypting
N123-161	DYNAMIC TUNER FOR NARROW-BAND VLF SUBMARINE COMMUNICATION TRANSMITTING SYSTEM
N123-162	Analyzing the Data-Plane in a Heterogeneous Network
N123-164	Reducing Bandwidth Requirements for Cybersecurity Information Exchanges

NAVY SBIR 12.3 Topic Descriptions

N123-152 TITLE: Blast dosimeter for monitoring and documenting Blast exposure for Breacher and route clearance personnel

TECHNOLOGY AREAS: Biomedical, Battlespace, Human Systems

ACQUISITION PROGRAM: Warfighter PPE EOD ensemble

RESTRICTION ON PERFORMANCE BY FOREIGN CITIZENS (i.e., those holding non-U.S. Passports): This topic is “ITAR Restricted”. The information and materials provided pursuant to or resulting from this topic are restricted under the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 - 130, which control the export of defense-related material and services, including the export of sensitive technical data. Foreign Citizens may perform work under an award resulting from this topic only if they hold the “Permanent Resident Card”, or are designated as “Protected Individuals” as defined by 8 U.S.C. 1324b(a)(3). If a proposal for this topic contains participation by a foreign citizen who is not in one of the above two categories, the proposal will be rejected.

OBJECTIVE: Develop a sensor that can be incorporated into the current protective vests to measure and record blast over pressure and acceleration data that Marines are subjected to during blast type events.

DESCRIPTION: Develop a affordable, lightweight sensor that can record and document exposure to blast type events. The sensor should possess the following characteristics: Small, lightweight, low power capability to detect, measure and record concussive forces to personnel of interest. The unit should operate for 30 days continuously without recharging and provide 360 degree monitoring for blast overpressure coverage.

Key design elements are:
- Weighs approximately 4 oz or less.
- Event data can be downloaded via micro USB and summary event data can be queried using wireless RF signal.
- Data memory storage capability for 1000 events.
- Signal processing to reduce false readings and improve accuracy.
- GPS interface (objective).

Desired capabilities:
- Degrees of Freedom 6
- Linear Acceleration 1000 g
- Rotational Acceleration 50,000 rad/sec^2
- Pressure Measurement 4-100 psi
- Pressure Measurement Standoff Distances 50 ft
- Microprocessor Response Time 100 microseconds
- Microprocessor Sampling Rates 20kHz
- Microprocessor Sampling Duration 512 milliseconds
- Bandwidth 5kHz-10kHz
- Accuracy less than 2.5% error
- Trigger Thresholds (variable)
- Data Transfer USB and wireless
- Battery Life 12 month rechargeable
- Hardened for Military environment
- Immune to Jammer interference
- Cost less than $25/unit

PHASE I: Select from available technologies for monitoring and recording blast overpressure and acceleration. Perform trade study to optimize design against design criteria, identify trades for interfaces to perform measurement and threshold alert on a timely basis. Prepare plan as to how the sensor will be developed tested and manufactured in Phase II and III.

PHASE II: Integrate technologies identified in Phase I in a prototype unit.

Demonstrate technical maturity and performance.
Develop final packaging and design.
Submit samples to USMC for testing and evaluation.
Produce and test down load device and demonstrate data interface and database format.
Validate performance in military environment for moisture, heat, cold, dust dirt, impact and EMI.
Demonstrate interface with the plate carrier and vest.

PHASE III: Present manufactured item for first article test.
Perform first article test and mature manufacturing process.
Submit samples for testing by USMC and DOD.
Complete commercial product program

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: A blast sensor could be used by anyone in the private sector that is exposed to blast

REFERENCES:
1. Journal OF NEUROTRAUMA 26:841-860 (June 2009) Mary Ann Liebert, Inc. DOI: 10.1089/new. 2009.0898 An Introductory Characterization of a Combat-Casualty-Care Relevant Swine Model of Closed Head Injury Resulting from Exposure to Explosive Blast

2. Taylor, Sir Geoffrey Ingram, "The formation of a blast wave by a very intense explosion. I. Theoretical discussion," Proceedings of the Royal Society of London. Series A, Mathematical and Physical Sciences, Vol. 201, No. 1065, pages 159 - 174 (22 March 1950).

3. Chavko, M. et al., Measurement of blast wave by a miniature fiber optic pressure transducer in the rat brain. J Neuroscience Methods, 159:277-281, 2007

4. Bradley, J., Shock Waves in Chemistry and Physics, Chapman and Hall, London, 1962.

5. DARPA point paper on Blast sensors

6. Vest image/photograph. Uploaded in SITIS 9/11/12.

KEYWORDS: Blast sensor; Overpressure; electronics; Acceleration meter; data recorder; explosive blast;

N123-153 TITLE: <u>Application of a Treatment to the Military Fabrics that is Affordable and Provides Durable Flame Resistant Properties</u>

TECHNOLOGY AREAS: Materials/Processes, Battlespace, Human Systems

OBJECTIVE: To develop an affordable and durable flame resistant (FR) treatment for the fabrics used in combat systems and other pieces of equipment.

DESCRIPTION: Advances in technologies may enable the development of affordable and durable FR materials by treating the current fabric vice developing expensive flame resistant materials. Proposed material concepts should meet as many of the current requirements for Combat Clothing as possible and must meet the vertical flame requirement listed below. The treatment should not negatively impact other non-FR fabric properties, including fabric strength, stiffness, and weight. Preference will be given to technologies that meet the vertical flame requirement and significantly exceed requirements, especially with attributes that correlate to durability (e.g. tear and break strength). Novel and innovative concepts are sought.

The targeted cost increase for this technology should be less than 5% of the current Marine Corps Combat Utility Uniform (MCCUU) (objective) and less than 10% of the current MCCUU (threshold) cost. Preference will be given to technologies that can be applied to the current NYCO fabrics, although, the Marine Corps may consider other technical options (e.g. other fabrics).

PHASE I: Detail the feasibility and approach of applying the treatment to the current NYCO fabric. Develop concepts and compounds and evaluate their technical feasibility. Conduct physical property evaluations of the proposed materials. Provide samples of NYCO material treated with the retardant.

PHASE II: Optimize the material properties and scale-up the production process to reduce manufacturing costs. Provide enough materials to the Marine Corps for evaluation to demonstrate product passes all criteria.

Improve upon the design concept developed in Phase I and deliver a quantity of samples. The product shall be robust and geared toward use in multiple environmental conditions. In depth testing shall be conducted to demonstrate performance with respect to its intended use, and shall verify/expand upon the design characteristics addressed during the Phase I effort.

Deliver a report detailing: (1) the fabrication processes and associated materials/equipment; (2) testing conducted (to include equipment and methodology) along with results demonstrating the degree of effectiveness of the treatment for its intended purpose; (3) any limitations such as durability, etc; (4) updated summary of key characteristics, end item cost estimates, and manufacturing considerations, to include any special processes or equipment anticipated for production purposes; (5) produce and deliver samples to the Government for the purposes of testing in a relevant environment.

The success of performance evaluation and testing results, if favorable, may lead into Phase III applications. All research, development and prototype designs shall be documented with detailed descriptions and specifications of the materials, designs, processes, and performance.

