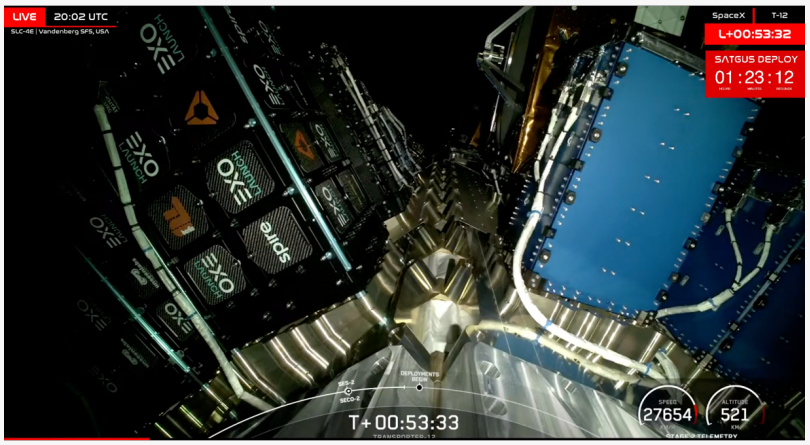
NPS’ Latest CubeSat Launch Furthers International Collaboration in Space

The second of two NPS CubeSats blasted-off in a SpaceX Falcon 9 rocket from Vandenberg Space Force Base on Jan. 14, 2025 and was successfully deployed.

MONTEREY, CA, UNITED STATES, January 24, 2025 /EINPresswire.com/ -- The Naval Postgraduate School (NPS) has once again boldly gone into low Earth orbit, where its faculty and students’ research will impact the national security of the nation and its allies.

A SpaceX Falcon 9 rocket launches the Transporter 12 mission from Vandenberg Space Force Base on Jan 14, 2025. Its payload includes Otter, a Naval Postgraduate School CubeSat.



A SpaceX Falcon 9 rocket deploys the Naval Postgraduate School CubeSat, a partnership with National Reconnaissance Office and New Zealand's military.

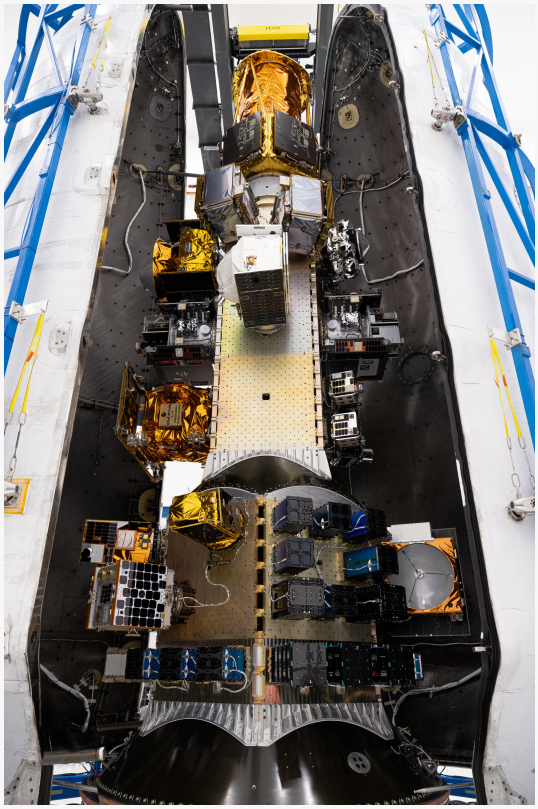
At 11:09 a.m. PST, Jan. 14, the National Reconnaissance Office (NRO) - in partnership with NPS and the New Zealand military’s Defence Science & Technology unit (DST) - launched Otter, an NPS CubeSat suite aboard the commercial SpaceX Falcon 9 Transporter 12 rocket from Space Launch Complex-4E Vandenberg Space Force Base in California.

Its mission: to explore new technological developments and experimental concepts to operate in an increasingly complex space environment.

