NAVY
SBIR FY08.3 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 general inquiries or problems with electronic submission, contact the DoD Help Desk at 1-866-724-7457 (8:00 am to 5:00 pm EST). 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 on the Web site before **25 August 2008.** Beginning 25 August, the SITIS system (http://www.dodsbir.net/Sitis/Default.asp) listed in section 1.5c of the program solicitation must be used for any technical inquiry.

TABLE 1: NAVY ACTIVITY SBIR PROGRAM MANAGERS POINTS OF CONTACT

Topic Numbers	Point of Contact	Activity	E-mail
N08-205 thru N08-207	Mrs. Janet McGovern	NAVAIR	navair.sbir@navy.mil
N08-208 thru N08-221	Mr. Dean Putnam	NAVSEA	dean.r.putnam@navy.mil
N08-222 thru N08-226	Mr. Steve Stewart	SPAWAR	steve.stewart@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 Web site at **http://www.onr.navy.mil/sbir**. Additional information pertaining to the Department of the Navy's mission can be obtained by viewing the Web site 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 activity's facility for one day of meetings are recommended for all proposals and required for proposals submitted to NAVSEA, and SPAWAR. 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. For NAVAIR topics N08-205 thru N08-207 the base amount should not exceed $80,000 and 6 months; the option should not exceed $70,000 and 6 months. For all other Navy topics the base effort should not exceed $70,000 and 6 months; the option should not exceed $30,000 and 3 months. **PROPOSALS THAT HAVE A HIGHER DOLLAR AMOUNT THAN ALLOWED FOR THAT TOPIC WILL BE CONSIDERED NON-RESPONSIVE**.

The Navy will evaluate and select Phase I proposals using the evaluation criteria in section 4.2 of the DoD solicitation in descending order of importance with technical merit being most important, followed by the qualifications, and followed by commercialization potential. 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

In addition to the final report required in the funding agreement, all awardees must electronically submit a non-proprietary summary of that report (and without any proprietary or data rights markings) through the Navy SBIR Web site. Following the template provided on the site, 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". This summary will be publicly accessible via the Navy's Search Database.

NAVY FAST TRACK DATES AND REQUIREMENTS

The Fast Track application must be received by the Navy 150 days from the Phase I award start date. Phase II Proposal must be submitted within 180 days of the Phase I award start date. Any Fast Track applications or proposals not meeting these dates may be declined. All Fast Track applications and required information must be sent to the Technical Point of Contact for the contract and to the appropriate Navy Activity SBIR Program Manager listed in Table 1 above. The information required by the Navy, is the same as the information required under the DoD Fast Track described in section 4.5 of this solicitation.

PHASE II GUIDELINES

Phase II proposal submission, other than Fast Track, is by invitation only. If you have been invited, follow the instructions in the invitation. **Each of the Navy Activities has different instructions for Phase II submission. Visit the Web site 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 solicitation in descending order of importance with technical merit being most important, followed by the qualifications, and followed by commercialization potential. 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.

Under the new OSD (AT&L) directed Commercialization Pilot Program (CPP), the Navy SBIR Program will be structuring more of our Phase II contracts in a way that allows for increased funding levels based on the projects transition potential. This will be done through either multiple options that may range from $250K to $1M each, substantial expansions to the existing contract, or a second phase II award. For currently existing phase II contracts, the goals of the CPP will primarily be attained through contract expansions, some of which may significantly exceed the $750K recommended limits for Phase II awards not identified as a CPP project. All projects in the CPP will include notice of such status in their Phase II contract modifications.

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.

As with the Phase I award, Phase II award winners must electronically submit a Phase II summary (without any proprietary or data rights markings) through the Navy SBIR Web site at the end of their Phase II.

A Navy Activity will not issue a Navy SBIR Phase II award to a company when the elapsed time between the completion of the Phase I award and the actual Phase II award date is eight (8) months or greater; unless the process and the award have been formally reviewed and approved by the Navy SBIR Program Office. Also, any SBIR Phase I contract that has been extended by a no cost extension beyond one year will be ineligible for a Navy SBIR Phase II award using SBIR funds.

The Navy typically awards a cost plus fixed fee contract or an Other Transaction Agreement 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 the Law (PL102-564) permits Phase III awards during Phase II work, the Navy 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. If you have questions, please contact the Navy Activity SBIR Program Manager.

PHASE III

Public Law 106-554 and the 2002 Small Business Innovation Research Program Policy Directive (Directive) provide for protection of SBIR data rights under SBIR Phase III awards. Per the Directive, 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

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.

Any contractor proposing research that requires human, animal and recombinant DNA use is advised to view requirements at Web site http://www.onr.navy.mil/sci_tech/ahd_usage.asp. This Web site provides guidance and notes approvals that may be required before contract/work may begin.

PHASE I PROPOSAL SUBMISSION CHECKLIST:

All of the following criteria <u>must be met</u> or your proposal will be REJECTED.

____1. Make sure you have added a header with company name, proposal number and topic number to each page of your technical proposal.

____2. Your technical proposal has been uploaded and the DoD Proposal Cover Sheet, the DoD Company Commercialization Report, and the Cost Proposal have been submitted electronically through the DoD submission site by 6:00 a.m. EST 24 September 2008.

____3. After uploading your file and it is saved on the DoD submission site, review it to ensure that it appears correctly.

____4. For NAVAIR topics N08-205 thru N08-207, the base effort does not exceed $80,000 and 6 months and the option does not exceed $70,000 and 6 months. For all other proposals, the Phase I proposed cost for the base effort does not exceed $70,000 and 6 months and for the option $30,000 and 3 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.

Navy SBIR 083 Topic Index

N08-205	Radar Detection and Tracking of Small Maritime Targets at High Grazing Angles
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N08-225	Wideband Networking Waveform (WNW) Enhancement
N08-226	Efficient Wideband Antenna for JTRS Ground Mobile Radio (GMR) Communications Systems

N08-205 TITLE: Radar Detection and Tracking of Small Maritime Targets at High Grazing Angles

TECHNOLOGY AREAS: Air Platform, Sensors, Battlespace, Weapons

ACQUISITION PROGRAM: PMA-265

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop high-grazing-angle radar signal processing techniques utilizing a long integration time approach with a pulse to pulse agile beam which has control to detect and discriminate small maritime targets and maintain overall situational awareness.

DESCRIPTION: Maritime surface search radars have traditionally been operated at low grazing angles when searching for small maritime targets such as periscopes and small boats. A major reason for this operational choice is that the mean radar sea clutter return drops significantly at low grazing angles (i.e., <10-15 degrees grazing), so target radar returns are readily masked by the large clutter signature. However, operation at higher altitudes will greatly extend the radar horizon, and, with effective signal processing techniques, will yield large search rates and hence enable persistent wide area surveillance. With current and future missions being developed for unmanned aerial vehicles (UAV), it is essential to their success to be able to execute intelligence, surveillance, and reconnaissance missions from higher grazing angles than has been routinely done in the past. The feasibility of radar operation in this high altitude (10,000 ft and higher) and high grazing angle regime is dependent in part on the development of methods to discriminate between sea clutter and small targets of interest.

PHASE I: Determine the feasibility of and define a candidate signal processing approach leveraging the statistical characteristics of sea clutter and hard body radar returns at high grazing angles. Identify radar architectures necessary to support the signal processing approach. Identify how current and emerging radar systems might exploit these techniques with modest enhancements.

PHASE II: Design, build, and test a prototype radar processor that automatically detects and discriminates signatures associated with small maritime targets in near real time.

PHASE III: Transition developed technology to UAV and/or manned systems and platforms.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The signal processing approaches could be applied to a wide range of surveillance applications including large-area search and rescue operations, maritime counter-drug operations, and monitoring activities within the exclusive economic zone. The products of this small business innovative research would also be of significant importance to Homeland Security for coastal and harbor surveillance.

REFERENCES:
1. Ward, K.D., Baker, C.J., and Watts, S. "Maritime Surveillance Radar Part 1: Radar Scattering from the Ocean Surface." IEE Proc. F, Radar & Signal Processing, Vol. 137, 1990, pp. 51-62.

2. “Sea Clutter: Scattering the K-Distribution and Radar Performance.” By Keith D. Ward, Simon Watts, Published 2006, IET.

KEYWORDS: Radar Scattering; Radar Sea Clutter; Maritime Surveillance; Small Maritime Targets; Target Detection; Homeland Security

TPOC: 301-342-2637
2nd TPOC: 631-673-8176

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

N08-206 TITLE: High Density, Fiber-Optic Sensors, Single Mode/Multi-Mode and High Power Fiber-Optic Rotary Connection Technology

TECHNOLOGY AREAS: Sensors, Electronics, Battlespace, Weapons

ACQUISITION PROGRAM: PMA 231

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Design and implement a High Performance, High Density, Low Signal Loss, Fiber Optic Rotary Joint (FORJ), which offers low weight, minimum working volume, immunity to electromagnetic interference, and reliable fault free rotation.

DESCRIPTION: Electro Optic (EO) technology is rapidly replacing coax based applications. Photonic routing and distribution offer new opportunities for digital and analog RF signal transport over optical fiber networks. Core utilities for adopting optical fiber systems are speed, functionality bandwidth, reliability, and Electro Magnetic Interference (EMI) immunity. Current commercial FORJ technology comes with size, weight, packaging, environmental and optical performance limitations which are posing deployment challenges in Naval aviation applications. NAVAIR is looking for innovative technology and product design that will provide robust mechanical performance, environmental toughness and leading edge optical performance, packaged for reliable operation on military fixed and rotary wing aircraft.

Aviation fiber based architectures utilize intrinsic and extrinsic sensors positioned in and on airframe structures to perform mission critical functions. Data collected from these sensing operations are analyzed for aircraft health monitoring, threat response, control, command, communication and environmental awareness. To achieve these objectives, sensors are mounted strategically throughout the airframe and require complex routing. For example, many carrier based air vehicle designs include wing folding requirements for below carrier deck stowage. Placement of fiber sensors beyond that boundary is rare due to reliable concerns. FORJ’s provides a vehicle for accessing and utilizing these vantage points, as well as radome protected sensors. Key threshold design goals for the multi-channel Fiber Optic Rotary Joint (FORJ) modules are:
1. Port Count: 2, 4, 8, 16, 32…
2. Operating Wavelength: 850 nm, 1300 nm, 1530 – 1565 nm
3. Insertion loss (dB): 1.0 /channel
4. Crosstalk (dB): - 50
5. Return Loss (dB): < - 50
6. Power: 1W/channel
7. Operating Environment: - 40C to +100C
8. Fiber Types: Multimode or Single mode
9. Connector Type: MIL-PRF- 29504/4 & /5
10. Number of simultaneous transmit channels: 8
11. Mechanical Reliability: > 10 8 Rotations
12. Rotational Speed: 0 to 100 RPM

PHASE I: Determine the feasibility of defining a FORJ technology by taking into account photonic loss budget of existing technology, associated bandwidth, and environmental ruggedness in an aircraft environmental profile.

