



## USMC Deputy Commandant for Information Honors NPS Winter Quarter Graduates

By MC1 Nathan K. Serpico

One year removed from the last ceremony fully relegated to cyberspace, the Naval Postgraduate School (NPS) honored its 2022 Winter Quarter graduates March 25 during an in-person commencement ceremony in King Hall Auditorium.

U.S. Marine Corps Lt. Gen. Matthew Glavy, Deputy Commandant for Information, served as the commencement speaker for the 248 graduates, including 28 international students from 15 countries. He began by acknowledging the current geopolitical climate and lingering consequences of the COVID-19 pandemic and how these trials affected the graduates' time at NPS.

Glavy continued his remarks by quoting President George H.W. Bush, who said, "The best and brightest military officers from the U.S. and around the world are assigned to the Naval Postgraduate School."

“You're not just students, but also the future of our ability to be invested in the warfight that is in front of us, no matter where it might be,” noted Rondeau. “You are a select group in ways that very few other graduates on the globe [are] ... For all of you that are graduating, it's been an extraordinary privilege to serve you on this journey.”

-NPS President retired Vice Adm. Ann E. Rondeau

“Your boldness, insight, imagination and innovation will have to be brought to bear to get the full value of your NPS education,” said Glavy. “They've instilled in you an insight that very few people get in this world.

“I was never assigned to the Naval Postgraduate School,” added Glavy. “I am not qualified to talk about what happens at this school. However, I am qualified to talk about what happens after this school.”

Glavy shared numerous personal stories about his encounters with NPS-educated Marine Corps officers who set themselves apart through their knowledge, expertise and problem-solving abilities. As an example, Glavy recalled sitting in on a briefing provided by a Marine Corps captain to U.S. Army Gen. James Dickinson, Commander, U.S. Space Command, and his staff, and how impressed Glavy was at the captain's ability to hold his ground with the deep technical expertise that he got from his NPS education.

NPS President retired Vice Adm. Ann E. Rondeau congratulated the graduates on their perseverance through the challenges of COVID-19, a fast-paced academic schedule, the deadline and demands of thesis production, and all the rigors of earning the degree that will be awarded to them during the ceremony.

To read the rest of the article, visit our [website](#). To view photo, visit the Winter 2022 [Graduation site](#).



NAVAL POSTGRADUATE SCHOOL

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# NPS Professor, Students Issued Provisional Patent for Liquid Air Energy Storage, Recovery System

By Javier Chagoya

Naval Postgraduate School (NPS) Department of Systems Engineering Assistant Professor Tony Pollman, along with university graduates U.S. Navy Lts. Nicholas Bailey and Christopher Girouard, were issued a provisional patent by the U.S. Patent and Trademark Office, Feb. 10, for a novel apparatus using a dual-Stirling engine charge and recovery method for liquid air energy storage (LAES) systems.

“This is a technology that has the potential to shape things we do in life,” said Pollman.

Put simply, the dual-Stirling engine is capable of utilizing stored excess energy generated by renewable sources like solar and wind, so it can be utilized when and where it’s needed most. Unlike other systems using compressed air energy storage, the NPS team’s discovery would not require large tanks for storage, or the geographical constraints that hydro-electric recovery systems require.

“The greatest benefit of this type of energy storage system using liquid air, is that the resource is all around us. It’s free, and has no carbon footprint. And it can be built anywhere. And the Stirling engine is also scalable,” Pollman said.

The history of the Stirling engine began as a competitor to steam engines in the early 1800s. Unfortunately, inefficiencies in the engine’s work cycle could not keep up with a sustained and heavy workload, so its practical use was largely confined to low-power domestic applications.

But, as Pollman quickly noted, the Stirling “is a system that would be used in a micro-grid environment,” he said.

This type of engine would augment renewable energy systems which encounter curtailment periods, like wind, hydro-electric and solar panel farms. Curtailment is the reduction of output of a renewable resource below what it is capable of producing.