PHASE III: Given successful completion of Phase II, a larger quantity of the integrated product shall be manufactured for larger scale testing and demonstration of manufacturability, reliability, and quality assurance. Demonstrate the suitability of the treatment in a clothing design and field evaluation. Integrate the treatment into relevant items for system level testing, evaluation and demonstration. Provide adequate garment samples to the Marine Corps for evaluation.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: In addition to the military market, a durable and affordable FR treatment for standard fabrics would have applications to clothing worn in the first responder community, oil and gas industry (well drilling, servicing, production-related operations) and electrical/utility industry.

REFERENCES:
1. ASTM D 6413

2. NFPA 701, D1.1

3. UL 723

KEYWORDS: Flame Resistant; Textile Production; Military Clothing; Combat Clothing; Individual Protection

N123-154 TITLE: Next Generation Passive Hearing Protection

TECHNOLOGY AREAS: Biomedical, Human Systems

ACQUISITION PROGRAM: hearing conservation program

OBJECTIVE: Develop and demonstrate a passive hearing protection that affords true sense of presence for normal sound with directionality.

DESCRIPTION: Hearing loss secondary to blast trauma, is now the most common combat injury in Iraq and Afghanistan. The use of passive hearing protection that protects against transient impact noise at the same time allowing ambient sound would enable Marines to continue to hear and respond in combat, thereby enhancing situational awareness while blocking and/or reflecting harmful blast shock waves in the ear canal. Current ear plugs and over the ear muffs block both loud sounds and the sound of normal speech. As a result, they are not worn when needed, or are worn in a manner that permits normal verbal communication but that makes the devices ineffective for hearing protection.

This research effort seeks to demonstrate hearing in a modular fashion, while enhancing communication capabilities at short distances, in a small compact form suitable for field use. Solutions should provide adequate fit across the majority of the population (5th percentile – 95th percentile), be easy to clean/maintain, be environmentally durable, maximize ability to detect/identify/pinpoint sounds, be lightweight, easily donned/doffed, and be compatible with currently fielded military equipment, to include helmets.

The successful solution should meet the following specifications:
- Minimal/No electronic components.
- Attenuates impact noise at 125 dB, 140 dB, 160 dB and 171 dB by at least 30 dB.
- Maintain a Noise Reduction Rate (NRR) of 12 or less. (NRR is a measure of how much noise earplugs block in the 30 decibel to 60 decibel volume range).
- Afford both a sense of presence and directionality of the noise source.
- Not interfere with headphones or helmets.
- Be available in multiple sizes to fit comfortably in the 5th percentile to 95th percentile Marine.
- Not be a custom mold design and should be considered a low cost consumable product.
- Material should be compatible with long term use.

Hearing protection shall target a NRR of 30 dB or greater and accommodate steady-state and impulse type noise. The system shall maintain the ability of the User to detect, identify, and localize sound, be capable of being turned on/off by either hand (as applicable), with a goal of allowing for near-normal hearing in quiet environments. The design shall provide a good fit, be comfortable, and maintain proper seal for the majority of User population (5th percentile – 95th percentile), be easy to clean/keep sanitary, be compatible with currently fielded equipment such as helmets, be lightweight, and be durable in an operational environment. Enhanced communication capability shall be provided, effective at short ranges. The system shall be robust and geared toward operation in multiple environmental conditions. The system shall be capable of being used without removal of helmet.

PHASE I: Select from the potential approaches to hearing protection currently used, such as non linear and membrane technologies, to identify an alternative approach that will allow significant enhancement in the ability to detect low level ambient sound while being worn.

PHASE II: If needed, Improve upon the design concept developed in Phase I and deliver a quantity of refined working prototype systems. The phase II prototype shall demonstrate a means of incorporating hearing protection and communications capability. In depth testing of the system shall be conducted to demonstrate performance with respect to its intended use, and shall verify/expand upon the design characteristics addressed during the Phase I effort.

Deliver a report detailing: (1) the design of the device, to include detailed drawings and schematics; (2) the fabrication processes and associated materials/equipment; (3) testing conducted (to include equipment and methodology) along with results demonstrating the degree of effectiveness of the system for its intended purpose; (4) any limitations of the device, such as effective range, length of operation, etc; (5) updated summary of key characteristics, end item cost estimates, and manufacturing considerations, to include any special processes or equipment anticipated for production purposes; (6) produce and deliver ten prototype devices to the Government for the purposes of testing in a relevant environment.

The success of performance evaluation and testing results, if favorable, will lead into Phase III applications. All research, development and prototype designs shall be documented with detailed descriptions and specifications of the materials, designs, processes, and performance.

PHASE III: Given successful completion of Phase II, a larger quantity of the integrated device shall be manufactured for larger scale testing and demonstration of manufacturability, reliability, and quality assurance. Prior to use in an operational environment, the complete system must, at a minimum, demonstrate a reasonable degree of hearing protection. In addition, this technology can be applied to civilian law enforcement, industrial and recreational users with similar needs for protection.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Commercial applications that would benefit from this technology include: protection for police and other security forces while maintaining situational awareness and the ability to communicate with other team members; factory settings in which machinery produces high levels of noise and where communication between operators is essential; competitive sports, such as those involving firearms; hunting and recreational shooting; etc.

REFERENCES:
1. DoDI 6055.12, “Hearing Conservation Program (HCP)”, Dec 2010

2. OPNAVINST 5100.23G, Navy Safety and Occupational Health Program Manual, Chapter 18 “Hearing Conservation and Noise Abatement”, Dec 2005

3. OPNAVINST 5100.19E, Navy Safety and Occupational Health (SOH) Program Manual for Forces Afloat, Chapter B4 “Hearing Conservation”, May 2007

4. ST 4-02.501, “Army Hearing Program”, Feb 2008

KEYWORDS: Hearing; Noise; Military; Protection; Steady-State; Impulse;

N123-155 TITLE: Field Drying System using no power for clothing and boots

TECHNOLOGY AREAS: Materials/Processes

ACQUISITION PROGRAM: Combat Clothing Program in PM ICE

OBJECTIVE: The objective of this program is to develop and demonstrate the feasibility of a system that will allow Marines to dry boots (and potentially other clothing items) overnight without the need for a power supply.

DESCRIPTION: The system will use the selected technology to efficiently extract or evaporate moisture from the intended item. It must have at least 3 uses before needing to be replaced. Development will include an effort to increase the number of uses to a greater number. A successful product will allow for the overnight drying of boots and other items of clothing without the need for an external power supply. It will be lightweight, portable, durable and low cost.

a. The task is to develop and demonstrate the elements of a system that will allow Marines to dry boots (and potentially other clothing items) overnight without the need for a power source. The ideal system will additionally incorporate a means for regeneration of the moisture-trapping potential of the system once it has been used multiple times. The product(s) will be a cost-effective consumable and will be easy to carry and use by the war fighter. Successful variants will provide a rapid moisture removal system, include features to provide antimicrobial protection and green materials technologies to reduce environmental impact.

b. Current Solutions

1. Common boot drying systems involve inverting the boots and forcing warm, dry air through them. This method is often inaccessible to the Marine when deployed in an area without heaters and generator power.
2. Another method involves using newspaper stuffed in boot to wick out moisture. Availability of newspaper is an issue.
3. There is also the choice of waiting several days for the boots to dry, but wet boots are not only uncomfortable but also render the Marine susceptible to foot health issues, including blisters and infections. These distractions can reduce the focus critical to success in battle.
4. There is the choice of wearing an alternate pair of boots which only adds to the logistics burden.
5. There are desiccants which can dry, but the current products are too bulky and heavy for field use.

