GENERAL INFORMATION

The National Geospatial-Intelligence Agency has a responsibility to provide the products and services that decision makers, warfighters, and first responders need, when they need it most. As a member of the Intelligence Community and the Department of Defense, NGA supports a unique mission set. We are committed to acquiring, developing and maintaining the proper technology, people and processes that will enable overall mission success.

Geospatial intelligence, or GEOINT, is the exploitation and analysis of imagery and geospatial information to describe, assess and visually depict physical features and geographically referenced activities on the Earth. GEOINT consists of imagery, imagery intelligence and geospatial information.

With our unique mission set, NGA pursues research that will help guarantee the information edge over potential adversaries. Additional information pertaining to the National Geospatial-Intelligence Agency’s mission can be obtained by viewing the website at https://www.nga.mil.

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

National Geospatial-Intelligence Agency
Attn: SBIR Program Manager, RA, MS: S75-RA
7500 GEOINT Dr., Springfield, VA 22150-7500
Email: SBIR@nga.mil

For technical questions and communications with Topic Authors, see DoD Instructions, Section 4.15. For general inquiries or problems with electronic submission, contact DoD SBIR Help Desk at DoDSBIRSupport@reisystems.com or 1-703-214-1333 between 9:00 am and 5:00 pm ET (Monday – Friday).

PHASE I PROPOSAL INFORMATION

Follow the instructions in the DoD SBIR Program BAA for program requirements and proposal submission instructions at https://rt.cto.mil/rtl-small-business-resources/sbir-sttr/.

NGA has developed topics to which small businesses may respond to in this fiscal year 2020 SBIR Phase I iteration. These topics are described on the following pages. The maximum amount of SBIR funding for a Phase I award is $100,000, and the maximum period of performance for a Phase I award is nine months. While NGA participates in the majority of SBIR program options, NGA does not participate in the either the Commercialization Readiness Program (CRP), Technical and Business Assistance (TABA) or Phase II Enhancement programs.

The entire SBIR proposal submission (consisting of a Proposal Cover Sheet, the Technical Volume, Cost Volume, and Company Commercialization Report) must be submitted electronically through the DoD SBIR/STTR Proposal Submission system located at https://www.dodsbirsttr.mil/submissions/ for it to be evaluated.
• **Proposal Cover Sheet (Volume 1):** The Cover Sheet must include a brief technical abstract of no more than 200 words that describes the proposed R&D project with a discussion of anticipated benefits and potential commercial applications. Do not include proprietary or classified information in the Proposal Cover Sheet. If your proposal is selected for award, the technical abstract and discussion of anticipated benefits may be publicly released.