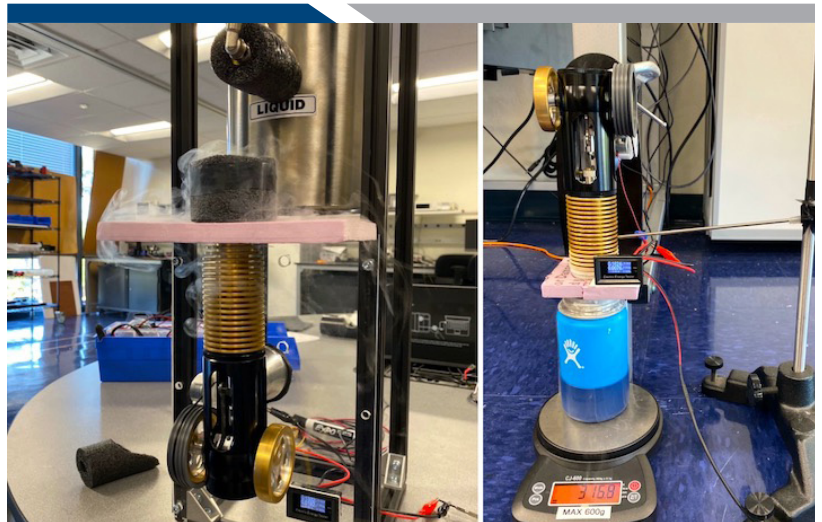
The two NPS students included on the patent are a couple of years removed from completing their NPS studies. Bailey and Girouard are now working at Naval Shipyards on opposite coasts, and are getting ready to transfer to new jobs following their two-year Engineering Duty Officer qualification tours at Puget Sound and Portsmouth, respectively.

The news about the team’s patent award was a pleasant surprise, as they didn’t hear about its issuance until a technology reporter published a piece about it from information he gathered from the USPTO Gazette for Patents publication.

“Wow! This news was out of the blue,” said Bailey. “To learn that our theses have advanced liquid-air technology a little further is very cool. My mom was very proud of me when she found out.”

Girouard was just as surprised to discover the possibility of a patent for his contributing thesis in the Stirling engine research.

“I had to ask, is this really going to work? And as we went along, I was



*A provisional patent has been issued for this prototype Stirling dual-engine apparatus constructed by NPS Systems Engineering students Lts. Christopher Girouard and Nicholas Bailey, with the support of advisor Dr. Anthony Pollman. The students’ theses led to this novel approach, using a dual-Stirling engine charge and recovery method for liquid air energy storage (LAES) systems. (Courtesy asset)*

really pumped to see how this was going to turn out in our search for an energy storage solution for liquid air,” said Girouard.

“The experience that we had in designing and building the prototype was interesting,” said Girouard. “Most of the time these [engines] are used to keep highly-sensitive electronic equipment cool rather than generating a phase change for energy storage.”

While Girouard worked on the charging and containment of the system, Bailey worked on the recovery of the heat exchanger to minimize loss. Another key benefit of this type of energy generation is the low maintenance power requirements for the system itself.

Bailey said it was an incredible feeling to have the initial prototype work.

“Chris and I worked for over a year using modeling tools that proved that the system could work, but until we saw it actually turn the engine for the first time, we couldn’t be sure,” said Bailey. “While the initial prototype was inefficient due to design and manufacturing tradeoffs for time, we were able to prove that such an idea had merit and even potential use cases.

“As for scalability, I believe that for [limited] building size, isolated microgrids, this LAES system could solve resiliency troubles seen with renewable sources like wind or solar energy sources,” Bailey continued. “Such use cases even have some applicability inside the Department of the Navy like small Marine detachments forward deployed away from infrastructure.”

