



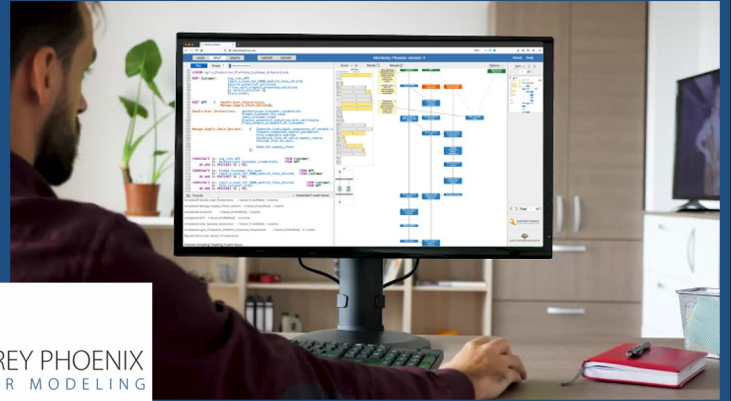
SYSTEMS ENGINEERING NEWSLETTER

July 2021

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<https://nps.edu/mp>

Letter from the Chairman

From Outgoing Chairman Dr. Ronald Giachetti:

This marks my last letter as Chair of the Systems Engineering department. I have held the position for the past six years, and now the chair position will be turned over to Oleg Yakimenko. I am not leaving the department, but will return to being a regular faculty member.

During my tenure as Chair, there were many changes to the systems engineering department and NPS. Foremost on my mind is the start of the MS in Systems Engineering Management program for Army Acquisition. Adding this program has significantly altered the student composition of the department. I think it is great to have these Army officers in the program because we all benefit when diverse views and experiences can come together in the academic environment we provide.



Outgoing SE Chairman
Dr. Ronald Giachetti

Another change has been the growth of the PhD program, which now has 14 students enrolled in it. I expect we will be graduating on average one new PhD per year and in some years two.

During the past six years, we have seen the entire systems engineering community, but especially the Navy, Army, and Air Force, move to model-based systems engineering (MBSE) and digital engineering. We have positioned ourselves at NPS to be technically conscious of the Navy in this area. MBSE has been seamlessly incorporated into our programs, and we also



Incoming SE Chairman
Dr. Oleg Yakimenko

have developed special courses for MBSE and digital engineering. I look forward to seeing how our efforts in MBSE continue. Personally, I hope to be more active in MBSE in education and research for the Navy.

This past month I was able to participate in the PD21 Industry Trip. Visiting industry is an important component of the PD21 program. During the trip we learn how they operate, how they are similar to the DoD, and how they are different. I always learn something new whenever I get the opportunity to participate. What is even more important is the ability for the distance-learning students to meet face to face with each and with faculty. The networking that occurs is important to the success of the program and serves the students long after they leave NPS.

I hope you find the newsletter informative about the important and valuable work being done by the SE Department at the NPS.

Best,
Ron Giachetti

From Incoming Chairman Dr. Oleg Yakimenko:

On behalf of faculty, staff, and students of the Systems Engineering department, I would like to thank Professor Ronald Giachetti for leading our department for the past six years. Under his leadership, our department continued to grow and remain mission-focused and relevant to the needs of the Navy, Marine Corps, Army, Air Force and Space Force.

I would also like to congratulate our Spring graduates. For the first time since COVID-19 began, many students were able to participate in the still-limited in-person graduation ceremony, greeted by VADM Jeff Hughes, Deputy Chief of Naval Operations for Warfighting Development (DCNO N7). With one challenge almost over (COVID-19), it looks like we should expect other challenges in the near future (budgetary constraints, Bullard Hall renovation). I am confident that together, we will be able to overcome these challenges and stay on an ascending trajectory.

SE Spotlight

INCOSE Academic Equivalency Recognized for Naval Postgraduate School

Article originally published at incose.org

SAN DIEGO (19 April 2021) – The [International Council on Systems Engineering](http://incose.org) (INCOSE) has announced the award of Academic Equivalency to the [Naval Postgraduate School](http://nps.edu) (NPS) for students to prove their knowledge of systems engineering through their SE3100 (Fundamentals of Systems Engineering) course. The Naval Postgraduate School draws talented military officers from around the world, bringing exceptional individuals into the systems engineering practice. INCOSE awarded this equivalency in January 2020.

With this equivalency in place, students who demonstrate systems engineering knowledge through approved coursework will not have to take the INCOSE Knowledge Exam to certify. This knowledge demonstration is key in the CSEP (Certified Systems Engineering Professional) journey, so this equivalency is highly beneficial to the Naval Postgraduate School students.

Kerry Lunney, INCOSE President stated “Collaborating with the Naval Postgraduate School (NPS) to establish the academic equivalency to the INCOSE systems engineering handbook is highly beneficial to all. For most participants in the academic equivalency from NPS who already have work experience in

systems engineering, it is a good stepping stone towards obtaining their CSEP qualification. For INCOSE and NPS it demonstrates a great partnership.”

About the International Council on Systems Engineering: INCOSE is a not-for-profit membership organization that promotes international collaboration in systems engineering practice, education, and research. INCOSE’s mission is to “address complex societal and technical challenges by enabling, promoting and advancing systems engineering and systems approaches.” Founded in 1990, INCOSE has more than 70 chapters and over 18,000 members worldwide. For additional information about INCOSE, visit www.incose.org.

About the Naval Postgraduate School: The Naval Postgraduate School is a graduate university offering master’s and doctoral degrees in more than 70 fields of study to the U.S. Armed Forces, DOD civilians, and international partners. The university focuses on providing defense-focused graduate education, including classified studies and interdisciplinary research, to advance the operational effectiveness, technological leadership, and warfighting advantage of the Naval service. To learn more about the Naval Postgraduate School visit <https://nps.edu/>.

Alumni Update

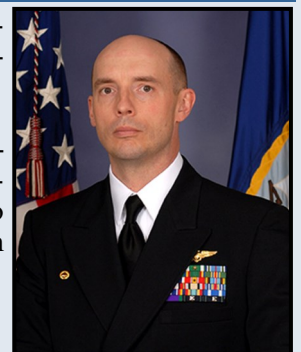
Former Distance Learning Student Promoted to Rear Admiral

By Professor of Practice Ron Carlson

Captain Joseph B Hornbuckle III was recently promoted to Rear Admiral (lower half) and will be assigned as the Commander, Fleet Readiness Centers, Naval Air Systems Command, Patuxent River, Maryland.

