

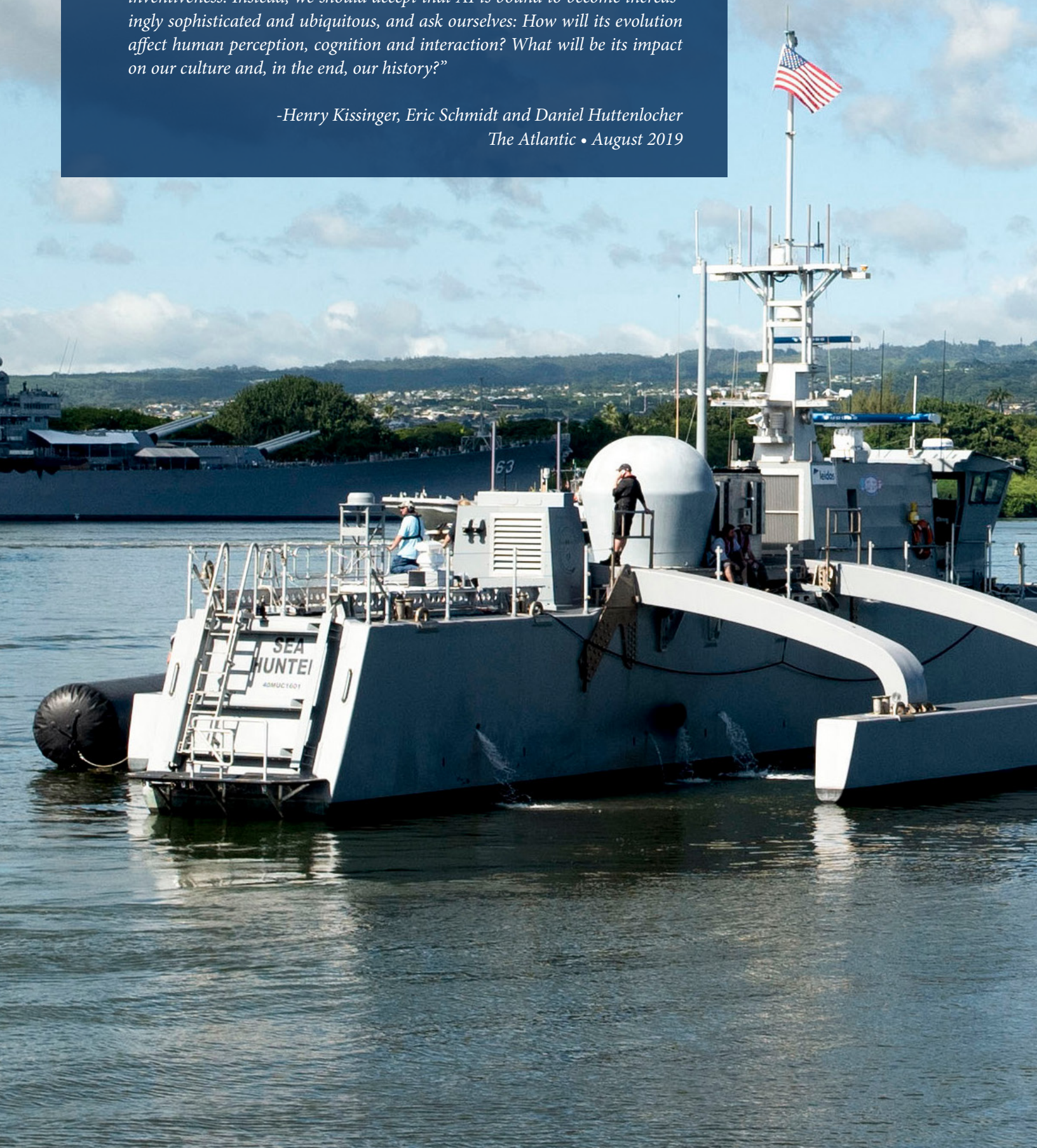


ARTIFICIAL INTELLIGENCE

Addendum to the NPS Strategic Plan 2018-2023

“Humanity is at the edge of a revolution driven by artificial intelligence ... This revolution is unstoppable. Attempts to halt it would cede the future to that element of humanity more courageous in facing the implications of its own inventiveness. Instead, we should accept that AI is bound to become increasingly sophisticated and ubiquitous, and ask ourselves: How will its evolution affect human perception, cognition and interaction? What will be its impact on our culture and, in the end, our history?”

