

# MISSION IMPACT REPORT

Highlights

“WHERE SCIENCE MEETS THE ART OF WARFARE”

Winter/Spring 23

## Education:

- [Winter](#) and [Spring](#) quarter graduations delivered 567 new warrior scholars:
  - 337 from U.S. naval services
  - 74 from U.S. joint services
  - 112 DOD civilian/federal agencies
  - 44 international from 20+ countries

## Research:

- 6 new Cooperative Research & Development Agreements (CRADA) and 4 Limited Purpose CRADAs supporting autonomy, oceanography, data science, aerospace, AI, 3D printing, and networks

## Innovation:

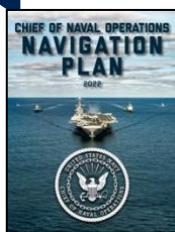
- 4 new [NPS patents](#) have been issued thus far in 2023 in:
  - Power electronics
  - Millimeter-wave authentication
  - Micro-bacterial fuel cell chips
  - Modeling fibrous composites
- USMC Maj. Chris Phifer and his professor Dr. Ray Gamache [patented a new polymer-based, self-sealing fuel line](#) capable of withstanding a .50 caliber bullet without losing a single drop.

## Institution:

- [ICYMI](#): The NPS [2022 Annual Report](#) details data and accomplishments:



**SPOTLIGHT:** NPS recognized its 2023 Spring Quarter graduates – 349 including six doctoral degrees and 25 international students representing 16 countries – during a commencement ceremony, June 16. Commencement speaker Gary Wipfler, who served as Vice President and treasurer for Apple Inc. from 1997 to 2021 under CEOs Steve Jobs and Tim Cook, talked about Apple’s remarkable journey, passing on encouragement and lessons about change and innovation.



**CNO NAVPLAN:** Lt. Aubrey Jaicks, a Naval Intelligence officer in the Defense Analysis department, earned the Highest Academic Achievement Award sponsored by the Monterey Navy League. Jaicks’ research, the first of its kind, examined the body of existing work regarding trauma response in non-Western societies to explore the connections between PTSD and culture. Building on her undergraduate degrees in neuroscience and psychology, her work shed new light on alternative approaches to recognizing, diagnosing and informing potential treatments. Jaicks’ next assignment will be with the Office of Naval Intelligence (ONI) in Washington, D.C. [Watch video.](#)



**Commandant’s Planning Guidance:** U.S. Marine Corps Lt. Col. Pedro Ortiz focused his Ph.D. dissertation on helping to enable rapid, effective decision-making for commanders in an era of ever-increasing sensor data and uncertainty. Through the application of probabilistic models to massive satellite remote sensing data sets, Ortiz examined uncertainty quantification (UQ) methods that are pivotal in reducing the impact of uncertainty during optimization and decision-making processes. Ortiz joins an elite group of graduates from the Marine Corps’ competitive Ph.D. Program (PHDP). [Read more.](#)



## EDUCATION

- Aviation Support:** More than 100 Student Naval Aviators (SNAs) awaiting flight school in Pensacola began a special NPS distance learning (DL) program. In coordination with CNATRA and the aviation community, NPS is providing a six-month course for the SNAs focused on STEM and Operations Analysis. **IMPACT:** All learning is via DL from Pensacola, and students will earn two stackable graduate certificates that count towards their future advanced degree. The SNA program is an example of NPS institution-wide efforts to deliver relevant, flexible, non-traditional offerings that integrate into URL officer career paths, leveraging a new DL portal, [NPS Online](#).
- Emerging Tech Ex-Ed:** The Center for Executive Education (CEE) at NPS took its Emerging Tech course on the road in May to Makalapa, Hawaii at the request of Adm. Paparo, CPF. Participants included leaders from CPF (N1, N9, N3), MARFORPAC, USARPAC, NIWDC and the installation. **IMPACT:** Led by Dr. Alan Weber with a team from CEE, feedback on the 2-day course was very positive to include increasing the length, frequency and access to other senior Fleet staffs and the NCR, and to combine with Innovation for application to GRGB, process change and talent management.
- Black Sea Security Symposium:** 100+ participants, nearly half from NATO countries bordering the Black Sea/Caspian regions, including Ukraine, joined U.S. counterparts and energy experts at NPS in February. **IMPACT:** [The symposium served](#) as a platform to address energy security issues related to the Russia-Ukraine war, strengthen collaborative relationships, and commitments to increase international student enrollment at NPS.
- Autonomy:** NPS Meyer Scholar and Laser Physics Ph.D. candidate Lt Cmdr. Brian Curran, led planning and execution of Autonomous Systems Week at NPS. Experts from DOD and industry provided more than 20 seminars to NPS students and faculty on topics including Collaborative Combat Aircraft, Distributed Sensor Networks, Cognitive Electronic Warfare (CogEW), and Project Overmatch. The week highlighted the technical ways and means essential for implementing NAVPLAN 2022 guidance, DMO required capabilities and C5F initiatives.
- LEAD:** Ten Navy and Marine Corps officers became the latest cohort to graduate from the [Leadership Education and Development](#) (LEAD) Program in June. **IMPACT:** LEAD prepares highly-qualified, mid-career officers to serve as Company Officers at the U.S. Naval Academy for two years upon completion of their 1-year NPS Professional Master's of Business Administration (PMBA) degree through the Department of Defense Management.
- Wargaming:** NPS [conducted a two-week Basic Analytic Wargaming Course \(BAWC\) for C6F](#) in March in support of establishing their new wargaming department. 18 students from NAVEUR/C6F, CTF-63, CTF-64, CTF-67, Marine Corps Forces Europe, and NATO Joint Forces Command attended and applied what they learned in the second week conducting a wargame to examine C6F's real-world operational plans. **IMPACT:** As a result of their newly developed capability, Adm. Munsch tasked the team to develop/conduct their first official maritime wargame for a NATO ally.
- Tech Lectures:** NPS Provost Lecture series focused on two critical technologies: "The Quantum Promise" by Dr. Frank Narducci, professor of Physics, and "Hypersonics: Why Faster Isn't Just Faster, But a Game Changer" by Dr. Garth Hobson, professor of Mechanical/Aerospace Engineering. **IMPACT:** Quantum and Hypersonics are game-changing technologies for any future conflict, and it is critical all students have better understanding of their impacts. [View online](#)