6. There are reactive systems similar to that used for MREs, but they are either hazardous or the heat is uncontrolled and damages the boot.

c. The successful participant will identify the best combination of technologies that can effect rapid drying in a safe lightweight methodology. The ideal choice in this situation is a portable, reusable, self-contained drying system that is light weight and cost effective.

There are many technologies showing potential, but our market research has not been able to identify any current product that is capable of performing the drying function without the above mentioned issues. The concept of a bag that the Marine can fold up and place in his pack has tremendous merit.

PHASE I: Phase I would target the development of the drying and containment system.
Study and propose a system that meets these criteria.
Present a concept as to how to address this need and demonstrate how the approach could meet these needs.
Demonstrate safety and affordability.

PHASE II:
a. Demonstration of a prototype system design.
b. Manufacture and test the drying system in combat a type environment.
c. Provide test system prototypes of a proof of concept.
d. Prepare detailed cost and manufacturing plan to include unit cost and production capacity.
e. Optimize number of drying cycles.
f. Together with the Marine Corps team, establish the test protocols for the testing and verification of product.
g. Conduct testing and verification at an approved government test facility, provide a test report for analysis and evaluation.
h. Provide adequate samples for user evaluation.

PHASE III: Package the process and optimize manufacturing. License the process and technology to a large manufacturer or scale up for production internally. Place product on GSA and other government procurement vehicle.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Product has considerable commercial application in the camping and survival markets.

REFERENCES:
1. Lavan, Z.; Jean-Baptiste Monnier, Worek, W. M. (1982). "Second Law Analysis of Desiccant Cooling Systems". Journal of Solar Energy Engineering 104 (3): 229–236. doi:10.1115/1.3266307.

2. Effectiveness of Desiccant Coated Regenerative Wheels from Transient Response Characteristics and Flow Channel Properties – Part II: Predicting and Comparing the Latent Effectiveness of Dehumidifier and Energy Wheels Using Transient Data and Properti Desiccant 2009
http://www.gndzero.com/techdocs/Shielding/Shielding%20 Bags/Moisture_barrier_bags.pdf

KEYWORDS: scavenger laminates; drying bag; Composite water-trapping films; Drying Technologies; small molecule desiccants; active desiccants; hygroscopic polymers

N123-156 TITLE: <u>Post-IED Hull Inspection Tool</u>

TECHNOLOGY AREAS: Ground/Sea Vehicles, Materials/Processes

ACQUISITION PROGRAM: ALL GROUND VEHICLES

OBJECTIVE: The objective is to provide post IED inspection tool(s) that can assess structural damage to combat vehicles by forward deployed Marines.

DESCRIPTION: A capability gap exists in non-destructive testing of vehicle hulls in Forward Operating Bases (FOB) and combat outposts. Forward-deployed Marines are dependent on visual inspection of hulls to evaluate damage following IED events. The visual inspection is conducted road-side using a flashlight often lying face-up under a vehicle that still has Chemical Agent Resistant Coating (CARC) paint on the damaged area. The vehicle is fully assembled with minimal disassembly executed for visual inspection. The visual inspection results in a recommendation to either continue operations or send the vehicle for higher echelon repair.

The toolset will be used to identify various types of hull deficiencies including full or partial cracks, work hardening, stress fractures, and material mechanical properties. Many vehicles that could be returned to service are currently scrapped or sent to a Depot because of the inability to accurately assess damage. Vehicles that are returned to service are likely to be involved in subsequent IED attack(s) posing significant safety risk to the Operators if damaged areas are not identified and repaired. This can lead to a shortage of available vehicles in theater. It also results in high costs from unnecessary transportation, Depot repairs and premature washout.

The Post-IED Hull Inspection Tool will be used under field conditions. The toolset will provide a go/no-go decision to return a vehicle to maintenance or continue to conduct operations. The toolset shall have the ability to be deployed on mobile equipment used by the Marine Corps as well as housed on industrial shop floors such as depots and maintenance facilities CONUS and OCONUS.

The Marine Corps needs a Post-IED Hull Inspection Tool to support combat vehicle survivability inspection and analyses. This device will provide physical data on blasted hulls to conduct a Battle Damage Assessment and Repair (BDAR) analysis. Inspection and repair standards and procedures need to be developed to keep USMC vehicles in operation when damage has not exceeded thresholds that would make the vehicle unsafe.

The toolset will be used roadside by Marine Corps operators and maintainers in adverse conditions such as lying face-up under vehicles with minimal lighting available. The system proposed shall be a standalone system with its own power supply or have the ability to interface with NATO slave power receptacle. It shall be used to determine armor and hull degradation levels by identifying hull deficiencies and anomalies on CARC painted surfaces. The Post IED Hull Inspection tool shall be able to identify these deficiencies on USMC fielded vehicles currently operating in theater. The focus of the effort shall be underbelly and side-wall inspection following IED events resulting in the identification of armor deficiencies and degradation.

PHASE I: The contractor shall identify various types of post-blast hull deficiencies and technologies that can adequately identify deficiencies in a field environment. The contractor will propose a combination of commercially available inspection tools and new tools that would be required to conduct a Battle Damage Assessment and Repair (BDAR) inspection. The tool set will be presented to the government in a design review.

The contractor will propose a plan for the development and testing of the tools to be conducted in Phase II.

PHASE II: The contractor will develop the tools proposed in Phase I and demonstrate their effectiveness through a series of lab tests. The contractor will provide a complete set of tools for acceptance. These tools will be demonstrated in a field environment and their accuracy will be assessed through a series of designed blast experiments. The Government shall supply vehicles with blast damage to evaluate effectiveness of the proposed tool.

PHASE III: The developed tools would be procured by PM's and maintainers to conduct BDAR in the field.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The systems can also be sold to maintainers of On Road trucks and Construction Equipment to assess material damage from impact and fatigue.

REFERENCES:
1. "Impact Mechanics and High-Energy Absorbing Materials: Review", Published in Journal of Aerospace Engineering 21:4 (October 1, 2008), pp. 235–248; doi 10.1061/(ASCE) 0893-1321 (2008)21:4 (235) Copyright © 2008 ASCE.

2. "Vulnerability/Lethality Modeling of Armored Combat Vehicles", (Aberdeen proving Ground) Baker, William E.; Smith, Jill H.; Winner, Wendy A.

3. "DAMAGE ASSESSMENT OF IMPACTED ARMOR VIA 3-D X-RAY COMPUTED TOMOGRAPHY", (Aberdeen Proving Ground), Joseph M. Wells

KEYWORDS: Battle Damage Assessment and Repair (BDAR); Materials; Non Destructive Inspection; Weld Repair; Blast Modelling; Fatigue

N123-157 TITLE: Efficient, Cost-Effective, Low-Emissions Method to Cutting Nuclear Submarine and Aircraft Carrier Hulls

TECHNOLOGY AREAS: Materials/Processes

ACQUISITION PROGRAM: PMS 392 Strategic and Fast Attack Submarine Program Office

OBJECTIVE: The objective is to develop an innovative metal cutting system for submarine and aircraft carrier hull disposal that achieves competing requirements for environmental compliance; safety and health requirements; scheduling, manpower and time constraints; while achieving increased cost efficiencies to translate into life cycle cost reductions.