-Henry Kissinger, Eric Schmidt and Daniel Huttenlocher
The Atlantic • August 2019





ARTIFICIAL INTELLIGENCE

An Addendum to the Strategic Plan

Published August 15, 2019

STRATEGIC VISION

Artificial intelligence (AI) brings a radical new dimension to sea power: machines making battle-related decisions and recommending actions to commanders. Trusted AI technologies support combat operations, distill data to provide the most salient support for decision-making, engage-on-remote, and assist with weapons control and in battle management, making AI a function critical to the success of commanders at sea.

The United States recognizes that its adversaries are investing immense resources into AI and integrating their solutions into their warfighting systems. The United States must match and exceed these efforts, not only because AI is vital to the Navy's future, but also because commanders predict that the warfighting advantage of both the United States and its allies will be compromised within five years if the pace of innovation in AI is not accelerated. [A Design for Maintaining Superiority 2.0]

OUR RESPONSE

In response to the Department of Navy’s need for solutions to naval concerns, and for advanced AI development, the Naval Postgraduate School (NPS) will integrate the ongoing efforts of researchers involved in over 100 current projects with a unique cohort focused solely on creating AI applications into the newly established NPS AI Consortium. Through the university’s education and thesis research initiatives, NPS students will function as the primary agents for translating AI into naval operations, bringing new technology into their respective fields of study, promoting trustworthy AI technologies and instructing others on their use. Through partnerships on NPS current projects and with other institutions, NPS students and researchers will advance discovery and establish new channels and methods that influence the rapid adoption of AI technologies.

The NPS AI Consortium will work within four main themes:

1. Emerging AI technologies (What is coming?)
2. Education (What is there to learn?)
3. Adoption of AI innovations (How do we use it?)
4. Strategy and Policy (What does it mean?)

The accompanying table shows possible action areas grouped under these themes.

GENERAL CONSIDERATIONS

The focus of the NPS AI Consortium will be on machines and algorithms that perform cognitive-like tasks, including simulations and machine learning. To ensure its success, the coalition will also develop and maintain internal partnerships with experts from all four schools, collaborate with constituents in high-performance computing, the Office of University Communications, Information Technology and Communications Services, and with stakeholders in the Big Ideas Exchange, Joint Interagency Field Experimentation and the Emerging Technology Center. The group will also collaborate with researchers at MIT, Stanford, Carnegie-Mellon University, Joint Artificial Intelligence Center, and the Defense Innovation Unit (DIU), who are developing new AI solutions of interest to the Navy and operationalizing AI technologies in Fleet operations. The NPS AI Consortium will also provide a support staff to assist faculty in their participation and to run general programs such as visiting lecturer seminars.

Emerging AI Technologies	Education	Adoption of AI Innovations	Strategy and Policy
<i>What is coming?</i>	<i>What is there to learn?</i>	<i>How do we use it?</i>	<i>What does it mean?</i>
Labs and partnerships in emerging areas	Raising the institutional level of awareness of the limits and benefits of AI	Raise awareness of student theses operationalizing AI	Strategic studies on AI in support of operations of the Observe, Orient, Decide and Act (OODA) loop, networks, and swarms
Data Science partnership	Frameworks for thinking about AI	Outreach to industry, universities, & AI centers	Interface with Ethics of War center on automation and cyberwar
CRUSER partnership in autonomous vehicles	Publication stream to “Navy Proceedings” – culled from theses and faculty research	Innovation fellows	Trust in AI
Explore AI potential and connections with new technology	Partnership with Big Ideas Exchange (BIX) on AI Big Ideas AI certificate	Validation and field testing of AI technologies – Joint Interagency Field Experimentation (JFIX)	Human-machine teaming
Internal partnerships bring students and AI Subject Matter Experts (SME) together	“Harnessing AI” a short course available to all NPS students; eventually converted to an all-access online module	Proposing operational concepts and implementations to Fleet consumers	
Applications of AI across the education, human, and Science and Technology domains of NPS		High-quality webinars and podcasts on hot questions	
		VIP roundtables	
		Innovation leadership program	





