

CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM

General Information

In response to Congressional interest in the readiness and effectiveness of U.S. Nuclear, Biological and Chemical (NBC) warfare defenses, Title XVII of the National Defense Authorization Act for Fiscal Year 1994 (Public Law 103-160) required the Department of Defense (DoD) to consolidate management and oversight of the Chemical and Biological Defense (CBD) program into a single office within the Office of the Secretary of Defense. The public law also directed the Secretary of Defense designate the Army as the Executive Agent for coordination and integration of the CBD program. The executive agent for the SBIR portion of the program is the Army Research Office-Washington (ARO-W).

The objective of the DoD CBD program is to enable U.S. forces to survive, fight and win in chemical and biological warfare environments. Numerous rapidly-changing factors continually influence the program and its management. These forces include declining DoD resources, planning for warfighting support to numerous regional threat contingencies, the evolving geopolitical environment resulting from the breakup of the Soviet Union, U.S. participation in the Chemical Weapons Convention, and the continuing global proliferation of chemical and biological weapons. Improved defensive capabilities are essential in order to minimize the impact of the use of such weapons. U.S. forces require aggressive, realistic training and the finest equipment available that allows them to avoid contamination, if possible, and to protect, decontaminate and sustain operations throughout the non-linear battlespace.

The overall objective of the CBD SBIR program is to improve the transition or transfer of innovative CBD technologies between DoD components and the private sector for mutual benefit. The CBD program includes those technology efforts that maximize a strong defensive posture in a biological or chemical environment using passive and active means as deterrents. These technologies include chemical and biological detection; information assessment, which includes identification, modeling and intelligence; contamination avoidance; and protection of both individual soldiers and equipment.

Tri-Service Program

The U.S. Army, Navy, and Air Force have developed 15 separate SBIR topics for research and development in various CBD areas of interest. As lead agency, the Army will coordinate Tri-Service efforts related to the receipt, evaluation, selection, and award of Phase I proposals and similarly for potential follow-on Phase II efforts under this program.

Topic Submission

All proposals submitted in response to CBD topics must be mailed to the address provided below. Potential offerors must follow the proposal submission rules for the agency which has proponentcy for topics. Topics are numbered in series, with Army topics starting at 101 and running to 107, Navy topics numbered 201 through 207. There is only one Air Force topic, numbered 301. Detailed instructions for proposals to be submitted against Army topics are given below. Refer to the appropriate Navy and Air Force sections in this Solicitation for information on how to prepare proposals for submission against Navy and Air Force CBD topics.

Notice for Navy proposers: The Army Research Office-Washington is not equipped to handle online (Internet or e-mail) proposals or Appendix A & B submissions. For all Navy an original and four copies must be submitted to the address provided below. Supplementary diskettes required by the Navy will also be accepted.

Army CBD Proposal Guidelines

The maximum dollar amount for proposals submitted against Army CBD Phase I topics is \$100,000 and for Phase II awards is \$750,000. Selection of Phase I proposals will be based upon technical merit, according to the evaluation procedures and criteria discussed in this solicitation document. Due to limited funding, the Army reserves the right to limit awards under any topic and only those proposals considered to be of superior quality will be funded. To reduce the funding gap between Phase I and Phase II, the Army follows a disciplined milestone process for soliciting, evaluating, and awarding superior Phase II proposals. Phase II proposals are invited by the Army from Phase I projects which have demonstrated the potential for commercialization of useful products and services. Invited Phase II proposers are required to develop and submit a commercialization plan describing feasible approaches for marketing developed technology. Cost sharing arrangements in support of Phase II projects and any future commercialization efforts are strongly encouraged, as are matching funds from independent third-party investors, per the SBIR fast track (see section 4.5). Instructions for submitting a Phase II proposal will be issued as part of the contract package for Phase I winners.

Proposals not conforming to the terms of this solicitation and unsolicited proposals will not be considered. Awards are made contingent on availability of funding and successful completion of negotiations.

Mailing Address for all CBD topics

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PROPOSAL CHECKLIST

This checklist is provided to assist in preparing your proposal for submission. Please review the checklist carefully to assure that your proposal meets the SBIR requirements. Failure to meet these requirements may result in your proposal being returned without consideration. Do not include this checklist with your proposal.

_____ 1. The proposal is limited to only one solicitation topic.

_____ 2. The proposal is 25 pages or less in length. (Excluding company commercialization report.) Proposals in excess of this length will not be considered for review or award.

_____ 3. The Cover Sheet (Appendix A) is complete and is PAGE 1 of the proposal

_____ 4. The Project Summary Sheet (Appendix B) is complete and is PAGE 2 of the proposal.

_____ 5. The Technical Content of the proposal begins on PAGE 3 and includes the items identified in Section 3.4 of the solicitation.