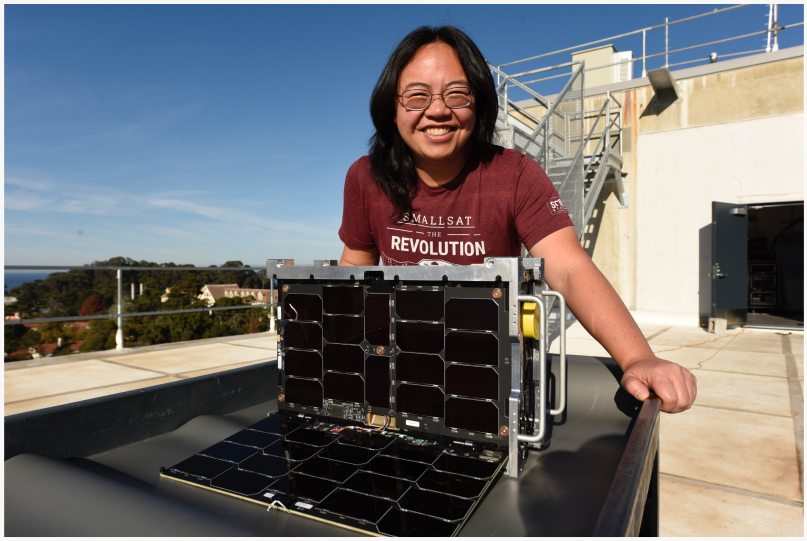
The Otter launch occurs at a time of an upswing in space technology investment, particularly in the commercial sector. As NPS leans in on partnering with commercial entities in all Naval Science and Technology Focus Areas, the Otter spacecraft is a prime example of the benefits to

its students from these relationships, noted Dr. Wenschel Lan, interim chair of NPS' Space Systems Academic Group (SSAG), an interdisciplinary academic association serving as the focal point for space-related research at the university.

"In working with our commercial vendors, we have lessons learned that we continue to share with our students – from acquisitions, to spacecraft integration and testing, and spacecraft operations – that are relevant and representative of both the successes and challenges for the aerospace industry," she said. "In gaining first-hand knowledge and experience with a space mission life cycle through these types of opportunities at NPS, our students are better prepared to serve as Space professionals in the Navy, throughout the DOD, and beyond."



The payload section of the SpaceX Falcon 9 rocket with the Naval Postgraduate School CubeSat, and more 100 other small satellites.



Dr. Wenschel Lan, interim chair of the Naval Postgraduate School, Space Systems Academic Group poses with the Otter CubeSat.

Two hours after the rocket's successful launch and Otter's separation, Dr. Lan and her team were huddled in NPS' Space Operations Center (SOC), the university's heart for interacting with space assets.

As the satellite arced across Canada into the Northern Pacific 515 km above the earth, the team prepared to make first contact.

"We're tracking!" exclaimed Alex Savattone, SSAG faculty associate for research involved with the daily management of the CubeSat missions, as the satellite's beacon came into focus.

Word reached the office of then 78th Secretary of the Navy, Carlos Del Toro, himself an '89 NPS alumnus with a master's in Space Systems Engineering, who offered his congratulations.

“Well done to the NPS student-faculty team and all the partners involved,” Secretary Del Toro said. “The strength of NPS’ innovative space education program is a force multiplier, impacting critical talent development needs and shaping future technology concepts.”

Several days later, the Otter team tracked down the orbit plane, transmitted several commands, and the data began streaming to the NPS SOC: good status confirmed.

U.S. Navy Lt. Jibri Kea (left) and Kurt Heyde (right) configure tracking software for telescope to follow the Otter CubeSat to test optical communications to a ground station.