EMERGING AI TECHNOLOGIES

The United States has entered a new era of great power competition in which AI and automation will play a decisive role. Adversaries are aggressively pursuing AI-enabled capabilities to offset our nation's military power. To counter this challenge, as stated in this document's Strategic Vision, the United States must accelerate its research in AI and increase the pace of adopting AI technologies. The NPS AI Consortium will assist in this effort, staying abreast of emerging AI technology through cross-department collaboration and leveraging our operationally-savvy student body, mastering complex technologies and communicating their use and function throughout the naval service in plain language.

1. Labs and partnerships in emerging areas. Near-term research areas include:

- a. Finding patterns useful for prediction in movements of vehicles, personnel, supplies, and malicious actors in cyberspace
- b. Processing imagery to recognize and classify threats
- c. Predictive maintenance from sensor data on assets and equipment
- d. Automated mission planning to increase chances of success and minimize resources
- e. Planning and control of autonomous vehicles
- f. Biometrics for authentication
- g. Adversarial attacks on neural networks
- h. Explainability of AI decisions
- i. Applying game learning systems such as AlphaZero to wargaming
- j. Design of effective human-machine teams
- k. Assessing trustworthiness of AI based systems

2. Data Science partnership

- a. Bringing machine learning to data analytics
- b. Generating properly representative data samples to train neural networks



3. **CRUSER partnership in autonomous vehicles**
 - a. Intelligent drone swarms
 - b. Reverse swarms to counter attack swarms
 - c. Enlarging swarm networks to include air, land, sea, and space assets
4. **Explore AI potentials and connections with new technology**
5. **Internal partnerships bring students and AI SMEs together**
6. **Applications of AI across the education, human, and S&T domains of NPS**

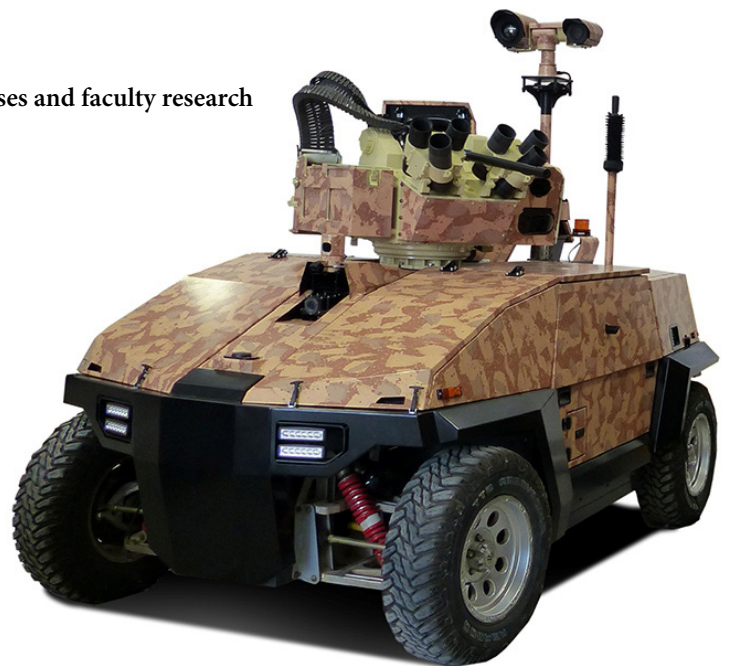


EDUCATION

AI and machine learning involve powerful tools and sophisticated practices that require skilled engineers, mathematicians, statisticians and other experts to design, build, and maintain them. Without extensive knowledge of AI technologies, teams can be blindsided by attacks they do not understand and cannot prevent, despite having tools designed to detect and block assaults. To win, teams must know their technologies thoroughly, and be prepared to create and build new defensive and attack strategies and tools on the fly. To prepare our officers to succeed, naval education in AI at NPS will emphasize two dimensions: the technologies of computer science, information science, networking, machine learning, sensor-data acquisition and analysis, and advanced statistics; and the geopolitical forces that are shaping the uses and aspirations for AI.