PHASE II: Develop, build and demonstrate prototype Fiber Optic Rotary Joints for use in next generation phased array radar and electronic warfare systems. Fabricate a FORJ test bed to demonstrate a Low Signal Loss fiber interconnect modules that can survive and reliably operate in harsh military environments. Characterize the packaged test bed fiber-optic hardware prototypes for optical performance using aircraft representative fiber optic cable interconnect technology.

PHASE III: Characterize the packaged test bed over the full –40 C to +100 C temperature range and aircraft environmental profile. Verify and validate first article production fiber-optic hardware prototypes for optical performance in a typical avionics environment, including repeated temperature cycling, altitude immersion, humidity, fluids, shock, vibration, etc. Transition technology to fixed and rotary wing aircraft.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The research under this program could extend beyond military systems to commercial ATC radar systems and networks. Further, the effort here to reduce the size and weight even gives a competitive advantage in the commercial telecommunications marketplace.

REFERENCES:

1. R.C. Hansen, "Phased Array Antennas"; ISBN: 978-0-471-53076-3 January 1998.

2. Sophocles J. Orfanidis, "Electromagnetic Waves and Antennas"; November 2002.

3. MIL-STD-29504, Termini, Fiber Optic Connector, General Specification 12 November 2002.

4. MIL-STD 810F, Environmental Engineering Considerations and Laboratory Tests.

KEYWORDS: Fiber Optics,; Packaging; Interconnect Solutions for Future Airborne Phased Array Radar Antennas; EMI; Fiber Optic Rotary Joint

TPOC: 301-342-9102
2nd TPOC: 301-342-9115

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

N08-207 TITLE: Develop Novel Concepts for Continuous Ground Moving Target Surveillance

TECHNOLOGY AREAS: Sensors, Electronics, Battlespace, Weapons

ACQUISITION PROGRAM: PMA-265

OBJECTIVE: Develop novel techniques for the simultaneous detection, track, geo-location and automated target recognition of move-stop-move ground targets.

DESCRIPTION: The requirement for multidimensional situation awareness is increasing for both military and commercial sensors. Dominance in the military theater demands systems that can perform multiple functions such as ground moving target indication (GMTI), and synthetic aperture radar (SAR) that maintain continuous track and surveillance of specific move-stop-move targets. State of the art solutions to solve this problem revolve around the incorporation of shared aperture techniques or multiple radar systems. Limitations in physical implementation of the shared apertures, prime power availability, and basic phenomenology associated with the multiple functions must be balanced against command situational awareness constraints. Innovative methods to integrate these modes need to be developed.

PHASE I: Identify, define and model the necessary radar technologies required to accomplish radar detection, track, geo-location and automated target recognition of move-stop-move ground targets either simultaneously or in a manner that appears simultaneous to the radar operator. Computer simulation should be utilized to bound the problem by providing performance envelops under various prime power, update rate and field of regard conditions. Measures of effectiveness will be developed and used to assess the techniques developed.

PHASE II: Develop and demonstrate the prototype technology through either unclassified hardware demonstration of selected techniques or computer analysis of data cubes representative of the stressing technologies being reduced to practice.

PHASE III: Finalize the technology and transition to the fleet.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The signal processing approaches could be applied to a wide range of surveillance applications including large-area search and rescue operations, maritime counter-drug operations, and monitoring activities within the exclusive economic zone. The products of this small business innovative research would also be of significant importance to Homeland Security for coastal and harbor surveillance.

REFERENCES:
1. The improvement of the conventional GMTI method with single-channel SAR, Wei Song; Wang Hongyuan, Geoscience and Remote Sensing Symposium, 2004. IGARSS apos; 04. Proceedings. 2004 IEEE International, Volume 4, Issue, 20-24 Sept. 2004 Page(s): 2626 - 2628 vol. 4.

2. Real time simultaneous SAR/GMTI in a tactical airborne environment "EUSAR'96, Konigswinter, Germany," M Tobin 1996, P 63-66.

3. Battlefield awareness via synergistic SAR and MTI exploitation, "IEEE Transactions on Aerospace and Electronic Systems," MT Fennel 1998, 13, 02 P 39-45.

KEYWORDS: Multi-mission Radar; Radar Scheduling; Ground Moving Target Indication (GMTI); Synthetic Aperture Radar (SAR); Intelligence, Surveillance and Reconnaissance (ISR); Multifunction Waveforms

TPOC: 301-342-2637
2nd TPOC: 631-673-8176

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

N08-208 TITLE: Ultra low-cost integrated laser and SOA modulator switch

TECHNOLOGY AREAS: Ground/Sea Vehicles, Sensors, Electronics

ACQUISITION PROGRAM: PMS450 - VIRGINIA CLASS PROGRAM ACAT I

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: OBJECTIVE: To develop an inexpensive and compact semiconductor distributed-feedback laser (DFB) laser with a linewidth of 1 MHz, with a phase noise performance typical of other commercial DFB lasers without an external cavity [1]. The desired output power is 10 mWatts, with an integrated high-speed switch for generating 1 nsec wide pulses. The laser should consume very little electrical power, operate mode-hop-free without the need for a thermo-electric (TE) cooler from 0 C to 20 C. The switch needs to not introduce chirp and can be either an integrated traveling wave semiconductor optical amplifier (SOA) or a reflective SOA. At the end of the program, the cost of such an integrated package should be less than $150 in large volumes (> 5000). The laser should have a rugged design, be fiber coupled, and be insensitive to modest levels of vibration.

DESCRIPTION: DESCRIPTION: Optoelectronic (OE) component cost is one limitation in the use of fiber optic acoustic sensors for Navy systems. The Navy seeks innovative approaches to reducing the cost of two key OE components, the laser source and the high-speed switch. The 1550 nm laser source can be an edge emitting DFB laser or vertical cavity surface emitting laser (VCSEL) with a 1 MHz linewidth. The SOA switch needs to have very low light leakage in the off state (< 80 dB). An integrated DFB laser / SOA switch would be the ideal solution.

PHASE I: PHASE I: Demonstrate an ultra-low-cost, fiber-coupled, DFB laser with 10 mWatts of output power at 1550 nm, which requires no TE cooler, has a 1 MHz linewidth with low frequency noise consistent with other DFB lasers per refernce [1]. Demonstrate an SOA switch with a saturation power of 10 dBm, a noise figure of 7, 1 nsec pulse width, and a gain factor of 20 in a compact package for ultra-low-cost.

PHASE II: Phase II: Develop an integrated DFB laser, high speed switch with the above specifications and very low light leakage (<80 dB) and low chirp level in a compact fiber-coupled package.

PHASE III: Phase III: After detailed component testing, provide an integrated ultra-low-cost DFB laser with an integrated nsec switch to NavSea for integration into fiber optic acoustic sensing systems.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: PRIVATE SECTOR COMMERCIAL POTENTIAL. DUAL-USE APPLICATIONS: An ultra-low-cost integrated DFB with an external switch will have applications in commercial fiber optic sensing technology in addition to telcom applications in the area of passive optical networks.

REFERENCES: [1]. "Achieving narrow linewidth low-phase noise external cavity semiconductor lasers through the reduction of 1/f noise," Robert E. Bartolo, Clay K. Kirkendall, Vladimir Kupershmidt, and Sabeur Siala, Proc. of SPIE, Vol. 6133, 1 (2006).

KEYWORDS: distributed feedback laser; coherent laser; semiconductor laser; fiber coupled; semiconductor optical amplifier

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N08-209 TITLE: Embedded Training Techniques for Target Discrimination Systems

TECHNOLOGY AREAS: Sensors, Electronics, Human Systems

ACQUISITION PROGRAM: PEO IWS 2/5 SPS-74 CVN Periscope Detection Radar

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop embedded training technology which will enhance and maintain operator proficiency for sensor systems with human-assisted automatic target discrimination capability.

DESCRIPTION: The Navy is deploying high resolution sensor systems, SPS-74(V) for example, with unique capabilities to extract target feature information and classify targets using a combination of automated algorithms and operator discrimination. These sensors systems provide detail-rich visual signatures which require operators to develop human pattern recognition capability as part of their watchstation training. They also require operators to interpret results of automation processes to supplement manual pattern recognition. This human-machine collaboration presents difficult challenges for operator proficiency training. An effective training approach must provide realistic data fidelity for automation algorithms and operator analysis simultaneously, while implementing an affordable stimulation approach. Stimulation with raw sensor data is nearly prohibitive due to high data rates. Emulation of complex and evolving automation is problematic and expensive. Any effective implementation must have efficient, testable interfaces with the tactical system software to facilitate integration and spiral development. An embedded training approach that addresses these challenges is preferable to a stand-alone trainer.

The Navy seeks an affordable embedded training technical approach that can provide the fidelity to support effective operator proficiency training. It is also desired that the architecture support basic operator functional training and limited maintenance training. Other functions of interest include qualification management and operator performance analysis. An ideal training architecture would support commonality across multiple sensor systems. Proposed approaches should be compatible with current Navy training standards for reusable content such as Sharable Content Object Reference Model (SCORM) and the Integrated Learning Environment (ILE).

PHASE I: Design an embedded training concept for an advanced target discrimination system. Identify technologies that can support the functions of the notional system. Assess the readiness of these technologies and estimate required resources to implement the embedded training concept. Determine quantitatively the capabilities provided by the embedded trainer and methods/metrics for assessing the effectiveness of the training system

PHASE II: Produce an embedded trainer design, which could include prototype software or hardware components. Demonstrate the feasibility of the training concept and determine the effectiveness of the system against the metrics created in Phase I.

PHASE III: Integrate successful technology into existing Navy radar systems.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: These embedded training technologies could be readily transitioned to many deployed Department of Defense systems which use pattern recognition, require operator qualification management, and an innovative means of implementing existing US Navy and/or DOD training content standards. Some examples include land mine detection and classification, passive sonar automation, radar target recognition, automated mechanical fault detection. Any system which requires proficiency of operating personnel, such as power plants, process controllers, automated assembly systems, will benefit from technologies providing embedded training and quality assurance.

REFERENCES:
1. SCORM 2004 (3rd Ed) Sharable Content Object Reference Model Overview (www.adlnet.gov).

2. Navy Integrated Learning Environment (ILE) Introduction (https://ile-help.nko.navy.mil/ile/contentItems/Navy%20ILE%20An%20Introduction_20070815.pdf).

