CRUSER Seed Research Program (SRP)
2023 Call for Proposals

Overview

•	Call for Proposals Announcement:	29 August 2022
•	Proposals Due	2 October 2022
•	Funding Announcement (Anticipated)	Mid-November
•	Period of Performance (Anticipated)	1 January to 31 December 2022
•	Maximum Funding Levels	$150,000, typical. $300,000, multidisciplinary projects closely tied to the CRUSER seed research themes.

Program Objective

The Consortium for Robotics and Unmanned Systems Education and Research (CRUSER) at the Naval Postgraduate School (NPS) seeks to shape generations of naval officers through education, research, concept generation, and experimentation in maritime applications of robotics and autonomous systems.

The CRUSER Seed Research Program (SRP) is a critical aspect of how CRUSER achieves this objective. The program provides an environment for students, faculty, and staff to collaborate both internally and externally with the common goal of accelerating the development and fielding of unmanned systems across the Department of the Navy (DON). Furthermore, the SRP functions as an incubator, providing initial support for the NPS community to explore new, relevant concepts with the potential to transition to externally supported NPS research program.

Scope of Research

CRUSER research provides an authentic academic experience for NPS students within the many fields that constitute Intelligent Autonomous Systems (IAS) science and technology. CRUSER continues to support a wide diversity of research topics, "from technical to ethical, from concept to experiment". CRUSER prioritizes support for seed projects that have a clear transition path for follow-on external support, e.g., research grant support, fleet investment, etc.

CRUSER supports both fundamental research (both basic and applied), "the results of which ordinarily are published and shared broadly within the scientific community,"[1] and development, design, production, and product utilization efforts, the results of which ordinarily are restricted or classified or national security reasons.

Multi-Year Seed Research Support

CRUSER financial support is limited to single-year funding, but the initiation of new research often requires proposals for follow-on support during the incubation phase. CRUSER seed research support is intended as an early-state resource to incubate new concepts with potential to transition to future reimbursable support. Furthermore, the magnitude of CRUSER support is insufficient to sustain

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[1] See National Security Decision Directive (NSDD) 189, National Policy on the Transfer of Scientific, Technical, and Engineering Information.

research beyond the initial stages. For these reasons, the details of the proposal evaluation will increasingly emphasize progress towards transition for projects that extend past two years.

Research initiation activities are often not well-suited for completion within a one-year period of performance. While CRUSER funding is always for only one year, the intent of the program is to provide a second year of support for new projects as long as the second-year proposal demonstrates tangible progress towards transition to extramural support.

Proposals for a third year of CRUSER seed research support must include evidence of progress towards transition in year two and a detailed transition plan to be executed in year three.   Progress toward transition may include evidence of solicitation for reimbursable support, e.g., copies of submitted proposals or planning letters.

Proposals for a fourth year of CRUSER seed research support will only be considered with evidence of complementary reimbursable support – or under extenuating circumstances.

Anticipated Support

Funding has not yet been received for FY23; however, the purpose of this call for proposals is to prepare researchers on campus to begin work as soon as possible in the new year. Subject to available funds, the program will provide support that begins 1 January 2023.

We anticipate being able to fund roughly 1-2 projects at the $200-300k level, 10-12 projects at the ~$100k -$150k level, and 5-6 projects at the $50-75k level.

Terms and Conditions

The Seed Research Program Terms and Conditions document provides guidelines for project execution.

Proposal Process

Proposal Content and Submission Process
The proposal package must include the following documents:

1. Proposal Document - .pdf format
2. Quad Chart - .pdf format
3. Budget Spreadsheet - .xlsx format

All files submitted via Qualtrics should be authorized for release. If your proposal documents require the inclusion of CUI, please contact the CRUSER team to arrange for an alternate means of submission.

In the absence of explicit distribution statements, all documents submitted to CRUSER will be assumed as authorized by the submitter for public release (Distro A). The materials will be treated as sensitive, but CRUSER reserves the right to provide the proposal materials to external evaluators (e.g., ONR program officers and warfare center SMEs) for confidential evaluation.

Submitted materials not authorized for public release should include the appropriate distribution statement and will be treated accordingly.

Submit the documents with required programmatic information online at CRUSER Seed Research CFP Submission by COB 2 October 2022.

*Proposal Document (**5 pages maximum**)*

The proposal should describe the proposed project and clearly address the evaluation criteria. The document should contain, but is not limited to, the following:

- Project narrative or statement of work that describes the objective, approach and expected outcomes.
- Transition plan describing where follow-on, external, reimbursable support will be solicited for the research.
  - For projects that are a continuation of previous CRUSER support, the proposal must include specific programs for potential follow-on support and descriptions of any proposals, planning letters submitted.
- Description of current or pending support for similar or complementary research by the researchers.
- Self-evaluation of the proposal criteria listed below. You must explicitly address each of the five required criteria in your submission.
- Budget summary[2] as a table, breaking out the labor, travel, equipment, contract and indirect components of the proposal.
  - Describe briefly any contracts, NRC postdoc support, funds transfers or other large expenditures[3]. Describe any CRUSER operational support required to execute these expenditures.