_____ 6. The Technical Abstract contains no proprietary information, does not exceed 200 words, and is limited to the space provided on the Project Summary Sheet (Appendix B).

_____ 7. The proposal contains only pages of 8 1/2 x 11 size. No other attachments such as disks, video tapes, etc. are included.

_____ 8. The proposal contains no type smaller than 11 point font size (except as legend on reduced drawings, but not tables).

_____ 9. The Cost Proposal (Appendix C) is complete, is signed with an original signature, and is included as the last section of the proposal.

_____ 10. The proposals are stapled in the upper-left-hand corner, and no special binding or covers are used.

_____ 11. An original and four copies of the proposal are submitted.

_____ 12. The Company Commercialization Report, (Appendix E), is included in accordance with Section 3.4.n. (This report does not count towards the 25 page limit)

_____ 13. Acknowledgment of proposal receipt will be sent if the proposal includes a self-addressed stamped envelope and Reference B needing only a signature showing receipt is included.

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CBD98-202 CBW Low Profile Man-Mounted Filter and Blower Unit

CBD98-203 Improved CBW Protective Hood Material

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CHEMICAL BIOLOGICAL DEFENSE TOPIC DESCRIPTIONS

CBD98-101 TITLE: Labelless Methods of Biodetection

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: Advanced Development

OBJECTIVE: Develop a biodetector that does not require labeling reagents such as fluorescent, radioisotopic or enzymatic tags, i.e. a "reagentless sensor."

DESCRIPTION: Most biosensors rely on some sort of reporter label attached to either an antibody or DNA. This label enables a detection event to be transduced by the sensor into a signal. One biodetection goal is to detect toxins, viruses, and bacteria using sensing techniques that do not require the use of labels. Detection is to take place through a direct chemical, biochemical, or physical action.

PHASE I: Phase I will be a proof-of-principle of the proposed technique. A sensing scheme and appropriate hardware are to be developed and tested with a model protein, virus/bacteriophage, and bacteria. Highest consideration will go to those methods that propose to detect all three classes as well as those that also will focus on limiting background and non-specific binding effects, achieving high sensitivity, and broadening the dynamic range.

PHASE II: The basic method(s) of Phase I will be optimized and extended to matrices of background contaminants and sets of proteins, viruses/bacteriophages, and bacteria. The end product will be a fully functional optimized piece of hardware. A fully optimized sensor system must be a deliverable to the Government to include, where applicable: initial training, consumables, six months service/repair support, and one years technical support. Finally, a solid and realistic commercialization plan is essential.

PHASE III DUAL USE APPLICATIONS: Medical diagnostics, industrial and environmental monitoring.

KEY WORDS: Biosensors, labelless detection, biodetection.

CBD98-102 TITLE: Microfabrication Based Biodetectors

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: Advanced Development

OBJECTIVE: Reduce the size and sample and power needs of biodetectors using microfabrication.

DESCRIPTION: Microfabrication methods offer the possibility of producing biosensors and biodetector components of unprecedented smallness (ie. chip based) as well as enabling novel designs, chemistries, and general biosensing approaches not possible with macrofabricated systems. Biological detection goals include deployment of microfabricated sensor systems that are capable of processing and analyzing microliter amounts of sample for a variety of threat bioagents: toxins, viruses, and bacteria. Such systems would include microfabricated pumps, actuators, reaction platforms, fluidic systems, detectors, and sample isolation systems; all automated into a continuous process. Such systems would be able to take sample from the macro world and process and analyze it in a microfabricated environment.

PHASE I: A successful Phase I effort will be one where the feasibility of applying microfabrication technology to aspects of immunochemical and/or DNA biosensing are demonstrated. For a Phase I effort, a laboratory based proof-of-principle is sufficient. Topics for consideration include the areas listed in paragraph 1.a.2 above. However, greatest consideration will be given to proposals that seek to develop microfabricated sensing platforms; and sample isolation, cleanup, and separation methods. DNA analysis and processing will be given priority over antibody or physical methods. The topic calls for more than an engineering effort - concept demonstration must be tied to an actual biochemical system (ie. detecting a sample or isolating it).

PHASE II: A successful Phase II will optimize the technology or methods demonstrated in Phase I and then develop a fully functional and optimized microfabricated biosensing system or system module. A fully optimized sensor system/component must be a deliverable to the Government to include, where applicable: initial training, consumables, six months service/repair support, and one years technical support. Finally, a solid and realistic commercialization plan is essential.

PHASE III DUAL USE APPLICATIONS: Diagnostics, industrial monitoring and process control, environmental pollution assessment.

