UNITED STATES SPECIAL OPERATIONS COMMAND
SBIR FY05.2 Proposal Submission

The United States Operations Command's (USSOCOM) mission includes developing and acquiring unique special operations forces (SOF) equipment, material, supplies and services. USSOCOM is seeking small businesses with a strong research and development capability and an understanding of the SOF operational characteristics. The topics represent a portion of the problems encountered by SOF in fulfilling its mission.

Inquiries of a general nature or questions concerning the administration of the SBIR program should be addressed to:

United States Special Operations Command
Attn: SOAL-KS/Ms. Karen L. Pera
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MacDill Air Force Base, Florida 33621
Email: perak@socom.mil

USSOCOM will only accept proposals for those topics stated in this solicitation. The USSOCOM Program Executive Officers (PEOs) responsible for the research and development in these specific areas initiated the topics and are responsible for the technical evaluation of the proposals. The Phase I and Phase II proposal evaluation factors are listed below. Each proposal must address each factor in order to be considered for an award.

Selection of proposals for funding is based upon technical merit and the evaluation criteria included below. Phase I and Phase II funding is limited, therefore USSOCOM will select and fund only those Phase I and Phase II proposals considered to be superior in overall technical quality and most critical to the mission. USSOCOM may fund more than one proposal in a specific topic area if the technical quality of the proposal is deemed superior, or it may fund no proposals in a topic area.

Evaluation Criteria – Phase I & II

1) The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution.

2) The qualifications of the proposed principal/key investigators supporting staff, and consultants. Qualifications include not only the ability to perform the research and development but also the ability to commercialize the results.

3) The potential for commercial (Government or private sector) application and the benefits expected to accrue from this commercialization.

Potential offerors must submit proposals in accordance with the DoD Program Solicitation at www.dodsbir.net/solicitation. The maximum amount of SBIR funding for a USSOCOM Phase I award is $100,000 and the maximum time frame for a Phase I proposal is 6 months. A Phase I proposal for less than 6 months and/or less than $100,000 is encouraged where low risk technologies are being proposed.

All firms shall include as part of the Phase I proposal transportation costs to travel to Tampa, Florida for two separate meetings. The first travel requirement shall be the Phase I kick-off meeting and the second travel requirement shall be for the Phase I out brief. The meetings shall take less than four hours and at least the Principal Investigator is required to attend both meetings. Notwithstanding the requirement for the Principal Investigator to attend both meetings, any other individual needed to discuss all aspects of the firm's approach to address the SBIR topic shall also attend the meetings.

USSOCOM, may request a Phase II proposal from any Phase I contractor, based on the results of the Phase I effort using the evaluation criteria above. A Phase II proposal for less than 24 months and/or less than $750,000 is encouraged. The maximum amount of **SBIR funding** allocated for a USSOCOM Phase II award is $750,000 and the maximum time frame for a Phase II award is 24 months. Proposals should be based on realistic cost and time estimates, not on the maximum time (months) and dollars. The cost of the project is based on the overall amount of hours spent to accomplish the work required and the overall term of the project should also be based on the same effort. In preparing the proposal, (including the statement of objectives and milestones), firms should consider that workload and operational tempo will preclude extensive access to government and military personnel beyond established periodic reviews.

Electronic Submission Instructions

All proposal information must be received electronically via the DOD SBIR/STTR Submission site. To submit, proceed to http://www.dodsbir.net/submission. Once registered, a firm must prepare (and update) Company Commercialization Report Data, prepare (and edit) Proposal Cover Sheets, complete the Cost Proposal form, and upload corresponding Technical Proposal(s). The proposal submission, exclusive of the Company Commercialization Report, must not exceed 25 pages.

Paper copies will not be considered. A complete electronic submission is required for proposal evaluation. An electronic signature is not required on the proposal. Please note that there have been problems reported in the past when using AOL for large file uploads; therefore, we suggest using an alternate internet service provider for files larger than 5MB. It is strongly suggested that all firms **submit final, completed proposals 5-7 days prior to the solicitation closing date to ensure complete submission**. *Firms are entirely responsible for complete and timely submission of the proposal.*

Firms are encouraged, but not required, to embed graphics within the technical proposal file. When including images, care should be taken to ensure images are not of excessive size. A resolution of 200 dpi or below is requested for all embedded images. Please use standard fonts in order to prevent conversion difficulties.