• **Format of Technical Volume (Volume 2):** The Technical Volume must be a single Portable Document Format (PDF) file, including graphics. Perform a virus check before uploading the Technical Volume file. If a virus is detected, it may cause rejection of the proposal. Do not lock or encrypt the uploaded file. Do not include or embed active graphics such as videos, moving pictures, or other similar media in the document. The length of each part of the technical volume is limited to 20 pages. The Government will not consider pages in excess of the page count limitations. Number all pages of your proposal consecutively. Font size should not be smaller than 12 point Times New Roman font, with at least a one-inch margin on top, bottom, and sides, on 8½” by 11” paper. The header on each page of the Technical Volume should contain your company name, topic number, and proposal number assigned by DSIP when the Cover Sheet was created. The header may be included in the one-inch margin.
  o (1) Significance of the Problem. Define the specific technical problem or opportunity addressed and its importance.
  o (2) Phase I Technical Objectives. Enumerate the specific objectives of the Phase I work, and describe the technical approach and methods to be used in meeting these objectives.
  o (3) Phase I Statement of Work. The statement of work should provide an explicit, detailed description of the Phase I approach, indicate what is planned, how and where the work will be carried out, a schedule of major events and the final product to be delivered. The methods planned to achieve each objective or task should be discussed explicitly and in detail. This section should be a substantial portion of the total proposal. Include how and where the work will be carried out, a schedule of major events and the final product to be delivered. The methods planned to achieve each objective or task should be discussed explicitly and in detail.
  o (4) Related Work. Describe significant activities directly related to the proposed effort, including any conducted by the PI, the proposer, consultants or others. Describe how these activities interface with the proposed project and discuss any planned coordination with outside sources. The proposal must persuade reviewers of the proposer’s awareness of the state of the art in the specific topic. Describe previous work not directly related to the proposed effort but similar. Provide the following: (1) short description, (2) client for which work was performed (including individual to be contacted and phone number) and (3) date of completion.
  o (5) Relationship with Future Research or Research and Development. State the anticipated results of the proposed approach if the project is successful.
  o (6) Key Personnel. Identify key personnel who will be involved in the Phase II effort including information on directly related education and experience. A concise resume of the PI, including a list of relevant publications (if any), must be included. All resumes count toward the page limitation.
  o (7) Foreign Citizens. Identify any foreign nationals you expect to be involved on this project.
  o (8) Facilities/Equipment. Describe available instrumentation and physical facilities necessary to carry out the Phase I effort. Items of equipment to be purchased (as detailed in the cost proposal) shall be justified under this section. If proposing to perform classified activities during the period of performance you need to provide the following: 1) Will the information include controlled unclassified information (CUI) and; 2) What unclassified IT systems will be required.
(9) Subcontractors/Consultants. Involvement of a university or other subcontractors or consultants in the project may be appropriate. If such involvement is intended, it should be identified and described according to the Cost Breakdown Guidance. Please refer to section 4.2 of this BAA for detailed eligibility requirements as it pertains to the use of subcontractors/consultants.

(10) Prior, Current or Pending Support of Similar Proposals or Awards. If a proposal submitted in response to this is substantially the same as another proposal that was funded, is now being funded, or is pending with another Federal Agency, or another or the same DoD Component, you must reveal this on the Proposal Cover Sheet and provide the following information: a) Name and address of the Federal Agency(s) or DoD Component to which a proposal was submitted, will be submitted, or from which an award is expected or has been received. b) Date of proposal submission or date of award. c) Title of proposal. d) Name and title of the PI for each proposal submitted or award received. e) Title, number, and date of BAA(s) or solicitation(s) under which the proposal was submitted, will be submitted, or under which award is expected or has been received. f) If award was received, state contract number. g) Specify the applicable topics for each proposal submitted or award received. Note: If this does not apply, state in the proposal "No prior, current, or pending support for proposed work."

(11) Commercialization Strategy. NGA is equally interested in dual use commercialization of SBIR/STTR projects that result in products sold to the U.S. military, the private sector market, or both. NGA expects explicit discussion of key activities to achieve this result in the commercialization strategy part of the proposal. The Technical Volume of each Direct to Phase I proposal must include a commercialization strategy section. The Phase I commercialization strategy shall not exceed 5 pages. The commercialization strategy should include the following elements:

- Problem or Need Statement. Briefly describe what you know of the problem, need, or requirement, and its significance relevant to a Department of Defense application and/or a private sector application that the SBIR/STTR project results would address.

- Description of Product(s) and/or System Application(s). Identify the commercial product(s) and/or DoD system(s), or system(s) under development, or potential new system(s). Identify the potential DoD endusers, Federal customers, and/or private sector customers who would likely use the technology.

- Business Model(s)/Procurement Mechanism(s). Discuss your current business model hypothesis for bringing the technology to market. Describe plans to license, partner, or self-produce your product. How do you plan to generate revenue? Understanding NGA’s goal of creating and sustaining a U.S. military advantage, describe how you intend to develop your product and supply chains to enable this differentiation.

- Target Market. Describe the market and customer sets you propose to target, their size, their growth rate, and their key reasons they would consider procuring the technology. Describe competing technologies existent today on the market as well as those being developed in the lab.

- Funding Requirements. Describe your company’s funding history. How much external financing have you raised? Describe your plans for future funding sources (internal, loan, angel, venture capital, etc.).