KEYWORDS: Microfabrication, biosensors.

CBD98-103 TITLE: Large Scale Production of Antibodies in Transgenic Animals

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: Exploratory Development

OBJECTIVE: Investigate feasibility of moderate scale production of recombinant antibodies in transgenic systems.

DESCRIPTION: The SBIR should address the Fab fragment antibody procurement needs of the DoD through the production of the recombinant protein in the milk of a cow, rodent, pig, rabbit, or sheep. The total yearly production needs range in the 15 gram to 100 gram range and it is expected that multiple clones will eventually need to be produced in this fashion. The SBIR aims to develop methodology whereby the high cost of transgenics can be amortized through multiple clones over several years. The smaller scale of production, in comparison to traditional transgenic projects, could offer the SBIR company the ability to penetrate the lower end of the production market. The intended advantages of the system should include large scale production of the antibody, easily transferred purification technology, and the ability to test for successful production within 9 months of the initiation of the project. The production of transgenic animal production lines is not an absolute requirement of the SBIR and methods employing an insertion of the genes of interest directly into the mammary epithelium are also acceptable. It is understood that in this method genetic modification is limited to somatic cells - the mammary epithelium - and the exogenous genes are not transmitted to the offspring.

PHASE I: Phase I would involve the production of at least two individual antibody clones in the desired system. Confirmation of successful construct or genetic uptake should be provided during this period.

PHASE II: This would involve the delivery of at least 5 grams of purified antibody and the transfer of purification methodology. Optimization of purification systems and issues relating to extraction of the product will be resolved. Test samples (i.e., by induced lactation or sampling) should be provided with 1.5 years of the start date.

PHASE III DUAL USE APPLICATIONS: The high cost of transgenics often prohibits the use of this technology for moderate scale production needed for many applications. The development of this technology and the need for multiple clones should allow the company to streamline its procedures. This may allow the penetration of the lower end production markets. Additionally the production of human antibodies by recombinant means can have a dual use in therapeutics and imaging applications.

KEY WORDS: Transgenics, antibodies

CBD98-104 TITLE: Intermolecular Force Measurements for Molecular Identification

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: Exploratory Development

OBJECTIVE: Detect biological agents by measuring intermolecular forces.

DESCRIPTION: Miniaturization of mechanical and electronic devices and increasing abilities to manipulate macromolecules have resulted in technology that provides the possibility of measuring interactive forces between individual macromolecules and microscopic structures. Such force measurements could be used to identify molecules by the forces they exert on known molecules or microstructures. The U.S. Army ERDEC envisions using this knowledge to detect and identify chemical and biological battlefield threats by using, for example, an array of immobilized antibodies that would interact with antigens with a measurable force.

The goal of the project is to successfully use the one-to-one mapping capability of cantilever based technology and thus to effect single particle detection and identification. By virtue of design this provides sensitivity on the level of a single virus, particle or molecule. The ultimate sensitivity of the detector will depend on the efficiency of the front end sampling system used. This topic focuses on the detection and identification aspects while contractors are encouraged to consider the requirement of eventually marrying the system to an appropriate sampler. Inclusion of an efficient sampling scheme is encouraged but not required. The entire system, including sampler, should be capable of detecting and identifying particles in concentrations down to 1 particle per liter.

In terms of specificity, the minimum useful level would be the ability to differentiate between pathogenic and nonpathogenic particles. Such a system would be useful but on a very limited basis. The desired level of specificity is the ability to differentiate between the major biological agent suspects (B. anthracis, C. botulinum, Y. pestis and viral threats). The ideal system would derive its specificity from the measured interactions between unknown sample and a generic interacting probe, thus relieving the need for predetermination of specific potential threats. This way the limits to specificity would be based on databases rather than on hardware design. Due to the difficulties and dangers of testing with live agents it is considered reasonable to test with standard biological agent simulants or to test with inactivated agents provided the mechanism of detection is proven unaffected by inactivation of agents (this is not expected to be the case with most approaches).

The final device should be readily portable, on the size scale of a PC. It should be able to complete detection in less than ten minutes. The military applications require that the final product be rugged for field application. Military applications also require that it be simple enough to use that troops can be readily trained to operate it effectively.

PHASE I The contractor will be expected to develop a method to measure intermolecular forces and demonstrate repeatability of such measurements. The contractor will also determine the practicality of distinguishing between very small forces as a method of identifying the interacting particles, using either a threshold or quantitative approach. The approach should allow for a final product that is versatile with respect to the molecules to be used as probes. It should be kept in mind that the final

application requires an interface with sampling technology. In Phase I the contractor will also plan a prototype user friendly device incorporating these measurements. PHASE II: The contractor will build and test a prototype device for measuring intermolecular forces and/or forces between macromolecules and small structures. This phase will include communication between the device and output devices as well as a complete study of data analysis and interpretation, as required to translate raw force measurements into useful information.

