FUNDING OPPORTUNITY ANNOUNCEMENT (FOA)

FOA #**WHS-AD-FOA-19**

MINERVA RESEARCH INITIATIVE

INTRODUCTION:

This publication constitutes a FOA as contemplated in the 32 CFR 22.315(a). A formal Request for Proposals (RFP), solicitation, and/or additional information regarding this announcement will not be issued.

The Office of the Secretary of Defense (OSD) will not issue paper copies of this announcement. OSD reserves the right to select for award all, some or none of the proposals in response to this announcement. OSD and other participating Department of Defense (DoD) agencies provide no funding for direct reimbursement of proposal development costs. Technical and cost proposals (or any other material) submitted in response to this FOA will not be returned. It is the policy of OSD to treat all proposals as sensitive competitive information and to disclose their contents only for the purposes of evaluation.

Awards will take the form of grants. Therefore, proposals submitted as a result of this announcement will fall under the purview of the Department of Defense Grant and Agreement Regulations, 32 CFR Part 22 (DODGARs). This grant and any subawards are also subject to 32 CFR Part 32.

Any assistance instrument awarded under this announcement will be governed by the award terms and conditions that conform to DoD's implementation of OMB circulars applicable to financial assistance.

Prospective proposers shall include responses to Representation Regarding an Unpaid Delinquent Tax Liability or a Felony Conviction Under any Federal Law-DoD Appropriations, Prohibition on Contracting with Entities that Require Certain Internal Confidentiality Agreements, and Certification Regarding Restrictions on Lobbying in proposal submission. See below for additional information.

Prospective proposers may obtain information by checking the following websites:

- Information regarding this FOA and amendments:
  http://www.grants.gov or
  http://www.defenseinnovationmarketplace.mil
- Information regarding submission of white papers and full proposals:
  http://minerva.defense.gov
- Information regarding Research Directorate (RD), Office of the Under Secretary of Defense for Research & Engineering:
  https://www.acq.osd.mil/rd/

Table of Contents

I. GENERAL INFORMATION

1. Agency Name/Address

Washington Headquarters Services/ Acquisition Directorate

2. Research Opportunity Title

Minerva Research Initiative

3. Program Name

Department of Defense Minerva Research Initiative

4. Research Opportunity Number

WHS-AD-FOA-#

5. Response Date

White Papers: Thursday, June 20, 2019 3:00 PM EDT
Full Proposals: Thursday, September 26, 2019 3:00 PM EDT

6. Research Opportunity Description

Just as the Cold War gave rise to new ideas and fields of study such as game theory and Kremlinology, the challenges facing the world today call for a broader conception and application of national power that goes beyond military capability. The Office of the Secretary of Defense (OSD) is interested in receiving proposals for the Minerva Research Initiative (http://minerva.defense.gov), a university-led defense social science program seeking fundamental understanding of the social and cultural forces shaping U.S. strategic interests globally. OSD is particularly interested in projects that align with and support the National Defense Strategy, found at:

https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf

The Minerva Research Initiative (Minerva) emphasizes questions of strategic importance to U.S. national security policy. It seeks to increase the Department's intellectual capital in the social sciences and improve its ability to address future challenges and build bridges between the Department and the social science community. Minerva brings together universities and other research institutions around the world and supports multidisciplinary and cross-institutional projects addressing specific interest areas determined by the Department of Defense. The Minerva program aims to promote research in specific areas of social science and to promote a candid and constructive relationship between DoD and the social science academic community.

The Minerva Research Initiative competition is for research related to nine (9) topics listed below. Innovative white papers and proposals related to these research areas are highly encouraged. Detailed descriptions of the interest areas—which are intended to provide a frame of reference and are not meant to be restrictive—can be found in Section IX, "Minerva Topics."

Topic 1: Peer/Near-peer Statecraft, Influence, and Regional Balance of Power
Topic 2: Power, Deterrence, and Escalation Management
Topic 3: Alliances and Burden Sharing
Topic 4: Economic Interdependence and Security
Topic 5: Economic Viability, Resilience, and Sustainability of Logistics Infrastructure
Topic 6: Multi-Domain Behavioral Complexity and Computational Social Modeling

Topic 7: Autonomy, Artificial Intelligence, Machine Ethics, and Social Interactions
Topic 8: Models and Methods for Understanding Covert Online Influence
Topic 9: Automated Cyber Vulnerability Analysis

Proposals will be considered both for single-investigator awards as well as larger teams. A team of university investigators may be warranted because the necessary expertise in addressing the multiple facets of the interest areas may reside in different universities, or in different departments of the same university. The research questions addressed should extend across a fairly broad range of linked issues where there is clear potential synergy among the contributions of the distinct disciplines represented on the team. Team proposals must name only one Principal Investigator as the responsible technical point of contact. Similarly, one institution will be the primary recipient for the purpose of award execution. The relationship among participating institutions and their respective roles, as well as the apportionment of funds including sub-awards, if any, must be described in both the proposal text and the budget. As well, the basic research contribution of the project must be clearly described in the proposal text.

The Minerva Research Initiative is a multi-service effort. Ultimately, however, funding decisions will be made by OSD personnel, with technical inputs from the Services.

7. Point(s) of Contact (POC)

Questions of a technical nature shall be directed to the cognizant Technical Points of Contact:

Science and Technology Point of Contact:
Dr. David Montgomery
Basic Research Office, OUSD (Research & Engineering) and OUSD (Policy)
Email address: david.w.montgomery61.civ@mail.mil

Questions of a business nature shall be directed to the cognizant Grant Officer:

Ms. Christina Gess
Washington Headquarters Services/ Acquisition Directorate (WHS/AD)
Email address: christina.l.gess.civ@mail.mil

Chrissandra Smith
Washington Headquarters Services/Acquisition Directorate (WHS/AD)
Email address: chrissandra.smith.civ@mail.mil

Note that many questions may be answered in the *Frequently Asked Questions* section of http://minerva.defense.gov/Contact/FAQ. **Proposers should raise questions they have with the point-of-contact (POC) listed on the proposal description in Section IX at least two weeks before the deadline; queries after that point may not receive a response. Additionally, the due dates for submission of the white paper and/or full proposal will not be extended.**

Applicants should be alert for any amendments that may modify the announcement. Amendments to the original FOA will be posted to one or more of the following web pages:

- Grants.gov Webpage – https://www.grants.gov/
- The DoD Minerva program website – http://minerva.defense.gov/

8. Instrument Type(s)

DoD anticipates that all awards resulting from this announcement will be grants. Grants awarded under this announcement will be governed by the award terms and conditions that conform to DoD's implementation of OMB circulars applicable to financial assistance. See: https://www.onr.navy.mil/Contracts-Grants/submit-

proposal/grants-proposal/grants-terms-conditions.aspx

9. Catalog of Federal Domestic Assistance (CFDA) Number

12.630

10. Catalog of Federal Domestic Assistance (CFDA) Title

Office of the Secretary of Defense (OSD) Basic, Applied, and Advanced Research in Science and Engineering

11. Other Information

Work funded under a FOA may include basic research and applied research.

As defined therein the definition of fundamental research, in a DoD contractual context, includes [research performed under] grants that are (a) funded by Research, Development, Test and Evaluation Budget Activity 1 (Basic Research), whether performed by universities or industry or (b) funded by Budget Activity 2 (Applied Research) and performed on campus at a university. The research shall not be considered fundamental in those rare and exceptional circumstances where the applied research effort presents a high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that are unique and critical to defense, and where agreement on restrictions have been recorded in the grant.

Pursuant to DoD policy, research performed under grants that are a) funded by Budget Activity 2 (Applied Research) and NOT performed on-campus at a university does not meet the definition of fundamental research. In conformance with the USD (R&E) guidance and National Security Decision Directive 189, WHS/AD will place no restriction on the conduct or reporting of unclassified fundamental research, except as otherwise required by statute, regulation, or Executive Order. For certain research projects, it may be possible that although the research being performed by the Grantee is restricted research, a sub-awardee may be conducting fundamental research. In those cases, it is the ***Grantee's responsibility*** in the proposal to identify and describe the sub-awardee unclassified research and include a statement confirming that the work has been scoped, negotiated, and determined to be fundamental research according to the Grantee and research performer.

Normally, fundamental research is awarded under grants with universities. Potential prospective proposers should consult with the appropriate program Technical POCs to determine whether the proposed effort would constitute basic research or applied research. **Minerva funds basic, not applied, research.**

II. AWARD INFORMATION

A. Award Amount and Period of Performance:

- Total Amount of Funding Available: $15.0M over 3 years.
- Anticipated Number of Awards: 10–12
- Anticipated Range of Individual Award Amounts: $150 K/year to $1.0 M/year
- Previous Years' Average Individual Award Amounts: $440 K/year
- Anticipated Period of Performance: 3-5 years

DoD anticipates that awards will be made in the form of grants to U.S. institutions of higher education (universities).

There is no guarantee that any of the proposals submitted in a particular category will be recommended for funding. More than one proposal may be recommended for funding for a particular category. The Government reserves the right to select for negotiation all, some, one, or none of the proposals received in response to this announcement.

B. Funding Restrictions

An institution may, at its own risk and without prior approval, incur obligations and expenditures to cover costs up to 90 days before the beginning date of the initial budget period of a new or renewal award if such costs: 1) are necessary to conduct the project, and 2) would be allowable under the grant, if awarded, without prior approval.

All pre-award costs are incurred at the recipient's risk. OSD and the military service research organizations are under no obligation to reimburse such costs, if for any reason the institution does not receive an award or if the award is less than anticipated and inadequate to cover such costs.

C. Expectations for Minerva Researchers

1. Project meetings and reviews

In additional to an annual Minerva-wide program review held in the Washington, DC area, individual program reviews between the Service sponsor and the performer may be held as necessary. Program status reviews may also be held to provide a forum for reviews of the latest results from experiments and any other incremental progress towards the major demonstrations. These meetings will be held at various sites throughout the country. For costing purposes, potential recipients should assume that 40% of these meetings will be at or near the appropriate Service Headquarters in the Washington, DC area and 60% at other contractor or government facilities. Interim meetings are likely, but these will be accomplished via video telephone conferences, telephone conferences, or via web-based collaboration tools.

2. Research output

All Minerva research is unclassified and by federal policy is not subjected to any restrictions on publication or participation by foreign nationals. It is expected that copies of all products emerging from Minerva-supported research, such as academic papers, will be shared with the Minerva program staff.

Publications should acknowledge Minerva Research Initiative support through language such as: "This project was supported through the Minerva Research Initiative, in partnership with [*relevant Service partner issuing grant*] under grant number [*award_number*]." Posters and other publications should include reference to the Minerva program and/or Minerva program logo.