## RESEARCH

- Acoustics:** Through a CRADA with Northrup Grumman, NPS Physics professors Drs. Alves, Karunasiri and Grbovic demonstrated their Microelectromechanical Systems (MEMS) acoustic directional sensor's capabilities showing marked improvements over conventional units. Funded by ONR, this outcome resulted from more than 20 master's theses and Ph.D. dissertations. **IMPACT:** The MEMS sensors can detect range and direction of small multi-rotor drones and gunshots, and underwater versions are being developed for detection of tonal sources and UUVs.



- Logistics:** Through a CRADA with Hybrid Air Vehicles, U.S. Marine Corps Captains Ben Cohen and John Schmaltz researched the potential of civilian hybrid aircraft technologies and evaluated how to adapt the airships for USMC logistics and mobility applications in the Pacific. **IMPACT:** Their work led to [ground-breaking research announced in April](#), funded by the DOD Operational Energy Office to simulate and analyze the use of an Airlander hybrid airship in the INDOPACOM AOR.
- Surface:** NPS Operations Research student Lt. Jacob Shafer supported SWOSCOM on reevaluating a 360-feedback instrument used for the Advanced Division Officer Course (ADOC). **IMPACT:** Working with an interdisciplinary team of faculty from Defense Management and the Center for Executive Education, Shafer examined 100 random feedback instruments to validate application to today's surface force. The research earned Shafer an in-person briefing to Vice Adm. Kitchener as part of CNSP's leadership initiatives and a follow-on request from the Surface Analytics Group.
- Sonar:** Spring quarter graduates Lt. Cmdr. Jacob Webb and Lt. Robert Platt's data analytics research assessed increasing failure rates of submarine towed array systems and their potential causes; this research was delivered to Submarine Group Ten and the Undersea Acoustic Program Office (PMS401). This work was completed as part of a Masters of Systems Analysis capstone project, and the final report is CUI with a classified annex.
- Arctic:** NPS Oceanography student Lt. Kyle Wheeler, with faculty John Joseph and Ben Reeder, deployed to Beaufort Sea, 180nm north of Prudhoe Bay, Alaska to [test experimental cryophones](#) during ARCEX23. **IMPACT:** Supported by ONR and the Arctic Submarine Lab, their research aims to remotely infer the mechanical properties of sea ice to improve Arctic ice prediction models and other applications of the system for maritime surveillance.
- China/PLA:** Associate Professor Christopher Twomey is contributing TS/SCI level work for INDOPACOM's China Strategic Focus Group (SFG) focused on deepening understanding of China's decision-making process. **IMPACT:** Dr. Twomey is a specialist in Chinese foreign policy and Asian security in the National Security Affairs department and is providing the SFG classified research in inform deterrence efforts.
- USMC Planning:** Capt. Ryan Helm's Joint Campaign Analysis research is an innovative adaptation combining Machine Learning and geospatial data recommendations for helo landing sites into one tool that recommends ground stationed anti-ship missile sites for specific islands and operational situations. **IMPACT:** Supported by NIWCPCAC and ONR TechSolutions, Helm's work contributes to ongoing NPS research for "Mission Planning Optimization for Infantry Operations" and was shared with MCWL and MARFORPAC for use in concept development.



