LINCOLN LABORATORY
COMMUNITY OUTREACH

MIT LINCOLN LABORATORY

2024 COMMUNITY INVOLVEMENT REPORT

WHY I VOLUNTEER

> We do some pretty cool stuff at the Laboratory, and I think we get a little desensitized to that. Showing people outside the Laboratory what we do makes you appreciate the great things that go on here.
>
> – David Whelihan
> BWSI and SeaPerch mentor

> Volunteering is an experience well-described by a quote from Maya Angelou: "I've learned that people will forget what you said, people will forget what you did, but people will never forget how you made them feel." By contributing to STEM outreach, you can help students feel empowered.
>
> – Juliana Furgala
> LL EduCATE creator

> Seeing the students engage with hands-on exercises and master complex cryptographic ideas was not only personally fulfilling but also a testament to the dedication and hard work they put into class every day.
>
> – Dhir Patel
> LLCipher co-leader

> Sharing my path to my current position is important to show that careers often take winding paths, and there is no problem with that.
>
> – Emily Voytek
> Careers with Data panel member

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Melissa Choi speaks with Beaver Works Summer Institute students to field questions and hear about their projects.

A Message

From the Director

Over the past 20 years, Lincoln Laboratory has built a strong portfolio of educational outreach programs that encourage students to explore science, technology, engineering, and mathematics (STEM). These programs foster an interest in STEM among young people and help them gain confidence in their ability to tackle technical challenges. We see this outreach as vital to our nation's technological future.

Three of our most successful project-based summer programs—the Lincoln Laboratory Radar Introduction for Student Engineers (LLRISE), Beaver Works Summer Institute (BWSI), and Lincoln Laboratory Cipher (LLCipher)—engaged hundreds of high school students in hands-on experiential learning in 2024. The two-week LLRISE workshop immersed students in building small radar systems, troubleshooting, collecting data, and presenting results. The four-week BWSI program offered 430 students from across the country the chance to take one of 13 courses covering various topics, from programming robotic cars and building small satellites to transforming remote-sensing data into actionable intelligence for disaster or humanitarian response. During an intensive week of classes, LLCipher introduced students to cryptography for secure computing.

Throughout the year, our Middle School STEM program offered hands-on engineering workshops to students in the greater Boston area. Middle schoolers conducted forensic investigations, created a mechanical arm, and performed chemistry experiments, among other activities. The Summer Research Program provided a three-month internship to 231 undergraduate and graduate students. Interns contributed to Laboratory projects that complemented their academic studies. Through the Military Fellows Program, military officers pursuing graduate degrees worked alongside Laboratory staff to develop technologies important to national security.

I encourage you to look through this booklet to learn more about the many programs we offer to students at every level of education as well as the programs we support for community giving. All of these efforts are part of our commitment to serve the nation and our local communities.

Melissa G. Choi
Director

01 EDUCATIONAL OUTREACH

The Communications and Community Outreach Office develops relationships with community organizations and members, with a focus on engaging students in K–12 STEM (science, technology, engineering, and mathematics) outreach. Any Laboratory staff member is welcome to propose a topic for a STEM workshop; volunteers are recruited to help develop the material. Over the past few years, we have adapted many of our educational programs into virtual events.

- K–12 STEM Outreach
- Partnerships with MIT
- Community Engagement

K–12 STEM Outreach

Lincoln Laboratory considers science, technology, engineering, and mathematics (STEM) outreach a strategic imperative. The Laboratory leverages its relationship with MIT through collaborations between Laboratory engineers and MIT faculty, exposing students to exceptional engineering facilities and technical curricula on topics such as aerospace engineering, autonomous systems, cybersecurity, advanced design and prototype fabrication, signal processing, Earth remote sensing, and energy systems—all with a focus on U.S. Department of Defense (DoD) needs.

Lincoln Laboratory's STEM outreach is guided by the needs of the defense and national security communities and is supported by high-caliber scientists and engineers. Lincoln Laboratory's STEM program

- **Inspires students to move toward STEM careers of relevance to the national security community**
- **Engages educators through teacher training, online learning, and mentorship from Laboratory engineers**
- **Cultivates the future talent pool by welcoming upwards of 300 undergraduate and graduate students annually for internships at the Laboratory**
- **Promotes increased participation through targeted recruiting campaigns**

Left: A Laboratory volunteer helps a student use chemistry to identify an unknown substance in the forensics workshop. **Above:** At the Brookview Open House, students build Bristlebots.

Middle School STEM Program

Lincoln Laboratory's Middle School STEM program offers hands-on engineering workshops primarily for middle school students at various schools and organizations in the Boston area. Lincoln Laboratory partners with Brookview House, a shelter in Dorchester, Massachusetts, to hold STEM workshops for students who are new to STEM. In 2024, a fluctuating team of volunteers assisted with various STEM workshops at Brookview House and Lincoln Laboratory. These volunteers included Yari Golden-Castaño, Rdan Golden-Castaño, John Hybl, Peter Asuzu, Jennifer Hritz, Chiamaka Agbasi-Porter, and Daphne Maldonado.

Brookview – Open House

Lincoln Laboratory volunteers attended Brookview House's Family Open House in March to build a relationship in hopes of encouraging their greater participation over time. The volunteers offered three workshops that let kids try out engineering on a small scale. Attendees of the first workshop used Makey Makey kits to create games with Scratch programming; kits could be programmed to play a maze game, a piano, or a Super Mario–like game. In the second workshop, participants created mini lightsabers by building a simple circuit that lights up a light-emitting diode (LED) at the end of a popsicle stick. Specifically geared toward younger children, the third workshop had participants build Bristlebots—small robots made by combining a toothbrush head and a vibrating pager motor. The vibrations from the pager motor travel down the bristles and cause the brush to scoot and spin on flat surfaces. Children added googly eyes and pipe-cleaner legs to make the robots look like insects.

The Middle School STEM Program has hosted **50** workshops and reached more than **300** students.

John Hybl helps a budding scientist brace for what will happen when he attaches a deflated balloon onto a bottle filled with baking soda and vinegar and shakes the contents.

Brookview – Intro to Forensics

In May, Laboratory volunteers helped 20 students discover the world of forensic science. Participants spent the day looking at hair and fabric samples under a microscope, identifying substances using chemistry, using ink chromatography to observe and analyze ink pigments on filter paper, and analyzing fingerprints. At the end of the workshop, the students used the skills and techniques that they had learned to solve a "crime" by comparing the evidence—handwriting samples, fabric samples, substance residue, and fingerprints—found at the scene of the crime.

Asuzu, a first-time STEM volunteer, was delighted to be a part of the event: "It's a wonderful opportunity to get younger students inspired about science and the scientific approach to analyzing and solving problems. What I found particularly interesting was that the problem exercises covered a wide range of aspects—fingerprint recognition, hair and fiber analysis, and substance identification—that appealed to the curiosities of the students."

Brookview – Intro to Chemistry

In May, Lincoln Laboratory volunteers guided students at Brookview House through the scientific method and different facets of chemistry. Three experiments showed the difference between fluorescence, luminescence, and chemiluminescence. Students then enjoyed hands-on experiments making citric acid art by mixing powdered food coloring with citric acid powder and baking soda. After sprinkling the powder mixture on watercolor paper, the students sprayed water on the paper. When combined, these substances start fizzing into colored foam, creating a unique piece of art that shows evidence of a chemical reaction. For the second experiment, students added baking soda into a balloon and attached the balloon to a bottle filled with vinegar. They shook the contents and watched the balloon inflate from the carbon dioxide released when the baking soda and vinegar combined.

Mechanical Arm

On November 16, Lincoln Laboratory hosted a workshop focused on mechanics. Nearly 50 middle school students recruited from Empower Yourself and Girls, Inc. assembled a mechanical arm out of cardboard by tracing a hand template and using string to move the fingers through a mechanism similar to a puppeteer controlling a marionette's limbs. Students then attached an LED strip onto the back of the arm and programmed Adafruit boards to customize the lights. Throughout the day, students were not only introduced to mechanical engineering, wearable technology, circuitry, and programming but also reverse engineering by dismantling old technology to see how it works.

Yari Golden-Castaño led the workshop and wrote code to make the arm's lights change color; she was supported by 16 volunteers from the Laboratory: Jennifer Hritz, Peijun Shao, Bich Vu, Mikayla Boyers, Juliette Garcia-Flahaut, Amelia Kestrica, Amy Fang, Bethany Lettiere, Samantha Betts, Todd Jackson, Trevor Ashley, James Clifford, Samuel Dalrymple, Dominique Edgerson, Daphne Maldonado, and Chiamaka Agbasi-Porter. The volunteers also served on a STEM pathway panel, sharing their academic and career journeys so that students could envision a path forward.

Golden-Castaño, right, shows workshop participants how to attach an LED strip and a battery pack to a mechanical arm.

Brian Fandel, right, gives interested students from Brockton a tour of the machine shop.

Empower Yourself

In November, 29 middle and high school students from Empower Yourself, a small nonprofit in Brockton that offers STEM programs, visited the Laboratory to see STEM careers in action. They went behind the scenes at the Aviation Weather Decision Support Laboratory, where Bradley Crowe explained the basics of air traffic control, the importance of good weather information, and the purpose of decision support tools. In the machine shop, Brian Fandel gave the students an up-close view of all of the different machines and explained what they do. Margarete Groll and Spencer Granlund showed the Brockton students a few examples of uncrewed aerial vehicles in the Autonomous Systems Development Facility. The final destination of the tour was the Technology Office Innovation Laboratory, where Andrew Volpe described 3D printing and showed the students many 3D-printed models. After the tours, the students discussed STEM pathways with Laboratory staff members Julian Fontes, Kesler Mathieu, Allister Azagidi, Alexandra Chin, David Langus-Rodriguez, and John Nwagbaraocha.

Team Creatos Mythos of Brockton High School operates their drone to pick up tennis balls and drop them into baskets. Photo: Union Leader

Aerospace Robotics Competition

After months of designing, building, and programming drones, students from Brockton High School in Brockton, Massachusetts, competed in the third annual Aerospace Robotics Competition (ARC) New England Regional Event at Saint Anselm College in Manchester, New Hampshire, in May. ARC is sponsored by STEM-ED, an organization that holds drone events designed to give students accessible and affordable hands-on engineering experience to prepare them for potential STEM careers. Students from schools across the country compete in challenges that test their technical understanding and applicable skills in robotics, aeronautics, and coding.

Brockton High School offers an introduction to engineering class but has no aviation or aeronautical engineering elective, so students instead turn to Empower Yourself, a small nonprofit in Brockton that offers STEM programs. Empower Yourself connected the Brockton High School drone team with Lincoln Laboratory outreach volunteers.

Laboratory staff members Johnny Worthy and David Langus Rodriguez mentored two teams of students eager to learn about aerospace dynamics and aerospace vehicles. Mentors provide technical guidance, project planning assistance, and instruction on how to design and run code on drones. After learning how to pilot their drone, students get Federal Aviation Administration certification.

Once the teams perfected their designs, they attended regional competitions to try to outperform each other at the podium and in the field. First, teams presented technical briefings to describe their vehicle, design choices, and plan for completing flight missions; then, they headed outside for a student-piloted quadcopter flight competition.

One Brockton team was outplayed at the onset; the other team won third place in the regional competition and thereby advanced to the national level. At the national competition—held in Los Angeles, California, in June—they did not place against the 12 teams competing. However, they are already strategizing for next year's event.

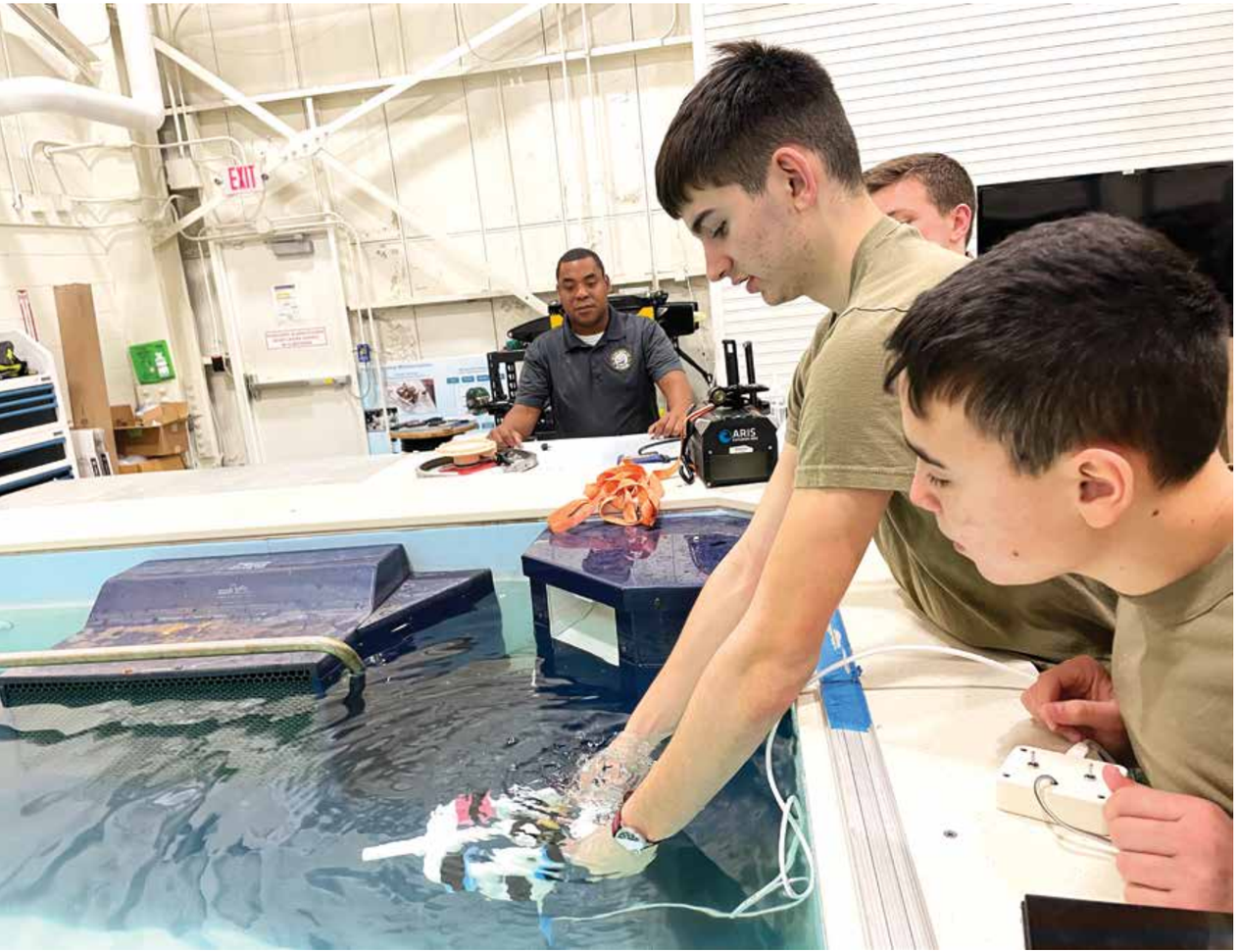
> "It's easy to get bogged down in our work sometimes and forget just how cool this job can be. Seeing kids get excited about something that we get to do every day is really refreshing."
>
> —JARED MONNIN, OCEAN SENSING DISCOVERY NIGHT VOLUNTEER

Ocean Sensing Discovery Night

In February, staff members created ocean-themed demonstrations for a STEAM [science, technology, engineering, arts, and mathematics] Discovery Night and Science Fair at Claypit Hill Elementary School in Wayland, Massachusetts. "The concept for the event [which started in 2020] originated when parents realized that the town had no science fair or STEAM-based extracurriculars at any of the elementary schools," said Janice Crager, whose children attend Claypit Hill Elementary. "Another parent and I came up with the concept of a night science fair for kids to design their own projects and present their work, and for local organizations to further inspire kids and give them a glimpse of what they could be when they grow up."

Left: Claypit Hill Elementary School's STEAM Discovery Night and Science Fair had its largest turnout this year, with around 140 families attending the event, which has since expanded to other elementary schools in Wayland. **Above:** Jared Monnin, middle, helps a student interacting with Lincoln Laboratory's passive sonar demonstration.

This year, the event organizers asked the Advanced Undersea Systems and Technology Group to put together demonstrations. Their Ocean Sensing Discovery Night featured three demonstrations: a passive sonar demonstration in which children pressed buttons triggering sounds in a fish tank, with the acoustic energy turning into a colorful spectrogram on a large display; a small remotely operated vehicle demonstration in which children made their own boats; and an uncrewed underwater vehicle demonstration in which children learned how to use the vehicles to collect data that human divers couldn't. The hands-on activities catered to both young and old children—for example, in the sonar demonstration, high schoolers learned about signal processing, while younger children made the screen change colors. "Our demonstrations were surrounded by kids for two hours straight, so I would say they were well received," said Jared Monnin.



Cadets in SeaPerch practice driving their self-built vehicles through an underwater obstacle course in the Laboratory's testing pool.

SeaPerch

High school cadets from the U.S. Naval Sea Cadet Corps Massachusetts Bay Division visited the Laboratory's testing pool once a month for seven months to prepare for SeaPerch. An international underwater robotics competition, SeaPerch challenges teams to build an underwater vehicle to maneuver through an obstacle course and perform tasks such as moving objects and opening a door.

Lincoln Laboratory started the SeaPerch outreach effort in 2023. The same staff members returned as advisors and facilitators this year. Ronald Ross, Benjamin Evans, Matthew Avison, and David Whelihan not only secured time for the cadets to use the Laboratory's testing pool but also shared their domain expertise in underwater physics and robotics engineering, and provided oversight to ensure safety. The cadets were in charge of assembling and testing their vehicles.

Whelihan said, "Working with the cadets is fun. They are motivated, organized, and respectful. I feel very lucky to be able to share my 30-plus years of engineering experience and the Laboratory's world-class facilities with them. Aside from logistics, the activity is cadet led—they define the schedule for the build events, empowering them and leading to ownership and engagement."

Ross, a career submariner himself, takes great pride in being part of SeaPerch and working with cadets and future engineers: "At our unit's graduation ceremony this past May, I was approached by a parent who told me that their son learned a great deal about systems engineering and underwater robotics by participating in SeaPerch. His experiences were a contributing factor to him selecting the U.S. Merchant Marine Academy for college."

LLCipher

The Lincoln Laboratory Cipher (LLCipher) one-week summer program annually introduces 25 high school students to theoretical cryptography. Students learn how to build a secure encryption scheme and digital signature. Time permitting, they also study some more recent developments in cryptography, like homomorphic encryption and multiparty computation, both of which enable computation over secret data without revealing those data. The class has no official prerequisites, though instructors cover some abstract algebra, number theory, and complexity theory, upon which much of theoretical cryptography is built.

