NAVY
SBIR FY07.2 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, williajr@onr.navy.mil. For general inquiries or problems with electronic submission, contact the DoD Help Desk at 1-866-724-7457 (8AM to 5PM 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 website before **14 May 2007.** Beginning 14 May, 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	Email
N07-114 thru N07-126	Mrs. Janet McGovern	NAVAIR	janet.mcgovern@navy.mil
N07-127 thru N07-129	Mr. Nick Olah	NAVFAC	nick.olah@navy.mil
N07-130 thru N07-133	Ms. Janet Jaensch	NAVSEA	janet.l.jaensch@navy.mil
N07-134	Ms. Bree Hartlage	NAVSUP	bree.hartlage@navy.mil
N07-135 thru N07-158	Ms. Linda Whittington	SPAWAR	linda.whittington@navy.mil

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

PHASE I GUIDELINES

Follow the instructions in the DoD Program Solicitation at **www.dodsbir.net/solicitation** for program requirements and proposal submission. Cost estimates for travel to the sponsoring activity's facility for one day of meetings are recommended for all proposals and required for proposals submitted to MARCOR, 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 N07-114 thru N07-126 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, email 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 through the Navy SBIR website. 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 website cited in the invitation to get specific guidance before submitting the Phase II proposal**.

The Navy will invite, evaluate and select Phase II proposals using the evaluation criteria in section 4.3 of the DoD 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 through the Navy SBIR website 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 provided for protection of SBIR data rights under SBIR Phase III awards. A Phase III SBIR award is 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. 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. 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 website http://www.onr.navy.mil/sci_tech/ahd_usage.asp. This website 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 13 June 2007.

____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 N07-114 thru N07-126, 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.

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N07-149	Extended Frequency Range Wide Band RF Distribution System for Shipboard Systems
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Navy SBIR 07.2 Topic Descriptions

N07-114 TITLE: High Power, High Repetition Rate, Pulsed, Blue Laser for ASW Purposes

TECHNOLOGY AREAS: Air Platform, Sensors

ACQUISITION PROGRAM: PMA 264; Claymore Marine; ACAT 4

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: The objective of this SBIR is to develop a high power, high repetition rate, pulsed, blue laser for airborne Anti-Submarine Warfare (ASW) systems.

DESCRIPTION: The Navy needs a high power, high repetition rate, pulsed blue laser for airborne ASW systems that is rugged, compact, and light enough to be used in Naval aircraft. The current State Of the Art (SOA) which includes Optical Para-Metric Oscillators (OPOs), wave length doubling of TiSa based lasers, doubling and tripling of other laser hosts, and blue laser diodes, does not currently support the objectives needed for our purposes. While many commercially available lasers and near term developmental lasers meet a few of the required characteristics that we need there are none that meet all of them. Our system requires all of the design objectives in order to be effective. After consulting with DARPA, ONR, and NRL it has been determined that there are no lasers either commercially available or in near term development that can meet all of the objectives for this SBIR.

PHASE I: Define and develop a method a for producing a laser with the following characteristics and proposed a laser system design based on this method:

1. High repetition rate (>1000 hertz)
2. High power („d10W average = 10 milli joules per pulse)
3. Blue wavelength (Ideal wavelength is to match a Fraunhofer line in the blue (460 - 490 nano meters) but a laser with suitable power and repetition rate in that range would be acceptable)
4. Line width of < 0.1 nano meter
5. Wall plug efficiency of >5%.
6. Light weight. Total weight including the cooling system, power supply, and control system should be less then 100 pounds.
7. Small volume. Total volume for the cooling system, power supply, control system and laser head should be < 3 cubic feet.
8. Ability to be ruggedized and packaged to withstand the shock, vibration, pressure, temperature, humidity, electrical power conditions, etc. encountered in a system built for airborne use.
9. 1-20 nano second pulse width (FWHM)

PHASE II: Develop and build a breadboard laser based on results of Phase I. Demonstrate and fully characterize the system operation in the laboratory.

PHASE III: Build a ruggedized brass board system and obtain certification for flight on a NAVAIR R&D aircraft.

PRIVATE SECTOR COMMERCIAL POTENTIAL: High power, pulsed lasers have applications in manufacturing and lithography. Oceanographic bathymetry systems for survey and exploration work would benefit greatly from this laser.

REFERENCES: 1) Fundamentals of Photonics; B.E.A. Saleh; Wiley Interscience; 1991
2) Handbook of Lasers; Marvin Weber; CRC; 2001

KEYWORDS: Blue Laser; High Power; High Repetition Rate; ASW; Airborne

TPOC: (301)757-5735
2nd TPOC: (301)342-2034
3rd TPOC: (301)342-2022

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

N07-115 TITLE: Non-toxic process for depositing highly-dense, corrosion-resistant aluminum on complex geometry components

TECHNOLOGY AREAS: Air Platform, Materials/Processes, Electronics

ACQUISITION PROGRAM: PMA-271: E-6B Program, PMA-276: H-1 Program, PMA-275: V-22 Program

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 non-toxic process for depositing highly-dense, corrosion-resistant aluminum on complex geometry aircraft components.

DESCRIPTION: Highly dense aluminum and aluminum alloy coatings show better corrosion performance than cadmium for protection of high-strength steel, aluminum and other materials, especially in environments with SO2. The current process to deposit these coatings on complex components is based on toxic chemicals that preclude the implementation of the process at Fleet Readiness Centers or Original Equipment Manufacturers. Parts currently must be sent off-site to be processed. This complicates logistics and usually increases cost, inhibiting the breadth of applications where the coating could be used, such as landing gear, electrical connectors, and aluminum structural components. A non-toxic process that can deposit highly-dense aluminum and aluminum alloy coatings on these types of complex parts which historically have been coated with cadmium is needed. Aluminum coating will also need to be able to accept standard chromate and non-chromate conversion coatings, primers and topcoats.

PHASE I: Investigate potential processes and variables to deposit aluminum and aluminum alloy coatings. Identify potential environmental, safety and health issues of new process. Identify technical issues to be resolved to mature process.

PHASE II: Develop and validate technology on representative components. This includes scale up of process, completing environmental, safety and health (ESH) assessment, and completing technical performance assessment of coatings based on NAVAIR and OEM requirements as detailed in DoD Environmental Security Technology Certification Program (ESTCP) joint test protocol for cadmium alternatives. Report results, including technical performance, life-cycle cost impact, and limitations of technology.

PHASE III: Commercialize process and use on targeted applications.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The process could be applied to the commercial aviation community as well as any other user of cadmium or aluminum coatings.

REFERENCES: 1) TP for Validation of Alternatives to Low-Hydrogen Embrittlement Cadmium for High-Strength Steel Landing Gear and Component Applications
2) Phase I Test Report for Alternatives to Low-Hydrogen Embrittlement Cadmium for High-Strength Steel Landing Gear and Component Applications
3) MIL-DTL-83488D, Coating, Aluminum, High Purity
4) ASTM-B117, Salt Spray (Fog) Apparatus, Operating
5) ASTM- G85 Annex 4, Salt Spray (Fog) Testing, Modified
6) MIL-PRF-23377J(1), Primer Coatings: Epoxy, High Solids

7) MIL-PRF-85582, Primer Coatings: Epoxy, Waterborne
8) MIL-PRF-85285D(1), Coating: Polyurethane, Aircraft and Support Equipment
9) MIL-DTL-81706; 10- TT-P-2756, Chemical Conversion Materials for Coating Aluminum & Aluminum Alloys

KEYWORDS: aluminum; process; non-toxic; high-strength steel; electrical connectors; cadmium alternative

TPOC: (301)342-9372
2nd TPOC: (301)342-8864

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

N07-116 TITLE: Automated Tool for Reporting Aircraft Damage and Queuing and Screening Repair

TECHNOLOGY AREAS: Air Platform, Information Systems, Materials/Processes

ACQUISITION PROGRAM: JSF JPO/PEO, Joint Strike Fighter

OBJECTIVE: Develop an automated repair processing system that combines a method of digitally describing damage on composite components with a system that evaluates repairability options for a given damage set and provides repair time estimates. In addition, this work should provide a system that informs maintainers when they will not be allowed to repair a component, and automatically generates a request for engineering disposition that can be sent to the appropriate engineering authority.

DESCRIPTION: The extensive use of advanced composite materials on fixed and rotary wing aircraft has dramatically affected the methods and processes used for aircraft structural repair. In contrast to historical methods that focused on sheet metal and fasteners, modern aircraft damage is repaired with complex, tailored patches that often require analysis and engineering support that does not exist in deployed field activities. Unfortunately, as analysis and design methods have improved over the last decade, the methods used for repair development have not been updated, leaving a technology gap that reduces the applicability of current methods for future platforms.

One key component to next generation aviation repair will be the intelligent processing of work flow within the repair activities detailed to each operational unit. Methods currently in use all require man-in-the-loop decision making, and often require reference to established repair methods and limits in digitized media. Unfortunately, with limited workspace shipboard and limited trained personnel, this practice is easily overwhelmed by high damage events (e.g. hailstorms) or high operational tempo.

PHASE I: Demonstrate proof-of-concept of proposed system to digitize the location (outline and distance from reference points) of damage on a large surface with complex contours and to provide the digitized damage location in a standard data format. Demonstrate the ability to evaluate whether the damage described exceeds allowable damage limit sizes for a given region in the component.

PHASE II: Further develop the damage digitization system so that it is integratable into a compact form and compatible with either existing maintenance computer systems or a new palmtop computer. Develop a central decision making point capable of obtaining input from several damage input sources, prioritizing damage based on several key logistical and operational parameters, and providing this output list to a work center. Integrate dedicated logistics tools that provide asset management capability by accounting for limited shop space, limits of available repair materials, time consumed in repairs, and available spare components.

PHASE III: Integrate new technology with a given platform's (e.g. F-35) electronic manual and technical data. Develop addition required support equipment to fully utilize the system, and validate this support equipment for shipboard use (e.g. explosion proof and EME/I requirements).

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Primary candidate would be airline customers with centrally located engineering and distributed repair capability.

KEYWORDS: Composite; Repair; Deployed Logistics; Repair Planning; Damage Digitization; Queueing

TPOC: (301)995-7561
2nd TPOC: (301)342-9348

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

N07-117 TITLE: Robust, Non-Toxic, Corrosion Inhibitor System

TECHNOLOGY AREAS: Air Platform, Materials/Processes, Weapons

ACQUISITION PROGRAM: PEO(A); PEO(JSF) - ACAT I

OBJECTIVE: Develop a non-toxic corrosion-inhibiting package that protects as well as, or is superior to, chromates and is versatile enough to be used in multiple corrosion prevention and control techologies, e.g., metal pretreatments, primers, corrosion preventive compounds, etc.

DESCRIPTION: Current corrosion-inhibiting materials, such as conversion coatings and primers that utilize non-chromated corrosion inhibitors, in many cases have sacrificed technical performance in order to comply with the new regulations. Materials such as phosphates, molybdates, rare earth metals, and some organic compounds individually provide some level of corrosion inhibition, but one-for-one substitution for chromates has not resulted in equivalent corrosion prevention capabilities. Synergistic effects from combinations of some inhibitors have exhibited nearly equivalent performance to chromates, but none have yet to match or exceed them. It is imperative that any novel materials must not only meet new environmental rules, but also perform as well as, or superior to, the benchmark chromated inhibitors.

PHASE I: Demonstrate proof-of-concept of proposed corrosion inhibitors, including toxicity assessments of candidate materials. Research corrosion inhibition mechanisms of these novel materials. Define a set of data requirements for inhibitor development, analyze toxicity data to determine which materials will be investigated further in Phase II, and deliver a report proposing a long-term development plan for the new inhibitor packages and procedure for performance verification.

PHASE II: Continue mechanistic studies. Demonstrate the performance of candidate systems and pursue the possibilities of synergistic combinations of materials. Investigate the breadth of corrosion protection (i.e., general surface corrosion, filiform corrosion, galvanic corrosion, etc.). Develop new optimized inhibitor package and perform compatibility studies with existing application technologies (coatings, pretreatments, etc.). Provide an optimized non-toxic corrosion inhibiting package with documentation as to its potential usage and chemical/physical properties.

PHASE III: Transition the package developed in Phase II to a commercial supplier to incorporate into a pretreatment, primer, corrosion preventive compound, etc. These materials will be further evaluated by NAVAIR in future demonstration/validation programs to assess performance in the operational environments.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This non-toxic corrosion-inhibiting package will be used to develop materials for corrosion prevention and control. Though mostly designed for aircraft and support equipment, other military services should be able to protect their assests with these materials. Also, commercial aviation will benefit for the same reasons as NAVAIR.

REFERENCES: 1) G. S. Frankel and R. L. McCreery, "Inhibition of Al Alloy Corrosion by Chromates", Interface, Winter, 34 (2002)
2) Joint Test Report for Nonchromate Primers for Aircraft Exteriors dated 24 February 1998, Project Number J-95-OC-002, developed under the Joint Group for Pollution Prevention (www.jgpp.com)

KEYWORDS: Corrosion; Inhibition; Environmentally Friendly; Non-Toxic; Chromates; Performance

TPOC: (301)342-8049
2nd TPOC: (301)342-8050

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

N07-118 TITLE: Rapid and Conformable Field Repair and Nondestructive Evaluation of Rotor Blade Skins and Honeycomb in Blade Afterbody

TECHNOLOGY AREAS: Air Platform, Materials/Processes, Battlespace

ACQUISITION PROGRAM: PMA-275, V-22 Program; PMA-276, USMC Light/Attack Helicopter Program

OBJECTIVE: Develop a field-portable device that can detect skin to core disbonds on rotor blades and other areas of skin and honeycomb construction.

DESCRIPTION: Detection of honeycomb to skin disbonds, especially in rotor blades, has been largely limited to a very slow and insensitive technique known as tap testing. All the traditional nondestructive test methods are less sensitive to skin-core disbonds than to skin delaminations. Both tap testing and ultrasonic testing do not respond well when the adhesive from the core is left on the inside of the skin as the core pulls away from the skin, especially if the core is a thin nonmetallic. A field portable and rapid wide area inspection method for evaluating the skin to core bond is needed for the Fleet Readiness Centers (FRCs).

PHASE I: Utilizing composite samples with representative in-service skin to core bond defects, design and fabricate a breadboard instrument for operational (field) level use to rapidly detect skin to core disbonds in composite materials fabricated from composite skin and nonmetallic and metallic core and demonstrate the capability to detect the representative defects.

PHASE II: Develop a prototype system with a refined user interface. The prototype should be portable, light, and capable of being operated by personnel that are not certified NDI Technicians.

PHASE III: Implement full-scale production of the Nondestructive Evaluation (NDE) devices in quantities proportional to market and Navy demand. Desired unit cost is less than $10,000.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Successful development of a cost-effect, ultra-portable NDE device is of interest to commercial and military aircraft industries.

REFERENCES: 1) In-Service NDI of Aging Helicopters Main Rotor Blades used in Polish Armed Forces
http://www.agingaircraftconference.org/all_files/40/40a/40a-ppt.pdf

KEYWORDS: Composite; Repair; Inspection; Nondestructive; Blade; Honeycomb

TPOC: (301)342-8020
2nd TPOC: (301)342-3761

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

N07-119 TITLE: Portable Surface Bondability Detector

TECHNOLOGY AREAS: Materials/Processes

ACQUISITION PROGRAM: PMA-275, V-22 Program; PMA-276, USMC Light/Attack Helicopter Program

OBJECTIVE: Develop an innovative field-portable device that can detect any contamination on the surface of a composite material so the surface can be certified to be contamination-free prior to commencement of the repair process.

DESCRIPTION: The strength of bonded repairs is highly dependent on the cleanliness of the surface to which the repair is applied. To date, post-repair inspections have been unable to quantify the strength of the bondline. To mitigate the risk of creating a poorly bonded repair, a new innovative inspection device is sought that can measure the degree of contamination of the repair surface prior to applying the repair.

PHASE I: Utilizing composite samples with representative in-service defects, design and fabricate a breadboard instrument for operational (field) level use to rapidly detect thermal and/or mechanical damage and demonstrate the capability to detect the representative defects.

PHASE II: Develop a prototype system with a refined user interface. The prototype should be portable, light, and capable of being operated by personnel that are not certified Nondestructive Inspection (NDI) technicians.

PHASE III: Implement full-scale production of the Nondestructive Evaluation (NDE) devices in quantities proportional to market and Navy demand. Desired unit cost is less than $10,000.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Successful development of a cost-effect, ultra-portable NDE device is of interest to commercial and military industries. Adhesive bonding is used in many industries, applications could include commercial aircraft, automotive, sporting goods, and many others.

REFERENCES: 1) The Effects of Surface Prepartion on Long-Term Durability of Adhesive Bonds
http://aar400.tc.faa.gov/aar-430/reports/01-8.pdf
2) Adhesive Bond Surface Prep Qualifications Considerations
http://www.niar.wichita.edu/faa/FAAAB/Thursday%20Afternoon/Material%20&%20Process%20Qualification%20and%20Control/FAA%20Bonding%20Workshop_Mazza.pdf

KEYWORDS: Composite; Repair; Contaminants; Inspection; Nondestructive; Bonding

TPOC: (301)342-8020
2nd TPOC: (301)342-3761

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

N07-120 TITLE: Extremely Low Frequency (ELF) for Anti-Submarine Warfare (ASW)

TECHNOLOGY AREAS: Sensors

ACQUISITION PROGRAM: PMA-264, PMA-290, PMA-299

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: Provide innovative concepts leading to the development of an inexpensive A-size (*) sonobuoy that is capable of detecting and processing Extremely Low Frequency (ELF) magnetic field signals in both deep and shallow water regions.

DESCRIPTION: A sonobuoy that could detect the ELF (0.5 to 30 Hz.) emissions from a submarine would be an appealing complement to the U.S. Navy's acoustic detection capability. This concept is unique in that it is the first time that an effort has been made to provide this magnetic capability in a free floating sonobuoy. These emissions arise from the modulation of the corrosion currents of the submarine, and they are expected to be of substantial value in poorly maintained platforms. This band of frequencies is of interest because at these higher magnetic detection frequencies, the usual electromagnetic noise sources (geology, geomagnetic, motion and wave) should be much less of an issue than in the traditional magnetic anomaly detection (MAD) frequency band. The sensor should be able to detect ELF signals independently, and the cost should be within the cost envelope of the expendable acoustic sensors in use today. The sensor/processing package must be compatible with that of an A-sized sonobuoy and employ the same data link. A major challenge in this effort will be the ocean engineering. Innovative design concepts are sought to develop a free-floating magnetic sensor that provides isolation from ocean induced motion noise. Other technical challenges include the choice of sensing element, sensor orientation, electrical power and size.

PHASE I: Determine the feasibility of developing an optimal magnetic field sensor for this application. Categorize and quantify the various noise sources that the free-floating magnetic field sensor will experience. Conduct operational analyses to predict the performance of these sensors against various target strength levels in the presence of the various noises.

PHASE II: Develop the critical technologies identified in Phase I. Fabricate, test, and evaluate an over the side stand-alone prototype of the system. Demonstrate that the prototype system meets performance requirements in a laboratory environment.

PHASE III: Optimize the system design based upon the test and evaluation results of Phase II. Fabricate A-size prototype units and conduct at-sea tests with operational commands. Integrate the system into the air platform's missions and ensure compatibility with avionics and platforms.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Variants of the system could be used in oil, gas, and mineral exploration fields to measure magnetic signals that characterize these fields taking into consideration the various geomagnetic and geologic background noises.

REFERENCES: 1) M. B. Kraichman, "Handbook of Electromagnetic Propagation in Conducting Media," Second Printing, U.S. Government Printing Office, Stock No. 008-040-00074-5 (1976).
2) E. C. Field, "High-Latitude Geomagnetic and Atmospheric Noise in the 0.001 to 100Hz Frequency Band," Pacific Sierra Research Report No. 2158 (1991).
3) R. J. Dinger and J. A. Goldstein, "Spatial Coherence Measurements and Evaluation of a Noise Reduction Technique for Ambient Noise from 0.3 to 40Hz," NRL report No. 8430 (October 1980).
4) K. A. Poehls, M. J. Shearer, R. F. Sinclair, D. M. Crandall, and C. I. McNeil, "ELF Noise and Signal Detection," Pacific Sierra Research Corporation, Report No. 2544 (March 1995).