Captain Hornbuckle started his military career as a fleet S-3 Viking pilot and later transited to an Aeronautical Engineering Duty Officer. He is currently serving as the Chief of Staff, Naval Air Warfare Center Aircraft Division, Patuxent River, Maryland and has also served as the Senior Military Assistant to the Office of the Under Secretary of Defense for Acquisition and Sustainment as well as the Program Officer of PMA213, Naval Air Traffic Management Systems.

Captain Hornbuckle is a June 2012 graduate of the PD-21 Program where he received a Masters Degree in Systems Engineering Management.



Rear Admiral Hornbuckle III

Former Systems Engineering Lecturer Wins ALTies Award

Former NPS Systems Engineering Senior Lecturer John Dillard, COL, USA (retired), won the Audience Choice Award for best article during the Army AL&T's annual ALTies awards. The Army AL&T magazine is the Army Acquisition Executive's quarterly professional journal for the Army Acquisition Workforce.



John Dillard, COL, USA
(retired)

The winning article, titled "[The Big Ask](#)," recounts how the new M.S. degree in Systems Engineering Management was implemented at the Naval Postgraduate School (NPS). The implementation was part of a plan to upgrade the technical education programs available under its Systems Acquisition curricula.

Although the Army had sponsored the Systems Acquisition Curricula at NPS since 1991, it wasn't until 2011 that the then sitting Army's Principal Military Deputy to the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASA(ALT)), asked for technological upgrades to the program. Subsequent principal military deputies made the same requests until, finally in 2017, strides were made when principal military deputy Lt. Gen Paul Ostrowski (Pictured Right) began working in earnest to upgrade the program.

Lt. Gen Ostrowski collaborated closely with NPS President Ann Rondeau, Vice Adm. USN (Ret.), to make the changes happen. With the added assistance of NPS Systems Engineering Faculty, U.S. Army Director, Acquisition Career Management, and the U.S. Army Acquisition Support Center, the Army's 18-month master's degree program at NPS reorganized to provide Level III Defense Acquisition Workforce Improvement Act (DAWIA) training equivalencies in three different disciplines: systems engineering, program management and contract management; with Level II in test and evaluation.



Lt. Gen Paul Ostrowski

On Dec. 20, 2019, the first cohort of 30 Army Acquisition Corps officers graduated from the new degree curriculum, called 522, at NPS with a master of science degree in systems engineering management.

The Army continues to invest in the Systems Acquisition program at NPS and has recently established a new military position on the faculty, the Systems Engineering and Army Acquisition Chair, to help administer the Army's programs and oversee them for the military deputy and DACM.

Systems Engineering Faculty Member publishes in IEEE Journal

Naval Postgraduate School Systems Engineering Professor Raymond Madachy has published an article in IEEE's journal [Transactions on Software Engineering](#).

IEEE (Institute of Electrical and Electronics Engineers) is the world's largest technical professional organization dedicated to advancing technology for the benefit of humanity.

The article, titled "Empirical Effort and Schedule Estimation Models for Agile Processes in the US DoD ," was co-authored by Wilson Rosa (NCAA Dept of Navy), Bradford Clark (Software Metrics, Inc) , and Barry Boehm (USC Center for Software Engineering) and can be found at <https://ieeexplore.ieee.org/document/9432729>.

Abstract Follows:

Estimating the cost and schedule of agile software projects is critical at an early phase to establish baseline budgets and schedules for the selection of competitive bidders.

The challenge is that common agile sizing measures such as

story points and user stories are not practical for early estimation as these are often reported after contract award in DoD.

This study provides a set of effort and schedule estimation models for agile projects using a sizing measure that is available before proposal evaluation based on data from 36 DoD agile projects.

The results suggest that initial software requirements, defined as the sum of functions and external interfaces, is an effective sizing measure for early estimation of effort and schedule of agile projects.

The models accuracy improves when application domain groups and peak staff are added as inputs.



Professor Raymond Madachy

Systems Engineering Participates in SAR Training Exercise

By Chairman Oleg Yakimenko

The NPS Systems Engineering Department partnered with Monterey Fire, Central Fire Santa Cruz, Monterey County Sheriff's Office and Insight Up Solutions to organize and conduct a joint interagency search and rescue (SAR) training exercise off La Selva Beach (Monterey Bay Academy).

This exercise involved three vessels, two aerial unmanned systems (multi-rotor and fixed-wing) and manned aircraft collaborating to locate and imitate a rescue of two men overboard (rescue manikins).

Being a valuable Navy-related exercise by itself, this particular mission involved communication and control aspects as well as

gathering data for training the AI/ML system that could drastically improve the effectiveness of finding and identifying different objects floating at the surface of the ocean. Depending on the sensor, there is a potential for finding objects in a shallow water and close to the surface.

The training exercise attracted other parties/perspective participants, including Naval Research Laboratory (NRL) in Monterey, Monterey Bay Aquarium Research Institute (MBARI), National Oceanic and Atmospheric Administration (NOAA), as well as a few local companies dealing with robotics and AI research.



Picture courtesy of are Courtesy of MC2 Tom Tonthat (PO2), Office of University Communications –SAR Training Participants



Systems Engineering Faculty Member Wins Award for Teaching Excellence



Dr. Kristen Giammarco

Systems Engineering Associate Professor Kristin Giammarco has won the 2021 Schieffelin Award for Teaching Excellence.

While there are many excellent teachers at the Naval Postgraduate School, only one professor is selected each summer to win the distinction of having been voted the recipient of the Admiral John Jay Schieffelin Award for Excellence in Teaching as the school's most outstanding faculty instructor.

The annual winner joins a long list of other faculty members selected each summer as the "best-of-the-best" at the Navy's University.

The recipient is determined by ballot information supplied by current and recent alumni students. The ballot information and a performance history are processed through a series of objective computer programs which eliminate bias and award merit rankings to eligible candidates. A Schieffelin Award committee, comprised of appointed faculty members, evaluates the results of the balloting and selects a winner.

In addition to the honor, this award serves to augment existing incentives for superior teaching. The Schieffelin Award provides a substantial stipend for the recipient. This has been made possible through a gift from the endowment of the NPS Foundation. The award is presented annually by the Superintendent at the Spring Quarter Graduation Commencement Ceremonies in June.

The John Jay Schieffelin Award was first presented in 1970.

System Engineering Senior Lecturer Presents at International Conference



Senior Lecturer Bonnie Johnson

Dr. Bonnie Johnson, a senior lecturer in the Systems Engineering Department at NPS, gave a presentation at the special track on "Challenges for Artificial Intelligence-Machine Learning in Complex Systems & Systems of Systems" during the 16th International Conference on Systems on 20 April 2021.