PHASE III DUAL USE POTENTIAL: Medical diagnostics, environmental monitoring, medical research

KEY WORDS: Atomic force, molecular identification, biodetection, pathogen identification, molecular force, cellular force.

CBD98-105 TITLE: Automated Bacterial Detection with Electrospray Ionization Mass Spectrometry

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: Basic Research

OBJECTIVE: Successful results from this effort will result in an on-line, automated system that processes protein toxin and bacterial samples, releases and separates biomarker compounds, and transfers and detects the compounds with electrospray ionization mass spectrometry.

DESCRIPTION: The detection and identification of pathogenic biological species has been the subject of many analytical techniques. Mass spectrometry techniques comprise analytical dimensions which have the capability of providing a wide mass range window for a majority of the biomarker biochemical constituents in bacteria and protein toxins. The diversity of well-characterized, biochemical constituents in pathogenic bacteria and the protein toxins can lend themselves to detection of presence and identification based on mass patterns. Key biomarker constituents of bacteria include proteins, DNA and phospholipids. Phospholipids are known to be sensitive to cell viability. Within hours of the death of a bacterial cell, the phospholipids are quickly degraded. Thus, dead cells would not provide the phospholipid set of biomarkers. Current methods can detect and characterize the various biochemical marker bacterial compounds at the picogram levels, and this is roughly equivalent to 1000 Gram positive cells. Protein toxins have been successfully analyzed by electrospray ionization mass spectrometry at the picogram-femtogram levels. Methods are needed in order to automate the handling and processing of microorganisms and the efficient transfer of the many discrete bacterial biochemical components and protein toxin compounds to a mass spectrometry based detector. Proposals shall concentrate on the aspects of bacterial and protein toxin processing and handling, extraction of key biochemicals, separation stage(s), purification steps and efficient transfer to an electrospray ionization mass spectrometry detector.

PHASE I: A concept system shall be proposed and demonstrated as a self-contained, automated device for accepting bacterial and protein toxin samples, processing the samples, and yielding relatively pure, well-characterized biochemical constituents for introduction into an electrospray ionization mass spectrometry detector. Candidate bacterial and protein toxin biomarkers and the microbiological/biochemical/chemical/physical methods of biomarker extraction shall be identified. Preliminary evaluation and laboratory tests and procedures shall be implemented in order to ascertain the optimal detection/identification information content of the candidate biomarkers and the logistic requirements of the respective extraction processing methods.

PHASE II: Two breadboard systems shall be constructed. Elements of the system shall include, but not be limited to, a bacterial and protein toxin sample processing and extraction module, a component to allow for separation of the various biomolecules, biomolecule purification and transfer into an electrospray-tandem mass spectrometry system. Salts and interference matrices shall also be eliminated in order to provide for a satisfactory mass spectral signal for the sample analyte biomarkers. The footprint and power requirements of the system shall be less than or equal to 3x2x2 feet and 400 watts, respectively.

PHASE III DUAL USE APPLICATIONS: An automated bacterial and protein toxin processing system coupled to a highly sensitive and robust analytical mass spectrometer would benefit the biotechnology QA/QC sector enormously. The automated, on-line technology could also be used for screening of new potential pharmaceuticals, medicines, and medically-related compounds where many samples collected from a wide variety of sources need to be analyzed in a relatively short period of time. Labor costs could be significantly reduced with such a proposed system.

KEYWORDS: Bacteria processing, automation, on-line processing, protein toxin detection, electrospray ionization, mass spectrometry, biomarkers, bacteria detection, bacteria identification.

CBD98-106 TITLE: Fast, Low Power Consumption Gas Chromatograph

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: Exploratory Development

OBJECTIVE: To demonstrate feasibility of development of a Gas Chromatograph for field analyses of volatile and semi-volatile organic chemicals. The GC is to consume less than 10 watts of electrical power during continuous use and will be compatible with other field analytical instruments.

DESCRIPTION: A number of attempts to develop small, low power consumption GC devices have been described in recent years. So far, all suffer from similar problems, i.e., unacceptable power consumption, lack of uniform heating, and

inadequate sensing of column temperatures. The goal of this topic is to develop a GC instrument that requires very little electrical power (10 watts continuous power consumption is set as an upper limit) yet provides temperature programming that allows analyte separation and analyses to be performed to produce low limits of detection and good interference rejection for small field detection and analysis systems. Inherent in the development is a suitable vapor sampling inlet for the device. GC system reliability is paramount. It is desirable that the GC device be compatible with other field analytical instruments such as hand-held ion mobility spectrometers, surface acoustic wave devices, portable mass spectrometers, etc.