(*) A-size refers to the standard U.S. Navy Sonobouy form factor. A-size dimensions are 4.875" D x 36" L

KEYWORDS: ELF Signals; Geomagnetic Noise; Geologic Noise; Shallow Water; ASW; Underwater Sensors

TPOC: (301)342-2535
2nd TPOC: (301)342-2048

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

N07-121 TITLE: Ultra Low Frequency (ULF) Sonobuoy

TECHNOLOGY AREAS: Sensors

ACQUISITION PROGRAM: PMA-264, PMA-290, PMA-299

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: Provide innovative concepts leading to the development of an air deployed in-water acoustic sensor capable of Ultra Low Frequency (ULF) performance in the ocean environment.

DESCRIPTION: The ULF frequency band is largely unexplored in the world of tactical underwater acoustics. This is an attractive acoustic band for passive detection because of the nature of the ocean ambient noise in this band and because at these frequencies, propagation is good and target signals are likely to be impossible to mask or suppress. The ULF ambient noise in the open ocean is attributed to microseisms at frequencies down to approximately 0.1 Hz. Infragravity waves have been identified as the source of pressure fluctuations at frequencies below 0.02 Hz. There are several published spectra that show a noise minimum between 0.02 Hz and 0.1 Hz. This frequency regime may be of interest for the measurement and exploitation of ULF signals, if any exist. For an air deployed sensor to operate in this frequency band an innovative approach to suppressing motion and flow induced noise will be required. For a concept to be of interest to the Navy as an air-deployed expendable sensor the components must be compact and affordable. The sensor will be expected to perform in the operating environment specified for the Navy's production sonobuoy sensors, up to sea state 5 and with current flow past the sensor on the order of 0.2 knot and 8 hour life. Such a sensor could be a pressure sensor, particle velocity sensor, pressure gradient sensor or any combination of these. The acoustic frequency band limits for the sensor will be determined as part of this investigation.

PHASE I: Determine the feasibility of developing suspension and sensor designs for ULF acoustic sensing. Conduct design and development and identify critical components required to fabricate laboratory models and measure appropriate parameters to assess the performance of various design alternatives in the ocean. Devise a means to discriminate self-noise from ambient noise.

PHASE II: Using the results from Phase I, develop an A-size (*) over-the-side model and demonstrate that the sensor meets performance requirements in a laboratory environment. Demonstrate the discrimination of self-noise vs. ambient noise.

PHASE III: Optimize the design based on the test and evaluation results of Phase II. Fabricate A-size prototype units and conduct at sea testing with operational commands and in collaboration with oceanographic research experiments.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Since many of the ambient noise phenomena are generated by distant seismic or meteorological conditions, these sensors have the potential to be rapidly deployable environment sensors for weather applications and potentially may be used in nuclear non proliferation measurement programs.

REFERENCES: 1) McCreery, C.D.; "Long term Ambient Ocean Noise, 0.05 – 30 Hz, from the Wake Island Hydrophone Array"; Ph.D. Dissertation University of Hawaii, May 1992.
2) Babcock, Jeffrey M., Kirkendall, Barry A., Orcutt, John A.; "Relationships Between Ocean Bottom Noise and the Environment" University of California San Diego, Scripps Institute of Oceanography, 27 Jun 1995.

(*) A-size refers to the standard U.S. Navy Sonobouy form factor. A-size dimensions are 4.875" D x 36" L

KEYWORDS: ULF Acoustics; Microseisms; ASW; Underwater Sensors; Hydromechanics

TPOC: (301)342-2048
2nd TPOC: (301)757-2063

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

N07-122 TITLE: Method and Device for In-Service Repair of Magnesium, Aluminum and High-Strength Steel

TECHNOLOGY AREAS: Air Platform, Materials/Processes

ACQUISITION PROGRAM: PMA-271: E-6B Program, PMA-276: H-1 Program, PMA-275: V-22 Program

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OBJECTIVE: Develop portable process to repair magnesium, aluminum, and high-strength steel base alloy and typical metallic protective coating like cadmium or aluminum.

DESCRIPTION: Magnesium, aluminum and high-strength steel components damaged in the field must be removed from the aircraft to complete typical repairs. In addition, protective coatings on these components, especially sacrificial coatings, have no viable, on-aircraft repair processes. Novel methods or devices to repair base alloys or protective coatings are needed to repair components in the field.

Critical to success will be the demonstration of the feasibility of the process including portability, ease of use, and technical performance. Technical performance includes repairing substrate to achieve base substrate and protective material properties like adhesion and corrosion as close to original as possible.

PHASE I: Investigate new processes or protection schemes with a focus on portability, ease of use, cost and technical performance. Effort may focus on one metal or all three, if applicable. Demonstrate portability, ability to repair or fill defect back to original dimension, ability to match base material properties, ability to match original protection properties.

PHASE II: Develop and validate technology on representative components. Report results, including technical performance, cost, and life-cycle cost impact.

PHASE III: Apply technology to specific aircraft repair problems. Complete implementation packages and other logistics so technology can be used by the fleet.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Process could be used on commercial aircraft and any other application where magnesium, aluminum or steel components need to be repaired in the field.

REFERENCES: 1) JTP for Validation of Alternatives to Low-Hydrogen Embrittlement Cadmium for High-Strength Steel Landing Gear and Component Applications (www.jgpp.com)
2) Phase I Test Report for Alternatives to Low-Hydrogen Embrittlement Cadmium for High-Strength Steel Landing Gear and Component Applications (www.jgpp.com)
3) MMPDS-02 (MIL Handbook 5); 4- AMS QQ-P-416; 5- ASTM B-117; 6- ASTM G-85 Annex 4; 7- MIL-C-83488

KEYWORDS: Magnesium; Aluminum; High-Strength Steel; Repair; Field; Portable

TPOC: (301)342-9372
2nd TPOC: (301)342-8864

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

N07-123 TITLE: Environmentally Friendly Removal of Fluid Contamination from Composite Aircraft Structure

TECHNOLOGY AREAS: Air Platform, Materials/Processes

ACQUISITION PROGRAM: JPO/PEO(JSF), Joint Strike Fighter

OBJECTIVE: Develop a cleaning solvent that is capable of removing hydraulic fluid from composite components. The cleaner must be environmentally friendly so that it may be used in an unregulated manner, and it must be non-hazardous so that it can be used in the shop. It still must be able to remove the hydraulic fluid from a composite panel that has been saturated with hydraulic fluid, and do so with the efficacy of an organic solvent.

DESCRIPTION: Over the past two decades, military aviation has seen a dramatic shift in the design of aircraft structures. The introduction and deployment of composite materials have provided new design challenges and possibilities for tactical aircraft, patrol aircraft, and rotary wing vehicles. Unfortunately, the use of these materials has led to unforeseen consequences in the support community. For many repair scenarios today, a cost and readiness driver is the absorbtion of fluids into composite structure. Hydraulic fluid is certainly the most widespread contaminant today, and its removal is a costly and time consuming process.

Currently, the process for the removal of hydraulic fluid involves the use of methyl-isobutylketone (MIBK) and a heated drying cycle. The MIBK is used because it is not environmentally hazardous, and does not pose a threat to the repair personnel. Unfortunately, MIBK is ineffective in the removal of hydraulic fluid. Consequently, after several unsuccessful attempts to remove the contamination, the part will be sent to a separate facility, where n-Hexane will be used in a controlled environment to remove the contamination.

These additional processing steps can take days or weeks to accomplish, and the additional time reduces the overally readiness of the component. Furthermore, when hydraulic fluid contamination is observed while an aircraft is deployed, there is little that can be done other than sending the component back to a depot for maintenance.

In the past, NAVAIR's Aging Aircraft IPT has provided resources to NAVAIR's Repair Fleet Focus Team to evaluate Commercial Off-The-Shelf (COTS) materials that could provide environmental and personnel safety while improving the efficacy of hydraulic fluid decontamination. Many materials commercially available met those criteria, but were also deleterious to the performance of the composite materials.

To address this growing problem for today's fleet and tomorrow's emerging aircraft, it is necessary to develop an environmentally friendly, non-hazardous solvent that provides decontamination efficacy similary to that of n-Hexane, but has no negative impact on the mechanical, thermal or durabilty properties of the composite structure.

PHASE I: Demonstrate feasibility of proposed solvent or blend of solvents to be as effective as n-Hexane at removing hydraulic fluid from composites while not introducing environmentally or physically harmful constituents and evaluate the effect of exposure to this solvent or blend of solvents on the composite laminates mechanical properties.

PHASE II: Develop prototype cleaner material and validate decontaminant performance on representatively contaminated structure, complete standard composite property fluid exposure matrices to test for effects of the cleaner on composites. Evaluate production scale up of cleaner material.

PHASE III: Verify that cleaner does not degrade structural performance of the composite material. Verify that it is usable in large scale cleaning operations in a shop environment and validate production scale up of material.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: All structural composite applications (aircraft, rotorcraft, ground vehicles and ships) that have hydraulic fluid contamination concerns

REFERENCES: 1) NTSB Report detailing fluid contamination; www.ntsb.gov/Recs/letters/2006/A06_27_28.pdf.
2) Abaris Training; http://www.netcomposites.com/education.asp?sequence=69.

KEYWORDS: Cleaner; Composite; Repair; Fluid Contamination; Solvent; Environmental

TPOC: (301)995-7561
2nd TPOC: (301)342-8054

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

N07-124 TITLE: Isolation of Composite Repairs in Austere Environments

TECHNOLOGY AREAS: Air Platform, Materials/Processes

ACQUISITION PROGRAM: JPO/PEO(JSF), Joint Strike Fighter

OBJECTIVE: Develop a lightweight, portable and low cost technology that enables field level maintainers to keep repair areas free of debris and contamination present in austere environments (e.g. blowing sand, leaves, snow).

DESCRIPTION: The use of composite materials on aircraft structure has introduced significant complexity in the repair and maintenance of military aircraft. Of particular importance is the ability of field level maintainers to perform complicated repairs in austere environments. In many cases, high winds and loose debris (e.g. dirt, sand, leaves) contaminate the repair surface during the critical steps leading up to, and including, material application and cure.

Previous attempts to use commercial, off the shelf (COTS) environnmental containment systems have not been successful, and would only have addressed the blowing debris environment. To be functional, the system should allow the user to establish a barrier that prevents blowing debris from contaminating the repair area without restricting the maintainer's ability to effect the repair.

To this end, the maintainer must be able to set up and take down the system quickly and easily, and the system must remain fixed on the desired part of the aircraft (may be upside down). In addition, the system should be compact when stored, and should be light weight to allow it to be very portable. Finally, it should be possible for the maintainer to manipulate the repair while the system is deployed, and for the maintainer to pass repair materials through the boundary while executing the repair.

While the initial work should focus on the blowing debris environment, consideration should be made for future expansion into other austere environments (e.g. cold, rain and sea spray).

PHASE I: Demonstrate feasibility of proposed environmental boundary system to allow a maintainer to perform a repair on aircraft, but prevent blowing debris from contaminating the repair surface. Weight and stored size of the proposed environmental boundary system should be minimized.

PHASE II: Develop prototype a prototype system with the addition of environmental considerations, reduction in weight and size of the system, optimization of the operational system size for consideration of actual fielded repair use. Demonstrate production readiness evaluation.

PHASE III: Deliver multiple systems and ready for field test by deployed units. Demonstrate operation of the system in alternate environmental conditions.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Primarily the aerospace usages of composites, but additional composite materials in other industries (infrastructure, automotive).

KEYWORDS: Composite; Repair; Austere Environment; Environmental Boundary; Containment; Contamination

TPOC: (301)995-7561
2nd TPOC: (252)464-7159

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

N07-125 TITLE: Innovative Surface Modification for Aluminum, Magnesium and High Strength Steel Alloys to Enhance Corrosion Resistance

TECHNOLOGY AREAS: Air Platform, Materials/Processes, Weapons

ACQUISITION PROGRAM: PMA 275, V-22 program; Joint Strike Fighter Program

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OBJECTIVE: Develop an innovative method or process that would enhance alloy surface corrosian resistance.

DESCRIPTION: The Navy spends approximately $1 billion a year to address corrosion maintenance problems and fatiuge failure is mostly driven by corrosion effects. Specific examples of this issue include blade fold, wing fold actuation system for carrier based aircraft, hydraulic actuators, rotary gear assembly, aluminum fuselage and wings, and magnesium transmission gear housing. An innovative approach is needed to address the root causes of issue. New low cost approaches are sought that would drastically improve corrosion resistance of the alloys by modifying the surface of the alloy without sacrificing other mechanical properties. Techniques such as dealloying, gradient surface, low temperature carburizing, microalloying, alternative anodizing and high temperature oxidation etc. may be explored. The trade-off between cost, safety, environmental impact and expected performance should be demonstrated. Performance goals are:

1. Aluminum alloy with strength of 7075-T6 and stress corrosion cracking threshold strength of 75% of the yield strength without sacrificing other mechanical properties.
2. Steel alloys with AerMet 100 strength and toughness with stress corrosion cracking threshold strength 70 ksi-in1/2.
3. 50% improvement in life-cycle costs for cast magnesium alloys compared to ZE41 and AZ91C.
4. Low cost, ultra high strength stainless steel with hardness equal to or above that of hard chrome coating requiring minimal material processing.

PHASE I: Demonstrate proof-of-concept of proposed surface modification process for high strength steel, aluminum and magnesium alloys. Develop an implementation plan and identify candidate component pieces for further development of the proposed process in Phase II.

PHASE II: Develop and demonstrate a prototype surface modification process on components identified in Phase I. Develop a production cost estimate and detailed processing development for manufacturing.

PHASE III: Transition the surface modification technologies developed in Phase II to Navy aircraft and selected commercial aircraft.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Since commercial aircraft also experience severe corrosion problems, there is a clear market for commercial sector. Major airframers and subsystem (hydraulics, wingfold, actuation systems, weapons bay door drive system, wing stow etc.) manufacturers will be benefited from this program.

REFERENCES: 1) Shipboard Exposure Testing of Aircraft Materials Aboard USS Ranger; NAWCAD Report 94019-60, 1994.
2) Multiple Shipboard Exposure Testing of Aircraft Materials Aboard USS Nimitz; NAWCAD Report, 1994.
3) Assessment of internal protective coating systems used on landing gear and landing gear components processed at NADEP Jacksonville, MELR 04JX00929.
4) Aluminum 7075-T6: AMS 4044, AMS 4045, or QQA-250/12 AerMet 100: AMS 6532

5) AZ91C: ASTM B80, B93, B199
6) ZE41: AMS 4429

KEYWORDS: Steel; Aluminum; Magnesium; Stress Corrosion Cracking; Corrosion Resistance; Surface Modification

TPOC: (301)342-8071
2nd TPOC: (301)342-4078

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

N07-126 TITLE: <u>Ultra-Portable, Low-cost, Nondestrutive Evaluation Technologies for Rapid Damage Assessment in Epoxy-based Composite Materials</u>

TECHNOLOGY AREAS: Air Platform, Materials/Processes

ACQUISITION PROGRAM: PMA-275, V-22 Program; Joint Strike Fighter Program

OBJECTIVE: Develop a cost-effective, ultra portable system to detect mechanical and/or thermal damage in composite materials.

DESCRIPTION: In-theater operations of US Navy/Marine Corps aircraft can result in operational damage that requires rapid detection and repair so as not to interrupt mission operations. Multiple Nondestructive Inspection (NDI) technologies are available for in-depth analysis of suspected damage zones at higher-level maintenance activities. Unfortunately, the only inspection methods available for rapid on-site damage detection at the squadron level are visual and tap testing. Mechanical damage is typically in the form of delaminations or disbonds (laminate-to-laminate or laminate-to-core). Thermal damage can be caused by fire, engine bleed air leaks, and prolonged exposure to moderate heat (slightly above resin cure temperatures).

PHASE I: Utilizing composite samples with representative in-service defects, design and fabricate a breadboard instrument for operational (field) level use to rapidly detect thermal and/or mechanical damage and demonstrate the capability to detect the representative defects.

PHASE II: Develop and demonstrate a prototype system with a refined user interface. The prototype should be portable, light, and capable of being operated by personnel that are not certified NDI technicians.

PHASE III: Implement full-scale production of the Nondestructive Evaluation (NDE) devices in quantities proportional to market and Navy demand. Desired unit cost is less than $10,000.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Successful development of a cost-effect, ultra-portable NDE device is of interest to commercial aircraft and military industries.

REFERENCES: 1) A Portable Maintenance Aid Applied to Battle Damage Assessment
http://ieeexplore.ieee.org/iel2/653/6713/00270081.pdf?arnumber=270081
2) Warning signs
http://www.newscientisttech.com/channel/tech/mg19125601.400-warning-signs.html

KEYWORDS: Nondestructive; Inspection; Composite; Damage; Portable; Delamination

TPOC: (301)342-8020
2nd TPOC: (301)342-3761

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

N07-127 TITLE: Ultra-Wideband (UWB) Imaging Array Surveillance Sensor

TECHNOLOGY AREAS: Materials/Processes, Sensors

ACQUISITION PROGRAM: NAVFAC Anti-Terrorism/Force Protection ACAT IV

OBJECTIVE: Develop and demonstrate an Ultra-Wideband (UWB) Radio Frequency (RF) imaging array surveillance system to monitor unauthorized movement of personnel, craft, robot, and vehicle activities around perimeters of airfields, waterfronts, critical infrastructure, and facilities. The system must be able to detect and track movements of non-authorized personnel, craft, robots, and vehicles crossing perimeters and entering secure areas [exclusion zones]. The system must identify and discriminate personnel and robots from clutter, debris, foliage, and animals. The system must operate in all weather conditions, including fog, rain, sleet, hail, snow, and sand. The objective is high probability of detection, with low nuisance and false alarms in exterior environments. The system must identify and present the cause of alarms. The system must be difficult to defeat and bypass. The system may be used stand-alone, or to queue other optical/infrared (IR) sensors for intrusion/threat assessment. It should provide sufficiently accurate position information to direct remotely controlled closed circuit television (CCTV) and forward looking IR (FLIR) cameras for threat assessment.

DESCRIPTION: The Federal Communication Commission (FCC) authorized the use of unlicensed Ultra-Wideband (UWB) for Imaging Systems including: Through-Wall Imaging Systems, and Surveillance Systems. UWB imaging systems/surveillance sensors can operate from 1.99-10.6 GHz. These frequencies are sufficiently high, with short enough wavelengths, and wide enough bandwidth, to provide high ranging resolution, sufficient to detect heartbeat and respiration. RF's longer wavelengths than optical and IR provides the advantage of working in all weather conditions.

The system should combine the advantages of both microwave (all-weather penetration) and IR break-beam (high density) sensors, with low cost afforded by UWB radars. Low-cost UWB radars are commercially available and may be employed in arrays to provide increased range and provide rudimentary imaging capability. Linear arrays of inexpensive UWB sensors, mounted in poles similar to a fence, can be deployed/installed along waterfronts, perimeters, around critical infrastructure, and outside and inside facilities. Arrays can operate as mono-static (reflection) radars, or bi-static (break-beam), or both. Linear arrays can be staggered to provide complex 3D meshes of beams with sufficient density and redundancy to provide volumetric imaging. This allows determining the size and shape of targets to discriminate real, false, and nuisance alarms. Reflections from surrounding terrain and nearby structures can provide improved coverage over irregular surfaces and terrain, minimizing blind spots. UWB pulse focusing from multiple radars, using timing, can provide factor of N increased field strength or N2 power increase in focus zones. This can be used to increase range of mono-static (reflection) radar operation.

Linear arrays need to be rapidly, temporally, or permanently installed. The system must not require precision alignment, rather be self-aligning and self-healing, to compensate for placement, movement, and blockage. Ideally, linear arrays should be stand-alone, generating their own power, not requiring cabling or external power. Linear arrays need to communicate between themselves, for coordination, synchronization, and communicating detection information to remote displays and Command, Control Communications and Intelligence (C3I) systems. Communication between arrays and to outside likewise should be wireless and secure.