Dr. Johnson's presentation, titled "Metacognition for Artificial Intelligence Systems," discussed how advances in computational thinking

and data science have led to a new era of artificial intelligence systems being engineered to adapt to complex situations and develop actionable knowledge.

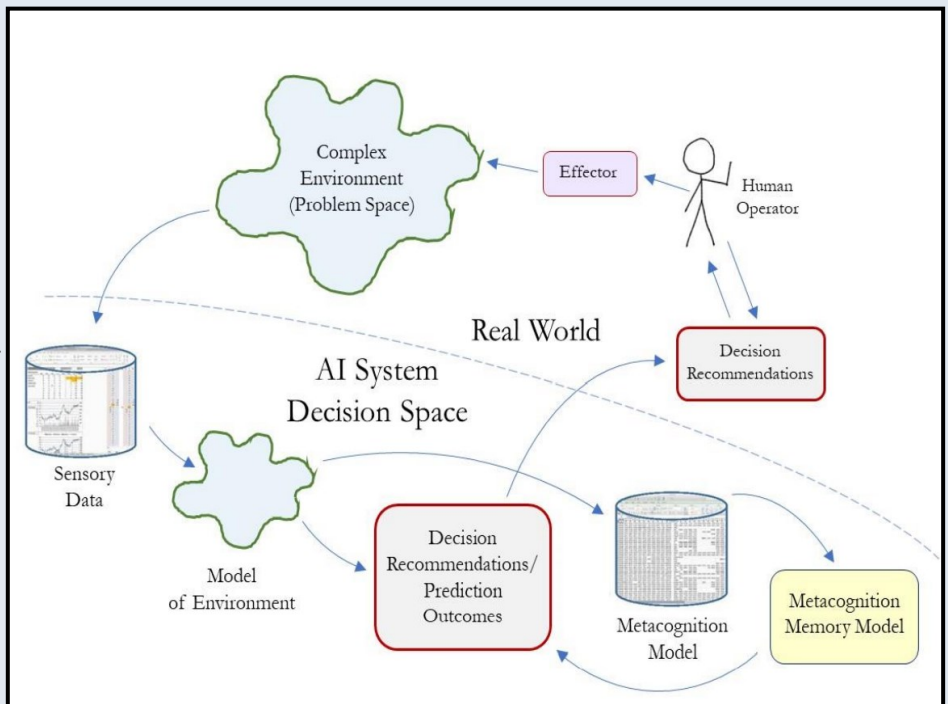
These learning systems are meant to reliably understand the essence of a situation and construct critical decision recommendations to support autonomous and human-machine teaming operations. In parallel, the increasing volume, velocity, variety, veracity, value, and variability of data is confounding the complexity of these new systems – creating challenges in terms of their development and implementation.

For artificial systems supporting critical decisions with higher consequences, safety has become an important concern. Methods are needed to avoid failure modes and ensure that only desired behavior is permitted. Dr. Johnson discussed an approach that promotes self-awareness, or metacognition, within the artificial intelligence systems to understand their external and internal operational environments and

use this knowledge to identify potential failures and enable self-healing and self-management for safe and desired behavior.

The conference was hosted by Dr. Ali Raz (George Mason University) and Dr. Ramakrishnan Raman (Honeywell Aerospace Corp).

Co-host Dr. Raman wrote of the special track that, "Overall, it was a wonderful session that witnessed enriching discussions, and brought in novel insights from the latest advancements and cutting-edge research on Artificial Intelligence applied for complex systems and system-of-systems, covering various challenges being faced and the barriers overcome in an innovative way."





Assoc Professor Andy Hernandez

Alejandro (Andy) Hernandez is an Associate Professor in the Systems Engineering Department at Naval Postgraduate School in Monterey, California. He holds a B.S. in Civil Engineering from the U.S. Military Academy, a M.S. and Ph.D in Operations Research from NPS, and a M.A. in Strategic Studies from the Army War College. He is a retired Army officer whose assignments include Director of Analysis & Assessment – Iraq, and Chief of the Warfighting Analysis Division in the Department of the Army Programs and Resources Directorate. Dr. Hernandez focuses on developing robust decision support systems that improve design, development, operation, and management of complex systems. He applies modeling and simulation, experimentation, and scenario methodologies in his efforts. His studies are inherently cross-disciplinary and promote systems thinking.

Can you tell us a little about your current research and how you have been able to work around the COVID restrictions?

I have a number of interests, but the majority of them involve the development of decision support systems. I merge a number of techniques including scenario methodologies and wargames, computer simulation, experimentation, and statistical analysis.

Some of my sponsors are the Marine Forces Reserve, NAVFAC, and Army Engineer Research and Development Center. Frequently, my sponsors wish to address a number of topics. Therefore, I normally form and lead research teams to provide a comprehensive set of solutions. In a COVID environment, the majority of our engagements have been virtual.

While difficult, we have been able to make progress. We have had to forgo face-to-face discussions and in-progress reviews. In cases that require an interview, the inability to meet personally make “reading” and “reacting” to an interviewee’s responses difficult. The team has adjusted with iterative virtual meetings in Teams. There is value in this technique, but can be taxing to the interviewees.

There are some cases where there is no alternative to a direct engagement. I found myself in a situation where a product needed to be repaired. After a period of troubleshooting remotely, it became evident that we were not making progress. There were too many people and sections in the organization that had introduced errors to the system. I requested a waiver to travel. The NPS leadership understood the importance of delivering quality products to customers and approved my request. I was able to work with the organization for two days to trace the errors and find solutions.

You received your MS and PhD from NPS. How have you seen NPS grow from the time you were a student here?

On the surface, the look of NPS has changed. Students no longer wear coat and tie to class. Graduate Schools and Deans have been established. New processes and administrative levels have been added with mixed effects. Technology has been a value to course delivery, especially in animating theories and concepts. And technology has certainly come to the rescue in this current environment. With the exception of PhD students, most students at NPS would have had little knowledge about research efforts at the school. Today, research has emerged as a catalyst for discovering and presenting new ideas to faculty and students.

What has not changed is the dedication of faculty and staff to deliver the very best education to the students. It would be newsworthy if there was an instance in which a faculty member refused an opportunity to meet with a student. I do not believe that this would be the case in a civilian university.

You get a lot of (virtual) facetime with NPS students. How would you describe the collective student body?