PHASE I: The desired output of Phase I is a breadboard temperature programmable GC device that demonstrates through laboratory experimentation the goals of the Topic. Demonstrations should be toward determinations of organic materials in air and water.

PHASE II: Phase II should result in field demonstration of concepts that were developed in Phase I and should result in several copies of a prototype device that demonstrates potential for commercial applications.

PHASE III DUAL USE APPLICATIONS: Market potential is in field screening for toxic chemicals in the environment, i.e., the environmental monitoring market -- chemical warfare detection is a subset of environmental monitoring.

KEYWORDS: Gas chromatography, Chemical Warfare detectors, Field screening, Hand-held detectors, Chemical detection, Air monitor, Environmental monitors, Water monitor

CBD98-107 TITLE: Hand-Held Gas Chromatography-Mass Spectrometry

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: Exploratory Development

OBJECTIVE: This topic addresses the fabrication of a true hand-held, gas chromatography-mass spectrometer (GC-MS) device.

DESCRIPTION: The ability of an analytical device to replace the discriminatory power of the human nose for chemical vapors is a long sought-after goal in many areas of vapor detection applications. Mass spectrometry is a sensitive and comprehensive analytical detection and identification tool, however, it can be overwhelmed and confused by high sample concentration and when an analyte is present in a complex mixture. Mass spectrometry lends itself to accurate chemical sample analyses because of unique chemical signatures based on signal intensity and mass patterns. When coupled to a gas chromatograph, the dimension of separation allows for a distillation of the many interferences which can be present in complex, vapor samples. Thus, the MS has a relatively pure analyte to interrogate. A GC-MS system is the gold standard with respect to chemical vapor identification.

PHASE I: A concept system shall be proposed and demonstrated as a self-contained, hand-held chemical vapor sampling device based on GC-MS technology. Ambient air or its equivalent may be used as carrier gas. A bottled gas canister will not be considered as a source of carrier gas.

PHASE II: Three breadboard, hand-held portable, GC-MS vapor sampling systems shall be fabricated. The breadboard unit shall not exceed 30 pounds. The GC column shall not experience appreciable degradation at 100 C over a period of 8 hours of continuous use. The GC component shall be modular in nature so as to facilitate convenient column replacement onto the MS detector. The ionization component of the MS detector shall include, but not necessarily be limited to, electron ionization.

PHASE III DUAL USE APPLICATIONS: In addition to accurate, unambiguous chemical agent identification for military use, Treaty Verification (CWC) and Demilitarization of chemical agent applications would benefit to a great extent. A hand-held GC-MS device has comprehensive implications for environmental (EPA, USHA, Superfund, monitoring hazardous waste sites for fugitive emissions) screening, detection and identification applications. Current, relatively large detection techniques, including standard laboratory-sized GC-MS instruments, can realistically be replaced by a hand-held GC-MS device. Indoor monitoring of vapors in factories and QA/QC assembly lines can be accomplished with a hand-held GC-MS. A most appealing aspect of a hand-held GC-MS device is its relatively low cost in quantity and high return on investment. Obtaining sample identification information in the field would significantly reduce the steps and cost in chain-of-custody for contaminants. Thus, legal, defensible evidence can be directly derived from a hand-held chemical vapor identification device.

KEYWORDS: hand-held device, gas chromatography, mass spectrometry, chemical vapor, GC-MS, environmental monitoring, chemical identification

CBD98-201 TITLE: CBW Ensemble Pass-Through for a Man-Mounted Microclimate Cooling System

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: Exploratory Development

OBJECTIVE: To develop a CB protective ensemble pass-through capability that would allow a liquid active microclimate cooling system to circulate cooling fluid from a torso garment to an external man-mounted system without compromising CB protection.

DESCRIPTION: Current Chemical/Biological (CB) protective ensembles impose a thermal burden on aircrew which not only limits mission time but poses a physiological danger to aircrew operating in even moderate temperature environments. A small man-mounted cooling system employing active liquid based technology would enhance mission effectiveness and more importantly, would prevent a hazardous rise in core

body temperature. Active liquid systems consist of a torso garment worn directly over the skin, a fluid reservoir, a circulating pump that is worn external to the ensemble, and connecting hoses. These state-of-the-art systems, however, were not designed to be utilized in a CB environment. Therefore, a self-sealing, CB agent hardened, quick disconnect pass-through device or garment provision is required to integrate the torso garment with the circulating pump without compromising CB protection. The device shall be decontaminable and reusable.