Over the course of the project, Minerva researchers are encouraged to produce 1000-word analytical summaries articulating the broader relevance of the findings presented in these academic papers, that could be shared within the government and/or others interested.

3. Reporting requirements

Grants typically require annual and final technical reports, financial reports, and final patent reports. Copies of publications and presentations should be submitted in accordance with award documentation. Additional deliverables may be required based on the research being conducted.

III. ELIGIBILITY INFORMATION

A. Eligible Institutions

All responsible sources from academia, including DoD institutions of higher education and foreign universities, may submit proposals under this FOA. Historically Black Colleges and Universities (HBCUs) and Minority Institutions (MIs) are encouraged to submit proposals and join others in submitting proposals. No portion of this FOA, however, will be set aside for HBCU and MI participation.

Teams are encouraged and may submit proposals in any and all areas. Non-profit institutions and commercial entities may be included on a university-led team as subawardees only, receiving funding for their efforts accordingly. Federally Funded Research & Development Centers (FFRDCs), including Department of Energy National Laboratories, are not eligible to receive awards under this FOA. However, teaming arrangements between FFRDCs and eligible principal applicants are allowed provided they are permitted under the sponsoring agreement between the Government and the specific FFRDC.

Grants to a university may be terminated if the Principal Investigator (PI) severs connections with the university or is unable to continue active participation in the research. Grants to a university may also be terminated if the university severs connections with the PI.

B. Other Eligibility Criteria

Number of PIs: A single PI must be designated on the application to serve as administrative and technical project lead. There is no restriction on the number of additional key research personnel who can be included on a single application, but each position should be justified by the scope and focus of the research.

Number of Applications: There is no limit to the number of applications that an individual PI may have submitted by their institution in response to this FOA.

Cost Sharing: Cost sharing is not required.

IV. APPLICATION AND SUBMISSION INFORMATION

The Minerva application process is conducted in two stages:

1. White Paper submission (via email)
   Deadline: June 20, 2019 3:00 PM EDT

2. Full Proposal submission (via Grants.gov)
   Deadline: September 26, 2019 3:00 PM EDT

Stage 1 – **Interested entities are strongly encouraged to submit white papers**, an opportunity for reviewer feedback intended to minimize the labor and cost associated with the production of detailed proposals that have little chance of being selected for funding. Based on an assessment of the white papers submitted, the responsible point-of-contact (POC) (see Section IX) will advise prospective proposers whether the proposals outlined in their white papers were judged to be competitive for Minerva award selection, and will then invite the most promising subset of proposals to submit a full proposal for funding consideration.

Interested entities are strongly encouraged to contact the appropriate POC two or more weeks prior to white paper submission to discuss their ideas. White papers and other technical queries arriving after the deadline are unlikely to receive feedback unless an invitation for full proposal submission has been extended.

Stage 2 – Subsequent to white paper feedback, interested entities are required to submit full proposals. All proposals submitted under the terms and conditions cited in this FOA will be evaluated in accordance with the evaluation criteria stated herein. Entities may submit a proposal without submitting a white paper, though this is discouraged. Interested parties who do not participate in the white paper review stage should contact the appropriate POC prior to submission of a full proposal to discuss options, though feedback at that late stage is not guaranteed. **Full proposals submitted after the posted deadline will not be evaluated for funding consideration.**

A. General requirements

1. *Document format*

All documents included in both white paper and full proposal packages must be submitted in Adobe Portable Document Format (PDF) in compliance with the guidelines below. Proposals with attachments submitted in word processing, spreadsheet, zip, or any format other than Adobe Portable Document format will not be considered for award. NOTE: Titles given to the white papers/full proposals should be descriptive of the work they cover and not be merely a copy of the title of this solicitation.

Documents must be submitted with the following specifications:

- Paper Size – 8.5 x 11 inch paper
- Margins - 1 inch
- Spacing – single spaced
- Font – Times New Roman, 11 point
- PI's name and institution in header or footer
- Appropriate markings on each page that contains proprietary or confidential information, if applicable.

White papers, supporting documentation, and full proposals submitted under this FOA are unclassified. All proposals shall be submitted in accordance with Section IV.

2. *Marking proprietary or confidential information*

OSD and WHS/AD will make every effort to protect any proprietary information submitted in white papers and full proposals. Any proprietary information included in application materials must be identified. Prospective proposers should be aware, however, that under the Freedom of Information Act (FOIA) requirements, proprietary information contained in white papers and proposals (marked or unmarked) may still potentially be subject to release.

It is the prospective proposers responsibility to notify WHS/AD of proposals containing proprietary information and to identify the relevant portions of their proposals that require protection. The entire proposal (or portions thereof) without protective markings or otherwise identified as requiring protection will be considered to be furnished voluntarily to WHS/AD without restriction and will be treated as such for all purposes.

It is the intent of WHS/AD to treat all white papers and full proposals as proprietary information before the award and to disclose their contents to reviewers only for the purpose of evaluation.

B. White Paper Preparation and Submission

1. *White Paper package components*

Submitted documentation should be in PDF format and include **in a single document**:

- A cover letter (optional), not to exceed one page.
- A cover page, labeled "PROPOSAL WHITE PAPER," that includes the FOA number, proposed project title, and prospective proposer's technical point of contact with telephone number, e-mail address, and most relevant area number(s) and title(s) (see Section IX).
- Curriculum vitae (CV) of key investigators (optional)
- The white paper (four (4) page limit, single-sided) including:
  - Identification of the research and issues including the state of the field
  - Proposed methods

- Potential contribution to fundamental social science basic research
- Potential implications for national defense
- Potential team and management plan
- Data management plan for data or tools to be generated in the course of research
- Summary of estimated costs
- Reference citations are not required but may be included outside the four-page limit.

The white paper should provide sufficient information on the research being proposed (e.g., hypothesis, theories, concepts, methods, approaches, data collection, measurement and analyses) to allow for an assessment by a subject matter expert.

2. *White paper submission*

White papers and supporting documentation must be submitted as email attachments to osd.minerva@mail.mil no later than **3:00 p.m. Eastern Daylight Time on June 20, 2019**. E-mail transmission is not instantaneous and delays in transmission may occur anywhere along the route. The Government takes no responsibility for any delays in the transmission of an e-mail. The prospective proposer is responsible for allowing enough time to complete the required application components, upload the white paper, and submit via e-mail before the deadline. It is not necessary for white papers to carry official institutional signatures.

The submission email subject line should indicate relevant area categories (see Section IX), written as: *FY19 Minerva WP - Area [Topic Number]*

An e-mail confirmation will be sent to the applicant within two days of submission. Documents submitted after the deadline or found to be non-compliant with the requirements in 1. above will not be reviewed.

C. Full Proposal Package Preparation and Submission

Full proposal packages must be submitted electronically via Grants.gov (https://www.grants.gov/) no later than **3:00 p.m. Eastern Daylight Time on September 26, 2019**. The forms required for Grants.gov submission are summarized in Table 1 and described in detail below.

Table 1. Summary of Full Proposal Submission Forms

Form	Attachment	Action
SF-424 (R&R) Application for Federal Assistance		Enter appropriate information in the data fields as described in Section IV.C.i. Attach Representation Regarding an Unpaid Delinquent Tax Liability or a Felony Conviction Under any Federal Law – DoD
R&R Personal Data Form	None	Request voluntary completion of gender field for PDs/PIs Co-PDs/Co-PIs in support of Women in STEM Title IX compliance. This form will not be

R&R Senior/Key Person Profile Form (Expanded)	PI Curriculum Vitae (5-page limit)	Attach to PI Biographical Sketch field
	Key Personnel Biographical Sketches (3-page limit)	Attach to Biographical Sketch field for each senior/key person (LastName_Bio.pdf)
	Statement of Current and Pending Support	Attach to Support field for each senior/key person
	None	Complete the Degree Type and Degree Year fields for all persons identified as Project Directors/Co-Project Directors and/or Principal Investigators/Co-
R&R Project/Performance Site	None	Enter appropriate information in the data fields as
R&R Other Project Information Form	Project Summary	Upload to Field #7 (LastName_Abstract
	Project Narrative	Upload to Field #8 (LastName_Narrative
	Comprehensive Budget Chart	Upload to Field #12 (LastName
	Letters of Support (optional)	Upload to Field #12 (optional)
R&R Budget Form	Budget Justification	Enter appropriate information in the data fields as described below. Attach budget justification to Section L of the budget form
R&R Subaward Budget Form (optional)	Budget Justification (optional)	If project contains a subaward, enter appropriate information in the data fields as described below. Attach budget justification to Section L of the subaward budget form for each
SF-LLL Disclosure of Lobbying Activities (optional form)	None	If making a required disclosure, complete and add the form to the application package

Full proposal package form descriptions:

i. SF-424 Research & Related (R&R) Application for Federal Assistance Form

The SF-424 (R&R) form must be used as the cover page for all proposals. Forms are completed in Grants.gov Workspace by either completing the forms on-line using a web browser and/or downloading individual PDF forms, completing them, and uploading them to the Workspace. Complete all required fields in accordance with the on-screen help or "pop-up" instructions on the PDF form and the following instructions for specific fields. To see the instructions, click on the on-screen help icons or roll the mouse over the PDF field to be filled out and additional information about that field will be displayed. For example, on the SF-424 (R&R) the Phone Number field says "PHONE NUMBER (Contact Person): Enter the daytime phone number for the person to contact on matters relating to this application. This field is required." Mandatory fields will have an asterisk

marking the field and will appear yellow on most computers. In Grants.gov, some fields will self-populate based on the FOA selected.

Please fill out the SF-424 first, as some fields on the SF-424 are used to auto populate fields in other forms. The completion of most fields is self-explanatory except for the following special instructions:

Field 3 - Date Received by State. The Date Received by State and the State Application Identifier are not applicable to research.

Field 4a - Federal Identifier. No identifier required.

Field 4b - Agency Routing Identifier. Input "RD [Minerva Topic #]" For the Topic #, input the number corresponding to the topic area to which the proposal is being submitted.

Field 7 - Type of Applicant. Complete as indicated. If the organization is a Minority Institution, select "Other" and under "Other (Specify)" note that the institution is a Minority Institution (MI).

Field 9 - Name of Federal Agency. List the "Washington Headquarters Services/ Acquisition Directorate" as the reviewing agency. This field is pre-populated in Grants.gov.

Field 16 - Is Application Subject to Review by State Executive Order 12372 Process? Choose "No". Check "Program is Not Covered by Executive Order 12372."

