

# VERSION 2

## STRATEGIC CAPABILITIES OFFICE (SCO) 21.3 Small Business Innovation Research (SBIR) Program Direct to Phase II Proposal Submission Instructions

The Strategic Capabilities Office (SCO) seeks small businesses with strong research and development capabilities to pursue and commercialize specific technologies to meet SCO objectives.

The 2021.3 SCO SBIR Direct to Phase II proposal submission instructions are intended to clarify the Department of Defense (DoD) instructions as they apply to SCO requirements. This Announcement is for Direct to Phase II proposals only. All Phase II proposals must be prepared and submitted through the DoD SBIR/STTR electronic submission site: <https://www.dodsbirsttr.mil/>. The offeror is responsible for ensuring that their proposal complies with the requirements in the most current version of instructions. Prior to submitting your proposal, please review the latest version of these instructions as they are subject to change before the submission deadline.

Specific questions pertaining to the SCO SBIR Program should be submitted to the SCO SBIR Program office at:

E-mail – [sbir@sco.mil](mailto:sbir@sco.mil)

### 1. DIRECT TO PHASE II

15 U.S.C. §638 (cc), as amended by NDAA FY2012, Sec. 5106, and further amended by NDAA FY2019, Sec. 854, PILOT TO ALLOW PHASE FLEXIBILITY, allows the Department of Defense to make an award to a small business concern under Phase II of the SBIR Program with respect to a project, without regard to whether the small business concern was provided an award under Phase I of an SBIR Program with respect to such project. SCO is conducting a "Direct to Phase II" implementation of this authority for this 2021.3 SBIR Announcement and does not guarantee Direct to Phase II opportunities will be offered in future Announcements.

SCO Direct to Phase II Proposals are different from traditional SCO SBIR Phase I proposals. The chart below explains some of these differences.

	STANDARD SCO SBIR PROCESS	SCO D2P2 PROCESS
PHASE 1 TYPICAL FUNDING LEVEL	\$250,000	None
PHASE 1 TECHNICAL *POP DURATION	6 months	None
PHASE 2 TYPICAL FUNDING LEVEL	\$1,500,000	\$1,500,000
PHASE 2 TECHNICAL *POP DURATION	24 months	24 months

\*POP= Period of Performance

### 2. INTRODUCTION

Direct to Phase II proposals must follow the steps outlined below:

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1. Offerors must create a Cover Sheet using the DoD Proposal submission system. Offerors must provide documentation that satisfies the Phase I feasibility requirement\* that will be included in the Phase II proposal. Offerors must demonstrate that they have completed research and development through means other than the SBIR/STTR Program to establish the feasibility of the proposed Phase II effort based on the criteria outlined in the topic description.
2. Offerors must submit a Phase II proposal using the SCO Phase II proposal instructions below.

\* NOTE: Offerors are required to provide information demonstrating that the scientific and technical merit and feasibility has been established. SCO will not evaluate the offeror's related Phase II proposal if it determines that the offeror has failed to demonstrate that technical merit and feasibility has been established or the offeror has failed to demonstrate that work submitted in the feasibility documentation was substantially performed by the offeror and/or the Principal Investigator (PI).

### **3. PROPOSAL SUBMISSION**

The complete proposal, i.e., DoD Proposal Cover Sheet, technical volume, cost volume, and Company Commercialization Report, must be submitted electronically at <https://www.dodsbirsttr.mil/>. Ensure your complete technical volume and additional cost volume information is included in this sole submission.