PHASE I: Examine current state-of-the-art microclimate cooling system technology and develop a device for integrating a torso cooling garment with a man-mounted cooling unit when utilized in a CB environment. A report and prototype shall be delivered to NAWCADPAX.

PHASE II: Perform detailed design and finished development of pass-through device. Fabricate and deliver 3 pass-through devices for laboratory evaluation at NAWCADPAX. Laboratory evaluation results will be provided to the contractor for incorporation into the final developed product. Three shall be delivered along with a final report. These final 3 systems shall represent the final configuration based on Navy evaluation. Integration with latest technology cooling systems shall also be verified.

PHASE III: Initiate the production program for the CBW ensemble pass-through and transition into the USN CB garments. Also transition into other military services garments and similar industrial protective garments.

PHASE III DUAL USE APPLICATIONS:: This technology can be used by other military services, as well as for commercial and industrial applications operating in similar environments.

REFERENCES: SBIR, NAWCADPAX, Phase Change Material (PCM) Enhanced Man-mounted Liquid Active Microclimate Cooling System

KEY WORDS: microclimate cooling, chemical/biological, pass-through, CB ensemble, man-mounted

CBD98-202 TITLE: CBW Low Profile Man-Mounted Filter and Blower Unit

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: Advanced Development

OBJECTIVE: Develop a Chemical/Biological Warfare (CBW) protective low profile man-mounted blower unit with filter canister that is lighter, and more compact while providing performance equal to or better than existing blower unit combinations. The blower unit shall be powered by a battery and integrate with a low profile filter canister that provides agent protection equivalent to, or better than, existing systems.

DESCRIPTION: Current man-mounted blower units and filter canister combinations are bulky and protrude from the front of the aircrew overvest making it difficult for aircrew to

maneuver in the cockpit. They also present a risk for getting hung-up in the controls during flight and/or snagging during emergency egress. This can result in an in-flight hazard and also impede emergency egress.

PHASE I: Examine current state-of-the-art blower and filter technology and develop an improved system for use in a CBW contaminated environment. A report shall be delivered to NAWCADPAX on the recommended system.

PHASE II: Perform detailed design and development and deliver 6 blower units (with filter canisters and batteries) and final report to the US Navy for testing. Laboratory evaluation results will be provided to the contractor for incorporation into the final developed system. Integration with current aircrew life support systems will also be verified.

PHASE III: Start production of blower units and initiate transition to USN/USMC rotary and tactical aircrew and into similar industrial applications.

PHASE III DUAL USE APPLICATIONS:: This technology has great potential for use by other services, as well as for hazmat, industrial spill, and chemical weapon destruction personnel who require protective ensembles.

KEY WORDS: CBW, blower unit, filter canister, man-mounted, battery

CBD98-203 TITLE: Improved CBW Protective Hood Material

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: Exploratory Development

OBJECTIVE: Develop a new state-of-the-art Chemical/Biological Warfare (CBW) protective hood material that is impermeable to CB agents, breathable for release of heat and sweat vapor, fire resistant, easily decontaminable, durable, easy to maintain and that can be bonded to polycarbonate. This improved material shall also be able to be shaped to conform to the head without compromising its protective characteristics.

DESCRIPTION: CBW hood cowls that are manufactured from impermeable materials provide the best level of protection. However, these same hood cowls impose the highest heat stress on the wearer. Current US Navy hood cowls are manufactured of butyl and bromo-butyl rubber and are very hot. This heat build-up within the hood degrades mission performance. Therefore, a new material is sought that would replace the current rubber material thus reducing the thermal burden. This new material shall reduce heat stress while providing agent protection to the wearer equal to or better than current systems.

PHASE I: Exploratory development and delivery of a prototype material sample for USN evaluation. The sample shall be bonded to a piece of clear polycarbonate, simulating the actual integration of a hood to a polycarbonate optical lens. A report shall be delivered to NAWCADPAX describing the technical specifications and prior testing performed on this new material, the bonding utilized and any special bonding procedures.

PHASE II: Deliver 2 prototype hood cowls manufactured from the new material (presented in Phase I) to the US Navy for inspection and testing along with a final report. These 2 prototypes shall demonstrate that the material can be formed/shaped to the head. Laboratory evaluation results as well as critical hood cowl sizing and dimensions will be provided to the contractor for incorporation into the final developed product.

PHASE III: Start production of hood cowls incorporating the sizing and dimensions provided by the USN in Phase II and utilizing the selected new material. Initiate transition to USN/USMC rotary and tactical aircrew and similar industrial hood/masks.

PHASE III DUAL USE APPLICATIONS: This technology has great potential for use by other services, as well as for hazmat, industrial, and chemical weapon destruction personnel who will be wearing protective ensembles.