Performing a virus check on each proposal to be uploaded electronically is the responsibility of the firm. The detection of a virus on a submitted electronic technical proposal may be cause for proposal rejection. *E-mail submissions will not be accepted.*

The DoD SBIR/STTR Submission site will present a confirmation page when a technical proposal file upload has been received. The upload will be available for viewing on the site within an hour. It is in your best interest to review the upload to ensure the server received the complete, readable file.

For additional information about electronic proposal submission, including uploading your technical proposal, refer to the instructions on the solicitation and the on-line help area of the DoD SBIR/STTR Submission site, or call the DoD SBIR/STTR Help Desk at 866-SBIRHLP (866-724-7457).

Please note that e-mail is the only method of communication that will be used by the contracting office to notify the submitter/proposer if they have or have not been selected for an award, therefore please include the e-mail address of the person authorized to negotiate contracts for your firm.

SOCOM SBIR 05.2 Topic Index

SOCOM SBIR 05.2 Topic Descriptions

SOCOM05-005 TITLE: Unmanned Autonomous Vehicle Intelligence, Surveillance, and Reconnaissance (ISR) Payload Interface Master Module, PIMM

TECHNOLOGY AREAS: Air Platform, Sensors, Electronics

ACQUISITION PROGRAM: Advanced EHF

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 a light weight, rugged, and low cost Internet Protocol (IP) based ISR payload master module that is user programmable to command, control, communicate, and cross-queue multiple ISR payloads via commercial standards Line of Site (LOS) and Beyond Line of Site (BLOS) communications paths.

DESCRIPTION: With the increasing incidence of deploying Special Operations Forces into remote areas, the need for technically innovative UAV ISR sensor data in near real time via common secure data dissemination architectures continues to be undertaken but not yet accomplished. Despite technology advances, relevant images, video and other sensor data is not available down to the SOF team level over a single medium in near real time. It is envisioned PIMM will provide a common interface to various payload sensors, digitizing analog video and cross-queuing multiple ISR sensor payloads based on user programmable event thresholds. Transmitting streaming MPEG; still frame JPEG/MJPEG images and other binary, text, META and/or sensor data over the embedded IP based LOS and BLOS communication paths. The sensor data should be in a common format for display on existing and fielded tactical display processors. PIMM should provide the capability to interface with up to three (3) payload sensors via commercial standard Input/Output ports. PIMM should remotely receive and process ISR payload command and control messages over commercial standard IP based LOS and BLOS communication paths. PIMM should be rugged and light weight (< 5 pounds), accept DC power inputs meeting electromagnetic interference specifications in accordance with MIL-STD 461E. PIMM should ultimately be designed to withstand MIL-STD 810F environmental engineering standards. PIMM should be plug and play technology, and allow for 100% growth for future upgrades.

Proposals should reflect the vendor's expertise, especially in electronics system design, small package mechanical design, and the advantages of their technical approach of connecting components together to tailor a tactical system. The proposal should concentrate on electrical/mechanical interfaces and address software interfaces in only general terms as they influence the electrical/mechanical design approach. Phase I companies will discuss their proposed research in detail and propose in general what they would continue in Phase II. Teaming with larger companies is not encouraged, but is acceptable.

Design considerations:
• Performance is the primary concern.
• The total RF sensor package (less batteries) must be less than 7 lbs. as a prototype, and less than 5 lbs. at final design (Phase II).
• The RF sensor design should take maximum advantage of current and emerging SDR on a chip designs.
• All components will be powered at the lowest possible voltages to get desired performance.
• Minimum distance between UAV sensors and/or the PIMM C^2 node is envisioned to be 10 miles for proof of capability.
• The use of IEEE 802.11 network solutions is to be explored, but other more capable solutions are also desirable.
• Antenna(s) do not have to be disguised/camouflaged during development.
• Military environmental standards are relaxed during development.
• Keep in mind that SOF usually manpack or parachute into an operational area.

Proposers should budget for a single one day trip to Tampa, Florida for a Phase I kickoff meeting.

Successful proposals will use novel ideas to improve soldier usability, create future commercial markets, and increase functional capability. Pluses include:
• Fully demonstrating the company's past and present experience;
• Supplying references on proposing company's products/programs (particularly government program managers);
• Giving detail on its proposed technologies to show expertise.
• Showing detailed expertise in technologies related to this SBIR.
• Experience designing products for use in wilderness areas or for military customers.
• Companies that can assist the topic author in commercializing the product.

