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Richard Hamming Award for Interdisciplinary Achievement, March 7, 2022

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MEMORANDUM

From: Provost and Academic Dean
To: NPS Faculty and Staff

Subj: 2022 Richard W. Hamming Annual Faculty Award for Interdisciplinary Achievement

We are very honored to announce two recipients of the 2022 Richard W. Hamming Faculty Award for Interdisciplinary Achievement

- Dr. Mark Orescanin, Assistant Professor in the Computer Science Department, and
- Dr. Bonnie Johnson, Senior Lecturer in the Systems Engineering Department

Dr. Orescanin leads an interdisciplinary team of faculty and students conducting cutting-edge research at the intersection of computer science, meteorology, oceanography, operations research, physics, systems engineering, and undersea warfare. This team is advancing the U.S. Navy's ability to obtain accurate weather forecasts—a critical capability for warfighting and for addressing other national security interests such as climate change. Since joining NPS Dr. Orescanin was involved in advising or co-advising 23 MSc students and was advising 2 PhD students. Several of his students received awards for their thesis research.

Dr. Orescanin's work on uncertainty quantification is the most promising path toward integration of new AI/ML synthetic products into the Fleet Numerical Meteorology and Oceanography Center (FNMOC) operations. He teamed up with Assistant Professor Scott Powell of the Department of Meteorology to form an ongoing collaboration with the Naval Research Laboratory's Marine Meteorology Division (located in Monterey) and the University of Maryland's Cooperative Institute for Satellite Earth System Studies (sponsored by the National Oceanic and Atmospheric Administration) to test out new synthetic products with the Navy Environmental Prediction System (NAVDAS).

Dr. Orescanin led the establishment of an interdisciplinary research program on the application of AI/ML to undersea warfare in cooperation with the NPS' Undersea Warfare Academic Group, Naval Surface Warfare Center Carderock Division, Naval Information Warfare Center Pacific, and Norwegian Defense Research Establishment. That work included subject-matter experts from several departments across NPS campus: Physics Department, Mechanical and Aerospace Engineering, Oceanography, Computer Science, Electrical & Computer Engineering and Operations Research. The work helped generate eight theses (two students were Bowman Scholars), and multiple faculty publications. The AI/ML technology developed through this research is being transitioned into operational use as part of the Future Naval Capabilities program.

Dr. Johnson's research focuses in two main areas: (1) automation/artificial intelligence (AI) for defense applications and (2) directed energy (DE) warfare studies. These broad topics involve interdisciplinary research for which she collaborated with various organizations in the Navy, Army, Marine Corps, and Air Force as well as industry partners. Within NPS she leads projects involving faculty in System Engineering, Information Sciences, MOVES, and Physics Department.

Dr. Johnson and her students have demonstrated the use of automation and AI for tactical battle management aids for air and missile defense in the fleet. This work has been a joint advising effort between faculty in System Engineering, Information Sciences, Operation Research, Computer Science, and Physics Department. The students use AI, machine learning (ML), game theory, and complexity to develop automated decisions and cognitive aids for tactical warfighters. Students have studied air and missile defense scenarios, AI safety, human-machine interactions, human-machine trust, and AI methods for the kill chain. Dr. Johnson worked closely with faculty from the IS department to advise a student team that developed a concept for managing navy-wide data to support the needs of AI/ML development in the Navy.

As part of her DE research, she has worked closely with faculty from MOVES, the Physics and Meteorology Departments, to develop a shipboard laser weapon modeling and simulation capability to support student's research on shipboard power requirements for lasers, maritime atmospheric effects on lasers, methods for battle damage assessment, and integration designs for laser placement on ships and for coordination with existing

kinetic weapons on ships.

Dr. Johnson has developed course work in directed energy and she is the course coordinator for a set of four DE courses taught jointly by System Engineering and Physics. She has developed course work in AI and supports an interdisciplinary NPS course for DoD personnel in the Joint AI Center (JAIC) taught by Computer Science and System Engineering. She has also partnered with faculty in the Energy Academic Group to conduct a broad study to achieve naval net-zero emissions by 2050 and to study the use of AI to detect cyber-attacks from energy monitoring data. Dr Johnson has advised over 240 students in their master's degree research who have graduated, and she is currently advising 40 students working on their graduate research who will graduate in 2022 or 2023. Although most of her students are in the Systems Engineering program, she has co-advised several students in other departments including Information Sciences and Operations Research. She is currently on the PhD committee for a student in the Information Sciences Department.

In summary, Dr. Orescanin's and Dr. Johnson's research, teaching and advising exemplify the qualities honored by the Hamming Award for providing innovative and interdisciplinary solutions to current military problems, engaging our students in interdisciplinary research and developing interdisciplinary course material. Their excellent work embodies the core spirit of the Hamming Award, and the outstanding quality of these two professors' interdisciplinary achievements, consistent with the award criteria, is the basis of the committee's award selection.

I want to thank the Hamming Interdisciplinary Achievement Award Committee composed of Giovanna Oriti, Professor, ECE, Chair, Ted Huffmire, Associate Professor, CS, Amela Sadagic, Research Associate Professor, CS, Javier Salmeron, Professor, OR, Chong Wang, Associate Professor, DDM for their excellent job in selecting two very deserving winners.

SCOTT S. GARTNER
Provost and Academic Dean