Software algorithms need to be developed to process the radar signals, learn environments, determine target signatures, provide alarm indications and displays, and interface to C3I systems. The objective is to use the rich information from a high density of multi-modal UWB sensors to improve detection, reduce false and nuisance alarms, and improve resistance to defeat.

PHASE I: Develop proof-of-concept design for UWB imaging array sensor. Model UWB radar performance against a variety of environments, targets, and scenarios. Incorporate UWB radars for bi-static and mono-static operation and determine range and ability to detect intruders in both modes. Assess or test UWB radars in different weather conditions. Determine effective range and sensor spacing possible within FCC UWB power limits. Compare with conventional microwave and IR break-beam sensors. The objective is a minimum of 100 ft between sensors (bi-static) or to target (mono-static).

PHASE II: Develop a prototype system with linear arrays of UWB radars. Demonstrate and test both mono-static (reflection) and bi-static (break-beam) operation. Demonstrate mesh imaging, target recognition, and false & nuisance alarm identification/rejection. Demonstrate ability to recognize different animals including birds, rodents, cats/dogs/rabbits, reptiles, deer, and humans. Demonstrate ability to measure heartbeat and respiration to recognize animal type. Demonstrate ability to recognize and ignore blown debris and foliage. Demonstrate ability to work over irregular surfaces, and to defeat crawling and ladder attacks. Demonstrate ability to work in different weather conditions, e.g.: fog, rain, up to and including piled snow, and sand. Demonstrate inside and around buildings, single and double fence lines, fenced/walled areas, around metal structures (pipes, valves, pumps, tanks), along shorefronts with sand and salt water, and around aircraft on runways and tarmacs. Cabling between linear arrays is allowed for the prototype system for communication and synchronization. Wireless operation is not required. Identify secure wireless communication and synchronization approaches.

PHASE III: Develop final system with fully wireless operation, without cables or external power. Demonstrate wireless operation. Submit models to FCC for testing and certification. Develop final processing, display and interface software. Develop Application Programming Interfaces (API). Demonstrate interfaces to industry standard security display and monitoring systems. Demonstrate automatic CCTV/FLIR camera queuing. Transition to production for widespread commercial distribution.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: These UWB surveillance sensors fill a gap between available sensors and have widespread potential for industrial and utility protection. They can be used for high-security perimeter applications around airports and prisons. They can also be used for open un-fenced perimeters near shorelines.

REFERENCES: 1) Physical Security Systems Inspectors Guide, U.S. Department of Energy Office of Safeguards and Security Evaluations, OA-10 GTN, Germantown, Maryland, Sept 2000, http://www.ssa.doe.gov/Sp40/guidedocs/
2) Perimeter Security Sensor Technologies Handbook, NISE East, Electronic Security Systems Division, North Charleston, South Carolina, 1997, http://www.nlectc.org/perimetr/handbook.htm
3) First Report & Order, Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems, ET Docket 98-153, Federal Communications Commission, FCC 02-48, Adopted February 14, 2002, Released April 22, 2002

KEYWORDS: ANTI-TERRORISM FORCE PROTECTION; EXTERIOR, PERIMETER, INTRUSION DETECTION SENSORS; IDS;ULTRA-WIDEBAND; UWB; MICROWAVE

TPOC: Steve Gunderson
Phone: (805)982-1262
Fax: (805)982-3981
Email: steve.gunderson@navy.mil
2nd TPOC: Nick Olah
Phone: (805)982-1089
Fax: (805)982-4429
Email: nick.olah@navy.mil

N07-128 TITLE: Reliable Tool for Assessing Structural Integrity of Guy Wires on Tall Antenna Tower

TECHNOLOGY AREAS: Materials/Processes, Sensors

ACQUISITION PROGRAM: ACAT IV

OBJECTIVE: The objective is to develop a lightweight tool for regularly inspecting the guy wires that support tall antenna towers. For use on guys up to 2000 ft in length, the tool should ideally have one simple haul-up line and no power or data transmission lines. In particular, the tool needs to be lightweight, self-powered and self-recording and work reliably in the field. It must smoothly track guys of up to 3.5 inches in diameter with varying amounts of swelling in a manner that ensures high quality inspection data.

DESCRIPTION: The preferred technology for non-destructive inspection of wire rope is to surround the wire rope with rare earth magnets, saturating the rope with a magnetic field. Corrosion along the wire rope creates anomalies in this saturated magnetic field, detectable using an electro-magnetic sensor. This electro-magnetic method has proven useful for mine hoists and large cranes, whereby the wire rope travels through a stationary inspection tool. Theoretically, a moving inspection tool hauled up a fixed guy wire, should work just as well. However, electro-magnetic sensing tools are not currently used for inspection of guy wires because the currently available configurations have proven problematic for guy wire application.

PHASE I: Develop a design for a lightweight, self-powered and self-recording tool appropriate for guy wire inspection based on superior magnetic flux sensing techniques. Extension or modification of an existing tool is encouraged. Account for electromagnetic interference. Include your concept for how the sensing information could be recorded and transmitted.

PHASE II: Build prototype of new tool for testing at a high voltage test facility and on a set of guy wires representative of Navy submarine broadcast towers. Matching funds from another source will actually be used to run tests and analyze the tool's effectiveness at assessing the structural integrity of guy wires. The packaging and deploymennt of the proposed system is an important consideration in this testing phase.

PHASE III: Develop process for using tool. Implement the tool as a supplemental method for regular inspection of Navy submarine broadcast antennas. Implementation may be through the local antenna rigging staff at each antenna, through a tower inspection service company, or according to some other acceptable business model. The Navy follows the advice of Telecommunications Industry Association, which recommends inspection of guyed towers every three years.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Commercial business for the desired inspection tool is potentially large, given the thousands of telecommunications towers across the world that rely on guys to hold themselves vertically up. Commercial AM/FM/TV antennas tend to be much younger than the typical Navy submarine broadcast antenna, so the need for non-visual inspection has not yet reached maturity like it has for Navy antennas.

REFERENCES: 1) 2005, P. McCann & D. Smith. Evaluation of instruments for the non-destructive testing (NDT) of wire ropes, Reading, UK : Redaction, Reading Rope Research, Reading, University, P. 25-41, O.I.P.E.E.C. Bulletin, Vol. 89.
2) 1985, H.R. Weischedel. The inspection of wire ropes in service : a critical review, American Society for Nondestructive Testing, Materials Evaluation, Vol. 43, No. 13, pp. 1592- 1605.
3) 1985, P.M. Gammell, L.D. Underbakke. Evaluation of the LMA (TM) series of wire rope testing instruments, NSWC-TR-85-388, Naval Surface Weapons Center (Dalgren, VA)

KEYWORDS: Wire Rope; Electromagnetic; Magnetic Flux; Guyed Tower; Inspection; Corrosion

TPOC:	Robert Zueck
Phone:	(805)982-1210
Fax:	(805)982-3481
Email:	robert.zueck@navy.mil
2nd TPOC:	Nick Olah
Phone:	(805)982-1089
Fax:	(805)982-4429
Email:	nick.olah@navy.mil

N07-129 TITLE: <u>Tool for Recovery, Maintenance and Repair of US Navy Cable Systems</u>

TECHNOLOGY AREAS: Information Systems, Materials/Processes

ACQUISITION PROGRAM: ACAT IV

OBJECTIVE: Develop a tool for planning, modeling, simulation, and at-sea control for the recovery, maintenance, repair, and redeployment of US Navy seafloor cable systems.

DESCRIPTION: The U.S. Navy has special requirements for recovery and repair of seafloor cable systems. Existing software systems are focused on submarine cable installations for the commercial telecommunication industry. The Navy requires a more advanced computer tool for planning, modeling and simulation, and real-time feedback during recovery and re-laying of the cable systems.

The Navy frequently makes repairs to cable systems damaged by seafloor hazards. Cable repairs are time-consuming and costly. The process of recovering the cable to make the repairs is slow. Recovery of the cable often requires the use of a grapnel hook. The recovery process potentially results in damage to the cable and seafloor from dragging and snagging the cable with the grapnel as it is pulled up by the ship. A cable repair tool can provide improved cable recovery performance by more accurate placement of the vessel and grapnel rigging, and minimizing the dragging of cable across the seafloor. The repair tool can reduce the probability of fouling with other cables in the repair area by displaying accurate, detailed positions of cables and seafloor obstacles. The cable repair tool can help plan the recovery by providing an inventory of repair cable and equipment. The repair tool can provide feedback to cable engineers on available equipment and hardware, and basic guidance on repair operations to improve standardization of processes and equipment.

A cable repair tool will improve the Navy's efficiency at making repairs, and will minimize damage to both the cable and seafloor habitats. The repair tool can reduce the ship time and quantity of repair cable required to make a repair, thus reducing or avoiding costs.

The tool must accommodate large multi-body systems with complex hydrodynamic properties. The tool must be able to plan accurate placement of these cable systems, and provide detailed analysis for the recovery, maintenance and replacement of underwater components.

A recovery, maintenance, and repair tool for Navy applications must be operational on a PC platform and work in a GIS environment. It must readily incorporate large amounts of environmental data (e.g. detailed bathymetry in point and contour form, fishing threat data, seafloor hazards, detailed soil information, charts, and maps) and military data (e.g. acoustic performance, detection probability, threat and other data affecting performance and survivability). The planner must support seamless integration of large data sets coming from commercial and Navy sources (e.g. NAVOCEANO) having different formats and with varying Datum/Projections. All data must be properly geo-referenced on the GIS platform to facilitate mission planning and maintenance operations.

The tool must include the ability to perform detailed dynamic simulations of the installation and recovery process. Simulation output must be convertible to ship installation instructions (Sail Sheet), and the resultant installation records must be flexible enough to include the necessary documentation to efficiently plan and conduct follow-on recovery and maintenance operations. To generate an accurate repair plan, the system must be able to dynamically model the installation of the cable system in the water column in order to determine the optimum vessel instructions to lay the cable bodies as planned. Furthermore, the model must have the capability to use 3D bathymetry to calculate accurate touchdown conditions instead of conventional solutions which use the water depth along the planned route to calculate touchdown coordinates. In addition, simulation capabilities must include accurate computations of all forces acting on the suspended cable at any point in time during installations.

PHASE I: Develop a PC-based tool that uses interactive COTS GIS technology allowing the user to plan the recovery and maintenance of submarine cable systems laying on the seafloor or buried, with multiple in-line bodies and cable types. The tool shall use interactive techniques, in a GIS environment, to create and manage the recovery, maintenance, and relaying of multi-body cable systems. At a minimum, the system must be able to load into a GIS environment a wide variety of database formats including: bathymetry, fishing threat data, seafloor hazards, geologic features, sediment information, marine hazards, vector and raster maps, nautical charts, digital terrain data, and existing cables in the area. The tool shall allow for the manipulation of any cables and nodes/bodies to easily generate a specific cable system design appropriate for the laydown plan.

PHASE II: Expand the software tool to include detailed 3D modeling and simulation of the entire system installation or recovery in order to generate a detailed Ship Plan. The modeling tool shall include capabilities to use 3D bathymetry and to analyze expected deviations from the desired plans due to ocean currents and other changes in the physical ocean environment and the type of deployment platform used. The system shall be capable of importing installation data and recorded environmental data to estimate the as-laid position of array bodies for element localization and calibration. The expanded GIS based tool must include cable maintenance and repair modeling tools allowing the user to easily import planning data and detailed information on the cables to be repaired as well as nearby cables (slack, transitions, electrical and optical properties, etc). Access to these data must be efficient and complimented with electronic charting capabilities. The as-laid conditions of the cable must be easily updated after the repair into an integrated database. The tool shall incorporate specific maintenance-related planning features such as hardware recovery via grappling or ROV, buoy rig selection, and numerically modeling and simulating the deployment of replacement components. The tool shall include basic inventory control software to simplify selection of recovery hardware and repair cable, and support tanking decisions for improved efficiency at shifting of cable inventory within the ship.

PHASE III: Incorporate the developed system for specific applications at U.S. Navy facilities

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Potential exists in the commercial oil and gas sector for installation of seismic measuring systems which include large multi-body sensor systems. Potential exists for improved performance with recovery and reuse of retired cable systems.

REFERENCES:1) Cable Reuse: http://www.soest.hawaii.edu/soest/facilities/esf/Projects/DEOSCableRe-UseReport.pdf
2) http://www.soest.hawaii.edu/GG/DeepoceanOBS/History_of_ESF/
SL280_560_Experts_Report.pdf
3) Cable Recovery and Repair: http://www.fas.org/irp/program/collect/t-arc.htm
4) http://www.nttwem.co.jp/english/MAR/MAR-SER02.htm
5) http://www.makai.com/c-abstracts.htm
6) http://www.oceanexplorer.noaa.gov/explorations/sound01/sound01.html
7) http://www.mbari.org/news/homepage/2006/cable.html

KEYWORDS: cables; ocean; acoustic arrays; simulation; mission planning; GIS; cable installation; cable maintenance

TPOC:	David Warren
Phone:	(805)982-1197
Fax:	(805)982-1090
Email:	david.warren1@navy.mil
2nd TPOC:	Nick Olah
Phone:	(805)982-1089
Fax:	(805)982-4429
Email:	nick.olah@navy.mil

N07-130   TITLE: High Power Density Power Electronic Devices and Components

TECHNOLOGY AREAS: Ground/Sea Vehicles, Electronics

ACQUISITION PROGRAM: PMS 500 DDG 1000 ACAT 1D

OBJECTIVE: Develop power electronic devices and components to enable the development of very high-power density, multi-megawatt power electronic converters for propulsion motor drives and shipboard power distribution.

DESCRIPTION: Future all-electric warships will have a greater demand for improved electrical power density, conversion, and system reliability. This topic addresses the development of power electronic switching devices, passive components, and packaging techniques that can be applied to small-footprint, lightweight, propulsion motor drives and shipboard power distribution system elements to meet the needs of these greater demands. The power converters utilizing these devices and components will interface with the shipboard high voltage bus (4160-13,800 VAC or up to 10kV DC) and provide power to their loads with appropriate voltage and current characteristics. Present power electronics technology is able to satisfy most system electrical performance requirements but does so at the cost of high weight, large volume, and a large footprint. With the higher electrical demand anticipated for future surface combatants, it will be necessary to increase the power density of power converters to greater than 2MW/m3 without compromising their functional performance.

PHASE I: Demonstrate the feasibility of an approach(es) for reducing the volume, footprint, and weight of power electronic converters through the use of improved power electronic devices, smaller passive components, or novel packaging techniques. These improvements in volume and weight should not come at the cost of reduced functional performance. Modeling and simulation as well as three-dimensional computer aided design are encouraged to demonstrate the performance and feasibility of proposed approaches. Develop an initial conceptual design(s) and establish performance goals and metrics to analyze the feasibility of the proposed solution(s). Develop a test and evaluation plan that contains discrete milestones for product development for verifying performance and suitability.

PHASE II: Develop and demonstrate prototype materials/methods based on Phase I results. In a laboratory environment, demonstrate that the prototype(s) meet the performance goals established in Phase I. Develop a cost benefit analysis and a Phase III testing and validation plan.

PHASE III: The small business will work with the Navy and commercial industry, as applicable, to transition the power electronics devices, passive components, or novel packaging techniques in shipboard power electronic converters to reduce the converters' weight, footprint, and volume.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: These approaches could be used in any system where high power density power converters are used – electric vehicles, aircraft power system, distributed generation among others.

REFERENCES: 1) Power electronics innovation with next generation advanced power devices; Ohashi, H.; Telecommunications Energy Conference, 2003. INTELEC '03. The 25th International 19-23 Oct. 2003 Page(s):9 - 13
2) Power Electronics Building Blocks and potential power modulator applications; Ericsen, T.; Tucker, A.; Power Modulator Symposium, 1998. Conference Record of the 1998 Twenty-Third International 22-25 June 1998 Page(s):12 - 15
3) Design and technology of compact high-power converters; Shenai, K.; Neudeck, P.G.; Schwarze, G.;Energy Conversion Engineering Conference and Exhibit, 2000. (IECEC) 35th Intersociety Volume 1, 24-28 July 2000 Page(s):30 - 36 vol.1
4) Three-Dimensional Packaging for Power Semiconductor Devices and Modules; Calata, J.N.; Bai, J.G.; Xingsheng Liu; Sihua Wen; Guo-Quan Lu; IEEE Transactions on Advanced Packaging; Aug. 2005 Page(s): 404 – 412
5) Assessment of medium voltage PWM VSI topologies for multi-megawatt variable speed drive applications; Shakweh, Y.; Lewis, E.A.;Power Electronics Specialists Conference, 1999. Volume 2, 27 June-1 July 1999 Page(s):965 - 971 vol.2

KEYWORDS: Power electronics; power distribution; semiconductor devices; propulsion system components; electronics; IPS;

TPOC: Steven Swindler
Phone: (215)897-8384
Fax: (215)897-8380
Email: steven.swindler1@navy.mil
2nd TPOC: Joseph Borraccini
Phone: (215)897-8797
Fax: (215)897-8380
Email: joseph.borraccini@navy.mil

N07-131 TITLE: Innovative Flow Control Devices for Shipboard Fluid System Rupture Isolation

TECHNOLOGY AREAS: Ground/Sea Vehicles, Materials/Processes

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

OBJECTIVE: Explore the development of non-traditional flow control devices that utilize innovative, low cost technologies and methods for autonomously isolating fluid system ruptures in a shipboard damage environment without a dependency on primary shipboard power. Candidate shipboard systems include the fire main and the chilled water system.

DESCRIPTION: Presently, autonomous flow control is accomplished through the use of Smart Valves. These valves have the ability to sense changes in fluid pressure and through the use of ship's power and motor controllers, open or close themselves as the situation warrants. Due to the size and construction of these valves, the associated motor controllers need to be powerful enough to provide enough energy to operate the valve. As a result, these valve assembly configurations are typically very large, heavy and cumbersome and their dependency on ship's power to provide autonomous control is a survivability concern during the event of a power casualty. Should the ship loose power these valves will fail in their current state (e.g. open or closed).

This SBIR is exploring the development of innovative flow control devices as a replacement for current MIL-SPEC motor operated valves where the primary function is to provide for autonomous isolation in a damage control environment. Proposers are encouraged to explore non-traditional methods of flow control as well as the application of alternative materials and autonomous operation protocols. These new flow control devices would be in a normally open state and upon detecting a rupture would close to restore pressure in the system. To improve survivability, alternative energy sources should be utilized to reduce dependency on primary shipboard power. Under non-damaged conditions the device state should be monitored through the ships control system using primary shipboard power sources and traditional communications methods. For this reason, the approach(es) proposed should employ the use of open architecture principles as practicable. The device should be capable of bi-directional flow, should be operable for use on 2" - 8" piping and should have the capability of being opened (reset) or closed by an operator, either remotely or locally. Detection of a rupture should be determined at the device and ideally should not require communications with the ships control system after damage in order to optimally isolate a rupture (optimal isolation ensures that portions of the system are not over isolated, starving needed sections of the system). Solutions should address the use of survivable communications (e.g. wireless) as an alternative method of communication between flow control devices and/or with the ships' control systems in a the event of a damage casualty.

PHASE I: Demonstrate the feasibility of a innovative flow control device concept design that will autonomously isolate fluid system piping ruptures in a damage control environment. As practicable, computational and scaled physical methods should be employed to demonstrate the technical feasibility of the flow control approach(es). Establish performance goals and metrics to analyze the feasibility of the proposed solution(s). Develop a test and evaluation plan that contains discrete milestones for product development for verifying perform and and suitability.

PHASE II: Develop and demonstrate a prototype based on the Phase I results. In a laboratory environment, demonstrate that the prototype(s) meet the the performance goals established in Phase I. Develop a cost benefit analysis and a PHase III testing and validation plan. Provide detailed design drawings and test report.

PHASE III: The SBIR firm will work with the Navy and commercial industry, as applicalbe, to develop the detailed design and production plans for a complete family (2 to 8 inch) of autonomous flow control devices.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This device can be used in factory automation, remote fluid operation facilities like oil pipelines, and in building automation. It would be especially useful in high-value buildings such as skyscrapers, military buildings, and embassies where manned responses to pipe ruptures are delayed.