The proposing company should be prepared to deliver products in accordance with the general information outlined in each of the phases as listed below:

PHASE I: Develop an overall system design that includes expected internal software communication architectures to include the cross queuing feature, hardware layout supporting the software architecture, human operational factors, environmental and operational requirements. Design documents must include MTBF projections, maintenance concept, an overall concept for a lightweight rugged payload interface master module, and a commercialization concept. Provide a Final Technical Report which will be evaluated to determine which Phase I company will be selected to continue development in Phase II.

PHASE II: Develop, build, and demonstrate two (2) PIMM prototypes in a realistic military field environment. Conduct extensive testing to prove feasibility over varied extended operational conditions, to refine/validate MTBF data, validate HMI and mechanical design, establish power efficiency data, and to validate the total system design. Make system design modifications, as necessary, within the proposed budget to ensure Government satisfaction with the prototype. Provide a Final Technical Report of Phase II activities which will be evaluated to determine which Phase II company will be selected to continue development refinement in Phase II (Extended), or go into production in a Phase III contract. Provide the two (2) PIMM prototypes and selected spare parts to the Government for 90 days of Government testing and validation

PHASE III DUAL-USE APPLICATIONS: At the completion of successful Government test and validation a limited production run is envisioned for SOCOM requirements. The vendor may conduct marketing activities for additional DoD and other Federal and State Government customers only to increase the initial production run.

KEYWORDS: SENSORS, VIDEO, MPEG, JPEG, UAV, INTELLIGENCE, SURVEILLANCE, RECONNAISSANCE, ISR, WIRELESS COMMUNICATIONS, PAYLOADS.

SOCOM05-006 TITLE: <u>Improved Display Technology for SOF Combatant Craft</u>

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

ACQUISITION PROGRAM: All SOF Combatant Craft Programs, present and future

OBJECTIVE: The focus of this project is to develop panel displays (e.g. navigation, integrated bridge systems, etc.) which are brighter, thinner, lighter, lower power, more water tight, less expensive, and faster than the Active Matrix liquid crystal display (LCD) used currently onboard SOF Combatant Craft. The project should Identify new technology (ies) to improve panel displays aboard SOF Combatant Craft. An example (and a potential solution) is a display made with organic light-emitting diode (OLED) technology which emits light when a voltage is applied to it. Such displays need less power to run, offer higher contrast, and look just as bright as LCD(s) from all viewing angles. OLED displays are potentially far less expensive to produce than LCD screens. Because they generate their own light, light-emitting diodes have long been considered the way to a better display. The pixel diodes are selectively turned on and off to form images on the screen. This produces a more discernable display, aiding greatly both day and night operations. (See attached articles.)

DESCRIPTION: This USSOCOM SBIR seeks to determine the new technology which best satisfies the needs articulated above. Solution must also be able to be packaged into displays that can withstand the maritime environment extremes (shock, vibration, salt, water, high and low temperatures) experienced by SOF Combatant Craft. As a matter of interest, the US Army currently has an SBIR in place to develop OLED displays for land based applications (See attached articles.)

SOF Combatant Craft operate in harsh air (salt) and sea state conditions, to include up to SS-5. Currently, Active Matrix LCD screens are used on the SOC Combatant Craft for navigation displays. The purpose of this SBIR is to develop an enhanced display which is Night Vision Imaging System (NVIS) compatible; sunlight readable; requires low power; and has a wide view angle. Display light levels need to be easily controlled while being able to withstand the harsh marine environment including shock, vibration, temperature extremes, and salt water. Total system weight and cost needs to be reduced when compared Active Matrix LCD displays currently used on combatant craft. It is also highly desirable (not required) that the new technology or application lend itself to being manufactured into moveable and/or flexible displays.