Field 17 – Certification. All awards require some form of certifications of compliance with national policy requirements. By checking the "I agree" box in field 17, and attaching the representation to field 18 of the SF424 (R&R) as part of the electronic proposal submitted via Grants.gov, the Grant Applicant is providing the certification on lobbying required by 32 CFR Part 28 and representation regarding an unpaid delinquent tax liability or a felony conviction under any federal law – DoD appropriations.

ii. Research & Related Senior/Key Person Profile Form (Expanded)

Complete the *R&R Senior/Key Person Profile (Expanded)* form for those key persons who will be performing the research. Information about an individual is subject to the requirements of the Privacy Act of 1974 (Public Law 93 579). The information is requested under the authority of Title 10 USC, Sections 2358 and 8013.

To evaluate compliance with Title IX of the Education Amendments of 1972 (20 U.S.C. A§ 1681 Et. Seq.), the Department of Defense is collecting certain demographic and career information to be able to assess the success rates of women who are proposed for key roles in applications in STEM disciplines. The Degree Type and Degree Year fields on the Research and Related Senior/Key Person Profile (Expanded) form will be used by DoD as the source for career information. In addition to the required fields on the form, applicants must complete these two fields for all individuals that are identified as having the project role of PD/PI or Co-PD/PI on the form. Additional senior/key persons can be added by selecting the "Next Person" button.

The principal purpose and routine use of the requested information are for evaluation of the qualifications of those persons who will perform the proposed research. Failure to provide such information will delay award. Attach curricula vitae (CVs) and/or a Biographical Sketch for the principal investigator and senior staff. CVs should **list any previous DoD funding and engagement within the last eight years** including project titles.

Attach statements of current and pending support for the Principal Investigators and co-investigators listed in the proposal, as applicable. These statements require that each investigator specify all grants and contracts through which he or she is currently receiving or may potentially receive financial support. Describe the research activities and amount of funding.

Page limits for attachments:

- Key Personnel Curriculum Vitae (five (5) page limit)
- Key Personnel Biographical Sketches (two (2) page limit each)

i. Research & Related Personal Data Form

To evaluate compliance with Title IX of the Education Amendments of 1972 (20 U.S.C. A§ 1681 Et. Seq.), the Department of Defense is collecting certain demographic and career information to be able to assess the success rates of women who are proposed for key roles in applications in STEM disciplines.

This form will be used by DoD as the source of demographic information, such as gender, race, ethnicity, and disability information for the Project Director/Principal Investigator and all other persons identified as Co-Project Director(s)/Co-Principal Investigator(s). Each application must include this form with the name fields of the Project Director/Principal Investigator and any Co-Project Director(s)/Co-Principal Investigator(s) completed; however, provision of the demographic information in the form is voluntary. If completing the form for multiple individuals, each Co-Project Director/Co-Principal Investigator can be added by selecting the "Next Person" button. The demographic information, if provided, will be used for statistical purposes only and will not be made available to merit reviewers. Applicants who do not wish to provide some or all of the information should check or select the "Do not wish to provide" option.

iii. Project/Performance Site Locations Form

Complete all information as requested.

iv. Research & Related Other Project Information Form

***Fields 1 and 1a - Human Subject Use*.** Each proposal must address human subject involvement in the research by addressing *Fields 1 and 1a* of the *R&R Other Project Information* form.

For any proposal for research involving human subjects, the potential recipient must submit or indicate an intention to submit prior to award: documentation of approval from an Institutional Review Board (IRB); IRB-approved research protocol; IRB-approved informed consent form; proof of completed human research training (e.g., training certificate or institutional verification of training); and any other relevant requirements[2]. In the event that an exception criterion under 32 CFR.219.101(b) is claimed, provide documentation of the determination by the Institutional Review Board (IRB) Chair, IRB vice Chair, designated IRB administrator or official of the human research protection program including the category of exemption and short rationale statement. If research is determined by the IRB to be greater than minimal risk, the potential recipient also must provide the name and contact information for the independent medical monitor. For assistance with submission of human subject research related documentation, contact the relevant point of contact (POC) below.

- **Air Force:** stephanie.a.bruce4.civ@mail.mil, DoD Human RDT&E Protection Programs
- **Navy:** sevgi.bullock@navy.mil, Human Research Protection Official

[2] Proposals with POCs based at the Office of Naval Research will require an application for a DoD-Navy

Addendum to the prospective proposer's DHHS-issued Federal-Wide Assurance (FWA) or the prospective proposer's DoD-Navy Addendum.

Fields 2 and 2a - Animal Use. Each proposal must address animal use protocols by addressing Fields 2 and 2a of the R&R Other Project Information form.

If animals are to be utilized in the research effort proposed, the prospective proposer must submit prior to award a DoD Animal Use Protocol with supporting documentation (copies of Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC) accreditation and/or National Institute of Health assurance, Institutional Animal Care and Use Committee (ACUC) approval, research literature Database searches, and the two most recent USDA inspection reports). For assistance with submission of animal research related documents, contact Minerva staff to identify the appropriate point of contact.

Fields 4a through 4d - Environmental Compliance. Federal agencies making grant or cooperative agreement awards and recipients of such awards must comply with various environmental requirements. The National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. Sections 4321- 4370 (a), requires that agencies consider the environmental impact of "major Federal actions" prior to any final agency decision. With respect to those awards which constitute "major Federal actions," as defined in 40 CFR 1508.18, federal agencies may be required to comply with NEPA and prepare an environmental impact statement (EIS), even if the agency does no more than provide grant funds to the recipient.

Questions regarding NEPA compliance should be referred to Minerva program staff. Most research efforts funded through the Minerva program will, however, qualify for a categorical exclusion from the need to prepare an EIS. For those proposing under Navy projects, Navy instructions/regulations provide for a categorical exclusion for basic and applied scientific research usually confined to the laboratory, if the research complies with all other applicable safety, environmental and natural resource conservation laws. Each proposal shall address environmental impact by filling in Fields 4a through 4d of the *R&R Other Project Information* form. This information will be used by DoD to make a determination if the proposed research effort qualifies for categorical exclusion.

***Field 7 – Project Abstract/Summary*.** In a single page, describe the research problem, proposed methods, basic research contribution, anticipated outcome of the research, if successful, and impact on DoD capabilities or broader implications for national defense. Identify the Principal Investigator, the university/research institution (and other institutions involved in the Minerva team, if applicable), the proposal title, the Minerva interest area number, and the total funds requested from DoD for the 3-year base period (and, in the case of 5-year proposals, the additional 2-year option period and the potential 5-year total period).

***Field 8 – Project Narrative*.** Describe clearly the research, including the objective and approach to be performed, keeping in mind the evaluation criteria listed in Section V ("Evaluation Criteria").

Generate a single PDF file containing all proposal narrative sections described below and attach as the *R&R Other Project Information* form in Field 8. **Full proposals exceeding the page limits defined below may not be evaluated.**

- **Cover page**, including:
  - Proposal title

- Institution proposal number
- Interest area number and title
- Principal Investigator name
- Phone number, fax number, and e-mail address
- Institution, Department, Division
- Institution address
- Other institutions involved in the Minerva team, if applicable
- Whether the PI is a past or current DoD Contractor or Grantee. If yes, provide agency and point of contact information.

- **Table of Contents**. List project narrative sections and corresponding page.

- **Technical Narrative** *(25-page limit for this section, excluding list of references)*. Describe the basic scientific or technical concepts that will be investigated, giving the complete research plan. Describe the technical approach and what makes it innovative. Discuss the relationship of the proposed research to the state-of-the-art knowledge in the field and to related efforts in programs elsewhere, and discuss potential scientific breakthroughs, including appropriate literature citations/references. Discuss the nature of expected results. Discuss potential applications to defense missions (including alignment with the National Defense Strategy) and requirements. Describe plans for the research training of students. Include the number of full time equivalent graduate students and undergraduates, if any, to be supported each year. Discuss the involvement of other students, if any.

- **Project Schedule, Milestones, and Deliverables**. A summary of the schedule of events, milestones, and a detailed description of the results and products to be delivered. Any proposed option period beyond three years should be explicitly scoped accordingly.

- **Management Approach.** A discussion of the overall approach to the management of this effort, including brief discussions of: required facilities; relationships with any subawardees and with other organizations; availability of personnel; and planning, scheduling, and control procedures.

  (a) Designate only one Principal Investigator for the award to serve as the primary point-of-contact. Briefly summarize the qualifications of the Principal Investigators and other key investigators to conduct the proposed research.

  (b) Describe in detail proposed subawards to other eligible universities or relevant collaborations (planned or in place) with government organizations, industry, or other appropriate institutions. Particularly describe how collaborations are expected to facilitate the transition of research results to applications. If subawards to other universities/institutions are proposed, make clear the division of research activities, to be supported by detailed budgets for the proposed subawards.

  (c) Describe plans to manage the interactions among members of the proposed research team, if applicable.

  (d) Identify other parties to whom the proposal has been, or will be sent, including agency contact information.

- **Facilities.** Describe facilities available for performing the proposed research and any

additional facilities or equipment the organization proposes to acquire at its own expense. Indicate government-owned facilities or equipment already possessed that will be used. Reference the facilities grant and/or contract number or, in the absence of a facilities grant/contract, the specific facilities or equipment and the number of the award under which they are accountable.

Field 9 – Bibliography and References Cited. Attach a listing of applicable publications cited in above sections.

Fields 10 and 11 – These fields are not required.

Field 12 – Other Attachments. In addition to the *Research and Related Budget* form, researchers are encouraged to submit a comprehensive, single page version of the budget for the prime and subawardee institutions, where rows are budget categories and columns indicate budget periods.

Letters of support are neither required nor expected in application packages. Some prospective proposers may feel a letter of support demonstrating the importance of the research to the national security community may strengthen their proposals. Such letters should not exceed 2 pages.

v. Research & Related Budget Form

You must provide a detailed cost breakdown of all costs, by year and cost category, corresponding to the proposed Technical Approach which was provided in Field 8 of the *R&R Other Project Information* Form. Any proposed option years must be separately priced. For planning purposes, assume that grant awards will begin in January 2020.

Budget elements:

Annual budgets should be driven by program requirements. Elements of the budget should include:

- Direct Labor — Individual labor category or person, with associated labor hours and unburdened direct labor rates. Provide escalation rates for out years. Provide the basis for the salary proposed. If labor costs are not provided for listed principal investigators, the budget justification document should include an explanation.

- Administrative and clerical labor — Salaries of administrative and clerical staff are normally indirect costs (and included in an indirect cost rate). Direct charging of these costs may be appropriate when a major project requires an extensive amount of administrative or clerical support significantly greater than normal and routine levels of support. Budgets proposing direct charging of administrative or clerical salaries must be supported with a budget justification which adequately describes the major project and the administrative and/or clerical work to be performed.