KEYWORDS: Chemical/Biological, protective material, CBW mask, impermeable, heat stress

CBD98-204 TITLE: Integrated CBW Flight Glove

CATEGORY: Advanced Development

KEY TECHNOLOGY AREA: Chemical and Biological Defense

OBJECTIVE: Develop an integrated CBW protective flight glove that provides protection equal to or better than the current three glove system and provides higher tactility.

DESCRIPTION: Current CBW protective flight handwear consists of three pairs of gloves: an inner cotton liner glove for comfort and perspiration absorption, a 7 mil butyl rubber glove for agent protection and a nomex flight glove for fire protection. These three pairs of gloves when worn together are very bulky and cumbersome making it very difficult to perform aircrew tasks that require high tactility, such as depressing small buttons and switches. Therefore, a new integrated glove is sought that would replace the current 3-glove system thus enhancing dexterity and providing high tactility. This new integrated flight glove shall provide CBW agent and fire protection equal to or better than current protective handwear.

PHASE I: Evaluate current state-of-the-art CB flight glove ensemble technology. Develop and recommend an integrated glove for use by aircrew and submit material samples. A report shall be delivered to NAWCADPAX on the recommended design concept.

PHASE II: Perform detailed design and development and deliver 6 pair of gloves to the US Navy for testing by NAWCADPAX along with a final report.

PHASE III: Start production of gloves and initiate transition to USN/USMC rotary wing and tactical aircrew.

PHASE III DUAL USE APPLICATIONS: This technology has great potential for use by other services, as well as for hazmat, industrial spill, and chemical weapon destruction personnel who require protective ensembles.

KEY WORDS: CBW, flight glove, protective, high tactility

CBD98-205 TITLE: CBW Ensemble Protective Coating

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: Exploratory Development

OBJECTIVE: Develop a Chemical/Biological Warfare (CBW) protective coating that can be applied on site to an entire aircrew ensemble (except for the optical area) prior to flight which will increase the level of protection when exposed to a contaminated environment. The coating shall not interfere with the operation or function of any man-mounted equipment. When applied to aircrew clothing and life support equipment it shall be quick drying and act as a liquid agent repellent. Once applied, the coating shall allow for release of heat and sweat vapor, be fire resistant, and enhance decontamination procedures. Ideally, this protective coating would be sprayed on immediately prior to a CBW mission.

DESCRIPTION: Current CBW ensembles consist of multi-layers of protective clothing as well as man-mounted equipment, i.e., torso vests, restraint harnesses, survival vests, blower units, pouches, pockets, etc. Much of the ensemble, that can't be laundered, is difficult if not impossible to decontaminate. Applying a protective coating to the complete ensemble including mask would increase the level of protection during exposure to CB agents and make it easier to decontaminate after exposure. Ideally, decontamination would consist of a brisk hose down with water to wash off all contaminants settled upon the repellent coating.

PHASE I: Exploratory development and delivery of a sample of liquid/aerosol for USN evaluation in the laboratory. A report shall be delivered to NAWCADPAX specifying the active ingredients and other pertinent technical information.

PHASE II: Finish development and thoroughly test protective coating. Deliver an ample supply of liquid/aerosol spray to coat a minimum of 12 aircrew ensembles to the US Navy for inspection and testing, along with a final report. This supply shall demonstrate that the ensembles can be quickly sprayed prior to flight and that it will increase the level of protection during agent exposure and make it easier to decontaminate following exposure.

PHASE III: Start production and initiate transition to all services and similar industrial protective ensembles.

PHASE III DUAL USE APPLICATIONS: This technology has great potential for use by other services, as well as for hazmat, industrial spill, and chemical weapon destruction personnel who require protective ensembles.

KEY WORDS: CBW, protective coatings, repellent, decontamination, aerosol spray

CBD98-206 TITLE: Development of a Universal Chemical/Biological Decontamination System

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: Advanced Development

OBJECTIVE: Develop a universal chemical/biological (CB) warfare agent decontamination system to be used in response to a chemical attack on joint military aircraft.

DESCRIPTION: The CB threat potential for military personnel and civilians is increasing at an accelerated pace throughout the world. Consequently the need for a universal decontamination system for the joint US forces is of vital importance. The decontamination system must be effective in neutralizing the G, V, and H family of chemical agents. The decontamination system as well as any by-products generated during chemical reactions with the chemical agents must be non-corrosive, non-toxic and non-hazardous to personnel and equipment. The development of a delivery system should take into account the fluid transport and mixing properties of the decontamination fluid to ensure effective application.