Dhir Patel and Nicholas Cunningham co-led LLCipher at the MIT Lincoln Laboratory Beaver Works Center in Cambridge, Massachusetts. Other Lincoln Laboratory technical staff—including Parker Diamond, Noah Luther, David Wilson, Ian McQuoid, Hanson Duan, and Andrea Lin—served as instructors. An MIT admissions officer also spoke to the students about campus life and the college admissions process.

> "I am passionate about encouraging young students to study STEM, and LLCipher provided the perfect platform to do so. I love the challenge of coming up with intuitive ways to present esoteric mathematical ideas and make students excited to explore them further."
>
> —DHIR PATEL, LLCIPHER CO-LEADER

In their first year as co-leaders of LLCipher, Nicholas Cunningham, left, and Dhir Patel, above, used creative ways to help students understand the basics of cryptography.

On co-leading LLCipher for the first time, Patel said, "I enjoyed shaping and refining various aspects of the curriculum and activities to enhance students' experience. One of the highlights this year was welcoming two new Lab members to the teaching team and collaborating closely with them to deliver impactful lectures."

Cunningham shared why he enjoys mentoring LLCipher students: "I've been part of LLCipher since 2017. Every single year, the students amaze me with how excited they are to learn. I was glad to see every student develop their understanding over the week. I was also glad to bring in new cryptographers to share the work and joy of teaching such a wonderful class." Patel added, "It was deeply rewarding to watch these talented high school students progress from exploring classical cryptography to modern encryption methods, and to witness their eureka moments along the way."

Artificial Intelligence Outreach

Staff Create Mentoring Program for Illinois Math and Science Students

By Haley Wahl

Staff from the AI Technology and Systems Group created a mentoring program to teach high school students about AI, influence operations, and natural language processing.

Staff in the Laboratory's Artificial Intelligence (AI) Technology and Systems Group started a new program that aims to give students experience in the area of AI systems and technology.

In September 2022, a high school student at the Illinois Mathematics and Science Academy (IMSA) in Aurora, Illinois, was inspired by Laboratory work and reached out with a research proposal to work on natural language processing. Group member Courtland VanDam volunteered to mentor the student because of her enjoyment mentoring a college freshman during her PhD work. VanDam helped the student learn the basics of natural language processing. The student presented his work to the group and at the IMSA colloquium in April 2023.

Rohan Leekha, Nour Jedidi, and Tim Reid joined VanDam in mentoring three IMSA students. This year, VanDam, Leekha, Reid, and Jedidi were joined by six additional mentors from the group: Andrew Alini, Asa Harbin, Ana Smith, Adaku Uchendu, Pooya Khorrami, and Danielle Sullivan. They expanded the program to include six IMSA students; one student from William Fremd High School in Palatine, Illinois; and one local student from Billerica High School in Billerica, Massachusetts. Mentors met with the students for one hour a week to guide them through research projects. Each mentor was impressed with the students' work and benefitted themselves from the mentorship program.

"I signed up to mentor students to help them gain practical skills in machine learning and show them how it can be applied to solve exciting and meaningful real-world problems," said Sullivan. "Mentoring is about making the subject more approachable, breaking down complex concepts, and demonstrating that anyone can achieve mastery with the right support. It's also crucial to ensure that the field has strong, diverse, and capable students to continue advancing the work and drive future innovations."

"I believe that what I have learned throughout my years as an undergraduate and a graduate student is because of mentors and teachers who took time from their personal lives to help me shape my goals," said Leekha. "I see IMSA as a pathway to pay it forward by helping students achieve their goals of learning about AI and research."

RONALD ROSS

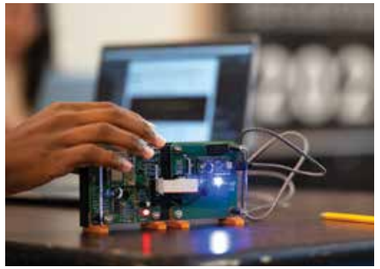
EMPLOYEE SPOTLIGHT

Which outreach activities do you volunteer for?
After a 28-year career with the U.S. Navy, I chose to focus on outreach that supports sea service members and their families. At the U.S. Naval Sea Cadet Corps, I lead 35 high school Naval Sea Cadets to help them build skills, knowledge, and confidence in both naval and civilian subjects. I also volunteer with the Massachusetts Bay Council, Navy League of the United States. In 2023, I hosted technical presentations for crew members of the USS MASSCHUSETTS about the Lab's outreach. We are expecting some applications to LLRISE next summer. In 2023, I also helped my cadets take part in SeaPerch.

Can you elaborate on the SeaPerch program?
SeaPerch is an underwater robotics competition that challenges student teams to build and race an underwater remotely operated vehicle. We held our building sessions at the Laboratory's test pool with help from my colleagues Ben Evans, David Whelihan, and Matt Avison. They presented on systems analysis and electrical and laboratory safety, and gave demonstrations on soldering. SeaPerch allowed me to share my experiences as a submariner with my cadets, a behind-the-scenes look which may help them if they choose a future in the Navy or in engineering.

What motivated you to become involved in outreach?
My children benefitted from the kindness of volunteers like coaches and chaperones who made their participation in extracurricular activities possible. I attribute their success to their home environment and the experiences offered during their youth. Volunteers are key enablers to providing meaningful opportunities for our youth, and I feel privileged to participate.

Which volunteering moment are you most proud of?
I was most proud of my cadets when they were selected in 2023 as the U.S. Naval Sea Cadet Corps "#1 unit in the country" out of 400 units across the United States. That was a testament to the quality of the cadets and adult volunteers in our unit. I came from very humble beginnings and I enjoy seeing others with similar stories given opportunities to succeed.



Above: A student tests their radar's ability to detect nearby motion, which is represented on the computer as a spectrogram. **Right:** Allister Azagidi, left, helps an LLRISE student understand what constitutes good experimental design as she develops ways to test her self-built radar.

LLRISE

Twenty-six students from across the country traveled to Lincoln Laboratory in July for an intensive two-week program introducing them to radar. The Lincoln Laboratory Radar Introduction for Student Engineers (LLRISE) challenges rising high school seniors with college-level courses in electromagnetic signal processing, radio-frequency design, pulse compression and ranging, and synthetic aperture radar. They apply knowledge gained from the lectures to build their own small radar systems while learning how to code in Python, use a soldering iron, and 3D print an antenna frame. After completing a lesson on how to use a radar and what makes a good experiment, the students work in groups to stage experiments with their radars and present their experimental results.

Laboratory instructors and assistants included Ryan Bohler, David Maurer, Peter Asuzu, Reginald Wilcox, David Scott, Andrew Volpe, Julian Fontes, David Brigada, Juliette Garcia-Flahaut, Alexandra Chin, Zachary Chance, John Lessard, and Allister Azagidi.

Alan Fenn and David Culbertson gave tours of the Flight Facility. Led by Daniel Salvucci, the participants also toured the Haystack and Millstone Hill radars in Westford, Massachusetts. A career panel lunch gave students the opportunity to ask scientists and engineers questions about college, careers, life trajectories, and job expectations. Mabel Ramirez, Yari Golden-Castaño, Qiana Curcuru, John Yirrell, Alexis Prasov, Raymundo Moya, George Pantazis, Eric Phelps, and Juliana Furgala participated on the panel.

LLRISE Spring Session

Over five Saturdays in the spring, 21 students visited the Beaver Works Center to experience LLRISE: Spring Session, an abridged version of the LLRISE summer program. Recruitment for the program focused on local schools and partner organizations such as Empower Yourself, John D. O'Bryant School of Mathematics and Science, Pioneer Charter School of Science (Saugus and Everett locations), and Excel Academy Charter Schools.

After working in groups to assemble a small continuous wave radar, students designed and performed pulse compression and ranging experiments. Ryan Bohler instructed the students in radar basics and electromagnetic signal processing, Julian Fontes explained how to code in Python, David Maurer provided the lectures on radar hardware components and radar assembly (assisted by Alexandra Chin, Peter Asuzu, Reginald Wilcox, and Allister Azagidi), and David Brigada taught the lectures on synthetic aperture radar and pulsed compression radar. Allister Azagidi helped students create good experimental design, and Roberto Martinez provided tips for writing résumés and building a LinkedIn profile.

"LLRISE Spring Session gives students a brief taste of what engineering projects look like. It's a whirlwind tour, and some students who didn't initially consider engineering come back thirsty for more," said Brigada. ▸

256 students have learned about radar from the LLRISE program over the last **12** years.

Chiamaka Agbasi-Porter, center, and other mentors assist students with their first soldering exercise.

Mentors and students participating in LLRISE Spring Break 2024 gathered at Beaver Works for all-day classes.

LLRISE Alumni Highlights

Sashan Umashankar

Before participating in LLRISE 2024, Sashan Umashankar developed a podcast that discusses opportunities in STEM. After working with mentor Julian Fontes in LLRISE, Umashankar hosted a special podcast episode with Fontes discussing this theme as it relates to working in technology industries.

Sebastian Estrada

Sebastian Estrada was so excited about his experience in LLRISE 2024 that he wanted to introduce younger students to radar. As co-president of the Science National Honor Society at his school, he developed his own radar demonstration and shared it with various groups: children at a local hospital, a school in his community, and his local Boys and Girls Club. In each demonstration, he shared the basics of radar by having children make a telephone out of cups connected by a string, helping them understand that sound waves are vibrations. Using his self-built radar, Estrada showed the children how to use pulse compression and ranging signal processing techniques. Students experimented with various objects of different shapes and materials and determined which ones would be detected at greater distances. Estrada explained, "In the radar demonstration to second graders, I explained the concept of electromagnetic waves and how range is calculated based on the time it takes the waves to travel to an object and back. I also had them make cool patterns on the waterfall plot by moving back and forth with different speeds. The children greatly enjoyed it!" ▸

DAVID BRIGADA

EMPLOYEE SPOTLIGHT

When and why did you start volunteering?
I've been helping with LLRISE since 2020. I've also been volunteering for Technical Education courses since 2018 and the Career Mentoring program since 2022, though I've been informally mentoring for quite a while now.

Why did you decide to volunteer?
I've enjoyed teaching students about engineering ever since I was an undergraduate. LLRISE is a great program in which students get hands-on experience with radar. I've gotten a lot of good advice while I've been at the Lab, and I like helping other staff grow through mentoring.

What would you like people to know about volunteering?
The Lab's Community Outreach team works very hard on managing the logistics and recruits a great group of students each year for LLRISE. The team is very open to suggestions about how my lecture is run, so I can make changes to keep the students interested and engaged while they learn.

Why is mentoring students important to you? What makes it worth the time?
There's always more need for future workers in engineering and science, and I like to do what I can to help young students explore a rewarding future career path. I'm very thankful for the team's effort; it means I can focus my outreach effort on teaching and mentoring the students, and be confident that they are eager to learn.

ROLL

Robotics Outreach at Lincoln Laboratory (ROLL) stimulates youth interest in STEM through hands-on robotics programming. Members of ROLL help sponsor robotics teams participating in regional and national competitions and supply mentors to area schools. Through the FIRST (For Inspiration and Recognition of Science and Technology) program, ROLL volunteers help children learn how to program robots to complete challenges.

FIRST LEGO League

Students aged 4–16 join FIRST Lego League (FLL) and compete in the FLL Challenge, which has three parts: the Robot Game, the Innovation Project, and the FIRST Core Values. Using LEGO MINDSTORMS technology, teams built autonomous robots that perform a series of missions. In two and a half minutes, each team attempts to complete as many robot missions as possible. Then, they have five minutes to present their solution to a real-world problem related to the year's theme. Students are judged on their demonstration of core values like creativity, inclusion, and teamwork.

This season's challenge, "Submerged," encouraged students to explore the layers of the ocean, uncovering the complexities of underwater ecosystems. Teams used their STEM skills and creative thinking to develop innovative solutions that could help protect and preserve marine environments. This exploration of the underwater world aims to inspire students to think about how their contributions can lead to a healthier planet and more sustainable communities.

Two FLL teams set up their game board and practice programming their robots to accomplish objectives relating to underwater ecosystems.

The MIT BeaverBots FTC robotics team hold up their robot in celebration of earning the Finalist Alliance Award in their rookie season with the help of their Lincoln Laboratory mentors.

This fall, Lincoln Laboratory sponsored four teams comprising 19 children aged 9–12, coached by eight mentors—Tan Trinh, Samuel Kesner, Ritesh Patel, Roger Khazan, Michael Vixamar, Jesse Linnell, Alexandru Vasile, and Swaroop Appadwedula—along with two non-Laboratory coaches and two high school students.

Judges praised the teams' accomplishments:

"Great teamwork and inclusion, very innovative autonomous solution, and a lot of fun!"

"Great job determining strategy for optimizing points versus time, involving everyone, and exploiting individual skill sets (e.g., coding versus building)."

"Very clear presentations, well-thought-out problem."

The transformative experience taught the children engineering principles, collaborative teamwork, and public speaking. They learned the importance of trial and error in design, problem solving under constraints, and effective communication of ideas. Above all, their experience in robotics cultivated a passion for STEM and innovation.

The MIT BeaverBots robotics team explains their robot design process to judges.

Kesner described the season for his team of rookies as a win: "Our team scored 180 points, exceeding what they had hoped to score on the basis of the missions that they identified. They did well on their presentation for the Innovation Project, and their coaches and families are very proud of all they learned and achieved. The team members are all excited to compete again next year."

Reflecting on the program, Khazan shared, "Mentoring these young minds has been incredibly rewarding. This Lab-sponsored outreach activity is instrumental in raising the next generation of scientists, engineers, and leaders for our nation. It directly contributes to Lincoln Laboratory's mission of advancing technology to meet critical national security needs by ensuring a pipeline of skilled and innovative professionals."

FIRST Technical Challenge

In the FIRST Technical Challenge (FTC), students aged 12–18 design, build, and program their robots to compete in an alliance against other teams. Robots are built using a reusable TETRIX platform. Teams are recognized with awards for values such as teamwork, creativity, and innovation. Last year, MIT BeaverBots, FTC Team 23708, was mentored by Stephen Li-Tyson, Hemonth Rao, and Vishal Chawla, with Jacob Huang advising the team. Under their guidance, the team won the Finalist Alliance Award, which recognizes the alliance between two teams that advance to the final match.

Li-Tyson said, "Most of the students were new to robotics, so a lot of their time was spent learning the basics and prototyping. The team was nervous at the competition because it was their first time competing, but each round built up their confidence. Before they knew it, they were in the finals. Although they ultimately lost first place, everyone had a great time and learned a lot."

This year, the season's theme, "Into the Deep," challenged students to explore life beneath the ocean surface, innovating a better world for healthy oceans. The FTC team, representing a mix of old and new students, consisted of seven students guided by head coach Vishal Chawla and supported by mentors Kelly Strus and Bich Vu. Beginning in early September, the team met weekly to design, build, and refine their robot for competition. Returning members leveraged their prior knowledge and fostered collaboration by mentoring newer members, ensuring that the team quickly gained essential technical skills. The students diligently maintained weekly activity logs and documented their design iterations and technical progress. Prior to their first qualifier competition in late December, the students addressed size and weight constraints and further refined their robot to meet all requirements.

LL EduCATE

Lincoln Laboratory Courses for Accessible, Technical Education (LL EduCATE) visits schools to help students build core engineering skills. Each course practices a hands-on engineering application for students to see how STEM topics can apply to their own lives.

The LL EduCATE team first created an Introduction to Engineering Concepts course, featuring hands-on lab activities on filtration, Clausewitzian chess, and Bluetooth technology. The course content was successfully tested in a pilot program for middle and high school students in Stoneham, Massachusetts. This course has since been made available on the MIT OpenCourseWare platform and the MIT YouTube channel, where it has received more than 13,000 views. The team hopes that the course's online presence will spread awareness of the remote-learning options that LL EduCATE can offer to students and educators. In 2023, Jeffrey Lim, Juliette Garcia-Flahaut, David Langus-Rodriguez, Juliana Furgala, Cristina Gath, Adam Kern, Brandon Luo, and David Maurer began developing their second course, Online Safety and the Internet. Focusing on the unexplored space between safe online practices and fundamental technical concepts that underlie internet use—such as cookies, HTTP and HTTPS, phishing, and passwords—the course aims to help students become informed online citizens.

This year, LL EduCATE team members Lim, Garcia-Flahaut, Langus-Rodriguez, and Furgala participated in the MassHire Greater Brockton Workforce Board's Annual STEM Career Exploration Event at Bridgewater State University, where they led an activity to teach students about Bluetooth-based proximity detection. Furgala, who led the charge to develop LL EduCATE, discussed the success of the program so far and the way forward: "Our first course achieved our goal of exploring a multiformat, accessible way of providing technical education. We've already adapted the course for weeklong events, a semester-long class, and even one-off lab exercises. Ideally, our future courses will be aligned with state standards." ▸

Students built their own Bluetooth tracker from a kit supplied by LL EduCATE and used the tracker to find "buried treasure" and understand Bluetooth signal strength.

Robert Shin, left, in a celebratory beaver-themed hat, makes his last BWSI appearance as the director of Beaver Works and transitions the role to Scott Van Broekhoven, who, donning a Beaver Works–themed shirt, provides an overview of the BWSI program.

Beaver Works

The Beaver Works Center is jointly chartered by Lincoln Laboratory and the MIT School of Engineering and located in Cambridge, Massachusetts, near MIT campus. Open to MIT students, faculty, and collaborators, the center provides flexible spaces and state-of-the-art tools to foster innovative development and fabrication work. Half of the facility is devoted to common-use activities such as prototyping, brainstorming, classwork, and open collaboration; the remainder of the space supports hands-on, project-based educational initiatives and STEM workshops such as the Beaver Works Summer Institute (BWSI) and Beaver Works Spring and Fall programs for high school students across the country. ▸

Beaver Works Leadership Transition

After serving as director of the Beaver Works Center for more than 10 years, Robert T.-I. Shin stepped down from this role. As a senior advisor, he will further enhance the impact of Beaver Works and continue to direct Beaver Works STEM education activities.

Scott Van Broekhoven will succeed Shin as Beaver Works director. Van Broekhoven has been heavily involved in Beaver Works since its establishment. He worked closely with faculty on capstone classes at Beaver Works, and recently served as the academic co-director of BWSI. He developed new concepts to expand the scope and scale of Beaver Works, and, in his new role, will have a platform for implementing these initiatives. ▸

Melissa Choi, director of MIT Lincoln Laboratory, and Scott Van Broekhoven, director of the Beaver Works Center, speak with a student about her experience in BWSI.