#### **Complete proposals must include all of the following:**

- a. DoD Proposal Cover Sheet (Volume 1)
- b. Technical Volume (Volume 2):
  - Part 1: Phase I Justification
  - Part 2: Phase II Technical Proposal
- c. Cost Volume (Volume 3)
- d. Company Commercialization Report (Volume 4)
- e. Supporting Documents (Volume 5)
- f. Fraud, Waste, and Abuse (Volume 6)

**The SCO SBIR Program is accepting Volume 5 (Supporting Documents). This volume should not exceed 10 pages.**

Phase II proposals require a comprehensive, detailed submission of the proposed effort. SCO SBIR Direct to Phase II periods of performance are 24 months. SCO may award SBIR Direct to Phase II efforts up to a maximum value of \$1,500,000 per contract award. Commercial and military potential of the technology under development is extremely important. Proposals emphasizing dual-use applications and commercial exploitation of resulting technologies are sought.

### **4. Direct to Phase II PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS**

#### **PROPOSAL FORMAT**

**A. Cover Sheet.** As instructed on the DoD SBIR proposal submission website, prepare a Proposal Cover Sheet. Proposal Abstract and Expected benefits and Government or private sector applications of the proposed research should also be summarized in the space provided. The

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abstract/benefits of selected proposals will be submitted for publication with unlimited distribution. Therefore, the summary should not contain classified or proprietary information.

## B. Volume II (14 pages Maximum)

1. **Phase I Justification:** Offerors are required to provide information demonstrating the establishment of the scientific and technical merit and feasibility. **Feasibility documentation MUST NOT be solely based on work performed under prior or ongoing Federally funded SBIR or STTR work.**
2. **Phase II Technical Objectives and Approach:** List the specific technical objectives of the Phase II research and provide a detailed technical approach in in order to meet these objectives.
  - **Phase II Work Plan.** Provide an explicit, detailed description of the Phase II approach. The plan should indicate what is planned, how and where the work will be carried out, a schedule of major events, and the final product to be developed. A Phase II effort should attempt to accomplish the technical feasibility demonstrated in Phase I, including potential commercialization of results. Phase II is the principal research and development effort and is expected to produce a well-defined deliverable product or process.
  - **Related Work.** Describe significant activities directly related to the proposed effort, including those conducted by the Principal Investigator, the proposing firm, consultants, or others. Report how the activities interface with the proposed project and discuss any planned coordination with outside sources. The proposers' awareness of the state-of-the-art in the technology and associated science must be demonstrated.
  - **Relationship with Future Research or Research and Development.** State the anticipated results of the proposed approach if the project is successful. Discuss the significance of the Phase II effort in providing a foundation for a Phase III research or research and development effort.
  - **Technology Transition and Commercialization Strategy (nte 5 pages within VOLII).** Describe your company's strategy for converting the proposed SBIR research, resulting from your proposed Phase II contract, into a product or non-R&D service with widespread commercial use -- including private sector and/or military markets. Note that the commercialization strategy is separate from the Commercialization Report described in Section 4.L below. The strategy addresses how you propose to commercialize this research, while the Company Commercialization Report covers what you have done to commercialize the results of past Phase II awards. Historically, a well-conceived commercialization strategy is an excellent indicator of ultimate Phase III success. The commercialization strategy must address the following questions:

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- What is the first product that this technology will go into?
  - Who will be your customers, and what is your estimate of the market size?
  - How much funding will you need to bring the technology to market, and how will you raise those funds?
  - Does your company contain marketing expertise and, if not, how do you intend to bring that expertise into the company?
  - Who are your competitors, and what is your price and/or quality advantage over your competitors?
- **Key Personnel.** Identify key personnel, including the Principal Investigator, who will be involved in the Phase II effort. List directly related education and experience and relevant publications (if any) of key personnel. Include a concise resume of the Principal Investigator(s).
  - **Facilities/Equipment.** Describe available instrumentation and physical facilities necessary to carry out the Phase II effort. Justify items of equipment to be purchased (as detailed in the cost proposal) including Government Furnished Equipment (GFE). All requirements for government furnished equipment or other assets, as well as associated costs, must be determined and agreed to during Phase II contract negotiations. State whether or not the facilities where the proposed work will be performed meet environmental laws and regulations of federal, state (name) and local governments. This includes, but is not limited to, the following groupings: airborne emissions, waterborne effluents, external radiation levels, outdoor noise, solid and bulk waste disposal practices, and handling and storage of toxic and hazardous materials.
  - **Consultants.** Involvement of university, academic institution, or other consultants in the project may be appropriate. If such involvement is intended, it should be described in detail and identified in the Cost Volume.