Virtual or not, the NPS student population is unique. NPS students are by and large older than their civilian counterparts. Their life experiences, which includes combat and leadership roles at a relatively young age, open opportunities for dialogue about course topics that you would not normally have in a civilian classroom. Imagine being able to discuss the reliability of a communications network. Reliability no longer means just an equation jotted on a whiteboard or PowerPoint slide. Reliability now means the probability that you will lose connectivity and the ability to defend your people, equipment, and facilities, or conversely, the probability of death, loss, and destruction. The discussion takes on a whole new meaning.

In general, our students have a mission when they arrive at NPS: transform themselves into experts that can successfully perform in their next assignment. This seems somewhat trite, but it is still true. The students, and we at NPS, have a common responsibility: produce a professional who will succeed at their job. The sponsors who pay for the students’ education and the US population who pay all of our salaries demand it.

What advice can you offer new students?

In terms of work, treat the time at NPS as any duty assignment, except you get to start later, come home earlier, and most of your weekends and holidays are yours! Therefore, whatever amount of time that you stay on campus, use it wisely. Dedicate the time to read and do homework while you are not in the classroom. Minimize what you need to take home.

READ purposefully. You must become voracious readers. Learn how to learn.

Try new activities. You will undoubtedly be busy with classwork, but it would be a rarity if you did not have any free time. The area has opportunities for kayaking, surfing, rock climbing, theater, golf. There are groups galore of different activities such as biking and dancing. There are a myriad of different types of food in hundreds of restaurants. Try a bite.

Monterey is a site that must be experienced. Walk the coastal and mountain trails. Visit the Aquarium. See the marine life. Get out of the house or apartment.

Systems Engineering Faculty Member Elected ICEAA Region 2 Director

By Lecturer Tim Anderson

Timothy Anderson, a lecturer in the Systems Engineering Department, was recently elected as the Region 2 Director, for the 2021-2023 term, in the International Cost Estimating and Analysis Association (ICEAA). Region 2 consists of ICEAA chapters in the Washington, DC, Maryland, and Virginia areas. As regional director, he will be responsible for the regional affairs of ICEAA and shall provide necessary liaison between the chapters of Region 2 and the ICEAA Board of Director, and for fostering networking and professional development within his region. Regional directors are nominated by each region's chapter presidents, and then elected by the membership within each region.

Mr. Anderson is an intermittent faculty member teaching Engineering Economics and Cost Estimation (SE3011) for the Systems Engineering Department as well as Risk and Uncertainty Analysis (OS4012) for the Operations Research Department. He has been an active ICEAA member for over 25 years and has a solid understanding of the importance of a strong liaison between the chapters and the international board. Examples of issues he will tackle include ensuring adequate funding from the international board for chapter activities; sharing of best practices between the international board and the chapters; and communication of international initiatives to the chapter boards.

Mr. Anderson began his cost estimating career in 1995 at the Naval Center for Cost Analysis (NCCA), quickly gaining professional experience, and in that same year began participating in local chapter events. He earned his Certified Cost Estimator/Analyst (CCE/A) certification in 2002 and has faithfully kept it up to date ever since. Following his tour at NCCA, he was invited to serve as a military faculty member at the Naval Postgraduate School (NPS), where he wrote a new version of the Cost Estimating course for the OR department. Many parts of that course are still in use today in both the OR and SE departments. Tim retired from the Navy in 2000, and is still actively involved with NPS as a remote distance learning instructor. He has also taught, as an adjunct professor, Cost Estimation in the

Military Operations Research curriculum at George Mason University. Over his professional career he has taught cost estimating and methods concepts to over 1,000 students, many of whom have gone on to become professional cost estimators themselves.

Mr. Anderson has faithfully served both the international and local ICEAA organizations over his career. At the chapter level, he served for over seven years as the Program Chair for the Wash-



Lecturer Timothy Anderson

ington Capital Area chapter, coordinating monthly luncheons and recruiting speakers for the benefit of the chapter members. He developed and implemented the chapter's "Speaker of the Year" award, which is now awarded each year to the most effective luncheon speaker. He has also served as membership chair and Vice President of the Washington Capital Area chapter. Tim has participated in nearly every ICEAA conference since 1995, serving in some leadership capacity from track chair, to awards committee member, to training track instructor. He has been a moderator for panel discussions and proctored CCE/A certification exams. On the international board, he served as the chair of the Governance Committee at a crucial time following the merger of ICEAA from its predecessor organizations, making necessary changes to the ICEAA constitution and bylaws. He has also served on the international Cost Estimating Body of Knowledge (CEBoK) committee, and has written two articles for the National Estimator on how to work with learning curves. Tim's contributions to ICEAA over the last 25 years have been frequent, substantial and sustained, and the association has always been able to count on him to take on the difficult roles that make ICEAA effective.

Student Stories

Distance Learning Student Receives Meyer Award

Ms. Meagan Parker was selected for the Meyer Award for the 2021 Spring quarter.

The Wayne E. Meyer Award for excellence in systems engineering is presented for superior academic achievement and leadership to an outstanding NPS graduate from the distance learning systems engineering degree program.

Meagan was nominated for the Student Meyer Award based on her outstanding contributions to her capstone team's project. She has exemplified everything that graduates of the Systems Engineering Department at the Naval Postgraduate School

are known for throughout the Navy and across DOD. The work she and her capstone team have performed will make a real and significant impact on the Navy and especially naval expeditionary warfare.

Meagan Parker currently works for the Naval Surface Warfare Center, Dahlgren Division, as a Threat Systems Engineering Project Lead in the Warfare Analysis and Digital Modeling Department.

She leads the development of Post-Intercept Debris Simulation (PIDS), a modeling and simulation project designed to provide

a software solution to the U.S. Surface Navy Operational Test & Evaluation shortfall of post-intercept debris in multi-missile engagements.

Her other duties include working closely with the Intelligence Community and warfare system developers to understand technical weapon system requirements and translating those requirements into specific products for the Surface Navy to ensure effective warfighting systems.

Additionally, she assists the Deputy Director of Threat Engineering in coordinating threat representation requirements across Surface Navy stakeholders by providing technical guidance and expertise in the area of threat characteristics, features, vulnerabilities, and capabilities.

She has a Bachelor of Science degree in Science with a minor

in Technical Writing from the Pennsylvania State University.

Meagan Parker would like to thank her SE Department advisors, Dr. Douglas Van Bossuyt and Dr. Amela Sadagic, for their support and guidance throughout the capstone process.

Additionally, she would like to thank her capstone group members, Leslie Amodeo, Brian Dick, Charles Flynn, and Rebecca Nagurney, for having such a positive impact on her experience at NPS.