PHASE I: Conduct an extensive literature search on agent chemistry, toxicology, and potential decontamination technologies for GB, GD, thickened GD, VX, HD, and thickened HD. Identify, evaluate, and rank the best technical approach for the development of a decontamination system which will neutralize the listed agents individually or in combination on contaminated US military personnel and equipment. The neutralization of the chemical agents must meet decontamination requirements as described in the NBC Contamination Survivability Criteria for Army Material.

PHASE II: Develop a live agent test plan to verify capability of the decontamination system. Develop and test delivery system concept for the decontamination system. Evaluate decontamination system using live agent tests on specified military coupon surfaces. This testing will provide the following data, a) kinetic study of the decontamination system to determine the reactivity of the decontamination system for each of the chemical agents b) mass balance on all coupon tests to account for all the mass of the agent used in the tests, c) pH analysis of the decontamination system, d) corrosion testing to examine the effects of the decontamination system on the coupon surfaces, e) shelf life studies on the decontamination system. The feasibility of the proposed decontamination technology shall be demonstrated by performing laboratory tests with live agent simulants and with live agents.

PHASE III DUAL USE APPLICATIONS: A multitude of military and commercial applications exist for the use of a universal decontamination system. In recent years there has been a proliferation of CB threats in military conflicts and in terrorist activities. The primary applications will involve the effective decontamination of physical structures both in the military and civil arena.

REFERENCES: NBC Contamination Survivability Criteria for Army Material, August 12, 1991.

KEYWORDS: decontamination system, delivery system, CB

threat, simulants, chemical agents, live agent tests.

CBD98-207 TITLE: CBW Safe Water Pouch

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: Advanced Development

OBJECTIVE: Develop a Chemical/Biological Warfare (CBW) hardened water pouch that is small, lightweight, soft, and flexible which will fit into an aircrew overvest and provide hydration for aircrew during flight operations in a contaminated environment.

DESCRIPTION: Current tactical aircrew utilize a water canteen as a source of hydration during pre-flight and post flight only. They do not carry a source for hydration in-flight because there is no real estate available within the cockpit to store the canteen. There is also an imminent hazard should the aircrew have to eject. Reducing the bulk and weight of the current canteen to a soft pouch will allow the aircrew to store it in an overvest pocket. This would allow the aircrew to hydrate themselves in-flight and precludes the risk of injury during an ejection. The proposed chemical hardened water pouch shall integrate with current CBW respirator ensembles.

PHASE I: Evaluate proposed sources and recommend and develop a system for use in a CBW contaminated environment. A report shall be delivered to NAWCADPAX with the recommended system.

PHASE II: Perform detailed design and development and deliver 6 chemical hardened water pouches to the US Navy for testing by NAWCADPAX along with a final report. Laboratory evaluation results will be provided to the contractor for incorporation into the final developed system. Integration with current aircrew life support systems will also be verified.

PHASE III: Start production of chemical hardened water pouches and initiate transition to USN/USMC tactical aircrew and into other services and similar industrial applications.

PHASE III DUAL USE APPLICATIONS: This technology has great potential for use by other services, as well as for hazmat, industrial spill, and chemical weapon destruction personnel who require protective ensembles.

KEY WORDS: CBW, water pouch, hydration, man-mounted

CBD98-301 TITLE: RNA Probe Methodology for
Microorganism Biodetectors

KEY TECHNOLOGY AREA: Chemical and Biological Defense

CATEGORY: 6.1 or 6.2 Exploratory Development

OBJECTIVE: To develop the methodology of fluorescence based RNA probes to identify and quantify microorganisms including bacterial spores and animal virions collected from an

aerosol in a very short time.

DESCRIPTION: Fluorescence based RNA probes have been developed for various microorganisms. A method is needed to incorporate such a probe into a system which can detect the presence of one or all of a list of several target microorganisms. It should also have the potential of detecting, identifying, and quantifying a very few (ten to one hundred) target microorganisms in the presence of a large background of interferent particles (e.g. dust) which are also in the one to ten micron size range. The method must be capable of utilizing a sample collected from an aerosol with total time from collection to identification less

than thirty minutes.

PHASE I: In Phase I the contractor will obtain fluorescent RNA probes and develop the methodology to demonstrate with experiments the capability described above. The method must also be shown to be capable of being incorporated into an instrument which can be operated with minimal training.

PHASE II: In Phase II, the contractor will do further experimentation to show that the method can be used with RNA based animal viruses, and a target list of microbial pathogens. A demonstration instrument incorporating the new methodology in a way which is automatable will be designed, fabricated, and experimentally characterized. A prototype device will be delivered complete with instructions in a form suitable for further laboratory or field testing.

PHASE III DUAL USE APPLICATIONS: Hospital and building Monitoring, Environmental monitoring, Medical diagnostics

KEY WORDS: RNA Fluorescent probes, Microorganism detection, Automatable Biosensors