- Indirect Costs — Fringe benefits, overhead, G&A, etc. (must show base amount and rate). Provide the most recent rates, dates of negotiations, the period to which the rates apply, and a statement identifying whether the proposed rates are provisional or fixed. If the rates have been negotiated by a Government agency, state when and by which agency. Include a copy of the current indirect rate agreement (via Field 12 of the *Research and Related Other Project Information* Form).

- Travel — Identify any travel requirements associated with the proposed research and define its relationship to the project. List proposed destinations, cost estimate, and basis of cost estimate. Please include all Service or Minerva program travel needs, described further in Section II, Part C ("Expectations for Minerva Researchers").

- Subawards — Provide a description of the work to be performed by the subrecipients. For each subaward, a detailed cost proposal is required to be included in the principal investigator's cost proposal. Fee/profit is unallowable.

- Consultant — Consultants are to be used only under exceptional circumstances where no equivalent expertise can be found at a participating university; strong justification is required. Provide consultant agreement or other document that verifies the proposed loaded daily/hourly rate. Include a description of the nature of and the need for any consultant's participation. Provide budget justification.

- Materials — Specifically itemized with costs or estimated costs. Justify.

- Other Directs Costs — Provide an itemized list of all other proposed direct costs such as Graduate Assistant tuition, laboratory fees, report and publication costs and the basis for the estimate (e.g., quotes, prior purchases, catalog price lists).
  NOTE: If the grant proposal is for a conference, workshop, or symposium, the proposal should include the following statement: "The funds provided by the Department of Defense will not be used for food or beverages."

- Fee/Profit — Fee/profit is unallowable.

Budget justification
The budget proposal should include a budget justification for each year, clearly explaining the need for each item and attached to Section L of the *R&R Budget* form.

Budget summary
In addition to the *Research and Related Budget* form, researchers are encouraged to submit a comprehensive, single page version of the budget for the prime and subawardee institutions, where rows are budget categories and columns indicate budget periods. Include as an attachment to *R&R Other Project Information* Form Field 12 ("Other Attachments").

Cost sharing is not a factor in the evaluation but is permitted. Cost sharing may support items such as salaries, indirect costs, operating expenses, or new equipment. In each category, show the amount and nature of the planned expenditure share (e.g., equipment, faculty release time for research). A signed statement of commitment regarding the cost sharing or matching funds described above must be obtained from the appropriate institutional and/or private sector officials, and included at time of submission. Any cost sharing or matching plan should be included in the budget justification.

v. SF-LLL Disclosure of Lobbying Activities (optional form)

If the applicant is required to disclose any lobbying activities, complete the SF-LLL and include it with the other forms in the application package.

D. Grants.gov Application Submission Procedures and Receipt

1. This section provides the application submission and receipt instructions for WHS/AD program applications. Please read the following instructions carefully and completely.

WHS/AD is participating in the Grants.gov initiative to provide the grant community with a single site to find and apply for grant funding opportunities. WHS/AD requires applicants to submit their applications online through Grants.gov.

1. How to Register to Apply through Grants.gov

a. Instructions: Read the instructions below about registering to apply for DoD funds. Applicants should read the registration instructions carefully and prepare the information requested before beginning the registration process. Reviewing and assembling the required information before beginning the registration process will alleviate last-minute searches for required information.

Organizations must have a Data Universal Numbering System (DUNS) Number, active System for Award Management (SAM) registration, and Grants.gov account to apply for grants. If individual applicants are eligible to apply for this funding opportunity, then you may begin with step 3, Create a Grants.gov Account, listed below.

Creating a Grants.gov account can be completed online in minutes, but DUNS and SAM registrations may take several weeks. Therefore, an organization's registration should be done in sufficient time to ensure it does not impact the entity's ability to meet required application submission deadlines.

Complete organization instructions can be found on Grants.gov here: https://www.grants.gov/web/grants/applicants/organization-registration.html

1) Obtain a DUNS Number: All entities applying for funding, including renewal funding, must have a DUNS Number from Dun & Bradstreet (D&B). Applicants must enter the DUNS Number in the data entry field labeled "Organizational DUNS" on the SF-424 form. For more detailed instructions for obtaining a DUNS Number, refer to:
https://www.grants.gov/web/grants/applicants/organization-registration/step-1-obtain-duns-number.html

2) Register with SAM: All organizations applying online through Grants.gov must register with the System for Award Management (SAM). Failure to register with SAM will prevent your organization from applying through Grants.gov. SAM registration must be renewed annually. For more detailed instructions for registering with SAM, refer to:
https://www.grants.gov/web/grants/applicants/organization-registration/step-2-register-with-sam.html

3) Create a Grants.gov Account: The next step is to register an account with Grants.gov. Follow the on-screen instructions or refer to the detailed instructions here:
https://www.grants.gov/web/grants/applicants/registration.html

4) Add a Profile to a Grants.gov Account: A profile in Grants.gov corresponds to a single applicant organization the user represents (i.e., an applicant) or an individual applicant. If you work for or consult with multiple organizations and have a profile for each, you may log in to one Grants.gov account to access all of your grant applications. To add an organizational profile to your Grants.gov account, enter the DUNS Number for the organization in the DUNS field while adding a profile. For more detailed instructions about creating a profile on Grants.gov, refer to:
https://www.grants.gov/web/grants/applicants/registration/add-profile.html

5) EBiz POC Authorized Profile Roles: After you register with Grants.gov and create an Organization Applicant Profile, the organization applicant's request for Grants.gov roles and access is sent to the EBiz POC. The EBiz POC will then log in to Grants.gov and authorize the appropriate roles, which may include the AOR role, thereby giving you permission to complete and submit applications on behalf of the organization. You will be able to submit your application online any time after you have been assigned the AOR role. For more detailed instructions about creating a profile on Grants.gov, refer to:
https://www.grants.gov/web/grants/applicants/registration/authorize-roles.html

6) Track Role Status: To track your role request, refer to:
https://www.grants.gov/web/grants/applicants/registration/track-role-status.html

b. Electronic Signature: When applications are submitted through Grants.gov, the name of the organization applicant with the AOR role that submitted the application is inserted into the signature line of the application, serving as the electronic signature. The EBiz POC must authorize people who are able to make legally binding commitments on behalf of the organization as a user with the AOR role; this step is often missed and it is crucial for valid and timely submissions.

3. How to Submit an Application to WHS/AD via Grants.gov

Grants.gov applicants can apply online using Workspace. Workspace is a shared, online environment where members of a grant team may simultaneously access and edit different webforms within an application. For each funding opportunity announcement (FOA), you can create individual instances of a workspace.

Below is an overview of applying on Grants.gov. For access to complete instructions on how to apply for opportunities, refer to:
https://www.grants.gov/web/grants/applicants/workspace-overview.html

1) Create a Workspace: Creating a workspace allows you to complete it online and route it through your organization for review before submitting.

2) Complete a Workspace: Add participants to the workspace to work on the application together, complete all the required forms online or by downloading PDF versions, and check for errors before submission. The Workspace progress bar will display the state of your application process as you apply. As you apply using Workspace, you may click the blue question mark icon near the upper-right corner of each page to access context-sensitive help.

a. Adobe Reader: If you decide not to apply by filling out webforms you can download individual PDF forms in Workspace. The individual PDF forms can be downloaded and saved to your local device storage, network drive(s), or external drives, then accessed through Adobe Reader.

NOTE: Visit the Adobe Software Compatibility page on Grants.gov to download the appropriate version of the software at:
https://www.grants.gov/web/grants/applicants/adobe-software-compatibility.html

b. Mandatory Fields in Forms: In the forms, you will note fields marked with an asterisk and a different background color. These fields are mandatory fields that must be completed to successfully submit your application.

c. Complete SF-424 Fields First: The forms are designed to fill in common required fields across other forms, such as the applicant name, address, and DUNS Number. Once it is completed, the information will transfer to the other forms.

3) Submit a Workspace: An application may be submitted through workspace by clicking the Sign and Submit button on the Manage Workspace page, under the Forms tab. Grants.gov recommends submitting your application package at least 24-48 hours prior to the close date to provide you with time to correct any potential technical issues that may disrupt the application submission.

4) Track a Workspace Submission: After successfully submitting a workspace application, a Grants.gov Tracking Number (GRANTXXXXXXXX) is automatically assigned to the application. The number will be listed on the Confirmation page that is generated after submission. Using the tracking number, access the Track My Application page under the Applicants tab or the Details tab in the submitted workspace.

For additional training resources, including video tutorials, refer to:
https://www.grants.gov/web/grants/applicants/applicant-training.html

Applicant Support: Grants.gov provides applicants 24/7 support via the toll-free number 1-800-518-4726 and email at support@grants.gov. For questions related to the specific grant opportunity, contact the number listed in the application package of the grant you are applying for.

If you are experiencing difficulties with your submission, it is best to call the Grants.gov Support Center and get a ticket number. The Support Center ticket number will assist the WHS/AD with tracking your issue and understanding background information on the issue.

4. Timely Receipt Requirements and Proof of Timely Submission

a. Online Submission. All applications must be received no later than **3:00 p.m. Eastern Daylight Time on September 26, 2019.** Proof of timely submission is automatically recorded by Grants.gov. An electronic date/time stamp is generated within the system when the application is successfully received by Grants.gov. NOTE: White Papers should not be submitted through the Grants.gov Apply process, but rather by email as described in Section IV, subsection B. The applicant with the AOR role who submitted the application will receive an acknowledgement of receipt and a tracking number (GRANTXXXXXXXX) from

Grants.gov with the successful transmission of their application. This applicant with the AOR role will also receive the official date/time stamp and Grants.gov Tracking number in an email serving as proof of their timely submission.

When WHS/AD successfully retrieves the application from Grants.gov, and acknowledges the download of submissions, Grants.gov will provide an electronic acknowledgment of receipt of the application to the email address of the applicant with the AOR role who submitted the application. Again, proof of timely submission shall be the official date and time that Grants.gov receives your application. Applications received by Grants.gov after the established due date for the program will be considered late and will not be considered for funding by DoD.

Applicants using slow internet, such as dial-up connections, should be aware that transmission can take some time before Grants.gov receives your application. Again, Grants.gov will provide either an error or a successfully received transmission in the form of an email sent to the applicant with the AOR role attempting to submit the application. The Grants.gov Support Center reports that some applicants end the transmission because they think that nothing is occurring during the transmission process. Please be patient and give the system time to process the application.