Currently, Bailey is anticipating a new set of orders following his two-years at Puget Sound Naval Shipyard. Girouard is now heading to Naval Surface Warfare Center Philadelphia to be the Program Managers Representative (PMR) for the FFG 62 Land Based Engineering Site, where the team is building the propulsion plant for the Constellation class frigate to test prior to the operation of the full vessel.

# NPS Research Seeks to Advance Aircraft Turbine Resilience to Particulates

By Rebecca Hoag

In late 2015, two Marines were killed and 20 others injured after a MV-22 Osprey crashed during pre-deployment training at Bellows Air Force Base in Hawaii. The culprit ... Airborne sand and dust particulates caused brownout conditions for the aviators and were ingested into the aircraft's engines, melting due to the high temperatures and degrading internal components compromising the aircraft's power and lift.

Less than a month later, when Volcano Momotombo erupted, commercial flights were forced to stay grounded to avoid particulate ingestion from the volcano's lingering blast.

Sand, dust and other particulates have been a thorn in the side of aircraft technology for decades. In the 90s, the issue was mainly centered on erosion, but better coatings on the engines have solved that problem.

Now, the problem is more related to the high temperatures generated in newer turbine engines, allowing for increased performance and power. To their detriment, however, these higher temperatures melt particulates when ingested into the engine, which can clog the turbine.

Naval Postgraduate School (NPS) physics student and Meyer Scholar Lt. Erick Samayoa and his advisor Dr. Andy Nieto, NPS Assistant Professor of Mechanical and Aerospace Engineering (MAE) – with the help of fellow NPS MAE Assistant Research Professor Troy Ansell and UC San Diego NanoEngineering Professor Jian Luo – found that ultra-high temperature ceramics (UHTCs) might be sand-phobic ... In other words, molten sand doesn't stick to them.

Their study, funded by the Strategic Engineering and Research Development Program (SERDP), was the first to look at the potential of utilizing UHTCs in aircraft turbines. SERDP is a joint effort by the Department of Defense (DoD), the Environmental Protection Agency (EPA), and the Department of Energy (DoE). This project was part of a collaboration between NPS, the U.S. Army Lab, Stony Brook University, and the materials company Oerlikon Metco.

While different companies have developed filters to reduce sand intake, it's nearly impossible to keep every particle out of a turbine, and unfortunately, the tiniest particles are the ones that melt the easiest. Other research has looked into ways to slow down sand and other particulates from melting by quickly resolidifying them through the introduction of counter-reaction, but this has not stopped particulates from sticking onto the engine in the first place.

The NPS team, therefore, decided to look at the problem from a materials standpoint. Before coming to NPS about four years ago, Nieto worked at the U.S. Army Research Laboratory (ARL), and brought his research and partnership with ARL with him to NPS.

Ansell brought to the team images of different particles exposed to ultra-high temperatures captured with a transmission electron



*A U.S. Marine MV-22B Osprey lands at Babadag Training Area, Romania, in this 2015 photo illustration, kicking up clouds of potentially dangerous particulates in the process. Research at NPS employing the latest in Ultra High Temperature Ceramics has the potential increase the resilience of turbine engines to particulate ingestion, critical for DOD aircraft operating in sandy and salty environments. (U.S. Marine Corps photo illustration/Released)*

microscope to see if and how they interacted with the UHTCs. Luo provided the ceramic materials and helped analyze the results using his expertise in high-entropy ceramics.

Samayoa says this whole project was a heavy learning curve since he was a physics student, but the research fit well within his goals. And the quality of his work showed, Nieto claimed, saying the research Samayoa performed would be work fit for a Ph. D. student.

Adding to the complexity of research using UHTC is the challenge of simulating the heat emitted by modern gas-powered turbines. The researchers needed to find a way to test out materials at that temperature, requiring the team to acquire the hottest furnace NPS has ever had. Once up and running, the research team developed a project to test the UHTCs at different temperatures for different lengths of time.