DESCRIPTION: The primary metal cutting technology used today for shipbreaking is Oxy-fuel torches. This is also the main generator of visible particulate matter (PM), which is measured by "opacity". Opacity is the smoke generated by burning of the torch gas, the iron and carbon in the steel, and the steel surface coatings at/near the kerf (including paint and a rubber-like special hull treatment and its adhesive). The PM emissions linger in the air long enough to be detected and reported by observers using the Ringelmann Method. The fuel that causes 90% of the dark smoke is the surface coatings. A minimum of 9" of each side of the torch path must be cleared to bare steel—inside and out—to avoid these substrates from burning and contributing to opacity). Reducing the opacity emissions will have added safety and health benefits. On November 4, 2010, Occupational Health and Safety Association Instruction CPL 02-00-136 was replaced by CPL 03-00-012 with significant changes to increase the overall worker safety during shipbreaking operations.

The Navy has been searching for alternative or modification technologies to achieve the competing requirements listed above, with a focus toward faster cold-cutting methods to avoid the cost and time associated with preparing the steel to a bare surface inside and out. For in-service submarines, the latest technology is a much slower but safer method of using a "Super-Saw", as shown in Reference 1, which is being used by several shipyards. The current problem with the Super-Saw for shipbreaking is that it is prohibitively slow, does not have a wide enough kerf, and is cumbersome for access in shipbreaking applications, particularly for surface ships.

Currently, the Navy is taking a short-term, preventative approach to reduce opacity in order to continue its mission in shipbreaking: Oxy-propane torches are used to dismantle submarines inside tensile fabric tents equipped with fans to capture fugitive PM emissions. This method is very costly with respect to support functions, because as each hull section has been completed, the containment needs moved, the hull section craned out of the dock, and the containment reset for the next cut. Due to size and the fact that submarines sit below the dry dock wingwall, whereas a cruiser is far larger and sits above the wingwall, the containment method would be at least ten times as complex, thus prohibitively expensive. Further, an aircraft carrier, using the same methodology would be at least one hundred times as complex, and entirely infeasible.

So far, a variety of cutting technologies have been demonstrated for the Navy, each of unique design, and therefore, its own set of pros and cons, many addressed in Reference 2. In general, technologies included both cold and hot cutting; including slurry jet, diamond wire, plasma arc, and different torch fuel gases. Over the years, many methods have been attempted and studied for shipbreaking by several countries, and they are collected in References 3 and 4. The Navy has not yet seen a single technology with all its desired advantages.

This effort is looking for an innovative, revolutionary solution that will meet or exceed federal, state and local environmental and safety standards while meeting the scheduling constraints (as measured in distance cut per unit time), and efficiency/cost/manpower constraints (as measured by distance cut per man day--accounting for all operating and support personnel required, including setup and teardown between cuts). Constraints are discussed below.

Innovative research is needed to develop and construct a cold cutting method such as a circular or reciprocating saw or milling head system, preferably with at least a semi-robotic control, that meets the following additional requirements:
- Able to cut high-tensile steel
- Portability: preferably in "man-handle-able" modules sized to be brought into inside ship spaces, with the ship within a drydock.
- Power: hydraulic/electric/pneumatic
- Control: hydraulic/electronic at cutter, man drivable, preferably not requiring programming for each cut
- Cut: Quality of cut and accuracy of cut are NOT an issue. This is scrap. Speed must be high to compensate for setup and removal time (minimal accepted lineal cutting speed of 10 inches per minute on 2" thick steel sheet, with the same speed or better on thinner work pieces). Considerations must be taken that submarine and ship hulls are not flat plate and have a radius of curvature. Ideally the cutter would be flexible in its cutting path so that it could be steerable around obstructions. Cut kerfs (width) is required to be ½" minimum ¾-1" preferred. Depth of cut from ½" to 4" This can be accommodated by changing cutting tool. Cutter should not require access to both sides of panel.
- Cutter: If a cutter is used, cutter should be designed for dry or very minimal coolant/lubrication.
- Cutter system must be suitable for use in year-round, open-weather, salt waterfront environment.
- Resultant opacity below the limit set by Puget Sound Clean Air Act (PSCAA) and also lower than the norm of oxy-propane torch cutting
- With respect to safety, designing a cutter to cut large sheets of plate at high speed within OSH noise limits will pose a challenge. Other safety challenges, as discussed in Reference 2, involve repetitive motion and fatigue injuries and ergonomics which need to also be taken into consideration for a successful product.

Since Oxy-fuel torches are also the globally dominant technology for large-scale metal-cutting, more organizations, including private entities will likely be affected by more stringent environmental regulations, enforcement and good environmental stewardship, making the tool developed good potential for commercial use.

PHASE I: Develop concepts for an improved ship cutting operation/system that meet the requirements described above. Demonstrate the feasibility of the concepts in meeting Navy needs and will establish that the concepts can be feasibly developed into a useful product for the Navy. Provide data on expected cutting rates on 2" and ½" thick HY-80 plates, including kerf width and feasibility of performance in a realistic environment with curved hulls that are sitting in a dry dock. Data, if applicable, should be included with respect to portability, the expected power requirements, the identification and quantity of lubricant required, the expected quantity and identification of byproducts entering the environment (to include expected opacity levels), and expected life/replacement frequency of the cutter blade or bit for both 2" and ½" thick specimens. Finally, the expected number of workers and the skill sets needed for a cut from setup though completion should be included. Document optimum parameters, approach, tradeoffs, benefits and risks. 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, develop a working prototype of the selected concept. The prototype will be evaluated to determine its capability in meeting the performance goals defined in Phase II development plan and the Navy requirements for the Improved Hull Cutting Operation System. Demonstrate that the system will work in a simulated shipyard operating environment, which could also include paint or residual special hull treatment coatings. Evaluation results will be used to refine the prototype into an initial design that will meet the described Navy requirements. The company will prepare a Phase III development plan to transition the technology to Navy use.

PHASE III: The Company will be expected to support the Navy in transitioning the technology for Navy use. The company will finalize an Improved Hull Cutting Operation System solution, including any refinements identified and lessons learned in Phase II. The company will support the Navy for test and validation to certify and qualify the system for Navy use.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Since Oxy-fuel torches are also the globally dominant technology for large-scale metal-cutting for public and private companies alike, more organizations will likely be affected by more stringent environmental regulations, enforcement and good environmental stewardship, making the tool developed good potential for commercial use. As submarines are among the toughest structures to dismantle due to type of material and thicknesses, any system designed to efficiently cut a submarine hull will, in turn, work on any other Navy hull or commercial ship application. With the growing popularity in recycling and conscientious environmental stewardship, metal cutting work is expected to increase. Further, commercial potential can be realized in similar type metal cutting operations that go beyond shipbreaking. As air quality regulations become stricter, any large-scale metal cutting facility or installation may become potential customers for alternative metal cutting techniques.