V. EVALUATION INFORMATION

A. Evaluation Criteria

The Minerva program seeks to invest in basic research and to identify challenging fundamental scientific areas of investigation that may have potential for long term benefit to DoD. Proposed research should describe cutting-edge efforts on basic scientific problems.

Subject to funding availability, white papers and proposals will be evaluated under the following criteria:

Principal Criteria

1. **Scientific merit**, soundness, and programmatic strategy of the proposed basic social science research; and
2. **Relevance** and potential contributions of the proposed research to research areas of DoD interest as described in Section IX. ***The Minerva Research Initiative is particularly interested in proposals that align with and support the National Defense Strategy, which is available at:***

https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf

Other Criteria

3. Potential **impact** of the basic research on the defense-relevant social sciences and defense communities that apply them. DoD encourages innovative submissions that, in addition to knowledge generation in critical areas, also build new communities, new frameworks, and new opportunities for dialogue.
4. The **qualifications** and availability of the Principal Investigators and key co-investigators (if applicable) and the **overall management approach**; and
5. The realism and reasonableness of **cost**.

The Principal Criteria are of equal importance and are more important than Other Criteria. Other Criteria are of equal importance to each other. The U.S. Government does not guarantee an award in each research area. Further, be advised that as funds are limited, otherwise meritorious proposals may not be funded.

B. Evaluation Process

The Minerva Research Initiative selects awards using merit-based competitive procedures according to 32 CFR Sec 22.315. Preparation and submission requirements for the two-stage proposal process are described in **Section IV** of this document. Evaluation processes are described below.

1. *White papers*

White papers will be reviewed by the responsible Research Area POC for the interest area and may be reviewed by one or more subject matter experts. Systems Engineering and Technical Assistance (SETA) contractor employees may provide technical and administrative assistance to the evaluation team. Individuals other than the POC will sign a conflict of interest statement prior to receiving white papers.

White papers that best fulfill the evaluation criteria will be identified by the white paper reviewers and recommended to the OSD Minerva Steering Committee. The Steering Committee is composed

of representatives from the research and policy organizations within OSD and may include representatives from the DoD Military Components and/or Defense Agencies. The Minerva Steering Committee expects to invite approximately thirty (30) to forty (40) individual PIs to submit full proposals. Thorough feedback on white papers will be provided to those invited to submit a full proposal. Feedback will be provided to all other proposers upon request.

2. ***Full proposals***

Full proposals submitted under this FOA undergo another multi-stage evaluation procedure. Technical proposals will be evaluated through a peer or scientific review process. Reviewers may include Government personnel and Non-Government reviewers including university faculty and staff researchers. Each reviewer is required to sign a conflict-of-interest and confidentiality statement attesting that the reviewer has no known conflicts of interest, and that application and evaluation information will not be disclosed outside the evaluation panel. The names and affiliations of reviewers are not disclosed.

Cost proposals will be evaluated by Government business professionals and support contractors. Findings of the various interest area evaluators will be forwarded to senior DoD officials who will make funding recommendations to the awarding officials. Restrictive notices notwithstanding, one or more support contractors or peers from the university community will be utilized as subject-matter-expert technical consultants. However, proposal selection and award decisions are solely the responsibility of Government personnel. Each support contractor's employees and peers from the university community having access to technical and cost proposals submitted in response to this FOA will be required to sign a non-disclosure statement prior to receipt of any proposal submission.

The recommendations of the various area POCs will be forwarded to senior officials from the OSD who will make final funding recommendations to the awarding officials based on reviews, portfolio balance interests, and funds available.

Due to the nature of the Minerva program, the reviewing officials may recommend that less than an entire Minerva proposal be selected for funding. This may be due to several reasons, such as insufficient funds, research overlap among proposals received, or potential synergies among proposals under a research interest area. In such cases, the government will discuss proposal adjustments with the applicant prior to final award.

C. Evaluating Proposed Option Periods

The Government will evaluate the total cost of the award including base award costs and stated cost of all options. Evaluation of options will not obligate the Government to exercise the options during grant performance.

Decisions for exercising additional option years of funding, should funding be available, will be based on accomplishments during the base period and potential research advances during the option years that can impact DoD research priorities and capabilities. Options should be detailed in the original proposal and must be clearly separable from the base proposal in all documents detailing research activities and budget specifications.

VI. SIGNIFICANT DATES AND TIMES

Table 2. Anticipated Event Timeline

Event	*Date*	*Time*
Pre-Proposal Conference/Industry Day	N/A	
Last day for White Papers questions to Interest Area POCs	June 6, 2019	
White Papers Due	**June 20, 2019**	**3:00 PM EDT**
Notification of Initial Evaluations of White Papers*****	August 1, 2019	
Last day for Full Proposal questions to Interest Area POCs	September 12, 2019	
Full Proposals Due	**September 26, 2019**	**3:00 PM EDT**
Notification of Selection for Award *****	November 22, 2019	
Contract Awards*****	January 23, 2020	
Kickoff Meeting*****	April 4, 2020	

* Dates are estimates as of the date of this announcement.

VII. AWARD ADMINISTRATION INFORMATION

A. Access to your Grant

Hard copies of award/modification documents will **not** be mailed to potential recipients. All award/modification documents will be available via the DoD Electronic Document Access System (EDA). EDA is a web-based system that provides secure online access, storage, and retrieval of awards and modifications to DoD employees and vendors.

If a prospective proposer does not currently have access to EDA, complete a self-registration request as a "Vendor" via https://eda2.ogden.disa.mil following the steps below:

Click "New User Registration" (from the left
Menu) Click "Begin VENDOR User
Registration Process"
Click "EDA Registration Form" under Username/Password (enter the appropriate
data) Complete & Submit Registration form

Allow five (5) business days for your registration to be processed. EDA will notify you by email when your account is approved.

Registration questions may be directed to the EDA help desk toll free at 1-866-618-5988, Commercial at 1-801-605-7095, or via email at cscassig@csd.disa.mil (Subject: EDA Assistance).

VIII. OTHER INFORMATION

A. Federal Funding Accountability and Transparency Act of 2006

The Federal Funding Accountability and Transparency Act of 2006 (Public Law 109-282), as amended

by Section 6202 of Public Law 110-252, requires that all agencies establish requirements for recipients reporting information on subawards and executive total compensation as codified in 2 CFR 33.110. Any company, non-profit agency or university that applies for financial assistance (either grants, cooperative agreements or other transaction agreements) as either a prime or sub-recipient under this FOA must provide information in its proposal that describes the necessary processes and systems in place to comply with the reporting requirements identified in 2 CFR 33.220. An entity is **exempt** from this requirement **UNLESS** in the preceding fiscal year it received: a) 80 percent or more of its annual gross revenue in Federal contracts (and subcontracts), loans, grants (and subgrants), and cooperative agreements; b) $25 million or more in annual gross revenue from Federal contracts (and subcontracts), loans, grants (and subgrants), and cooperative agreements; and c) the public does not have access to information about the compensation of the senior executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 or section 6104 of the Internal Revenue Code of 1986.

B. Military Recruiting on Campus (DoDGARs §22.520)

This applies to domestic U. S. colleges and universities. Appropriate language from 32 CFR 22.520, Campus access for military recruiting and Reserve Officer Training Corps (ROTC), will be incorporated in all university grant awards.

C. Certification regarding Restrictions on Lobbying

Grant and Cooperative Agreement awards greater than $100,000 require a certification of compliance with a national policy mandate concerning lobbying. Grant applicants shall provide this certification by electronic submission of SF424 (R&R) as a part of the electronic proposal submitted via Grants.gov (complete Block 17). The following certification applies likewise to each cooperating agreement and normal OTA applicant seeking federal assistance funds exceeding $100,000:

(1) No Federal appropriated funds have been paid or will be paid by or on behalf of the applicant, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the applicant shall complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

(3) The applicant shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, U.S.C. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

D. Representation Regarding an Unpaid Delinquent Tax Liability or a Felony Conviction Under

any Federal Law - DoD Appropriations:

All grant applicants are required to complete the "Representation on Tax Delinquency and Felony Conviction" found at http://www.onr.navy.mil/Contracts-Grants/submit-proposal/grants-proposal.aspx by checking the "I agree" box in block 17 and attaching the representation to block 18 of the SF-424 (R&R) Application for Federal Assistance form as part of the electronic proposal submitted via Grants.gov. The representation reads as follows:

(1) The applicant represents that it is/is not a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in timely manner pursuant to an agreement with the authority responsible for collecting the tax liability

(2) The applicant represents that it is/is not a corporation that was convicted of a felony criminal violation under any Federal law within the preceding 24 months.

NOTE: If an applicant responds in the affirmative to either of the above representations, the applicant is ineligible to receive an award unless the agency suspension and debarment official (SDO) has considered suspension or debarment and determined that further action is not required to protect the Government's interests. The applicant therefore should provide information about its tax liability or conviction to the agency's SDO as soon as it can do so, to facilitate completion of the required consideration before award decisions are made.

E. Security Classification

OSD does not provide access to classified material under grants.

F. Department of Defense High Performance Computing Program

The DoD High Performance Computing Program (HPCMP) furnishes the DoD S&T and RDT&E communities with use-access to very powerful high performance computing systems. Awardees of ONR contracts, grants, and other assistance instruments may be eligible to use HPCMP assets in support of their funded activities if OSD Program Officer approval is obtained and if security/screening requirements are favorably completed.

Additional information and an application may be found at https://www.hpc.mil/.

G. Organizational Conflicts of Interest (OCI)

All prospective proposers and proposed sub-awardees must affirm whether they are providing scientific, engineering, and technical assistance (SETA) or similar support to any DoD or military service technical office(s) through an active contract or subcontract. All affirmations must state which office(s) the prospective proposer supports and identify the prime grant numbers. Affirmations shall be furnished at the time of proposal submission. All facts relevant to the existence or potential existence of organizational conflicts of interest must be disclosed. The disclosure shall include a description of the action the prospective proposer has taken or proposes to take to avoid, neutralize, or mitigate such conflict. A grantee cannot simultaneously be a SETA and a research and development performer.

Proposals that fail to fully disclose potential conflicts of interests will be rejected without technical evaluation and withdrawn from further consideration for award. For additional information regarding OCI, contact the appropriate Interest Area POCs. If a prospective proposer believes that any conflict

of interest exists or may exist (whether organizational or otherwise), the prospective proposer should promptly raise the issue with the appropriate Interest Area POC by sending his/her contact information and a summary of the potential conflict by e-mail to the Business Point of Contact in Section I, item 7 above, before time and effort are expended in preparing a proposal and mitigation plan. If, in the sole opinion of the Grants Officer after full consideration of the circumstances, any conflict situation cannot be effectively avoided, the proposal may be rejected without technical evaluation and withdrawn from further consideration for award under this FOA.