BWSI

To rising high school seniors, BWSI offers hands-on STEM learning through project-based courses. In 2024, BWSI—which started with a single course enrolling 46 students nine years ago—offered 13 courses serving 431 students attending virtually, in person at Beaver Works, or in person on Kwajalein Atoll.

The four-week program, hosted at the Beaver Works Center, featured a daily speaker from a leader in the field. Robert Seater, who served as one of the many volunteer teachers, said, "The students are very eager to apply everything to real problems, and knowing that they are not going to let any shortfalls or omissions slip by them keeps me on my toes."

The courses offered in the 2024 program were

Autonomous RACECAR (for Rapid Autonomous Complex Environment Competing Ackermann steeRing Robot) Grand Prix – Students explored the broad spectrum of research in autonomy and learned how to program a small-scale robotic system by applying knowledge gained in basic control systems, computer vision, sensing, perception, and elementary navigation and planning. Ultimately, they demonstrated fast, autonomous navigation in a mini Grand Prix.

Autonomous Underwater Vehicles Challenge – Students received an introduction to vehicle control, sensor integration, data analysis, image processing, and autonomy. Then, they designed, built, and programmed an autonomous underwater vehicle to navigate an underwater obstacle course, applying real-time decision-making based on feedback from onboard sensors.

Students in the Build a CubeSat course present a technology demonstration to share what they built (a small satellite that performs image processing to capture data on population change and urban development) and what they learned (programming, systems engineering, image processing, computer-aided design, and error correction).

Medlytics – Medlytics, short for medical analytics, students applied machine learning approaches to real medical problems: predicting hypothyroidism, using physiological signals to classify sleep states, and spotting cancer in mammography images. Students demonstrated a wide range of machine learning approaches, including decision trees, support vector machines, and convolutional neural networks.

Microelectronics and Hardware Development – Students were introduced to the fundamentals of hardware system design, gaining experience working with circuits, transistors, and digital logic while learning how semiconductors, microchips, lasers, and solar panels work. Using a hardware kit, participants designed and built their own unique electronic component.

Unmanned Air System–Synthetic Aperture Radar – Participants explored radar imaging, drones, and data processing by building a fully functioning radar imaging system on a small uncrewed air system. Students learned about radar and programming in order to control a commercial radar, develop and improve radar imaging software, conduct simulated data collections, and perform data analysis.

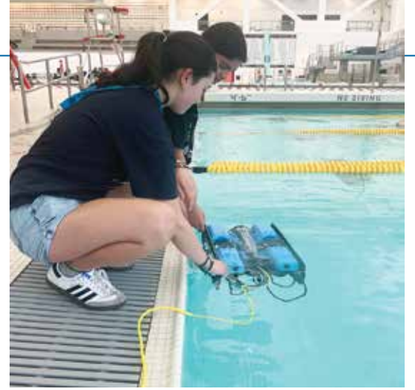
Embedded Security and Hardware Hacking – Future security engineers learned the fundamentals of computer engineering, cryptography, system security, and cybersecurity. Student teams designed and built a secure system and then engaged in an attack-and-defend-style exercise against other teams.

Cyber Operations – This course introduced students to techniques for conducting full-spectrum cyber operations, including networking, system administration, network defense, digital forensics, and malware analysis. Students touched on topics such as human factors, cryptography, software reverse engineering, and side channels and how those technologies can be applied to nontraditional computing environments, such as industrial control systems and satellites. The course culminated in a capstone project.

Quantum Software – The course took students through the fundamentals of quantum information and the concepts underlying quantum computation. Students practiced with hands-on coding exercises and were challenged to implement a quantum algorithm as a software program so it could be tested, analyzed, and run.

Basics of ASICs – In this course on open-source semiconductor design and fabrication, students made their own semiconductor devices. Students designed application-specific integrated circuits (ASICs)—devices that perform a specific function. Using a blank canvas (silicon substrate), participants followed the entire design process, including foundry manufacturability, after which, their designs were sent to a foundry for fabrication.

Students in the Autonomous Air Vehicle Racing course test their drones.



A student in the Autonomous Underwater Vehicles (AUV) Challenge submerges her AUV to test its ability to maneuver through an underwater obstacle course.

Remote Sensing for Disaster Response – This emergency management immersion course showed students how to leverage open-source information and imagery collected from drones, airplanes, and satellites to generate actionable intelligence for disaster relief. Students learned about remote sensing, image processing, network science, analysis techniques with AI, and data-based decision-making.

Serious Games Development with Artificial Intelligence – This course explored the use of serious games to better understand real-world situations such as disease spread. Students were introduced to software development, user interface design, human factors engineering, game design, and AI. Then, they developed a modification to a game and leveraged AI to investigate how a computer handles moral dilemmas.

> “Seeing the students not only succeed in their own learning journeys but also support and uplift their peers was inspiring. Their hard work and dedication to their projects, along with the creativity and energy they brought to class every day, made this experience incredibly rewarding.”
>
> — DHIR PATEL, BWSI MENTOR

E-textiles and Wearable Tech – This new course provided students with opportunities to find wearable technology applications spanning health to fashion. After learning about textile and apparel manufacturing and electronic prototyping, students created their own piece of fully functioning wearable technology.

Autonomous Air Vehicle Racing – This course examined the electrical, software, and aerodynamic characteristics of an autonomous air vehicle. After gaining experience building and debugging code using cutting-edge robotics software, students dove into computer vision and control theory and wrote code to guide the vehicle toward goals in a challenging environment.

During BWSI, Kwajalein students toured the Ground-Based Radar, guided by Mark Smith, leader of the Kwajalein Field Site.

BWSI Kwajalein

The fifth year of BWSI on Kwajalein Atoll saw participation by 24 students from high schools on Ebeye Island and the Kwajalein Junior/Senior High School at the U.S. Army Garrison–Kwajalein Atoll. In 2024, students studied the Medlytics curriculum. They spent four weeks learning how to code in Python, studying computer vision and data science, and applying this knowledge to problems in medicine. Students also explored a variety of STEAM career paths. This career exploration included visiting one of the radars located on Kwajalein Atoll and meeting the archeology team that investigates artifacts from the World War II battle on Kwajalein. The program is coordinated by Sarah Willis and taught by Christopher Edwards, Magnus Ljungberg, Steven Colello, Suzannah Riccardi, and Jordan Montgomery. The team was supported this year by non-Laboratory volunteers Andrew Strong, Nate Jones, Jenna Gray, and Kristen Schoenenberger. ▸

Kwajalein students visit an archeologist as part of a career exploration segment of BWSI.

BWSI Spring and Fall Programs

Beaver Works offered a variety of hands-on engineering courses for beginners. Completion of a course, for which no prior experience is required, is considered a stepping stone to participation in BWSI. The courses, which take place over eight weeks, are offered as a spring program, Yes! You Can! for students in grades 9–10, and as a fall program, Girls Who Can, for girls in grades 10–11. Other spring courses were offered as precursors to the summer BWSI to help students feel more comfortable with engineering concepts before applying to the summer program.

Priscilla Yao, an alumna of the Yes! You Can Design, Build, and Fly Model Aircraft course, credits the course with guiding her toward her career path: "As a high school student, I found it challenging to gain knowledge from professionals in the aerospace industry. However, this course provided an excellent introduction to the field. I gained valuable hands-on experience in building aircraft, understanding the engineering process, and exploring professional careers in aerospace engineering. This practical experience ignited my passion for testing and experimenting with aircraft, leading me to pursue a major in either aeronautical or astronautical engineering." Currently a freshman at the U.S. Air Force Academy, Yao ultimately seeks to become a pilot or engineer in the U.S. Air Force or Space Force.

Volunteers from Lincoln Laboratory and the U.S. Air Force and students from Worcester Polytechnic Institute, California Polytechnic State University, Carnegie Mellon University, and MIT taught the courses. Funded by a partnership between Lincoln Laboratory Outreach, DoD STEM, MITRE, MIT School of Engineering, and the Patrick J. McGovern Foundation, the BWSI courses offered this year were

Practical Radio – In this class taught by the MIT Radio Society, students built antennas and radios, talked on the air with ham radio operators, found hidden transmitters, communicated with satellites, and learned about radio hacking.

Program Autonomous Cars – Students started with introductory programming in Python and worked their way up to machine vision and control algorithms to code an autonomous model car.

Program Cognitive Assistants – This course provided an introduction to programming and built up to coding machine learning algorithms. Students learned the basics of AI and natural language processing to develop a computer assistant like Alexa.

Design, Build, and Fly Model Aircraft – Hands-on activities and interactive lessons engaged students in the principles of aerodynamics, propulsion, avionics, control systems, and aircraft design. Students then experimented with aircraft designs to build their own paper airplane.

Many Interesting Things for Aspiring Engineers – Students were introduced to the technologies that shape our world.

Student teams programmed a small-scale robotic system by applying knowledge gained in control systems, computer vision, sensing, perception, and basic navigation.

> BWSI gave me a space to discover the balance between being a leader and collaborator, which was an invaluable experience.
>
> —ALEXIA, BWSI STUDENT

Students in the new E-textiles and Wearable Tech course designed fabric-based prototypes to address a health issue. This student explained and is wearing her prototype.

Basics of ASICs – This course explored topics on open-source semiconductor design and fabrication. Students received hands-on instruction on how to design and arrange semiconductors on a nanometer scale to perform a specific function.

Program Racing Drones – Applying computer vision techniques and control theory, students programmed uncrewed aerial vehicles to autonomously navigate through an obstacle course.

Learn Python – Students interested in coding learned the basics of Python and got hands-on practice writing code to achieve specific outcomes.

Hydraulic Machines – Students learned about mechanical engineering and hydraulics by designing a model hydraulic mechanical arm using everyday objects.

Build a Solar Oven – Participants constructed a solar oven to understand the greenhouse effect and the power of solar energy.

Build a Pinhole Camera – Students built a camera with a tiny hole to visually explore the basic principles of optics and image formation.

Build a Disc Launcher – To understand energy conservation, students used a disc launcher kit to build a flywheel.

Build a Vortex Cannon – This course demonstrated the principles of physics and aerodynamics as students created their own vortex cannon.

Build a DC Motor – This activity introduced the basics of electromagnetism, motor design, and the conversion of electrical energy into mechanical energy.

Explore Optics Experiments – Through interactive experiments, students explored the fundamentals of ray optics, reflection, refraction, and the science behind optical devices.

3D Printing – This course introduced engineering problem-solving methods and explained how they can be applied to design and fabricate a custom tool using 3D printing.

JULIANA FURGALA

EMPLOYEE SPOTLIGHT

What outreach efforts are you involved in?
In 2020, I founded LL EduCATE, a group that develops accessible STEM courses for middle school and high school students, with a focus on underserved communities. Before that, I volunteered with G.I.R.L and BWSI.

Why do you volunteer? How does volunteering affect you personally?
Volunteering has been close to my heart since I was a kid, as a family activity and a way to engage with my local community. This experience evolved into a desire to give back to future STEM students when I encountered the teacher's assistant culture of the Department of Computer Science at Tufts University. The idea that students went on to guide others as teacher's assistants in their subsequent years was inspiring. It made computer science feel more welcoming, and, along with impactful mentors, allowed me to see myself in the field. The opportunity to instill this same feeling in other students trying to find their way is so fulfilling.

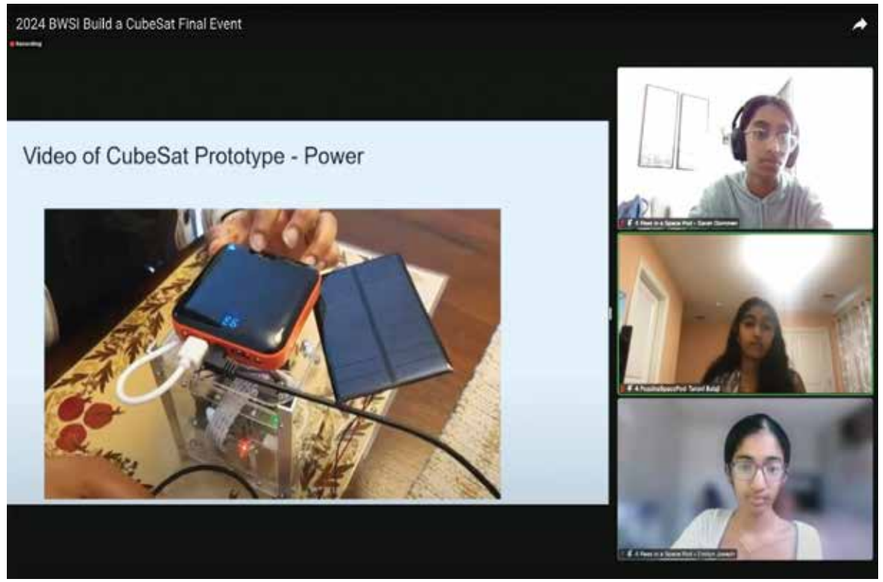
How did LL EduCATE start, what has it developed into, and where do you see it heading?
LL EduCATE began with a question: What can STEM professionals do to bridge the gap between school curriculum and real-world applications? This gap was especially of concern in 2020 because students' education was being negatively affected by the sudden switch to online learning. So we designed our first course, Introduction to Engineering Concepts, with key tenets in mind: accessibility in cost and presumed knowledge; hands-on lab experimentation; and flexibility of format and content, facilitating individual course completion and varying-length classroom visits.

These principles remain important as we develop our next course, Online Safety, which focuses on data privacy rights and data collection. The goal is to provide a technical understanding of data trails, allowing students to make informed decisions about their online interactions. I'm looking for volunteers to help me develop this new course.

Build a CubeSat Challenge

Beaver Works partnered with the American Institute of Aeronautics and Astronautics (AIAA) and the Patrick J. McGovern Foundation to provide a challenge for high school students interested in building a prototype satellite. Beginning in November, student teams met with their Laboratory and MIT mentors to learn how to develop satellite subsystems that can power and support an optical payload while analyzing data and wirelessly transmitting the results to a ground station.

The mission of this challenge was to build a CubeSat that can detect colored plastic in the ocean from space. The students worked through the end of the year, and the challenge will culminate in a final competition in March 2025. In addition to having access to the online course and weekly mentoring support, each student team received a hardware kit featuring various components: a Raspberry Pi flight computer with Bluetooth for wireless communication, a Raspberry Pi camera (the payload for the imaging mission), a battery, a solar panel, an inertial measurement unit, an acrylic and aluminum structure, a white poster board and colored acrylic pieces to image, and building and testing tools such as a screwdriver and USB power meter.



Students in the Build a CubeSat Challenge learn about different ways to power a self-built CubeSat.

MITES

During the summer, 61 students from across the country lived on MIT campus for the six-week MIT Introduction to Technology, Engineering, and Science (MITES) program. In between rigorous courses in math, science, and humanities, students were treated to laboratory tours and helpful workshops like college admissions counseling.

Mabel Ramirez presented an overview and history of Lincoln Laboratory to provide some perspective, followed by Eric Quintero describing various STEM career pathways. The students then toured the Microelectronics Laboratory, the Rapid Hardware Integration Facility, the Aviation Weather Decision Support Laboratory, the Autonomous Systems Development Facility, and the Technology Office Innovation Laboratory. Daniel Pulver, Craig Keim, Eric Statz, Bradley Crowe, Margarete Groll, and David Scott, respectively, explained each laboratory's purpose.

Crowe often speaks with the tour groups to explain the basics of air traffic control, the importance of good weather information, and the use of decision support tools. He said, "I like to ask the kids if they have ever been delayed on flights, especially if they have had to travel through New York City airports. On this tour, one of the kids asked how pilots know their flight paths, so I showed them some older FAA sectional charts. They were a big hit—all the kids asked if they could have some to take home, and I ended up handing out about 30 charts."

Left: Bradley Crowe explains how Lincoln Laboratory staff use the Aviation Weather Decision Support Laboratory. **Below:** To MITES program students, MITES alumnus Eric Quintero explains his STEM career path.

Laboratory technical staff have a long history of volunteering as judges for local science fairs.

Science Fairs

Massachusetts Science and Engineering Fair

High School Science Fair

Gillette Stadium in Foxborough, Massachusetts, was full of high school students competing not in sports but in science during the Massachusetts Science and Engineering Fair in April. At the fair, 326 students presented an impressive 250 projects (some team projects). Lincoln Laboratory volunteers May Kim, James Nowak, Jordan Wynn, and Peter Asuzu were among the 260 judges who provided invaluable feedback on seven to 10 projects each and encouraged aspiring young scientists and engineers from across the Commonwealth.

"Whenever I look over the projects and speak with students, I am, without fail, impressed by their creativity and intelligence, which continually renew my hope for humanity!" said Kim, who has been volunteering as a science fair judge for six years, including the past three years at the Massachusetts Science and Engineering Fair.

Middle School Science Fair

In May, the Massachusetts Science and Engineering Fair for middle school was held at Worcester Technical High School in Worcester, Massachusetts. Fair organizers recruited scientists and engineers from across the state to evaluate seven to 10 projects each and ask students questions about their project. Lincoln Laboratory staff who served as judges in their respective field of expertise included Rituparna Basu, Kerri Prinos, Amy Alexander, Judith Reilly, Jessica Weaver, Peter Asuzu, Tristan Carlson, and Yeray Pabon Gonzalez. In total, almost 100 judges reviewed 190 projects completed by more than 260 students.

"I was interested in volunteering at the Massachusetts Science and Engineering Fair to encourage young students and make them aware of how their projects relate to careers in STEM," said Carlson. "One middle school student had an impressive experimental setup to generate piezoelectricity using sugar. The student was surprised to hear that piezoelectricity is used in nanopositioners in precision optical systems."

A PCSS student waits to present her science project to judges at the 17th Annual Science and Engineering Fair. Photo: Saugus Advocate

> "I'm proud of the Laboratory's extensive support to this science fair, inspiring the next generation of Apollo 13 engineers. That's why I volunteer every year!"
>
> —ANDREW HEIER, PIONEER CHARTER SCHOOL OF SCIENCE SCIENCE FAIR JUDGE

Pioneer Charter School of Science Annual Science and Engineering Fair. The Pioneer Charter School of Science (PCSS) is a public charter school network with campuses located in Everett and Saugus, Massachusetts. Their mission is to provide students with the science and engineering skills needed to be successful in college and contribute positively to their communities. In February, PCSS I in Everett, Massachusetts, and PCSS II in Saugus, Massachusetts, hosted the 17th Annual Science and Engineering Fair.

For the fair, Lincoln Laboratory provides judges to review science projects and hosts several demonstrations for parents and students in attendance. This year's theme, "New Ways to Solve Problems: Science, Engineering, and Artificial Intelligence," was addressed by more than 300 students pursuing 175 projects such as predicting forest fires using AI, building robots to assist with medical needs, and studying the effects of social media and technology on concentration and learning.