**C. Volume III- Cost (\$1,500,000 Maximum).** A detailed, Phase II Cost Volume must be submitted online and in the proper format shown in the Cost Breakdown Guidance in the DoD BAA Preface. Some items in the cost volume template may not apply to the proposed project. If such is the case, there is no need to provide information for each and every item. Provide enough information to allow the SCO evaluators to assess the proposer's plans to use the requested funds if the contract is awarded.

1. List all key personnel by name as well as number of hours dedicated to the project as direct labor.
2. Special Tooling, Test Equipment, and Materials Costs:
  - a. Special tooling, test equipment, and materials costs may be included under Phase II. The inclusion of equipment and material will be carefully reviewed relative to need and appropriateness for the work proposed; and
  - b. The purchase of special tooling and test equipment must, in the opinion of the Contracting Officer, be advantageous to the Government and should be related directly to the specific effort.
3. Cost for travel funds must be justified and related to the needs of the project.

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## **5. METHOD OF SELECTION AND EVALUATION CRITERIA**

**A. Evaluation Criteria.** All proposals will be reviewed for overall merit based on the evaluation criteria published in the DoD SBIR Program BAA:

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.

## **6. CONTRACTUAL CONSIDERATIONS**

- A. Awards.** The number of Direct to Phase II awards will depend upon the quality the Phase II proposals and the availability of funds. Each Phase II proposal selected for award under a negotiated contract requires a signature by both parties before work begins. SCO awards Phase II contracts to Small Businesses based on results of the agency priorities, scientific, technical, and commercial merit of the Phase II proposal.
- B. Reports.** For incrementally funded Phase II projects an interim, midterm written report maybe required (at the discretion of the awarding agency).
- C. Payment Schedule.** SCO Phase II Awards Level of Effort Firm Fixed Price contracts. Monthly invoices are based on the labor hours recorded and the monthly costs associated with the project.
- D. Markings of Proprietary Information.** Per DoD SBIR Program BAA.
- E. Copyrights, Patents and Technical Data Rights.** Per DoD SBIR Program BAA.
- F. Security Information.** SCO anticipates work produced in Phase II may become classified. Note: The prospective contractor(s) must be U.S. owned and operated with no foreign influence as defined by DoD 5220.32-M, National Industrial Security Program Operating Manual, unless acceptable mitigating procedures can and have been implemented and approved by the Defense Counterintelligence and Security Agency (DCSA). The selected company will be required to safeguard classified material IAW DoD 5220.32-M during the advanced phases of this contract.

Access to CUI is required for performance on this contract. IAW DoDI 5200.48, EO 13556, 32 CFR Part 2002, NIST SP 800-171 Rev 1, DFAR Supplement Clause 252.204-7012 as amended, and applicable guidance provided by the CSA, certain types of information require safeguarding or dissemination controls to ensure it is not released improperly. CUI categories include, but are not limited to: (1) Procurement and Acquisition Information (i.e., contractor proposals and source selection information), (2) Proprietary Data (i.e., information protected under the Trade Secrets Act, 18 USC §1905), (3) Export Restricted or Controlled Technology (e.g., defense articles and technical data restricted by the International Traffic in Arms Regulations (ITAR), 22 CFR §§120-130), (4) Program-specific Financial Data, (5) Limited Distribution Unclassified Intelligence Information, (6) Law Enforcement Sensitive Information, (7) Personal Identifying Information (PII), (8) Critical Infrastructure, (9) North Atlantic Treaty (NATO) Restricted or Unclassified Information, (10) DoD Unclassified Controlled Nuclear Information. At a minimum, all SCO technical program information should be marked as CUI.