The display shall be mounted in the MK V Special Operations Craft console. Support for a resolution of at minimum of 800 by 600 (SVGA) shall be available to ensure compatibility with other installed components. The viewing size will be maximized for the available mounting space but should be no less than 10.4 inches diagonal. The display shall be readable in bright sunlight. The display must be night vision device compatible. The display should incrementally dim from brightest setting to zero (absence of light) with controls in front of the screen. The power requirements for the display should be 24v DC. The operating temperature range of the display should be at least from 0„a to 150„a F. For shock and vibration, the display should withstand accelerations and g-forces experienced by the MK V SOC in a high-speed environment (50 knots plus) and in seas of 4-8 foot waves; a good model is a 20g shock for 20 milliseconds. Demonstrated, documented ability to meet MIL-STD-810D requirements is a good initial start toward demonstrating ability to withstand environmental conditions. A design to reasonable commercial shock and vibration standards may be acceptable. The display shall be watertight and shall not allow water intrusion when exposed to complete submersion for depths up to three feet for periods up to one hour. A NEMA 4 or IP 65/66 watertight enclosure is a good initial start toward demonstrating watertightness. The display shall withstand changes in climatic conditions and external pressures ranging from those that may be found at sea level while underway in any part of the world to those experienced in the cargo hold of an aircraft flying up to forty thousand feet. The display will be inserted on a craft that requires a long (~50ft) video cable run between a computer and display.

PHASE I: The Proposer in Phase I will develop a design for the improved panel displays discussed above.

PHASE II: The Proposer will develop a prototype based on they Phase I design. The Proposer will fabricate the prototype and conduct developmental testing to ensure that the prototype meets the requirements discussed above.

PHASE III DUAL USE APPLICATIONS: This display technology is applicable to all craft, military or commercial, which operate in open seas or in other harsh environments. Additionally, there is substantial demand for improved display technologies in the consumer electronics market.

KEYWORDS: Navigation systems, integrated bridge systems, maritime combatant craft, panel displays

SOCOM05-007 TITLE: Identify and Track Important Assets

TECHNOLOGY AREAS: Information Systems, Sensors, Electronics

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 development of an innovative, inexpensive device that provides the ability to identify important assets using light weight, low power, man portable technology without exposing the monitoring position or the person/device monitoring the intended target.

DESCRIPTION: Identification and tracking of important assets would be very valuable for military, law enforcement and commercial applications. While Industry is predominately focused on identification at close range e.g. inventory control systems, a need exist to identify important assets at range. Application of this technology could include military and law enforcement surveillance activities, large-scale commercial control systems, as well as security for retail stores and the gaming industry. Current technology focus areas include RFID, barcode scanning, fingerprinting and facial recognition to name a few. These technologies require relatively close proximity to the asset as well as a baseline database for comparison. RFID and facial recognition technologies show the most promise for large-scale stand-off identification of important assets but each has drawbacks and limitations. RFID technologies require tagging of assets and may not be practical in all scenarios, also power requirements increase with range. Facial recognition proves problematic in low light conditions and requires further algorithm development and increased computing power. Any new technology should satisfy the following requirements:

• The asset should not be manipulated during the identification or monitoring process
• Identification should be feasible in all light/environmental conditions
• Any method used for identification must be visually undetectable
• The identification must occur without physical contact with the individual to be monitored
• Should be ruggedized and have a small, lightweight form factor
• Should utilize Commercial Off-The-Shelf equipment to minimize follow-on production costs
• Should be low power with the ability to use AC or DC power
• Should be designed with a network environment in mind to allow for unattended operation

Development of such a capability would satisfy aspects of Sensors, Electronics and Electronic Warfare a DoD Critical Technology Area.

PHASE I: Develop a proof of concept for the proposed method of identifying individuals at range.

PHASE II: Develop a working prototype that can be tested by end users in a real life working environment that resembles the form factor of the final system.

PHASE III DUAL-USE APPLICATIONS: Produce operation units that can be employed by the military, law enforcement and the commercial market sector.

KEYWORDS: sensors, tagging, tracking, electronics

SOCOM05-008 TITLE: Advanced Tactical Threat Warning Radio

TECHNOLOGY AREAS: Information Systems, Sensors, Electronics

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, build, and demonstrate a small, lightweight integrated wideband threat warning receiver and communications radio using the latest software definable receiver (SDR)/transceiver technology.

DESCRIPTION: In order to reduce the weight and cube that the SOF operator must carry into an operational area, we desire to integrate the function of a handheld tactical radio with a body-worn threat warning signal intelligence (SIGINT) receiver into a single piece of hardware. Understanding the engineering complexity involved and the fact that more than one antenna may be required, USSOCOM is looking to industry to provide technological approaches to a satisfactory tactical solution to this requirement. We believe that the solution is to be found in multiple SDRs on separate MOS FET chips powered by a low voltage digital signal processor (DSP) within an integrated handheld or bodyworn chassis, but are open to all technological approaches. The design weight goal is less than five lbs. including antenna(s), but not including battery or other power source. The design power budget goal is less than 15 watts when fully operating (receiver scanning and transmitting simultaneously).