REFERENCES: 1) Roach, J.M., "Laboratory Development Platform Simulation of the Ex-PETERSON Autonomic Fire Suppression System." ASNE Reconfiguration and Survivability Symposium, 2005

2) Václav Tesar, Axel König, Jan Macek, Pavel Baumruk, “New Ways of Fluid Flow Control in Automobiles: Experience with Exhaust Gas After treatment Control,” Seoul 200 FISITA World Automotive Congress, 2000

KEYWORDS: flow control; valves; autonomous control; low power actuator; energy harvesting;

TPOC: John Roach
Phone: (812)854-1393
Fax: (215)897- 8380
Email: john.r.roach@navy.mil
2nd TPOC: Don Dalessandro
Phone: (215)897-8010
Fax: (215)897-7564
Email: donald.dalessandro@navy.mil

N07-132 TITLE: <u>Hand Deployed Situational Awarness Sensor for Shipboard Damage Control</u>

TECHNOLOGY AREAS: Materials/Processes

ACQUISITION PROGRAM: PMS 400D DDG 51 New Construction Destroyers

OBJECTIVE: Develop a rugged, lightweight, multifunctional situational awareness system for shipboard damage control and casualty analysis that can be dropped, thrown, or planted during a casualty event for remote situational monitoring.

DESCRIPTION: Current methods of damage control assessment onboard US Navy ships subject personnel to hazardous environments. These methods are labor intensive and dangerous. Where stationary ship sensing systems are utilized, ships power and the ability to access the ships’ Damage Control System is required. Adopting a new innovative way of assessing and monitoring damage locally with the ability to feed back to the Damage Control System will increase situational awareness, ensure personnel safety and speed the response time of the Damage Control Team. This would also decrease the spread of costly damages to critical electronics and systems that could inhibit a ships warfighting capability and mission effectiveness.
The US Navy is exploring the development of an innovative multi-function sensor system that can be easily carried and hand delivered into extremely harsh environments and provide continuous environmental condition assessment information to a remote monitor.   This system will, at a minimum, consist of a remote monitoring unit and corresponding multi-function sensing devices. The rugged monitoring unit will be utilized for remote data display, should not exceed the size and weight of a standard laptop computer and should be able to accommodate shipboard Local Area Network (LAN) connectivity for the purpose of transferring information. The multi-function sensor system must provide real time video feedback of the location being monitored and be capable of monitoring additional critical parameters continuously for a period of at least 8-hours. Both the remote monitoring device and the multi-function sensing device must be self-powered and should not require shipboard power during casualty events. The system proposed should be able to analyze and assess damage to compartments and provide the user with feedback of the condition of the space being monitored. Critical data elements include; the presence of fire, smoke, toxic elements (including Halon), the measurement of temperature, ventilation/air flow, and Chemical, Biological, and Radiation (CBR) levels. The sensing device and remote monitoring unit will need to operate effectively in; hot spaces due to fire that may contain soot, grime, and dust, have little or no lighting, poor air quality, limited oxygen content and/or wet environments caused by flooding or leaks. The system must also be capable of operating in an atmosphere containing toxic and explosive gases.
Due to the extreme conditions that the sensor will be subject to and the potentially rough delivery method, it should not be cost prohibitive to carry and/or use multiple sensors. The multi-function sensing device should be rugged, not weigh more than 7 lbs. so as to be portable by individual Damage Control Team Members, be easily thrown into compartments through scuttles and small openings, and have the ability to be tethered, if needed, for possible monitoring and/or retrieval. The sensor must also be able to communicate wirelessly with the monitoring station through steel bulkheads in compartments with operating machinery and equipment over a distance of not less than 50 ft. Both the sensing device and the remote monitoring unit will be required to withstand shock, vibration, and Electromagnetic Interference (EMI) testing. The technological challenge presented by this effort will require

proposed solutions that can address: affordability; advanced modular sensor technology; rugged packaging for extreme environmental operating conditions, portability/size limitations, and the use of wireless technology.

PHASE I: Demonstrate the feasibility of the development of a rugged, lightweight, multifunctional situational awareness system for shipboard damage control and casualty analysis that can be dropped, thrown, or planted during a casualty event for remote situational monitoring. Solutions proposed shall identify suitable materials, equipment, and anticipated manufacturing processes as well as the method(s) of sensing device delivery and associated manufacturing costs. Establish performance metrics to analyze the feasibility of the solution. Develop a test and evaluation plan that contains discrete milestones for product development for verifying performance and suitability.

PHASE II: Develop and demonstrate a prototype system(s) based on Phase I results.. Prototype system(s) shall be demonstrated and tested to various environmental and atmospheric conditions replicating extreme shipboard damage control situations. Verify final prototype operational methodology and operational capabilities using laboratory testing and provide results. Develop a cost benefit analysis and perform all testing and prototype validation requirements.

PHASE III: Construct a full scale prototype system based on the Phase II results for testing in a US Navy simulated shipboard environment or US Navy shipboard test facility.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Potential commercial applications include all classes of U.S. Naval and Commercial ships and land based fire/HAZMAT response teams.

REFERENCES: 1) MIL-STD-461, Requirements For The Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
2) UL 1709 Rapid Rise Fire Tests
3) MIL-S-901D, SHOCK TESTS. H.I. (HIGH-IMPACT) SHIPBOARD MACHINERY, EQUIPMENT, AND SYSTEMS, REQUIREMENTS FOR
4) NAVSEA Damage Control, Fire Protection Engineering and CBR-D Website: http://www.dcfp.navy.mil/
(Documents listed below may be found on this website).
5) NAVSEA S9086-CH-STM-020/CH-079V2R2 Damage Control Practical Damage Control
6) NAVSEA S5090-B1-TAB-010 Training Aid Booklet For Damage Control Equipment
7) NAVSEA SS-100-AG-MAN-010 Damage Control and Firefighting Equipment Layout Booklet

KEYWORDS: Damage Control, Gas Free, Sensor, Monitor, Rugged, Fire, Camera, Toxic, Smoke

TPOC: Henry Kuzma
Phone: (202)781-3634
Fax:
Email: henry.j.kuzma@navy.mil
2nd TPOC: Alfred Peters
Phone: (215)897-1253
Fax: (215)897-1134
Email: alfred.peters@navy.mil

N07-133 TITLE: Increasing Automation in the Shipbuilding Production Process

TECHNOLOGY AREAS: Information Systems, Materials/Processes

ACQUISITION PROGRAM: ACAT 1D, PMS 500 DDG 1000

OBJECTIVE: Develop innovative technologies that will increase the level of automation in common shipbuilding manufacturing processes. The focus of this topic is to reduce the complexity of the work and work content of the task. The solutions must be robust, user-friendly or autonomous, affordable and reasonably implementable in order to be substituted for current processes and be of significant value to the shipbuilding community.

DESCRIPTION: The Navy's Program Executive Office for Ships is leveraging the National Research Program (NSRP) to effect change across the non-nuclear surface shipbuilding, modernization and repair enterprise by coordinating with U. S. shipbuilders to adapt and implement "World Class" commercial best manufacturing practices. This topic seeks innovative scientific and engineering solutions to inefficiencies in long-standing design and engineering methods. This topic offers an opportunity to infuse new ideas/innovations into the smaller, 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.

Proposals under this topic must address integration of the research areas identified. Efforts cited within each research area are illustrative only and proposals dealing with related efforts within each research area are also solicited.

1. Computerized methodologies to implement continuous process improvement techniques. Shipbuilding can benefits from this feedback, however are often limited by resources capable of collecting, analyzing and reporting available process data. Examples include, but are not limited to novel methodologies:
- To autonomously collect, classify data and assess the utility of work content involved in logistics and manufacturing processes
- Interactive work-site access to work instructions and best practices
- Practical affordability tools to provide rapid guidance on choosing fabrication alternatives and make-buy decisions

2. Advanced methods to automate common shipyard manufacturing tasks such as:
- Innovative tools to evaluated product acceptance based upon objective quality evidence requirements (examples: Neural network modeling to automate digital radiographs reading/screening; autonomous, in-process noncontact dimensional/feature monitoring)

Of particular interest are initiatives with a clear business case. Proposal should specifically describe the technology that will be applied to solve the problem, how it will be developed, what the specific benefit 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. Contact with these resources is encouraged both prior to proposal development and during any subsequent SBIR-related activity. Teaming with a NSRP member (or Government shipyard) is voluntary and will not be a factor in proposal selection.

PHASE I: Demonstrate feasibility for improvements being developed and also identify impact upon shipbuilding affordability. Include a first order Return-On-Investment (ROI) analysis for industry 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 operation 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) Anderson, B. et al, Shipyard Operational Improvement Through Process Management, Paper presented at the 1997 Ship Production Panel Annual Meeting

4) Computer Applications in the Automation of Shipyard Operation and Ship Design, VII: Proceedings of the Ifip Tc5/Wg 5.6 Seventh International Conference, (1991 : Rio de Janeiro, Protasio Martins, Claudio Barauna Vieira, Chengi Kuo (Editor)

KEYWORDS: automation; manufacturing; affordability; shipbuilding;

TPOC: William Palko
Phone: (202)781-1732
Fax: (202)781-4570
Email: william.palko@navy.mil
2nd TPOC: Christipher Chiodo
Phone: (301)227-5025
Fax: (301)227-5576
Email: christopher.chiodo@navy.mil

N07-134 TITLE: Quasi Dynamic Dehumidification (QuaDD)

TECHNOLOGY AREAS: Materials/Processes

OBJECTIVE: Develop a cost-effective and reliable desiccant renewal system, powered by solar or other alternative energy sources, to service Navy reusable shipping & storage containers. A successful design will serve to reduce container inspection and desiccant maintenance costs, and help to eliminate corrosion of container contents (e.g., high value engines, transmissions, auxiliary power units, etc.).

DESCRIPTION: A Quasi Dynamic Dehumidification (QuaDD) system for sealed shipping and storage containers will capture energy from alternative forms of external sources (eg. solar radiation, thermal energy, etc..) to promote a phase change of desiccant accumulated moisture to a vapor state, to be expelled into the atmosphere via specially designed valves, thereby prolonging the life of the desiccant.

The system will need to integrate separately functioning components, possibly including:

- Alternative energy capturing devices
- An evaporative mechanism to cause moisture phase changes
- Humidity relief expulsion valves
- Relative humidity level indicators
- A mechanism capable of isolating the desiccant receptacle within the container during periods of moisture phase changes

The critical design element involves the sealing of the desiccant chamber within the controlled breathing container, to enable heating of the desiccant for the purpose of evaporating its captured moisture, which must then be channeled for discharge through the container wall. At the completion of the desiccant renewal process, the desiccant chamber must be re-opened to the container's interior to begin a new dehumidification cycle.

Successful development of the QuaDD system is expected to greatly reduce inspection and maintenance of stored shipping containers, lessening the need for replenishment of desiccant materials and reducing corrosion effected damage to assets by providing overall lower relative humidity levels of sealed volumes.

PHASE I: Concept creation and design development of the QuaDD desiccant renewal system. Designs should include an alternative energy power source, and may include energy scavenging or other innovative methods. Concept documentation may include optional designs (employing different technologies), with separate developmental approaches, which should then be evaluated in terms of cost, risk and reliability.

PHASE II: Develop a prototype QuaDD system performing to the designed specifications finalized during the Phase I period. The prototype should also demonstrate the potential for being integrated with, and to service, U.S. Naval Air Forces specialized shipping and storage containers.

PHASE III: Develop systems scalable for follow-on military or commercial use. Production systems could potentially service single, or multiple container units, in either the private aviation industry or any of the U.S. or foreign military Service Components.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The commonality existing between military and commercial aviation will provide ample commercialization potential. In addition, the autonomous capability to control the humidity within a sealed shipping and storage container will provide opportunities for QuaDD to crossover into non-aviation applications and industries.

REFERENCES: 1) SAE-ARP 1967, Containers, Shipping and Storage, Reusable; published Dec 99, adopted 28 Mar 06. This SAE Aerospace Recommended Practice (ARP) recommends design and test criteria for reusable shipping and storage containers for aircraft engines and modules, and other weapon system components. The containers are to provide water/vapor-proofing and other physical protection.
2) SAE-AS 5135, Desiccant Port and Desiccant Holder; published Jul 97, adopted 25 Nov 97. This SAE Aerospace Standard (AS) describes the characteristics of a desiccant port installed through the flat wall of a shipping & storage container. With the cover removed, the desiccant port provides access to the interior of the container for installation and removal of desiccant.
3) MIL-STD-648C, Design Criteria for Specialized Shipping Containers; issued 11 Feb 99. This military standard establishes general design guidelines and associated tests for specialized shipping containers used by the Department of Defense. This standard is intended as a basic reference document for specifications and standards prescribing performance requirements of shipping containers.

KEYWORDS: Corrosion Control, Controlled Humidity, Shipping Container, Storage Container, Specialized Container, Desiccate, Desiccated Volumes, Moisture Phase Change, Desiccant Cells, Desiccant Containers, Solar Cells, Thermal Energy, Energy Capture, Heat Transfer, Drying Agents, Moisture Sensing, Sensors, Indicators, Expulsion Mechanisms, Asset Protection.

TPOC: Irv Gleaner
Phone: (215)697-3435
Fax:
Email: irving.gleaner@navy.mil

N07-135 TITLE: Multiple Vocoder Translation Software Application

TECHNOLOGY AREAS: Information Systems, Human Systems

ACQUISITION PROGRAM: JTRS-NES 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 minimum loss vocoder translation capability that enables the interoperation of voice communications between systems employing different CODECs.

DESCRIPTION: The translation of audio has been shown to suffer degradation in quality in the direct translation between digital encoding schemes than is induced when analog voice is used in an intermediate stage. The goal of this effort is to develop a software application that can translate between a the following codecs, at a minimum: MELP, MELPe @2.4k[reference 1], CVSD [reference 2], LPC10 and G.729A/B @9.6k. All combinations need to be supported, including the translating of communications between users who are all employing different codecs in a voicenet or conferencing scenario. Support for additional codecs used in commercial VoIP applications will be needed. The software must be modular and portable. Its resource foot print on the processing platform must be minimized. The software must enable the translation of multiple communications flows simultaneously. After quality, limiting the amount of processing platform resources required is of primary interest. The resultant software must operate in a Software Communications Architecture (SCA) environment [reference 4].

PHASE I: Identify the present state-of-the-art in Research and Development (R&D) within government, industry and academia on multiple vocoder translation. Research and develop the approach for implementing the translation capability. Accomplish modeling to identify the expected efficiency of the application. Identify an approach to evaluating the speech recognition degradation caused by the translation. Provide a paper documenting the present state of the art, the approach and modeling results.

PHASE II: Create a software implementation suitable for development and capability demonstration. Measure quality of translation, Baseline actual platform processing requirements. Provide a demonstration of the capability to JTRS JPEO/NED. The demonstration should identify potential capabilities that can be adapted by JTRS domains. The demonstration should identify developmental and implementation costs, porting and adaptation of the software to the real-time operating system environment and Application Programming Interfaces (APIs) of JTRS radios, and other concerns if applicable.

PHASE III: Refine the translation implementation. Improve resource utilization. Transition implementation to JTRS software environment and perform Development Tests. The software generated in this project is subject to NSA approval prior to incorporation into a JTRS radio, which will have national security requirements and impacts to the vendor. 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: 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.

REFERENCES: 1) Kevin Brady, Thomas F. Quatieri, Joseph P. Campbell, William M. Campbell, Michael Brandstein, Clifford J. Weinstein, MULTISENSOR MELPE USING PARAMETER SUBSTITUTION, http://www.ll.mit.edu/IST/pubs/040517_Brady.pdf
2) MADHAVI K. GANAPATHIRAJU, N. BALAKRISHNAN, RAJ REDDY, Improving Recognition Accuracy on CVSD Speech under Mismatched Conditions, http://www.cs.cmu.edu/~madhavi/publications/Ganapathiraju-WSEAS.pdf
3) TED PAINTER AND ANDREAS SPANIAS, Perceptual Coding of Digital Audio, PROCEEDINGS OF THE IEEE, VOL. 88, NO. 4, APRIL 2000, http://www.eas.asu.edu/~spanias/papers/paper-audio-tedspanias-00.pdf
4) Software Communications Architecture, JTRS Standards, JPEO JTRS, http://jtrs.spawar.navy.mil/sca/home.asp

KEYWORDS: vocoder; translation; communications; audio; software; JTRS

TPOC: Brian Salisbury
Phone: (619)553-0879
Fax:
Email: brian.salisbury@navy.mil
2nd TPOC: Bill Schemensky
Phone: (619)553-3619
Fax: (619)553-3221
Email: bill.schemensky@navy.mil

N07-136 TITLE: <u>Human Performance Modeling in the Naval Capabilities Development Process</u>

TECHNOLOGY AREAS: Information Systems, Human Systems

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: The objective of this work is to integrate human decision making analyses into NCDP assessment processes, specifically by modeling capability-driven performance requirements, information/resource considerations and workforce planning. In particular, this effort is needed in order to bring human performance data into the Doctrine, Organization, Training, Materiel, Leadership, Personnel and Facilities (DOTMLPF)-analysis process before selecting a materiel solution, and to highlight associated Manpower, Personnel, Training and Education (MPT&E) requirements that impact proposed, or new, war-fighting capabilities. DOTMLPF analysis is a critical part of the Joint Capabilities Integration and Development System process, the basic requirement for all acquisition.

DESCRIPTION: As the Navy transforms from independent system acquisition to a capabilities based approach, the NCDP is used to identify problems with current solutions and devise cost effective ways to solve them before deciding to propose a materiel solution. The NCDP process that primarily focuses on this approach is DOTMLPF analysis or, specifically, what the Navy uses to ensure that DOT_LPF factors are being implemented properly before determining that the M solution is required. A critical aspect of DOTMLPF analysis is that that root causes of identified problems can be difficult to extrapolate without first gaining an understanding of the underlying factors that determine process outcomes and trigger and/or constrain goal-directed performance. As a result, since many problems involve human-system interactions, there is a need for NCDP to compare the effects of both human and equipment performance on process outcomes, as this would facilitate evaluation of all solution options before committing to the purchase and/or upgrade of (often extremely costly) equipment.

Currently, standardized human behavior modeling and simulation tools are not readily available for these types of analyses. A methodology needs to be developed for defining the performance requirements for the mission(s) driving the proposed capability, and then estimating the effect of different options for supporting or modifying human performance process outcomes. For example,
speed of decision making is determined by assigned tasking, training received, accessibility to the information that must be collected to support the decision, perceived window of opportunity and priority for making the decision, and the procedures that must be carried out to organize and evaluate the supporting information. Often, best-, worst-case and average estimates of how long that decision process takes are used. These are useful, but can be misleading when compared to real-world situations. Consequently, it is important to also consider what causes variations from these best-, worst- and average-case conditions, and this is best accomplished through some form of human-performance modeling.

A human performance modeling approach that decomposes mission threads into series of nodes in which human-decision making is considered as part of proposed system performance is necessary. The DOTLPF information required to support those decisions is identified, and the communication links that transfer that information between nodes are specified, all for the purpose of ensuring that the human performance is adequately considered before making a materiel-solution decision. Specific features of this approach would be delineated over the three (3) proposed phases of the SBIR effort:

A human performance modeling approach that decomposes a mission thread into a series of nodes in which human performance occurs is necessary. The information required to support those decisions is identified, and the communication links that transfer that information between nodes can be specified.

PHASE I: Create a general model of the decision-making process in C4I:

(1) Describe the general decision-making process, including a time-sequence of steps from initial identification of the need for a decision, until enough information has been assembled to identify decision alternatives and enable the selection of the best decision for action.

(2) Identify decision-performance metrics, and allow for the effect of external performance drivers and process-mitigation factors.

(3) Include performance-shaping factors such as information requirements, collection and distribution latencies, workload, training and tasking effects, uncertainty, resolution techniques, and perception and alerting mechanisms.

Output: Descriptive model of the human-decision making that can be used to drive a simulation of overall system performance and assess the impact of various performance-shaping factors on that performance.