## INNOVATION

- Power Density:** NPS completed a TRL 6 demonstration of the Fast Lightweight Altitude Solid-state circuit breaker for Hybrid-electric (FLASH) electric propulsion aircraft delivering Megawatt-scale solid-state technology with power density/efficiency of 99.3-99.8%. **IMPACT:** NPS teamed with NSWC, University of Connecticut, Clemson and NASA Glenn to advance the FLASH capability now based on a modular strategy that can be scaled up and integrates with solid-state distributed thermal recycling technology for max powertrain net efficiency.
- Innovation Capstone Project (ICP):** The [NPS ICP is a new program](#) that enables interdisciplinary student teams with varied technical and acquisitions backgrounds to collaborate on a capability requirement. **IMPACT:** Managed by the [Department of Defense Management \(DDM\)](#), the ICP teams prepare proposals to a point where they're pitching their capstone ideas to a panel of military, industry and acquisitions experts. Those with the most compelling solutions and transition plans will be selected to move forward into the next phase of rapid prototyping and development with the acquisition community.
- Naval Innovation Exchange (NIX):** The NPS [NIX launched in June](#) with three initial multidisciplinary student teams pursuing technologies in Intelligent Autonomous Systems, AI and Additive Manufacturing. **IMPACT:** Integral to the function of the Naval Innovation Center at NPS, the NIX program is focused on developing prototype solutions in research "sprints" with new technologies and industry partners.





- **5G BCA:** In support of a DON PEO Digital and Joint Base Pearl Harbor-Hickam 5G initiative, Ensigns Jacob L. Staples and Haydn T. Tidball, both NPS Shoemaker scholars, developed a business case analysis (BCA) comparing the costs of the current telecommunications infrastructure with four different 5G-enabled modernization alternatives for the Lualualei Annex, a NCTAMS facility, which must eliminate costly/outdated time division multiplexing (TDM) switch technology. **IMPACT:** Their Cost Model tool, which can be applied to other cases, identified the optimal COA for adopting 5G technology that meets DOD CIO requirements with enhanced performance at significant long-term cost savings.
- **Additive Manufacturing:** A [milestone in additive manufacturing](#) was achieved by NPS researchers from the institution's Consortium for Additive Manufacturing Research and Education (CAMRE) with the successful demonstration of in-flight 3D printing aboard an MV-22 Osprey from Marine Medium Tiltrotor Squadron (VMM) 164. **IMPACT:** In collaboration with NIWC PAC, who developed the printer utilized with CAMRE, the demo was part of larger-scale support provided by CAMRE and the Marine Innovation Unit (MIU) participating in an ITX at Marine Corps Air Ground Combat Center Twentynine Palms in June, and validated the tech for additional use cases.
- **Directed Energy:** Funded by ONR, NPS faculty and students teamed with NRL and NASA Ames to develop microwave metamaterials for counter directed energy weapons (CDEW). **IMPACT:** Under a CRADA with Raytheon, the NPS-metamaterials were successfully tested at Raytheon. The work supported five NPS Master's student theses, two of which received the Johns Hopkins Applied Physics Laboratory Award for Excellence in Applied Physics Research.



## EVENTS & PARTNERSHIPS

- **Space Summit:** SECNAV [convened the inaugural Naval Space Summit at NPS](#) that included CMC Gen. David Berger, VCNO Adm. Lisa Franchetti and CPF Adm. Samuel Paparo, Commander of SPACECOM Gen. James Dickinson, and Vice Chief of Space Ops U.S. Space Force Gen. David Thompson. **IMPACT:** The Summit fostered greater understanding of Navy and Marine Corps needs in space operations, education and research unique to the maritime domain.
- **Climate TTX:** In support of Climate Action 2030, NPS partnered with the Stanford Doerr School of Sustainability to assemble 100+ leaders/experts from DOD, industry, academia, nonprofits, state and local civic leaders [for the second ASN\(EI&E\) Climate Tabletop Exercise](#) in April. **IMPACT:** Teams concentrated on three areas: Water Security, Energy Security, and Coastal Resilience and briefed recommended solutions and POA&M to ASN (EI&E), NPS and Stanford.
- **5G Wireless:** Through a [LP CRADA with Qualcomm](#), NPS faculty and students will conduct research into 5G communications, AI, hardware development, and associated technologies. **IMPACT:** Qualcomm provided technologies to NPS for experimentation, assessment, and evaluation to understand the capabilities, benefits and limitations of the software and technology and to determine potential military applications.



## PUBLICATIONS

- **Power Electronics:** Dr. Giovanna Oriti, a professor of Electrical and Computer Engineering, published two papers in [IEEE Journal Transactions on Industry Applications](#) about a Field Programmable Gate Array (FPGA) prototype for power electronics-based energy management systems for microgrids or islanding applications.
- **Cybersecurity:** Drs. Britta Hale and Douglas Van Bossuyt in the Computer Science department published a position paper accepted by the ASME Journal of Computing and Information Science in Engineering (JCISE), for "[Zero-Trust for the System Design Lifecycle](#)."
- **Autonomy:** Research by Drs. Doron Drusinsky, Matthew Litton, and James Bret Michael on "[Machine-Learned Verification and Advance Notice Oracles for Autonomous Systems](#)," was published in the prestigious journal, Computer, vol. 56, no. 7, pp. 121-130, July 2023.
- **Defense Analysis:** Dr. Bradley Strawser and his co-authors propose principles on the [ethics of boycotting by corporations](#) after studying cases of the proliferation of harmful content published in the highly competitive Journal of Business Ethics.