"We were the first to even experiment at these higher temperatures for any material for these applications," Nieto says. "It was completely unexpected that as you would go higher in temperature, you would actually get some degree of chemical inertness from these ultra-high temperature ceramics where they were not interacting with the molten sand. It opens up a possible path forward in how we are designing these engines."

The researchers published their findings in the materials science focused journal, *Materialia*, in December 2021. Samayoa, a surface warfare officer, has now graduated and is now completing the Department Head pipeline before reporting as Weapons Officer onboard USS Princeton (CG 59).



# Career Submariner Steps in as NPS' New Undersea Warfare Chair

By MC2 Tom Tonthat

Retired Navy Vice Adm. Phillip G. Sawyer has taken the helm as the Naval Postgraduate School (NPS) Undersea Warfare (USW) Chair, and will now serve as the primary liaison and advisor between the university and the Navy's submarine force.

Sawyer retired from active duty in September 2021, serving as Deputy Chief of Naval Operations for Operations, Plans and Strategy (N3/N5) in his final assignment. In fact, Sawyer visited NPS in May of 2021, and says he was highly impressed with the school's capabilities, and the direct Naval application of student research.

"The lieutenants and lieutenant commanders bring an enthusiasm through their academics and research that is rejuvenating and adds an operational advantage to the world-class organization that is the Naval Postgraduate School," said Sawyer. "It's just an ideal place to be able to come and work to progress the Navy and Marine Corps down the paths that we need for the future."

As a career submariner, Sawyer brings years of experience and knowledge to the USW program in guiding its future direction. He understands the importance of maintaining an advantage in the USW domain and how NPS can help solve Fleet problems and create operational advantage for the U.S. Navy to stay ahead of its rivals.

"There's a lot out there for undersea warfare and there's plenty of work for us to do both here at NPS and in the Navy," said Sawyer. "My goal here is twofold. First, help the students understand what undersea warfare is while helping the world-class academic staff here better understand the operational side of what they're doing and how it applies to the fleet."

"Also, I'm here to make sure that we're helping the fleet as best we can," he continued. "It's making sure that they have an open door to come in and say, 'Here's something we're trying to solve. Can Naval Postgraduate School help us with that?'"

Sawyer also sees the interdisciplinary capabilities of NPS as a way to support the USW program, finding ways for various areas of research to connect with the domain.

"I think the research that's done here – from acoustics or physics to mechanical engineering and additive manufacturing, even [artificial intelligence] and machine learning – have applications within the Navy and specifically USW," he said. "A strong link between what NPS is doing and how we're going to use that operationally is needed. With maybe some tweaks to refine or focus a project a little bit differently to leverage it for undersea warfare."

Sawyer says that NPS' interdisciplinary capacity is further demonstrated through its Naval Warfare Studies Institute (NWSI) and its task force approach to research to benefit USW and other programs.

"The point is that most Navy problems don't neatly fall into one degree discipline," said Sawyer. "If you're outside looking in, you may not know if it's a physics problem or an acoustic issue. NWSI is now the



Retired Navy Vice Adm. Phil Sawyer is the Naval Postgraduate School's new Undersea Warfare (USW) Chair, taking over for longtime USW chair retired Rear Adm. Jerry Ellis. Sawyer will serve as the principal advisor and liaison between the university and the Navy's submarine forces. (Courtesy photo)

place to bring that problem and the NWSI team let the subject matter experts who understand NPS to all work on it. They will direct it to the right NPS experts – researchers, academics, professors, students – across departments to attack the problem. As Undersea Warfare Chair, I will be a senior advisor to some of the teams to develop an operational voice. I am very excited about the advent of NWSI here. I think it's going to be significant for the Fleet and NPS."

NPS President retired Vice Adm. Ann Rondeau also expressed excitement about the future of the USW program under Sawyer's leadership, while also offering her deep appreciation for the exemplary performance of former chair retired Rear Adm. Jerry Ellis, who served in the position from March 2009 until his retirement in 2021.