- Commercialization Risks. Describe the major technology, market and team risks associated with achieving successful transition of the NGA funded technology. NGA is not afraid to take risks but we want to ensure that our awardees clearly understand the risks in front of them.
g) Expertise/Qualifications of Team/Company Readiness. Describe the expertise and qualifications of your management, marketing/business development and technical team that will support the transition of the technology from the prototype to the commercial market and into government operational environments. Has this team previously taken similar products/services to market? If the present team does not have this needed expertise, how do you intend to obtain it? What is the financial history and health of your company (e.g., availability of cash, profitability, revenue growth, etc.)?

- Format of Cost Volume (Volume 3): The Cost Volume (and supporting documentation) DOES NOT count toward the page limit of the Technical Volume. Some items in the Cost Breakdown Guidance below may not apply to the proposed project. If such is the case, there is no need to provide information on each and every item. ALL proposed costs should be accompanied by documentation to substantiate how the cost was derived. For example, if you proposed travel cost to attend a project-related meeting or conference, and used a travel website to compare flight costs, include a screen shot of the comparison. Similarly, if you proposed to purchase materials or equipment, and used the internet to search for the best source, include your market research for those items. You do not necessarily have to propose the cheapest item or supplier, but you should explain your decision to choose one item or supplier over another. It’s important to provide enough information to allow contracting personnel to understand how the proposer plans to use the requested funds. If selected for award, failure to include the documentation with your proposal will delay contract negotiation, and the proposer will be asked to submit the necessary documentation to the Contracting Officer to substantiate costs (e.g., cost estimates for equipment, materials, and consultants or subcontractors). It is important to respond as quickly as possible to the Contracting Officer’s request for documentation. Cost Breakdown Guidance:
  - List all key personnel by name as well as by number of hours dedicated to the project as direct labor.
  - Special tooling and test equipment and material cost may be included. The inclusion of equipment and material will be carefully reviewed relative to need and appropriateness for the work proposed. 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 topic. These may include such items as innovative instrumentation and/or automatic test equipment. Title to property furnished by the Government or acquired with Government funds will be vested with NGA; unless it is determined that transfer of title to the contractor would be more cost effective than recovery of the equipment by NGA.
  - Cost for travel funds must be justified and related to the needs of the project.
  - Cost sharing is permitted for proposals under this announcement; however, cost sharing is not required nor will it be an evaluation factor in the consideration of a proposal.
  - All subcontractor costs and consultant costs must be detailed at the same level as prime contractor costs in regard to labor, travel, equipment, etc. Provide detailed substantiation of subcontractor costs in your cost proposal. The Supporting Documents Volume (Volume 5) may be used if additional space is needed. For more information about cost proposals and accounting standards, see the DCAA publication titled “Audit Process Overview – Information for Contractors” available at: http://www.dcaa.mil.

- Company Commercialization Report (Volume 4): Not available for 20.3

- Supporting Documents (Volume 5): The vendor may submit supporting documents (Volume 5) but that material WILL NOT be rated by the evaluation team as part of the proposal evaluation. Items that may go into, not all inclusive, are additional cost proposal information, Completed Form SF328, advocacy letters, etc.
• **Fraud, Waste and Abuse Training (Volume 6):** Will be addressed at time of contract award.

Selection of Phase I proposals will be in accordance with the evaluation procedures and criteria discussed in this BAA (refer to Section 6.0 of the BAA).

Proposals not conforming to the terms of this BAA, and unsolicited proposals, will not be considered. Awards are subject to the availability of funding and successful completion of contract negotiations.

The NGA SBIR Program reserves the right to limit awards under any topic, and only those proposals of superior scientific and technical quality in the judgment of the technical evaluation team will be funded. The offeror must be responsive to the topic requirements, as solicited.

An **unsuccessful offeror has 3 days after notification that its proposal was not selected to submit a written request for a debriefing to the Contracting Officer (CO).** Those offerors who get their written request in within the allotted timeframe above will be provided a debriefing.

Federally Funded Research and Development Contractors (FFRDC) and other government contractors, whom have signed Non-Disclosures Agreements, may be used in the evaluation of your proposal. NGA typically provides a firm fixed price contract for Phase I awards. The type of contract is at the discretion of the Contracting Officer.