3. US Navy PQS Program (https://pqs.cnet.navy.mil/).

4. Army Training Support Center (http://www.atsc.army.mil/TSAID/IntegrationDiv/embeddedTrg.asp).

5. Embedded Training Solution for the Bradley Fighting Vehicle (http://www.dtic.mil/ndia/2001technology/bernard.pdf).

6. Mutch, K.M. and Fox, V.T., “Embedded training for the joint surveillance and target attack radar system ground station module,” 1995 IEEE Aerospace and Electronics Conference.

KEYWORDS: Surveillance, Radar, Pattern Recognition, Embedded Training, Qualification Management, Learning Management, Distributed Learning, Sustainment Training

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N08-210 TITLE: Portable Multimodal Biometric Devices

TECHNOLOGY AREAS: Information Systems, Sensors, Electronics, Battlespace

ACQUISITION PROGRAM: PMS 480 Anti Terrorism Afloat Identity Dominance System

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop a compact, lightweight, rugged, portable device that integrates currently utilized biometric modalities to facilitate mobile identification/verification/enrollment of individuals encountered in an austere maritime environment and remote location.

DESCRIPTION: As stated in Ref 1, “Saltwater, dirt and rough handling are tough on electronics…which is why the Navy/Marine Corps team is developing the System for Intelligence and Identity Management Operations (SIIMON) to enable the use of biometrics in Navy and Marine Corps applications and environments.” Vessel Boarding Search and Seizure (VBSS) teams performing Expanded Maritime Interception Operations (EMIO) and USMC units on patrol require the ability to positively identify individuals encountered. The Identity Dominance System Capability Development Document (CDD) has established a need for a maritime expeditionary portable multimodal biometric enrollment and identification device that can withstand rough handling in austere environments (i.e. saltwater, sand, mechanical shock, etc.). The IDS CDD is not for public release, but References 2 through 4 below contain pertinent information. The innovative challenge and technical risk consists of miniaturizing current biometric devices and integrating them into one ruggedized multimodal unit that meets the requirements of the SIIMON performance specification (Ref 5). The target unit will be capable, in a maritime environment, of capturing iris images and rolled/slap fingerprints for local matching/identification against watch lists. It must also be capable of collecting facial images. Additionally, the device needs to be interoperable with systems/radios utilized to provide wireless transmission of the data back to authoritative databases. Collected biometric data will meet the standards for the Department of Defense as well as U.S. law enforcement agencies. The IDS CDD also recognizes that identification is solely supported by biometrics and calls for the enrollment of contextual data either through direct data entry or collection from electronic/smart media. It is assumed that the device proposed will have a robust computing platform at its core and be able to host the media exploitation application. Evaluation of the commercialization criterion at each Phase of the project will include the soundness of the plan to coordinate as needed with biometric technology vendors to ensure manufacture at a reasonable unit cost. The unit will be used at remote locations in the field and is intended to be unclassified.

PHASE I: Develop a design for multimodal biometric device IAW Ref 5 including hardware and software. Identify the high risk technical challenges and provide evidence of the ability to meet them. Develop an initial plan for the development of the required capability including cost, schedule, and required support.

PHASE II: Fabricate prototype device and test. Finalize the concept design and make recommendations for Phase III production-oriented designs. Refine the plan for development of the required capability provided in Phase I.

PHASE III: Produce and conduct testing of close-to-production model. Transition the technology to the Identity Dominance System program.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Private Industry uses biometric technology for commercial products and can benefit from this research in applying resulting concepts to develop smaller/lighter biometric products. Much of the technology developed under this effort will be applicable to homeland defense, law enforcement, and private sector security.

REFERENCES:

1. “New Handheld Device Meets Maritime Challenge”, Biometric Scan – Newsletter of the DoD Biometric Task Force, Jan 2008. http://www.biometrics.dod.mil/Newsletter/issues/2008/Jan/v4issue1_pm.html

2. www.biometrics.org, A Journal of the International Biometric Society.

3. "Expeditionary Biometrics Capability," September 20, 2006. http://www.biometrics.org/bc2006/presentations/Wed_Sep_20/Session_I/20_Boyd_task-force.pdf

4. “US Navy Biometrics: An Overview,” September 13, 2007. http://www.biometrics.org/bc2007/presentations/Thu_Sep_13/Session_I/13_Duong_DOD.pdf

5. DoN Identity Dominance System: System for Intelligence and Identity Management Operations (SIIMON) Performance Specification.; and Appendix A, System Description Document for SIIMON (Note: PDF uploaded for review).

KEYWORDS: Biometrics; latent prints; iris imaging; watchlist; palm prints

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N08-211 TITLE: Rapid Electrical Outfitting For Shipbuilding

TECHNOLOGY AREAS: Ground/Sea Vehicles, Materials/Processes, Electronics

ACQUISITION PROGRAM: PMS 317, LPD 17 Program, ACAT 1

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop a quick connect technology for distributive power wires that will help to reduce wire run lengths, reduce the number of multiple connector types aboard ship, and work with various wire types and sizes. The solutions should be focused on reducing the cost and time compared to current power distribution installation, modernization and repair.

DESCRIPTION: The Navy's Program Executive Office for Ships is leveraging the National Research Program (NSRP) to effect change across the surface shipbuilding, modernization and repair enterprise by coordinating with U.S. shipbuilders to adapt and implement "World Class" commercial best manufacturing practices. The U.S. shipbuilding industry lags behind the global shipbuilding market significantly in adapting new technologies to long-standing inefficient manufacturing processes and improvement is this area is key to closing this gap.

The US Navy currently manually installs long runs of power distribution wires on board ships. The type, size and lengths of these wire runs vary as do the types and sizes of the connectors that are utilized. The length of wire runs, uncertainty of wire location, and complexity of wire connections also make it difficult to modernize and repair Navy ships. Currently, many of the power distribution wires are installed once the ship modules are assembled. Installing this complex system of power distribution wires requires specially trained individuals which are difficult for shipyards to retain. Overall, the installation of power distribution wires is time and manpower intensive resulting in a substantial cost burden to the shipyards during the ship construction process.

The Navy seeks innovative and alternative material system solutions to reduce the cost and time required to install, modernize, and repair a ships power distribution network. The objective for this solicitation is to develop a quick connect technology for distributive power that will help to reduce wire run lengths, reduce the number of multiple connector types aboard ship, and work with various wire types and sizes. The solutions should be focused on reducing the cost and time compared to current power distribution installation, modernization and repair. The solution must be able to withstand marine environments for the life of the Navy vessel (20-50 year), be water tight, be externally non-conductive and require little training to install. The solution should also consider how ship modules are assembled and be adaptable to this process. The innovation should be able to be implemented in shipyard applications and be compatible with traditional shipyard practices and processes.

This topic seeks innovative scientific and engineering solutions to inefficiencies in long-standing business, design, engineering, and production planning and construction methods. This topic offers an opportunity to infuse new ideas/innovations into the domestic shipbuilding industry. Of particular interest are initiatives with a clear business case. Proposals should specifically describe the technology that will be applied to solve the problem, how it will be developed, what the estimated benefits will be and how it might be transitioned into the shipbuilding industry. NSRP members are available to provide guidance and assistance in the identification of common issues and needs.

PHASE I: Demonstrate feasibility for improvements being developed and also identify impact upon affordability. Include a first order Return-On-Investment (ROI) analysis for implementation and estimate potential Total Ownership Cost (TOC) reduction. Establish Phase II performance goals and key developmental milestones.

PHASE II: Finalize the design, as appropriate, and demonstrate a working prototype of the proposed system. Perform laboratory tests to validate the performance characteristics established in Phase I. Develop a detailed plan and method of implementation into a full-scale application.

PHASE III: Implement the Phase III plan developed in Phase II in coordination with the shipbuilding and repair industry.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The technology developed under this topic shall be directly applicable to current military and commercial shipbuilding operations and repair practices. The products developed should find wide use in most heavy industrial plant/processing facilities such as the power industry and will be marketable to the shipbuilding and repair industry.

REFERENCES:
1. NSRP ASE Strategic Investment Plan, available on line at http://www.nsrp.org/

2. US Naval Shipyard information is available at http://www.shipyards.navy.mil

3. GTR No. 28, ELECTRICAL AND ELECTRONIC SYSTEMS, MILITARY SEALIFT COMMAND GENERAL TECHNICAL REQUIREMENTS

KEYWORDS: shipbuilding; affordability; materials; electrical systems; quick connect; NSRP

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N08-212 TITLE: Vent Waste Recovery System for Ultracapacitors

TECHNOLOGY AREAS: Air Platform, Ground/Sea Vehicles, Electronics

ACQUISITION PROGRAM: Cross Platform Systems Development

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Establish approaches to vent and process toxic and flammable gases resulting from use of acetonitrile as an ultracapacitor electrolyte.

DESCRIPTION: We seek novel concepts able to (1) handle the erratic pressure venting of ultracapacitors and (2) inject vented gases into an existing combustion process. The resultant system should efficiently recover enough waste energy to meet its own power requirements without risking destructive corrosion of the combustion engine.

Preliminary testing has revealed erratic pressure venting in ultracapacitors. Large differentials between mild and high pressure relief inhibits efficient evacuation of gases and threatens the release of toxic, flammable and corrosive gases into habitable spaces. Injection of these gases into a combustion engine will recover lost energy and breakdown chemical toxicity.

Acetonitrile is commonly used – in combination with other solvents and salts – as the electrolyte in ultracapacitors. In some instances pressure has built rapidly resulting in a sudden release of carbon monoxide and hydrogen cyanide. A significant amount of residual acetonitrile could be flammable in certain conditions. While being highly toxic, the released gases are also highly flammable, containing energy that could be recovered. The resultant risks include the release of the hazardous gas into the surrounding environment, damage to the ultracapacitor, damage to the cost-effective vent system and energy loss.

PHASE I: Investigate processes to remove and harvest energy from the toxic and combustible gases associated with ultracapacitors, specifically those using acetonitrile solvent. The process should yield non-toxic byproducts. Perform an analysis on the efficiency of harvesting energy from the toxic gases emitted by ultracapacitors. The energy required to power the process to acquire the energy stored in the gas should not exceed the energy extracted from the gas.

PHASE II: Develop and evaluate the best approach from Phase I while considering retrofit capability into existing platforms.

PHASE III: Develop, test and demonstrate system for use on multiple Naval platforms.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Reducing the toxicity of ultracapacitors while simultaneously recycling hazardous waste as power has far-reaching applications in both military and commercial transportation. Ultracapacitors have the potential to replace modern automobile batteries, and this project is a step towards achieving that end. Additionally, the excess power retrieved could be used to power auxiliary systems such as emergency lighting or to provide backup resources in a crisis or when regular systems fail.

REFERENCES:
1. Electricity storage Ne plus ultra. Jan 31st 2008. Web site:
http://www.economist.com/science/displaystory.cfm?story_id=10601407 From The Economist print edition.