H. Reporting Executive Compensation and First-Tier Subawards:

The Federal Funding Accountability and Transparency Act of 2006 (Public Law 109-282), as amended by Section 6202 of Public Law 110-252, requires that all agencies establish requirements for recipients reporting information on subawards and executive total compensation as codified in 2 CFR 170.110. Any U.S. Institutions of Higher Education that applies for financial assistance (either grants, cooperative agreements or other transaction agreements) as either a prime or sub-recipient under this FOA must provide information in its proposal that describes the necessary processes and systems in place to comply with the reporting requirements identified in 2 CFR 170.220. This grant and any subawards are also subject to 32 CFR Part 32.

IX. SPECIFIC MINERVA RESEARCH INITIATIVE TOPICS

The following Minerva topics indicate domains of inquiry relevant to the Department of Defense. Interest areas are not mutually exclusive and proposers are not limited to the questions, scope, or regions listed. Researchers should aim to balance the specificity of their proposed research with the generalizability of the expected results. ***The Minerva Research Initiative is particularly interested in proposals that align with and support the National Defense Strategy, which is available at:***

https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf

In framing proposals, it is important to articulate the basic science contribution of the research proposed, and how its theoretical and methodological approach is generalizable such that it could influence how similar problem sets are approached in the future. Proposals that reflect basic research that engages the strategic priorities in this document may be reviewed more favorably. (See Section V of the FY 2019 Minerva Funding Opportunity Announcement for proposal evaluation criteria).

Proposals may leverage existing data or, with justification, collect new data. Preference may be given to studies by experts capable of analyzing source material in the original languages and to studies that exploit materials that have not been previously translated. *The DOD also values geospatially-referenced data across multiple geographic scales gathered in the course of research.* It is expected that collecting viable empirical data relevant to context and situation may require field research, which is looked upon favorably.

Researchers are encouraged to incorporate novel research methods. Well-theorized models linking micro and macro analyses and cross-method approaches, such as simultaneously using both inductive and deductive analytic strategies, and qualitative and quantitative methods are also of interest. Proposals should be fundamentally rooted in the existing social science research literature and have a clear basic science component that describes the future utility of the insights the research will generate for social science.

Disciplinary approaches of interest include, but are not limited to: anthropology, area studies, cognitive science, demography, economics, history, human geography, political science, psychology, sociology,

and computational sciences. Interdisciplinary approaches are strongly encouraged, especially when mutually informing and/or cross-validating (methodological integration). Researchers need not focus exclusively on the contemporary period, but they must be able to explain the relevance of findings to contemporary DOD strategic priorities.

The 2019 Topics are situated within DOD strategic priorities that reflect the general, department-wide interests and those more specific to each Service. There is, of course, overlap and collaboration between the respective interest areas, but in framing their proposals researchers are encouraged to consider both the area of interest and the general context of needs it represents.

Topic 1: Peer/Near-peer Statecraft, Influence, and Regional Balance of Power
Topic 2: Power, Deterrence, and Escalation Management
Topic 3: Alliances and Burden Sharing
Topic 4: Economic Interdependence and Security
Topic 5: Economic Viability, Resilience, and Sustainability of Logistics Infrastructure
Topic 6: Multi-Domain Behavioral Complexity and Computational Social Modeling
Topic 7: Autonomy, Artificial Intelligence, Machine Ethics, and Social Interactions
Topic 8: Models and Methods for Understanding Covert Online Influence
Topic 9: Automated Cyber Vulnerability Analysis

Topic 1: Peer/Near-peer Statecraft, Influence, and Regional Balance of Power

POC: David Montgomery, Basic Research Office, david.w.montgomery61.civ@mail.mil

In line with the 2018 National Defense Strategy, this topic is especially interested in the role of great powers within the international system; in the interactions of peer and near-peer state actors and how to methodologically and analytically research the sociopolitical context of statecraft and influence. It will prioritize proposals that offer innovative, interdisciplinary insights into thematic topics including:

- The role of great-powers in managing global stability: How are traditional and emerging great-powers'—including but not limited to China and Russia—understandings of security impacted by the social, cultural, commercial, economic, and political environments in which they exist and what factors shape the ability of great-powers to mobilize within and beyond their territories? To what extent do culture and society determine how the identities of great powers evolve and how do those identities shape their perceptions of security and interactions with other states? How does the political influence on commercial and economic activities create a landscape of statecraft opportunities? How do structural changes among various states affect global order and create a "new global order"? Do changing ideological visions impact the utility of multilateral alliances? How do non-state actors influence established state mechanisms for managing conflict?
- The concept of the balance of power in ordering and shaping great power relations within contemporary and historical international systems, including how great powers understand their status in relation to one another and efforts to transform their momentary favorable position into an enduring strategic advantage. Here, the question is how states seek to shape or achieve a favorable balance of power and the range of military, diplomatic, and economic instruments they employ for this purpose. Key questions of interest include: How do we study the role foreign influence, foreign investment, emerging technologies, and military exports play in the balance of power? What elements comprise a balance of power and how do these relate to understandings of international order? How do states achieve a (favorable) balance of power and what is the role of the military in relation to other tools of state? How have balances of power varied historically or across different parts of the world? How do balances of power emerge in regions where they were previously absent? What is the relationship between regional and global balances of power?
- Influence underlies effective statecraft and power alliances, but nuances of what constitutes a productive strategy of influence is situationally dynamic and complex, occurring across multiple

domains of competition and cooperation. As such, there is interest in understanding what contributes to favorable influence (including and beyond soft power) with allies and adversaries? What factors affect state decisions in effort to influence other states and regional bodies? Work should include approaches for validating causal dynamics between specific influence strategies and outcomes as well as the advancing of theory that allows a prediction of outcomes resulting from influence. Alongside this, understanding how multi-domain competition works in relation to influence will be important. How do nations compete selectively when in a disadvantaged environment? What governs the calculative dynamics of various competitors' behavior? How do peers and near-peers compete for influence in ungoverned and semi-governed spaces, especially dominance in space and cyber domains? What role does emerging technology and technological dominance play in asserting influence?

Topic 2: Power, Deterrence, and Escalation Management

POC: Martin Kruger, Office of Naval Research, martin.kruger1@navy.mil

This topic supports basic research on power, influence, and escalation management methodologies with an emphasis on empirically tested or theoretically founded decision support tools for selecting the best strategies. A continued emphasis on multidisciplinary approaches to generate new theories and methodologies that incorporate strategy and strategic thought, psychology and decision-making, area studies, and culture, sociology and economics are needed to understand the potential and limitations of power, influence, and escalation management options and to understand how to develop predictive capabilities. Additionally, an emerging area of interest is "deception" by nation states, particularly through use of media, traditional and social as well as the use of cyber instruments as a non-traditional means of power projection and influence, and economic pressure through stimulus packages with unruly consequences to non-payment of loans.

The information environment includes multiple platforms, social communities, and topic areas that are polluted with disinformation and attempts to manipulate state decision and population beliefs and decisions. Currently there are not well-formed theories on how these campaigns are used, how their efficacy is measured, and how they fit into larger power, influence, and/or escalation management campaigns.

Emerging powers—including Russia, China, and Iran—have an increasing presence in black market environments, though little is understood about the structures and strategies that occur in these contexts. Also, we lack scientific understanding of the impact of black-market strategies on U.S. operations and interests, despite the proliferation of these markets. Another area of interest is the use of cyber tools in support of nation states more traditional power and influence strategies.

This topic seeks predictive models of power, influence, and/or escalation management strategies in shaping the future of broad regions as well as specific hot-spots and whether generalized theories allow lessons learned in one region or hot spot to be applied to another region. Theories that establish causality between action and outcome and action and prediction are desired on power projection, influence, and escalation management strategies to predict and measure their ability to shape an area of interest. The aim is to make it easier for US and allies to identify the best strategy for a situation and to recognize strategies that are most dangerous options for the US and allies. Specific areas of interest include the use of power projection/influence/escalation management actions on/between peer states, non-state institutions, rising military powers and rogue states.

Power projection

- Drivers affecting how a state or states influence other states.
- For those drivers, what observables (direct and/or proxy) can determine if actions are effective?

- Novel approaches for validating the causal dynamics between specific *power projection strategies (diplomacy, information, military, and economic* (DIME)) actions and outcomes
- Advancing theory that allows a prediction of outcomes resulting from power used by A on B.
- The balance of power between the state and other traditional and non-traditional institutions
- The use of cyber and black markets to project power.

Deterrence Theory

- Drivers affecting how states decide how to deter decisions made by others
- For deterrence drivers, what observables can be used to determine if actions taking are effective?
- Measuring the balance of power between the state and traditional and non-traditional institutions
- Approaches for validating causal dynamics between specific deterrence strategies and outcomes.
- Advancing theory that allows a prediction of outcomes resulting from a deterrence

Beyond conventional deterrence and power projection

- Approaches for the intentional use of deception to influence
- For deception, what observables can be used to detect its use and to determine if actions are effective.
- Approaches for validating the relative importance of deception on outcomes
- Advancing theory that predicts outcomes resulting from the use of deceptive actions

Shaping theory:

- Approaches for using military strategic action to influence future actions by other states
- What variables can be used to detect its use and to methods to measure its success
- Approaches for validating the relative importance of military

Escalation management

- Approaches for validating the relative importance of power/influence actions on outcomes
- Advancing theory that predicts outcomes resulting from multiple power and influence actions
- Theory governing the use of power and influence concurrently
- Frameworks for escalation dynamics in reciprocal power and influence actions

Area studies

- Social, cultural, economic, and historical factors affecting success/failure of power projection or influence actions applied to an area to shape decision spaces, and application to the realities of today
- Social, cultural, and historical factors affecting the choice of power projection or influence actions to shape the decision space of others, and application to the realities of today.

Operational effectiveness

- What combination of power/influence/escalation management techniques, under what conditions are successful in creating decision outcomes that favor US and Allied interests? Given successful decision outcomes, can those techniques be generalized and applied to similar or varied conditions?

Topic 3: Alliances and Burden-Sharing

POC: David Montgomery, Basic Research Office, david.w.montgoemry61.civ@mail.mil

Global security in the contemporary world is characterized by inter-state alliances. The dynamics of these alliances may vary substantially, depending on the partners to alliances, the resources they bring to the alliance, and the objectives of the different allies. One challenge is ensuring that the different partners contribute to common objectives. Allies, however, may have different resources to bring to the table, different objectives with respect to maintaining an alliance, and different perspectives on what constitutes a fair distribution of the burden for maintaining an alliance. That is, burden-sharing is a complex issue that depends on the interests of different partners, their resources, their goals, and the extent to which their goals are being met. An ever-present risk in forming an alliance is that one's partner(s) will free-ride. That is, one or more agents may take advantage of the resources others bring and access those resources

for their own interests without providing comparable contributions to the alliance.