The science fair is a culmination of student work that begins at the start of the school year. Students in grades 6–12 at PCSS participate in the preliminary competition in December. The top 40% of students are then selected to compete in the February science fair. Fifty volunteers and judges from the New England area participated, including those from Lincoln Laboratory, Yale University, Boston University, and industry. Laboratory staff serving as judges included Andrew Heier for the Middle School Science Fair on February 1 on the Saugus campus, and Kathryn Cruz, Yeray Pabon Gonzalez, and Allan Rodas for the High School Science Fair on February 2 on the Everett campus.

A student scientist meets with her mentor for advice on her project. Photo: One8 Applied Learning Hub

"Growing up, I didn't have a science fair offered by my primary schools," said Heier. "So, three years ago, I seized the chance to help judge the PCSS Science and Engineering Fair and support middle school scientists. The event transforms the gymnasium into a lively hub, buzzing with the excitement of hundreds of voices and the distinct smells of various experiments. Each project reflects a solid understanding of scientific or engineering principles, crafted largely at home with materials sourced by the students and their families. The highlight of my day of volunteering was hearing students proudly share how they salvaged parts from old appliances or repurposed recycled materials to build innovative prototypes or test challenging hypotheses. I'm proud of the Laboratory's extensive support to this science fair, inspiring the next generation of Apollo 13 engineers. That's why I volunteer every year!"

Lincoln Laboratory offered science demonstrations during the Middle School Science Fair. Sigrid Flender, Chiamaka Agbasi-Porter, and Daphne Maldonado taught participants about electrical currents, material conductivity, and circuitry. Then, students could use Scratch and a Makey Makey board to turn celery into a piano, or create a Super Mario-like game using dinosaur-shaped Styrofoam as the controls. Joel Grimm and Lisa Kelley let students try their hand at recreating a picture using tanagrams—a dissection puzzle consisting of flat shapes that can be put together to form a picture. These demonstrations were repeated at the High School Science Fair, and demonstrations with radar and racecars from BWSI were also included.

Student-Industry Comments Science Fair. For one week in April, One8 Applied Learning Hub (formerly Mass STEM Hub) hosted Student-Industry Connects, a new breed of science fair program that provides a transformative learning experience for K–12 students across the United States. One8 Applied Learning Hub is an educational administration organization that works alongside K–12 schools to provide applied learning and STEM programs developing students' critical thinking, complex problem-solving, and collaboration skills, which are crucial to their college and career success in a rapidly changing world.

In Student-Industry Connects, middle and high school students submit a computer science, engineering, or biomedical science project that solves a problem. They share their ideas with industry mentors, who submit constructive feedback for improvement and reinforce in-class learning, offering a glimpse of how industry solves real-world problems. Student-Industry Connects provides an easy way for students to show off their hard work to an authentic industry audience—a connection that helps make coursework more motivating, engaging, and meaningful. Getting input from "real pros," as one student put it, helps students sharpen their technical and professional skills, and offers priceless encouragement and motivation.

Lincoln Laboratory staff—including Tara Canny, John Cho, Kathryn Cruz, May Kim, Jordan Wynn, and Keith Hinrichs—virtually reviewed proposed projects from local classes and helped approximately 70 students in only three hours. The volunteers also shared insights about their career path and profession.

About their Laboratory mentor, May Kim, Team Reese said, "We took her advice in all projects, such as adding captions to the design process pictures and making sure that the code is big enough to read! We were happy to hear her job description. She answered all of our questions and helped us learn more about possible career paths. Overall amazing feedback!"

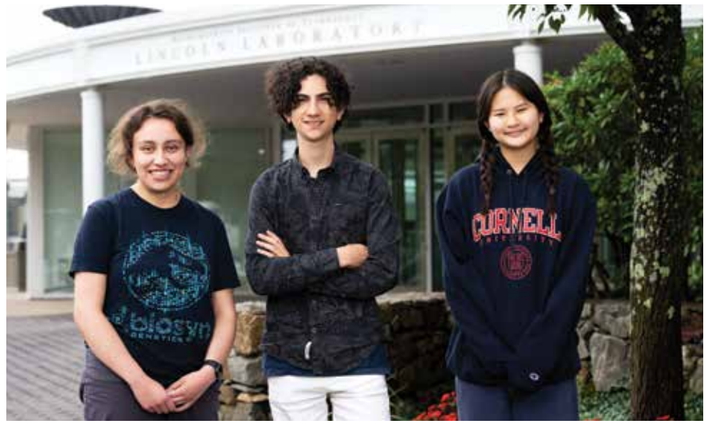
Pioneer Charter School of Science Speaker Series. Annually during Massachusetts STEM Week in the third week of October, PCSS hosts a speaker series. The primary demographic of PCSS is first-generation Americans who will become first-generation college students, and the speaker series aims to empower students to pursue STEM subjects.

During hour-long seminars, students engaged with STEM professionals from Lincoln Laboratory, Boston University, Harvard Stem Cell Institute, Tufts University, and Massachusetts Eye and Ear and learned what it is like to work in technical fields. Representing the Laboratory, Thomas Sebastian spoke with approximately 60 students in grades 9–12 about his work on advanced designs and concepts in aerodynamics and propulsion, his pathway to STEM, and his deployment to the Laboratory's Kwajalein Field Site. Past speakers have said this volunteer effort is a favorite because of how engaged and enthusiastic the PCSS students are during the discussions.

National STEM Festival. The National STEM Festival fosters creativity, critical thinking, and a passion for STEM among middle and high school students. Presented by EXPLR, this event is a key initiative to promote STEM education and careers, advancing excellence for all students.

From September through December, virtual judges from across the nation evaluated student projects, providing feedback to help determine which students would be selected to present at the National STEM Festival in Washington, D.C., next March. Thomas Sebastian reviewed the engineering design process applied to projects.

Thomas Sebastian talks to PCSS students about aerodynamics and propulsion.



High school students Mellanie Rodriguez, Drew Michaeli, and Anna Wang, left to right, interned at Lincoln Laboratory from mid-July through mid-August 2024.

Student Internships

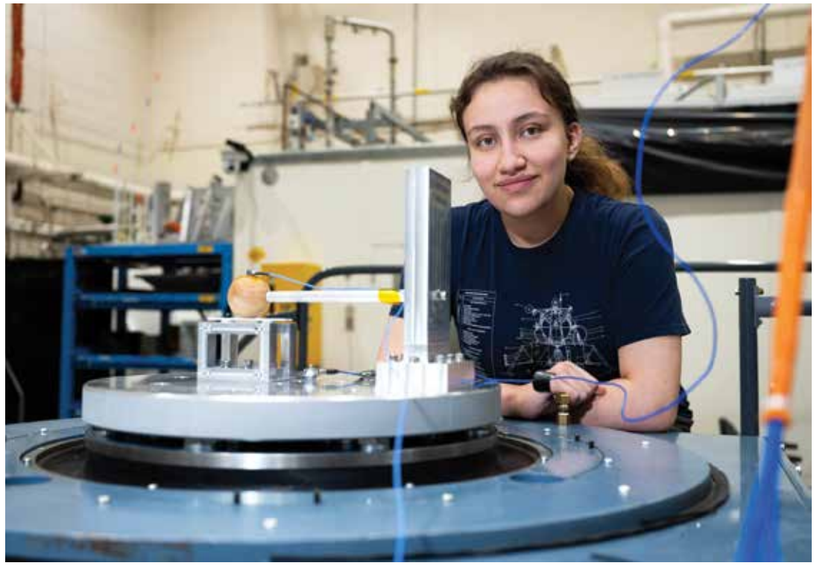
High School Internship Program

In 2022, the Laboratory officially extended its internship program beyond undergraduate and graduate students to high school students, providing them with an opportunity to work with staff on research projects and explore STEM careers. In 2024, three high school students interned in the Advanced Concepts and Technologies Group, Fabrication Engineering Group, and Control and Autonomous Systems Engineering Group.

This year's program was coordinated by Chiamaka Agbasi-Porter, Daphne Maldonado, and Cheryl Bartolone. "The Summer High School Internship Program provides a unique opportunity for rising seniors who live and attend high school in the New England area to experience and explore STEM careers before committing to an area of study in college," said Bartolone. "Paired with Laboratory staff mentors, local high school students learn and apply crucial technical and interpersonal skills in a hands-on, professional environment. This internship program helps create a strong pipeline for hiring top talent to support the mission at the Laboratory."

Intern Mellanie Rodriguez was mentored by Bethany Lettiere in the Fabrication Engineering Group to create an auditory demonstration of how systems with different masses produce different natural frequencies. "Being at the Laboratory was not something I thought was possible before I went to college, and I'm incredibly grateful for the people who gave me the chance to spend part of my summer in such an amazing place," said Rodriguez. "Working on national security seemed intimidating, but I found the opposite was true; Lincoln Laboratory is full of enthusiastic and very friendly people."

As a mentor, Lettiere found the program to be equally rewarding: "This mentoring experience was unique compared to my typical experiences as a mentor because my mentee is in high school, not in college or elementary school. She is approaching the significant next step of applying to colleges and considering what field to major in. I worked to provide her with something that I wished I had prior to college: an opportunity to see the different fields of engineering at the Laboratory. She heard from scientists with different backgrounds who shared what their career journey looked like—and I learned a lot about my colleagues in the process!"



Intern Mellanie Rodriguez learned various engineering skills to design an instrument that demonstrates the different frequencies produced by different masses.

Kristan Tuttle in the Advanced Concepts and Technologies Group based Anna Wang's internship around creating, communicating, and measuring real signals. For Wang, this internship expanded her professional goals: "I've been interested in computer science, neuroscience, and psychology. However, after these six weeks, I realized that I also want to incorporate engineering into my studies. Not only are there more hands-on experiments, but also I can apply my love for math to solve real-world problems. Therefore, I plan to pursue a major that combines all of these interests, such as neuroengineering."

A large part of the mentors' motivation to accept a mentee for the summer stemmed from their own experiences with mentorship in the early stages of their career and the desire to pay forward the guidance they benefited from. "As a first-generation college graduate, I didn't know what to expect when I started my journey through college," said Lettiere. "Through fantastic friends and mentors, I developed confidence, engineering and research skills, and the ability to navigate through the unknown territory of college applications. Through mentorship, I hope to provide similar opportunities to help the next generation of young scientists and engineers understand different fields and how to approach problems." ▸

AFCEA Student Intern

The Armed Forces Communications and Electronics Association (AFCEA) internship program arranges summer internship opportunities for graduating high school seniors interested in STEM careers. Lincoln Laboratory accepts one to two students as paid interns in a variety of disciplines, such as engineering, chemical and biological defense, optical systems technology, advanced sensor techniques, electrooptical systems, and weather sensing. During their internship at the Laboratory, they tour facilities, hear about the latest research, and get exposed to different technical career choices.

High school graduate Riley Harn interned this year in the Laboratory's Mechanical Engineering Group. Harn, who graduated from the Massachusetts Academy of Math and Science at Worcester Polytechnic Institute, was one of 40 students selected for this year's AFCEA internship program.

Under the mentorship of Rob Reeve, back, Riley Harn applied her knowledge of coding to solve challenges for the Mechanical Engineering Group's 3D-printing laboratory.

Harn's task during her internship was to optimize a 3D printer housed in one of the Mechanical Engineering Group's laboratories. She wanted to figure out how to automate the printer's cost-management system. Because multiple users share the printer to make parts for their prototypes, mapping each charge number to its associated print job was difficult. Before Harn tackled the problem, group staff members manually kept track of printing costs, which was time consuming and tedious. "You could see how much filament somebody used, but it's a lot easier to set the printer up so that the charge number automatically goes with the print job," Harn says.

"It was during Riley's approach to this problem that we discovered her extensive programming skills and tenacious drive to solve her way through the various coding, network communication, and information security–related impasses that she encountered along the way," says Rob Reeve, Harn's mentor in the Mechanical Engineering Group.

By the end of her internship, Harn built a cost-management software that communicates directly with the 3D printer to track the type and quantity of materials used for a print job. The software then sends emails to users to request cost-assignment information, and automatically produces cost-assignment reports on a biweekly basis, greatly streamlining 3D-printing jobs. "I had coded in Python before, but this coding was next-level Python. Connecting over the printer and getting data from the printer was definitely challenging," Harn says.

In addition to improving the Laboratory's prototyping processes, Harn left her internship with new skills that she believes will be useful for future academic and professional settings. Harn says, "I'm grateful to Lincoln Laboratory and AFCEA for making this experience possible."

STEM Career Exploration

Bridgewater State University

Members of the Laboratory's LL EduCATE and Beaver Works teams volunteered at the MassHire Greater Brockton Workforce Board's 13th Annual STEM Career Exploration Event in March. This event was organized for high school students who are interested in STEM. More than 120 high school students from 14 different schools in the Brockton and South Shore areas attended the event at Bridgewater State University in Bridgewater, Massachusetts.

LL EduCATE develops lessons for middle and high school students by curating and organizing STEM materials around common core topics. For this event, the LL EduCATE team led an activity called "Bluetooth Bandits." This activity aimed to teach students about the concept of Bluetooth-based proximity detection through a hide-and-seek-style game with a small development board. While explaining the game, the Laboratory volunteers touched on the physics of radio-frequency propagation and provided real-world examples of phone-to-phone Bluetooth chirp communication like the "Find My Device" feature. Later in the day, the team participated in a panel on which they answered questions related to STEM career paths and discussed how diversity can be introduced into STEM careers.

Volunteers for the outreach event included LL EduCATE members Juliette Garcia-Flahaut, Juliana Furgala, Jeffrey Lim, David Langus Rodriguez, Chiamaka Agbasi-Porter, and Daphne Maldonado. "I'm grateful to the outreach office for providing opportunities for staff to give back to the community," said Garcia-Flahaut. "With more events like these, I hope that we can encourage students to explore and be curious about potential careers in STEM."

At the STEM Career Exploration Event, Beaver Works also hosted a booth to expose a new generation of students to opportunities in engineering, research, and service to the nation and world.

David Rodriguez helps students understand how Bluetooth technology works at the 13th Annual STEM Career Exploration Event at Bridgewater State University.

The Beaver Works team—Joel Grimm, Lisa Kelley, and Sigrid Flender—ran a wind-turbine demonstration that challenged the students to create their own replica of a wind turbine. Students cut turbine blades out of cardstock in various shapes, modifying and testing their design to see if they could increase the voltage generated when the turbine was exposed to wind. "We saw heart-shaped propellers and curly, thick, thin, big, and small ones all get tested," said Grimm. "The students learned that it was okay to fail and try again and again, and how to experiment in a way to get better performance."

When MassHire repeated this event in October during Massachusetts STEM Week, Grimm, Kelley, and Flender repeated the wind-turbine demonstration, while Yari Golden-Castaño and Justin Lin led circuitry activities—namely, creating a wired circuit to power a 3D-printed flashlight.

David Le Sage and Stephanie Fried, each standing to the right of their mentee, mentored two Kwajalein High School students, Justin Pace and Avery Acosta, building a tree-climbing robot.

High School Independent Study

Justin Pace and Avery Acosta, two students at Kwajalein High School, participated in a one-semester independent study course advised by Lincoln Laboratory staff David Le Sage and Stephanie Fried in fall 2024. The students chose a STEM research topic that interested them: building a robot that could climb a coconut tree. After receiving three months of mentorship and coming up with several design concepts, the students built a simple robot using a Lego robotics kit and tested their selected design concept.

The students demonstrated that a wheeled robot could climb a tree if the frame holding the wheels was under sufficient tension to grip the tree and if the motors had sufficient torque to pull the weight of the robot up the tree.

Le Sage said, "The project was a partial success. It turns out that the motors in the LEGO robotics kit did not have sufficient torque to pull the full weight of the robot up the tree, but the robot could climb up and down part of the tree if some of the weight of the robot was supported by the students."

Astronomy on Kwajalein

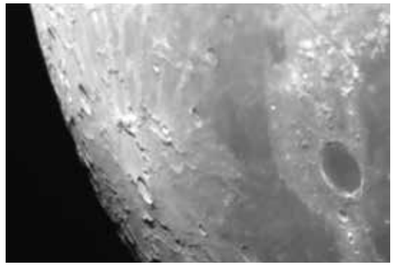
As part of the "Talks on the Rock" educational series, several Kwajalein staff members—including Suzannah Riccardi, Jordan Montgomery, Charles Wynn, and Sarah Willis—delivered the first Community Astronomy Night on Ebeye Island, the neighboring Marshallese community just down the atoll from Kwajalein. In January, the team spoke to dozens of people on Ebeye about astronomy and the great journeys that humans have taken into space. Willis summarized a variety of space missions from the past, noting the first trip, the farthest trip, and major discoveries. The team also described upcoming launches and space science missions, focusing on the new era of space exploration and encouraging young participants to set out on their own journey of exploration to learn about the universe. Each talk ends with a chance to view the night skies through a telescope. In January, attendees saw the Moon, Saturn, and Jupiter. The event sparked a lot of interest in the community because it was the first time that most of the Ebeye students had used a telescope and seen the surface of the Moon and the planets.

Space Week on Kwajalein

In December, NASA astronauts Nick Hague and Suni Williams, from the International Space Station, held a 20-minute question-and-answer session via video with Kwajalein students. Questions that the astronauts could not get to in time were answered afterward by U.S. Army Garrison–Kwajalein Atoll Commander Col. Andrew Morgan, who is an active NASA astronaut.

Bolstered by the opportunity to talk to astronauts, the Kwajalein School System developed a first-ever weeklong event focused on learning about space. The resulting Space Week brought together local STEM resources to inspire students across the atoll.

More than 200 students—nearly the entire school system plus home-schooled students—enjoyed tours of Lincoln Laboratory's Ground-Based Radar. The tours brought students into the radome and onto the radar platform while



Children of Ebeye excitedly gather around a telescope to see their first glimpse of the surface of the Moon during Community Astronomy Night in January.

Laboratory staff stationed on Kwajalein provided radar tours, seminars, and hands-on demonstrations during Space Week.

Thomas Sebastian uses a self-built Lego-based closed environment with adjustable pressure to show Space Day attendees how a drone might fly easily in Earth's atmosphere but struggle to stay aloft in Mars' atmospheric pressure.

staff explained how the radar works and how the Laboratory uses radars to keep track of satellites and space debris. Reagan Test Site Range Director Lt. Col. Casey Rumfelt joined a few of the tour groups to talk with the students about the mission on Kwajalein and to encourage them to pursue STEM careers. Laboratory staff rounded out Space Week by offering classroom learning sessions on orbital mechanics and other radar topics, followed by water-bottle rocket demonstrations.