Ms. Megan Parker

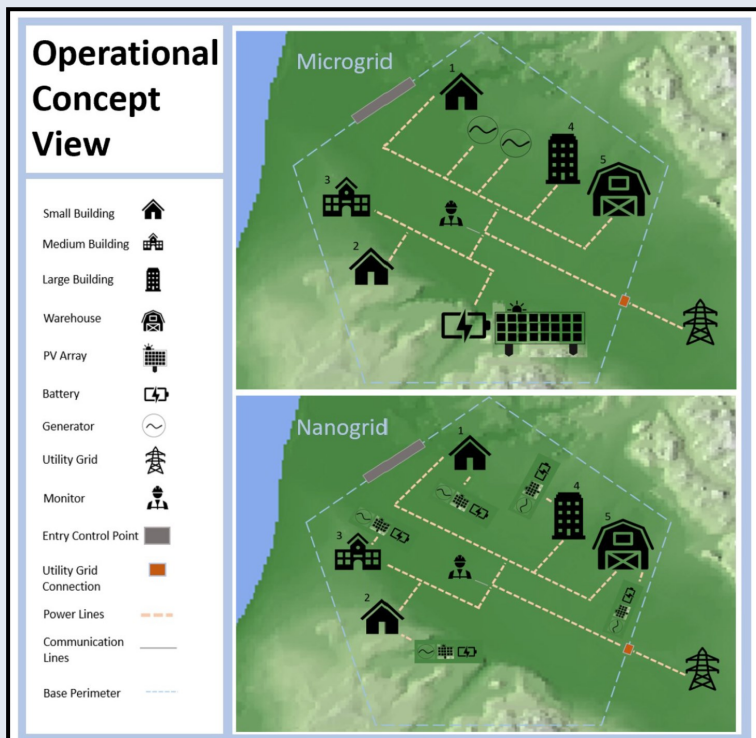
Systems Engineering Student is Published in On-Line Journal

Naval Postgraduate School Systems Engineering Masters Degree student LT Alissa Kain has published an article titled [“Investigation of Nanogrids for Improved Navy Installation Energy Resilience”](#) in *Applied Sciences*, an online journal published semi-monthly by MDPI.

Applied Sciences is an international, peer-reviewed open access journal on all aspects of applied natural sciences.

configurations may improve energy resilience and by how much for critical loads from a national security perspective. This then allows targeted deployment of nanogrids within existing microgrid infrastructures.

A case study of a small military base with an existing microgrid is presented to demonstrate the potential of the methodology to help base energy managers understand which options are preferable and justify implementing nanogrids to improve energy resilience.



Operational Concept View of Naval Support Activity Monterey. Baseline microgrid is represented in the top diagram while the proposed microgrid augmented with nanogrids is represented in the bottom diagram.



LT Alissa Kain

LT Alissa R. Kain is a native of Leesburg, VA. She commissioned with a Bachelor of Science and degree in Ocean Engineering from the United States Naval Academy in 2015.

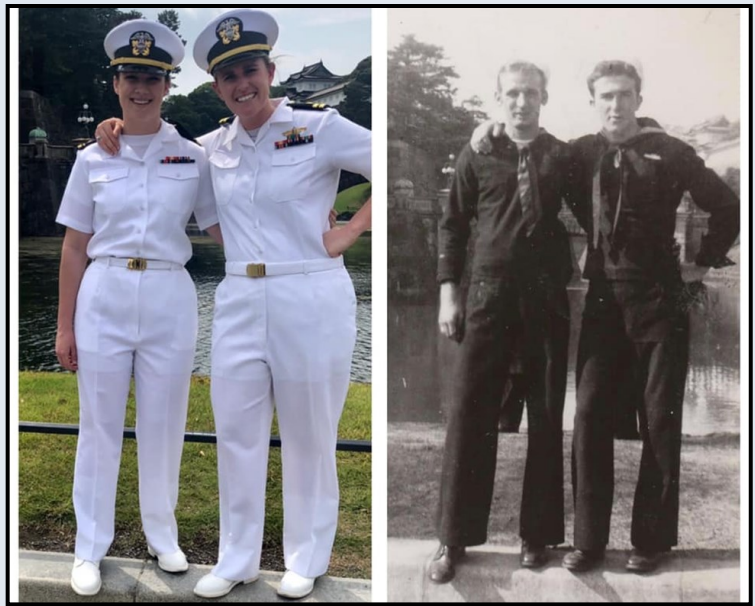
Upon commissioning she served as the Main Propulsion Officer and the Operations Intelligence Officer onboard USS O’Kane (DDG 77) in Pearl Harbor, HI. After fulfilling of her tour in 2017, where she earned her Surface Warfare Officer and Engineering Officer of the Watch qualifications, she traveled

west to Yokosuka, Japan. From 2018-2019 she served as the Assistant Chief Engineer onboard the USS Shiloh (CG 67).

The Kain family is no stranger to serving overseas; as seen pictured above (left image, right side), Ms. Kain had the opportunity to promote in the same location as her grandfather (SN Terrance Kain (right image, right side)) who was also in Tokyo, Japan 76 years ago in front of the Nijubashi Bridge at the Imperial Palace after the historic signing of the Instrument of Surrender onboard USS Missouri in Tokyo Bay.

Returning back to the United States, LT Kain sought to further her education at the Naval Postgraduate School with a master's degree in Systems Engineering.

Upon completion in June 2021, she will return to the Fleet as an Engineering Duty Officer at Pearl Harbor Naval Shipyard in Pearl Harbor, HI.



Left Picture: LT Alissa Kain (right) poses with shipmate ENS (Now LTJG) Danielle Leahy (left)

Systems Engineering SEA Students Brief CNSF

By Associate Professor Fotis Papoulas

The 30th Systems Engineering Analysis (SEA30) cohort, with support from students in the National University of Singapore (NUS) Temasek Defense Systems Institute (TDSI) program and other students in various degree programs at the Naval Postgraduate School (NPS), were assigned by the Office of the Chief of Naval Personnel branch N9I (OPNAV N9I) to provide an analysis and solution to logistics support in a major conflict. The diverse backgrounds of the group, from officers from all forces and civilians from three countries, were ideally suited for this effort.