Scientific research in this problem domain of burden-sharing in alliances is scant, although social science has a long history of research on social exchange, distributive justice, social network analytics, and economics, all of which may be relevant to addressing this issue. These and other scientific approaches require scaling to more macro scales to address the issue of global alliances and burden sharing. Additionally, cultural variation, international agreements, national policies/laws, regional economies, and governance structures may all play a role in shaping the form of burden-sharing and capacity to limit free-riding. This Minerva topic seeks to support research that will generate and validate new models to better capture the dynamics of burden-sharing in alliances with attention to factors that limit or eliminate free-riding. Empirical questions that the research should address may include:

- What are the incentives for burden-sharing within alliances?
- What constraints limit burden-sharing in alliances?
- How does burden-sharing differ within the context of bilateral and multilateral alliances?
- How do changes in the alliance partners impact burden-sharing?
- How can states more effectively manage alliances in order to achieve a greater degree of burden-sharing?
- How do we measure the depth of a relationship as opposed to the perceived depth of a relationship in relation to the return of investment on the relationship? What types of actions undermine the strength of alliance relations and what areas increase confidence in the relationship?

Topic 4: Economic Interdependence and Security

POC: David Montgomery, Basic Research Office, david.w.montgomery61.civ@mail.mil

Great power competition is taking place in an international system characterized by high levels of economic interdependencies. These interdependencies may have implications for how states pursue their national security and defense objectives. Yet there is little basic scientific understanding of how these economic relationships arise and evolve. Moreover, the short- and long-term implications of these relationships have not been accurately modeled to provide insight on how economic interdependencies impact a state's national security and defense objectives. The interdependencies are often multi-faceted (e.g., involving a complex network of trade partners that changes over time and involves different goods/services exchanges). Depending on the market, balances of power in the economic sphere may change suddenly and rapidly, or may be relatively stable over time. The factors that impact such balances may include governance shifts, cultural change, technological innovations, educational opportunities, entry/exit of trading partners from a market, and other factors that have consequences for the network of states engaged in economic relationships.

This Minerva topic seeks to develop new approaches to studying complex economic interdependencies and assess the implications of those interdependencies for national security among the nation states in the networks. Ideally, data and models will capture longitudinal relationships and identify how those relationships change over time, are linked to policy, relationships, and operational outcomes relevant to the states in the networks. Questions of interest for this topic could include:

- What is the relationship between economic solvency and national security?
- What are the implications of economic interdependence for states in diplomatic and military competition with each other?
- How do states use their economic power to achieve national interests in competition short of armed conflict?
- To what extent have economic instruments been used as effective means of coercion in international politics?

- How do different states understand the nature of a free-and-open market and fair competition? What do these difference conceptions mean for how large economies wield their economic influence? Where do OECD countries agree and disagree?
- What are the different models for understanding and managing anti-trust or non-competitive commercial behavior? Where do these models agree or disagree? Where are these models prominent?

Topic 5: Economic Viability, Resilience, and Sustainability of Logistics Infrastructure

POC: Harold Hawkins, Office of Naval Research, harold.hawkins@navy.mil

Logistics centers, whether they are ports, airports, road, or rail hubs, are critical to a country's global and sub-national trade. They are the major nodes for commodity imports and exports, and thus are critical infrastructure. They need to be (re)built or expanded in the aftermath of armed conflict, and they remain vulnerable to disruption from further civil strife, terrorism, natural disasters, and climate change.

Logistics centers may serve large hinterlands. Specific sites may be a country's primary portal for commodities not produced in country. In many cases, these are critical products—food, medicines, etc. Developing countries are often dependent on natural resource exports—e.g. oil, timber, textiles—that are competitive only via centralized transport (often, most economically, via ocean). In conflict zones, ports and airports often incur damage and their major connections inland—railroads and highways—are destroyed or deteriorated. Government institutions required to manage trade may no longer function. These damages reduce capacity and lead to large economic losses. Terrorism, natural disasters, and sea level rise associated with global climate change often exacerbate these losses. Logistics centers can thus become chokepoints for the continuation of commerce and economic development in the aftermath of conflict. Natural aftermath of these events opens opportunity for replacement of manual systems for cargo and natural resource movement with automated systems for increased economic prosperity and increased vulnerabilities to statecraft manipulation.

This research topic focuses on the role performed by logistics centers as critical infrastructure for societies to be economically viable, resilient, and sustainable in the aftermath of conflict. Sub-topics of interest include:

- A systems analysis of logistics centers and interior regions in terms of infrastructure (re)construction and expansion, economic interdependence, logistical operations, vulnerability, and resilience analysis. This helps inform the strategic importance of ports, airports, and rail hubs in conflict zones and regions of economic expansion.
- More nuanced analysis of critical logistics and infrastructure configurations, including surface transportation. This also integrates workforce training of management and front-line employees.
- Vulnerability analysis in terms of probabilistic assessments of threats and the direct and indirect intraregional consequences of disruptions to critical logistics centers.
- Resilience analysis regarding strategies and tactics to regain functionality and optimize the time path of repair and recovery.
- Computable general equilibrium modeling of economic interdependence, vulnerability, and resilience. Prior analyses have utilized ad hoc methods that only partially resolve the path-dependence issues of resilience analysis.
- Dynamic optimization of the large investments logistics centers/infrastructure represent and their connection networks require, and the long life span of these investments.
- How can we evaluate the interdependence between economic viability and information dependence? Does control over networks yield systemic advantage to the commercial firms of other competitors? Can states create commercial advantages for their firms by influencing standards?

Topic 6: Multi-Doman Behavioral Complexity and Computational Social Modeling

POC: Jean-Luc Cambier, Air Force Office of Scientific Research, jeanluc.cambier@us.af.mil

Warfare is a complex, large-scale enterprise, subject to many uncertainties, difficult to control, and yet which must be predicted as accurately as possible. The globalization of trade, technological infrastructures, and access to natural resources has resulted in complex and often hidden dependencies in the economic and technological networks, bringing significant uncertainties in the value of the outcome, as well as in the optimal strategy of such a conflict. From a game-theoretic point of view, we must deal with a multi-player hierarchy in a very large parameter space, and with uncertain and time-varying objectives.

This research topic addresses the imperative to understand better both the short-term and long-term consequences of all types of actions associated with total warfare in a complex, multi-domain framework. It covers how total warfare could be conducted and aims to discover connections leading to the failure of executing strategic and tactical planned military actions, or their degradation. Conversely, it also aims to identify strategies that would safeguard these plans against such cross-domain disruptions. This will require research on several fronts, which must be ultimately integrated into a comprehensive capability which would adequately describe the complexity of the problem, model the dynamics (i.e. the state evolution), and infer optimal strategies. The main aspects of interest are:

Cross-Domain Relationships in Total Warfare

While regional conflicts have been the norm in recent years, the focus of attention is shifting to scenarios involving larger-scale engagements, with peer or near-peer competitors. This is especially relevant as some actors are actively pursuing a strategy of "total warfare", where every domain becomes a battlefield, be it cyber, economic infrastructure, social media, environment, etc., as well as the traditional military domains and capabilities.

Research is required to support identification and fundamental understanding of inter-relationships between different domains of influence, e.g. social, economic, political or legal, that is both *representative* and *predictive*. Here, *representation* means that one should be able to accurately describe the state of the domain. In particular, one should also be able to evaluate the sensitivity to the various domains and the possible actors. The *prediction* aspect implies that the interactions between the domains and their elements can be cast into a form that can be fast-forwarded in time, whether by interpolation, mappings, or time-stepping algorithms.

This requires a very careful and rigorous analysis of events, the social and economic conditions, and sound reasoning. It is also a multi-disciplinary task. Besides sociological and economic expertise, the ability to manipulate potentially large amounts of data and extract information from various sources may also prove to be critical. We can gain insight from historical analysis, whether small or large-scale events, and specifically seek the (initially) subtle effects of correlated events in non-military domains, that have military and strategic implications. In addition, a focus on more remote events and decisions, which may appear unrelated at first, may offer insights into a cascading effect across the social and economic layers and impact military campaigns, even at later times. By reaching deep into this causal network, one can gain a better sense of the scope of the complexity, and inform future models.

Societal Resilience in Cross-Domain Warfare

Total warfare across multiple domains is likely to challenge societal resilience, particularly in the event of any protracted conflict. The effects of conflicts upon society is likely to extend beyond the immediate kinetic impacts to encompass the social, political, and economic institutions and relationships that underpin societal cohesion. Better understanding of the nature of the interrelationships across domains

will yield insights into the effects of protracted warfare on societies, particularly in an era of technological developments that blur the lines between civilian and military spheres. Researchers are encouraged to consider how to evaluate societal resilience of all actors involved, and how that may evolve over extended timeframes.

This topic is interested in research and strategies that would support planning against cross-domain disruptions. This is a more difficult problem; the adversary could experiment with any action(s) that would sow chaos, until finding one with a maximal impact, while designed protection against such attempts would require examining all possible actions. A practical outcome here is the identification of trends and general rules, which may not provide strict guarantees, but useful guidance for reducing the scope of the search for threats and make the problem solvable. In turn, this provides information about which policies to formulate and implement, that would minimize the socio-economic damage while also minimizing the resources required for their implementation.

AI in Cross-Domain Total Warfare

An important evolutionary trend concerns the increasing reliance on artificial intelligence (AI) at multiple levels of sophistication. The consequences of this explosive growth of AI in the entire socio-economic and military ecosystem, and the implications on national security, are not well understood. Threat analysis which relies on the understanding of group behavior may no longer apply; machine intelligence is not subject to emotional drivers and does not respond to mechanisms of social influence. If the intelligent machines are designed and trained with objectives and rules that originate from a few human actors, they effectively become replicas with little or no variation in behavior; statistical averaging becomes meaningless, and this increases the brittleness of the whole ecosystem. The AI becomes a new class of "alien" actor which does not obey the same rules, and yet it is turning into a dominant factor in the evolution of *all* the socio-economic and military networks. There is no comprehensive theory on how to characterize, understand, and model this blended human-AI sociology. Exploratory advances in this area are also desired.