Adam Gjersvik said, "Having the entire Kwajalein School System visit as a part of Space Week was a thrill. We really enjoy connecting the broader island community with the mission on Kwajalein. Talking with students during Space Week about how the Ground-Based Radar can observe objects flying in space was an excellent way to do that."

MIT Museum Space Day

The MIT Museum hosts Space Day each year during Massachusetts Space Week. Held during April vacation week for Massachusetts public schools, Space Week is a community effort among space experts across the state that aims to make space science accessible to all. This annual, weeklong celebration seeks to foster a shared enthusiasm for space science through engaging activities such as a film festival, career fair, and more than 20 space events statewide.

MIT Museum joins in the fun by hosting space-themed talks, demonstrations, and activities that are free with museum admission. This year's talks covered topics including black-hole echoes, moonwalk navigation, and rules governing space activities. Lincoln Laboratory and Brown University co-hosted a talk, "Flying Helicopters on Other Worlds," describing how NASA's Ingenuity Mars Helicopter achieved the first powered, controlled flight on another planet and completed 72 flights before its mission ended in January 2024. Thomas Sebastian from Lincoln Laboratory and Sam Birch from Brown University spoke about the challenges of flying rotorcraft in conditions different than those on Earth. They explained NASA's Dragonfly mission, which aims to launch an octocopter-mounted flying laboratory to Saturn's moon in 2028, and then led a Lego demonstration depicting the complexities of flying on another planet.

Lincoln Near-Earth Asteroid Research

Children Name an Asteroid After Japanese God

By Nathan Parde

The Children's Selection Committee that helped name the asteroid consisted of nine elementary and junior high school students from the Young Astronauts Club of Japan and the Children, Space, Future Association. The students' acceptance to the committee was based on an application and essay.

In 1998, in collaboration with the U.S. Air Force and under NASA sponsorship, the Laboratory formally initiated the Lincoln Near-Earth Asteroid Research (LINEAR) program. LINEAR's goal is to apply technology originally developed for the surveillance of Earth-orbiting satellites to the problem of detecting and cataloging near-Earth asteroids—also referred to as near-Earth objects (NEOs)—that might threaten the Earth. All discoveries and observations of asteroids and comets are reported to the International Astronomical Union's (IAU) Minor Planet Center at the Smithsonian Astrophysical Observatory. The Minor Planet Center is responsible for verifying, designating, and calculating the orbits of all known minor planets and comets, and is the official archive for these data.

"As part of the Congressionally directed NASA effort to find one-kilometer and larger NEOs, LINEAR was incredibly successful," said Grant Stokes, principal investigator of the LINEAR program. "In fact, LINEAR has discovered more one-kilometer and larger NEOs than any other asteroid search program, and, since most of them that exist have now been discovered, that record will stand."

The LINEAR program has discovered hundreds of thousands of minor planets, mostly in the main asteroid belt between Mars and Jupiter. Of those, more than 150,000 objects have been confirmed as LINEAR discoveries by the IAU and formally numbered, which makes them eligible for naming. LINEAR has also discovered 2,680 near-Earth asteroids.

As the discoverers of these NEOs, the LINEAR team can propose names for their discoveries, which often have been named under the Ceres Connection program in honor of science students and mentors. For the latest asteroid to go through this process, the LINEAR team accepted a request from the Japanese Hayabusa2 extended mission team to collaborate on a naming campaign in which Japanese school children could propose names with a mythological origin. That asteroid was named Ryugu. For this next asteroid requiring naming, the LINEAR team once again collaborated with Japanese parties.

An artist depicts the Hayabusa2 spacecraft passing near Earth. Image: Japanese Aerospace Exploration Agency

Previously identified as (98943) 2001 CC21, the asteroid in question was first discovered by the LINEAR team on February 3, 2001. Approximately 60 names were proposed during the 2001 CC21 naming campaign, which ran from December 6, 2023, to May 9, 2024, with assistance from the Children's Selection Committee, whose nine members consisted of Japanese elementary and junior high school students.

Selection committee members were asked to choose the most appropriate name based on the knowledge they had gained of the forthcoming Hayabusa2 flyby mission. In July 2026, the Hayabusa2 spacecraft will fly by the asteroid at an ultrahigh speed of 5 km/s, getting as close as possible to the asteroid and allowing for imaging at high resolution. After a lively discussion, the committee selected the name Torifune, which is a reference to the Japanese mythological god Ame-no-Torifune, who, lore states, rides upon a ship that can travel safely and steadily at high speeds. During the naming campaign, 10 people had proposed either Torifune or Ame-no-Torifune for the asteroid's name.

Following the naming campaign, LINEAR team members proposed the chosen name Torifune to the IAU. After a review by the IAU, the new name was officially announced on September 23, 2024. Today, the LINEAR team consists of Laboratory staff Arthur Lue, Jenifer Evans, John Vaillancourt, Zoe Clark, Deborah Woods, Antonio Ruscitti, and Stokes. "The naming of Torifune has been a good story of international collaboration between the Laboratory, the Hayabusa2 extended mission team, and the elementary and junior high school students of the Children's Selection Committee," said Stokes. ▸

Eric Evans and Melissa Schoenfeld brought their respective Scout troops to the Haystack Radar in November to learn about radar.

Scouting at Lincoln Laboratory

The Scouting at Lincoln Laboratory outreach team encourages the natural curiosity of youth members about STEM through activities, educational outreach, and STEM-based merit badge support.

Electricity Merit Badge. Eric Evans—Director Emeritus of Lincoln Laboratory, Laboratory Fellow, and MIT Professor of the Practice—helped Troop 135 from Carlisle, Massachusetts, learn about electricity and how to respond to electrical emergencies. In pursuit of the Electricity merit badge, the Scouts learned about electromagnetism and electrical components. Evans explained how static electricity is generated, how charges accumulate on a surface, and how like charges repel each other. He also demonstrated how a Van de Graaff generator can create very high voltages with low discharge current. Evans, who serves as the Scoutmaster for Troop 135, enjoys volunteering with Scouting America: "I grew up as a Scout, and it really helped me to develop a love of the outdoors and to understand the importance of service."

Haystack Radar Tour. Evans arranged a tour of the Haystack Radar in Westford, Massachusetts, for Troop 135 and Girl Scout Troop 70538 from Concord, Massachusetts, whose Troop Leader is Melissa Schoenfeld. The Scouts learned how radars work and observed the 120 ft dish antenna in motion within the Haystack radome.

STEM Fest. Every April, the Girl Scouts of Eastern Massachusetts host STEM Fest, an event held at Camp Cedar Hill in Waltham, Massachusetts, during school vacation week. This premier regional STEM event offers all Girl Scout levels the chance to engage in STEM activities and meet STEM professionals.

In September, Eric Evans, far right, helped Troop 135 explore what a Van DeGraaff generator does.

The 2024 event explored STEM concepts like coding, lasers, cryptography, optics, wearable technology, chemistry, ocean acidification, magnets, plant DNA, and aerospace engineering. Organizations including Code Wiz, Procter and Gamble, Gillette, Formlabs, Harvard Medical School, Medtronic, Woods Hole Oceanographic Institution, Draper Laboratory, Boeing, Society of Women Engineers, MIT Department of Biological Engineering, and MIT Plasma and Science Fusion Center joined Lincoln Laboratory in an effort to increase participants' interest in STEM careers. Representing Lincoln Laboratory and Beaver Works, Lisa Kelley, Sigrid Flender, and Joel Grimm showed children what solar cells look like and explained how they convert sunlight into electric power. They helped them build a solar-powered circuit, attach the circuit to a Bristlebot, and watch as the solar energy caused enough vibration to make the Bristlebot dance around.

Sigrid Flender, left, helps young Scouts build a solar-powered Bristlebot.

JOHN LESSARD

EMPLOYEE SPOTLIGHT

How many years have you assisted with LLRISE?
I became a teaching assistant for LLRISE in 2013. I have continued as a teaching assistant for the program almost every year since.

How did you decide to start volunteering for this program?
I learned about LLRISE through a University of Massachusetts Lowell colleague who was a teacher's assistant during the first year of the program. I wanted to offer a STEM experience to students and inspire them, so I was eager to contact the program director.

What motivates you to keep volunteering year after year?
After my first experience with LLRISE, I wanted to continue having meaningful impacts on high school students who were about to make life-changing decisions. This short two-week program could completely change their perspective on STEM, universities, and careers. Having volunteers share their college and career experiences is one of the many ways that LLRISE prepares its participants for their futures.

What is a particular outcome from your mentoring that you are proud of?
I had a strong mentoring relationship with one student during LLRISE 2023. Jacob went into LLRISE with an interest in science and engineering and left knowing that he would like to concentrate on aerospace engineering. I spent a lot of time with Jacob discussing career and education paths, specifically highlighting co-ops, internships, and schools aligning with his interests. I am happy to say that Jacob will be attending an engineering program at University of Massachusetts Lowell, my alma mater. He also secured his first internship at Analog Devices and hopes to return to Lincoln Laboratory.

Why should others consider engaging in STEM outreach?
STEM outreach is undoubtedly a rewarding experience. I would not have found myself in this career without outreach programs like LLRISE, and I feel that giving back is important. Having been a student not too long ago, I remember exactly how impactful these programs can be. Whether you volunteer for an intensive two-week engineering workshop or an afternoon STEM seminar, getting involved will help prepare future young professionals and ultimately strengthen our fields.

Data Paths Summer Professional Development

In August, Emily Voytek represented Lincoln Laboratory on a "Careers with Data" panel discussion during the two-day Data Paths Summer Professional Development workshop hosted by the Education Development Center (EDC). Middle school math teachers applied to participate in this training, with the goal of finding opportunities for their students to build data skills. Panel members included data scientists, teachers, researchers from EDC's Data Paths project and members of the EDC curriculum development team, who prepared data investigations to use during the 2024–2025 school year. Panel discussions provided educators with perspectives on careers involving data. Organizers from EDC hope that the interactions among educators and industry professionals encourage future collaborations while strengthening paths for students to pursue careers in data.

"It was important to share my experience with these teachers—who could then share with their students—to provide role models of what a career in data science can look like," said Voytek. "I was very fortunate to have multiple scientist role models growing up, even within my own family, and so the idea of becoming a scientist myself was always a possibility. But not all students have opportunities to see people who look like them in these types of roles."

Emily Voytek describes her path to becoming a data scientist and what a career in data science can look like.

Thomas and Daphne Maldonado show participants how to build their own mini lightsaber.

Science on State Street

Every April, Framingham State University (FSU) holds Science on State Street, a community-wide event organized by the Christa McAuliffe Learning Center in Framingham, Massachusetts, in collaboration with the MetroWest STEM Education Network. Many demonstrations and activities focus on how STEM supports renewable energy and sustainability. Lincoln Laboratory joined other exhibitors, including the Cummings School of Veterinary Medicine at Tufts University; FSU's Chemistry and Food Science Department; Energize Framingham; Mass Audubon; Environmental Partners; FSU's Green Initiative Student Club; Electric Hydrogen; Boston Scientific; New England Sci-Tech Inc.; and FSU's Department of Environment, Society, and Sustainability.

Participants built and tested earthquake-resistant structures, toured a virtual geothermal network, drove a model car using hydrogen gas, and learned how to increase renewable energy use. Lincoln Laboratory volunteers helped visitors build a circuit to conduct electricity from a battery through copper tape to light up an LED, creating a take-home mini lightsaber. This activity is always popular and shows the fun things that engineers can build.

Kids Day

For two days during Massachusetts' April vacation week, kids aged 8–18 visited Lincoln Laboratory and saw the various ways that scientists and engineers use STEM to do their work. Each day, the event began with Chelsea Curran presenting an overview of the Laboratory and her work in the Technology Office.

On the first day, Bethany Huffman explained quantum computing and nanofabrication techniques, and Rituparna Basu discussed the model-based engineering design process she uses to build complex systems quickly. On the second day, Allister Azagidi described the pros and cons of wind turbines, and Michelle George explained her work on autonomous systems.

For the remainder of each day, kids toured the many STEM demonstrations set up by groups, divisions, and departments. Kids built their own satellites, used a search algorithm, operated an amateur radio, drove a remotely operated vehicle, and controlled an aircraft collision-avoidance simulator, among other activities. ▸

02 EDUCATIONAL COLLABORATIONS

Inspired by employee desires to connect with the community and to motivate student interest in STEM, our outreach initiatives include:

- University Student Programs
- MIT Student Programs
- Military Student Programs
- Technical Staff Programs

Interns participating in the 2024 Summer Research Program convene in the Laboratory lobby.

Summer Research Program

Each summer, hundreds of undergraduate and graduate students from universities and military schools and academies participate in the Laboratory's Summer Research Program, contributing to Laboratory projects that complement their courses of study. Students interface with national experts in numerous STEM fields, access the Laboratory's state-of-the-art resources, and present their research results at the end of the summer. In 2024, 231 students participated in the program.

Marika Schubert, who spent her summer in the Embedded and Open Systems Group training medical ultrasound denoising algorithms, said, "This internship was exactly what I was looking for in a research and professional experience. I feel like I have grown in the ways that I intended to, filling in technical gaps and pursing novel research through exposure to a variety of projects."

Joe Simeone interned in the Air Traffic Control and Weather Systems Group, making improvements to a web application that gathers data about air traffic and weather events. Simeone said, "My experience was overwhelmingly positive. Everyone in my group was very welcoming and supportive. I met with my supervisor almost once a day and always felt like I had something to do. I had the opportunity to speak directly with people who used my work, which made me feel valued."

Left: Visitors to the Poster Challenge learn about innovations envisioned by teams of interns. **Below:** As Poster Challenge visitors listen, Kenneth Lang explains team COSMOS's idea for a novel data compression method for hyperspectral imaging.

Intern Innovative Idea Challenge

Summer Research Program students can participate in the Intern Innovative Idea Challenge (I3C), an annual engineering competition that challenges teams of interns to design a device or technique that solves a real-world problem. This is an internal event that interns participate in voluntarily on their own time, and I3C projects are not paid for by Lincoln Laboratory or federal funding. During the 2024 program, teams submitted 36 innovative concepts to I3C.

In July, each team showcased their project to fellow interns and Laboratory community members at the I3C Poster Challenge. Visitors to the Poster Challenge learned about each project and then voted for their favorite one through an online portal.

"The I3C experience pushed me to be a better salesman and to practice the soft skills not often found in engineering courses—skills like ideation, pitching, and poster making," said Charles Kowalski, a member of team CODEC: Cryptographic Optimized Data Edge Compression.

The top teams picked by voters advance to I3C's final challenge, Interns vs. Sharks. This event is inspired by the reality-television show "Shark Tank," in which competing entrepreneurs pitch their ideas to a panel of judges called "sharks." Interns vs. Sharks invites I3C finalists to present their projects to the sharks—in this case, members of Lincoln Laboratory's leadership.

This year had six finalist teams: InGluco: A Smart Pill for Continuous Glucose Monitoring, B-FoRE: Bee-Foraging of Residual Explosives, SNAKE EYES: Situational Noise Adaptive Kinetics and Enhanced Environmental Yield System, SPACE ENCASE: Damage Mitigation from Micrometeoroids and Space Debris, SAFER: Synthetic Attack Framework for Evaluation and Response, and NEBULA: Novel Extension of Birth control Use on Long-term Assignments.

"I3C helped me develop many skills in the areas of innovation, like defining project scope, researching, pitching, and presenting. I have never been in a program that challenged me to think about problem solving quite in the same way I3C did," said Abigail Dixon, a member of the InGluco team. "Additionally, I3C gave me the opportunity to work with interns and staff members from other groups across the Laboratory, and I have made some great connections as a result of the collaborative nature of the program."

After the teams pitched their projects, the judges convened to select the winners. The third-place award went to the team behind SAFER, a tool that would let users simulate and combat malware to better protect their systems against cyber threats. The second-place award recognized the B-FoRE team for their idea to use sniffer bees to find unexploded landmines. The bees, which are sensitive to vapors emitted by landmines, would be marked with a fluorescent substance and have their movements tracked by a fluorescence-detecting lidar.

"Learning more about tracking technology while proposing an idea to address a humanitarian need was rewarding. I am grateful that I had hardworking and motivated teammates throughout the entire project as well as mentors and staff members who helped us along the way," said B-FoRE team member Josue Luna.

Judges granted the first-place award to team NEBULA. This project proposed substituting a common ingredient used in birth control with an alternative that could potentially extend the shelf life of birth control and make it more accessible to astronauts. NEBULA received recognition for shedding light on issues related to women's health and the longevity of medications.

Laboratory staff members who mentored I3C teams were also rewarded for their efforts. Recipients of the individual and team mentor awards included Robert Natividad, Ryan Bohler, Carla Varela-Rosa, and Zachary Ellenbogen.

Kerissa Duliga, co-creator of NEBULA, presents her team's idea to the panel of judges at the Interns vs. Sharks event.

ARCHER LIU

INTERN SPOTLIGHT

You worked as a summer intern in the Advanced Sensor Systems and Test Beds Group. What projects did you work on?
I refined a graphical user interface for a new model of a signal transmitter that will enable users to configure the signal in real time while getting status feedback. I also tested a number of high-frequency digital receivers for usability in future field tests. The receivers will be deployed next summer as part of the group's over-the-horizon radar test bed.

Did anything surprise you about working at Lincoln Laboratory?
The work culture at the Laboratory was not what I expected. Everyone is approachable and open to conversations. Our supervisors encouraged us interns to attend all the events that aligned with our interests. More than anything, I love how work here is mostly driven by passion instead of stress and strict deadlines.

What did you like best about your internship?
The Laboratory is genuinely invested in the personal growth of its employees, including the interns. There is an abundance of resources, such as the library, staff members, and seminars. Questions are encouraged within work settings and seminars. The Laboratory respects the fact that everyone comes from different technical backgrounds.

You were accepted into LLRISE in 2021. How did this program prepare you for your internship?
LLRISE really solidified my decision to go into computer engineering and provided the backbone knowledge for my projects at the Laboratory. Having had experience with radio frequency, I was able to pick up the technical concepts pretty quickly, which made for a smooth onboarding.

You spoke to the current year's LLRISE students. What message would you like to impart to these and other students?
Life is a marathon. Don't belittle your achievements by comparing them to other people's. Be proud of your achievements and all the effort you've put into getting to where you are today. Explore everything you have an interest in, and, most importantly, have fun in the process. Life is too short to not have fun!