PHASE II: Use the created decision-making model as the basis for the initial construction of a modeling tool to evaluate the effect of various decision-support options on decision performance:

(1) Develop and provide process algorithms associated with proposed decision-making model.

(2) Research and describe the operational features of candidate process-modeling tools that could potentially be adapted for use with proposed decision-making model.

(3) Provide specifications for an evaluation engine embedded within the proposed decision-making model that will take as inputs available information on human capabilities, and specific mission thread decision-performance criteria.

Output: Provide a tool that can be used to identify expected human decision-making problems and then evaluate options for eliminating them. It is expected that options to be evaluated, among others, would include process improvements, workload adjustments, decision support aids, and training interventions.

PHASE III: Develop proposed C4I human decision-making prototype:

(1) Develop and test capability that will perform specified process modeling and produce appropriate evaluation reports.

(2) Use capability to drive a simulation of human decision-making performance for an existing system, and assess the effect of performance-shaping factors on that performance. It is expected that options to be evaluated would include process improvements, workload adjustments, decision support aids, and training interventions.

(3) Use capability to identify expected human decision-making problems and proposed options for eliminating them.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Most human-performance models deal with human performance deficits and their consequences. Human performance deficits involve failure to do something, doing the wrong thing, or taking too long to do it. To find the consequences of those deficits one just adds any sequential delays and multiplies the probabilities of doing the wrong things. Most of these deficits, however, are dependent on what they are trying to do and the conditions under which they are accomplished. This tool will facilitate that analytical process, and support the creation of a more effective and efficient design aimed at the identification of human-operator limitations.

REFERENCES: 1) G. Salvendy (2006) Handbook of Human Factors and Ergonomics. New York: John Wiley & Sons.
2) H. Booher(2003) Handbook of Human Systems Integration. New York: John Wiley & Sons.

KEYWORDS: human systems integration; human performance modeling; human performance simulation; human errors; ergonomic analysis; decision analysis

TPOC: Robert Smillie
Phone: 619-553-8015
Fax:
Email: robert.smillie@navy.mil

N07-137 TITLE: Artifact Assessment Tool Suite Infrastructure (AATSI)

TECHNOLOGY AREAS: Information Systems, Materials/Processes

ACQUISITION PROGRAM: JTRS-TD 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: The Artifact Assessment Tool Suite Infrastructure (AATSI) allows for the deployment, execution and storage of the results obtained from independent, self-contained compliance and quality assessment tools. Compliance and assessment tools are used in the evaluation of design documents, models, source code, meta-data, product build services and other electronic artifacts created and maintained over the life-cycle of software centered systems. These tools assess artifacts against evaluation criteria derived from regulations, program requirements, customer needs and industry standards. The AATSI framework shall support integration of assessment tools and services from commercial, open source and locally developed resources and provide a common open architecture for the process, storage and retrieval and analysis of tool results. The infrastructure will permit organizations responsible for product life-cycle support to select and integrate the 'best-of-breed' tools and services into their development and oversight process freeing them to capitalize their investment independent of limited proprietary or close single source solutions. In addition, this tool will incorporate capabilities specific to embedded real-time systems which utilize different operating systems and techniques than the majority of the commercial and military software products.

DESCRIPTION: AATSI will support compliance and quality assessment analysis of digital artifacts produced for all phases of code intensive product development, particularly code intended for embedded real-time systems. The AATSI system should provide a multi-tiered infrastructure to support 'plugging together' commercial, open source and privately developed compliance and quality assessments tools into a common framework. This framework should support data collection, retention, and data reduction as well as analysis report generation for input produced by tools or 'content providers'. The framework should utilize an open common language such as XML to describe the input, query and report criteria to be implemented by content providers and data requestors. The use of open language description may promote acceptance by content providers' thereby stimulating support for common data interchange. Similar service capabilities are under development in projects such as the 'Eclipse Test & Performance Tools Platform (TPTP)'. This investigation should examine opportunities to extend these capabilities to provide historical reporting and tracking for the life cycle of the products. The system should support rapid processing and generation of either artifacts in either an "in batch" mode, or by individual elements. Artifacts may include source code, meta-data, build scripts, project documentation, architectural drawings and legal contracts. There can be any number of tool results associated with an artifact that shall be stored and queried by relational criteria provided by open schema definitions defined by the AATSI service framework. All AATSI support schemas, data and meta-data used to describe projects, artifacts, tests and results must be open and readily available for integration with assessment tools and reporting services. The design of the AATSI should be scalable and include operational capabilities for single workstation implementations through distributed web services capable tools and distribution.

PHASE I: Survey industry and available technology, determine feasibility and develop system concept and architecture. Develop an infrastructure design road map to support the iterative development and architecture to support the evolution of the product. Deliver a proposal to develop a prototype system in Phase II.

PHASE II: Implement the prototype of the architecture defined in Phase I. Provide plug-in adaptors for a sampling of existing commercial assessment and compliance products to demonstrate the usability of the framework design. Provide minimal query and reporting capabilities to demonstrate the flexibility of framework data store associations. Deliver a specification and cost estimate to complete the development of the capability in Phase III.

PHASE III: Expand the prototype development of Phase II to support the integration of tools, chains and other specialized compliance assessment services utilized by the JPO JTRS, Life Cycle Support organization and other JPO JTRS testing organizations. These tools will be used by government laboratoroies and industry vendors to support the quality assurance processing and report generation service needs of the JTRS family of radios and support products.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Compliance testing and quality assessment tools are widely available for many commercial software applications, but the lack of standards and proprietary product solutions limit the integration and distribution of information for business analysis in major multi-vendor open-source programs. There are number of initiatives such as the Eclipse TPTP currently underway to provide frameworks for the integration of tooling for specific problem domains. However, the products developed under this effort have the potential of extending capabilities to support integration of product quality information and history across the business domain, including embedded and real-time systems used increasingly in commercial and non-DOD interoperable communication system, sophisticated transportation systems, and increasingly complex consumer handheld devices.

REFERENCES: 1) Eclipse Test & Performance Tools Platform (TPTP) http://www.eclipse.org/tptp/
2) Netcentric Enterprise Solutions for Interoperablitity (NESI) http://nesipublic.spawar.navy.mil/
3) Web Services http://www.w3.org/2002/ws/

KEYWORDS: Software; quality, compliance, testing, artifact, JTRS

TPOC: David Frank
Phone: (619) 553-4167
Fax:
Email: david.frank@navy.mil

N07-138 TITLE: Extremely Wideband Antenna for Airborne and Land Mobile Communications Systems

TECHNOLOGY AREAS: Air Platform, Electronics, Battlespace

ACQUISITION PROGRAM: JTRS-AMF 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: In order to successfully implement the DOD goals of Joint Forces interoperable high-bandwidth networked communications, an extremely wideband antenna system is required to support the wideband software-defined radio communication systems currently in development. The emerging infrastructure will enable multi-channel, multi-band, and wideband communication capabilities for all users. Conventional HF/VHF/UHF antenna design options cannot achieve the required bandwidth or gain characteristics when integrated into fixed/rotary wing aircraft or land mobile vehicles due to size, weight, and power limitations. A full-scale improvement in antenna performance and a revolutionary approach to antenna design and the integration of antennas on airborne and land mobile platforms are needed if the above-described mission parameters are to be realized.

DESCRIPTION: The objective is to develop antenna technologies that can be incorporated into compact, efficient, and wideband antennas that can be militarized for air and land mobile platforms use. The primary requirements are as follows:

(1) A Line Of Sight (LOS) wideband capability is required that simultaneously covers the entire 2 – 2000 MHz spectrum with a maximum Voltage Standing Wave Ratio (VSWR) of less than 3 and a power handling capacity of approximately 100W (continuous duty). The radiation pattern should be omni-directional with vertical polarization. For rotary wing aircraft use, a suitable form factor would be a height of 10 inches, with the objective for the antenna radome to be “blade” style. Conformal form factors are desired for fixed-wing aircraft. Land mobile platforms will require an antenna that can be located in the space currently utilized by vertical antennas.

(2) A UHF satellite communications (SATCOM) capability is required for the 240-380 MHz band, which will enable the operation of multiple narrowband transmit/receive channels. Right–Hand Circular Polarization (RHCP) is

required with hemispherical coverage. The form factor requirements are similar to (1) above. The receive gain and radiation efficiency must be adequate to achieve the required data link margins with the UHF Follow-On (UFO) satellite payloads and the emerging Mobile User Objective System (MUOS) satellite system. Nominal power handing capability is 200W continuous duty.

Recent research points to several innovative approaches for improving the operating bandwidth of conventional antenna designs. Here the technical challenge is to develop and validate a design approach that allows efficient operation and stable radiation pattern performance over an extremely wide operating bandwidth. The computational and modeling efforts should address the antenna performance requirements with a specific emphasis on these technical issues.

PHASE I: Identify near-term and far-term innovative approaches for development of efficient, wideband, omnidirectional antennas. Characterize performance of current airborne antennas that operate in the HF/VHF/UHF/L-band frequency spectrums. Develop and demonstrate the feasibility of a wideband, omnidirectional antenna that addresses the performance objectives described above. Validate the computational approaches by test of a physical model.

PHASE II: Validate the proposed antenna design approaches through development, fabrication and test of a prototype article that functionally meets the stated performance objectives. Quantify the electrical RF performance to include VSWR, gain, radiation patterns, and power handling. Demonstrate that the mechanical design approach will be suitable for airborne and land mobile applications.

PHASE III: Develop Engineering Development Models (EDMs) and perform Development Test and Initial Operational Tests to verify conformance with JTRS and platform requirements.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Compact, broadband antennas are required to support future generations of terrestrial wireless communications, including high bandwidth Internet connectivity with much greater data and user capacity than is currently available. The high cost of communications base stations requires service providers to provide more capability with a minimal increase in the number of stations; in addition, civic codes often restrict the size and quantities of antennas that may be installed. A high performance compact antenna could provide a cost-effective solution to the execution of these commercial communications services.

REFERENCES: 1) J. L. McDonald, F. Lalezari, and D. S. Filipovic, “Design of a Broadband Biconically Offset Fed Thick Dipole,” IEEE AP Symposium, Volume 1A, pp. 541-544, 3-8 July 2005
2) J. L. McDonald, F. Lalezari, and D. S. Filipovic, “Multioctave Broadband Dipole and Monopole Antennas,” 2005 Antenna Applications Symposium
3) C. B. Ravipati and C. J. Reddy, “Low profile disk and sleeve loaded monopole antennas,” IEEE AP Symposium, Volume 2A, pp. 160-163, 3-8 July 2005
4) J. R. Jahoda, “Development of a JTRS/SINCGARS Ultra-Broadband Airborne Blade Antenna,” High Frequency Electronics Magazine, Dec. 2006, pp.50-56.

KEYWORDS: antenna; JTRS; wideband; satellite; aircraft; mobile

TPOC: LT Timothy Wilson
Phone: (781) 271-8970
Fax:
Email: timothy.wilsonII@hanscom.af.mil

N07-139 TITLE: Electromagnetic Propagation Characterization using Communication Networks

TECHNOLOGY AREAS: Information Systems, Sensors, Battlespace

ACQUISITION PROGRAM: PMA 180 Navy Integrated Tactical Environmental Subsystem (NITES) ACAT IV

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 real-time system to monitor and display the radio frequency environment using organic communications systems and through-the-sensor (TTS)technology to allow Navy assets to optimize employment and placement of communications systems, sensors and platforms – for efficient operations, detection and counter detection. The primary goal of using TTS technology is to minimize integration cost by using existing communication links to quantify environmental effects on link performance.

DESCRIPTION: The variability of the physical environment has a significant impact on communications and sensor systems of Navy/USMC ships and aircraft. Of the various aspects of the physical environment, the local refractivity conditions play a dominant role in communication system and radar employment by changing the propagation environment. Anomalous propagation conditions (ducting, super- and sub-refraction) can enhance or degrade operational communication ranges and ranges at which threats can be detected by aircraft. Additionally, the same propagation conditions can have a very significant impact on the range at which a ship or aircraft can be counter detected by an enemy asset. Accurate, real-time knowledge of local propagation conditions is a prerequisite to effectively managing the impacts of varying refractivity and optimizing sensors and systems for tactical advantage.

Over the past few decades, a number of approaches have been recommended and employed to improve local measurement of propagation conditions. Although many provide accurate measurements of the parameters that allow for estimation of radio frequency (RF) propagation conditions, they often have less than optimal characteristics such as requiring the use of significant dedicated equipment and providing periodic (not continuous) measurements at an update rate that does not capture real-time conditions.

Additional propagation condition sensing capabilities need to be developed to more fully exploit knowledge about local propagation conditions, while leveraging existing hardware found on aircraft and ships. Utilization of existing sensors and systems in a through-the-sensor methodology should avoid additional hardware as well as providing continuous monitoring of conditions. In addition, utilization of existing systems should avoid the need for additional operational and maintenance personnel. Examples of similar capabilities which have been demonstrated recently include the capability to estimate refractivity profiles (which define propagation conditions) through existing tactical radar systems such as the SPY-1 and SPS-48 radars.

PHASE I: : The Phase I proposal should provide a methodology to evaluate the feasibility of leveraging existing ship and aircraft communications systems to evaluate local propagation conditions. This should include the identification of appropriate communication systems that could be leveraged, define any additional processing requirements, hardware modifications, system additions, and software modifications required to implement the capability. The design must be developed in sufficient detail to permit a reasonable evaluation of the approach, using either simulated data or measured data to demonstrate the feasibility of the capability.

PHASE II: Develop a working Prototype system and conduct a field demonstrations of the capability. Demonstrate the accuracy of the system, and demonstrate minimum modifications to existing systems and the ability to operate without dedicated manning by an operator. Validate the accuracy through instrumented field experiments. Develop a methodology to display RF capability and vulnerability to military operators.

PHASE III: The phase II prototype system will be integrated into onboard communications system and the Navy Integrated Tactical Environmental Sub-system (NITES) display system under the Nites Next Generation POR.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The technology successfully developed in this project will have multiple military and commercial applications. Military applications will include feedback to operational radar and communication systems to optimize performance with respect to operational range and minimized counter detection risks. Non-military applications will include the ability to apply this capability to provide improvements to numerous commercial communications systems such as microwave, WiMax, etc., and weather modeling, by improving the temporal and spatial resolution of measurements of the planetary boundary layer.

REFERENCES: 1) Kim, John C. & Muehldorf, Eugen I., "Naval Shipboard Communications Systems", Prentice Hall PTR 1995
2) Boithias, Lucien, "Radio Wave Propagation", McGraw-Hill Book Co., 1987
3) Hall, M.P.M., Barclay, L.W. & Hewitt, M.T., editors, "Propagation of Radiowaves", Institution of Electrical Engineers, 1996

KEYWORDS: communication systems, refractive environment, Anomalous propagation, radio frequency, spectrum, optimizing sensors

TPOC: Ed Mozley
Phone: (858)537-0230
Fax: (619)524-3034
Email: edward.mozley@navy.mil
2nd TPOC: Tom Piwowar
Phone: (619)524-7921
Fax: (619)524-3034
Email: thomas.piwowar@navy.mil

N07-140 TITLE: Diversity Combining for Fleet Broadcast receive

TECHNOLOGY AREAS: Information Systems, Electronics, Battlespace

ACQUISITION PROGRAM: Digital Modular Radio (DMR) ACAT III

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: The aim of this project is to analyze the use of and develop a software filter/correlator to combine space/phase separated UHF SATCOM signals in order to overcome antenna blockage and poor gain.

DESCRIPTION: The existing Fleet Broadcast receive systems provide omni-directional reception of UHF SATCOM Fleet Broadcast. they provide four antennas for spatial diversity which are phase shifted and combined in an external combiner before being sent to the radio. The Fleet Broadcast signals include a unique bit sequence to aid in determining the phase of each receive signal. In order to eliminate the legacy combiner, these four signals would instead be combined in a simple signal combiner, input to a single receive channel of a radio where the four signals would be separated, phase shifted and recombined to maximize signal quality. In the case where an antenna is blocked, the legacy combiner still sums in the noise from the blocked signal which can degrade S/N substantially.

This topic will determine if this problem can be solved in software vice the current hardware-only solution. It will also determine how mature the technology is and areas of focus as well as theoretical limits on data rates and waveform types and coding.

PHASE I: Develop algorithms for identifying the individual receive signals among the four combined spatially diverse Fleet Broadcast signals and then re-combining them to maximize signal quality. Compare performance through simulation of the processed Fleet Broadcast signal with the performance of the legacy combiner in a variety of conditions.

PHASE II: Implement the Fleet Broadcast combiner algorithms on prototype hardware that can interface with a radio RF receive input. Demonstrate performance of the combiner relative to a legacy combiner and radio for realistic test signals as well as for live Fleet Broadcast.

PHASE III: Integrate diversity combining design and evaluate performance in an operational environment.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This approach to diversity combining with minimal additional hardware would be useful for commercial applications.

REFERENCES: 1) Software Radio: A Modern Approach to Radio Engineering (Paperback), Jeffrey H. Reed, Prentice-Hall, 2002.
2) Communication Systems and Techniques, Schwartz, M.; Bennett, W. R.; Stein, S.; McGraw-Hill, 1966.
3) A blind multichannel combiner for long range underwater communications, Sharif, B.S.; Neasham, D.; Thompson, D.; Hinton, O.R.; Adams, A.E.; IEEE Int'l Conf. on Acoustics, Speech, and Signal Processing, Volume 1, pp 579 – 582, 21-24 April 1997.

KEYWORDS: Diversity Combining, Maximal Ratio Combining, Tactical Communications

TPOC: Charles Gooding
Phone: (619)524-7618
Fax: (619)524-7942
Email: charles.gooding@navy.mil
2nd TPOC: Sam Milligan
Phone: (619)553-2186
Fax: (619)553-2190
Email: samuel.milligan@navy.mil

N07-141 TITLE: Low Jitter Clocking and Distribution of Clocking in High Speed RZ Logic

TECHNOLOGY AREAS: Sensors, Electronics, Battlespace

ACQUISITION PROGRAM: PMw-180, Shipboard Signal Exploitation Equipment

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: The objective of this task is to insure that clock distribution errors do not prevent pulsed based (return to zero) digital logic from constructing complex circuits from clocking at aggressive (>20 GHz) rates.

DESCRIPTION: In both complex circuits and digitally steered active arrays, clocking can be problematic. Subdividing the circuit into smaller parallelized segments and then equalizing or compensating for differences in data transmission time to the points where the clock signal is impressed is a standard approach. However, as the clock speed rises, especially above 20 GHz, the number of devices that can be adequately synchronized by this approach diminishes, effectively keeping the maximum circuit size smaller than desired. The alternative approach of multiple, dispersed clocks require that each be slaved to a lower rate master clock. However, this adds noticeably to cost and can introduce short term errors such as cycle to cycle fluctuations and drift of average rate. These will still be independent and contribute to the effective clock jitter. A new method of distributing a pulsed based clock (sharper transitions) over large circuits is desirable.

PHASE I: Define an optimal scheme for clocking a spatially distributed digital circuits clocking at above 20 GHz and having <2% jitter. Design an experimental proof of concept test, conduct it, and evaluate the results. Determine a mathematical model that predicts as a function of circuit size and other parameters how uniform the circuit clocking will be for the tested distribution scheme.

PHASE II: Mature the concept device into a test of coherence of clocking over a 500 min device circuit and productize the result.

PHASE III: Integrate the optimized clocking scheme into complex circuits.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Active arrays are becoming widely popular as a way of realizing directional antennas. Thus this topic is relevant to the commercial communications world, especially the wireless one. Complex circuits are epitomized by consumer electronics. If there are to be any commercial applications of InP and other high speed semi- and super- conducting electronics, they will require this type of clock distribution system.

REFERENCES: 1) Walden, R. 2005

KEYWORDS: complex circuits, clock jitter, clock synchronization, clock screw, distributed clocking, aperture jitter

TPOC: Anna Leese de Escobar
Phone: (619)553-5987
Fax: (619)553-1090
Email: anna.leese@navy.mil
2nd TPOC: Deborah VanVechten
Phone: (703)696-4219
Fax:
Email: vanvecd@onr.navy.mil

N07-142 TITLE: Assessing the Impact of GPS Degradation Using Campaign-level Warfare Modeling

TECHNOLOGY AREAS: Information Systems, Battlespace, Space Platforms

ACQUISITION PROGRAM: PMW-170

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 integrate an engineering-level simulation of GPS receivers with a constructive large-scale model to show the impact of denial and spoofing of GPS signals at the campaign level. Develop a relevant campaign scenario to demonstrate proof of concept.