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All organizations participating in SCO programs have an OPSEC requirement. Due to SCO's increased media attention and the high potential for adversaries to target/collect program data, properly applied OPSEC measures must be taken into account to protect sensitive unclassified information. The PM at each work location (government and industry) is responsible for the protection of both unclassified and classified SCO technical program information. The PM will: (1) Not provide any SCO technical program information (unclassified or classified) to any individual or organization (this includes periphery program support; contracts, finance, etc.), until they have read and understand program-specific security requirements (This applies only if the individual has a Need- To-Know (NTK) for technical program information for execution of their duties.

### **7. TECHNICAL AND BUSINESS ASSISTANCE (TABA)**

The SCO SBIR Program will not participate in the Technical and Business Assistance.

### **8. REPORTING OF PHASE III OR ANY OTHER COMMERCIALIZATION EFFORTS**

A. Each small business receiving a Phase II award is required to report all Phase III activities on their Company Commercialization Report (Volume 4 of proposal submission). In addition, please send any corresponding Phase III documents in PDF format to: [sbir@sco.mil](mailto:sbir@sco.mil). Information contained in the CCR will not be considered during proposal evaluations.

Reportable activities include: sales revenue from new products and non-R&D services resulting from the Phase II project; additional investment from sources other than the Federal SBIR program in activities that further the development and/or the commercialization of the Phase II technology; the portion of additional investment representing clear and verifiable investment in the future commercialization of the technology (i.e. "hard investment"); whether the Phase II technology has been used in a fielded DoD system or acquisition program and, if so, which system or program; the number of patents resulting from the contractor's participation in the SBIR/STTR program; growth in number of firm employees, and; whether the firm completed an initial public offering (IPO) of stock resulting in part from the Phase II project.

### **PROTEST PROCEDURES**

Refer to the DoD SBIR Program Announcement for procedures to protest the Announcement.

As further prescribed in FAR 33.106(b), FAR 52.233-3, Protests after Award should be submitted to: [sbir@sco.mil](mailto:sbir@sco.mil)

### **NOTIFICATION OF SELECTION OR NON-SELECTION**

Proposing firms will be notified of selection or non-selection status for a Phase II award within 90 days of the closing date of the BAA. The individual named as the Corporate Official on the Proposal Cover Sheet will receive an email for each proposal submitted from [sbir@sco.mil](mailto:sbir@sco.mil) with their official notification of proposal selection or non-selection

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## **SCO SBIR 21.3 Direct to Phase II Topic Index**

SCO213-002	Midpoint and tactical data aggregation to enable cyber operations
SCO213-003	High Throughput Photonic Processor for AI/ML programs

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**SCO 213-002** TITLE: Midpoint and tactical data aggregation to enable cyber operations

OUSD (R&E) MODERNIZATION PRIORITY: Cybersecurity

TECHNOLOGY AREA(S): Information Systems

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 3.5 of the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

**OBJECTIVE:** Develop unsupervised, automated, and encrypted or secure means of exploiting machine learning algorithms in adversary space (midpoint or cloud-based aggregation points) to evaluate and securely exfiltrate only data of relevance to the government missions. The government must have the ability to specify how reporting is generated based on confidence thresholds of data screening, and primarily security of data during exfiltration and at rest (during investigation / inquiry).

**DESCRIPTION:** Securely exfiltrating or transferring data from a midpoint of aggregation into U.S. owned networks at a speed and quantity sufficient to support intelligence or operational needs represents a significant technical challenge to cyber and information warfare operations. The objective desired is secure, data transfer with low or no probability of detection from a point of presence in an adversary network, on a midpoint or cloud-based aggregation point. The SBIR would propose a manner of on sight or in situ analysis to decrease the size and amount of data copied and removed from that network or cloud. The method of obfuscation, encryption, or non-attributable exfiltration are key requirements for any proposed solution. This SBIR is a Direct to Phase II effort. Awardee(s) will be responsible for providing their own hardware and software, chargeable to the contract, but not to exceed the maximum funding limits. During the SBIR Phase II effort, neither SCO, nor its partners, will provide access to any training material, government furnished information, or equipment.