2. H. M. DeJarnette, C. S. Winchester, T. N. Tran, C. J. Govar, J. A. Banner. Preliminary Abuse Tolerance Assessment of Acetonitrile Based Super-Capacitors for Navy Power Applications. Systems and Materials for Power and Protection Branch, Code 6160.

KEYWORDS: Ultracapacitor, acetonitrile, battery, flammable gas, vent systems, venturi effect, waste fuel injection

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N08-213 TITLE: Affordable small diameter heading sensors

TECHNOLOGY AREAS: Sensors, Electronics

ACQUISITION PROGRAM: PEO IWS

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop an affordable, small diameter heading sensor for use in thin line towed array applications. Sensor dimensions should not exceed 0.5 inch in diameter and 5.0 inch in length (3.0 inch maximum length is preferred). Power consumption should not exceed 500 mW. The rms accuracy of magnetic heading should be 0.5 degrees or less for vertical to horizontal ratios of magnetic field strength up to 10:1. The sensor should support sample rates up to 20 hertz. An industry standard digital data interface is preferred.

Heading accuracy should be maintained through roll angles of 360 degrees and for pitch angles of +/- 5 degrees. Heading resolution should be at least 0.01 degrees. Sensors should have an operating pressure range of 0 to 1000 psia, a survival pressure of 2500 psia, an operating temperature range of -2 to +40 degrees C and a storage temperature range of -30 to +60 degrees C. Sensors will be expected to survive at least 7 years in isoparaffinic hydrocarbons. Roll measurement shall be provided and shall have accuracy better than 1.0 degrees rms.

DESCRIPTION: Acoustic Thin Line Towed array performance is dependent upon precise knowledge of the location of the acoustic sensors within the array. One technique used to estimate the shape of a line array is to instrument the line array with heading sensors. The performance of line arrays increases with length subject to environmental constraints. If the volume for stowing the array is fixed, the diameter of the line array must decrease as the length is increased to maintain the same volume. Current commercially available heading sensors that have the requisite resolution are too large for application in a small diameter line array. In addition, at approximately $25,000 each, the current heading sensors that meet the resolution and accuracy requirements are too expensive. Therefore an affordable small diameter heading sensor is needed for thin line towed array applications.

PHASE I: Conduct design studies and analysis to determine whether an innovative heading sensor approach can meet requirements.

PHASE II: Design, develop, build, and test a breadboard prototype sensor that could meet Navy requirements.

PHASE III: Develop, fabricate, and test prototype in Navy approved heading sensor calibration facility. Fabricate ADM sensors for installation into a thin line towed array that would be tested at a government approved facility to assess if the sensors meet system performance requirements

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Small diameter, low cost heading sensors would also have application in unmanned autonomous surface and undersea vehicles as well as autonomous Distributed Network Sensor programs.

REFERENCES:
1. Tutorial introduction and historical overview of the need for heading sensors in sonar applications Atkins, P.

2. IEE Colloquium on Heading Sensors for Sonar and Marine Applications, 12 Jan 1994.

KEYWORDS: sonar towed array, heading sensor, small diameter, affordable

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N08-214 TITLE: Develop a Electronics encapsulation or hardening that can survive 40 kG force accelerations and continue operations

TECHNOLOGY AREAS: Ground/Sea Vehicles, Materials/Processes, Sensors, Electronics, Weapons

ACQUISITION PROGRAM: PMS 405

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OBJECTIVE: Investigate cost effective alternative electronics hardening (such as for a Global Positioning System (GPS)) that can reliably survive high acceleration forces approaching 40 kG.

DESCRIPTION: New smart munitions designed for the electromagnetic or rocket assisted launch and general electronics are having difficulties developing electronics that can survive the high acceleration forces and explosive forces. A cost effective hardened GPS is needed for accurate targeting. The ability to reliability survive the launch forces is the critical need being addressed. Additionally if the electronics encapsulation or hardening technologies prove effective, then the same process could be used to harden Navy systems to improve survivability and reliability.

The selected solution will need to be manufactured and evaluated in conjunction with other constraints (power, time delay, G-forces, excessive range of temperatures, high velocity time phase compensation, and limited operating space) within smart munitions. The final solution will also need to be successfully integrated into a smart munitions guidance system.

PHASE I: Research and develop a electronics hardening solution that will survive a high acceleration event and provide the responsiveness as part of a real time embedded guidance and targeting system.

PHASE II: For phase two, the performer will need to develop and build a hardened prototype GPS component for lab based testing. Additional units for further reliability testing will need to be created to ensure production and design repeatability and affordability.

PHASE III: Finalize procedures for cost-effectively mass producing the hardened munitions GPS system and for investigating integration requirements into the munitions guidance system.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The Research and Development product can be used in the development and manufacturing of the GPS and any hardened electronics to increase product reliability across a wide range of electronics and sensors. The process will also enable improved reliability of safety and critical systems.

If the process works, the navy could implement component and system hardening across a wide range of ship board systems, eliminating or reducing the need for mechanical hardening of electronic systems which will save weight and increase reliability across a range of systems.

REFERENCES:
1. GPS Sensor design, http://assets.zarlink.com/AN/an4855.pdf

2. Precision Guided Weapons Aim for Increased War Impact, http://www.aciusa.org/randd/randd_mems.htm
Alternative location: Precision Guided Weapons Aim for Increased War Impact,
http://www.empf.org/empfasis/apr04/guided.htm

3. The Investigation of Basic Mechanisms of Radiation Effects on SemiConducter Devices,
http://stinet.dtic.mil/cgi-bin/GetTRDoc?AD=A076940&Location=U2&doc=GetTRDoc.pdf

4. Laser microprocessing for nanosatellite microthruster applications, http://www.riken.go.jp/lab-

5. www/library/publication/review/pdf/No_32/32_057.pdf

KEYWORDS: manufacturing; control electronics; power electronics; GPS; sensors

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N08-215 TITLE: High Temperature, High Stress GPS Antenna Window

TECHNOLOGY AREAS: Air Platform, Weapons

ACQUISITION PROGRAM: PEO IWS, Naval Surface Fire Support Program (IWS 3C)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop a low-cost, high-strength GPS antenna window assembly for a high acceleration (40kGee) and thermally stressed flight environment.

DESCRIPTION: Challenging aerothermal and high stress environments coupled with the necessity for stable dielectric properties creates a unique systems level challenge in the design and development of GPS antenna windows. The thermal environment in question can range in maximum temperature from 700 - 1100 K. The material will reach 80% of this maximum temperature from ambient conditions in seconds and remain above that temperature for as long as 6 minutes. This introduces not only a severe thermal shock issue, but also thermal soak. Launch environments will subject the flight mass to as much as 20 - 40 kG. The GPS system will have two bands of operation (1.227 Ghz and 1.575 GHz). Expected window size is approximately 1" x 1.5" and must be conformable to axisymetric bodies (such as munitions) and/or aerodynamic surfaces.

PHASE I: Develop or demonstrate the viability of a GPS antenna window material that is inexpensive to produce, launch survivable, thermally viable, and of relatively low density. Specifically, the material and assembly must survive launch accelerations of up to 40 kG in set back and 12.5 kG in both balloting and set forward at ambient conditions. It must also survive accelerations of up to 30 G at maximum temperature. The material and assembly must remain fully functional at temperatures of up to 1100 K, able to withstand thermal shock of 500 K/s, and maintain the GPS antenna temperature below 100 °C. The contractor shall fabricate samples and test material properties.

PHASE II: Fabricate GPS antenna window prototypes and demonstrate system level integration as well as gun-launch survivability via air- or chemical-gun launches. The contractor shall test instrumented prototypes to ensure thermal objectives have been successfully met.

PHASE III: The Navy is currently involved in multiple programs that involve hypersonic flight; transition programs will be identified in earlier phases to include Railgun, HyFly, or others. The contractor will provide integrated GPS antenna windows throughout a flight test series. Successful demonstrations will facilitate transition into a follow-on System Development & Demonstration Acquisition Program.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Low-cost, light-weight, high-strength and high-temperature components are always in demand by the aerospace and transportation industries.

REFERENCES:
1. http://www.darpa.mil/dso/thrusts/materials/index.htm

2. http://www.darpa.mil/dso/thrusts/materials/novelmat/nanocomp/index.htm

3. http://www.arl.army.mil/www/default.cfm?Action=29&Page=183

KEYWORDS: GPS, GPS antenna, antenna window, aerothermal, thermal protection, thermal shock, thermal soak

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N08-216 TITLE: Innovative Undersea Sensors Using Relaxor Piezoelectric Single Crystals

TECHNOLOGY AREAS: Materials/Processes, Sensors, Electronics

ACQUISITION PROGRAM: PEO IWS

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OBJECTIVE: Devise and fabricate innovative undersea sensors for Navy and civilian applications that exploit the extraordinary electromechanical properties of single crystal relaxor piezoelectrics, yielding devices with reduced size and/or increased sensitivity with enhanced bandwidth.

DESCRIPTION: Near the onset of 1997 came the discovery that single crystals of certain relaxor ferroelectric (lead magnesium niobate – lead titanate, and lead zinc niobate – lead titanate) materials exhibit extraordinary piezoelectric properties, namely, electromechanical coupling exceeding 90% (compared to 70-75 %, in state-of-the-art piezoceramics). Additionally, there is a 10 dB or more improvement in the material figures-of-merit for sensitivity and signal-to-noise relative to PZT-5H ceramics. These material properties allow for sensors with increased sensitivity and/or decreased size with dramatically enhanced bandwidths. Concerted efforts to grow these materials in a variety of forms, compositions and orientations now yield materials in quantities, and at a price, suitable for sensor applications. Three domestic manufacturing firms now supply these materials as well as several more overseas; initial devices have been developed and commercialized (References 3-6). This topic aims to exploit these enhanced electromechanical properties in practical sensing devices for towed and hull mounted arrays as well as distributed sensing applications. While this topic is open to a broad range of sensors, the proposed device should demonstrate the benefits, on a system level, of exploiting the unique properties of relaxor piezocrystals. In describing the application, which property of these crystals is being exploited and why the use of single crystal is essential to the success of the proposed application must be explicitly stated. A Navy application/system specialist endorsing the importance of the enhanced performance in the proposed device will be considered beneficial.

PHASE I: Design and show the feasibility of a practical sensor exploiting relaxor piezocrystals with a laboratory test. Demonstrate system impact of piezocrystal sensor by comparison to either a current Navy sensor or a comparably sized sensor constructed of piezoelectric ceramic.

PHASE II: Refine Phase I design and show the performance enhancements of the proposed device with brassboard prototypes in a field environment. Brassboard prototype should include appropriate preamplifier/signal conditioning hardware. A minimum of five identical prototypes should be built to demonstrate repeatability of the construction method and consistency of the device performance. Provide estimates of manufacturing costs in quantities appropriate to defense and civilian markets. In this cost analysis, assumptions regarding future reduction in piezocrystal material price may be made but must be justified/documented.