DESCRIPTION: The DoD has increasingly become reliant on the Global Positioning System for uses ranging from navigation, UAV control, precision weapons employment, ISR surveillance and targeting, and communications/network timing. Associated with this reliance is a growing threat capability to deny, degrade, or confuse GPS signals. While the DoD acknowledges this threat capability and the potential for it to be used in a hostile environment, GPS is still largely assumed to be intact in many military assessments.

PHASE I: Explore automated ways of linking engineering-level GPS models with campaign-level constructive models to capture the dynamics of GPS degradation. Consider approaches such as High Level Architecture, XML, and web-based paradigms for passing data between the models. Define data elements to be shared and the ways these data will be used. Develop a relevant campaign scenario to demonstrate proof of concept.

PHASE II: Using a relevant warfare scenario, model the impact of threat GPS denial through spoofing on US forces operating unmanned ISR platforms such as BAMS and UCAS-N. Coordinating with N8, SPAWAR 05, PMW-170 and other stakeholders, develop a study plan that outlines the study scope and objectives, the threat and US CONOPS, the modeling approach, the input data and data sources, and metrics that will be collected. Research data from approved sources such as N8 for authoratative scenario information, SPAWAR 05 for coordination with modeling and simulation interface models, and PMW-170 as the Navy's Navigation Program Office. Build a prototype application to test this arrangement. Execute the study and document the results in an annotated briefing.

PHASE III: Perform a complete implementation of the prototype application developed in Phase II and expand it to capture the impact of threat spoofing on GPS weapons and sensors. Demonstrate the new capability in a more extensive scenario with an updated threat laydown.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The resulting product would provide a Modeling and Simulation environment that could be used to assess the impact of denied or degraded GPS signals on any user of GPS signals, from commercial aviation to academia. This capability could be used by the Department of Homeland Security to explore vulnerabilities to terrorist actions and by any company that relies on the GPS to develop mitigating strategies in the event of GPS signal loss.

REFERENCES: Typical GPS physics based models references
1) For GPS Interfence And Navigation Tool (GIANT): http://giant.veridian.com/
2) For Navigation Tool Kit (NTK): http://www.stk.com/products/desktopApp/ntk/

For Campaign Level models
1) XML-Assisted Combined Simulation Using NETWARS and NSS (Alspaugh et al.), 2004 Fall Simulation Interoperability Workshop, Orlando, Florida 19-24 September 2004.
2) Network Modeling and Simulation to Support Warfare Analysis (Alspaugh et al.), 2004

KEYWORDS: GPS Vulnerability; GPS Simulation Assessment; Campaign Level Modeling; GPS Jamming; GPS Spoofing; GPS Interference Mitigation

TPOC: Kenneth Simonsen
Phone: (619)553 1251
Fax:
Email: kenneth.simonsen@navy.mil

N07-143 TITLE: Cognitive Radio Capability for Software Defined Radios

TECHNOLOGY AREAS: Information Systems, Electronics, Human Systems

ACQUISITION PROGRAM: JTRS-NED 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: The objective of this SBIR is to develop “Cognitive Radio” functionality that will enable Software Defined Radios (SDRs) to be capable of perceiving current network conditions and then learning, orienting, planning, deciding and acting according to end-to-end user’s goals.

DESCRIPTION: Software Defined Radios (SDRs) have the potential ability to implement cognitive radio technologies due to the nature of their complete software programmability. Conceptually, a “cognitive radio” is aware of its environment and intelligently adapts to the user’s needs by configuring itself to whatever combinations of waveform, protocol, operating frequency and networking are optimal. More simplistically, cognitive radio technology is generally thought of as “spectrum adaptability,” which was recently explored in the DARPA neXt Generation (XG) program. In this project, cognitive radios transitioned in and out of available spectrum bands as required, avoiding those frequencies that were already in use. This fast channel jumping characteristic should permit cognitive radio systems to seamlessly transmit voice, video, and data streams at operationally required speeds. Clearly, cognitive radio functionality extends beyond frequency control to many subsystems incorporated into SDRs: analog-to-digital conversion control, power amplifier control, waveform selection, network and data protocols, encryption, and so forth.

PHASE I: Leveraging the results of the DARPA XG program and other research in the field of cognitive radio development, the vendor will conduct analytical studies to identify feasible capabilities that can be incorporated into SDRs, specifically the JTRS family of radios. Based on this research, the vendor will deliver a design paper that presents expected performance capabilities that could be enabled with cognitive radio functionality integrated into all JTRS domains. In order to validate feasibility, the design paper should also define the cognitive radio functionality relationship with the JTRS Software Communications Architecture (SCA) and Application Programming Interfaces (APIs) and identify how it will work within the framework of this environment.

PHASE II: Demonstrate these adaptations in a modeling and simulation environment to show cognitive radio capabilities, such as improved spectrum utilization, within a realistic operational JTRS communications environment. In addition, the systems architecture for implementation of this capability within the JTRS family should be created at a sufficient level of detail to enable cost estimation and risk identification for implementation into the program.

PHASE III: Develop the Cognitive Radio capability product for use in JTRS radios. Perform Development Tests in simulated operational scenarios to verify that the performance of the capability is consistent with the expectations obtained from modeling. The software generated in this project is subject to NSA approval prior to incorporation into a JTRS radio, which will have national security requirements and impacts to the vendor. 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: Cognitive Radio technology has direct application in commercial communications applications, such as wireless telephony and high speed networked data, since SDR technology is emerging in future commercial communications systems. In addition, cognitive radio capabilities could greatly enhance the data throughput and availability of municipal/county/state/federal interoperable emergency communications systems, especially in the context of a Homeland Security operational environment.

REFERENCES: 1) Ian F. Akyildiz, Won-Yeol Lee, Mehmet C. Vuran, and Shantidev Mohanty,
"NeXt generation/dynamic spectrum access/cognitive radio wireless networks: A survey," Computer Networks Journal (Elsevier), Vol. 50, pp. 2127-2159, September 2006
2) BBN Technologies, AFRL-IF-RS-TR-2005-2B1, Final Technical Report, August 2005, "Next Generation (XG) Architecture and Protocol Development (XAP)"
3) http://SDRforum.com

KEYWORDS: cognitive; radio; software; XG; JTRS; SDR

TPOC: Bill Schemensky
Phone: (619)553-3619
Fax:
Email: bill.schemensky@navy.mil

N07-144 TITLE: <u>Small Buoy for Energy Harvesting</u>

TECHNOLOGY AREAS: Ground/Sea Vehicles, Sensors, Electronics

ACQUISITION PROGRAM: Communications at Speed and Depth

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: Devise a means for energy harvesting for a 3-inch diameter buoy free floating on the ocean surface. The buoy must also contain an antenna on the upper portion and electronics for the modem. Therefore the energy harvesting should occupy no more than 20 inches in length. The buoy should produce enough energy so that more than 4 milliwatts of power will be available for use at any one instance. Energy will be stored using a rechargeable battery. The battery should be able to store at least 60 joules.

DESCRIPTION: There are several energy harvesting concepts being evaluated for powering wireless sensors: solar, vibration, thermal and radioisotope. Choose and develop one methodology that is optimal for sea surface implementation.

PHASE I: Present a sea-surface energy harvesting solution for a small buoy. Demonstrate effectiveness of the candidate technology through mechanical and electrical modeling.

PHASE II: Fabricate a proto-type system and test with in water with wave action. Provide mechanical and electrical modeling results for various sea states and wave types (rolling waves in deep ocean and crashing waves in shore)

PHASE III: Examine ruggedizing the design for shock and vibration requirements for launch.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This could be an alternative means of energy and possibly utilized for larger scale ocean implementation for states with a coastline. This could also be implemented for buoy systems for the Coast guard, NOAA and Tsunami warning system.

REFERENCES: 1) “Harvesting Aware Power Management for Sensor Networks”
Kansal, A; Hsu, J; Srivastava, M; Raqhunathan, V;
Design Automation Conference, 2006 43rd ACM/IEEE
24-28 July 2006 Pages: 651 - 656
2) Hybrid power for wireless sensors, Lakeman, C.D, Fleig, P.F., DeGreeff J.L., Trainor, J.T., Proc SPIE Vol. 6231

KEYWORDS: buoys; energy harvesting; battery; submarine communications; communications at speed and depth; distributed network sensors

TPOC: Kimberly Hartka
Phone: (401)832-4744
Fax: (401)832-3303
Email: hartkaka@npt.nuwc.navy.mil
2nd TPOC: Julie LaComb
Phone: (401)832-5491
Fax: (401)832-3303
Email: LaCombJA@npt.nuwc.navy.mil

N07-145 TITLE: Automatic Code Generation and Testing Techniques for Real-Time Embedded Systems

TECHNOLOGY AREAS: Information Systems, Materials/Processes, Electronics

ACQUISITION PROGRAM: JTRS-NED ACAT I

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OBJECTIVE: Large software development programs for conventional operating systems utilize shared code modules and methodical development/test processes to ensure high quality code product; automated tools are available to reduce the labor and time required to implement these techniques. Although large software development programs for embedded applications and real-time operating systems also wish to use proven methodical development/test processes, they do not have effective automated tools available; this is due to the technical difficulty in automatically generating code that can execute with the efficiency required for a real-time embedded software application. Likewise, tools for rapidly validating the quality of manually or automatically generated code for embedded real-time systems are not available. Techniques for performing these coding and testing tasks need to be developed prior to the ability of industry to produce a complete product suitable for a programmer's use.

DESCRIPTION: The Joint Tactical Radio System (JTRS) is an example of a large scale software project developing code for an embedded application with a real-time operating system. Code modules are reused among a family of communications systems that are developed by different military services and vendors. This approach is being used to ensure code module reusability and interoperability. To achieve this portability, JTRS software must comply with a suite of JTRS standards. Other defense and commercial enterprise programs use similar concepts and techniques.

PHASE I: Survey industry and available technology; identify requirements and specifications; and develop a system concept and architecture. Perform proof-of-concept demonstration to validate one or more identified techniques. Develop a preliminary system design in sufficient detail to support a cost estimate and risk assessment for a Phase II project.

PHASE II: Develop a tool system concept, architecture, and a set of techniques suitable for the translation of draft C++ and VDHL-code into a compliant product. For the purpose of the Phase I demonstration, it is acceptable for the tools to integrate an open source product, such as an XML editor, into a complete tool package. Develop a prototype, with limited capability, that generates C++ and VDHL code that is compliant with accepted industry standards.

PHASE III: Transition the tool system and concept developed in Phase II into a scalable platform that can be developed into a complete product. The product, based upon the open-source Eclipse development platform, should include an embedded help system. A successful demonstration will generate code that is verified to be in compliance with specific JTRS software standards. The software created by the automatic code generation capability of this project is subject to NSA approval prior to incorporation into a JTRS radio, which will have national security requirements and impacts to the vendor.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Software Defined Radios and other sophisticated hardware devices with embedded real-time operating systems are emerging into commercial industry (such as wireless devices and requisite cellular base stations) and non-DOD government agencies (such as interoperable Homeland Security communications among municipal, county, state, and federal agencies). The Phase III product could be commercialized by the vendor; a service would be offered to customize the software generation and testing capability to meet the specific requirements of the customer.

REFERENCES: 1) Software Communications Architecture (SCA) Version 2.2.2, 15 May 2006, http://jtrs.spawar.navy.mil/sca/
2) Stephens, D.R., Salisbury, B., Richardson, K., "JTRS Infrastructure Architecture and Standards", MILCOM 2006, Washington, D.C.
3) JTRS Infrastructure Architecture, Version 1.0, 22 December 2006.
4) http://www.eclipse.org/

KEYWORDS: code; generation; test; software; embedded; JTRS

TPOC: Phil Chen
Phone: (619) 553-2858
Fax:
Email: chenpi@spawar.navy.mil

N07-146 TITLE: Business Process Transformation Tool for Rapid Reconfiguration of Navy Systems

TECHNOLOGY AREAS: Information Systems

ACQUISITION PROGRAM: GCCS-M, NTCSS, JPMIS, CLIP

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 Business Process tools and technologies that can be used represent services and data provided by Navy C4I systems while providing mechanisms that can transform these disparate systems according to a Service-Oriented paradigm.

DESCRIPTION: Navy C4I capabilities are supported by systems that provide Intelligence, Surveillance, and Reconnaissance (ISR), Command and Control (C2), and Fire Control (FC). These systems are fairly stove-piped in nature and require the resolution of disparate data models, messages, interfaces, and services across domains to address mission objectives in a manner that adheres to Business Processes. To assist in resolving these disparities, the Navy has defined the concept of FORCEnet Engagement Packs (FnEP) to align data models, messages, and services across diverse platforms and systems. Techniques used to address such disparities have included the use of data transformations, data filters, channel-based transformation operators, and even multi-level security based approaches. While these approaches have leveraged a rich state-of-the-art covering distributed information management techniques and multi-level data modeling to resolve information disparities, these techniques are fairly static in nature – meaning they are often implemented during system integration and are not reconfigurable in nature.

To address information disparities over evolving net-centric environments, the Navy is searching for technical approaches that will result automated Business Process Modeling tools and technologies that can be used to guide and analyze the reconfiguration and transformation net-centric systems on the fly. Such tools should build on basic FnEP technologies and Business Process modeling concepts to provide a means to reconfigure data models, messages, and services in a manner that addresses mission objectives, while infusing those models with real-time data extracted from the distributed enterprise. This effort should perform research into approaches that can take advantage of the inherent structure of common data models and XML-based schemas to capture data and present that data to the BPM domain. The approach should also consider the use of soft-computing (neural networks, genetic algorithms, fuzzy sets, simulated annealing) approaches to optimize the grouping of services and re-structuring of data flow across the distributed enterprise in support of mission objectives and overall system performance. Evaluation of the technology should demonstrate how that approach can be guide the transformation of systems into a cohesive Service-Oriented solution that utilizes common data models and services for a given FnEP while ensuring performance and Quality of Service guarantees are met.

PHASE I: Perform research into types of systems, data models, and services utilized in support of FORCEnet Engagement Packs and use that information to design a technology that can guide the reconfiguration of systems across the distributed enterprise with regard to mission objectives, while using Business Process models. Use simulation to verify that the solution can be shown to re-configure and re-allocated assets “on-the-fly” to re-constitute a new capability due to changing mission requirements as a proof-of-concept.

PHASE II: Develop and demonstrate full-fledged prototype of the Business Process Transformation Tool that adheres to the architecture defined in the Phase I proof of concept. Implement the prototype tool in a controlled setting in a Navy Laboratory and demonstrate its application in support of several FnEPs covering several C4ISR systems. Demonstrate how solutions developed can be used to guide the reconfiguration and reallocation of Navy assets.

PHASE III: Demonstrate the full-fledged Business Process Transformation Tool as part Advanced Concept Demonstration or a Fleet Battle Experiment. Demonstrate how the tool can be used to rapidly transform information flow between services in support of the reconfiguration and reallocation of Navy assets.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Operational agility is accomplished by composing, then orchestrating, information from various disparate and geographically dispersed services into business or mission-oriented application. The Business Process Transformation Tool removes the software developer from the loop and hands the role back to subject matter experts who better understand the operational requirements of the current mission, thus allowing mission-oriented capabilities to be quickly composed in response to new challenges, requirements, or demands in ways we have never seen before. Both Commercial and military capability packages will be readily assembled from their users, and customers. These SME, along with their respective business processes, will be tailored to meet the mission needs of the business community or the Joint Force Commander.

REFERENCES: 1) Cerami, Ethan, Web Services Essentials. O'Reilly Publishing.
2) For a description and definition of orchestration, see the Burton Group: Orchestrating Web Services: Driving Distributed Process Execution through Workflow Technology, December 18, 2003.
3) Frank Leymann and Dieter Roller. Business Processes in a Web Services World. IBM, 1 August 2002. http://www-106.ibm.com/developerworks/webservices/library/ws-bpelwp
4) http://www.omg.org/mda

KEYWORDS: BPEL4WS; Business Process; Orchestration; SOAP; UDDI; XML; SAML;

TPOC: Charles Schwartz
Phone: (619)804-3204
Fax:
Email: charles.schwartz@navy.mil
2nd TPOC: Mark Langfelder
Phone: (619)524-3320
Fax:
Email: mark-langfelder@navy.mil

N07-147 TITLE: Microwave switches for cryogenically cooled RF receivers

TECHNOLOGY AREAS: Materials/Processes, Electronics, Battlespace

ACQUISITION PROGRAM: PMw-180, Shipboard Signal Exploitation Equipment

OBJECTIVE: The objective of this task is to develop, propose and build very low loss microwave switches for use in cryogenic, high vacuum environment. the resulting switches must out perform current room temperature switches while operating at cryogenic temperatures under high vacuum and must be able to handle high power levels up to 33dBm as well as endure thousands of temperature cycles and tens of millions of switching cycles or better at speeds of at least 10 microseconds.

DESCRIPTION: Cryogenically cooled components and receivers require unique component design. Components experience and must be operational at 60 Kelvin under high vacuum for the life of the system. The winning proposal will in Phase I Propose clear technical solutions for very low loss microwave analog switches (30 MHz-20GHz) designed to operate at 60K under vacuum.

PHASE I: Develop new switch design and/or prove feasability of Commercial Off The Shelf (COTS) switches. Review and incorporate any known results on cryogenic microwave switches and consider the military operating environment.

PHASE II: Complete designs and build and test at temperature, vacuum and speed. The Government will help identifiy specific speeds and vacuum requirement as well as addressing environmental shock and vibration specifications. Prepare successful devices for productization in Phase III, e.g. consider cost, logistics and manufacturing in choosing the best design.

PHASE III: Productize and integrate swiches into industry and Government systems.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Superconducting devices are beginning to come into the mainstream, from notch filters in cell phone base stations, to magnetoencephalography which is fast becoming an essential tool for mapping functional brain activity, to various geophysical exploration instrumentation. There should exist a market now for good cryopackaging as described above.

REFERENCES: 1) Filter subsystems for wireless communications, Scharen, M.J. et al, Applied Superconductivity, IEEE Trans, Jun 1997
Vol 7, Iss 2, Pt 3, pp. 3744-3749
2) "Superconductor technology for wireless networks" Stephen M. Garrison, Mobile Radio Technology, Sep 1, 1997.
3) I. Hilerio, J. Reid, Y. Vlasov, T. Babij, G. Larkins, A Microelectromechanical Capacitive Switch for Superconducting RF Applications. 1998 Applied Superconductivity Conference, Palm Desert, California, ASC-98 Program, EQB-02, p. 137 (1998)
4) B. A. Willemsen, "HTS Filter Subsystem for Wireless Telecommunications," IEEE Transactions on Applied Superconductivity, Vol. 11, No. 1, March 2001, pp. 60-67.
5) H.Zhang, V. Bright, C. Lee, K. Gupta, Mechanical and electrical design of a novel RF MEMS switch for cryogenic applications. SPIE proceedings vol. 4931, pp. 372-376, (2002)
6) Superconducting microwave filter systems for cellular telephone base stations
R. Simon, R. Hammond, S. Berkowitz, B. Willemsen, Proceedings of the IEEE <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5> , Vol 92, pp 1585-1596 (2004)

KEYWORDS: superconductor, YBCO, CMOS, cryoelectronics, silicon-on-sapphire (SOS)

TPOC: Anna Leese de Escobar
Phone: (619)553-5987
Fax: (619)553-1090
Email: anna.leese@navy.mil
2nd TPOC: Edmond Wong
Phone: (619)553-2824
Fax: (619)553-3498
Email: edmond.wong@navy.mil
3rd TPOC: William Kordela
Phone: (619)524-7316
Fax: (619)524-7374
Email: william.kordela@navy.mil

N07-148 TITLE: High Dynamic Range Analog to Digital Converter (ADC) Utilizing Large Signal Subtraction or Cancellation

TECHNOLOGY AREAS: Electronics, Battlespace

ACQUISITION PROGRAM: PMw-180, Shipboard Signal Exploitation Equipment

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: The objective of this task is to design and develop a high dynamic range Analog to Digital converter, implementing unique architechture and technology to bring accurate detection of small signals (at the environmental noise limit) in a high power (up to 33dBm) environment.