REFERENCES:
1. Naval Safety Center Success Stories: Super-Saw. 11 April 2011. Accessed 16 March, 2012.
<http://www.public.navy.mil/navsafecen/Documents/SuccessStories/037_SuperSaw.pdf>

2. Paulson, Kathleen, et al. "Initiation Decision Report: Innovative Technologies to Control/Reduce Emissions from Metal Cutting Operations." NAVFAC Technical Report TR-2368-EV. Naval Facilities Engineering Service Center (NAVFAC ESC), October 2011.

3. Nijkerk, Alfred A. & W.L. Dalmijn. Handbook of Recycling Techniques. The Hague, Netherlands: Nijkerk Consultancy, 1998.

4. Sarkisov, Ashot A. & A.T. Du Clos. Analysis of Risks Associated with Nuclear Hull Decommissioning. Disarmament Technologies, Vol. 24. Dordrect, Netherlands: Kluwer Academic Publishers, 1999.

5. "NESDI Program Evaluates Technologies to Address Puget Opacity Limits"; CURRENTS Magazine, Summer 2012, 7 pages.

KEYWORDS: Ship or submarine hull cutting system; metal cutting; cold cutting system; opacity reduction; torch cutting; shipbreaking

N123-158 TITLE: <u>Innovative Approach to Low Cost Shock Testing Fixture for Medium Weight, Shock Isolated Equipment</u>

TECHNOLOGY AREAS: Ground/Sea Vehicles

ACQUISITION PROGRAM: PMS397 - Ohio Replacement Program

RESTRICTION ON PERFORMANCE BY FOREIGN CITIZENS (i.e., those holding non-U.S. Passports): This topic is “ITAR Restricted”. The information and materials provided pursuant to or resulting from this topic are restricted under the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 - 130, which control the export of defense-related material and services, including the export of sensitive technical data. Foreign Citizens may perform work under an award resulting from this topic only if they hold the “Permanent Resident Card”, or are designated as “Protected Individuals” as defined by 8 U.S.C. 1324b(a)(3). If a proposal for this topic contains participation by a foreign citizen who is not in one of the above two categories, the proposal will be rejected.

OBJECTIVE: Design, develop, and validate a low frequency deck simulating fixture for the Medium Weight Shock Machine that is a low cost alternative to Floating Shock Platform testing of medium weight deck mounted equipment.

DESCRIPTION: Shock testing and qualification is essential to the certification process of critical equipment installed in submarines. Shock qualification testing must adequately simulate the environment and input forces to ensure a level of resistance to shock, see reference 2. Currently, shock qualification testing of Class II medium weight (500-4500 lb) submarine equipment requires underwater explosion (UNDEX) testing utilizing a Floating Shock Platform (FSP). The conduct of a UNDEX testing against a Floating Shock Platform is substantially more expensive than testing on a Medium Weight Shock Machine (MWSM), see reference 1 and 3 below. It is not currently permissible to test Class II medium weight equipment on the more cost effective machine because there is no existing MWSM fixture/method that adequately simulates the dynamic environment.

Currently, no fixture or method exists for the MWSM that allows for Class II medium weight equipment testing on a MWSM. As a result, medium weight Class II equipment has to be shock tested on FSPs which is substantially more expensive and schedule intensive than testing on a MWSM. Testing on a MWSM is on average $20k, approximately five times less expensive than testing on a FSP. Although medium weight Class II equipment is light enough to be mounted in a MWSM, a technology, technique, or fixture does not exist that sufficiently replicates the low frequency during a FSP shock event.

This SBIR topic seeks an innovative and cost efficient solution for shock testing of medium weight Class II equipment. Solutions need to integrate with MWSM, simulate FSP deck responses, and replicate low frequency shock events and be tunable to 7, 10, 14, 20, and 28 Hz, see reference 3 below.

PHASE I: Develop solution concepts that will be able to determine the motion characteristics of the FSP inner-bottom and deck simulation fixtures. Concepts should be developed using available FSP test data and modeling and simulation techniques. Develop and analyze a solution concept compatible with a MWSM that can produce motions similar to the FSP inner-bottom and a tunable deck fixture. The concept must provide all of the potential damage producing mechanisms that are produced on the FSP and deck simulation fixture.

PHASE II: Prototype and implement the proposed solution concept on a MWSM and construct a tunable deck simulation fixture for a MWSM. Validate the design by comparing the MWSM test results with MIL-S-901D FSP results. Develop a process for shock qualification testing of Class II medium weight equipment on the MWSM.

PHASE III: If the Phase II is successful, the company will be expected to support the Navy in transitioning the technology for Navy use. The company will be expected to finalize fixture design and shock qualification testing process and complete certification process for test labs.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Most shock testing, for submarine and surface ship platforms, is performed at private test labs. Vendors, who develop Commercial Off the Shelf (COTS) equipment for military applications, may also use the test fixture and process to verify their COTS designs for non-military applications, such as commercial transportation.

REFERENCES:
1. Clements, E.W. “Shipboard Shock and Navy Devices for its Simulation”, Naval Research Laboratory Report NRL 7396, July 14, 1972.

2. O’Hara, G.J. “Effect upon shock spectra of the dynamic reaction of structures”, Experimental Mechanics, 1961.

3. “Shock Tests, H.I. (High-Impact) Shipboard Machinery, Equipment, and Systems, Requirements For”, MIL-S-901D Amended by Interim change #1.

KEYWORDS: medium weight shock machine; floating shock platform; shock absorption testing; Low-frequency simulations; deck mounted equipment; underwater explosion testing

N123-159 TITLE: NetOps as a Service - Mission Focused Analytics

TECHNOLOGY AREAS: Information Systems, Sensors, Battlespace

ACQUISITION PROGRAM: PMW 790, Shore and Expeditionary Integration Program, TSw (ACAT IV)

RESTRICTION ON PERFORMANCE BY FOREIGN CITIZENS (i.e., those holding non-U.S. Passports): This topic is “ITAR Restricted”. The information and materials provided pursuant to or resulting from this topic are restricted under the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 - 130, which control the export of defense-related material and services, including the export of sensitive technical data. Foreign Citizens may perform work under an award resulting from this topic only if they hold the “Permanent Resident Card”, or are designated as “Protected Individuals” as defined by 8 U.S.C. 1324b(a)(3). If a proposal for this topic contains participation by a foreign citizen who is not in one of the above two categories, the proposal will be rejected.

OBJECTIVE: Develop an operational prototype of a NetOps Analytics system that enables both Cyber and Maritime domain operators to proactively assess the impact of NetOps incidents in mission context of Mission.

DESCRIPTION: In today’s information age, access to data (both unstructured and structured), ubiquitous secure information exchange and situational awareness are critical elements to the success of organizations, especially those that support global military operations. The US Navy IT-21 tactical network that supports the warfighter globally is complex and distributed across the globe. Accessing, exposing and securing authoritative sources of data remains a challenge primarily due to the variety of systems that encompass the IT-21 network and complex interconnections between these systems. Fusing and correlating the various NetOps data sources into meaningful trusted information sources to the warfighter in context of a mission is another level of complexity. Success in this effort will require both facets to be executed and integrated seamlessly. Objectively, the goal is to ensure the delivery of accurate, relevant, trusted NetOps information derived from authoritative data sources to the warfighter operating at ‘the tip of the spear’. Being able to manage large amounts of disparate data geographically dispersed across the globe over many networks, servers and devices is key to this effort.