Phase I contracts will include a requirement to produce monthly status reports, a more detailed interim report not later than 7 months after award, a final report no later than 9 months after award and any software/algorithms/documentation from items developed in Phase I. These reports shall include the following sections:

- A summary of the results of the Phase I research to date
- A summary of the Phase I tasks not yet completed, with an estimated completion date for each task
- A statement of potential applications and benefits of the research.
- A summary of any risks or issues

The interim report (draft final report) and final report shall be prepared single spaced in 12 point Times New Roman font, with at least a one-inch margin on top, bottom, and sides, on 8½” by 11” paper. The pages shall be numbered.

**PHASE II GUIDELINES**

Phase II is the demonstration of the technology found feasible in Phase I. All NGA SBIR Phase I awardees from this BAA will be allowed to submit an UNCLASSIFIED Phase II proposal for evaluation without an invitation and for possible selection. To minimize the gap between the Phase I and Phase II, it is suggested that the vendor submit their proposal 60 days prior to the end date of the Phase I award.

Small businesses submitting a Phase II Proposal must use the DoD SBIR electronic proposal submission system ([https://www.dodsbirsttr.mil/submissions/](https://www.dodsbirsttr.mil/submissions/)). This site contains step-by-step instructions for the preparation and submission of the Proposal Cover Sheets, the Company Commercialization Report, the Cost Volume, and how to upload the Technical Volume. For general inquiries or problems with proposal
electronic submission, contact the DoD SBIR/STTR Help Desk at DoDSBIRSupport@reisystems.com or 1-703-214-1333 (9:00 am to 6:00 pm ET Monday - Friday).

NGA SBIR Phase II Proposals have four UNCLASSIFIED Volumes: Proposal Cover Sheets, Technical Volume, Cost Volume and Company Commercialization Report. The Technical Volume has a 40-page limit including: table of contents, pages intentionally left blank, references, letters of support, appendices, technical portions of subcontract documents (e.g., statements of work and resumes) and any attachments. Do not include blank pages, duplicate the electronically generated Cover Sheets or put information normally associated with the Technical Volume in other sections of the proposal as these will count toward the 40-page limit.

Technical Volumes that exceed the 40-page limit will be reviewed only to the last word on the 40th page. Information beyond the 40th page will not be reviewed or considered in evaluating the offeror’s proposal. To the extent that mandatory technical content is not contained in the first 40 pages of the proposal, the evaluator may deem the proposal non-responsive and score it accordingly.

Selection of Phase II proposals will be in accordance with the evaluation procedures and criteria discussed in this BAA (refer to Section 6.0 of the BAA). As part of factor c in the evaluation criteria, the vendor will be evaluated on how it addresses the following five questions on the overall commercialization strategy:

1. What is the first product that this technology will go into?
2. Who will be the customers, and what is the estimated market size?
3. How much money will be needed to bring the technology to market, and how will that money be raised?
4. Does the company contain marketing expertise and, if not, how will that expertise be brought into the company?
5. Who are the proposing firm’s competitors, and what is the price and/or quality advantage over those competitors?

Due to limited funding, the NGA SBIR Program reserves the right to limit awards under any topic and only proposals considered to be of superior quality will be funded.

NGA typically provides a firm fixed price contract as a Phase II award. The type of contract is at the discretion of the Contracting Officer.

**Initial Phase II proposals shall be limited to $1,000,000 over a two-year period with a Period of Performance not exceeding 24 months.** A work breakdown structure that shows the number of hours and labor category broken out by task and subtask, as well as the start and end dates for each task and subtask, shall be included.

Phase II contracts shall include a requirement to produce a monthly status and financial reports, an interim report not later than 12 months after contract award, a prototype demonstration not later than 23 months after contract award and a final report not later than 24 months after contract award. These reports shall include the following sections:

- A summary of the results of the Phase II research to date
- A summary of the Phase II tasks not yet completed with an estimate of the completion date for each task
- A statement of potential applications and benefits of the research.
- A summary of any risks or issues

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The interim and final report shall be prepared single spaced in 12 point Times New Roman font, with at least a one-inch margin on top, bottom, and sides, on 8½” by 11” paper. The pages shall be numbered.