The threat warning receiver will be a software definable receiver (SDR) that can be preloaded with modulations, bandwidths, and frequency bands of interest. The frequency band of initial interest is 30 MHz to 3 GHz. The threat warning receiver will be able to monitor frequencies of interest and upon command transmit the audio to a command and control (C^2) node if desired, will be able to scan the RF environment and alarm on signals of interest, and will perform RF direction finding (DF) on command and provide the resulting line-of-bearing (LOB) to a C^2 node via a wireless network for further processing if desired. The threat warning receiver will be able to demodulate: Amplitude Modulation (AM) signals, military/commercial Frequency Modulation (FM) unencrypted push-to-talk signals, Single Side Band signals, and commercial cellular modulations for proof of capability. The threat warning receiver must be able to demodulate more complicated modulations upon loading the appropriate software. The communications radio will have a unique address within the network. The network communications transceiver will be an SDR and able to maintain network connectivity to at least one other node in the network constellation and must be able to maintain network connectivity beyond physical line-of-sight. The threat warning receiver and the communications transceiver must be separate physical entities, although they can be of the same or similar design. The RF sensor and the network transceiver may use the same antenna only if there is a minus 120dB or greater RF isolation between modes. The network transceiver may use commercially available network control software. The use of IEEE 802.11 network solutions is not desired.

Proposals should reflect the vendor's expertise, especially in electronics system design, small package mechanical design, and the advantages of their technical approach of connecting components together to tailor a tactical system. The proposal should concentrate on electrical/mechanical interfaces and address software interfaces in only general terms as they influence the electrical/mechanical design approach. Phase I companies will discuss their proposed research in detail and propose in general what they would continue in Phase II. Teaming with larger companies is not encouraged, but is acceptable.

Design considerations:
• Performance is the primary concern.
• Total cost goal is less than $5000 for quantities of 5000 or more.
• The total system design package (less batteries) must be less than 7 lbs. as a prototype, and less than 5 lbs. at final design (Phase II).
• The system design should take maximum advantage of current and emerging SDR on a chip designs.
• All components will be powered at the lowest possible voltages to get desired performance.
• The system power budget goal is less than 15 watts fully operational.
• Maximum distance between network nodes is envisioned to be 3 miles for proof of capability.
• The use of IEEE 802.11 network solutions is not desired.
• Antenna(s) do not have to be disguised/camouflaged during development.
• Military environmental standards are relaxed during development.
• Keep in mind that SOF usually manpack or parachute into an operational area.

Proposers should budget for a single one day trip to Tampa, Florida for a Phase I kickoff meeting.

Successful proposals will use novel ideas to improve soldier usability, create future commercial markets, and increase functional capability. Pluses include:
• Fully demonstrating the company's past and present experience;
• Supplying references on proposing company's products/programs (particularly government program managers);
• Giving detail on its proposed technologies to show expertise.
• Showing detailed expertise in technologies related to this SBIR.
• Experience designing products for use in wilderness areas or for military customers.
• Companies that can assist the topic author in commercializing the product.

The proposing company should be prepared to deliver products in accordance with the general information outlined in each of the phases as listed below:

PHASE I: Develop an overall system design that includes expected human-mechanical interfaces (HMI), electro-mechanical interfaces, human operational factors, low noise operation, low heat signature, antenna(s) design, network protocols, and military operational requirements. Design documents must include MTBF projections, a maintenance concept, an overall concept for a lightweight, networked, tactical threat warning radio, and a commercialization concept. Provide a Final Technical Report which will be evaluated to determine which Phase I company will be selected to continue development in Phase II. Companies which develop a 'breadboard' prototype system during Phase I will receive preferment during Phase II selection.

PHASE II: Develop, build, and demonstrate a prototype advanced tactical threat warning radio in a realistic military field environment. Conduct extensive testing to prove feasibility over varied extended operational conditions, to refine/validate MTBF data, validate HMI and mechanical design, establish power efficiency data, finalize and validate antenna(s) design, finalize and validate communications capability and reliability, and to validate the total system design. Make system design modifications, as necessary, within the proposed budget to ensure Government satisfaction with the prototype. Provide a Final Technical Report of Phase II activities which will be evaluated to determine which Phase II company will be selected to continue development refinement in Phase II (Extended), or go into production in a Phase III contract. Provide two (2) prototypes and selected spare parts to the Government for 90 days of Government testing and validation

PHASE III DUAL-USE APPLICATIONS: At the completion of successful Government test and validation a limited production run is envisioned for SOCOM requirements. The vendor may conduct marketing activities for additional DoD customers only to increase the initial production run.