The following are attributes of the NetOps Analytical system:
• Integrates NetOps SA information into the overall Maritime Situation Awareness (SA) environment.
• Includes displays of information in the NetOps SA environment that are relevant to the unique needs of the Cyber Commander and their warfare needs.
• Stores data at (or near) point of collection.
• Tags collected data at point of collection (to begin the data provenance process).
• Enables data provenance (i.e. the method for data generation, credentialing, transmission and storage based on identity, access and user management).
• Provides for data retrieval through the use of pre-defined or on-demand crafted by *widgets* or users specifications.
• Provides for alerting based on pre-defined criteria to allow operators and analysts to be tipped to activity vice sifting through data via multiple queries.
• Conditions the data to ensure an interoperable query/response process.
• Presents the data to the user for analysis and display via common and shared mapping and/or other visual services (e.g. geographic displays, Topology maps, graphing services).

PHASE I: Identify data and information requirements of maritime and cyber operations in support of respective and representative mission areas. Produce NetOps data matrix and/or indexing capability that identifies the location and meaning of the data in context of a mission area and/or thread related to the STRATCOM Initial Capabilities Document (ICD). Provide a preliminary system design document that clearly describes the complete hardware/software architecture, user interfaces, input/output relationships and maps system functions to attributes. Describe the collection of enabling Analytics technologies in terms of its ability to access, normalize/condition and correlate/fuse the NetOps data sources into mission-relevant information. Use of automated technologies such as machine learning technologies centered around anatomic intelligence to better understand network operation patterns and overall network data ontologies, is highly encouraged. A list and description of enabling technologies and their relationship to the key system functions and attributes should be clearly articulated during this phase. Any assumptions or other system dependencies should also be clearly identified. Demonstrate limited analytics capability using the data identified and collected as an initial prototype.

PHASE II: Mature the prototype developed in Phase I to include potentially classified data (secret or SCI) and demonstrate its capabilities during a representative Fleet experiment to assess military operational utility. The phase II effort should also culminate in a system design document that clearly articulates all aspects of the design with clear traceability to user functions and system attributes. It should also include interface specifications as defined during this phase.

PHASE III: The phase II results will be evaluated and if deemed successful, a phase III may be awarded to continue the integration with government identified systems, testing, limited procurement, and deployment of the technology.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Large network operations are common throughout commercial industries. Issues of network performance, operational availability, security are intrinsic to these operations. The solutions envisioned here are likely to be generic and applicable to a broad range of large commercial network operations. While there are currently many network situational awareness tools available, the objective of this program is to develop superior secure situational awareness and user efficiency that would benefit any large network operating in a cloud environment.

REFERENCES:

1. P 051535Z AUG 11 COMFLTCYBERCOM FT GEORGE G MEADE MD

2. P 201730Z SEP11 COMPACFLT PEARL HARBOR HI

3. Tactical Switching - NetOps, ENMS 101 Presentation, 13 pages. Uploaded in SITIS 9/12/12.

KEYWORDS: Situational Awareness, Cyberspace, Cloud, SOA, Decision-Making, User Experience, Usability, Mission-Focused

N123-160 TITLE: Querying and Processing Encrypted Databases without Decrypting

TECHNOLOGY AREAS: Information Systems

ACQUISITION PROGRAM: Computer Network Defense (ACAT IV)

OBJECTIVE: Develop an efficient means of cryptographically protecting databases while also processing without decryption.

DESCRIPTION: Cloud-computing is a cost-effective solution that outsources storage and computational instances. As the Navy transitions into a cloud environment with consolidated data centers, three confidentiality and integrity use cases are of interest: (1) data stored, (2) data being processed, and (3) data in transit to and from the data center. Strong cryptography and key management are solutions to cases (1) and (3), but case (2) is problematic. If encrypted data is to be decrypted in the cloud environment before processing, it can be susceptible to leakage and modification should the cloud environment be compromised. This poses serious security risks, especially if the data is sensitive. The decrypt-process-encrypt also adds computation complexity, or processing time. The research question is to explore possible solutions to query and process the data while still in its encrypted form. Another interest is to determine the strength of mechanism available through the use of cryptography in such a cloud-computing environment.

Of particular interest is the use case for a database element operation where a remote, autonomous, automated sensor provides an update, involving a mathematical operation. In this use case, an unclassified subscriber could update a classified data store. Examples include changes in course and speed, quantity on hand, or status. Another use case is secure transaction processing by wireless sensor grids.

Lattice or homomorphic encryption, which allows mathematical computations to be performed on encrypted data without compromising the encryption, is not new to the cryptography world. Existing cryptosystems such as El Gamal are considered homomorphic but with respect to either addition or multiplication operations. It was not until 2009 when fully homomorphic encryption was introduced that both addition and multiplication operations (thereby allowing every computation) could be made on encrypted data. Homomorphic encryption provides a suite of benefits. This proposal scopes research and development efforts to secure database transactions, heavily used by both government and industry.

PHASE I: Conceptualize and design an innovative solution to protecting database data using homomorphic encryption (whether partial or fully homomorphic) such that the query and processing of such data will not require decryption. The solution should be practical, in terms of a small footprint and high efficiency.

The phase 1 deliverable will address at least these factors:

• Cryptographic processes utilized, including key management
• Database structures to which this method might be applied (e.g., relational, structured, unstructured)
• Operations (add, multiple, etc) possible vs. complexity
• Strength of mechanism – as generally defined in ISO 15408 and how it might be evaluated
• Computational comparison with traditional decrypt-process-encrypt process
• Description of potential solutions for both use cases described above

PHASE II: Provide a practical implementation of the solution researched and designed in Phase I. Testing and evaluation should be accompanied to illustrate both feasibility and practicality.

PHASE III: Transition this technology into current Navy systems that house tactical databases.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Databases are widely used in both the government and private sector. Financial institutions, in particular, would greatly benefit from the research and development efforts in homomorphic encryption, especially if transitioning to a cloud environment.

REFERENCES:
1 - Suat Ozdemir and Yang Xiao. 2011. Integrity protecting hierarchical concealed data aggregation for wireless sensor networks. Comput. Netw. 55, 8 (June 2011), 1735-1746.

2 - Duc H. Tran, Wee Keong Ng, Hoon Wei Lim, and Hai-Long Nguyen. 2011. An efficient cacheable secure scalar product protocol for privacy-preserving data mining. In Proceedings of the 13th international conference on Data warehousing and knowledge discovery (DaWaK'11), Alfredo Cuzzocrea and Umeshwar Dayal (Eds.). Springer-Verlag, Berlin, Heidelberg, 354-366.

3 - Marten Van Dijk and Ari Juels. 2010. On the impossibility of cryptography alone for privacy-preserving cloud computing. In Proceedings of the 5th USENIX conference on Hot topics in security (HotSec'10). USENIX Association, Berkeley, CA, USA, 1-8.

4 - Sabrina Sicari, Luigi Alfredo Grieco, Gennaro Boggia, and Alberto Coen-Porisini. 2012. DyDAP: A dynamic data aggregation scheme for privacy aware wireless sensor networks. J. Syst. Softw. 85, 1 (January 2012), 152-166.