USE OF FOREIGN NATIONALS

Due to the nature of the NGA mission and operations, foreign nationals are restricted from participating or working under certain NGA contracts. The participation of foreign nationals on NGA SBIR contracts is limited to only those that are scoped, proposed and awarded as exclusively Fundamental Research. For contracts that are scoped, proposed and awarded with either a portion of fundamental research, or no fundamental research, the Principal Investigator must be a US citizen, and participation of foreign nationals prohibited. Additionally, foreign nationals are prohibited from exposure to Controlled Unclassified Information.

CONTROLLED UNCLASSIFIED INFORMATION (CUI)

Controlled Unclassified Information (CUI) is information that requires safeguarding or dissemination controls pursuant to and consistent with applicable law, regulations, and government-wide policies but is not classified under Executive Order 13526 or the Atomic Energy Act, as amended.

Executive Order 13556 "Controlled Unclassified Information" (the Order), establishes a program for managing CUI across the Executive branch and designates the National Archives and Records Administration (NARA) as Executive Agent to implement the Order and oversee agency actions to ensure compliance. The Archivist of the United States delegated these responsibilities to the Information Security Oversight Office (ISOO).

32 CFR Part 2002 "Controlled Unclassified Information" was issued by ISOO to establish policy for agencies on designating, safeguarding, disseminating, marking, decontrolling, and disposing of CUI, self-inspection and oversight requirements, and other facets of the Program. The rule affects Federal executive branch agencies that handle CUI and all organizations (sources) that handle, possess, use, share, or receive CUI—or which operate, use, or have access to Federal information and information systems on behalf of an agency.

During performance of this contract, if the government provides the vendor a dataset that is not publicly released, the vendor must be CUI Compliant to receive it. For more information on this compliance please see DFARS Clause 252.204-7012, NIST Special Publication SP 800-171 and the National Archives and Records Administration (NARA) website (https://www.archives.gov/cui/about).

CERTIFICATE PERTAINING TO FOREIGN INTERESTS

Offers must submit a SF-328 in Volume 5 in order to be considered for award. If after review of the form, the offeror may be found ineligible for award if the offerors foreign interest are found to be unacceptable. The form can be found at https://www.gsa.gov/forms-library/certificate-pertaining-foreign-interests.

252.207-7000 DISCLOSURE OF INFORMATION

(a) The Contractor shall not release to anyone outside the Contractor’s organization any unclassified information, regardless of medium (e.g., film, tape, document), pertaining to any part of this contract or any program related to this contract, unless-

(1) The Contracting Officer has given prior written approval;
(2) The information is otherwise in the public domain before the date of release; or
(3) The information results from or arises during the performance of a project that involves no covered defense information (as defined in the clause at DFARS 252.204-7012, Safeguarding Covered Defense Information and Cyber Incident Reporting) and has been scoped and negotiated by the contracting activity with the contractor and research performer and determined in writing by the contracting officer to be fundamental research* (which by definition cannot involve any covered defense information), in accordance with National Security Decision Directive 189, National Policy on the Transfer of Scientific, Technical and Engineering Information, in effect on the date of contract award and the Under Secretary of Defense (Acquisition, Technology, and Logistics) memoranda on Fundamental Research, dated May 24, 2010, and on Contracted Fundamental Research, dated June 26, 2008 (available at DFARS PGI 204.4).

(b) Requests for approval under paragraph (a)(1) shall identify the specific information to be released, the medium to be used, and the purpose for the release. The Contractor shall submit its request to the Contracting Officer at least 10 business days before the proposed date for release.

(c) The Contractor agrees to include a similar requirement, including this paragraph (c), in each subcontract under this contract. Subcontractors shall submit requests for authorization to release through the prime contractor to the Contracting Officer.

*Note: This has to be negotiated prior to award of the contract. A request for determination after award will not be entertained.

5X252.204-7000-90 PUBLIC RELEASE OF INFORMATION

(a) Except as provided in paragraph (b) of this clause, information pertaining to this contract shall not be released to the public unless authorized by the Contracting Officer in accordance with DFARS 252.204-7000, Disclosure of Information. Requests for approval to release information pertaining to this contract shall be submitted to the Contracting Officer by means of NGA Form 5230-1, National Geospatial-Intelligence Agency Request for Clearance for Public Release.