PHASE III: Demonstrate the cost-effective manufacturability of the targeted sensor device in quantities appropriate to defense and civilian markets.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Commercial applications for single crystal undersea sensors include oceanography, oil exploration, and fisheries. Non-commercial applications include harbor defense and maritime traffic monitoring.

REFERENCES:

1. S.-E Park and T.R. Shrout, “Ultrahigh Strain and Piezoelectric Behavior in Relaxor based Ferroelectric Single Crystals, “ J. Appl. Phys., 82[4], 1804-1881 (1997).

2. S.-E Park and T.R. Shrout, “Characteristics of Relaxor-Based Piezoelectric Single Crystals for Ultrasonic Transducers,” IEEE Trans. On Ultrasonic Ferro electrics and Frequency Control, Vol. 44, No. 5, 1140-1147 (1997).

3. J. M. Powers, M. B. Moffett, and F. Nussbaum, "Single Crystal Naval Transducer Development," Proceedings of the IEEE International Symposium on the Applications of Ferroelectrics, 351-354 (2000).

4. Jie Chen and Rajesh Panda, "Review: Commercialization of Piezoelectric Single Crystals for Medical Imaging Applications," Proceedings of the 2005 IEEE Ultrasonics Symposium, 235-240 (2005).

5. Mark B. Moffett, Harold C. Robinson, James M. Powers and P. David Baird, "Single-crystal lead magnesium niobate-lead titanate (PMN/PT) as a broadband high power transduction material," J. Acoust. Soc. Am., Vol. 121, 2591-2596 (2007).

6. J.C. Shipps and K. Deng, “A miniature vector sensor for line array applications,” Proc. OCEANS 2003, Vol. 5, 2367-2370 (2005).

KEYWORDS: Electromechanical Sensors; Vibration Control; sonar ; Piezoelectrics; Lead Magnesium Niobate – Lead Titanate; Lead Zinc Niobate–Lead Titanate

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N08-217 TITLE: Low Cost, Low Power, SAASM GPS Receiver with Up Finding Capability for Gun Launched Projectiles

TECHNOLOGY AREAS: Air Platform, Ground/Sea Vehicles, Electronics, Weapons

ACQUISITION PROGRAM: PEO-IWS, Naval Surface Fire Support Program (IWS 3C).

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OBJECTIVE: Develop an integrated SAASM GPS receiver with up-finding and up-link capability as required for future advanced guided projectiles and many other DOD systems. A very small form factor is required as well an unprecedented decrease in the power and cost to implement these functions. These combined technologies will be applicable to wide range of applications across the tri-services from hypersonic gun-launched projectiles to spin-stabilized existing munitions as well as UAV’s and handheld radios. The topic goals are a power consumption of less than 1 watt at a production cost of less than $1,000 (quantities of 10,000) with a shock hardness of up to 45,000 G’s of launch acceleration.

DESCRIPTION: The high cost of SAASM GPS receivers for Navy/Army gun launched projectiles, munitions, and other small form-factor applications, such as marines, dismounted soldiers and micro UAVs has discouraged its adoption on many of these DOD platforms. Furthermore, the size and power of many of the current SAASM products in the market still do not meet many DOD platforms' size, weight and power (SWAP) requirements.

The guidance and control of spinning projectiles/munitions relies on an accurate knowledge of the roll attitude and roll rate measurement which in the past has been obtained by gyros and/or magnetometers onboard. These traditional methods of measuring roll rate and roll attitude are expensive. There is a need to develop an innovative low cost and low power integrated SAASM receiver architecture that can provide the required roll attitude/roll rate measurements for spinning projectiles while meeting future SWAP requirements. The program goals for an integrated Up-Finding SAASM GPS receiver system are: size: 40 mm OD form factor (or less than 2 square inch area); power 1 watt or less; cost less than $1,000 in production, navigation accuracy better than 10 meters; roll attitude accuracy of better than 10 degrees; on a platform spinning up to 300 Hz; gun launched 45,000 g; time-to-first-fix (TTFF) less than 10 seconds for up to 1 second time uncertainty.

It is also desirable that the abovementioned SAASM GPS receiver systems have advanced resistance to jamming environments, GPS M-Code compatibility, and other future GPS modernization features. Products available today have, for long, been designed and implemented as an appliqué (RF-in, RF-out) to the SAASM GPS receiver and most of the past developments have focused on non-spinning platforms, such as helicopters and aircraft or spin-stabilized missiles.

PHASE I: Develop an integrated SAASM GPS receiver architecture with Up-Finding capability and analyze its feasibility to meet the program goals for spinning projectiles. Document the integrated system architecture and its predicted performance results.

PHASE II: Develop a high level system simulation of the entire integrated SAASM receiver system and demonstrate that critical program performance parameters, such as TTFF, and navigation & roll attitude estimation accuracy that can be achieved at high spin rates of 300 Hz. Identify the critical component and devices and qualify these components at 45,000 gs. Develop a detailed program plan to implement the integrated receiver system.

PHASE III: Develop and implement the integrated system architecture and the integrated SAASM receiver product in the selected form factor and demonstrate its critical system performance through laboratory and field testing.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Primary applications will be DOD based; precision weapons, unmanned platforms, and hand-held devices such as radios and targeting equipment. Various spin-off technologies could result from this development and be applied to commercial aerospace and transportation sectors.

REFERENCES:
1. http://www.acq.osd.mil/dsb/reports/2005-10-GPS_Report_Final.pdf

KEYWORDS: GPS receiver; SAASM; anti-jam; up-finding; low power; gun-launch; projectile; M-Code

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N08-218 TITLE: Compact, Lightweight Magnetic Sensor for Small Unmanned Undersea Vehicles (UUV)

TECHNOLOGY AREAS: Ground/Sea Vehicles, Sensors, Weapons

ACQUISITION PROGRAM: Pre-Planned Product Improvement (P3I) for the Search, Classify, Map (S-C-M)

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OBJECTIVE: To develop and demonstrate a magnetic sensor system to aid in clutter rejection when required in missions for which acoustic or optical imaging alone are not effective.

DESCRIPTION: Develop and demonstrate a magnetic sensor system to provide acoustic clutter rejection when required in missions for which acoustic and/or optical imaging is not effective. High clutter, object burial, and heavy marine growth characteristic of very shallow water environments render image-only results inadequate for proper target localization and classification. The required package will be lightweight, low power, and modular and will house a high performance magnetic sensor for efficient integration into the various versions of the U.S. Navy MK 18 MOD 1 Swordfish and Remote Environmental Measurement UnitS (REMUS)-100 in-service Unmanned Underwater Vehicles (UUVs.) The system will be designed to correctly confirm acoustic or optical mine classifications, including those with low magnetic signature, and reject acoustic clutter or poor optical imagery in low-visibility waters where the acoustic and optical sensors are not effective. Co-registration of characteristic magnetic signatures (or lack of a characteristic magnetic signature) with imagery collected at the same precise location will enable improved object classification. The system must be self-contained for autonomous sensor control and for the collection and storage of sensor and vehicle data. It must also house an embedded computer to operate government-furnished software for autonomous, instride target detection and classification using sensor and vehicle data as they are collected.

PHASE I: Develop and support the feasibility of a conceptual design of an innovative compact, low power magnetic sensor system that can be used in conjunction with acoustic sensors to improve the probabilities of detection, classification, and identification in harsh environments.

PHASE II: Conduct tradeoff studies to size the system and necessary interfaces to fit in USN Swordfish/REMUS-100 vehicles. Carry out design and validation testing to confirm that reliable, characteristic magnetic signatures can be obtained without interference from other UUV subsystems. Develop and test a prototype magnetic sensor system including proposed interfaces. For best transition to UUV application, the system should fit in a flooded space with power being provided by the UUV.

PHASE III: Integrate and test of the system into the USN in-service MK 18 MOD 1 Swordfish and/or other REMUS UUVs as part of the existing Pre-Planned Product Improvement (P3I) requirement for a SCM UUV System.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This technology would reduce the complexity of the system being deployed, decrease cost, and increase operational effectiveness and flexibility. This technology would have applications in the oil and gas industry for conducting surveys where multiple sensors are needed. For the same reasons, the technology would have many applications to homeland defense.

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1. The Navy UUV Master Plan. November 9, 2004; http://www.chinfo.navy.mil/navpalib/technology/uuvmp.pdf

2. OSD Unmanned Systems Roadmap 2007-2032; http://www.acq.osd.mil/uas/

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5. T. Clem et al., “Magnetic Sensors for Buried Minehunting from Small Unmanned Underwater Vehicles,” MTS/IEEE Oceans 2004, pp. 902-910, 2004.

KEYWORDS: UUV, sensors, magnetic, acoustic, compact, low power.

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N08-219 TITLE: Advanced Communications at Speed and Depth

TECHNOLOGY AREAS: Information Systems, Sensors, Electronics, Battlespace

ACQUISITION PROGRAM: PEO IWS and PMW770; ACAT IV

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OBJECTIVE: Develop a technology, which may be hardware, software, or a combination, that permits a submarine to transmit information to another platform or shore while operating at deep depths and moderate speeds, without a high risk of detection by acoustic sensors. It is also desirable that the technology allows the surface or shore site to communicate back to the submarine.

DESCRIPTION: Several communications at speed and depth programs are underway to capitalize on the submarine digital acoustic communications system being installed as part of APB-05 and later Advanced Program Builds for the AN/BQQ-10 sonar system. These include legacy acoustic systems and the Acoustic to RF Buoy program. However, when the submarine sends messages by putting acoustic energy in the water, with a well-defined character, that energy may be detected by other platforms, buoys, or off-board sensors using hydrophones, and could be recognized as acoustic communications, and could be associated with the presence of a submarine, which is undesirable. A system is needed that allows the submarine to communicate in such a way that the communication would not be recognized as such, and/or would not be associated with a submarine if detected. The system may be acoustic, electromagnetic, or may use other technologies. The medium may be exclusively through water, or through seawater and the bottom, or through seawater and air. The system should be organic; it should not require large expendables such as communications buoys. Communications coming from the submarine must be able to be received by the intended recipient at distances greater or much greater than 50 nautical miles. The minimum data rate is 100 bps. It is desirable, but not required, that the submarine be able to receive communications in the same manner as they are transmitted. Knowledge of existing and developing acoustic communications systems is not necessary, but briefing material about existing sonar systems may be provided on request.

PHASE I: Demonstrate a brassboard model of a system, or if software, demonstrate a computer model of a system that meets the goals.

PHASE II: Demonstrate in the ocean the developed technology with an engineering model.

PHASE III: Transition to production via PEO IWS and PMW770.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL USE APPLICATIONS: Depending on the method chosen, if software, there could be applications to active sonar or radio, and there could be implications to reducing the impact of active sonar on marine mammals. If a hardware solution, there would be other applications of the same technology in a number of Defense fields.