The team researched the backwards extension and re-defining of the “kill chain” to include the processes of metal bending and metal delivery. The association of a “kill chain” is tied to the commonly accepted and practiced Surface Warfare (SUW) and Air Warfare (AAW) methodologies of F2T2EA (find, fix, track, target, engage, assess) and DTE (detect, track, engage). SEA30 focused on the non-kinetic kill chain, the “industrial

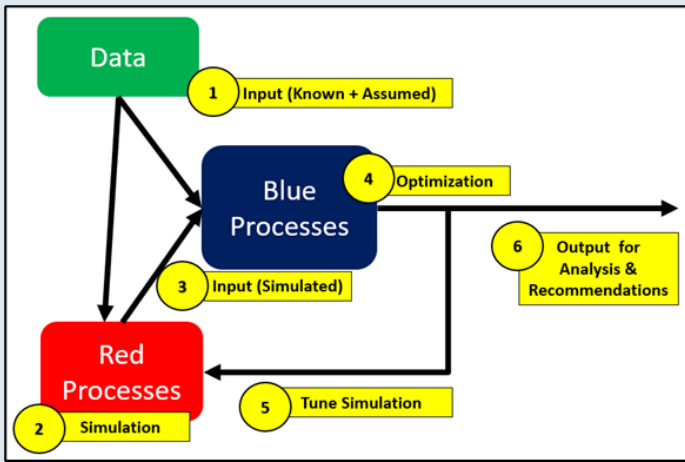
kill chain” discussed during the Warfare Innovation Continuum (WIC), which allows the United States Navy to have a kinetic kill chain at sea.

The team conducted literature reviews, made boundaries and assumptions, and received feedback from the stakeholders to refine the tasking statement. Since global operations are not just about striking capabilities but also being able to operate continuously with limited or no resources in the face of supply disruptions triggered by an adversary, the primary aim was to model ways to increase the resilience of the operational supply chain to ensure continuous operational output in the face of an extended conflict with other global powers. The complexity of the model created is captured in the following graphic:

As can be seen, four fundamental processes were considered for the model: adversarial, logistics, production, and Rare Earth Element (REE).



These processes were the foundation for the technical aspects of the model, schematically shown in the next graphic:



The red processes represent actions that may be executed by a potential adversary. Using simulation, these actions are gener-

ated by data inputs fed into the optimization model as scheduled attacks targeting specific routes traveled by convoys at certain times.

The blue process is the operation of one's force, which encompasses the movements of the various convoys along different routes, collection of REE materials, and component production at factories.

Outputs from the simulated red processes and the available data inputs are fed into the blue processes model. The model outputs are subsequently optimized using available large-scale optimization tools. In addition, the simulation model is further tuned where necessary to improve the robustness of the model

design to produce reliable outputs when presented with different operational scenarios. The goal of the large-scale optimization model would be to derive the optimal combination of factors that would maximize the weighted MOPs (measures of performance). An overview sample of typical input data used in the model is shown below.



All input data used in the model were unclassified information and can be fully customized as needed. The input data can be classified into four broad categories: (1) mines, (2) factories, (3) convoys, and (4) distances between location nodes. This was utilized to create three main design alternatives for analysis. Alternative 1 is to Produce Locally, where component production is limited to within the Continental United States (CONUS). Alternative 2 is to Produce Remotely, expanding the production capability to outside the Continental United States (OCONUS) only. Finally, Alternative 3 is to Produce "Near Me," where production is not limited geographically but optimized to the MOPs directly.

The optimization resulted in several interesting insights. First, when components were produced remotely and "Near Me" they tended to perform better and were almost identical when

using medium or large convoys. Local production performed the worst in all convoy variants, which is a counterintuitive data point that can be explained by the lack of mining in CONUS.

The examined scenario has shown how flexibility in production location, referred to as Produce "Near Me" in this work, achieves the best results amongst the alternatives and variants explored. It should also be noted that balanced fleet of fast-and-medium convoys offers a good mixture of the total balanced MOP as well as specific MOPs of interest. A major recommendation is to further explore this alternative in terms of Location Design and Fleet Design under additional scenarios. Such scenarios should include larger fleet design and longer time-period for examination.



SEA30 Team pictured above from bottom Left: ME5 Joel Li, CAPT Miroslav Bernkopf. From top left: LT Alex Kavall, LT Marian Jester, LT Colin Hust, MAJ Matt McClary, CAPT Amit Carmeli, ME5 Wen Xiang, LT Joe Meier, CAPT Robert Naquila.

Team Members not pictured (Singapore): Adrian Chua, Alvin Baixian, Axel Tan Choon Seng, Eugene Lee Boon Kien, Jason Yap Kok Siong, Lim Wei Qin, Marcus Tai Jia En, Ng Wee San, Nicholas Ng Wei Xiang, Peh Ming Hui

Capstone Corner

Capstone Competition Brings Operational Value to Relevant Army Missions

By COL Joyce Stewart

The Naval Postgraduate School's (NPS) Systems Engineering Management (SEM) programs held their Outstanding Capstone Project Award competition for the 522 SEM graduating class - Spring 2021.

The SEM Capstone Competition is the culminating event of the 18-month SEM (522) curricula developed by the NPS Graduate School of Engineering and Applied Science (GSEAS) Systems Engineering Department to support its Army Acquisition sponsors.

Three student cohort teams, each consisting of 4-5 students from various Army operational backgrounds and experiences, participated in the Spring quarter competition.

Each team presented research results on a current, real-world Army problem which had been presented to them by their specific DoD stakeholder. The participating stakeholders were the US Army Futures and Concept Center (FCC), the Army Engineering Research and Development Center (ERDC), and the Army Research Lab – West.

Over a six month period, the teams worked with their stakeholders and synthesized knowledge gained and applied engineering methodologies and acquisition processes taught in the SEM program to provide stakeholder sponsors with technical analysis and verifiable solutions.

Each project was assessed by a panel of judges based the relevancy and value of the study to the primary stakeholder and the demonstrated competency and application of systems engineering management methods and techniques promoted in the curricula.

The Spring 2021 Capstone Competition top honors went to "Team Forge." Team Forge members included MAJ Royah Rogomentick, MAJ David Yi, CPT Mathew Henderson, and CPT David Deibler. Their efforts formed an evaluation of the Forge Database Requirements Module and design, which supports the Joint Capabilities Integration and Development System (JCIDS) and Army Capabilities Integration and Development System (ACIDS) processes to determine Army Future's Command analysis and prioritization of its many requirements.