KEYWORDS: THREAT WARNING, SIGINT, RF, TACTICAL, LIGHTWEIGHT, ELECTRONICS SYSTEMS, NETWORK, SDR, COMMUNICATIONS.

SOCOM05-009 TITLE: <u>Engine Inlet Air Quality Alerting System</u>

TECHNOLOGY AREAS: Air Platform, Sensors, Electronics

ACQUISITION PROGRAM: CV-22/MV-22 Osprey

OBJECTIVE: Develop a particle sensor and monitoring/warning system to be integrated into aircraft engine air inlets and air intake to the Environmental Control Systems (ECS). The sensor would alert aircrews that continued operations in austere environmental conditions could cause system damage and /or accelerated life consumption of equipment to the point that current and future mission objectives are impacted. The sensor/monitoring system would work in tandem with current Air Particle Separators (APS) to analyze air particles missed by the APS system. The theory here is to combine current sensor technology, in the field of air particle detection, with the onboard aircraft monitoring systems, thus providing one more level of system protection to both aircrew and aircraft. Detection and monitoring system such as this would be ideal for tilt-rotor aircraft such as the V-22.

DESCRIPTION: Current operations in austere environmental conditions have proven to be very detrimental to equipment performance and component/system life. Debris have found their way into engine components as well as ducting and components within the ECS and Avionics bays during austere operations. Providing aircrews information to alert them that degraded system conditions exist and actions need to be taken or accelerated life usage and system performance degradation will occur is warranted. Currently, some devices exist to monitor ingestion of solid matter by aircraft turbines but these devices are primarily based on analyzing the composition of the exhaust gases, and therefore are not suitable for use with the ECS. Additionally, they fail to adequately characterize the size and quantity of particles ingested. Other devices for analyzing failures resulting from ingestion of solid matter detect vibration and fracture in the turbines themselves; in addition to the deficiencies identified above, these devices also serve as little more than warnings of impending catastrophic failure. Devising a system capable of analyzing the air quality or particle ingestion of the engine intake charge and ECS air intake would allow the pilot/commander to accurately characterize any reduction in the aircraft's operational capability and margin of safety and adjust accordingly.

PHASE I: Interface with government personnel to determine thresholds for particle size and flow-rate. Develop system design to detect solid particles entering engine inlet and ECS inlets and alert pilot when particle exposure thresholds are exceeded.

PHASE II: Build sensor system prototype and test to demonstrate threshold alert capabilities are met.

PHASE III: Integrate system developed and built in Phase II into Air Vehicle for product verification and validation testing and production application.

DUAL USE APPLICATIONS: As this sensor system would be used to determine the flow of particulate matter, there are several possible commercial opportunities for this technology. The sensor system could be used in commercial aircraft operating in dusty environments as a safety measure, or even in smog or smoke detector systems. The system could be adapted to use in monitoring the flow of particulate matter in water treatment or manufacturing facilities. Additionally, the sensor system could be adapted for use in the biomedical field to monitor blood composition, or even used as a warning system for thromboembolism, stroke, or other conditions resulting from small particles migrating through the bloodstream.

KEYWORDS: Austere environment, sand, dust, particle detection

SOCOM05-010 TITLE: Disposable Remote Chemical Sensor

TECHNOLOGY AREAS: Chemical/Bio Defense, Sensors

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 inexpensive disposable, broadcast capable chemical sensor that also provides sensor site weather conditions. The sensor shall be capable of operating autonomously for at least three months allowing the remote monitoring and triangulation of chemical events in urban and rural environments and provide weather measurements, chemical detection, identification and triangulation capabilities.