5 - Yu Yu; Leiwo, J.; Premkumar, B.; , "A Study on the Security of Privacy Homomorphism," Information Technology: New Generations, 2006. ITNG 2006. Third International Conference on , vol., no., pp.470-475, 10-12 April 2006

6 - Daniele Micciancio. 2011. The geometry of lattice cryptography. In Foundations of security analysis and design VI, Alessandro Aldini and Roberto Gorrieri (Eds.). Springer-Verlag, Berlin, Heidelberg 185-210.

7 - Yanping Xiao; Chuang Lin; Yixin Jiang; Xiaowen Chu; Fangqin Liu; , "An Efficient Privacy-Preserving Publish-Subscribe Service Scheme for Cloud Computing," GLOBECOM 2010, 2010 IEEE Global Telecommunications Conference , vol., no., pp.1-5, 6-10 Dec. 2010

8 - Vaikuntanathan, Vinod; , "Computing Blindfolded: New Developments in Fully Homomorphic Encryption," Foundations of Computer Science (FOCS), 2011 IEEE 52nd Annual Symposium on , vol., no., pp.5-16, 22-25 Oct. 2011

9 - Raluca Ada Popa, Catherine M. S. Redfield, Nickolai Zeldovich, and Hari Balakrishnan. 2011. CryptDB: protecting confidentiality with encrypted query processing. In Proceedings of the Twenty-Third ACM Symposium on Operating Systems Principles (SOSP '11). ACM, New York, NY, USA, 85-100.

KEYWORDS: lattice-based encryption; homomorphic encryption; encryption; data confidentiality; databases; query processing

N123-161 TITLE: <u>DYNAMIC TUNER FOR NARROW-BAND VLF SUBMARINE</u>

COMMUNICATION TRANSMITTING SYSTEM

TECHNOLOGY AREAS: Information Systems

ACQUISITION PROGRAM: Submarine Communications

RESTRICTION ON PERFORMANCE BY FOREIGN CITIZENS (i.e., those holding non-U.S. Passports): This topic is "ITAR Restricted". The information and materials provided pursuant to or resulting from this topic are restricted under the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 - 130, which control the export of defense-related material and services, including the export of sensitive technical data. Foreign Citizens may perform work under an award resulting from this topic only if they hold the "Permanent Resident Card", or are designated as "Protected Individuals" as defined by 8 U.S.C. 1324b(a)(3). If a proposal for this topic contains participation by a foreign citizen who is not in one of the above two categories, the proposal will be rejected.

OBJECTIVE: To provide a means for high power Very Low Frequency (VLF) transmitting systems to broadcast more efficiently and effectively in spite of the very narrow band antennas. They can do this by dynamically tuning the antenna(s) in sync with the modulated signal frequency shifts.

DESCRIPTION: Communication to submarines while at speed and depth utilizes high power VLF RF signals because they are able to penetrate the ocean to depths that can be received by a submerged antenna. The shore-based transmitting systems that broadcast the RF signals require very large antennas to launch the long wavelength signals, and operate with RF input power levels of several hundred kilowatts to 2 mega-watts. But in spite of their size the antennas are electrically small and have very narrow bandwidths, often less than the modulation bandwidth. As a consequence, the lack of bandwidth reduces the efficiency of the transmitter and causes a reduction in receive detectability due to slow frequency transitions of the broadcast signal. Typically, the antennas are tuned with series inductors that are several hundred micro-henries and are linear for RF currents up to 3,000 amperes. There is a critical need for a dynamic tuner that can rapidly tune an antenna (in less than 2 milliseconds) in sync with the 200 baud MSK modulation, thereby simulating a very broadband VLF transmitting antenna, which will dramatically increase the transmit efficiency and the detectability of the radiated signal.

Key Challenges to achieving the above goals are:
1) Developing an architecture that is compatible with existing VLF transmitter tuning circuits
2) Identifying new or advanced core materials that minimize core losses in an inductor while simultaneously operating at high flux density (if a non air-core inductor is used).
3) Avoiding non-linear behavior so that the transmitting system does not generate high order harmonics during the tuning transition between the two modulation frequencies.
4) Avoiding abrupt step tuning because this re-generates the undesirable modulation sidebands, causing adjacent channel interference.
5) Managing the high voltages and currents associated with volt-ampere requirements exceeding 4 MVA.
6) Offering accurate control of the inductance by minimizing the influence or compensating for the high RF current in the inductor from the transmitter.
7) The architecture and implementation must be robust, able to withstand lightning induced voltage transients in the antenna tuning circuit.
8) Developing a high level of confidence in the success of the approach when scaled up to the extremely high power levels that the existing VLF transmitters operate, especially due to the size and cost of a full scale deployment.

The circuits are electrically simple but physically large. The dynamic tuner must meet all requirements for any operating frequency from 15 kHz through 30 kHz.

PHASE I: Explore and define an architecture for incorporating dynamic antenna tuning into each of the five VLF transmitting systems operated by the U.S. Navy. The contractor shall perform detailed analysis and modeling of the characteristics of the dynamic tuner, including time domain and frequency domain analysis for predictions of harmonic generation and modulation sidebands. This analysis and modeling should substantiate any recommendations made and show that the chosen approach will meet the objectives and criteria set forth herein. The design concept must address the following risks:
-- Compatibility with existing antenna tuning systems
-- Core and winding heating

-- RF voltage breakdown
-- Lightning induced voltage transient breakdown
-- Overheating from RF current
-- Generation of harmonic energy exceeding the specification threshold
-- Sideband generation that exceeds the adjacent channel interference specification
-- Development of a reliable mechanism for accurate control of the dynamic tuner

PHASE II: Finalize and optimize the design(s) chosen in phase I, and build and test a one tenth to full scale prototype of the dynamic tuner. The contractor shall include a test plan that exercises the prototype dynamic tuner to its full rated KVA. This test plan may include coordination and use of one or more U.S. Navy facilities in order to obtain the high KVA required. The testing shall demonstrate to the maximum extent possible compliance with all of the goals outlined above.

PHASE III: Transition technology to the U.S. Navy FVLF In-Service Engineering Agent. Provide units for use in a U.S. Navy FVLF transmitter.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: More and more commercial applications are calling for electrically small antennas. There are various techniques for effectively receiving with electrically small antennas but transmitting efficiently is difficult. The technology being developed will apply to efficiently transmitting on electrically small antennas. The approach is independent of frequency

REFERENCES:
1. VLF Radio Engineering; by Arthur D. Watt; Pergamon Press 1967

2. VLF/LF High-Voltage Design and Testing, SSC San Diego TECHNICAL REPORT 1904; by Hansen, Peder & A. D. Watt, September 2003

3. Johannessen, Paul R., "Automatic Tuning of High-Q Antenna for VLF FSK Transmission", IEEE Transactions on Communications Systems Vol CS-12, No 1, March 1964

KEYWORDS: submarine communications; VLF; dynamic tuning; high power; RF-signals

N123-162 TITLE: <u>Analyzing the Data-Plane in a Heterogeneous Network</u>

TECHNOLOGY AREAS: Information Systems

ACQUISITION PROGRAM: JPEO JTRS ACAT 1D

OBJECTIVE: Develop algorithms for reasoning about the range of possible interactions among independently configured network components capable of predicting errors (e.g., packet loss, forwarding loops, and routing inconsistency) in a network due to misconfiguration and diagnosing faults from a model of a network and observed behavior.