Team Forge worked with FCC stakeholders to produce an initial conceptual design. Their solution is earmarked for use in the next iteration of system definitions for the Forge database requirements module. The team utilized several systems engineering frameworks to guide them in analyzing the Forge database Requirements Module's design. These approaches included those from the Systems Engineering Body of Knowledge (SEBoK), United States Air Force Space and Missile Systems Center (USAF SMC), and the Department of Defense and the Architecture Framework (DoDAF) frameworks. Team Forge's final product also provided additional recommendations that the stakeholders accepted. The insights that the team shared further support functional requirements development and improve organizational business processes.

Stakeholder sponsorship is a crucial part of the culminating six-month research activity designed into the 522 SEM program. The FCC stakeholder sponsors worked hand-in-hand with Team Forge to ensure a reasonable scope for the research and to identify essential regulatory and programmatic guidance that affected their unique problem. The student team incorporated their operational knowledge and experiences and support from several GSEAS systems engineering department advisors and subject matter experts for crucial oversight regarding system engineering methodologies to respond to FCC's operational and organizational problem.

According to team member CPT Mathew Henderson, "The SEM program provided by NPS offers a uniquely curated wealth of knowledge tailored to DoD acquisitions. In addition to the SEM program itself, the collective experience of the SE department and partners throughout NPS such as the Opera-

tions Research department and the Graduate School of Defense Management offers students a priceless resource of experiential wisdom from which to draw lessons learned. The 18-month program provides acquisitions professionals with a multidisciplinary foundation in defense acquisitions that is informed by experience and influenced by emerging acquisition trends."

According to Mr. Larry Larimer, SES, Director, Futures Integration Directorate, US Army Futures, and Concepts Center, "The NPS Systems Engineering Capstone Research Team provided the Army's Futures and Concepts Center (FCC) with a critical, independent look into the requirements and design of the Forge database at a crucial point in its development. They delivered a stakeholder analysis that enabled us to evaluate the needs, requirements, and influence of 11 key organizations across the Army Modernization Enterprise, as well as a requirements analysis that has helped us translate these critical stakeholder needs into system functional requirements for the requirements module. Ultimately these insights and findings will allow us to improve synchronization and streamlining of information between stakeholders and organizations, augmenting the capabilities of the Forge database that serves over 1500 users across the modernization community, including the Joint Community, HQDA, and AFC."

NPS's Systems Engineering Management programs (curricula 522 and 722) are interdisciplinary, combining systems engineering with acquisition management knowledge and skills. The program's intent is to broaden the technical capabilities of officers who may have non-technical backgrounds to better equip them to manage and lead acquisition programs for the increasingly complex combat systems that the DoD needs.



From Left: MAJ Royah Rogomentick, MAJ David Yi, CPT Mathew Henderson, and CPT David Deibler

Awards and Graduations

Awards

Naval Sea Systems Command Award for Excellence in Systems Engineering

LT Diego Custódio Rangel, Brazilian Navy

Naval Postgraduate School Outstanding Academic Achievement Award for Department of Defense Student

Mr. Brian Brayton Dick, Naval Information Warfare Center Pacific

Meyer Award for Outstanding DL Student in Systems

Ms. Meagan Brooke Parker, Naval Surface Warfare Center, Dahlgren Division

Rear Admiral John Jay Schieffelin Award for Teaching Excellence

Dr. Kristin Giammarco

Meyer Award in Systems Engineering for DL Teaching

CAPT Donald Muehlbach PhD, USN (ret)

Systems Engineering Management Capstone Competition

522-202 Team Forge

Title: STAKEHOLDER AND REQUIREMENTS ANALYSIS OF THE FORGE DATABASE REQUIREMENTS MODULE

Members: David Deibler, Matthew Henderson, Royah Rogomentick, David Yi

Advisors: Joseph W. Sweeney III, Alejandro Hernandez

Outstanding Capstone Report

311-1940 Team NEAM

Title: NAVY EXPEDITIONARY ADDITIVE MANUFACTURING (NEAM) CAPABILITY INTEGRATION

Members: Leslie Amodeo, Brian Dick, Charles Flynn, Rebecca Nagurney, and Meagan Parker

Advisors: Douglas Van Bossuyt and Amela Sadagic

Recommendation for Graduation with Distinction

MAJ Matthew A. McClary, USA

LT Alexander S. Fredrickson, USN

LT Diego Custódio Rangel, Brazilian Navy

Ms. Rebecca Ann Nagurney, United States Army Space and Missile Defense Command

Individual Theses

LT Alexander Fredrickson, USN

Thesis Title: A SYSTEMS ENGINEERING APPROACH FOR THE SELECTION OF A HEAT EXCHANGER FOR A SMALL-SCALE LIQUID AIR ENERGY STORAGE SYSTEM

Advisor: Anthony Pollman

Co-Advisor: Anthony Gannon

Second Reader: Paul Beery

LT Cameron Gunn, USN

Thesis Title: QUANTIFYING CONSEQUENCES OF EXTERNALLY-INDUCED FAILURES PROPAGATED THROUGH SYSTEMS DURING FUNCTIONAL SYSTEM DESIGN

Advisor: Bryan O'Halloran

LT Alissa Kain, USN

Thesis Title: INVESTIGATION OF NANOGIDS FOR IMPROVED NAVY INSTALLATION ENERGY RESILIENCE

Advisor: Douglas Van Bossuyt

Co-Advisor: Anthony Pollman

MAJ Matthew McClary, USA

Thesis Title: METHODOLOGY FOR MODELING COST AND SCHEDULE RISK ASSOCIATED WITH RESOURCE DECISIONS INVOLVING THE U.S. ARMY'S MODERNIZATION EFFORTS FOR 2035

Advisor: Gregory Mislick

Co-Advisors: Alejandro Hernandez and Brian Wade

Second Readers: Matthew Boensel and Jenifer McClary

LT Talaave Meyers, USN

Thesis Title: ADVANCING THE FUNCTION FAILURE PROPAGATION POTENTIAL METHODOLOGY

Advisor: Bryan O'Halloran

LT Diego Rangel, Brazilian Navy

Thesis Title: EXECUTABLE MBSE APPROACH WITH ILLUSTRATION OF A SATELLITE ENGAGEMENT MISSION DESIGN

Advisor: Oleg Yakimenko

Co-Advisor: Saulius Pavalkis

Second Reader: Fotis Papoulias

LTC Howard Swanson

Thesis Title: EXPERIMENTAL EVALUATION OF DEWAR VOLUME AND COLD FINGER SIZE IN A STIRLING CRYOCOOLER LIQUID AIR ENERGY STORAGE (LAES) SYSTEM