REFERENCES:

1. R. Istepanian, M. Slojasovic; "Underwater Acoustic Digital Signal Processing and Communication Systems," Springer Publishing, 2002.

2. Baggeroer, A. Acoustic Telemetry—An Overview, IEEE J. Oceanic Eng. 9, pp. 229-235, Oct. 1984.

3. Baggeroer, A.B., "Sonar Signal Processing," in Applications of Digital Signal Processing, edited by A. V. Oppenheim, Prentice-Hall, 1978, pp. 331-437.

4. Baggeroer, A.B. and Kuperman, W.A., "Matched Field Processing in Ocean Acoustics," in Acoustic Signal Processing for Ocean Exploration, edited by J.M.F. Moura and I.M.G. Loutrie, Kluwer Publishing, 1993.

KEYWORDS: Stealth communications; electro-magnetic communications; communications at speed and depth; submarine; communications

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N08-220 TITLE: Innovative Deployment & Stowage Technologies

TECHNOLOGY AREAS: Ground/Sea Vehicles, Materials/Processes

ACQUISITION PROGRAM: PMS 500, DDG 1000 Program, ACAT 1D

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OBJECTIVE: Develop an innovative, multi-degree of freedom system capable of deploying a weapon system, hailing/visual warning system or other device(s) from inside a ship’s hull or superstructure to an area external to the ship, through a relatively small opening in the hull of the ship.

DESCRIPTION: There is presently no technology approach that addresses the requirements of compactness, weight, precision, ease and speed of remote or automatic deployment for unmanned weapon and hailing/visual warning system(s) operations while preserving equipment alignment and stability in a constrained but dynamic ship environment.

This topic seeks innovative approaches to the development of a novel multi-degree of freedom system providing for minimum ship impact and rapid deployment of small caliber weapons and hailing/visual warning systems (acoustic hailer/spotlight), and potentially other systems from space-constrained locations internal to the ship. Per Ref (1), the device must be compatible with existing DDG1000 mooring station internal arrangements, and either be permanently mounted internally or allow for ease of assembly/disassembly and deployment by 2 sailors in under 30 minutes. An advanced goal would be for the system to go from stowed to fully deployed condition in less than 5 minutes. Concepts should address the ability to manually or automatically provide horizontal linear translation of the equipment 4 feet outside the ship's hull while accommodating equipment accuracy requirements. Deployment will be through a hull opening approximately 1 meter high by 2 meters in width and extension must be capable of supporting a roughly 500 lb. weight. To preserve equipment stability the compact and extended motion device should provide the ability to temporarily "interlock" with ship's structures. However, the system must be designed so as not to have any chance of damaging the ship's structures and particularly the outside hull surface.

Specific technical challenges include selecting a material system that is lightweight and durable and can operate in at-sea environments for extended periods without maintenance. Additional challenges will be the necessary technologies to permit controlled, automatic operation to the necessary degrees-of-freedom for motion sensitive equipment. All concepts will need to be eventually qualified for a Grade B shipboard shock and vibration requirements, should be compact so as not to interfere with mooring station operations, should minimize manual handling requirements, and should meet equipment accuracy requirements. For purposes of this effort, the MK49 Mod 0 ROSAM with MH2B .50 cal machine gun will be used for analysis and testing. Optimal solutions would meet all functions with few individual components in a compact system.

The pre-requisite information and requirements will be provided such that the Phase I and Phase II will be unclassified.

PHASE I: Demonstrate the feasibility of a concept that will meet the required performance over the range of specified parameters. Establish performance goals and metrics to analyze the feasibility of the proposed solution. Develop a test and evaluation plan that contains discrete milestones for product development for verifying performance and suitability. As applicable, provide a high level assessment of ship installation impacts.

PHASE II: Develop, demonstrate and fabricate a prototype as identified in Phase I. In a laboratory environment, demonstrate that the prototype meets the performance goals established in Phase I. Verify final prototype installation methodologies in a representative laboratory environment and provide results. Develop a cost benefit analysis and a Phase III testing and validation plan.

PHASE III: Working with the Navy and Industry as applicable, provide a production system which can be installed on a current or future U.S. Navy platform for an early determination of its operational effectiveness and suitability. Phase III transition potential will be based on system meeting physical space and timeline requirements, equipment stabilization and accuracy, cost effectiveness and availability while minimizing workload and ship structure impact.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The technology developed as a result of this topic would be applicable to hailing/visual warning systems as well as other shipboard deterrent systems used in commercial shipping and cruise lines to comply with International Maritime Organization (IMO) maritime security requirements.

REFERENCES:
1. "DDG 1000 Notional Mooring Station Representation" (see Drawing uploaded as PDF document to SITIS).

2. "MK 49 Gun Weapon System", available at http://www.gdatp.com/Products/PDFs/MK49.pdf

3. NAVY MIL-S-901D, Shock Tests, H.I. (High-Impact) Shipboard Machinery, Equipment, and Systems, Requirements For.

KEYWORDS: ATFP; ROSAM; Hailing System; Visual Warning System; Control Systems; weapon deployment

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~~N08-221 TITLE: Advanced ASW Signal Processing for Towed Vector Sensor Line Arrays (VSTA)~~

~~TECHNOLOGY AREAS: Information Systems, Sensors, Electronics~~

~~ACQUISITION PROGRAM: PEO IWS 5~~

~~The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.~~

~~OBJECTIVE: To develop innovative signal processing techniques for advanced acoustic vector sensors in towed line arrays for submarine ASW applications and improve sonar system performance at lower cost.~~

~~DESCRIPTION: Acoustic vector sensors (AVS) measure all three components of the acoustic particle motion as well as the pressure, at a single point in space. The Navy is currently developing advanced AVS arrays for a variety of passive sonar applications. (Conventional systems employ hydrophones that measure only pressure.) By making full use of the physical information available, systems built around these sensors have numerous advantages which considerably enhance its practical utility for Naval applications including:~~
- ~~improved location estimation with smaller arrays~~
- ~~reduction/elimination of left/right ambiguity in towed array processing~~
- ~~overall clutter reduction performance~~

~~In order to realize the fullest potential capability gains in future submarine VSTA ASW applications, two technology development areas are of particular interest:~~
1. ~~reduction of array flow noise coupling in the sensing of the acoustic particle velocity field~~
2. ~~advanced beamforming, detection processing, and tracking in highly cluttered littoral environments~~

~~Investigators may consider, but not be limited to, advanced flow modeling and near field velocity field analysis, sensor placements, isolation, and/or techniques such as Empirical Mode Decomposition (EMD) processing. Conventional linear, non-linear, and adaptive processing to improve left/right resolution of conical beams, as well as interferer cancellation are of interest.~~

~~Current efforts in flow noise rejection rely on standard processing techniques for averaging out the contaminating signal. Because of the particular nature of flow noise behavior and the response of the vector sensors, such techniques are not expected to improve performance to the desired levels at low frequency. For this study, the investigators will analyze two unique features of vector sensor towed arrays: (1) The scattered near-field within the array will be examined in fine detail to determine if there are specific features within the reactive field that discriminates the flow noise from the more distant sources of interest. Because the flow noise is in the near-field of the sensor, these signals may be distinguishable. (2) The impact of the hose mounting on the latest generation of vector sensors will be examined in fine detail. This will be supported by careful calibration studies of the individual sensors, the sensors mounted in the hose material, and the entire array of sensors. New mounting schemes or materials may then be proposed to reduce the observation of flow noise.~~

In addition, the current state-of-the-art in signal processing of vector sensor array data is adaptive MVDR with white noise constraints. Other, unconventional approaches have previously been suggested but remain untested on measured array data. Even with adaptive processing, little has been done to test the optimal configuration of array design (i.e., do all sensors need to be vector sensors, do all vector sensors need to measure all vector components, etc?). To address these issues, the investigators will test and compare the performance of various conventional and unconventional processing schemes with fully populated and sparsely populated vector sensor arrays. Such tests will include SNR enhancements, left/right ambiguity rejection, and ROC curve analysis.
The topics described above focus on passive use of vector sensor arrays. However, the investigators may also study the features of the vector field recorded from active systems. Such a study would entail a careful analysis of the active versus reactive fields, and other cross-component correlations, to search for characteristic features that will improve clutter rejection algorithms.

PHASE I: Define VSTA signal processing algorithmic, processing approach, and methodology.

PHASE II: Conduct proof of concept with analytical and/or simulated data that supports and enhances vector sensor developments based on phase I approach. Testing with sea test collected data provided.

PHASE III: Full prototype processing system for VSTA. Full integration with AN/BQQ-10(V) future system upgrades via the Advanced Processor Build (APB) Program.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The smaller footprint for acoustic sensors that could be realized by using vector sensor arrays has potential benefit to the both land based and off-shore oil and gas exploration and production industries. Acoustic well logging and cross-well seismic surveys can often resolve dynamic reservoir production processes much better than conventional surface seismic efforts, but sensor size down hole is always a consideration.

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2. Nehorai, A., and Paldi, E., 1994, "Acoustic Vector-Sensor Array Processing," IEEE Trans. on Signal Proc., Vol. 42, No. 9, 2481-2491.

3. Gabrielson, Gardner, D. L., and Garrett, S. L., 1995, A simple neutrally buoyant sensor for direct measurement of particle velocity and intensity in water, J. Acoust. Soc. of Am., Vol. 97, pp. 2227-2237

4. Cray, B. A., and Nuttall, A. H., 2001, "Directivity factors for linear arrays of velocity sensors," J. Acoust. Soc. Of Am., Vol. 110, pp. 324-331

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KEYWORDS: Acoustic Vector Sensor, Signal Processing

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N08-222 TITLE: MOUS Communication Optimization and Quick Planner

TECHNOLOGY AREAS: Information Systems

ACQUISITION PROGRAM: Mobile User Objective System (MUOS), an ACAT I program.

OBJECTIVE: Provide user-friendly applets that can be easily deployed on a PC, laptop or perhaps PDA, to assist communication planners or other MUOS operators. The first method will provide suggestions for optimal beam-carrier frequency assignments to maximize satellite bandwidth and throughput.

The second method provides a "quick planner" for fast analysis of capabilities with regards to assigning proposed communication system requirements on a specified apportionment (available bandwidth). The quick planner allows personnel to make "rough cuts" at communication plans without requiring access to SIPRNET, MUOS Communication Planning Management Stations and associated MUOS applications.

DESCRIPTION: Beam-Carrier Frequency Assignment Optimizer

One of a communication planners activities is to assign up to two (of 4 available) carrier frequencies to each of a satellite's 16 beams. In order to optimize the bandwidth/throughput of a MUOS satellite is it desirable to mitigate inter-beam interference caused by assigning same carrier frequencies to adjacent beams.