Currently, exfiltrated data is backhauled to appropriate government systems for analysis and action. The logistics of this extensive data supply chain process is both expensive and time consuming, negatively impacting the speed to mission. By deploying analysis tools in a gray-space/midpoint aggregation architecture, the process can take advantage of data timeliness and overcome backhaul and storage constraints by applying advanced, encrypted filter and selection, and return only the most relevant, pre-selected data. This will decrease data exfiltration requirements and detection while increasing speed of analysis.

Proposed solutions should be able to integrate into existing infrastructures and workflows and scale for use across multiple domains and also allow aggregated data to maintain a low probability of detection in lower trust environments while sensitive operations (search, watch listing, analytics,) are conducted. Awardees are responsible for providing their own training corpuses, and must be able to fully describe said corpuses, what criteria will be used to teach the system, and maintain continued/regular access to said training corpus in the Phase II proposals. The training corpus may be any government, commercial, academic, proprietary, or open source data set, or a combination of any or all. Loss of access to the training corpus before or during the SBIR program will result in cessation of participation of the contract.

At the close of the SBIR process, awardees will deliver a successful operational prototype with full

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government use rights. Awardees may use any developed efforts for other governmental or commercial opportunities, including continued service support in any Phase III options.

PHASE I: Documentation should be provided to allow government to make a feasibility determination to proceed direct to Phase II. This could include but is not limited to: examples or the technologies used in existing controlled scenarios or on wholly owned networks. Where else is the proposed encryption, transfer and analytical software used? How does it function? What are the technical limitations and requirements? How much memory is required? How much bandwidth? Processing time? Does it require software installed locally? Or is it accessible via remote solutions? Any reports on current use addressing Software Development Kit (SDK) size, analytical and processing speed, security of encryption and or packet transfer times along with availability and reliability reports (how often does the system go off line or require reprogramming, software rewrites, and or updates? Any possible training available and time to train to use, and mastery levels, if required?

PHASE II: SCO will accept DP2 proposals for a cost of up to \$1.5M for 24 months. The minimum required deliverable would be demonstration of the technology in a proxy ‘adversary owned’ network or cloud of the prototype technology allowing secure, low probability non-attributable exfiltration of selected data from a ‘neutral’ cloud.

PHASE III DUAL USE APPLICATIONS: Commercial applications would include providing select data from cloud environments for data analytics including support of machine learning and artificial intelligence for trend analysis and anomaly detection. This could reduce storage dependency and redundancy allowing cloud storage of most data and select targeted transfer of valued data. Awardees may use any developed efforts for other governmental or commercial opportunities, including continued service support in any Phase III options. Private sector commercial potential includes using the developed tools in a network security environment for data transfers either as a service provider or as a supplier to network security service providers. DOD and Military application of Midpoint and tactical data aggregation to enable cyber operations include intelligence gathering, cyber network analysis, target development, indications and warning, as well as transfer of technical data.

### REFERENCES:

Williams, Ellison Anne. “Practical Homomorphic Encryption: Three Business Use Cases.” *Forbes* Forbes Technology Council post, Aug 10, 2020  
[www.forbes.com/sites/forbestechcouncil/2020/08/10/practical-homomorphic-encryption-three-business-use-cases/?sh=bee4b9a2a460](https://www.forbes.com/sites/forbestechcouncil/2020/08/10/practical-homomorphic-encryption-three-business-use-cases/?sh=bee4b9a2a460)

Williams, Ellison Anne. “Homomorphic Encryption: Myths and Misconceptions.” *Helpnet security* Feb 18 2021 [www.helpnetsecurity.com/2021/02/18/homomorphic-encryption-myths-misconceptions/](https://www.helpnetsecurity.com/2021/02/18/homomorphic-encryption-myths-misconceptions/)