Advisor: Anthony Pollman

Co-Advisor: Alejandro Hernandez, and

Second Reader: Gary Parker

LT Masis Torosyan

Thesis Title: PERFORMANCE AND COMPLEXITY TRADE STUDY OF CANDIDATE LIQUID AIR GENERATION TECHNIQUES

Advisor: Anthony Pollman

Co-Advisor: Alejandro Hernandez

ENS Alexander Yeiser

Thesis Title: EXPLORING THE CAPABILITIES OF CAMEO ENTERPRISE ARCHITECTURE TO OPERATE A DYNAMIC MODEL OF MK 15 PHALANX CIWS

Advisor: Oleg Yakimenko

Second Reader: Fotis Papoulias

Capstone Teams

Team Name: *311-1940 Team NEAM*

Capstone Title: NAVY EXPEDITIONARY ADDITIVE MANUFACTURING (NEAM) CAPABILITY INTEGRATION

Members: Leslie Amodeo, Brian Dick, Charles Flynn, Rebecca Nagurney, and Meagan Parker

Advisor: Douglas Van Bossuyt and Amela Sadagic

Team Name: *311-1940 Team bEastcoast Miners*

Title: MODELING AND SIMULATION OF OFFENSIVE DENIAL MINING

Members: Anthony Deken, Bradley Leusner, Justin Lewis, and Kaylee Zagrocki

Advisors: Paul Beery, Anthony Pollman, and Richard Williams

Team Name: *311-1940 Team Time Zone*

Title: DATA MANAGEMENT FOR ARTIFICIAL INTELLIGENCE MACHINE LEARNING IMPLEMENTATION ACROSS THE DEPARTMENT OF THE NAVY

Members: Robert French, Wallace Fukumae, Kheng Hun, Obed Matuga, and Caitlyn O'Shaughnessy

Advisors: Bonnie Johnson and Scot Miller

Team Name: *311-193A Team HVP*

Capstone Title: HYPERVELOCITY PROJECTILE: EFFECTS OF A COMMON MUNITION IN MULTI-MISSION OPERATIONS

Members: Salvatore Licci, Daniel Millican, Kayla Rhynes, and Tamika Richardson

Advisor: Wayne Porter, Paul Beery, and Gene Paulo

Team Name: *522-202 Team Forge*

Title: STAKEHOLDER AND REQUIREMENTS ANALYSIS OF THE FORGE DATABASE REQUIREMENTS MODULE

Members: David Deibler, Matthew Henderson, Royah Rogomentick, and David Yi

Advisors: Joseph W. Sweeney III and Alejandro Hernandez

Team Name: *522-202 Acquisition Gamification*

Title: ANALYSIS OF PROCESS, PRODUCT, AND CONTEXT IN MILITARY ACQUISITIONS

Members: Evan Barber, Lane Berg, James Gallagher, David Garrison, and Richard Lofthouse

Advisors: Joseph W. Sweeney III, Gary Parker, and Alejandro Hernandez

Team Name: 522-202

Title: VIRTUAL REALITY MISSION PLANNING SUITE DEVELOPMENTAL RESEARCH

Members: Eugene Choi, Clayton Gaines, Alexander Kipetz, and Mark Mayor

Advisors: Joseph W. Sweeney III, Gary Parker, and Alejandro Hernandez

Team Name: 308-194

Title: RESILIENCE IN MAJOR CONFLICT

Members: Alexander Kavall, Collin Hust, and Matthew McClary

Advisors: Fotis Papoulias and Jefferson Huang

Graduations

Master of Science in Systems Engineering

Maj Joshua L Foxton, USMC

MAJ Thomas Joseph Boehm, USA

MAJ Matthew A. McClary, USA

LTC Howard M. Swanson, USA

LCDR Anthony Maurice Deken, USN

LT Alexander S. Fredrickson, USN

LT Cameron A. Gunn, USN

LT Alissa Rae Kain, USN

LT Alexander P. Kavall, USN

LT Talaave K. Meyers, USN

LT Masis B. Torosyan, USN

ENS Alexander X. Yeiser, USN

LT Diego Custódio Rangel, Brazilian Navy

Mrs. Leslie Jean Amodeo, Strategic Systems Programs

Mr. Brian Brayton Dick, Naval Information Warfare Center Pacific

Mr. Charles P Flynn, Naval Undersea Warfare Center, Division Newport

Mr. Robert Gordon French, Naval Sea Systems Command, Dahlgren Division

Mr. Wallace Y. Fukumae Jr., Naval Information Warfare Center Pacific

Mr. Thomas Henry Hatch, Naval Air Systems Command

Mr. Kheng Siek Hun, Naval Information Warfare Center Pacific

Mr. Bradley P. Leusner, Naval Undersea Warfare Center, Division Newport

Mr. Justin Francis Lewis, Naval Undersea Warfare Center, Division Newport

Mr. Daniel Millican, Naval Air Warfare Center, Training Systems Division

Ms. Rebecca Ann Nagurney, United States Army Space and Missile Defense Command

Ms. Caitlyn Renee O'Shaughnessy, Naval Undersea Warfare Center, Division Newport

Ms. Kayla Nykia Rhynes, Naval Air Systems Command

Ms. Tamika Marsha Richardson, Naval Air Systems Command

Mrs. Kaylee Marissa Zagrocki, Naval Surface Warfare Center, Dahlgren Division

Master of Science in Systems Engineering Analysis

LT Collin Riggs Hust, USN

Master of Science in Engineering Systems

Mr. Salvatore Licci, Naval Air Warfare Center, Aircraft Division
Mr. Obed Matuga, Naval Sea Systems Command
Ms. Meagan Brooke Parker, Naval Surface Warfare Center, Dahlgren Division

Master of Science in Systems Engineering Management

MAJ Evan Barber, USA
MAJ Lane M. Berg, USA
MAJ Eugene Choi, USA
CPT David R. Deibler, USA
MAJ Clayton L. Gaines, USA
MAJ James P. Gallagher, USA

Master of Science in Systems Engineering Management, continued

MAJ David C. Garrison, USA
CPT Mathew Stuart Henderson, USA
MAJ Alexander J. Kipetz, USA
MAJ Richard M. Lofthouse, USA
CPT Mark E. Mayor, USA
MAJ Royah Rogomentick, USA
MAJ David Yi, USA

Systems Engineering Distance Learning Graduation Photos



Spring Quarter Systems Engineering Distance Learning Graduation via Zoom—June 16, 2021

Request for Alumni News!

The SE Department is interesting in hearing how our alumni are doing.
Please feel free to send the [editor](#) news items for inclusion in future newsletters.

If you would like to subscribe to the Systems Engineering Newsletter, please click [here](#).

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