While NPS is known for having the most alumni of any graduate school become astronauts, NPS also has a strong history in developing standardized and modular nanosatellites such as CubeSats, which have many benefits over costly traditional satellites. Beginning with the NPS Petite Amateur Navy Satellite (PANSAT) launched into low Earth orbit (LEO) in 1998 aboard the shuttle Discovery, the NPS program evolved into CubeSat designs and launchers, now commonly used by commercial providers. Made up of 10 cm x 10 cm x 10 cm cubes called units (U), CubeSats are relatively inexpensive to design, develop and deploy payloads into orbit and are ideal for applied education and research.

Otter is a 6U CubeSat built and operated by NPS on behalf of NRO. Its primary payload, Tui, is a DST-built risk reduction platform for space-based maritime domain awareness capabilities. Two secondary payloads built by NPS, an X-band transmitter and an LED on-orbit payload (LOOP), will help develop and evaluate communication technologies and concepts of operations on future CubeSat missions.

“The NRO is always looking for innovative ways to advance our capabilities in space,” said Dr. Aaron Weiner, director of the NRO’s Advanced Systems & Technology Directorate. “This demonstrator, developed in coordination with academia and an international ally, showcases the value in rapidly qualifying low-cost, commercial off-the-shelf hardware.”

Otter is the second collaborative CubeSat mission run together with NRO and DST. The first, named Mola, launched in March 2024 with Tui’s predecessor, Korimako. Two NPS-built payloads are also manifested on Otter – an X-band transmitter and the next iteration of LOOP to continue experimenting with line-of-sight communications by using two banks of LEDs, transmitting in green and near-infrared wavelengths, that are capable of modulating light for basic messaging. More than 20 NPS students will have directly contributed to the Mola and Otter CubeSats as part

of their master's and Ph.D. research.

Both CubeSat missions are directly supported by the NPS maintained and operated Mobile CubeSat Command and Control (MC3) network, a Department of Defense-sponsored effort that began in 2011 at NPS. Since then, SSAG has cultivated partnerships with nine other tracking facilities nationwide, including three other DOD service universities, civilian institutions, industry partners, and governmental agencies. These all work together within a distributed operations network that shares tracking responsibilities via parallel ground stations.

Tui very much fits into this, according to Dr. Lan. The highly collaborative mission will provide space-based maritime awareness as well as serve as a pathfinder for policy development.

"The capability that we're developing is to add sensors in the space layer to be able to see what's going on in the water," she said. "It's not just a camera, but a lot of different phenomenologies that you can sense from space to then help paint the picture of what's going on."

The project also represents a risk reduction effort in the sense that it utilizes low-cost, off-the-shelf current technologies to explore the art of the possible.

"We're spending a small amount of money to buy down the risks so that when they actually do a full program of record, they're not going into it blind," Dr. Lan stated.

The NPS-built payloads, the X-band transmitter and LOOP projects, also employ the latest in rapidly developing commercial technology. The X-band transmitter, operating in the microwave radio region of the electromagnetic spectrum, is ideal for space communications optimized for data-intensive payloads.

The LOOP project utilizes a ground-based optical telescope to observe the LEDs on the CubeSat to evaluate how to track objects in low Earth orbit. Otter is a significant step forward toward the future goal of high-rate optical communications using the MC3 network. Now that Otter is launched, its operations will be undertaken by NPS faculty and students.

"Our operations have changed since the launch of Mola," observed Savattone. "During initial commissioning, our team manually ran each pass opportunity to check the satellite's health and troubleshoot as needed. Currently, operations are predominantly automated. Mola is provided with a schedule for executing specific sequences, such as a telemetry downlink to one of the ground stations. Today's daily operations primarily involve monitoring the health of the entire system, including ground stations, cloud resources, and satellites."

Otter also builds on lessons learned from the Mola mission, he said. "One significant lesson learned is the critical importance of having comprehensive knowledge of all subsystems. Since we procured the satellite buses from a commercial vendor instead of constructing the entire satellite ourselves, it took our team some time to understand the complexities of each system.

Mola facilitated our learning process regarding the efficient operation of Otter and served as a pathfinder for streamlining our flight operations."