Is there anything else you'd like to share about your experiences at the Laboratory?
The resources at the Laboratory are absolutely incredible. I really appreciate the Community Outreach Office's effort in providing channels for young brilliant minds around the country to develop their passions and interests. I would not be the same person I am today without LLRISE and all the support I've had from my supervisors and fellow staff members throughout this internship.

Northeast Microelectronics Internship Program

The Northeast Microelectronics Internship Program (NMIP) allows freshman or sophomore university students interested in a career in microelectronics, nanotechnology, or semiconductors the chance to spend a 10-week, full-time summer internship at a leading microelectronics company in the northeastern United States. Lincoln Laboratory is one of 25 industry partners who host NMIP interns. The program was founded by Tomás Palacios, the Clarence J. LeBel Professor in Electrical Engineering and Computer Science at MIT and the director of the Microsystems Technology Laboratories. In January 2024, NMIP received a grant from the Northeast Microelectronics Coalition (NEMC) Hub to expand the internship program's reach and impact. The NEMC Hub is part of a nationwide network of technology hubs with a shared mission to expand the nation's global leadership in microelectronics.

"We are humbled and deeply excited to share we have about 450 candidates who applied to our program with enthusiastic interest in diving further into various broad areas of microelectronics. We are all here as mentors and advisors with a sense of responsibility to ensure that the future of the semiconductor industry thrives," said an NMIP representative in a letter to the program's industry partners. The representative continued, "NMIP second-year intern Daniel Reyes, hired as a freshman, shares the very value we are trying to convey. Being hired in his first year opened up so many venues for him, and, as a junior, he is now very clear on his path forward, which started with his freshman-year internship. His is just one of many similar stories."

Daniel Reyes, a mechanical and microelectronics engineering student at MIT, interned at the Laboratory through NMIP in 2023. Reyes worked in the Microelectronics Laboratory to detect and analyze defects on wafers.

At the 2024 Microelectronics Commons Annual Meeting, Daniel Reyes, an MIT student and former NMIP intern at Lincoln Laboratory, speaks about his internship experience.

"Working at Lincoln Laboratory was an invaluable experience and a step in the right direction. The knowledge and hands-on experience that I gained from this internship cemented my decision to pursue a career in microelectronics," Reyes said.

In October 2024, Reyes attended the Microelectronics Commons Annual Meeting in Washington, D.C. The Microelectronics Commons is a network of organizations dedicated to microelectronics R&D. Reyes spoke about his experience cultivating new technical skills while working at microelectronics facilities, including those at Lincoln Laboratory.

University Cooperative Education Program

Lincoln Laboratory employs students from nearby colleges and universities—such as Northeastern University and Wentworth Institute of Technology in Massachusetts, and Rochester Institute of Technology in New York—under cooperative education agreements. The students work full time with Laboratory staff mentors during the summer or work-study semesters and part time during academic terms, gaining experience in their fields of study while earning academic credit. In 2024, 48 co-op students from area schools were employed in technical divisions and service departments at the Laboratory.

Left: Students from Hartwick College excitedly steer the Spot robot at the Autonomous Systems Development Facility. Top: Visiting students from Hartwick College had the opportunity to steer a miniature robot car around a racetrack.

Hartwick College Career Hop

In April, the Laboratory hosted visitors from Hartwick College in Oneonta, New York. Fourteen students and two faculty members received an overview of the Laboratory's work and attended technical presentations given by Laboratory staff members. The visitors then toured the Autonomous Systems Development Facility and steered miniature vehicles around the facility's racetrack. The students also took turns controlling the robot dog Spot and posed questions to members of the Control and Autonomous Systems Engineering Group. The event was organized by Joseph Campbell, Amanda Wait, and Cheryl Bartolone.

"We're thankful to everyone at the Laboratory who welcomed us; it was a privilege to visit," said Brandon Davis, the assistant director of career development and network engagement at Hartwick College. "We are grateful for everyone's hospitality and for allowing our students to get firsthand experience with some of the projects that staff are working on. The students loved the experience, and I have a number of students to follow up with who are interested in returning as interns."

BRAIR (TILBOON) ELBERIER

INTERN SPOTLIGHT

What did you work on during your internship?
I was tasked with two major projects in the Homeland Sensors and Analytics Group. The first project was based on implementing a computer vision and image processing pipeline for drone target identification and tracking. In addition, I worked on implementing target state-estimation capabilities in the form of a Kalman filter for target reidentification in the case of tracker failure. The second project was to develop the hardware and software for a handheld, through-obstacle, presence-of-life-detecting radar that will be used by rescuers in critical situations.

How would you describe your internship experience?
My internship has been incredibly fulfilling and eye opening in multiple ways. I come from a background with no exposure to graduate school, specifically PhD programs, so working at the Laboratory provided me with invaluable insights into the diverse paths that graduate education can offer and the various contexts in which my work can be applied. Moreover, I had the opportunity to learn from colleagues with diverse research specialties, providing me with new perspectives that I plan to integrate into my future research. This experience has been invaluable for my development as an individual and as a researcher in academia.

What was a highlight of working at the Laboratory?
The standout aspect of my internship at Lincoln Laboratory has been the people. The unique culture here blends academic rigor with a genuine openness to diverse perspectives to attack problems in novel ways. I've been impressed by how members of the Laboratory value and engage with each other's ideas and interests, creating a supportive environment where everyone is eager to assist and collaborate.

MARC ALENN JEAN MARY

INTERN SPOTLIGHT

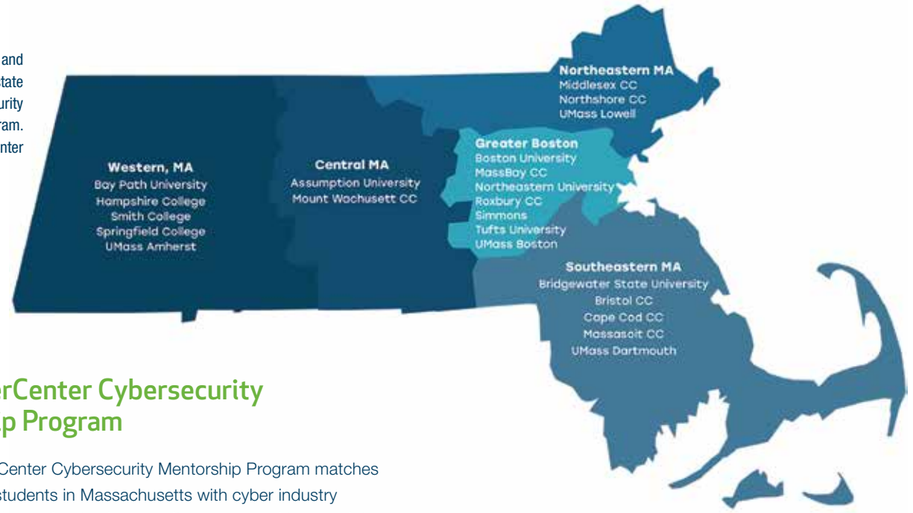
What projects did you work on over the summer?
I worked on two laser communications programs. I like to describe it as working on two sides of the same coin: One program looked from Earth to space, while the second program looked the other way around. I had the pleasure of diving deeper into several topics, ranging from vibrations to optics, with staff who are experts in those fields.

I learned through a variety of tasks, each highlighting a different topic. For instance, one task focused on random vibrations. The project wanted to test how well vibration isolators would perform on a space optical assembly during launch. I faced the challenge of designing a test fixture stiff enough to not react over a certain range of frequencies to avoid inducing vibrations and skewing test results. Another task focused on protecting laser parts from water damage. I made a model of an optical component for the Earth-to-space communications project to test how a new kind of gasket would handle heavy rain.

How would you describe your internship experience?
It was educational and inspiring. Seeing the interesting areas that other interns and employees were working on showed me how far we have come with technology and inspired me to help push us further.

What was a highlight of being at the Laboratory?
The community of Laboratory employees and other interns really made this experience special. I am glad to be calling many people I have met here my friends and look forward to seeing the great things they will achieve.

Did you participate in any activities for interns?
Yes, I participated in I3C. My team wanted to tackle the renewable energy sector and came up with two ideas: a kinetic tile system and an escalator that uses a regenerative braking capability to lower people while harvesting their potential energy. Our ideas unfortunately did not make it past the first stage, but meeting new people and hearing all of their innovative ideas was a blast.



Students from colleges and universities across the state participate in the Cybersecurity Mentorship Program. Photo: MassCyberCenter

MassCyberCenter Cybersecurity Mentorship Program

The MassCyberCenter Cybersecurity Mentorship Program matches undergraduate students in Massachusetts with cyber industry professionals to learn about cybersecurity careers and to complete a cybersecurity-related project. The program seeks to encourage undergraduate students to pursue careers in cybersecurity, ultimately promoting diversity within the cybersecurity workforce in Massachusetts. Since 2020, the program has supported 281 students from 40 schools across Massachusetts. Lincoln Laboratory is one of 72 participating organizations whose staff volunteer as mentors for the program. In 2024, eight Laboratory employees mentored 11 students.

"I have been serving as a mentor since the inception of the program in 2020. Many mentees are first-generation college undergraduates who are on the cusp of getting their first cybersecurity-related summer and full-time jobs. I have provided them with some perspective on what companies look for as they recruit hires and how opportunities can build sequentially. I have also connected a few mentees with cybersecurity professionals here at the Laboratory and elsewhere, and some of these connections have led to job offers," said Marc Zissman, a longtime MassCyberCenter mentor.

> "I want to thank my mentor for the guidance he gave me during the Cybersecurity Mentorship Program. Back then, I hadn't even taken a systems engineering course, but it ended up being one of the primary concentrations I have taken an interest in exploring."
>
> — ATHUL ASHOK, CYBERSECURITY MENTORSHIP PROGRAM ALUMNUS

Spotlight:

Yari Golden-Castaño is over the moon about outreach

Ariana Tantillo, Communications and Community Outreach Office

During a forensic science workshop held at the Laboratory in December 2023, Yari Golden-Castaño helps participants identify physical changes of similar-looking powders (corn starch, flour, sugar, and baking soda) reacting to iodine, vinegar, and water.

Yari Golden-Castaño knew she wanted to be an astronaut since she was a little girl in Mexico. An astronaut onesie had earned her the nickname "little astronaut," and her grandmother would read to her about space. In second grade, Golden-Castaño heard that teaching, medicine, or engineering were the astronaut career paths. Struggling to master English in grade school in Southern California and noting that math and physics came easy to her, she picked engineering. But she had no clue how an engineer became an astronaut or what being an engineer entailed. When she asked one of her high school teachers, he replied, "Are you high? You'll never be an engineer or astronaut as a girl." It wasn't until eighth grade when she was selected for an enrichment program for advanced science students that she experienced STEM in a hands-on way.

"Not everyone understands how things work just by reading a textbook," said Golden-Castaño, who joined Lincoln Laboratory in 2010 after earning her bachelor's degree in engineering science. "I personally need a visualization or demonstration."

At the Laboratory, Golden-Castaño was surrounded by colleagues who shared her astronaut aspiration. In 2013, the opportunity of a lifetime came: an application call for a one-way mission to Mars to establish the first human colony. As one of the 100 final candidates for Mars One, Golden-

Yari Golden-Castaño displays a mechanical arm made out of cardboard—the product of a hands-on activity for a workshop hosted at the Laboratory in November 2024.

Castaño felt like she had a platform to reach out and become a role model. In schools across Boston, she shared her dream to become an astronaut and her path to engineering. Grabbing students' attention, she realized she should do more than talk. She started volunteering for the Laboratory's Introduce a Girl to Engineering Day but noticed a trend: the girls already had access to these kinds of hands-on activities. So, in collaboration with the MIT AeroAstro Department, she created Girls Space Day Adventure, with a coed turnout of 60 students rotating through space-related demonstrations on MIT campus. After hosting this event, she had an idea to make outreach more self-sustaining over the long term by having demonstrations ready for volunteers to deploy at different schools.

Laboratory volunteers lead standalone hands-on workshops to empower students with the skills, knowledge, resources, and confidence to pursue STEM. Since its inception, this program has hosted about 50 workshops and reached more than 300 students from Greater Boston schools, organizations such as Brookview House and Boys and Girls Clubs of America, and STEM community events. Participants have built lightsabers based on light-emitting diode (LED) circuits (electronics), sorted candies to mimic how a decision tree algorithm works (artificial intelligence), made their own color reactions (chemistry), decrypted messages (cybersecurity), and identified fictional crime scene culprits (forensics), among other activities.

"I was really shy and didn't want to be standing in front of anyone, let alone having them rely on me for information," Golden-Castaño said. "But seeing the students react— wow, you're one of us and you didn't stop chasing your dreams because someone thought you were incapable—and engage with the material makes it all worthwhile."

Lincoln Laboratory and National Strategic Research Institute launch student research program to tackle biothreats to national security

National Strategic Research Institute and MIT News

MIT Lincoln Laboratory and the National Strategic Research Institute (NSRI) at the University of Nebraska (NU), a university-affiliated research center designated by the U.S. Department of Defense (DoD), have established a joint student research program.

The goal is to bring together the scientific expertise, cutting-edge capabilities, and student capacity of NU and MIT for critical issues within global health and agricultural security, aiming to foster solutions to detect and neutralize emerging biological threats.

"We are excited to combine forces with NSRI to develop critical biotechnologies that will enhance national security," said Catherine Cabrera of Lincoln Laboratory. "This partnership underscores our shared commitment to safeguarding America through scientific leadership."

"In an era of rapidly evolving dangers, we must stay ahead of the curve through continuous innovation," said David Roberts, the NSRI research director for special programs. "This partnership harnesses a unique combination of strengths from two leading academic institutions and two research institutes to create new paradigms in biological defense."

With funding from a DoD agency, the collaborators conducted a pilot of the program embedded within the MIT Engineering Systems Design and Development II course. The students' challenge was to develop methods to rapidly screen for novel biosynthetic capabilities. Currently, such methods are limited by the lack of standardized, high-throughput devices that can support the culture of traditionally "uncultivable" microorganisms, which severely limits the cell diversity that could be probed for bioprospecting or biomanufacturing applications.

Led by Todd Thorsen from Lincoln Laboratory, MIT students created the project, "Bioprospecting Experimentation Apparatus with Variable Environmental Regulation," which focused on developing simple high-throughput tools with integrated environmental control systems to expand the environmental testing envelope.

"This program, which emphasizes both engineering design and prototyping, challenges students to take what they learned in the classroom in their past undergraduate and graduate studies, and apply it to a real-world problem," Thorsen said. "For many students, the hands-on nature of this course is an exciting opportunity to test their abilities to prioritize what is important in developing products that are both functional and easy to use. What I found most impressive was the students' ability to apply their collective knowledge to the design and prototyping of the biomedical devices, emphasizing their diverse backgrounds in areas like fluid mechanicals, controls, and solid mechanics."

MIT students Rachael Rosco, left, and Brandon Sun work on the droplet-dispensing manifold inside the Lincoln Laboratory Beaver Works Center on MIT campus.

In total, 12 mechanical engineering students contributed to the program, producing and validating a gas gradient manifold prototype and a droplet-dispensing manifold that has the potential to generate arbitrary pH gradients in industry-standard 96-well plates used for biomedical research. These devices will greatly simplify and accelerate the microculture of complex mixtures of organisms, like bacteria populations, where the growth conditions are unknown, allowing the end user to use the manifolds to dial in the optimal environmental parameters without the need for expensive, bulky hardware like the anaerobic chambers typically used for microbiology research.

"This class was my first experience with microfluidics and biotech, and thanks to our sponsors, I gained the confidence to pursue a career path in biotech," said Rachael Rosco, an MIT mechanical engineering graduate student. "The project itself was meaningful, and I know that our work will hopefully one day make an impact. Who knows, maybe one day it will lead to cultivating extremophile bacteria on a foreign planet!"

The collaboration will continue to seek DoD research funding to create workforce development opportunities for top scientific talent and introduce students to long-standing DoD challenges. Projects will take place nationwide at several NSRI, NU, Lincoln Laboratory, and MIT facilities.

TITUS ROESLER

MIT UROP INTERN SPOTLIGHT

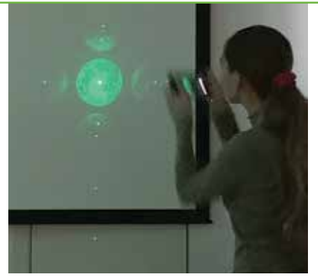
What did you work on during your internship?
I helped devise models for and experimentally characterize digital-to-analog and analog-to-digital converters. These data converters will be used in a modem developed by the Optical and Quantum Communications Group.

My mentor and I have backgrounds in signal processing. We come at engineering from an abstract signals-and-systems perspective, characterizing systems by the way in which they transform input signals into output signals. That's the approach we took in characterizing the data converters. We not only employed theory but also ran simulations and analyzed empirical data to validate theory.

What did you like about working at the Laboratory?
I couldn't believe that there were jobs that involve doing signal processing all day! I was very happy to spend the summer doing work that aligned well with my academic interests.

I greatly appreciate the dedicated effort and care that my mentor, Catherine Lockton, put into developing our mentor-mentee relationship. Rather than issuing orders, she let me take the lead in my summer project. That involved directing our informal meetings and determining what my next steps would be. When I needed to learn something new, Catherine had me teach it to her as well so that we both learned and acquired new tools to tackle questions arising later on.

What are some of your takeaways?
I now feel far better equipped to conduct unguided research. I am more comfortable with making a long-term plan, identifying what should get done next, and communicating both my progress so far and vision for what's ahead.



Left: Students in the Hands-on Holography IAP course use eye-safe lasers to create optical holograms. **Right:** A student demonstrates their computer-generated hologram of the Moon.

MIT Independent Activities Period

The Independent Activities Period (IAP) is a four-week period in January during which members of the MIT community are free to explore various academic and nonacademic topics, with IAP offerings emphasizing innovation and the fun of learning. During the IAP, MIT community members—including students, faculty, staff, and alums—can organize, sponsor, and participate in various activities. Lincoln Laboratory staff have led several IAP courses, including Hands-on Holography, Mathematics of Big Data and Machine Learning, Hands-on Full-Duplex Radio Design, and Practical High-Performance Computing.

Hands-on Holography

The Hands-on Holography course has been a staple of IAP for a dozen years. It teaches participants the theory of wave optics, interference, and diffraction, and participants make their own holograms at the Beaver Works Center. In 2024, 27 students signed up to learn about holography. Course instructors included Joe Vornehm, Robert Freking, Catherine DeVoe, Zachary Darling, Chris Roberts, Bayleigh Nugent, Benjamin Cohen, Roman Chapurin, and Ekaterina Sergan.

Students have ranged from postdoctoral researchers and museum docents to business retirees. Such diversity has made the course an enriching experience for lecturers and listeners but has posed a challenge for the course planners, who have had to improve and streamline the course each year to accommodate students from a range of backgrounds.