Evaluation Process and Criteria

Proposal packages are reviewed by the CRUSER Advisory Board according to the evaluation criteria below.   The CRUSER Advisory Board is co-chaired by the Dean of Research and the CRUSER Director and consists of past CRUSER directors, the Associate Dean of Research, and the Warfare Chairs and senior military representatives from each service at NPS.

Proposals are evaluated based on the following criteria:

- Clarity of the project's potential for impact. All proposals and quad charts must clearly state the anticipated contributions to both academics (see Research Scope above) and warfighting capabilities.
- Relevance to Intelligent Autonomous Systems as "the confluence of Autonomy with Unmanned Systems and Artificial Intelligence."[4]
- All proposals must clearly state how the project aligns with the [DoN S&T Strategy for Intelligent Autonomous Systems](#) and/ or [Unmanned Campaign Framework](#).
- All projects are required to involve NPS student research.
- Potential to attract future external, reimbursable support.

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[2] It is recommended that the RSPO Budget Template be used to develop this summary with the correct fringe, indirect, etc. (https://nps.edu/web/research/proposal-development)   The final budget for selected projects will be input through the Coeus system.

[3] CRUSER cannot support grants.

[4] Department of the Navy Science & Technology Strategy for Intelligent Autonomous Systems (2021).

- o For proposals to support continuing projects, please see the section titled "Multi-Year Seed Research Support" for details on proposal requirements.

In addition, the following project activities are encouraged, but not required:

- Relevance to the CRUSER Seed Research Themes (see below)
  - o For projects with a budget request greater than $150k, the proposal must clearly describe alignment with and contribution to one of the seed research themes.
- Interdisciplinary collaboration
  - o Special consideration for new partnerships across NPS
- External collaboration with academic, government and industry partners
- New NPS faculty are strongly encouraged to submit proposals.

CRUSER Seed Research Themes

The CRUSER seed research program will continue to solicit broad NPS community engagement and consider diverse project proposals. In addition to the broad support, special consideration will be given to projects that contribute to one of the following themes. Furthermore, for proposals that are directly relevant to one of these priority areas and that involve multidisciplinary teams, funding of up to $300k may be requested.

1. **Collaboration with Naval Education Enterprise (Continuing from FY22)**
   PMS-406 challenged the Naval Education Enterprise (NEE) to improve research alignment between NEE efforts. One of the outcomes of the resulting effort is that NPS and the US Naval Academy (USNA) have established the Naval Autonomy Working Group (NAWG) to facilitate collaboration. For FY22 CRUSER will give special consideration to collaborative projects that involve faculty and students from both NPS and USNA. To explore collaborative research opportunities at USNA, researchers are encouraged to contact the USNA NAWG leads: CDR Paul Frontera frontera@usna.edu and Professor Alexander Laun laun@usna.edu.

2. **Applying learning and adaptation to autonomous systems in the battlespace environment (New in FY23)**
   a. Possible research topics might include (but are not limited to) the following:
      i. Command and control of large numbers of heterogeneous autonomous systems in complex naval environments and performing complex missions
      ii. Perception-based decision–making, navigation and control in complex, unstructured and cluttered naval environments
      iii. Safe and fault-tolerant autonomous operations that address unique challenges of the maritime environment
      iv. Environmental adaptation for mobile autonomous acoustic sensor platforms
      v. Interactive sensing: Approaches for unmanned systems to improve perception via tighter coupling between recognition processes and platform behaviors (e.g., adapting sensing modalities/settings, modifying vehicle pose/trajectory, manipulating or physically interacting with the world, etc.)
      vi. Approaches to increase unmanned systems' ability to collaborate among, learn from and interact with other unmanned systems, manned systems and human

experts; perform basic tasks autonomously (e.g., obstacle avoidance, launch, etc.); and robustly adapt to changing environmental and contextual conditions

vii. Temporally non-myopic planning under uncertainty: Many-sortie, multi-objective (e.g., time and risk) planning, optimization and adaptation given multiple heterogeneous agents, subtasks and hierarchies of command that occur over extended time horizons

viii. UxS-based remote sensing tools and algorithms that can be used to initialize forecast models in distant, remote and/or denied areas

ix. Incorporating UxS to extend the reach of AI-based methods for environmental characterization

b. Alignment and possible collaboration/transition partners:
   i. ONR Science of Autonomy
   ii. ONR Maritime Sensing
   iii. ONR Ocean Engineering and Marine Systems