"The Otter mission was a success not only in its launch, but also in the opportunities it afforded the NPS students who worked on it," said Dr. Giovanni Minelli, SSAG research associate professor and co-principal investigator for its CubeSat program along with Dr. Lan.

"Most importantly, it serves as a means of providing hands-on experience with the design, test, launch and operation of a real spacecraft to complement the theoretical coursework offered to our students," he said. "We believe practically applying lessons learned in the classroom helps cement understanding of difficult concepts and better prepares our warrior scholars for leveraging space to advance our military's priorities after graduation."

"Furthermore," Dr. Minelli noted, "the CubeSat program grants students the chance to advance technologies jointly developed by international government research institutions."

"The students get to be involved in a mission with real stakeholders, requiring the successful operation of the spacecraft, its payloads, and the supporting ground infrastructure to collect and disseminate experimental test results to our strategic partners," he said. "An ideal training opportunity, this 'rubber meets the road' process is also used for the high-value operational missions our students will work on throughout their careers."

The LOOP project is a prime exemplar of this, with both iterations spanning the Mola and Otter missions.

LOOP was originally developed for Mola by Marine Corps Maj. Dillon Pierce to address a gap in the payload manifest as part of his doctoral research at NPS. Using his education from NPS as a Space Operations Masters student, he quickly designed, built, and tested a flight-ready payload. The Marine Corps infantry officer is on track to earn his doctorate this June. His work, sponsored by the Marine Corps Warfighting Laboratory, aims to fill critical operational capability and capacity gaps, with significant anticipated impacts on future military operations.

"What I truly fell in love with was the hands-on aspect of the applied research within the SSAG," Maj. Pierce said. "Coming into the lab and being able to apply theory to real-world capabilities, such as building rockets and CubeSat payloads, is fascinating. It provided me with a deep understanding of the technical concepts learned in the classroom and demonstrated how to apply those concepts to address the operational challenges facing the military today."

Maj. Pierce is elated to see the LOOP project evolve with its second iteration for the Otter mission, which he passed on to Dr. James Newman, NPS acting provost, SSAG professor and former Space Shuttle astronaut, who was able to upgrade its capabilities to include InfraRed LEDs and higher data rates.

Work on LOOP was also carried out by Navy Lt. Charles “Chuck” Bibbs for his master’s degree in Space Systems Operations. Lt. Bibbs, currently attached to Naval Special Warfare Basic Training Command (NSWBTC), is a SEAL phase officer at Basic Underwater Demolition/SEAL (BUD/S) training in Coronado, California. Lt. Bibbs was specifically involved with the planning, preparation and execution of environmental testing for LOOP, including thermal vacuum and vibration testing, as well as the integration of the total Otter payload.

“This experience gave me an appreciation for the entire lifecycle of a payload,” he said. “Upon joining the team, I was introduced to the remarkable collaborative effort that brought this particular payload to life, and I gained a clear understanding of where my contributions fit within that timeline. It was fascinating to see how NPS works with other countries and commercial entities to drive innovation for defense purposes!”

Lt. Bibbs also commended the SSAG faculty’s excellent alignment of the department’s research efforts with course objectives. His work on Otter was conducted as course projects for the AE4831 Spacecraft Systems II curriculum in the M.S. Space Systems Operations program.

“This experience was formative because, like the military as a whole, I have a significant interest in space and would like to involve myself in those efforts in the near future,” he continued. “Additionally, by working on this project I better understand the nuances of requirements, procurements, and fielding large-scale projects. This experience provided skills that will assist me in a wide-range of military duties that do not necessarily have to be space-related.”

Maj. Pierce and Lt. Bibbs’ observations cut to the heart of NPS’ mission: to provide defense-focused graduate education, including classified studies and interdisciplinary research, to advance the operational effectiveness, technological leadership and warfighting advantage of the Naval service.

As a naval command with a graduate university mission, NPS uniquely synchronizes mid-career student operational experience and education with applied research and faculty expertise to deliver innovative warfighting solutions and leaders educated to understand and employ them.

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