"We have developed a formula, honed with just the right balance of mesmerism and math, for keeping all levels of students engaged in a way that would be hard to replicate anywhere other than in the flexible, multifunctional Beaver Works facility. Some emerging advances in holographic technology will drive us to further update the content, but the course style is set: open, interactive, hands-on, and always technically solid in a way that reflects the Lincoln Laboratory ethic," said Freking, the course's founder.

Mathematics of Big Data and Machine Learning

Big data refers to datasets that are challenging to manage and analyze because of their large size and complexity. The Mathematics of Big Data and Machine Learning course describes the common mathematical foundations of big data and machine learning, and introduces students to the Dynamic Distributed Dimensional Data Model, a breakthrough concept in computer programming that combines graph theory, linear algebra, and databases to address the big data problem. The class discusses practical problems related to big data, introduces the appropriate theory, and then applies the theory to these problems. Students

Students in the Hands-on Full-Duplex Radio Design IAP course display their self-built full-duplex radios at the Beaver Works Center.

leverage what they learned during the course to create a final project on a big data–related topic of their choosing.

In 2024, 30 MIT students, MIT postdoctoral researchers, and Laboratory staff members participated in the course, instructed by Jeremy Kepner and Hayden Jananthan. "I was able to learn a lot and think it will really help with some of the work I am doing at the Lab and in school," said a student who took the course.

Hands-on Full-Duplex Radio Design

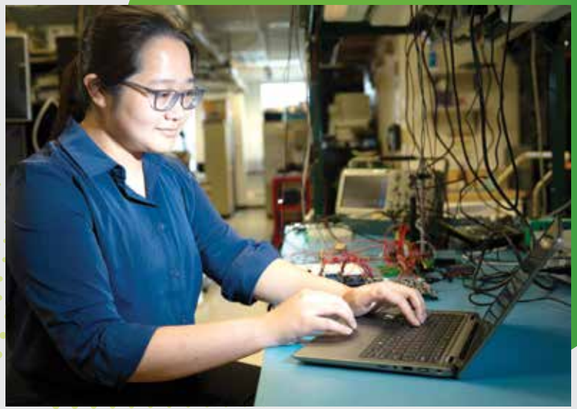
The Hands-on Full-Duplex Radio Design course was offered for the third time in 2024. Instructed by Ken Kolodziej, three MIT undergraduate students, three graduate students, and three Laboratory staff members learned about the mechanisms behind full-duplex radios. Unlike a traditional radio, which takes turns receiving and transmitting signals over one frequency band, a full-duplex radio can simultaneously transmit and receive wireless communications on the same frequency band. Students learned about the signal processing techniques that make full-duplex radio communications possible. At the end of the course, they designed, built, and tested their own full-duplex radios.

Practical High-Performance Computing

This course introduces the role of high-performance computing (HPC), also called supercomputing, in research. Students learn about the fields in which HPC is used and the strategies employed to scale computer applications to hundreds of processors, with real-world examples. Students also learn about situations in which they would need to transition a computational task from their laptop to an HPC system, the challenges that would introduce, and ways to address those challenges with efficient HPC workflows. The course instructors, including Julie Mullen, used online lectures and hands-on coding activities to foster students' understanding of HPC. In 2024, 15 MIT students, MIT postdoctoral researchers, and Laboratory staff members took the course.

MIT 6-A Master of Engineering Thesis Program

Lincoln Laboratory is an industry partner of the MIT Department of Electrical Engineering and Computer Science's 6-A Master of Engineering (MEng) Thesis Program. Students in the 6-A Program may spend two summers as paid interns at the Laboratory, participating in research projects related to their fields and receiving academic credit for their work. Then, the students work as research assistants while developing their MEng theses under the supervision of both Laboratory engineers and MIT faculty.



IVY LIU

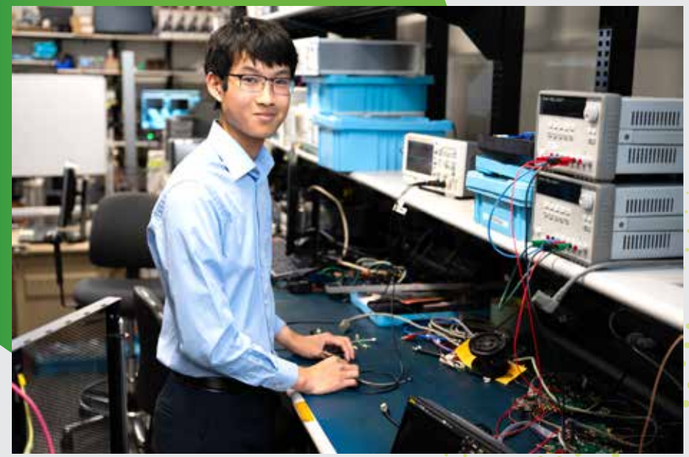
MIT 6-A PROGRAM INTERN SPOTLIGHT

What did you work on during your internship?
This summer, I worked in the Optical and Quantum Communications Group on a project exploring the design of a cost-effective ground terminal that can communicate with a satellite in low-Earth orbit. My work focused on the actualization of a gimbal test bed for risk-reduction testing. This work included learning how to interface between various pieces of hardware and our field-programmable gate array board and creating modules to do so.

What was unique about your experience at the Laboratory?
When I was growing up, I didn't actually know any engineers. But books, movies, and TV shows all cast engineers as problem solvers and inventors who worked on all sorts of novel things. After I went off to college and started interning at various places, I was a little disappointed to find that most engineering jobs are rote and repetitive. They almost always used solutions that were accepted as industry standards to maximize output and reduce risk. But working at Lincoln Laboratory was so different. It felt like what I thought engineering would be like as a kid.

What is something you learned recently?
I believe the most valuable thing I've learned this summer is how to solve problems without a predefined solution. Much of the work I've done in class or in industry is more about the speed at which the solution is implemented and less so about creating new solutions. Not knowing for certain whether I was approaching a problem in the most optimal way is a feeling I'm still getting used to. I've learned that I can really only try my best and ask questions so I can be more informed in the future.

Is there anything else you would like to share about the Laboratory or your internship?
I've said this many times before, but I've really appreciated the time and knowledge that Laboratory staff have been willing to share. Although everyone tells me that most people at the Laboratory maintain a good work-life balance, they still do genuinely seem passionate and proud about what they've worked on and sharing what they know. It's kind of amazing that I've only seen a small part of what goes on here.



WILL VU

MIT UROP INTERN SPOTLIGHT

What project were you involved in over the summer?
I designed and fabricated high-frequency planar devices and signal chains for radar systems from the microwave to millimeter-wave frequencies. My work supported the development of advanced radar architectures in both prototype and deployed systems by enabling the critical frequency-conversion hardware necessary for their operation.

What did you gain while working at the Laboratory?
Alongside improving my technical skills in electromagnetic modeling and simulation and radio-frequency and microwave design, I have gained a better ability to understand the bigger picture beyond my own role in developing solutions to a problem.

How would you describe your internship experience?
My internship experience has been a fun and exciting opportunity to support national security while doing cutting-edge research with the most knowledgeable technical staff in the country. I have had the chance to see the impact of what the Laboratory does and how my work contributes to it. I will be continuing my research for another year with Lincoln Laboratory as part of MIT's SuperUROP.

MIT Undergraduate Research Opportunities and Practice Opportunities Programs

Lincoln Laboratory is one of the research sites that partners with MIT's Undergraduate Research Opportunities Program (UROP) and Undergraduate Practice Opportunities Program (UPOP). Students undertaking UROP or UPOP assignments complete a research project for course credit or internship pay. Most participants at the Laboratory are interns working under the direct supervision of technical staff members. Students engage in every aspect of onsite research—developing research proposals, performing experiments, analyzing data, and presenting research results.

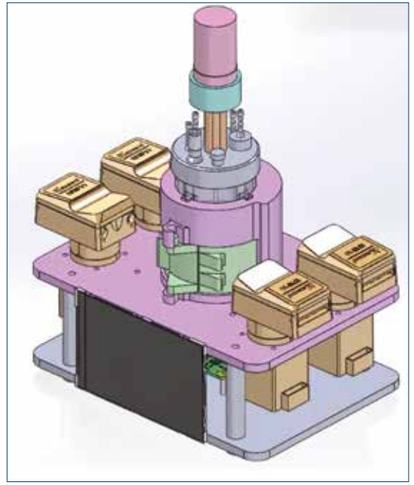
The team behind BEAVER imagines an environmental control system that could enable researchers to culture many bacteria that survive in extreme environments. This method would allow bioprospecting to be conducted in a more efficient and precise manner. In 2024, capstone project students designed a variety of technologies, including a hydrogen-powered bike; a buoyancy engine fueled by aluminum; and a noninvasive, miniature, personal bioreactor for use in laboratory engineering. Each project team spent a semester writing a white paper based on their technology idea. During the spring 2025 semester, the students will begin turning their designs into working prototypes.

Beaver Works Capstone Project

An initiative between Lincoln Laboratory and MIT School of Engineering, Beaver Works supplies students with space, mentors, and tools for project-based learning. Lincoln Laboratory staff and MIT faculty work together at Beaver Works to strengthen research and educational partnerships.

The main Beaver Works collaboration is the capstone project, an MIT engineering class in which students develop technologies that solve real-world problems. During two or three semesters, students from the MIT Department of Mechanical Engineering and Department of Aeronautics and Astronautics design a system that addresses a need and then fabricate a working prototype. Lincoln Laboratory researchers serve as advisors for these capstones, providing expertise in engineering design and fabrication of proof-of-concept models built by the students.

In fall 2023, capstone project students devised a system called Bioprospecting Experimentation Apparatus with Variable Environmental Regulation (BEAVER). Bioprospecting is the practice of examining organisms for their potential biochemical resources.



Beaver Works capstone course students designed this 3D-modeled concept for a miniature bioreactor.

U.S. Air Force Chief of Staff Gen. David Allvin, middle row, center, met with military fellows at Lincoln Laboratory on May 8. Allvin visited the Laboratory to learn about its research in wearable technology for military personnel.

Left: Military fellow Maj. Minnenne Holloway worked alongside Laboratory staff on cyber operations research. **Right:** At Modern Warfare Week, a symposium for members of the Special Operations Forces community, Katrina Thoms, right, accompanied by SOCOM Ignite alumnus Jack Perreault, spoke about her experiences in Lincoln Laboratory's Military Fellows Program. Photo: Global Special Operations Forces Foundation

Military Fellows Program

Active-duty military officers enrolled in graduate degree programs at Boston-area universities can engage in R&D at Lincoln Laboratory through its Military Fellows Program. Participants receive fully sponsored tuition and develop capabilities important to national security. The program pairs military fellows with Laboratory staff mentors, with mutual benefit: mentors provide technical expertise related to the fellows' areas of interest, while fellows contribute firsthand perspectives on military technology needs. The 2024 cohort consisted of 26 fellows sponsored by 17 groups from across the Laboratory.

As a fellow in the Laboratory's Cyber Systems Assessments Group, U.S. Air Force Maj. Minnenne Holloway helped conduct research on methods to effectively leverage modern technology, such as AI, for cyber operations. Her research focused on how AI tools can be used to counter influence operations, and examining these tools at work in test scenarios allowed her to gauge their potential limitations in the real world.

"One of the big takeaways from my fellowship is what is within the realm of the possible as it relates to technology. This exposure will help me when I go into future operations," Holloway said. "In addition, the connective tissue formed by networking here will let me reach back to the Laboratory to address emerging challenges."

U.S. Army Second Lt. Katrina Thoms's introduction to the Laboratory came through the U.S. Special Operations Command (SOCOM) Ignite program, an annual innovation challenge during which military students develop technologies that solve problems for the Special Operations Forces. Thoms participated in the program as a cadet. Upon returning to the Laboratory a year later as a military fellow, she mentored undergraduate students in SOCOM Ignite. During her fellowship, she acquired important skills such as summarizing research results in a concise and comprehensible manner, and tailoring explanations of technical concepts to an individual's interests. Thoms, who is studying applied behavioral analysis at Northeastern University, hopes to apply knowledge acquired from working as a mentor to research in human physiology and cognitive function.

"My work at the Laboratory is directly related to the work I hope to do in the future with the military. Understanding the value of innovation and seeing the big picture will help me as I move through my academic career. Being a mentor continues to teach me attributes of leadership. The connections I make and the work I do will allow me to serve the military in the best way I can," Thoms said.

SkillBridge Program

Lincoln Laboratory is an authorized provider organization for SkillBridge, a DoD program connecting active-duty service members with internships, apprenticeships, and job and employment skills training in civilian career areas. The program is designed to help service members transition to civilian employment once their military duties end. Active-duty personnel can spend up to the last 180 days of their military services at the Laboratory, gaining real-world work experience matched to their backgrounds and skillsets while continuing to receive military compensation and benefits. After completing the program, SkillBridge participants are encouraged to apply for employment at Lincoln Laboratory, which is committed to recruiting, employing, and retaining U.S. military veterans. Josephine Lewis started the Laboratory's SkillBridge program in 2023. Since then, 40 service members have been onboarded, and more than half of them have transitioned into full-time positions at the Laboratory.

> "I could tell that the Laboratory is an excellent environment where incredibly impactful technologies are developed. I lack experience in this type of research and development. It gave me a desire to participate in that."
>
> — CONNOR MATHEWS, SKILLBRIDGE INTERN

SkillBridge participants tour the Laboratory's Flight Test Facility.

In September 2024, the Laboratory held its first in-person networking event for SkillBridge participants and members of LLVETS, an employee resource group dedicated to supporting veterans at the Laboratory. The event served as a venue for people to discuss their experiences and for veterans to share advice with SkillBridge participants transitioning out of the military. After the networking session, SkillBridge members toured the Laboratory's Flight Test Facility.

> Making up about **10%** of the Laboratory's workforce, **400** veterans work at Lincoln Laboratory.

Military Courses

Laboratory staff teach four elective courses to officers attending the U.S. Naval War College in Newport, Rhode Island:

- The Ballistic Missile Defense course explores the critical technologies, capabilities, operational concepts, and policies that influence how ballistic missile defense affects U.S. military capabilities.
- The Space Technology and Policy course explores critical space technologies, capabilities, and policies that shape how the United States uses space for military and government purposes.
- The Cyber Security course describes cyber operations, cyber threats, and ways to defend critical systems.
- The Homeland Protection course, offered at the Homeland Security Institute on Hanscom Air Force Base, promotes a broad understanding of homeland protection missions, enabling technologies, and current challenges in homeland security. The course covers key areas of disaster response, critical infrastructure protection, and chemical and biological defense, followed by a half day of hands-on exercises to solidify concepts.

SOCOM Ignite students generate forward-looking prototypes

Kylie Foy, Communications and Community Outreach Office

Throughout the country, cadets have been hard at work turning their ideas into prototypes with real-world impact. They have been testing sensors that monitor human oxygen levels, combining small drones with ground vehicles to make hybrid platforms, and using lidar to autonomously navigate indoors. These ideas and others are coming closer to fruition through the U.S. Special Operations Command (SOCOM) Ignite program.

In SOCOM Ignite, Special Operations Forces (SOF) operators annually outline challenges requiring next-generation technology. Military students then work in teams and with Lincoln Laboratory mentors during the school year to innovate solutions addressing those challenges.

This year's effort culminated in a closing ceremony on April 25 at Lincoln Laboratory. Thirteen teams presented their solutions to an audience of technical staff, SOF operators, and SOCOM leadership. Following presentations, the students participated in a technical exposition to demonstrate and discuss their developed technology with attendees.

The program, now in its fourth year, kicked off last September. More than 80 students, representing military service academies and Reserve Officers' Training Corps (ROTC) programs nationwide, gathered at the Laboratory to receive the challenges. In hackathon style, they started formulating ideas while SOF operators and Laboratory technical experts fielded questions and provided feedback. The cadets then continued their work back at college, sharing progress updates throughout the year.

William Chu, an Army ROTC cadet from Rutgers University, served as the project lead on one challenge to develop a tool for communicating the medical status of casualties. The system and software his team developed uses AI algorithms, including those for computer vision and speech processing, to automate the documentation process. Such an approach could save combat medics valuable time to perform lifesaving procedures, and allow status information to reach higher echelons of care before a casualty arrives.

At the end of the closing ceremony, the casualty status team won the SOCOM Ignite Award for Operational Impact. "The award not only recognizes our efforts but also brings attention to the possibilities of AI technology in emergency medicine for solving crucial issues in medical documentation," Chu said.

U.S. Air Force Academy Cadet Victoria Salvador, left, discusses her landing-zone system to aid parachuters dropping into unfamiliar terrain.

Libby Ross, an Air Force ROTC cadet and nursing student at Texas Tech University, also pursued a challenge involving emergency medicine. Her team was tasked with improving the transport and storage of fresh blood in care facilities on the frontlines. Transport boxes used today are bulky and heavy, and can only keep blood viable for a short window of time. Aiming for modularity and adaptability, Ross presented a technique to put blood bags in insulated water bottles. A cooling agent would be added to the water at transport, making instant and replenishable cold packs lasting for several hours.

Other teams took on hardware development to solve communications challenges. One challenge asked for a way to enable operators in small units to communicate without radio frequencies. Jack Regan, an Army ROTC cadet at Worcester State University, and Jacob Brody, an Air Force ROTC cadet at Texas Tech, presented a system that uses shortwave-infrared lasers to communicate, and integrated it into an existing headset system. Another team developed hardware and software for a small device tracker inspired by Apple's AirTag but without proprietary limitations. This technology, developed by U.S. Military Academy Cadets Quintin Sherrod and Oumar Diop, was recognized with the event's Technical Excellence Award.

Left: Army ROTC Cadet Jack Regan, left, demonstrates a headset system that uses laser light, instead of radio frequencies, for in-squad communications. **Above:** Army ROTC Cadet William Chu explains his team's AI-enabled system for communicating a casualty's medical status and their plans for improving this system in the next round of SOCOM Ignite.

"It has been a pleasure seeing such entrepreneurial, innovative, and big thinking," said Col. Justin Bronder, program executive officer for Fixed Wing Programs, SOCOM. "Despite rigorous demands on the students' free time, the progress they made on these projects gives me hope that we can count on this up-and-coming generation to help those of us who are at the peaks of our careers shepherd the nation through the challenges we face ahead."