Williams, Ellison Anne. “Encrypting data on the Internet of Battlefield Things.” Video *C4ISRNET* June 11 2019. <https://www.c4isrnet.com/video/2019/06/12/encrypting-data-on-the-internet-of-battlefield-things/>

KEYWORDS: Encryption, AI, ML

**SCO 213-003**

**TITLE:** High Throughput Photonic Processor for AI/ML programs

**OUSD (R&E) MODERNIZATION PRIORITY:** Artificial Intelligence/ Machine Learning

**TECHNOLOGY AREA(S):** Information Systems

**OBJECTIVE:** The objective of this photonic processor is to address the need of a high throughput AI/ML processor that can address full sensor resolution output without the need for pre-filtering potential throughput of 480 frames per sec or 88k targets filtered and identified in 3 minutes. A one-step over a two-step inference process. All this capability could fit into a 1 or 1.5U rack system. The current processors are an adaptation of GPU and CPU performance that does not meet the Transition Partners' performance needs of throughput, weight, power, thermal, and size.

Phase II effort will use the latest photonic LED/LCD technology to accomplish photonic processor for automatic target recognition (ATR) of various sensor (i.e., E/O, MWIR, SAR, ISAR, etc.) inputs at a throughput >75k fps at full 4K imagery. A secondary goal would be to complete a study that 1) addresses  $\geq 100k$  fps and throughput  $\geq 8K$  imager resolution, and 2) addresses counter-adversarial issues.

**DESCRIPTION:** This SBIR topic is a Direct to Phase II effort. Awardee(s) will be responsible for providing their own hardware and software, chargeable to the contract, but not to exceed the maximum funding limits. During the first 12 months of the SBIR Phase II effort, neither SCO, nor its partners, will provide access to any training material, government furnished information, or equipment.

Digital processing technology is reaching its limitation as circuit resolution is now at single-digit nano- ( $10^{-9}$  m) resolution compared to 1995 of single-digit micron- ( $10^{-6}$  m) resolution. Resolution at this level at or near the quantum level of circuitry that affects the binary processing results of 1s and 0s only. In approaching the quantum state the system must address the fact that electrons have mass and issue that Heisenberg's uncertainty principle states that it is impossible to measure or calculate exactly, both the position and the momentum of an object. Therefore, it is impossible to know if the value is on/off or 1 or 0 or both.

As an alternative, photons can serve the same function of processing and do not have mass. Without mass, the photonic processes are not bound by Heisenberg's uncertainty principle. At the same time a photonic processor in the 1990s was built to process 2,500 images per second in the identification of image content and was referred to as Automatic Target Recognition (ATR). This processor, using current LED and camera technology could do far faster processing and identification. A processor would be used to do training of known target types, i.e., car vs trucks, commercial vessel types, fingerprint types, or famous artist painting at the unclassified level.

Application can use any type of photonic processor to address training and inference processing together or separately. Such system includes but are not limited to: Correlator (4f inference), Fourier Optics (2f), photonic quantum (inference), optical based FFTs, etc. Key is that such systems should be low power, low heat transfer, and small footprint.

Proposals must:

- Describe in detail how the proposed solution will take sensor data and provide a repeatable topological solution via a SCO approved test and evaluation (T&E) process.
- Must develop a Zemax tool, or equivalent, within the first 9-months to describe the photonic system design and performance to receive government approval.
- Must use the latest photonic 4K imaging technology or proven next-generation technology.

Proposals will:

- Provide a detailed description of training criteria and applicable evaluation schema. It should also

explain the topological criteria for assessing imagery, and any non-selected criteria with reason why it was not used in the system.

- Identify and explain all featurettes of training associated with various levels of the topology.
- Address the use of Photonic RGB pixels technology for gray-scale processing.
- Deliver two studies:
  1. To explore next generation photonic capability with greater throughput and resolution,
  2. To assess counter-adversarial capability over current neural network capability.