1. **Raising institutional level of awareness of limits and benefits of AI**
 - a. Generating “smart players”
 - b. Introduction of noon hour short course “Harnessing AI”
 - c. Website to find projects and possible POC for questions
 - d. Guest lectures in AI
2. **Frameworks for thinking about AI**
3. **AI certificate (also DL):**
 - a. Introduction to AI for everyone (cf. “Harnessing AI” above)
 - b. AI in support of operations such as OODA loop
 - c. Case studies in AI applications
4. **Publication stream to Navy Proceedings – culled from theses and faculty research**
5. **Partnership with Big Ideas Exchange (BIX) – AI big ideas**

BIG IDEAS EXCHANGE[®]



ADOPTION OF AI INNOVATIONS

There is no shortage of new AI ideas and technologies. The Department of Navy does not have an innovation problem; it has an adoption problem, a challenge to leadership. Innovation leaders bring communities not under their direct command into new operational practices supported by AI tools and thinking. The NPS AI Consortium will offer training in innovation adoption and build a support network for innovation leaders throughout the naval services. Through partnerships with other research centers and with industries the coalition will constantly scan the horizons for emerging AI technologies worthy of adoption by the naval services.

- 1. Raise awareness of student theses operationalizing AI – consortium website**
- 2. Outreach (via Emerging Technology Center)**
 - a. Joint projects with industry
 - b. Joint projects with other universities and major centers
 - c. Experience tours
- 3. Innovation fellows program**
 - a. Visiting officers from the fleet
 - b. Students with special projects for external naval sponsors
- 4. Validation and field testing of AI technologies– JIFX**
- 5. Proposing operational concepts and implementations to Fleet consumers**
- 6. External support to Fleet adopters of AI technologies (e.g., SURFDEVRON and aviation test squadrons)**
- 7. High quality webinars and podcasts on hot questions**
- 8. Roundtables for VIPs**
- 9. Innovation leadership program**
 - a. Basic course
 - b. Intermediate course
 - c. Master’s course
 - d. Online workbook for innovation adoption
 - e. Innovation leader network

STRATEGY AND POLICY

Emerging technologies, education, and innovation adoption represent an ongoing cycle from inception of AI technologies through their operationalization. This cycle is meaningful only in a context of strategy, policy, and ethics that connects AI to the nation’s geopolitical concerns. To that end, the NPS AI Consortium will develop centers of AI strategy, policy, and ethics and integrate them with the other three themes.

- 1. Strategic studies**
 - a. AI in support of OODA loop
 - b. AI in support of networks and swarms
- 2. Interface with Ethics of War center**
 - a. AI and automated weapon systems
 - b. AI and cyberwar
- 3. Trust in AI systems**
- 4. Human-machine teaming**



*"We will continue to provide
high-quality, defense focused
programs of education and research."*

OTHER ACTIONS

In addition to the actions specific to the themes, there are some general actions that are needed for the consortium to function and provide value as an entity. One of the biggest is a web presence. A website provides the means to answer the two most prominent external questions: What is NPS doing in AI? Who can I talk to about my AI question? This service requires a properly designed web page and a staff member to maintain it and keep it up to date. The website will have a guide to all AI projects and personnel at NPS and will be designed in cooperation with the Institutional Advancement, ITACS, and University Communications teams. It will have a good search function. This site will be the main window between NPS and the operational world of naval fleet.

