From Classroom to Orbit: NPS Student Team Builds ISS-Bound Imaging System

Naval Postgraduate School's Terahertz Imaging Camera is scheduled for launch to the International Space Station in 2027.

A multidisciplinary team of recent NPS graduates from the space systems, physics and electrical engineering programs developed a Terahertz Imaging Camera, combining their individual thesis research efforts.

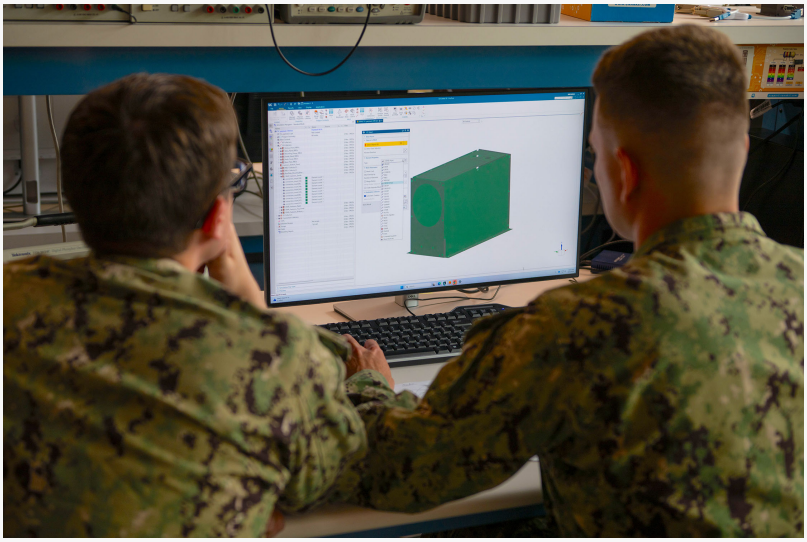
Members of the Terahertz Imaging Camera (TIC) team — U.S. Navy Ensign Yvonne Fu and Lt. Joshua McCowan and Marine Corps Lt. Col. Brian Neri, from left — review the technology's concept of operations in the space systems lab.

MONTEREY, CA, UNITED STATES, August 14, 2026 /EINPresswire.com/ -- At the Naval Postgraduate School (NPS), a team of students and faculty is demonstrating how space innovation is not the product of a single discipline, but the result of tightly coordinated teamwork across time and academic disciplines. Their project, the Terahertz Imaging Camera (TIC), set to launch to the International Space Station (ISS) in 2027, stands as a powerful example of how NPS transforms defense-focused education and applied research into real-world operational capability.

From its earliest stages, the TIC effort has been defined by integration, not just of hardware and software, but of people, expertise and ideas. Several students from NPS' space systems, physics and electrical engineering programs each took ownership of a piece of the system, working collectively to build a complex payload designed to operate in the harsh environment of space.

"Space systems are inherently multidisciplinary," said NPS Space Systems Academic Group (SSAG) chair

Dr. Wenschel Lan, co-principal investigator (co-PI) for the TIC. “This project gives our students the opportunity to work together with subject matter experts to design, build, test and operate real spaceflight hardware. That collaborative experience is critical to solving real-world problems.”



Ensign Justin Williams and Lt. Joshua McCowan demonstrate the Terahertz Imaging Camera (TIC) system’s casing in the space systems lab at NPS. The TIC was one of seven projects selected for the Digital AI Challenge.

The project is a low-cost, space-based terahertz (THz) imaging system for remote sensing of atomic oxygen emissions in Earth’s upper atmosphere. These emissions are critical for understanding upper atmospheric dynamics and winds, which impact satellite communications.

They can also be used for identification of human-induced sources of THz radiation, such as spacecraft launch and reentry, as well as other phenomena of interest to the defense and intelligence communities.

The THz band that the TIC surveils lies between microwave (radar) and infrared (thermal imaging) wavelengths and is generally very difficult to detect, according to Dr. Fabio Alves, professor of physics and co-PI for the TIC project.