(b) The contractor may provide past performance information regarding this contract, without Contracting Officer approval, to the Office of the Director of National Intelligence (ODNI), the Central Intelligence Agency (CIA), the National Reconnaissance Office (NRO), the National Security Agency (NSA), the Defense Intelligence Agency (DIA), and NGA to support source selections at those agencies. The contractor is responsible for the proper classification and handling of such information and shall provide a copy of the information provided to the Contracting Officer.

5X52.227-9000 UNAUTHORIZED USE OF NGA NAME, SEAL AND INITIALS

(a) As provided in 10 U.S.C. Section 425, no person may, except with the written permission of the Director, National Geospatial-Intelligence Agency, knowingly use the words “National Geospatial-Intelligence Agency”, National Imagery and Mapping Agency” or “Defense Mapping Agency”, the initials “NGA”, “NIMA” or “DMA”, the seal of the National Geospatial-Intelligence Agency, National Imagery and Mapping Agency or the Defense Mapping Agency, or any colorable imitation of such words, initials, or seal in connection with any merchandise, retail product, impersonation, solicitation, or commercial activity in a manner reasonably calculated to convey the impression that such is approved, endorsed, or authorized by the Director, NGA.

(b) Whenever it appears to the U.S. Attorney General that any person is engaged or about to engage in an act or practice which constitutes or will constitute conduct prohibited by paragraph (a), the Attorney General may initiate a civil proceeding in a district court of the United States to enjoin such act or
practice. Such court shall proceed as soon as practicable to hearing and determination of such action and may, at any time before such final determination, enter such restraining orders or prohibition, or take such other action as is warranted, to prevent injury to the United States, or to any person or class of persons whose protection the action is brought.
**NGA SBIR 20.3 Phase I Topic Index**

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TITLE: Enhancing Motion with Foundation

RT&L FOCUS AREA(S): Autonomy
TECHNOLOGY AREA(S): Information Systems; Sensors; Electronics

OBJECTIVE: Develop and demonstrate a capability to generate narrative descriptions and structured summaries of events, activities and anomalies associated with locations from mover intelligence (MOVINT), Geographic Information Systems (GIS) and contextual foundation data.

DESCRIPTION: Existing sources of MOVINT are generating massive amounts of persistent data of fixed locations, and more platforms are being planned. Detecting and tracking movers in full motion video (FMV), wide area motion imagery (WAMI), moving target indication (MTI) data, and other MOVINT sources have developed mature capabilities deployed for various platforms. However, converting tracks into meaningful intelligence has received relatively little attention beyond manual analysis and summary visualization techniques such as heatmaps of traffic density. Automated track analytics, such as complex threat and anomaly detection, have been hampered by short track durations, particularly in urban areas; intermittent coverage, leading to significant temporal gaps at arbitrary times; and the difficulty of incorporating higher-level, semantic understanding of the scene and cultural behaviors.

This topic will develop methods to automatically detect significant activities, anomalies and relationships from MOVINT and use them to produce human-level, semantic summaries of the most salient information associated with a location, facility or other fixed entity. GIS information from foundation feature databases should be incorporated to provide prior knowledge of the scene in the form of known buildings, facilities and structures. The interactions and relationships of movers to those features should be explicitly incorporated into algorithms to provide context sensitivity and semantic understanding that would be useful to an analyst responsible for monitoring the scene. For a designated area and temporal interval, the methods should produce an activity summary that includes structured information such as the most significant, unusual or salient events, and a narrative, textual description of that information in natural language text. Ideally, an analyst would be able to delve into any part of the summary to examine the intermediate layers of information, such as individual events, locations, and underlying raw data used to discover them.

The methods should scale to city-size areas with hours of coverage per day, enabling an analyst to rapidly obtain an automated summary of any specified region of the scene such as a single building, a parking area, a compound or a city block. Summaries should highlight activities that are unusual or significant within the local cultural context, such as high amounts of activity at a religious facility when it is not the normal time for ceremonies there, or no activity when there should be a ceremony there. The system should not rely on data-driven methods to learn patterns of life, but instead should infer expected behaviors and other information from prior cultural knowledge encoded in a suitable representation.