DESCRIPTION: Recent advances in electronic miniaturization and processing are making possible a new generation of inexpensive weather and chemical monitors. This trend has been demonstrated in a wide variety of related commercial products and throughout various industries. The current effort would use existing and emerging technologies to develop an expendable chemical sensor that shall provide detection and alert capabilities, and the transmission of collected parameters to include: own GPS location, chemical identification, chemical concentration measured in milligrams per cubic meter (mg/m3), humidity and wind speed and wind direction. The design shall be able to work in both urban and rural terrains and should autonomously operate for at least three months on battery and also by means of an 110v/220v AC adapter. The ability to also detect and report on large quantities of explosive compounds such as Types 2,4,6-TNT, Types 2,4-DTNT, and plastic explosive compounds is a plus and will weigh heavily in vendor selection. Multiple radio broadcast capable sensors will allow the accurate triangulation predictive projection of contamination.. To meet SOF operational requirements, the sensor shall be robust, and operate reliably under severe environmental conditions. Satisfaction of these SBIR requirements will enable chemical event detection and identification, and location and direction of movement of chemical agents. This capability will allow predictive effects analysis and management in support of civil and military force protection and would have a significant positive impact on peacekeeping and counterterrorism operations. Remote broadcast capable sensors working in concert with manned and unmanned autonomous vehicles, and a centralized automated analysis node would provide SOF operators with an around-the-clock persistent remote WMD surveillance and alert system.

Proposals should reflect the vendor’s expertise, especially in chemical sensing design, electronics system design, small package mechanical design, and the advantages of their technical approach to a remote chemical sensing system. The proposal should concentrate on chemical compound sensing and address the physical packaging in only general terms as they influence the chemical sensing design approach. Phase I companies will discuss their proposed research in detail and propose in general what they would continue in Phase II. Teaming with larger companies is not encouraged, but is acceptable.

Proposers should budget for a single one day trip to Tampa, Florida for a Phase I kickoff meeting.

Successful proposals will use novel ideas to improve soldier usability, create future commercial markets, and increase functional capability. Pluses include:
• Fully demonstrating the company's past and present experience;
• Supplying references on proposing company's products/programs (particularly government program managers);
• Giving detail on its proposed technologies to show expertise.
• Showing detailed expertise in technologies related to this SBIR.
• Experience designing products for use in wilderness areas or for military customers.
• Companies that can assist the topic author in commercializing the product.

PHASE I: Develop overall system design that includes specification of chemical and weather sensors, cooperative triangulation, data transmission elements and data rate, sensor specification, broadcast radio specifications, C^2 analysis node design and specifications, and protocol operation.

• Performance is the primary concern.
• Chemical compounds that must be detected are Sarin, Mustard, Cyclosarin, Tabun, and VX.
• Additional persistent toxic compound detection is desirable.
• The capability to also detect in parts-per-trillion (PPT) quantities TNT, DTNT, and plastic explosive compounds is a plus and will weigh heavily on vendor selection.
• Sensor cost in quantities must be less than $5000 each.
• Military system environmental standards are relaxed for development.
• Sensor target weight is 5 lbs. (less battery/power supply).
• Detection sensitivity goal is 5% of lethal dosage or less.

PHASE II: Develop, build, and demonstrate a prototype chemical sensor system of three (3) radio broadcast capable prototypes and a C^2 node in a realistic military field environment. Conduct extensive testing to prove feasibility over varied extended operational conditions, to refine/validate MTBF data, validate HMI and mechanical design, establish power efficiency data, and to validate the total system design. Make system design modifications, as necessary, within the proposed budget to ensure Government satisfaction with the prototype. Provide a Final Technical Report of Phase II activities which will be evaluated to determine which Phase II company will be selected to continue development refinement in Phase II (Extended), or go into production in a Phase III contract. Provide the three (3) prototypes, the C^2 node, and selected spare parts to the Government for 90 days of Government testing and validation

PHASE III DUAL-USE APPLICATIONS: This system could be used in a broad range of military and homeland security applications where automatic remote surveillance, tracking and predictive contamination modeling are necessary for example, in overseas peacekeeping or US civil protection operations. At the completion of successful Government test and validation a limited production run is envisioned for SOCOM requirements. The vendor may conduct marketing activities for additional DoD and Federal and State Government customers only to increase the initial production

KEYWORDS: CHEMICAL, WEATHER, SENSORS, PERSISTENT, UNATTENDED SURVEILLANCE, NETWORKING, WEAPONS OF MASS DESTRUCTION, WMD, VX, SARIN, CYCLOSARIN, TABUN, MUSTARD, TNT, DTNT.