Awardees are responsible for providing their own training corpuses, and must be able to fully describe said corpuses, what criteria will be used to teach the system, and maintain continued/regular access to said training corpus in the Phase II proposals. The training corpus may be any government, commercial, academic, proprietary, or open source data set, or a combination of any or all. Loss of access to the training corpus before or during the SBIR program will result in cessation of participation of the contract.

At the close of the SBIR process, awardees will deliver to the government:

- A successful prototype processor with full government use rights in a U rack configuration
- Associated artifacts of all documentation required to replicate the build and use of the processor for both training and inference use. Artifacts include, but are not limited to, a fully developed reference guide and detailed schema packages, specific machine learning criteria and teaching corpus description, detailed hardware/software requirements, all algorithms and unique/proprietary software needed to run the analysis, and all internal test plans and results.
- Fully trained dictionary to include at least two sensor packages.
- If applicable, any open source behavior or signatures analysis and analytical tools being used, and the source for each
- A completed Study on:
  1. Next generation throughput (fps) and imagery resolution ( $\geq 8K$ ) capabilities, including component sources, and
  2. Counter-adversary advantages/weakness of a photonic processor over current neural network GPU processor.

Awardees may use any developed efforts for other governmental or commercial opportunities, including continued service support in any Phase III options. The government shall have unlimited use rights to the resulting hardware, software, algorithms, dictionaries or other deliverables from this SBIR.

PHASE I: Feasibility study to be included in tech volume per proposal submission instructions.

A study will address plan system design/performance and address potential photonic risks. It must also address the specifications of size, weight, and heat transfer. Secondary would be addressing cybersecurity aspects of such a system. And finally, would like to the study to define classification plan, sources of unclassified training data, and understanding/exploitation of training featurettes and those advantages over traditional neural network approaches. The Program manager would like to see, if applicable any component or system demonstrations.

PHASE II: SCO will accept DP2 proposals for a cost of up to \$1.5M for 24 months.

Use of Phase 1 information to build a working model of the Photonic processor for 3<sup>rd</sup> party laboratory evaluation, based on existing training data set provided by performer. SCO is looking for expertise to address 2020+ technology to address a photonic (optical) process a performance factor of 20x that of the 1990 capability of 2,500 images per second to collect imagery with a screen resolution of 2K or better. Such a system would use a combination of or existing open source neuro network operating libraries or operating systems, such as Python, Strawberry, PennyLane, Torch, TensorFlow, and others. The program manager would like delivery of working system and appropriate use and training documentation as well as a study on the cybersecurity risks for such a photonic system.

#### PHASE III DUAL USE APPLICATIONS:

Commercial applications can include but not limited to: Medical (i.e., breast or colon cancer nuclear imagery), Biometrics (i.e., non-minutia fingerprint identification and gender classification), Civil Mass Video network (i.e., highway or street Amber alert identification), next generation Self-driving vehicles, and complex drome swam multi-dimensional maneuvers. Private sector commercial potential includes uses in medical radiology imagery, autonomous vehicles, residential video security, and traffic/pedestrian city camera systems.

#### REFERENCES:

1. Miniature Ruggedized Optical Correlator (MROC) for flight testing, SPIE Vol. 2237 Optical Pattern Recognition V, 01 March 1994;
2. MROC module for Space, SPIE Vol. 3124 • 0277-786X197, 17 Oct 1997;
3. MROC module -3rd Gene, SPIE Vol. 3386 • 0277-786X1981, 23 March 1998;
4. Use of Laser Radar Signal Processing in optical pattern recognition, Mar 1998;
5. Pattern Recognition Prototyping Tool, Nov 1997; Recognition System Rapid Application Prototyping Tool, Mar 1997;
6. Second Generation Miniature Ruggedized Optical Correlator (MROC) module, Mar 1997;
7. Performance of a second-generation miniature ruggedized optical correlator module, Oct 1997;

KEYWORDS: Machine Learning, Processor Throughput, Photonic processor.