PHASE I: Using WAMI data, show the feasibility to generate summaries of salient events at a designated location, emphasizing the improvement in salient activity detection and summarization from leveraging GIS and cultural information. Phase I will provide an initial proof of concept using constrained spatial and temporal information to create structured representation summaries.

PHASE II: Develop a mature algorithmic capability implemented within a prototype to generate salient summaries, both structured and narrative, of arbitrary regions across multiple scales, multiple MOVINT data types and multiple cultures. GIS and cultural information should be encoded in structured representations and leveraged for inference about important activities vice benign or insignificant ones. The prototype should provide a user interface for analyst evaluation of the system on operationally relevant data.
PHASE III DUAL USE APPLICATIONS: Fully develop and transition the technology and methodology based on the research and development results developed during Phase II for DOD applications in the areas of MOVINT analytics, and other anomaly surveillance and reconnaissance applications. For example, civil authorities might use MOVINT for disaster relief, or transportation monitoring.

REFERENCES:
None

KEYWORDS: full motion video (FMV); wide area motion imagery (WAMI); moving target indication (MTI) data

TPOC-1: Jason Schwendenmann
Email: Jason.S.Schwendenmann@nga.mil
Title: Enhanced Modeling and Simulations of Hypersonics

Objective: Develop advanced multi-physics tools to improve estimation of hypersonic flowfields and phenomenologies.

Description: Hypersonic flight has been studied for decades, yet it still presents challenges in hypersonic vehicle design and analysis [1]. Computational fluid dynamics (CFD) techniques are routinely employed to yield high accuracy numerical estimates of hypersonic flowfields given specific geometry and boundary conditions. Benchmarking CFD modeling tools with experimental data, such as from wind tunnels, is important to verify and validate accuracy of simulations. Additionally, CFD predictions can assist in improving system design and performance, as well as with interpretation and analysis of measurements from tests [2]. Analysis of complex hypersonic flowfields typically require large computational grids, and long simulation run times even when parallel processing on supercomputers. Accurate modeling of hypersonic flow under realistic flight conditions is complicated by the nonlinear and thermochemical nonequilibrium conditions experienced in the atmosphere [3]. Variations in atmospheric conditions, chemical reactions, vibrational excitation, ablation products, and gas-surface interactions further complicate accurate modeling of flowfields. The air can also become ionized under high enough Mach numbers which in turn affects the overall flowfield [4].

NGA seeks innovative modeling and simulation concepts for estimating hypersonic flowfields and phenomenologies. Enhanced modeling and simulation tools are needed to accurately and efficiently solve these complex fluid, thermal, kinetic, and structural problems using coupled multi-physics codes to assist with interpretation of observations [5]. Areas of interest include: coupling of CFD to ionized plasma, RF, and optical predictions; flowfield estimation from sparse measurements; CFD solutions for non-axisymmetric bodies; coupled flow-thermal-structural-vibrational analysis; advanced numerical techniques; improvements in chemical kinetics and turbulence models; and/or improvements in high performance CFD efficiency [6-11].

Phase I: Phase I proposal should focus on demonstrating feasibility of one or more novel concepts for enhanced modeling and simulation of hypersonic flowfields and phenomenologies. The proposal should identify current methods and develop quantifiable metrics to demonstrate improvement over state-of-the-art. The proposal should demonstrate feasibility of the concept by verifying with publically available data.

Phase II: The performer should expand the Phase I research to include feasibility of multiple concepts and perform verification and validation of those concepts. Additional quantifiable metrics should be developed to further demonstrate improvement over state-of-the-art. The Phase II proposal should focus on coupling solutions to a variety of the multi-physics problems described above.

Phase III Dual Use Applications: The performer shall work with industry to make their novel methods and codes available as part of a wider multi-physics effort in hypersonics. Hypersonic flight vehicles, atmospheric flow thermochemistry, multi-physics codes.