"We are building a sensor based on metamaterial films that can absorb terahertz waves of specific frequencies with high efficiency," Alves explained. "The terahertz sensor, designed with the help of physics professor Dragoslav Grbovic and 2025 graduate U.S. Air Force Lt. Col. Jennifer Nolta, is a matrix of more than 3,000 pixels that heat up on terahertz absorption. The heat of individual pixels is probed by an infrared camera on the backside, constructing an image of the terahertz scene.”

Additionally, Alves adds, the focalization optics for the terahertz and infrared portions was designed by U.S. Air Force Maj. Daniel Nelson, also a 2025 graduate.

The TIC was one of seven projects selected through NPS' inaugural Digital Trident AI Challenge in 2025, with partial funding and in-kind support provided by the NPS Foundation and Alumni Association. Chosen from 38 entries, each of the seven projects takes on key operational problems critical to U.S. national security.

In addition, Alves notes, TIC was selected by NPS' Consortium for Robotics and Unmanned Systems Education and Research (CRUSER) for seed project funding focused on the study of autonomous surveillance to be implemented in future terahertz sensors.

"The Digital Trident AI Challenge is part of NPS' effort to explore, experiment with, and operationalize emerging technologies that will have an immediate and advantageous impact on national security challenges," said Kaitie Penry, director of the NPS Emerging Technology and Innovation Office (ETIO).

Putting that vision into practice, the TIC payload reflects the combined expertise of the interdisciplinary team behind it.

It incorporates a novel microelectromechanical (MEMS)-based sensor, an intricate optics assembly, custom electronics, and a structure engineered to survive launch and on-orbit conditions. Each component represents a specialized challenge, but the true difficulty lies in bringing them all together into a single, functioning system.

"The optics assembly, the sensor, the structural design, the electronics … They're all individual problems," Lan explained. "But integrating everything into a functional instrument is where the team effort really comes in."

For the students, that integration began in the classroom and quickly evolved into a shared mission. Many joined the project through coursework before continuing into thesis research, creating a pipeline of contributors who built on each other's work.

"When I came onto the project, there was a gap in how we interfaced the camera with the onboard systems," said U.S. Navy Lt. Joshua McCowan, a June 2026 graduate in space systems operations. "That became my role, and from there it grew into my thesis. Everyone kind of found their niche and contributed where they were needed."

U.S. Marine Corps Lt. Col. Brian Neri, a dual degree graduate in space systems operations and applied physics, said the collaborative nature of the project was one of its biggest draws.

"You're not just working on your own piece in isolation," Neri said. "You're constantly working with others to make sure everything fits together and meets the overall objectives."

Neri was among a select group of students who had the chance to brief NASA Artemis II pilot and NPS alumnus U.S. Navy Capt. Victor Glover, when he returned to campus in June after his historic lunar mission. Glover picked up on the camera's potential naval applications, including its ability to detect objects leaving or entering space, and was keen to learn more as the system is finalized and prepared for launch early next year.

Each student's contribution to the TIC was distinct, but none stood alone.

McCowan focused on camera calibration, ensuring the imaging system could maintain accuracy despite thermal fluctuations in orbit. Neri developed the concept of operations, bringing together NASA requirements, hardware capabilities, and software constraints into a cohesive plan for how the payload will function on the ISS.

Neri's thesis, entitled "Concept of Operations and Functional Testing of Terahertz Imaging Camera 2.1," earned an NPS Outstanding Thesis award upon his graduation in June 2026.

"The concept of operations really pulls everything together," Neri said. "It takes everyone's work and defines how we actually use the system to achieve the mission."

Meanwhile, following the steps of 2025 graduate Nolta's sensor design, Ensign Yvonne Fu worked in the cleanroom fabricating the focal plane array, a delicate sensor built layer by layer from silicon and metals, designed to detect terahertz radiation. Her work required precision and patience, with each step building on the last.