We will also set up basic consortium-wide actions – including seminars, lectures, establishing the AI-for-all course, consulting services, and support of an AI network. Other consortium-wide services are possible after a positive evaluation of their costs and benefits:

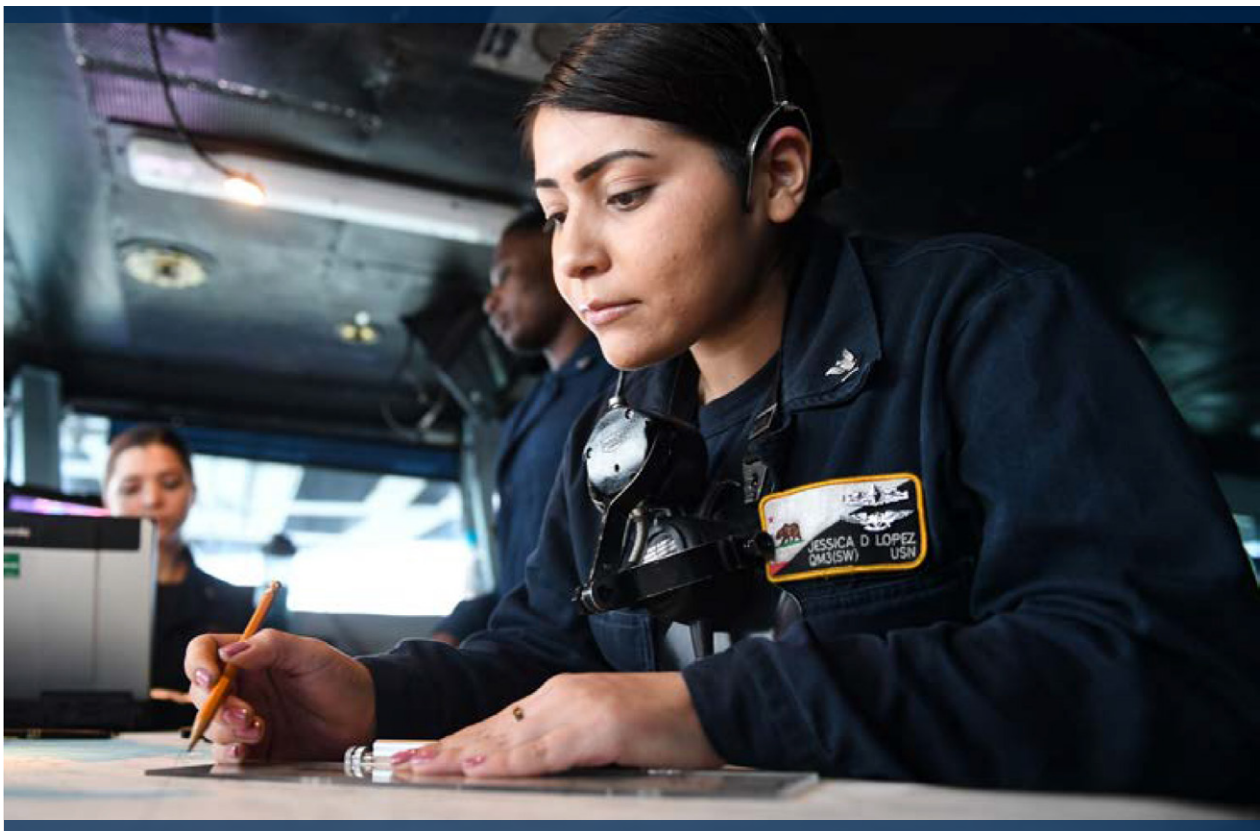
- Establishing a milSuite website - <https://login.milsuite.mil>. MilSuite is a social media platform curated by and for DOD members. It allows groups, blogs, podcasts, videos, documents and announcements, and requires CAC access.
- Establishing an AI podcast service. Podcasts are an increasingly popular way to disseminate information. We would appoint an editor to manage it.

RESOURCING

We will work with research funding agencies for sponsorship of a core research program.

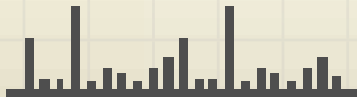
Our administrative staff will help faculty get sponsors for the action areas listed here.

We will support NPS efforts to obtain advanced facilities in supercomputing and cloud data storage.





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