Computational Modeling of Large-Scale, Cross-Domain Behavioral Dynamics

Computational science applied to socio-economics provides a powerful remedy, *if* accurate models for elementary interactions can be effectively implemented, and if the problem complexity can be scaled to within practical limits. Although various approaches can be considered and/or mixed, agent-based modeling (ABM) is a traditional yet powerful approach that can offer specific insights. We can then consider an ABM-network for each domain; financial (e.g. banks), industrial (factories, refineries, etc.), transportation (airlines, trucking, trains, etc.), etc. Agents can be linked to multiple networks, allowing cross-domain influence and the propagation of critical events (failures, jamming, paralysis, etc.). By predicting the range of actions and consequences of networked agents, one can aim at being able to reproduce total warfare scenarios *in-silico*, in a realistic and practical fashion.

To make computational models tractable and fully unleash their predictive power, we must be able to make progress along several directions. First, one must be able to reduce the complexity of the real world in a systematic and rigorous fashion. The higher the complexity of the representation, the higher the computational cost in evaluating "distances" or in performing additive, combinatorial, or averaging operations. Thus, this topic calls for advances in the design of representative (multi-dimensional) variables for complex description of agent states and motivations, as well as in the mathematical and numerical methods that model the socio-dynamics between the agents and these state variables.

A second problem is the development of methods to track the dynamics and the correlations of actions between the various domains. We need to be able to simulate a "perfect storm" in the context of multi-domain, total warfare, and examine resiliency of the networks. Practically speaking, the dynamics of the agent-based ecosystem cannot be analyzed a-posteriori, for arbitrary time delays; this suggests that

iterative procedures should be used, and/or the causality chains should be "learned" via a repetitive exploration of scenarios. Such approaches have the potential to dramatically focus on the most important chains of events, considerably reducing the dimensionality of the parameter space, and would dramatically expand our predictive abilities in very complex scenarios. These problems are challenging for both their sociological and mathematical aspects, and call for tightly coupled multi-disciplinary solutions, leveraging advances in multiple fields.

Topic 7: Autonomy, Artificial Intelligence, Machine Ethics, and Social Interactions

POC: Patrick Bradshaw, Air Force Office of Scientific Research, patrick.bradshaw.3@us.af.mil

The emergence of Artificial Intelligence (AI) presents opportunities for machines to augment human decisions and actions and it is certain to have sweeping social impacts, changing many aspects of how we live, learn, and communicate. The vast majority of research in this domain has focused on how AI can augment human performance, yet the use of advanced machine intelligence in complex situations characterized by moral dilemmas creates a precarious challenge for human tolerance/acceptance of machine actions. How do humans interact with machines when they take actions (or make decisions) that have negative consequences for humans? This challenge goes beyond the current liability issues facing the automotive industry, and extends to human perceptions of machine action. Fundamental research is needed to identify and isolate the psychological factors that influence human acceptance of machine actions in contexts where these actions can cause negative consequences to humans. Further, research is needed that understands both the ethical implications of AI social interactions as well as the environment of operating ethically in relation to an adversary or a coalition partner who may have a very different understanding of the limits of machine behavior. Relevant questions here include: How do relationships develop with machines, especially relationships of bidirectional trust? How does a reliance on machine intelligence affect human relations within communities, societies, and global order more broadly? How do social and moral norms shape the apportion of autonomy? How does reliance on autonomy shape individual and organizational decisions? For example, in human organizations, delegating serves to increase the moral distance from the consequences of one's actions. Might operating combat through robotic controls decrease empathy and increase dehumanization of others?

A related interest of this topic is analysis that interprets the dynamics of human and human-machine interaction, the synchrony or desynchrony of speech, posture, movement, reaction timing, emotional expression, and ownership of intellectual property. Any effort in behavioral informatics must be broad and multimodal. The common approach to computerized image understanding will not suffice. It is important to distinguish proposed work from research already underway or already accomplished. The social science context of the research must be articulated around AI and sociality, and it must offer predictive utility, not just retrospective analysis.

This topic invites novel approaches to understanding the implications of social interactions with machines and how such interactions may vary across cultural environments, especially those of peer and near-peer states. Are there cross-cultural universals in interacting with autonomy or are there culture-specific nuances that lead to different expectancies for automated behavior? Broad questions about trust, mentioned above, should construe trust as a bidirectional relation, involving both the human and the machine's ability to interpret a partner's goals, moral concerns, tacit assumptions, and framework of expectations and commitments. Research along these lines will be increasingly important as AI systems develop more sophisticated, dynamic, and unscripted partnerships with humans.

A project along these lines must offer an approach to discovery. It should frame a fundamental scientific problem, and it should avoid reliance on so-called Deep Learning or other approaches that can produce technical advances – via the computational magic of neural nets -- without revealing any deep insights. Disciplines for this topic may involve sociology, anthropology, philosophy, law, psychology,

mathematics, engineering, biology, neuroscience, and computer science, among others. Innovative multidisciplinary projects are preferred.

Topic 8: Models and Methods for Understanding Covert Online Influence

POC: Rebecca Goolsby, Office of Naval Research, Rebecca.goolsby@navy.mil

This effort will provide a regional focus on attempts to use online influence maneuvers to deceive, influence, polarize, and manipulate Indo-Pacific audiences for strategic political advantage by peer states and their proxies. In many cases, covert actors are orchestrating influence campaigns to target vulnerable audiences, to make fake and deceptive information appear authoritative, and to recruit vulnerable audiences into social formations that will cause them to increasingly reject information from outside the information world of the covert actor. Technical means as well as social engineering are used in combination to achieve these effects.

Recent studies indicate that Internet-aided programs of social hysteria propagation, propaganda, disinformation, and influence operations are being conducted by covert state and non-state actors across the globe. The invasion of Ukraine and Crimea are important cases that have promoted worldwide concern. In the last three years, numerous reports on the impact of these campaigns on civil society have been published across the globe, but little is known about the pathways by which groups encounter disinformation and influence campaigns or the unique social psychology of influence in cyberspace.

Less is known about social cyber influence operations in Indo-Pacific region. There is significant evidence to show that China, as well as Russia, are actively pursuing influence campaigns in the Indo-Pacific region. Some countries are particularly riddled with bot campaigns on Twitter. Youtube, WhatsApp, Vkontatke, and other platforms are also available for developing and executing influence operations. Australia's political parties recently found evidence of cyber-attacks on their data analysis projects, suggesting that adversarial manipulation of their elections is a growing threat.

Indo-Pacific is a large and diverse region. Therefore, it is expected that a successful effort will focus on a small collection of countries or specific topics such as elections, the Belt and Road project, anti-Western / anti-US influence campaigns, or attempts to obtain some strategic advantage for nation-state actors working through proxies.

The main objectives are: (1) to develop new theoretical understandings of the spread of propaganda, disinformation, and influence to vulnerable audiences by covert state and non-state actors in the Indo-Pacific area of responsibility; (2) to develop and validate models to assess the impact of these efforts on target communities; (3) to develop methods to assess audience vulnerability to methods and techniques of group polarization, influence, social hysteria propagation, and manipulation in the Indo-Pacific region; (4) to investigate methods to instill resilience to propaganda, deception and influence in vulnerable audiences; and (5) to investigate the specific socio-cultural dimensions and aspects of these influence campaigns and evaluate their resonance and efficacy in Indo-Pacific communities.

Social sciences, especially anthropology, sociology, computational social science, and social psychology with areal specializations in the Indo-Pacific region are recommended. Media studies and communications theory specialists are highly recommended. Information science and computer science are needed to help develop tools and models that manage up to 100,000 or more sites, accounts and make these high information flows useful and researchable by other experts.

Topic 9: Automated Cyber Vulnerability Analysis

POC: Harold Hawkins, Office of Naval Research, harold.hawkins@navy.mil

Over the past decade, cyber assault on military, governmental and industrial networks has grown dramatically in frequency, sophistication and effectiveness. These attacks range from data theft to system denial or degradation, and their impact, whether directly on military systems, or indirectly, on the networks used by organizations contracted or sub-contracted to support the military, has the potential to compromise the effectiveness of military operations. The vulnerability of our cyber systems constitutes a critical threat to national security.

Current approaches to vulnerability assessments of information technology (IT) or operational technology (OT) infrastructure suffer from two primary limitations. First, while static and dynamic code analysis tools are critical for secure development of specific components, they cannot account for complexities arising from all possible data-input/run-time execution paths. Vulnerability scanning tools such as Nessus are useful but they only provide a snapshot in time of known vulnerabilities on a small subset of nodes where scale is limited by the number of well-trained individuals and their availability to perform the scans. Second, state-of-the-art vulnerability scanning tools focus on assessing the logical software infrastructure while largely ignoring the human element that interacts with that infrastructure. This is the case, despite the fact that most vulnerabilities are introduced through human error as exemplified by acts of omission (e.g. forgetting to close a port), commission (clicking on a phishing link), misplacement (e.g. connecting a classified machine into an unclassified network), or malicious intrusion (e.g. insider threat). The state-of-the-art vulnerability scanners are not designed to detect vulnerabilities introduced by humans interacting with the system because they contain no formal characterization of the cognitive and social behavior of the attackers. While social engineering assessments can be effective, they also require expensive involvement of experienced security professionals.

Needed are autonomous vulnerability assessment tools that can work in conjunction with human analysts to provide greater coverage of a network over more sustained periods of time. The tools should be given a logical network coverage area and then work independently to discover vulnerabilities within that area while alerting the analyst only when they find significant vulnerabilities that require immediate attention. Autonomy is necessary to reduce cognitive workload of the cybersecurity analyst so that they can focus on more operational-level tasks such as determining the most critical parts of the network to scan based on mission criticality and current threat intelligence.

This Minerva topic seeks innovative multidisciplinary research, entailing the contributions of artificial intelligence (AI) as well as behavioral, social, and statistical sciences, aimed to develop automated techniques for the assessment of network vulnerability to cyber assault along lines described above. We seek solutions with four primary features. First, they should be designed to apply to a broad range of network types, extending across scales, structural implementations, and applications. Second, because the techniques and targets of cyberattack are rapidly evolving, the solutions must be developed to be modular and capable of extensive scale-up. Third, they should be developed with the capability to uncover an extensive range of possible sources of vulnerability. Lastly, they must be informed by socio-psychological theory and analyses addressing the sources of errors in judgment that raise the vulnerability of cyber systems to attack and provide the bases for techniques to mitigate/remediate these errors.
We envision a research effort that includes an analysis of existing cyberattack databases, augmented with insights from social psychologists and both civilian and military cyber subject matter experts, to identify potential vulnerabilities and their sources. It should include development and demonstration of an executable system for automated vulnerability analysis. In addition, it should include a creditable demonstration of the validity of the system.