SOCOM05-011 TITLE: Miniature Unmanned Aerial Vehicle (MUAV)

TECHNOLOGY AREAS: Air Platform, Information Systems, Sensors, Electronics, Battlespace

OBJECTIVE: Design, develop, and demonstrate a self-contained probe (i.e. MUAV) that will provide sensor videos on-demand to aircraft operators, e.g. sensor operators or helicopter pilots. The probe or MUAV would be capable of being launched from the airborne aircraft platform and controlled by the aircraft operator in flight.

DESCRIPTION: During war, timing is critical. Many times aircraft must fly at low altitudes in order to acquire tactical surveillance or feedback information. These low altitudes result in higher risks for Aircraft and Aircrew survivability. The goal of this program is to develop and integrate Miniature Aerial Vehicle technologies into militarily useful and affordable systems suitable for special-forces missions.

This program will focus on the development of MUAVs to accomplish unique military missions, particularly with regard to flight operations in restricted environments. The MUAV will provide useful, real-time combat identification information, of difficult to observe and/or distant areas, or objects in complex topographies such as mountainous terrain with caves, heavily forested areas, urban environments, and areas with a high concentration of civilians. Furthermore, the MUAV allows more complete looks of the target from multiple aspect angles to defeat potential camouflage and concealment and improve target recognition.

The initial MUAV technology development program will focus on technologies and components required to enable minimum MUAV flight, including flight control, power and propulsion, navigation and communications (surveillance and reconnaissance).

This self-contained probe/MUAV application presents some unique challenges. One challenge is the difficulty of launching from an airborne platform and transitioning to controlled flight. Another is the difficulty of recovery, necessitating either airborne pickup, potential long-range capability to ensure return to friendly controlled areas, or disposability (and thus low cost). Additionally, there are five significant challenge areas regarding MUAV development and employment:

Reliability of Communications both for Command and Control and for video feedback: Communications tend to be very line-of-sight (particularly video downlinks) and short-range. They are hindered by vegetation, obstacles (man-made and natural) and by radio-frequency noise. Current links are limited (even with line-of-sight) to about 10 miles under optimal conditions.

Power: Most of the small air vehicles are hand-launched and battery powered. This limits their range to about 90 minutes when the aircraft is carrying a camera. They are also speed limited to about 50 knots. Small gas engines are not compatible with military operations, and cause the air platform to be very noisy. Extended loiter periods, and more power available for payloads (such as a communications relay payload) are needed.

Stability and extended flight envelope: In order to penetrate winds and cover area, high speeds (>70 knots) are desired. To observe and track personnel and equipment on the ground, very low speeds or hovering capability is required. There is work being done in this area, but it has not been particularly successful to date.

Operator training and logistics: Systems should require very low operator training. Current systems require several weeks of operator training and currency requirements to keep from losing proficiency. Logistic support requirements should be minimal. Cost of lithium batteries is very high, so rechargeable batteries are preferred (however, see range limitations above). Military desires use of logistics fuel (JP-8/Diesel) for logistics and safety reasons.

Sensors: Current cameras require low altitude and do not provide wide field of view or high resolution. Extended range cameras with day and night capabilities are desired. Current state of the art is represented by the Indigo Thermovision camera. This is a small (1.35"x1.45"x1.90") and light (under 120 grams) infrared camera. It features SmartScene™ video (RS-170A) output to maximize picture quality in every frame.

PHASE I: Design and implement a Trade Study demonstrating the feasibility of a surveillance gathering miniature UAV that can be launched and controlled from an airborne aircraft platform. Develop a sensitivity analysis demonstrating the system design, including specification of video surveillance and target recognition technology, sensor specification, and mission boundaries. Determine type of sensor, design of sensor, cost, usefulness, and return on investment.

PHASE II: Develop and demonstrate a prototype system (hardware and software) within a realistic environment. The hardware/software can be a straight Commercial Off The Shelf (COTS), modified COTS, or a Research and

Design (R&D) system. Phase II will include testing to prove feasibility over extended operating conditions within a broad range of military scenarios.

PHASE III DUAL USE APPLICATIONS: Conduct flight demonstration and initial prototype manufacturing of the USSOCOM MUAV system. This system could have dual-use applications with USSOCOM and civilian law enforcement programs. For example, it will provide real-time situational awareness (SA) to firefighters during forest fires. Quite often, a firefighters view is obscured by heavy smoke and dense foliage; the MUAV system could improve Firefighters' SA--consequently saving civilians lives.

KEYWORDS: Miniature Unmanned Aerial Vehicles (MUAV), Sensors, Sensor properties, UAV, platform.