"It's a long process with a lot of opportunities for things to go wrong," she said. "But knowing that what you're building will be part of the final system makes it worth it."

Ensign Justin Williams approached the project from a modeling perspective, simulating the terahertz signatures the sensor is designed to detect. His work provided critical insight into how the payload will perform once in orbit.

Ensign Andrew Oleson, meanwhile, ensured the entire system could survive launch and operation in space, conducting structural analyses that tied together the physical integrity of all components.

"My work depends on everyone else's," Oleson said. "And their work depends on mine. It really shows how interconnected everything is."

The TIC team didn't just divide and conquer individual tasks; rather, the team worked continuously to integrate their efforts. Weekly meetings with faculty advisors and other SSAG faculty and staff, provided a forum to share progress, troubleshoot challenges, and refine designs.

"We were constantly presenting what we had done and getting feedback," McCowan said. "That helped us stay aligned and build off each other's work."

This iterative process mirrored real-world engineering environments, where collaboration and communication are essential to success. For Neri, one of the most important lessons came from navigating trade-offs as a team.

“We had to balance complexity, risk and timeline,” he said. “Those decisions weren’t made in a vacuum. They involved discussions across the team, and understanding how one choice would impact everyone else.”

The complexity of the TIC project inevitably brought challenges, many of which required collective problem-solving.

McCowan encountered discrepancies between the camera’s documentation and its actual capabilities, requiring coordination with manufacturers and adjustments to the team’s approach. Williams faced the challenge of learning specialized software with little existing expertise on campus, reaching out to external researchers for guidance while sharing his knowledge with the team. And Fu dealt with the realities of fabrication, where a single mistake could undo hours of work, all while Oleson reconciled simulation data with real-world testing, ensuring the payload’s structural integrity.

Through it all, the team relied on each other.

“Everybody was working toward the same goal,” Neri said. “That made it easier to push through the tough parts.”

Students consistently pointed to the NPS environment as a key enabler of collaboration. Access to specialized labs, equipment and computing resources allowed them to tackle complex problems, while faculty mentorship ensured they had the guidance needed to succeed.

“Everyone here is willing to help,” Neri said. “Whether it’s faculty, staff or other students, there’s always someone you can go to.”

The structure of the program also supports teamwork. Dedicated time for thesis work, combined with regular interactions with advisors and peers, creates a battle rhythm that encourages collaboration rather than competition.

“There’s a shared sense of purpose,” Fu said. “Seeing how hard everyone else is working motivates you to do the same.”

For SSAG leadership at NPS, learning by doing is a hallmark of their approach, exemplified by the group’s active CubeSat program where students conceive, design, build, test, launch, and operate satellites for real missions in orbit. The TIC project builds on this philosophy where the result is more than a technical achievement — it also develops the technical talent of graduates destined to be leaders in the space domain.

“Our goal is to educate our students to understand space fundamentals, apply this knowledge to real-world problems, and inform the fleet on how space affects the users of these assets,” Lan said. “Regardless of where our graduates go for their next tour, they hit the ground running and

are able to contribute meaningfully."

Graduates from the TIC team are already transitioning into their new roles across operational commands and advanced training pipelines, bringing with them the collaborative skills they developed at NPS. Meanwhile, the TIC payload moves closer to deployment on the ISS, representing more than just a technological milestone, but also a collective accomplishment.

For the students, the most memorable aspect of the project wasn't any single component or breakthrough. It was the experience of working together. "Seeing all the pieces come together into a single system was incredible," Fu said.

Neri echoed that sentiment.

"We had a phenomenal team," he said. "Everyone was dedicated, everyone cared, and we were all working toward something bigger than ourselves."

That spirit of collaboration, built in classrooms, labs and meeting rooms across campus, is what ultimately made the TIC project possible. And as it prepares for launch, the payload carries with it a clear message ... At NPS, teamwork isn't just part of the process — it's the driving force behind innovation.

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