"I am deeply grateful to these leaders," said Rondeau. "Rear Adm. Ellis dedicated his life to the Navy with nearly 60 years of total service. In the final chapter of his career, he focused his leadership into teaching and mentoring our warrior scholars, many of whom are leading the Naval forces today."

"Vice Adm. Sawyer brings a wealth of Fleet experience, strategic insight and exemplary leadership skill with him," she continued. "We are very fortunate to have Vice Adm. Sawyer join our senior leader team and faculty. Our students, NPS and future Navy are in very good hands."

As Sawyer steps into his new role, he says he's looking forward to being a part of the university's evolving impact on the future Fleet and force.

"I think Naval Postgraduate School is a world-class organization that brings together things you don't find anywhere else," Sawyer concluded. "Other civilian installations have world-class researchers and academics. Others have students like we have military students, but nobody brings it all together like NPS."

# NPS Defense Analysis Department Welcomes New Chair

By MC2 James Norket

The Naval Postgraduate School's (NPS) Department of Defense Analysis, nationally-recognized for its leading graduate education and research programs in information strategy, political warfare and innovation design, has welcomed a new faculty member to the team with Dr. Carter Malkasian joining the university as professor and chair of the department.

Malkasian brings a range of academic and advisory experience to the university. Following doctorate studies at Oxford University, Malkasian served across multiple conflict zones in varied advisory capacities, culminating in his service as the senior civilian advisor to then Chairman of the Joint Chiefs of Staff, Gen. Joseph Dunford from 2015-2019.

Malkasian's diverse experiences led to his service in a multitude of environments, ranging from Afghanistan to Washington, D.C. He served in Helmand province as a State Department political officer, in addition

to al-Anbar in 2004-2006, in Kunar in 2007, and in Honduras in 2012.

As he returns to academia, Malkasian says that he is excited to begin working with the exceptional faculty in the Defense Analysis department as they continue advancing the critical thinking skills of the DOD's future military leaders.

"I'm the chair, but a chair is only as good as a department," he said. "Together, with consultation from the students and others, we are going to be able to set the strategic direction and I'm going to try to help as much as I can. We want to make sure NPS continues to educate our future leaders in this changing environment."

"I'm really happy to be here at the Naval Postgraduate School," he stressed. "I think there is no larger goal than helping the students be able to advance in their careers, and to continue to help protect the United States."

## Nobel Laureate, Game Theorist Shares Perspective on Conflict with NPS Students, Faculty

By Javier Chagoya

Dr. Roger Myerson, an internationally-recognized economist and 2007 Nobel Memorial Prize recipient in Economic Sciences, offered an informal guest lecture with Naval Postgraduate School (NPS) students and faculty in the Defense Analysis (DA) department, Feb. 28.

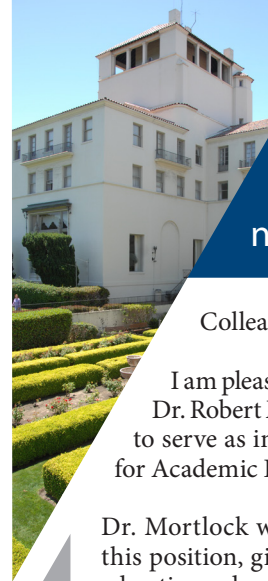
Myerson spoke of his research in game theory and its application to conflict studies, with a distinct focus on the current conflict in Eastern Europe, as well as its global, economic and political implications. He also expressed a keen interest in NPS faculty research in the areas of statebuilding and stabilization studies. Myerson was invited to the university by Dr. Carter Malkasian, who joined NPS as Defense Analysis chair in late 2021.

During his lecture, the Nobel Laureate drew on insights from his experience as a game theorist to describe how the U.S. should think about deterrence in the current conflict, and

the importance of local accountability in a robust democracy. He continued on to say, in his opinion, it is dangerous to appease an adversary's demands, and reinforced the critical role of trust across partner nations.