DESCRIPTION: This task will provide new architectures addressing the need for High Spur Free Dynamic Range in Co-site environments such as shipboard platforms. Accurate subtraction of unwanted signals at the front end of a receiver is a challenge and if performed successfully, enables and enhances the operation of the receiver in a high

EMI environment, such as that present on military platforms with multiple communication systems and radar systems operating simultaneously. If successful, this ADC circuit will enable multiple strategies for combating interference in Radio Frequency (RF) receivers providing better dynamic range utilization by removing undesired high power signals before the final quantization. This task should be performed while adding minimal or no noise onto the incoming signals which need digitization and further processing downstream. We plan to use this technique in addition to analog techniques at the front end of a system and therefore are specifying here techniques which are an integral part of the digitization process itself, neither analog microwave (e.g. filtering and limiting) nor post digitization (digital filtering) techniques will be considered. We are specifically looking for new ADC architectures which can acheive this goal.

PHASE I: Design and describe an ADC architecture which provides accurate subtraction of incoming high power signals in order to provide optimal utilization of dynamic range in the quantization process of the converter.

PHASE II: Build, and test this ADC in realistic military RF environments. The Government will suggest the specifics of these environments in an unclassified manor during the Phase I project.

PHASE III: The results the ADC dexcribed here should result in sigificant interest from any community experiencing significant Electromagnetic Interference. In a Phase III, it is expected that this ADC into a receiver system design for SIGINT or other military use.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This type of ADC will also be useful to commercial communication systems - wireless technologies.

REFERENCES: 1) S.R. Norsworthy, R. Schreier, and G.C. Temes, Delta-Sigma Data Converters: Theory, Design, and Simulation, New York: IEEE, 1997.
2) O. Mukhanov, D. Gupta, A. Kadin, and V. Semenov, “Superconductor Analog-to-Digital Converters,” Proc. of the IEEE, vol. 92, pp. 1564-1584, Oct. 2004.

KEYWORDS: Dynamic Range; Flux Subtractor; ADC; Interference; Signal Canceller; Superconductivity

TPOC: Anna Leese de Escobar
Phone: (619)553-5987
Fax: (619)553-1090
Email: anna.leese@navy.mil
2nd TPOC: William Kordela
Phone: (619)524-7316
Fax: (619)524-7374
Email: william.kordela@navy.mil

N07-149 TITLE: Extended Frequency Range Wide Band RF Distribution System for Shipboard Systems

TECHNOLOGY AREAS: Sensors, Electronics

ACQUISITION PROGRAM: PMW-180, Ship Signal Exploitation Equipment

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 build an extended frequency (2-18 GHz) RF distribution system (RFDS) for shipboard wide-band receivers. The RFDS must provide a low noise RF path from shipboard antennas to below decks processing electronics while operating in a high electromagnetic interference (EMI) environment. The system will optimize both sensitivity and selectivity over the entire band simultaneously. The system will also provide EMI mitigation geared toward maximum high power protection and maximized probability of detection.

DESCRIPTION: The shipboard use of wide-band receivers requires the ability to detect signals at or near the thermal noise floor. This requires the overall system to have a low noise figure and a high spurious free dynamic range. In addition, these missions must be performed in an extremely harsh EMI environment over a large frequency range. Future RFDS requirements will extend the operating frequency range from 3 MHz through 18 GHz. This extension requires new and innovative approaches to EMI mitigation. Further, creative approaches to increasing intercept points and reducing noise figures for components in the extended frequency ranges is necessary.

The focus of this topic is to model, develop, and demonstrate technologies for required to develop an RFDS for the extended frequency band (2-18 GHz). These demonstrated technologies shall be required to meet specification and probability of detection requirements while operating in the shipboard environment.

The maximum sensitivity will be defined as the minimum discernable signal (thermal noise plus 10 dB) plus a system noise figure of 3 dB (including cabling losses). The SFDR shall be no less than 100 dB through the frequency range. Any EMI mitigation techniques employed shall not effect degrade specifications in adjacent channels, should be reactive, and shall minimize impact on probability of detection. Further, if any EMI mitigation technique employed is digital, the digitization must be at least 16 bits and must maintain dynamic range requirements.

The size and weight should be form-fit (or less) of the current system, operate on 120 VAC/60 Hz, and tolerate temperature ranges of -30F to 140F for external components (if any) and 30F to 120F for internal components.

PHASE I: Develop basic technology concept and prove concept feasability using modeling and simulation for link analysis as well as key challenging components in a system design. Technologies chosen should push the state of the art and challenge areas for Phase II demonstration should be identified.

PHASE II: Design and construct an engineering prototype to be demonstrated at the end of this phase. The demonstration will include preliminary field tests. Classified tasks may be required to complete this phase.

PHASE III: Refine the prototype developed in phase II so that it can be fabricated and evaluated by operational forces. The refined prototype should be sufficiently close to production models so that field tests will demonstrate the operational benefit of the new technologies. These field trials will be the basis for additional modifications as well as any subsequent procurement decisions.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: For civilian uses, this technology can be used to provide situational awareness for a variety of homeland security applications such as border monitoring, port security, high value (power plants, chemical plants, water plants, etc.) facility protection. Other civilian applications include acquisition and location of cell phones and mobile emergency signals for quick response.

REFERENCES: 1) "Digital Techniques for Wideband Receivers" 2nd Edition, James Tsui, Artech House, May 2001
2) "Superconductor technology for wireless networks" Stephen M. Garrison, Mobile Radio Technology, Sep 1, 1997.

KEYWORDS: RF distribution, low noise, direction finding, electronic attack, communications,EMI, high-Q, wide band

TPOC: Anna Leese de Escobar
Phone: (619)553-5987
Fax: (619)553-1090
Email: anna.leese@navy.mil
2nd TPOC: William Kordela
Phone: (619)524-7316
Fax: (619)524-7374
Email: william.kordela@navy.mil

N07-150 TITLE: Packaging and signal transfer hardware for cryogenically cooled RF receivers

TECHNOLOGY AREAS: Materials/Processes, Electronics, Battlespace

ACQUISITION PROGRAM: PMw-180, Shipboard Signal Exploitation Equipment

OBJECTIVE: The objective of this task is to develop, propose and build standardized packaging for cryogenically cooled RF systems, so that regardless of cryocooler choice, components needing cryogenic cooling will have standardized reliable and effective interfaces with the temperature stages and at the electrical and/or optical ports to the system.

DESCRIPTION: Cryogenically cooled components and receiver require unique packaging. The packaging is key for several reasons: Reliability, efficiency and performance of the system are all dependent on properly designed and fabricated packaging. While significant investment has been made into low temperature technologies, investment in the overhead functions of those technologies is practically non existent and is preventing transition to military qualified systems. Packaging standardization needs to be proposed and adopted for analog, high speed digital and optical signal transfer between 4 Kelvin, 60 Kelvin and 300 Kelvin. Techniques for minimizing the effects of cryocooler vibrations are also needed. These tasks would include; packing of closed cycle cryocooler (SHI 4 K cryocooler or other) into a 19" rack, including compressor and coldhead; significantly reducing vibrations on coldhead while maintaining large percentage of cooling power; cryocooler motor modifications to improve efficiency; cryocooler motor modifications to reduce vibrations; simultaneous implementation two items above. The winning proposal will in Phase I Propose clear technical solutions to thermal, mechanical and electrical interface and transfer issues for microwave analog (30 MHz-20GHz), high speed digital (to 40GHz) and optical (multiple beams) signals moving from room temperature to 4 Kelvin and back without losing signal quality and using cryocooler lift most optimally. The Government will help define the candidate system.

PHASE I: Determine all interfaces and packaging requirements for a complex RF system utilizing 4 Kelvin, 60 Kelvin in one cryocooled system. Propose clear technical solutions to thermal, mechanical and electrical interface and transfer issues for microwave analog (30 MHz-20GHz), high speed digital (to 40GHz) and optical (multiple beams) signals moving from room temperature to 4 Kelvin and back without losing signal quality and using cryocooler lift most optimally.

PHASE II: Complete designs and build and test cryopackaging components in realistic RF system environment on cryocooler. Military environment specifications should be considered in the choice of designs as should the idea of industry standardization to promote progress and electrical signal quality required to send very small, fast signals out of the cold environment.

PHASE III: Provide cryopackaging components and solutions to industry and Government systems.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Superconducting devices are beginning to come into the mainstream, from notch filters in cell phone base stations, to magnetoencephalography which is fast becoming an essential tool for mapping functional brain activity, to various geophysical exploration instrumentation. There should exist a market now for good cryopackaging as described above.

REFERENCES: 1) B. A. Willemsen, "HTS Filter Subsystem for Wireless Telecommunications," IEEE Transactions on Applied Superconductivity, Vol. 11, No. 1, March 2001, pp. 60-67.
2) D. Gupta, A.M. Kadin, R.J. Webber, et al., "Integration of Cryocooled Superconducting ADC and SiGe Output Amplifier," IEEE Trans. Appl. Supercond. vol. 13, pp. 477-483, June 2003.

KEYWORDS: superconductor, YBCO, CMOS, cryoelectronics, silicon-on-sapphire (SOS)

TPOC: Anna Leese de Escobar
Phone: (619)553-5987
Fax: (619)553-1090

Email:	anna.leese@navy.mil
2nd TPOC:	Edmond Wong
Phone:	(619)553-2824
Fax:	(619)553-3498
Email:	edmond.wong@navy.mil
3rd TPOC:	William Kordela
Phone:	(619)524-7316
Fax:	(619)524-7374
Email:	william.kordela@navy.mil

N07-151 TITLE: Caching Software Updates Over a Wide Area Network

TECHNOLOGY AREAS: Information Systems

ACQUISITION PROGRAM: GCCS-M, NTCSS

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: This effort will develop a technology that supports the caching and dissemination information over tactical networks. The technology will allow for the seamless deployment and dissemination of software, data objects and messages over tactical networks.

DESCRIPTION: GCCS-M is deployed on approximately 400 mostly ship-board sites with limited and intermittent communications. Improved update and repair of GCCS-M and similar C4I applications require a managed update process to avoid degradation of services across platforms. To reduce update times for such C4I applications, techniques and technologies are needed that promote the caching software objects at remote nodes. These approaches can better manage data and software objects across the enterprise while ensuring the persistence of any C4I information at remote nodes on the tactical network. Current solutions to such challenges include the use of Tactical Storage Systems, which utilize abstraction techniques to allow users to access storage systems for any reachable node on the network, or Tactical Service Oriented Architecture (SOA) based caching techniques, in which architectures use mid-tier data caching techniques to store data on available nodes in their native format. While these techniques have been effective for caching information over a wide area network, they fall short in terms of performance, QoS, and memory storage requirements when Mobile Ad Hoc Network (MANET) architectures are considered.

The Navy is searching for novel caching protocols and storage techniques that can be deployed over tactical MANET environments to enhance the delivery of data objects. The offeror’s approach should investigate techniques for storage organization and optimization at mobile nodes, cache replacement strategies, long-haul caching protocols, compression mechanisms, adaptive link caching and distributed data caching. Additional caching approaches using predictive analysis and game theory should also be investigated. The resultant caching technologies shall be implemented in a SOA to provide storage and dissemination mechanisms as services that can be hosted at distributed nodes. Selected strategies and designs should be evaluated while addressing performance, QoS, and memory storage concerns pertinent to challenged environments

PHASE I: The Phase I should research the state-of-the-art in tactical Service-Oriented Architecture storage implementations and MANET caching mechanisms that can be used to define a storage architecture that supports the enterprise-wide update cycle for mobile environments. The Phase I effort will design and evaluate promising aspects of this architecture through the use of simulation and analysis to demonstrate how updates can be cached at remote nodes and delivered to clients requirements those updates. The Phase I proof-of-concept will assess various caching and updating strategies on bandwidth utilization, update efficiency, and cache memory requirements.

PHASE II: Phase II will build on the approach utilized for the Phase I proof-of-concept to build a full-fledged prototype that caches the updates at remote sites while providing the updates to clients as needed. The Phase II effort will also demonstrate the desired capabilities within the context of a controlled lab environment while evaluating the solution with regarding to bandwidth utilization and cache memory requirements and expected performance degradation over a distributed enterprise for a given system such as GCCS-M.

PHASE III: Phase III shall demonstrate the required capability within an operationally by taking part in an Advanced Concept Demonstration, a Limited Objective Experiment, or a Fleet Battle Experiment.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Any distributed industry / business that has periodic logical upgrades which need to be delivered would benefit. This technology would specifically target distributed environments with limited connectivity.

REFERENCES:

1) J2EE Specification
2) “File Distribution and Caching in MANET” http://zeus.elet.polimi.it/is-manet/Documenti/tecRep-disi-1.pdf
3) Lim, Sunho, et al. “A Caching Mechanism for Improving Internet Based Ad Hoc Networking Performance.” http://www.cse.psu.edu/hpcl/papers/slim_www03.pdf
4) Consistency of Cooperative Caching in Mobile Peer-to-Peer Systems. IEEE Computer Magazine. Feburary 2004.
5) “An Adaptive Link Caching Scheme for On-Demand Routing in MANETS”. http://www.item.ntnu.no/~jiang/publications/c-pimrc03.pdf

KEYWORDS: J2EE; Tactical Networks, Adaptive Link Caching; cache; MANET; software updates

TPOC: Charles Schwartz
Phone: (619)804-3204
Fax:
Email: charles.schwartz@navy.mil
2nd TPOC: Mark Langfelder
Phone: (619)524-3320
Fax:
Email: mark-langfelder@navy.mil

N07-152 TITLE: Advanced Metamaterial (MTM) Rapidly Reconfigurable Common Aperture Antenna

TECHNOLOGY AREAS: Sensors, Electronics, Battlespace

ACQUISITION PROGRAM: PMW-180, Ship Signal Exploitation Equipment

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: Utilizing advanced metamaterial (MTM) technology, numerical simulation of MTM structures, MTM relevant optimization algorithms and design concepts, develop a high-efficiency, multi-octave, common aperture antenna system capable of rapidly reconfiguring to accommodate a rapidly changing communications environment.

DESCRIPTION: As the number of antenna systems on individual military platforms grows, so do the problems of co-site interference, cost, maintainability, reliability, and weight. One solution to this situation is to provide multiple functions from each antenna aperture and its associated circuitry. This might be accomplished by the integration of developing technologies to provide the ability to reconfigure operational frequency, bandwidth, or radiation pattern.

The objective of this SBIR is to encourage the application of emerging technologies affording rapidly tunable or reconfigurable abilities leading to the fabrication of enhanced functionality antennas for future multifunction RF systems. Among the emerging technologies that potentially afford significant contribution to next generation common aperture antenna development is the class of materials termed metamaterials. Metamaterials are man-made materials which offer electromagnetic properties (from microwave to optical frequencies) that cannot be found among natural materials; e.g., negative refractive index. It is envisioned that electromagnetic metamaterials shall play a key role in providing new functionalities and enhancements to multifunctional, smart, compact antennas. Understanding and application of metamaterial structures requires new insight into the physics of electromagnetics in relatively complex environments. Moreover, numerical simulation of MTM structures remains a very challenging problem: the required accuracy of the solution still exceeds the capability of commercially available electromagnetic solvers. Finally, fabrication and characterization of MTMs will require the development of specific technologies incorporating recent developments in micro- and potentially nano-technology.

From a systems perspective, the use of MTMs in systems will require new trade-offs that will influence the whole development process from purely theoretical to fabrication. The potential afforded by this technology is anticipated to resolve in the near future some of the current problems associated with conventional subsystems; thereby resulting in the practical realization of more efficient and intelligent antenna systems.

PHASE I: Develop detailed conceptual designs for a high-efficiency, small form factor, two-octave (UHF through L-band) common aperture antenna exploiting MTM structures. The preferred solution set will be determined by application of MTM-specific simulation and optimization algorithms. The resulting design shall yield a rapidly reconfiguration common aperture antenna capability while simultaneously affording maximal gain and minimal sidelobe characteristics. Key in the selection is reconfiguration speed and path to future system manufacturability.

PHASE II: Utilizing phase I results, design, fabricate and demonstrate a prototype, rapidly reconfigurable, common aperture antenna capable of concurrently receiving/transmitting multiple waveforms within UHF through L-band. Investigate and define the packaging and I/O requirements to ensure suitability for shallow depth, conformal mount integration.

PHASE III: Working with sensor system OEMs, fabricate an advanced common aperture antenna satisfying shipboard communications requirements. Demonstrate the resulting common aperture antenna system with fielded shipboard SIGINT or communications system.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Rapidly reconfigurable common aperture antenna applications are needed on a wide range of civilian and military sensor systems.

REFERENCES: 1) “Negative-Refraction Metamaterials, Fundamental Principles and Applications”; Edited by George V. Eleftheriades and Keith G. Balmain; July 2005, Wiley-IEEE Press.
2) “Metamaterials”; Editor(s): Tomasz Szoplik, Ekmel Özbay, Costas M. Soukoulis, Nikolay I. Zheludev; ISBN: 0-8194-5962-3; Sep 2005; Proceedings of SPIE Volume: 5955.

KEYWORDS: metamaterials; reconfigurable; aperature; antennas; broadband; negative refractive index

TPOC: Anna Leese de Escobar
Phone: (619)553-5987
Fax: (619)553-1090
Email: anna.leese@navy.mil
2nd TPOC: William Kordela
Phone: (619)524-7316
Fax: (619)524-7374
Email: william.kordela@navy.mil

N07-153 TITLE: Runtime Integration of NETWARS with Warfare Assessment Models

TECHNOLOGY AREAS: Information Systems, Battlespace

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

OBJECTIVE: To develop a standard warfare assessment simulation interface based on the High Level Architecture (HLA) for communications models such as NETWARS

DESCRIPTION: NETWARS is the emerging DoD standard communications modeling framework for use by operational, analysis, and acquisition activities within the Department. One of the key concepts of the NETWARS architecture is the distributed simulation capabilities of the framework based on use of HLA. Using HLA as a means to integrate communications models such as NETWARS, and warfare assessment models provides capabilities to test and demonstrate communications architecture performance within the context of a virtual battlefield environment, and provides capabilities to capture effects from detailed communications modeling and their effect on overall theater force performance.

Current practice uses static methods based on data file transfer using XML based tools to move data between communications models and warfare models. This methodology neglects the feedback paths that exist between the use of the communications architecture, and the performance of the combatants within the theater. Actions taken by combatants mediated by the communications architecture can affect the other combatants in the theater, potentially resulting in a different message event stream than what was originally used to generate communications architecture parameters, thus invalidating the model of communications used in the warfare assessment model. Runtime integration of the models captures the effects of these feedback paths.

To achieve runtime integration using HLA requires the development of object models, interface software, and runtime tools for both the communications models and the warfare assessment models. Development of this integration toolset is the subject of this SBIR activity.

PHASE I: Identify the desired capabilities of the runtime interface toolset for NETWARS. Develop a Base Object Model (BOM) for the objects and interactions involved in the interface. Evaluate design approaches and select a design approach and implementation approach.

PHASE II: Develop a prototype implementation for NETWARS of the Implement the BOM within the context of selected Federation Object Models (FOMs) already implemented within an example warfare assessment simulation, NSS. Develop prototype support tools to ease the use of HLA federations for analysis purposes.

PHASE III: Expand the capabilities of the NETWARS runtime interface toolset and productize, including production of documentation, and implementation of quality assurance, configuration control, and product support.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The resulting product would provide a valuable modeling and simulation toolset for private defense industry, and other private sector companies whose products must interoperate in complex information networks.