Manually creating optimal beam-carrier frequency assignments is a time consuming and error prone task. A simple tool, i.e. EXCEL application, can automate the analysis and provide the communication planner with suggested optimum (minimal adjacencies) beam-carrier frequency assignments.

In situations where it is not possible to avoid adjacent beam-carrier frequency assignments, the communication planner can indicate which beams are handling lower priority communication allowing for greater optimization of critical communication paths.

NOTE: The tool does not automate entering the assignments in the MUOS Network Management System. COCOM will still be responsible for entering that mapping once they have produced an acceptable plan.

Quick Planner -- Accessing live MUOS communication planning tools, often via remote SIPRNET connection, may not be always be practical (logistically) and requires the user to first gain access to, then execute the full MUOS Communication Planning tool set. It would more effective to allow planners to first create rough draft or run "what if" scenarios that might be 80% or 90% accurate from an applet installed on a laptop, PC or perhaps a PDA when there need quick answers regarding the feasibility of proposed communication system requirements.

R&D/Technical Risk -- Mobile User Objective System (MUOS), an ACAT I Department of Defense (DoD) Ultra High Frequency (UHF) satellite communications (SATCOM) system, is being developed to provide the warfighter with modern worldwide mobile communication services that addresses the next generation of UHF Beyond Line Of Sight (BLOS) communication needs for the U.S and their allies. MUOS adapts a commercial third generation (3G) Wideband Code Division Multiple Access (WCDMA) cellular phone architecture for use in a military UHF SATCOM system using geosynchronous satellites in place of cell towers. MUOS provides users with priority-based access to communication services supporting voice, data, or a mixture of voice and data. Both point-to-point and network services are supported. All point-to-point services and pre-defined network services may be quickly activated on demand by users in the field and then released just as easily, freeing resources for other users. Networks can also be maintained active 24/7 or set up and terminated on a schedule according to a communications plan. MUOS provides assured access to designated high priority communication services, with the ability to preempt lower priority services when necessary.

Efficient by design, WCDMA will help satisfy expanding DoD requirements for higher UHF capacity and availability. The WCDMA waveform spreads power across a 5-MHz bandwidth allowing higher total signal power levels to users than permitted by legacy narrowband systems. MUOS provides some inherent Low Probability of

Interception / Low Probability of Detection / Low Probability of Exploitation (LPI/LPD/LPE) because of the low power density of the WCDMA signals. A 16-beam receive/transmit Multi-beam Antenna (MBA) and Multiport Power Amplifier (MPA) on the satellite provides the uplink gain and downlink power to support small handheld terminals. Use of RAKE receivers within user terminals further helps close links to stressed users by combining the multi-path signals present in both urban and scintillation environments. WCDMA uses adaptive power control to minimize interference and maximize system capacity by providing each user with the minimum signal power required to maintain Quality of Service (QoS). Each beam of the MBA supports four 5-MHz WCDMA carriers providing a total of 64 WCDMA carriers available per MUOS satellite. The ground system supports 32 carriers per satellite.

The MUOS architecture uses the Universal Mobile Telecommunications System (UMTS) infrastructure to gain access to a broad range of full-duplex point-to-point voice and data communication services and a very efficient IP data transport capability. Because the warfighter uses predominantly netted communications, MUOS added group services to provide netted communications to groups of two or more users.

Remote access to the network planning and management function is available over the SIPRNET using a web-browser interface. Due to required access to SIPRNET and the complexity of the MUOS communication planning algorithms, analysis and assessments to proposed communication system requirements modifications can be time consuming.

This solution would provide a fast analysis (80-90% confidence level) for new and existing changes to proposed apportionments and communication system requirements with quick answers to the feasibility of “what if” scenarios.

The following Research and Development objectives are required:
1. Research and develop the communication planning algorithms for beam-carrier frequency assignments.
2. Analyze these algorithms along with the impact of communication system requirements against an apportionment (reservation of available bandwidth).
3. Select the preferred application infrastructure and toolset.
4. Develop the prototype GUIs.

Initial results should indicate some promising capability to provide MUOS communication planners with the tool(s) to be able to quickly and accurately create optimal beam-carrier frequency assignments that maximize available bandwidth of a MUOS satellite.

This solution would mitigate the technical risk of the current MUOS communication planning algorithms being time consuming (due to complexity) and requiring SIPRNET access to execute. This solution would be a portable stand-alone application providing the UHF communication planners at the G/RSSCs and COCOMs a quick analysis tool that would provide a good confidence level to various communication scenarios that would subsequently need to be transferred and implemented within MUOS. Additionally, the technical risk exists that this solution’s communication planning algorithms would be as complex and time consuming as the existing MUOS algorithms, and a fast analysis capability wouldn’t be possible, so this risk would need to be addressed; an 80-90% confidence in the proposed algorithms would be optimal to allow for quick results.

PHASE I: Tasks to be developed under this phase include:
- Communication planning algorithms describing how optimization of beam-carrier frequencies more effectively maximizes satellite bandwidth and throughput in a short time-frame (within a few minutes).
- Recommended methods to integrate these algorithms into an application infrastructure toolset.
- Provide prototype GUIs with a description of the types of processing to be performed and what information could be extracted that would be useful to increasing the fidelity of the MUOS NMS communication planning models.

Note: The tool will not automate entering the assignments in the MUOS Network Management System. COCOM and communication planners will still be responsible for entering data once an acceptable plan has been created.

PHASE II: This phase will focus on the development of a deployable product to include development of the beam-Carrier Frequency Assignment Optimizer Applet; development of the quick Planner Applet itself which is the engine driving the entire software module; development of the user, Operational & Maintenance Documentation in accordance with the software documentation procedures required by SPAWAR; and finally development of a support document for Windows XP, Unix/Linux, Solaris

PHASE III: This phase will focus on the integration of the optimizer developed in phases I and II into the MUOS platform to automate output of the applets into the MUOS communication Planning application.

PRIVATE SECTOR COMMERCIAL POTENTIAL DUAL-USE APPLICATIONS:
Potential application for use by other communication satellite deployments is a very real consideration as shown in the references provided below. The commercial sector faces many of the same problems addressed by the system optimizer and the software developed here will provide solutions to many of those problems.

REFERENCES:
1. Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6250.01A, "Satellite Communications", 10 December 2001.

2. Navy UHF Satellite Communication System Description, 5 March 2001.

3. Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3320.02B, "Joint Spectrum Interference Resolution (JSIR)", 12 September 2003.

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6. UHF SATCOM Planner's Handbook; UHF SATCOM Management Policy and Procedures, 27 October 2003.

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KEYWORDS: UHF Communication Planning, Beam-Carrier Frequency Assignment, Optimization

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N08-223 TITLE: Cooling technology for JTRS Ground Mobile Radio (GMR) Communications Systems

TECHNOLOGY AREAS: Information Systems, Ground/Sea Vehicles

ACQUISITION PROGRAM: Joint Tactical Radio System (JTRS) Ground Mobile Radio (GMR) - ACAT I

OBJECTIVE: Develop or tailor cooling technology that reduces size and weight, increases reliability of a GMR, and does not complicate the operation and maintenance in environments consistent with Army ground communications.

DESCRIPTION: While a Ground Mobile Radio (GMR) is a highly flexible communication system, its high processing capability consumes significant power resulting in heat that is dissipated using large heat sinks and fans for cooling. Given a novel cooling approach targeted to processing elements such as FPGAs, DSPs, and Microprocessors and RF/analog circuitry, it is possible to reduce size and weight. The lower internal temperatures would also increase GMR reliability. While there are many cooling approaches, it must support operational and maintenance in a Military tactical environment that include altitudes up to 15000 ft, operating temperatures -40 to +55 degrees C, storage temperatures of -55 to +71 degrees C, driving rain and dust storms, corrosive environments such as salt-sea atmospheres, and can withstand indirect shock. The system needs to be safe and promote easy of operation and maintenance in these environments by trained military personal.

The main component of GMR is a Joint Tactical Radio (JTR) which consists of a Ground Vehicular Adapter (GVA) and up to five Line Replaceable Units (LRUs). The GVA is the card cage to interconnect LRUs, providing backplane, backplane connectors, power supply and additional miscellaneous active circuitry consuming around 340 Watts. There are three main LRUs types that are plugged into the GVA, the Network Infosec Unit (NIU), the Universal Transceiver (UT), and a Power Amplifier (PA). Each LRU is enclosed to withstand an immersion in water requirement and has its own heat sink. The NIU consists primarily of digital circuitry with many high speed processing elements and draws approximately 110 Watts. The UT consists of both RF/Analog and digital circuitry with multiple high speed processing elements and consumes approximately 55 Watts. There are multiple PAs consisting of primarily RF/Analog circuitry with at least one processing element for control and consuming 490 Watts during transmit and 25 Watts during receive. The dimensions of the GVA, NIU, and UT/PA are 15.4”x13.4”x7.5”, 9.65”Lx5.265W”x7.00”H, 9.65”Lx2.43”Wx7.00”H, respectively. Currently the PAs (12”Lx5.9”Wx7.0”H) are much larger than the UT and can not fit within a GVA which is one of the technical challenges this SBIR considers; how to get the PA back into the GVA to reduce GMR size. The GVA sits on a mount that contains a fan. While a fan is acceptable, there are a number of concerns such as fan noise, maintainability, and reliability. The GVA mount has a very small area that could hold cooling technology, if needed. The mount currently contains a fan and has overall dimensions of 9.8”x12.0”x2.0”H where only a small area, approximately 10”Lx6”Wx1.2”H, can be used for fan and/or cooling technology. The intention would be to decrease the JTR weight including the cooling technology while maintaining the same envelope as the GVA on a GVA mount.

Another significant challenge is to maintain unit cost and achieve an increased reliability that will decrease overall fielding costs. Reducing life-cycle costs is very important to the GMR program.

PHASE I: Develop the proof-of-concept showing how the cooling system meets objectives stated above. Show any mechanical changes that would be required, footprint, reliability and thermal analysis, unit and life-cycle cost projections, maintenance procedures, and maturity of the technology along with address additional concerns from GMR team.

PHASE II: After obtaining more detail information of the GMR, provide a full size model of the operating cooling assembly. If possible, the model will be used directly in a GMR JTR. If not feasible, the model will contain simulated JTR components to show functionality. Detailed thermal and reliability predictions will be made. Documentation will be provided that supports predicted size, weight, power and unit cost of the cooling system. Its impact to the GMR will be addressed. Maintenance of the cooling system will be demonstrated with a proposed logistics approach. The developer will interface with the GMR team and provide resolution of integration concerns.

PHASE III: Work with GMR Prime and Subcontractors to insert technology into the program of record.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Cooling technologies continue to evolve for high process intensive systems. This technology is beneficial for computer and communication systems trying to reduce Size, Weight, or to increase reliability.