References:

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8. Adam J. Culler et al., “Studies on Fluid-Structural Coupling for Aerothermoelasticity in Hypersonic Flow”, Aeronautics and Astronautics, Volume 48, Number 8, August 2010.;
10. Florent Duchaine et al., “Computational-Fluid-Dynamics-Based Kriging Optimization Tool for Aeronautical Combustion Chambers”, Aeronautics and Astronautics, Volume 47, Number 3, March 2009.;

KEYWORDS: Hypersonic; Computational fluid dynamics (CFD)

TPOC-I: Kevin Jackman
Email: Kevin.R.Jackman@nga.mil
TITLE: Novel Mathematical Foundation for Automated Annotation of Massive Image Data Sets

RT&L FOCUS AREA(S): Autonomy; Artificial Intelligence/Machine Learning
TECHNOLOGY AREA(S): Information Systems; Sensors; Electronics

OBJECTIVE: This announcement seeks proposals that offer dramatic improvements in automated object detection and annotation of massive image data sets. Imaging data is being created at an extraordinary rate from many sources, both from government assets as well as private ones. Automated methods for accurate and efficient object identification and annotation are needed to fully exploit this resource. This topic is focused on new artificial intelligence (AI) methods to effectively and efficiently solve this problem.

DESCRIPTION: Current choke points blocking optimal exploitation of the full stream of available image data include confronting widely different views (perspective, resolution, etc.) of the same or similar objects and the overwhelming amounts of human effort required for effective processing. Current manual processes require human eyes on every image to perform detection, identification, and annotation. Current state of the art AI requires intensive human support to generate giant training sets. Further, resulting methods frequently generate rule sets that are overly fragile in that training on one object is not transferrable to the detection of another object, even though the object might strike a human as essentially the same, and thus the need for increased human review of the algorithm decisions.

NGA seeks new types of AI tools optimized for the task of object identification and annotation across diverse families of image data that are reliable, robust, not dependent on extensive training demands, are applicable to objects of interest to both government and commercial concerns, and simultaneously be parsimonious with user resources in general. In particular, we seek solutions that make AI outputs both more explainable and more “lightweight” to human users.

The focus of a successful phase 1 effort should be on explaining the mathematical foundation that will enable the significantly improved AI tools described herein. Of specific interest are novel AI constructs that are more principled and universal and less ad hoc than current technology and can be used to construct a tool that performs relevant tasks. For the purposes of this announcement “relevant tasks” are limited to object identification across view types, drawing an object bounding box, and correctly labelling the object in a text annotation. A successful Phase 1 proposal should explain how the mathematical foundation needed to build the required tools will be developed in Phase 1 and implemented in a software toolkit in Phase 2. Examples should be developed during Phase 1 and should illustrate either improved reliability or robustness over the current state of the art, as well as reducing training demands and user resources. Proposals describing AI approaches that are demonstrably at or near the current state of the art in commercial AI performance, such as on ImageNet data sets, are specifically not of interest under this topic. The foundational element of a successful proposal under this topic is exploitation of novel mathematics that will enable new and better AI approaches.

Both Phase I and Direct to Phase 2 proposals are being accepted under this topic. A straight to phase 2 proposal should describe pre-existing mathematical foundations and illustrative examples described in the paragraph above. Phase 2 proposals should also propose a set of milestones and demonstrations that will establish the novel AI tools as a viable commercial offering.

PHASE I: A successful Phase 1 proposal should explain how the mathematical foundation needed to build the required tools described herein will be developed in Phase 1. Examples should be developed during Phase 1 and should illustrate either improved reliability or robustness over the current state of the art, as well as reducing training demands and user resources.
PHASE II: The performer shall implement a software toolkit based on the foundations developed in Phase I.

PHASE III DUAL USE APPLICATIONS: Follow-on activities are expected to be aggressively pursued by the offeror, namely in seeking opportunities to build more capable AI algorithms based upon the new mathematical foundation. This will deliver commercial benefits in the forms of improved algorithm performance.

REFERENCES:
None

KEYWORDS: artificial intelligence (AI); automated object detection; annotation of massive image data sets

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