REFERENCES: 1) C. Alspaugh, T. Hepner, C. Tran, W. Youm, A. Legaspi, S. Ferenci, R. M. Fujimoto. M. Choi, J. Monroe, J. Sonnenshein, J. Ocheltree, "NETWARS-NSS Integration and Federation: Design, Implementation, and Lessons Learned," 2004 Fall Simulation Interoperability Workshop, September, 2004
KEYWORDS: Architecture; Models; Simulation; Assessment; C4ISR; Modeling

TPOC: John Isaacson
Phone: (619)524-7962
Fax:
Email: john.isaacson@navy.mil
2nd TPOC: Bill Rix
Phone: (619)524-7416

Fax:
Email: bill.rix@navy.mil

N07-154 TITLE: Multi-carrier VHF/UHF amplifier with suppressed intermodulation products

TECHNOLOGY AREAS: Information Systems, Electronics, Battlespace

ACQUISITION PROGRAM: PMW-770 Digital Modular Radio (DMR) ACAT III

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 a four to eight channel VHF/UHF power amplifier with adaptively controlled low intermodulation distortion and maximized output power. From experience, it is known that running the outputs of separate power amps into hybrid combiners causes undesirable power losses and that driving a nonlinear amplifier with the combination of multiple individual inputs causes undesirable intermodulation products.

DESCRIPTION: When an amplifier amplifies more than one signal it also mixes these signals such that two singnals in become four: The two originals and the sum and difference of the two originals. These added signals are referred to intermods and are not desirable.

In theory, when a good description of the nonlinear behavior of a power amplifier is available, intermodulation products resulting from combining several inputs can be predicted. That prediction can then be used towards mitigation of those intermodulation products. Instead of counting on having a good description of the nonlinear behavior - or of it remaining the same with changes in time, power, input, etc – adaptive approaches can be used. The goal of this topic is to develop an adaptive approach that would remove the intermodulation products.

PHASE I: Study potential approaches for the (discrete- or continuous- or hybrid-time) adaptive estimation of intermodulation distortion products (so that they can be canceled by subtraction).

Characterize the performance of a conventional amplifier while amplifying 2, 4, and 8 input signals.

Establish reference measures for what level of intermods are generated and how much suppression is required to achieve proper output.

Assess the various commercial and DOD approaches to dealing with the intermod problem and make a recommendation for which would be the best value.

PHASE II: Develop a prototype implementation of the approach(es) from Phase I that is (are) deemed most likely to be successful.

Perform test and analysis of the various key components, such as field effect transistor (FET) types, that would needed to be improved upon to meet the required performance of a multichannel amplifier.

PHASE III: Phase III would entail the government making a design change to the current communications baseline architecture. This change would be to use the new multichannel amplifier in place of the existing single channel amplifiers. The contractor would be providing the new multichannel amplifiers.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: There may be quite a bit of potential here. The private sector still uses the VHF and UHF frequency bands and is likely confronted with the same technical issues. This multi-channel PA would be useful for commercial SATCOM applications also.

REFERENCES: 1) R. Gupta, S. Ahmad, R. Ludwig, and J. McNeill, Adaptive Digital Baseband Predistortion for RF Power Amplifier Linearization, High Frequency Electronics, September 2006.
2) A. Talwar, Reduction of Noise and Distortion in amplifiers Using Adaptive Cancellation, IEEE Microwave Theory and Techniques, June 1994.
3) S. Grant, J. Cavers, and P. Goud, A DSP Controlled Adaptive Feedforward Amplifier Linearizer, 1996.

KEYWORDS: PA, UHF, VHF, Intermodulation products

TPOC: Charles Gooding
Phone: (619)524-7618
Fax: (619)524-7942
Email: charles.gooding@navy.mil
2nd TPOC: Sam Milligan
Phone: (619)553-2186
Fax: (619)553-2190
Email: samuel.milligan@navy.mil

N07-155 TITLE: Efficient Linear Broadband RF Power Amplifier Technology

TECHNOLOGY AREAS: Information Systems, Electronics

ACQUISITION PROGRAM: JTRS-TD 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 Radio Frequency (RF) power amplifier technology with sufficient linearity and efficiency to enable the transmission of multiple simultaneous narrowband and broadband channels in the 2 to 2000 MHz spectrum at up to 200W continuous duty in a compact and robust package suitable for military ground mobile and aircraft use.

DESCRIPTION: An objective of the emerging generation of Software Defined Radios (SDRs) is to enable users to adapt their communications capability to their immediate operational need, which may be narrowband or wideband communications across a broad RF spectrum. One of the key shortfalls in implementing this capability is the linearity of conventional broadband solid-state RF power amplifiers. In order to avoid an unacceptable level of intermodulation products, conventional power amplifiers must be operated in a near “Class A” mode of operation; this would require a power amplifier of unacceptable size, power consumption, and heat dissipation for use in mobile platforms or handheld/man-pack applications. Neither RF power amplifiers available from commercial vendors nor those currently being developed by the Navy’s vendors can meet the high output requirements of military tactical communications; as a consequence, multi-channel operation or power output capability must be severely constrained. A 50-75% improvement in efficiency over the current state of the art is required to achieve linear ultra-broadband (2 MHz to 2 GHz) performance in a compact form factor suitable for aircraft, submarine, ground mobile, and handheld form factors. A fundamentally new power amplifier design is required that may require the use of compound semiconductors such as Gallium Nitride to obtain high power and high bandwidth, the use of advanced Digital Signal Processing (DSP) to mitigate non-linearities, and a combining technique to enable multiple sub-amplifiers with specialized frequency spectrum capabilities to be integrated into a single ultra-broadband amplifier. The end product will need to support a broad frequency spectrum of 2 to 2000 MHz, accommodate a wide variety of modulation types suitable for terrestrial or satellite communications applications, be scalable in output power from nominally 2 to 200 watts continuous duty, be operable with voltages and currents that are feasible using battery power sources, and be sufficiently environmentally and electrically robust to support military and high-reliability commercial applications.

PHASE I: Demonstrate the feasibility of the proposed approach using laboratory breadboard prototypes or high-fidelity simulation. Characteristics addressed in the analysis/demonstration need to include frequency range, linearity, range of output power capabilities, power efficiency, heat dissipation, power supply requirements, load matching sensitivity, temperature safe operating area, and packaging constraints. If the technical approach proposed requires the usage of semiconductor devices that are not in production, describe the process, timeline, and costs entailed to deliver devices in quantities of tens of thousands; provide personnel and facility data to validate vendor (or vendor team) capability in achieving success in working with the proposed technologies.

PHASE II: Design and build a prototype RF power amplifier, packaged to simulate a realistic radio form factor, suitable for laboratory measurements and demonstration. A demonstration of linearity, efficiency, and broad frequency spectrum performance is required. Full output power is not required, but data should be provided to validate the scalability of the technology to achieve the required output power. If the required semiconductor devices are not in production, a process and cost estimate should be provided to enable government analysis of viability for production and fielding.

PHASE III: Team with JTRS radio vendor(s) to design and implement a power amplifier that conforms to JTRS performance specifications and can be produced in required quantities at target cost.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE 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 power amplifier described in this topic is directly applicable to these non-DOD interoperable communications applications.

REFERENCES:

(1) PENGCHENG JIA, Broadband High Power Amplifiers Using Spatial Power Combing Technique, Dissertation, University of California at Santa Barbara, December 2002, http://my.ece.ucsb.edu/yorklab/Publications/Dissertations/Jia_thesis_file_final.pdf

(2) VAMSI K. PAIDI, MMIC Power Amplifiers in GaN HEMT and InP HBT Technologies, Dissertation, University of California at Santa Barbara, September 2004, http://my.ece.ucsb.edu/yorklab/Projects/GaN/Dissertations/Paidi%20Thesis.pdf

(3) Office of Naval Research, National Compound Semiconductor Roadmap http://www.onr.navy.mil/sci_tech/31/312/ncsr/materials/gan.asp (includes extensive list of applicable technical references for Gallium Nitride semiconductor technology)

KEYWORDS: power; amplifier; linear; broadband; RF; JTRS

TPOC: Karl Cain
Phone: (619)524-7614
Fax:
Email: karl.cain@hanscom.af.mil

N07-156 TITLE: Modeling and Simulation for Information Operations Training

TECHNOLOGY AREAS: Information Systems, Human Systems

ACQUISITION PROGRAM: PMW180 Ship

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: Use Modeling and Simulation (MODSIM) to enhance IO training.

DESCRIPTION: Information Operations (IO) is abstract on many levels for which training is difficult. Modeling and Simulation (MODSIM) can greatly enhance the learning of abstract concepts through descriptive languages and visualization. MODSIM can be used to enhance IO training. The innovation required is to leverage modeling and simulation to provide the same degree of insight to the IO practitioner as it provides to the discipline of engineering. IO mission planning support and effects based (physical and influence) operations are well suited for MODSIM. In addition, emerging model based and data driven architectures will allow MODSIM based training to keep pace with system development and emergent requirements. As a guide for innovation, consider the following: (1) provide innovative animation to visualize fundamental phenomena for the Information Warrior; (2) define canonical problem sets (representative scenarios for problem classes) which would span the problem space at the physical level in terms of modern radios, networks, and scenarios and at the objective level in terms of outcomes at each layer of the reference model. Alternatively, simulations can define patterns that a IO practitioner can recognize that can be applied to real scenarios.

PHASE I: Will include researching communications and process models and simulation frameworks to provide fundamental insight into the information problem space. A strategy will be developed to visualize abstract concepts in communications and mission planning for the warfighter. The relationship between measures of system performance, geometry of distributed assets, channel effects, and measures of mission effectiveness will be demonstrated using scenario based modeling and simulation. The results of the research will be analyzed to determine the content of training layers beyond system operations that leverage commercial success in network communications planning, and use animation to train features of complex communications and protocols. The development approach will include a plan to integrate commercial modeling capabilities to extend to influence operations.

PHASE II: Includes the development of a prototype system. The prototype will demonstrate system feasibility, sound conceptual design, database design, interface capability, and a practical implementation approach to provide effective learning. The database design, metadata tagging and cataloguing should adhere to standards outlined in reference 3.

PHASE III: Will include the development of a modular, scalable, and reusable system from PRIVATE SECTOR COMMERCIAL tools in a federated environment in which modeling centers in DoD/Industry environment can collaborate to train responses to emergent scenarios. The resulting product would provide a valuable training experience to a wide population of warfighters and practitioners at a deeper level. Within the Fleet Training Continuum (FTC) and the Integrated Learning Environment (ILE), IO M&S Training could be used by TYCOMs to certify their IO/IW personnel during any phase of the Fleet Response Training Plan (FRTP) for CSG/ESG operations. Additionally, IO M&S Training materials maintained within the ILE would allow Immediate Superiors in Command (ISICs) to tailor their own IO/IW training for all phases of the FRTP and facilitate unit level certifications.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: MODSIM is heavily used by industry to manage, plan and study networking and communications. The technology successfully developed in this project will have multiple military and commercial applications. Military applications will include feedback to operational communication systems to optimize IO performance. Non-military applications will include the ability to apply this capability to provide improvements to numerous commercial communications systems.

REFERENCES:

1. IEEE standard 1484 Learning Technology Training Architecture

2. IEEE standard 1516 Modeling High Level Architecture

3. Naval Personnel Development Command (NPDC) "Guidance for Development and Management of Navy Integrated Learning Environment Content", 5 August 2005

4. COMUSFLTFORCOM/COMPACFLT Instruction 3501.3A "Fleet Training Continuum (FTC)" 20 Dec 06

KEYWORDS: Information Operations, Modeling, Simulation, Training, Learning Object Metadata, effects based operations

TPOC: Ralph Skiano
Phone: (619)524-7890
Fax:
Email: ralph.skiano@navy.mil
2nd TPOC: Thomas Starai
Phone: (301)669-2133
Fax:
Email: staraitho@navy.mil

N07-157 TITLE: Geoacoustic Sea Bottom Characterization Using Passive, Cost-Effective Sensors

TECHNOLOGY AREAS: Ground/Sea Vehicles, Sensors, Battlespace

ACQUISITION PROGRAM: PEOC4I, PMW180, Littoral Battlespace Sensing Fusion & Integration ACAT

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 prototype survey technology consisting of a cost-effective passive sensor system with geoacoustic inversion algorithms to determine seabed properties. Promising research is underway that uses sound sources created by natural phenomena such as breaking ocean waves or by passing surface ships of opportunity to characterize the seafloor. This topic is designed to foster the development of an innovative survey technique with algorithms that could ideally determine true geoacoustic layer depths and properties from these types of acoustic sources. However, techniques that determine an "effective" acoustic bottom for a certain frequency band would be very useful. The sensor elements of a proposed system may be integrated into a buoy as an acoustic array or perhaps as a cost-effective sensor array that can be deployed by an ocean glider or autonomous underwater vehicle (AUV). Innovative, cutting-edge technologies, such as vector sensors, may be explored as alternatives to traditional beamforming techniques. Once a sensor/algorithm prototype is developed and tested, it will be evaluated by Naval Oceanographic Office (NAVOCEANO) and if effective would be transitioned to operations under the Littoral Battlespace Sensing, Fusion & Integration (LBSF&I) program.

DESCRIPTION: The U.S. Navy must have the capability to conduct anti-submarine warfare (ASW) and mine warfare (MIW) operations in the shallow littoral waters of the world. Acoustic energy generated by tactical sonar systems interacts with the seafloor and sub-bottom layers. Therefore knowing the geoacoustic properties of the ocean bottom is very important in the accurate prediction of sonar performance and is a key element in successful mission planning and asset deployment. Acoustic propagation models contained in ASW tactical decision aids (TDAs), require knowledge about the seafloor composition, bottom loss & backscatter, absorption and sediment thickness. MIW TDAs require knowledge about sediment thickness, bottom composition and clutter to predict the behavior of mines laid on the ocean bottom, forecast mine clearance times and perform feature analysis of the ocean bottom. Geo-acoustic inversion techniques use our understanding of the physics of acoustic propagation and in situ acoustic measurements to infer the properties of the ocean bottom. This inverse problem transforms the observed acoustic measurements into representative environment properties. A variety of geo-acoustic inversion techniques as described in the reference material are under development using tactical through-the-sensor approaches as well as traditional survey sensors systems. This topic has been developed to foster an innovative solution to this challenging problem through the use of inversion algorithms coupled with a cost-effective passive sensor suite, which use naturally occurring acoustic sources that are generated by breaking waves or use of acoustic energy that is generated by passing ships of opportunity.

PHASE I: The proposed approach should provide innovative concepts or techniques to quantify the seafloor properties using passive acoustic sensors. The proposed sensor architecture should focus on a low-cost alternative to expensive, large mass/volume survey sensors that are in current use. The sensor may be expendable, but does not have to be. Proposals should address sensor deployment issues, i.e. will the buoy bodies have the ability to self-scuttle themselves at the end of their operational lives, should they have an organic communications capability (e.g. Iridium), etc. If sensors are deployed on undersea vehicles (buoy, ocean glider or autonomous undersea vehicles) then the impact of the proposed sensor suite on vehicle performance should be addressed. Phase I design efforts should be conducted in sufficient detail to show the feasibility of implementing the proposed technologies to achieve the topic goals.

PHASE II: In this phase of the work, the proposed sensor system must be fabricated, tested and demonstrated to verify performance. The prototype sensor system must include all necessary inversion algorithms to provide quantitative estimates of seafloor geoacoustic properties. The sea bottom characterization should be valid over the range of acoustic frequencies available from ambient noise and/or ships of opportunity. During the demonstration phase of the effort, datasets should be acquired, interpreted, and compared to independent estimates of the seafloor to verify accuracy of the geo-acoustic products that are provided by the system. If the sensor suite is integrated into a vehicle (buoy, ocean glider or autonomous underwater vehicle) then it must be fully compatible with that vehicle's performance characteristics. Performance criteria to consider should include, but not be limited to, communications with the host vehicle, power consumption, deployment method and hydrodynamic drag. Additionally, the estimated production cost of the sensor system must make it a reasonable alternative to non-disposable existing survey sensor systems, e.g. NAVOCEANO's "Buoyzilla" that has the following general specifications: weight in air - approximately 300 lbs., length - 15 feet, diameter - 16 inches, and approximate small lot cost - $72K.

PHASE III: The prototype capability will be transitioned and integrated into the Littoral Battlespace Sensing, Fusion & Integration (LBSF&I) program or be provided directly to the Naval Oceanographic Office for deployment aboard T-AGS class survey vessels.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Commercial usage potential exists for this SBIR effort. Some applications include use of the developed algorithms and sensors for commercial seafloor mapping, fisheries studies, to assist with underwater cable-laying operations, for the identification of sub-seafloor geo-acoustic layers for geo-technical studies and exploitation/exploration by the oil industry.

REFERENCES:

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KEYWORDS: Geoacoustic inversion algorithm; acoustic sensor; bottom characterization; seabed classification; ocean glider; expendable buoy, intelligent preparation of the environment

TPOC: Ed Mozley
Phone: (858)537-0230
Fax: (619)524-3034
Email: edward.mozley@navy.mil
2nd TPOC: Tom Piwowar
Phone: (619)524-7921
Fax: (619)524-3034
Email: thomas.piwowar@navy.mil

N07-158 TITLE: High Reliability, Reduced Size, Weight, and Power (SWAP) Circuit Card Assemblies for Real-Time Embedded Systems

TECHNOLOGY AREAS: Information Systems, Electronics

ACQUISITION PROGRAM: JTRS-MIDS 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: The goal is to utilize improved manufacturing processes to lower procurement and life-cycle costs, reduce size and weight while improving performance capabilities by increasing the packaging density and improve the reliability of the fielded hardware associated with high performance, highly complex ground/air/sea fielded systems.

DESCRIPTION: Current conventional circuit card assembly manufacturing processes inhibit the ability of producing significantly smaller and lighter circuit cards due to thermal considerations associated with the Application Specific Integrated Circuit (ASIC) die packaging and other issues. New emerging manufacturing techniques attempt to solve these issues by using an embedded die or other ASIC mounting technique wherein the board and ASIC die are bonded without the use of ASIC die packaging. (e.g. plastic or ceramic material with circuit board interface pins) Embedded circuitry is attractive for electronics that must be reliable in harsh environments over long duty cycles, must rely on passive cooling, and are subjected to large shock and vibration loads. Embedded circuitry can extend the mean time between failures of assemblies by eliminating a large percentage of the total interconnections as well as eliminating or significantly minimizing solder as a method of interconnect. Also, embedded circuitry can operate at lower temperatures than traditionally packaged assemblies due to mounting of heat producing elements directly on a thermally conductive core.

PHASE I: Perform comprehensive analysis of various manufacturing processes that could be applied to multiple JTRS form factors, to include, as a minimum; the anticipated cost savings, examples of increased thermal dissipation, shock and vibration comparison results, reduction in moisture penetration, increase in computing processing speed, and overall reliability improvements. Demonstrate the reliability and durability of the technique using a generic (vendor defined and fabricated) circuit assembly by performing environmental testing consistent with JTRS requirements. Working with JTRS technical staff and/or vendors, a candidate circuit assembly will be identified for the proposed reduced SWAP technique. A detailed cost estimate and risk identification report will be prepared to enable the government to evaluate the viability of proceeding with Phase II.

PHASE II: Utilizing information collected from Phase I analysis, develop one or more prototype assemblies from the selected JTRS form factor (e.g. a universal transceiver circuit card assembly). Perform laboratory testing to verify performance, reliability and environmental survivability of assembly.

PHASE III: Team with JTRS vendors to develop a follow-on generation of low SWaP, low cost, and high reliability circuit card assemblies suitable for production and fielding.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The DOD is in the midst of developing numerous transformational products that rely on superior performance to penetrate enemy defense. Examples include smart weapons, remote vehicles, etc. All rely on miniaturizing the electronics (including radios), reducing the weight, and increasing the computational power. This technology is critical to the success of these systems. Some of the commercial applications that will benefit directly from the use of this technology are cellular technology, personal computers and precision medical equipment, and hybrid engine automobiles, in which high reliability and mean time between failures are key factors to the overall success of the product.

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KEYWORDS: Embedded Die Technology, Flip Chip Technology, DARPA Low temperature Co fired ceramics in a metal substrate (LTCC-M), Multi-Chip Modules, JTRS

TPOC: Carlos Alvarado
Phone: (619) 524-3451
Fax:
Email: carlos.alvarado@navy.mil