Myerson is the David L. Pearson Distinguished Service Professor of Global Conflict Studies in the Harris School of Public Policy and the Griffin Department of Economics at the University of Chicago. He has made seminal contributions to the fields of economics and political science, and in game theory, introduced refinements of Nash's equilibrium concept.

He is the author of *Game Theory: Analysis of Conflict* (1991) and *Probability Models for Economic Decisions* (2005), and is a member of the American Academy of Arts and Sciences, the National Academy of Sciences, the American Philosophical Society, and the Council on Foreign Relations.



## CAMPUS news & notes

Colleagues,

I am pleased to announce that Dr. Robert Mortlock has agreed to serve as interim Vice Provost for Academic Leadership (VPAL).

Dr. Mortlock will temporarily fill this position, giving us the time to advertise and search for a permanent candidate. He comes to this position from Defense Acquisition and Program Management in DDM and is a retired Army colonel with 15+ years as an Acquisition Professional in a variety of DoD programs.

The VPAL will be responsible for direct line supervision of the Department Chairs. Assisting Dr. Mortlock will be the VPAL Advisory Group. This Committee, which is chartered to provide advice and support to the VPAL in the execution of his duties. I'm pleased to announce that Dr. Matt Carlyle has agreed to serve as Chair of the VPAL Advisory Group.

We are grateful for the willingness of both Dr. Mortlock and Dr. Carlyle to take on positions of such significant scope on short notice, and I'm counting on your support as they establish these new positions at NPS.

**Dr. Scott S. Gartner**  
Provost and Academic Dean  
Naval Postgraduate School

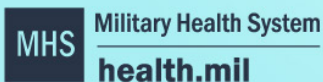
Send your campus news and notes to [update@nps.edu](mailto:update@nps.edu).

## Sexual Assault Prevention & Response (SAPR)

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## Sexual Assault Awareness *and* Prevention





# Any Day at NPS



NPS President retired Vice Adm. Ann E Rondeau speaks during the 2022 Winter Quarter Graduation ceremony in King Hall, March 25. (U.S. Navy photo by Javier Chagoya)



Students walk in formation en route to the 2022 Winter Quarter Graduation ceremony in King Hall, March 25. (U.S. Navy photo by Javier Chagoya)



Students listen intently during the 2022 Winter Quarter Graduation ceremony in King Hall, March 25. (U.S. Navy photo by Javier Chagoya)

## STUDENT voice

Hello, Peacocks!

Welcome back, Peacocks!

Spring is here! On behalf of the President's Board for Student Affairs (PBSA), we welcome you and hope your time at NPS is enriching for you and your family. Our team serves as the communication bridge between students and staff to make actionable recommendations to support you and improve our quality of life. The team and I look forward to seeing you on campus and hearing about your experiences thus far. Contact us through our [Student Recommendations Link](#) or email me directly at [domonique.hittner@nps.edu](mailto:domonique.hittner@nps.edu).

Our general student body meeting will be on Thursday, 14 April 2022, from 1200-1240, on campus outside of the Dudley Knox Library. Please email [pbsa@nps.edu](mailto:pbsa@nps.edu) if you are unable to attend, but would like to join one of our planning meetings. Follow these links to register for the [President's Cup](#), [Discovery Day at NPS](#), and many other volunteer opportunities. Additionally, we have posted some summer camp options for your family in our childcare resource list on our website for your convenience. Let us know how else we can support you.

**Domonique Hittner**  
Chair, Presidents Board for Student Affairs  
<https://nps.edu/group/pbsa>

# On campus this month

## April 4-8

Center for Executive Education NSLS Workshop  
*Online*



## April 19

Naval Research Working Group  
*Online*



## April 26

Center for Executive Education SCW Workshop  
*Online*

### Mobile Apps Leader Board

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