DESCRIPTION: Cognitive Radio, Mobile Ad hoc Networks (MANETs) and traditional packet-switching networks all depend on the proper interaction of independently configured network devices across a data plane. Devices are frequently operated by non-experts, policy changes can disseminate across a network with varying speed, and configuration options can be complex. In many cases, devices must support multiple protocols and/or services that, while defined separately, can interact with each other. While systems exist for providing point-protection (e.g., a firewall) in a network, no system exists for comprehending a network data plane as a whole and anticipating how components could interact in unintended ways. The algorithms should accept information about the configuration of the various components, along with knowledge about the sorts of data to be transmitted on the network and the physical connectivity between the components, and use that information to predict faults in the network arising from the interaction of the various components. Ideally, this prediction should be in the form of a counter-example that demonstrates the fault.

PHASE I: Investigate and validate network analysis algorithms capable of detecting faults in a simulated network. The simulated network (cognitive radio, mobile ad hoc, or packet-switching network) should support at least one service. The prototype demonstrations will draw conclusions about performance and scalability (e.g., time, required hardware resources, and scope of checkable polices) of the algorithms over network size, degree of interconnectivity, and capability.

PHASE II: Develop a prototype implementation applicable to a deployed cognitive radio, mobile ad hoc, or packet-switching network. The implementation should scale to network sizes representative of deployed networks and parse configuration information for multiple network component types and services. The implementation should be able to predict realistic fault scenarios, generate counter-examples, and, if supported, suggest remedial actions. The implementation should include a prototype operator interface and demonstrate the feasibility of using the technology to reduce network maintenance and operating costs by mitigating human error and/or improving overall network efficiency and integrity.

PHASE III: The network analysis algorithms developed under this topic could be used to detect defects and/or vulnerabilities in a wide range of DoD networks. The goal of this research is to be able to analyze a complete network deployment and assist human operators in maintaining, optimizing, and securing that network. In addition to the algorithms developed under this proposal, this will require the development of a suitable user interface, parsing technology for interpreting component configurations, and a language interface for defining connectivity, capability and operation policy parameters. Transition will be to a suitable operational environment.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Networks are ubiquitous in commercial industry. Tools capable of modeling networks and detecting and explaining misconfigurations could be deployed in industry to maintain any corporate intranet.

REFERENCES:
1. H. Mai, A. Khurshid, R. Agarwal, M. Caesar, P.B. Godfrey, S. King. “Debugging the Data Plane with Anteater,” ACM SIGCOMM, 2011.

2. N. Feamster, H. Balakrishnan. “Detecting BGP Configuration Faults with Static Analysis,” Proc. USENIX NSDI, 2005.

3. R. Mahajan, D. Wetherall, and T. Anderson. “Understanding BGP Misconfiguration,” Proc. ACM SIGCOMM, 2002.

4. G. G. Xie, J. Zhan, D. A. Maltz, H. Zhang, A. Greenberg, G. Hjalmtysson, J. Rexford. “On Static Reachability Analysis of IP networks,” Proc. IEEE INFOCOM, 2005.

KEYWORDS: Cognitive Radio; MANET; Network Configuration; Cyber Security

N123-164 TITLE: Reducing Bandwidth Requirements for Cybersecurity Information Exchanges

TECHNOLOGY AREAS: Information Systems, Sensors

ACQUISITION PROGRAM: Computer Network Defense (ACAT IV) Acquisition

RESTRICTION ON PERFORMANCE BY FOREIGN CITIZENS (i.e., those holding non-U.S. Passports): This topic is “ITAR Restricted”. The information and materials provided pursuant to or resulting from this topic are restricted under the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 - 130, which control the export of defense-related material and services, including the export of sensitive technical data. Foreign Citizens may perform work under an award resulting from this topic only if they hold the “Permanent Resident Card”, or are designated as “Protected Individuals” as defined by 8 U.S.C. 1324b(a)(3). If a proposal for this topic contains participation by a foreign citizen who is not in one of the above two categories, the proposal will be rejected.

OBJECTIVE: Develop an efficient or optimal means of reducing or compressing cybersecurity monitoring information and data collection for transmission via low bandwidth links.

DESCRIPTION: Within cybersecurity, Computer Network Defense (CND) relies partially on sensors to observe hosts and networks. Functions include pattern or signature matching against known hostile profiles, anomaly detection, log file collection and analysis, and raw packet capture and analysis. Many of these processes, especially raw packet capture, generate large amounts of raw collection.

Many incidents occur at locations remote from a cybersecurity incident response team. Often response discovery and analysis requires physically shipping storage media. Incident responses need to occur in minutes or hours, not days.

The target cybersecurity communications formats, schemas, and protocols for CND-related incident and sensor collection include:
• Security Content Automation Protocol (SCAP) – NIST IR-7511
• Incident Object Description and Exchange Format (IODEF) - RFC 5070
• Cybersecurity Exchange Framework (CYBEX) – X.15000-X.1589

Additionally, cybersecurity systems collect raw log files from hosts, servers, routers, switches, and other devices, commonly analyzed using AWStats, WebLogExpert. Some cyber security systems collect and analyze raw packet data (packet sniffing) within a network, commonly analyzed using WIRESHARK or similar software.

Upon actual incident detection, a response team must analyze what occurred, classify the cause, review attack vectors, determine the impact scope, and assemble evidence for later prosecution.

PHASE I: Conceptualize and design an innovative solution to reduce the total bandwidth required to exchange information from a remote subscriber LAN back to a centralized computer incident response team (CIRT).

The phase 1 deliverable will address at least these factors:
• Minimum essential information exchange for the common formats
• Methods for collecting, organizing, and compressing a minimum essential incident exchange, given the various sensors
• Examples of exchange messaging sizes for typical incidents, such as virus/worm infection, change in configuration,
• Optimal method for selecting and reducing actual incident collection requests to pass all monitoring and collection content about an incident. Provide metrics that show optimality methodology.
• Identifying analysis tasks most efficiently processed remotely that can further reduce bandwidth requirements
• Propose a phased, minimum bandwidth application for a designated sensor system – details to be provided at Phase 1 kickoff

PHASE II: Provide a practical implementation of an optimized solution researched and designed in Phase I. Testing and evaluation should be accompanied to illustrate both feasibility and practicality. This phase will demonstrate transaction for various combinations of incident data exchange.

PHASE III: Transition this technology into current Navy systems supporting the Naval Cyber Defense Operations Command (NCDOC).

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The concept of a cybersecurity incident response team is not new to the commercial world. The bandwidth savings achieved from this proposal can be applied to both government and industry realms.

REFERENCES:
1. CYBEX - http://www.sigcomm.org/ccr/papers/2010/October/1880153.1880163 <x-excid://6B4F0000/uri:http://www.sigcomm.org/ccr/papers/2010/October/1880153.1880163>

2. SCAP - http://scap.nist.gov/ <x-excid://6B4F0000/uri:http://scap.nist.gov/>

3. IODEF - http://www.ietf.org/rfc/rfc5070.txt <x-excid://6B4F0000/uri:http://www.ietf.org/rfc/rfc5070.txt>

KEYWORDS: bandwidth savings; sensors; incident reponse; packet compression; packet information extraction; low bandwidth