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KEYWORDS: cooling; thermal; heat; reduce size; weight; increase reliability; JTRS; Ground Mobile Radio (GMR)

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N08-224 TITLE: Universal Radio Frequency (RF) Communications Transceiver

TECHNOLOGY AREAS: Information Systems, Sensors

ACQUISITION PROGRAM: Joint Tactical Radio System (JTRS) Ground Mobile Radio (GMR) ACAT I

OBJECTIVE: Develop and demonstrate a prototype broadband Universal Transceiver (UT) for use with Software Defined Radios that substantially reduces the size and power consumption of a UT compared with conventional designs.. Use innovative components and techniques (e.g, high-performance semiconductors (SOS, GaAs, GaN), direct conversion, tunable filters, multi-core DSPs, etc.) to simplify the design, increase linearity and power efficiency, reduce manufacturing costs, and enable a more compact implementation. The focus of this task is an innovative radio frequency subassembly, which can be implemented with high-performance linear RF components and/or high-speed digital components. Interface functionality may be implemented using conventional technology.

DESCRIPTION: This Universal Transceiver device is a software-configured and digitally controlled radio frequency transmitter and receiver capable of operating over the spectrum of 2 MHz to at least 2 GHz with a variable simultaneous bandwidth of 5 kHz (narrowband voice) up to 30 MHz or more for spread spectrum applications. A radio frequency receiver includes functional blocks such as a low-noise amplifier, mixer, tunable oscillator, filtering, and A/D conversion. Transmitter functionality includes D/A conversion, tunable oscillator, mixer, and RF linear amplification up to a variable output level of -20 to 20 dBm (or greater range).

Conventional UTs face performance compromises in their RF components such as linearity, parasitic capacitance, and power consumption due to leakage currents. Manufacturing complexity of discrete RF assemblies leads to additional performance shortfalls, manufacturing defects, and reliability vulnerabilities. The application of more advanced semiconductor materials and a greater degree of integration is essential to meeting the combination of performance, reliability, and cost objectives.
Phase I will be a proof-of-concept design for the highest-risk aspect of this innovation. A complete prototype transceiver will be built in Phase II. Transition into a production-ready design will be the focus of Phase III.

PHASE I: Identify the highest risk segment of the proposed design. For example: A broadband direct conversion receiver; a high-linearity amplifier; or a a new integrated assembly. Design a prototype of this segment and demonstrate that it meets requirements through modeling and simulation or fabrication of an actual physical prototype. Compare results to those of a conventional baseline design to demonstrate the performance improvements of the new innovative design. Develop a plan to design a complete prototype transceiver in Phase II.

PHASE II: Design and fabricate a complete Universal Transceiver. The form-factor and interfaces provided need to be adequate for laboratory testing. Validate spectrum coverage, linearity, noise figure, sensitivity, power output, and other standard parameters that characterize universal transceiver performance. Identify the design changes required to produce a production-ready universal transceiver.

PHASE III: To transition into a complete product, package the UT into a stand-alone enclosure or a standard bus card (e.g., CompactPCI, VME) or sell complete product with required software for use as a test or development platform. Alternatively, the UT could be used as the basis for a complete radio system. To transition as a supplier, sell the newly developed component/assembly or design to a manufacturer that builds UTs or radio systems. A successful UT design could also be packaged to be a drop-in replacement for the UTs in the JTRS radios product lines.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Handheld SDRs available for commercial sale are becoming available (e.g., Thales Libertyâ„¢ radio). Multi-channel higher-end SDRs will be emerging over the next few years, and the UT being designed in this project is a critical subsystem for these radios. Consequently, there is likely to be a market for the product as a supplier to radio vendors â€“ both in the US and overseas.

There is also a market for SDR development hardware. Firms such as Spectrum Signal sell SDR development platforms but without actual radio frequency hardware. Rather, they package other vendorâ€™s products as accessories with their development platform. This SBIR vendor has an opportunity to leverage the marketing resources of a large company in selling this type of product.

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KEYWORDS: software defined radio; SDR; receiver; transceiver; RF; JTRS; SOS; GaAs

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N08-225 TITLE: Wideband Networking Waveform (WNW) Enhancement

TECHNOLOGY AREAS: Information Systems

ACQUISITION PROGRAM: Joint Tactical Radio System - Network Enterprise Domain - ACAT I

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop a set of more efficient and scalable protocols that improves the performance of Wideband Networking Waveform (WNW) that adapt to a highly mobile wireless tactical environment. The enhanced WNW shall be fully compatible with current WNW.

DESCRIPTION: The Wideband Networking Waveform (WNW) utilized by the Joint Tactical Radio System (JTRS) provides a tactical wireless internetworking capability for both users and backbone infrastructure. WNW uses an adaptive networking architecture that optimizes network routing performance and overall network stability for various tactical applications. WNW has a full set of networking features and is scalable to a large number of nodes with medium mobility and medium density network coverage areas. Good performance with large scalability is a significant challenge for WNW in a mobile ad-hoc tactical environment. Dynamic adaptation to maintain the waveform performance and continuation of the operation in a multi-channel and multi-data-rate SDR is also a challenge. The enhancement will be focusing on improving WNW protocols and algorithms in the areas of Link Adaptation algorithm, dynamic and distributed resource allocation, or mechanisms for improved packet delivery rates, to improve current WNW performance for large scale sparse and dense networks. One of the key ideas is that the new enhancements will enable dynamic adaptation to the changing physical channel conditions, dynamic spectrum allocation that are caused by operational events such as mission update and mobility, or provide augmentation to provide improved packet completion delivery rates. For example: traditional adaptive power control is a link layer protocol with the goal of minimizing the transmission power while maintaining the connectivity of a single link. In the new adaptive power control paradigm, the impacts of the transmission power adaptation are considered not only by the link layer design, but also by the MAC and MANET routing layers design. By changing a transmission power at a single node, it changes the interference level to neighborhood nodes and the local topology, and therefore, the channel scheduling and the routing path are altered. The enhancement shall provide an integrated adaptive power control solution in the link, MAC and routing layers to enhance the WNW performance.

PHASE I: Conduct design trade studies and perform a proof-of-concept demonstration (through either Simulation or Emulation) for a set of algorithms and protocols. The study shall identify performance criteria, any changes needed to the baseline JTRS WNW, and applicable test tools needed to implement the approach.

PHASE II: Develop and demonstrate a “reference implementation” on a SDR or some emulation and simulation test bed. Document as a stand-alone architecture and also as a change proposal package to the current JTRS WNW. Demonstrate the implementation in accordance with performance criteria developed in Phase I.

PHASE III: Transition the enhancement algorithms and protocols to applicable JTRS platforms and perform Development Tests. In addition, the software generated in this project is planned to be incorporated into the JTRS Enterprise Business model, which allows JTRS vendors to utilize common software.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: There is currently a significant market demand for an dynamic adaptive MANET technology in certain DoD/Government Agency, emergency services, Homeland Security applications. The product of this project will provide an enhancement that can be leveraged to current JTRS waveforms and future military applications. Homeland Security initiatives are driving municipal, county, state, and federal agencies to obtain an interoperable communications capability. Software Defined Radio and digital communications approaches are emerging as the next-generation solution to robust interoperability. The technology developed from this topic is directly applicable to these non-DOD interoperable communications applications.

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KEYWORDS: Joint Tactical Radio System (JTRS), Wideband Networking Waveform (WNW), Software Defined Radio (SDR), Mobile Ad Hoc Network (MANET), Link Power Adaptation, Dynamic distributed scheduling algorithm, dynamic spectrum allocation.

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N08-226 TITLE: Efficient Wideband Antenna for JTRS Ground Mobile Radio (GMR) Communications Systems

TECHNOLOGY AREAS: Information Systems, Sensors

ACQUISITION PROGRAM: Joint Tactical Radio System (JTRS) Ground Mobile Radio (GMR) ACAT I

OBJECTIVE: Utilize advanced technology and design concepts to develop a wideband antenna system capable of supporting wideband software-defined radio communication systems. The proposed design will enable multi-channel, multi-band, and wideband communication capabilities. A full-scale research and development effort in antenna performance, a revolutionary approach to antenna design, and the integration of antennas are required to increase the link budget and RF propagation.

DESCRIPTION: The objective is to develop and design an efficient, wideband antenna incorporating sate-of-the-art antenna technologies and operating in the 225 MHz to 2500 MHz frequency band. The required antenna will support Joint Tactical Radio System (JTRS) Ground Mobile Radio software-defined radio system. Computational and modeling efforts should address JTRS GMR antenna performance requirements. The primary requirements are as following:
a. Antennas shall have nominal input impedance of 50 Ohms and a VSWR 3.0 or less.
b. The antenna gain goal shall be a minimum of +3dBi gain at 225 MHz to +9dBi at 2500 Mhz.
c. The antenna shall be compatible with the standard 4-hole vehicular mount. CECOM Drawing A3207505 shall be used for the 4-hole dimensions and the dimensions of any physical container that may house antenna matching circuitry that will occupy the volume of the hole through the vehicle wall.
d. The antennas shall be capable of supporting 125 W PEP.
e. Use advanced design and packaging techniques to minimize height when mounted on a vehicle (Abrams/Bradley).
f. The antennas shall withstand the hazards of vehicle operation off improved roads, such as flexing, vibration, and striking overhead obstacles.
g. Antenna tips or other sharp rods shall have tip caps or other suitable design features (rounded to a minimum of 1.5" diameter) to minimize puncture hazards to eyes.
h. Antennas shall be provided with isolating protection (blocking capacitor or dielectric material) rated for a minimum of 10,000 volts RMS unless the proven that size and/or mounting precludes any contact with power lines.

PHASE I: Identify near-term and long-term innovative design approaches for development of an efficient wideband antenna from 225 MHz to 2500 MHz ranges. Demonstrate the feasibility of a wideband passive design by Modeling and Simulation analysis addressing the performance objectives described above. Provide validation of the Modeling and Simulation analysis by test of a physical model.

PHASE II: Validate the wideband antenna design through development, fabrication and test of a prototype that functionally meets the performance objectives and requirements. Provide electrical RF performance to include VSWR, gain, radiation patterns, and power handling. Demonstrate that the mechanical and physical design approach will be suitable for GMR applications. Make required changes to the design if required.

PHASE III: Validate the wideband antenna design through development, fabrication and test of a prototype that functionally meets the performance objectives and requirements. Provide electrical RF performance to include VSWR, gain, radiation patterns, and power handling. Demonstrate that the mechanical and physical design approach will be suitable for GMR applications. Make required changes to the design if required.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The development of an improved antenna technology can be incorporated into the existing radio communication systems that will increase their operating performance and will reduce the overall operating and support costs.

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KEYWORDS: antenna; gain; JTRS; wideband; Ground Mobile Radio (GMR)

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