As this year's program ends, many cadets will continue working on their projects. Some students will stay on as summer interns at Lincoln Laboratory or in SOCOM units to refine their ideas. These students will likely lead the projects in the fall at next year's kickoff event, where they will recruit new members. As projects mature, some technologies will begin transitioning to operations. ▸

Military Women's Symposium

In collaboration with the Valkyrie Project, a nonprofit organization dedicated to supporting women in the military, the Laboratory co-hosted the second annual Military Women's Symposium in March, which is Women's History Month. The symposium brought together experts knowledgeable about advanced technologies and research that could solve some of the longest standing challenges for women in the military and other occupational fields such as law enforcement and human space travel. The theme of this year's symposium was advocacy and technology. Panel discussions and guest speakers from academia and other federally funded research and development centers (FFRDCs) focused on potential ways to improve training, gear, physical and mental health resources, and professional development within the U.S. military. Laboratory staff presented ongoing research in areas such as physiological monitoring and advanced fabrics that could help keep military personnel safe from injuries.

From left to right, Fiona Thwaites, Samantha Sliney, Helene Guillaume Pabis, and panel moderator Candace Esquivel discuss challenges that women face in the military and how people can advocate for policy change to resolve these challenges.

From left to right, leaders from Air Command and Staff College, Lt. Col. Brian Hellesto, Col. (Ret.) Jeff Reilly, and Lt. Col. Sean Atkins met with Daniel Strassler at the Laboratory during a visit on September 22.

Air Command and Staff College Collaboration

From September 2023 to May 2024, 20 students from the Air Command and Staff College (ACSC)—a U.S. Air Force professional military education school—embedded at the Laboratory to engage in R&D. Participants learned how to manage technical challenges similar to those they may encounter in the future as leaders in the Air Force. Leaders from ACSC also visited the Laboratory to hear about the projects that their students would be contributing to.

"This program codifies the strategic importance that the Laboratory sees in educating our services' future leaders," said Daniel Strassler, who coordinates the ACSC collaboration at the Laboratory. "By exposing students to the art of the possible, the program prepares students such that, when they rotate into their future roles, they'll know what is available and that they can reach back to the Laboratory when faced with a problem."

U.S. Space Force members visit the MIT Haystack Observatory in Westford, Massachusetts.

Space Technology Acquisition and Research Course

The Space Technology Acquisition and Research Course (STARC) is an advanced educational internship open to members of the U.S. Space Force (USSF). The interns are introduced to multiple Lincoln Laboratory programs, operations, and technologies that support the USSF and other DoD agencies. Interns also work one on one with Laboratory staff members to identify and analyze USSF technology needs and develop potential solutions to meet these needs. STARC seeks to help USSF members understand the importance of FFRDCs and become familiarized with space capabilities and technologies that may be useful to the USSF. In July 2024, six members of the USSF engaged in a four-week internship at the Laboratory.

"In addition to educating USSF members on what the Laboratory has to offer, what we're really trying to accomplish is bridging those connections between the Space Force and this FFRDC so that USSF members are equipped with the resources and knowledge available to begin closing the technological gaps they may experience in their organizations," said USSF Capt. Jeffrey Guy, the chief operations officer of USSF 13th Delta Operations Squadron Detachment 1, which hosts the STARC program. "There are challenges operators face at the tactical level, and that's why we solicit younger experienced USSF members for this specific internship. They are daily witnesses, as the boots on the ground warriors, to where those gaps reside."

"My experience here has been incredibly insightful, although it left me wishing for more time to delve deeper into the projects," said Master Sgt. Charles Ezeike, a STARC intern. "One of the key takeaways from my time at the Laboratory is their remarkable ability in tech transfer, which has and will continue to significantly benefit various units across the Department of the Air Force. This experience has underscored the importance of innovation and collaboration in achieving our objectives."

Military officers and government employees converge from across the country to attend the 2024 DTS at Lincoln Laboratory.

Defense Technology Seminar

The Defense Technology Seminar (DTS), a one-week seminar offered to government-affiliated civilians and active-duty U.S. military officers from all services, introduces attendees to the Laboratory's ongoing research and capabilities that may be relevant to their interests. From March 18 to 22, 12 civilian government employees and 64 military officers attended DTS. Attendees learned about each of the Laboratory's R&D areas and listened to technical seminars given by Laboratory subject-matter experts. Topics included advanced 3D laser radar systems, microelectronics fabrication, AI for national security, and satellite communications. External speakers were invited to discuss issues ranging from climate change to the psychology of misinformation. Participants toured several of the Laboratory's facilities, including the Haystack Observatory, Defense Fabric Discovery Center, and Microelectronics Laboratory. The last portion of DTS featured a banquet and a keynote speech by David Berger, a retired general and commandant of the U.S. Marine Corps.

Technical Education Committee Program Onsite Courses

Lincoln Laboratory offers technical education programs designed to help employees expand their knowledge and versatility in unique areas across the Laboratory. The programs offer both short-term and semester-length courses taught by Lincoln Laboratory technical staff or outside experts. The 2024 Technical Education Committee Program included courses covering topics such as space control, systems analysis, adaptive antennas and phased arrays, weather and climate, spacecraft development, and technical storytelling.

Daniel Schuette taught the Light Detection and Imaging course, which has been offered at the Laboratory for several decades. The 11-week course introduced 60 staff members to optics, light detection, and imaging.

"The course is important to the Laboratory because of both the significant role that optical systems play in many of our mission areas and the increasing need to think about these systems in new and more innovative ways," Schuette said.

"I signed up for the course because I'm using a variety of different imagers in my system, and I wanted to get a better sense of how they worked," said Charlotte Jones. "The deeper understanding I gained of the sensors in my system has allowed me to identify issues in my test setup."

Daniel Schuette delivers a lecture to students enrolled in the Light Detection and Imaging course.

Lincoln scholars, including Kat Kononov, pictured above, presented overviews of their research at a Lincoln Scholars and Military Fellows Appreciation Luncheon in April.

Lincoln Scholars Program

The Lincoln Scholars Program enables Laboratory staff members to pursue full-time technical graduate education, at either the master's or doctoral level, at Boston-area academic institutions. Employees remain contributing members of the Laboratory, receiving compensation and a tuition support plan designed to reduce the financial cost of pursuing their degree. Jointly benefitting the Laboratory, its sponsors, and the employee, the program is managed by the director-appointed Lincoln Scholars Committee, with administrative coordination and management provided by the Human Resources Department. In 2024, 18 Laboratory staff members were enrolled in the program.

"The Laboratory invests in the development of its staff, and the return on this investment is clear—every Lincoln scholar I know has come back with new skills and ideas that readily apply to Laboratory mission areas," said Kat Kononov, a Lincoln scholar.

More than 200 Laboratory staff members have pursued graduate degrees full time through the Lincoln Scholars Program.

Activate Fellowship

The Activate Fellowship helps scientists and engineers who want to start their own businesses. Activate fellows embed in national organizations to receive insights from subject-matter experts and access to some of the country's top facilities. The two-year fellowship provides entrepreneurs with funding; technical resources; and support from a network of scientists, engineers, investors, commercial partners, and fellow entrepreneurs.

Since 2020, Lincoln Laboratory has supported 10 Activate fellows. The Laboratory program concluded this year with the graduation of its final Activate fellow, Terence Davidovits.

"This was the first program of its kind where scientists and researchers were selected to be embedded in a national research laboratory and be provided with mentorship and a project budget that they could use to grow their company and cross over the 'valley of death' that new companies face," said Connor Powers, the business manager of the Laboratory's Activate fellowship program. The "valley of death" refers to the difficult period after a company's launch in which the company must make enough revenue to survive.

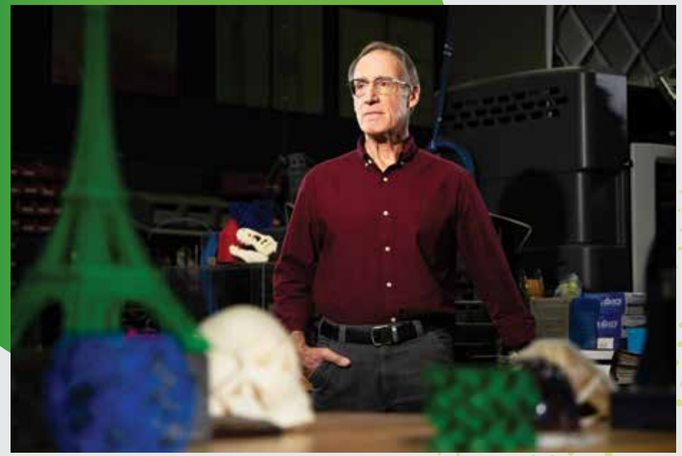
Many of the fellows who grew their startups with the Laboratory's support have been successful. One of them is Maël Flament, who was an Activate fellow at the Laboratory from 2021 to 2022. Flament's company Qunnect—based in Brooklyn, New York—develops hardware for quantum networks and has grown from a team of one to 21 staff. Qunnect was featured in multiple news articles in 2024 for groundbreaking experiments conducted on their quantum networking test bed, GothamQ.

MIT Professional Education Short Programs

Lincoln Laboratory collaborates with MIT faculty to offer courses through MIT Professional Education's Short Programs. These professional education courses attract participants from industry and business to campus for topics designed to expand familiarity with emerging technologies like biotechnology, cybersecurity, data modeling and analysis, machine learning (ML), big data, robotics, mechanical design, radar, and systems engineering. Lincoln Laboratory staff have led a variety of such courses since 2012, including Build a Small Radar System and Design and Analysis of Experiments, which are offered every year.

In fall 2024, David Martinez and MIT professor of electrical engineering and computer science Devavrat Shah co-led a course, AI and ML: Leading Business Growth. Many aspects of business and industry—whether manufacturing, customer service, branding, or data collection—are being transformed by AI and ML. Martinez and Shah taught participants how to become well versed in AI and ML technologies and how to use these technologies to improve one's business or organization. The course was catered toward business leaders, mid- to senior-level managers, consultants, and other business professionals.

Lincoln Laboratory's David Martinez and MIT's Devavrat Shah co-led a MIT Professional Education course about using AI and ML to improve one's business processes.



DAVID SCOTT

EMPLOYEE SPOTLIGHT

What outreach programs have you participated in?
I have been involved with the Lincoln Laboratory Radar Introduction for Student Engineers program, the Intern Innovative Idea Challenge, and Science on Saturday. I have also provided many tours of the Technology Office Innovation Laboratory to students from local high schools.

What have you learned from working with students?
As a former high school teacher, I find that working with students in an outreach environment feels very much the same. The only real difference for me is that outreach is a little less formal, and you have the opportunity to learn more about each student in a shorter period of time, making it much easier to adapt to their learning styles.

Why do you believe outreach matters?
Outreach allows us to expose students to technologies and information that they may have never seen or heard about. It opens the door to more options for academic and career paths. Hopefully, the students develop new interests that may help them move forward in life.

The Laboratory has done a great job with its outreach programs. I would like to see the Laboratory offer exposure to additional technologies and aspects of science.

Part-Time Degree Studies Program

The Part-Time Degree Studies Program (PGS) enables motivated and talented staff members to pursue graduate degrees part time, via distance learning or at local universities, while they continue to work at the Laboratory full time and receive tuition support. In 2023, the Part-Time Master's in Business Administration (MBA) Program, which specifically supported staff members pursuing MBA degrees, merged with PGS. In 2024, 39 Laboratory staff members participated in PGS.

> "I will continue to recommend the Part-Time Degree Studies Program to all staff members. It offers an excellent avenue for staff members to gain graduate-level knowledge in important topics."
>
> — IDAHOSA OSARETIN, PART-TIME DEGREE STUDIES PROGRAM ALUMNUS

Robert Palladino completed a master's degree program in aeronautics and astronautics at Purdue University in 2022 through PGS. "I liked that PGS had very few restrictions on where and when I took my classes, enabling me to get my degree remotely from a school outside of the Boston area, on a schedule that worked for me. I also appreciated that participating in the program involved minimal burden that did not interfere with my classes or my work at the Laboratory," Palladino said.

Idahosa Osaretin, who earned an MBA through PGS in 2024, credits his positive experience to the Lincoln Laboratory staff who coordinate the program: "The hidden advantage of PGS is the help and support from program staff, especially from Bridget Sheldon and Nancy Selander, who allowed me to focus on learning while all other plans and processes were adeptly taken care of. My success is in large part due to the support I received. The staff were with me all the way and made the challenging program much easier."

James Russo is currently engaged in graduate studies with the help of PGS. He said, "PGS has significantly reduced my out-of-pocket costs for tuition and the time taken to complete my master's degree in data science. I would recommend the PGS program to anyone interested in pursuing a graduate degree while continuing to work full time at the Laboratory."

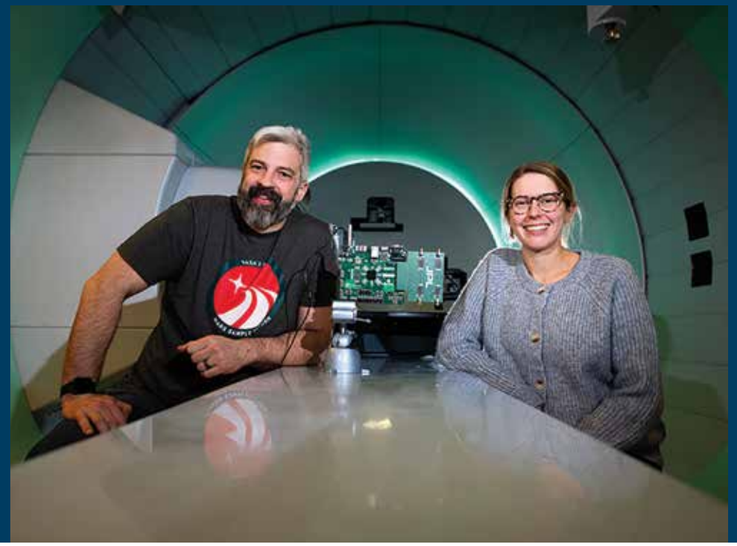
Palladino added, "PGS helped me afford graduate school, which would have otherwise come at a significantly increased personal cost, and allowed me to continue to work while I studied, so I didn't have to take a leave of absence. The program plus the annual tuition assistance enabled me to accomplish my goal in two-and-a-half years and at a much lower cost than if I had paid entirely out of pocket."

Space Electronics Radiation Testing Workshop reflects partnership between the Laboratory and Jet Propulsion Laboratory

Nathan Parde, Lincoln Laboratory Technical Communications

Approximately two dozen staff members from Lincoln Laboratory and NASA's Jet Propulsion Laboratory (JPL) attended the Space Electronics Radiation Testing (SERT) Workshop from January 4 to 7, participating in lectures at the Laboratory and hands-on radiation dosing of electronic devices at Massachusetts General Hospital (MGH) in Boston, Massachusetts.

The goal of the inaugural workshop was to strengthen the connections between JPL and the Laboratory while growing the radiation test workforce. In March 2022, the two organizations signed letters of support for a strategic partnership between them. Both are FFRDCs managed by top universities; both drive forward science and technology in the national interest; and both carry out space programs—the Laboratory through an extensive space portfolio primarily supporting national security, and JPL predominantly in support of solar system exploration. The SERT Workshop served as an extension of this strategic partnership.



Greg Allen, a radiation effects engineer at JPL, and Abigail Licht showcase an electronics board used for radiation testing at the 2024 SERT Workshop.

Ethan Cascio, the radiation test program manager at MGH, gives a tour of the Francis H. Burr Proton Therapy Center.

"Our goal in offering this workshop was to share knowledge and connect folks, both within the Laboratory community and across FFRDCs. As the Laboratory continues to develop systems and technologies for spaceborne applications, we will need staff who understand, in addition to the theory of radiation effects on electronics devices, how to fundamentally plan and execute test campaigns to validate these technologies," said Abigail Licht, who co-organized the workshop with Houssam Abouzahra.

"This workshop provided an opportunity to grow our internal radiation test workforce, as folks who had no prior experience were able to learn through testing on their own respective devices," Licht continued. "It also provided a forum for experts from the Laboratory and JPL to exchange knowledge across their distinct areas of expertise. A real indicator of success for this workshop is that everyone, regardless of years of experience, was able to deepen their knowledge by the workshop's end." Adam Shabshelowitz and Ashley Long were also instrumental in the success of the workshop.

The first two days of the workshop focused on lecture-based learning, with lectures presented by Gregory Ginet and David Fischi, as well as representatives from other institutions. In the latter days of the workshop, participants were given the opportunity to radiate devices relevant to their research areas. Participants were split into five teams, each with their own unique electronic device. The teams learned how to use protons to test for different effects such as displacement damage or single-event upsets. They then tested their devices at the Francis H. Burr Proton Therapy Center at MGH, and workshop organizers from the Laboratory and JPL offered further instruction and guidance. The radiation testing included aligning devices in the beamline and adjusting the beam flux to target the desired fluence and/or upset rates.

The organizers hope to continue to strengthen the partnership between the Laboratory and JPL, with future instances of the workshop exploring other aspects of radiation testing. "Testing with protons is one type of radiation testing," Abouzahra said. "In future workshops, the testing could focus on leveraging other types of radiation, such as heavy ions."

Abouzahra said that the workshop was very well received and generated a lot of buzz around the Laboratory afterward: "Feedback was extremely positive, and people really benefited from the hands-on testing at MGH. Having more staff trained in space radiation effects modeling and testing is critical for the Laboratory, given our rich history in developing space technologies." ▸

Olivier de Weck, a professor of astronautics and engineering systems at MIT, led a Technology Office seminar about the evolution of technology and methods for quantifying technological progress.

Technology Office Seminars

Technical talks motivate and inspire staff while facilitating working relationships. The Technology Office directs a program of in-person and virtual seminars presented by both in-house speakers and renowned researchers from universities and industry. The seminars are chosen to reflect current and leading-edge trends in today's technology. The 2024 Technology Office seminar program included the following presentations:

Roadmapping the Future of Technology: In Space and on Earth – Olivier de Weck

Smartphones and Chem/Bio-Sensors: Optical and RF Interfaces – Timothy Swager

Freeform Optics: Applications, Opportunities, and Challenges – David Mackey

Editing Speech Waveforms with Neural Codec Language Models – David Harwath

Application-Tailored Neuromorphic Computing Using Magnetic and 2D Materials – Jean Anne Incorvia

Revolutionizing Medicine with Brain Interfaces and AI – Chad Bouton

Designing Optically Active Semiconductor Nanocrystals for Sensing and Imaging Application – Allison Dennis

Breaking Waves: AI's Impact on the Computing Infrastructure Industry and Beyond – Aaron Sullivan

Nuclear Energy: Have We Entered a New Era? – Jacopo Buongiorno

Dimensional AI and Decentralized AI: Making the Invisible Visible Around Us and Beyond – Ramesh Raskar

Storing Electricity for Our Future: A Ca||Sb Liquid Metal Battery for Long-Duration Gride-Scale Electricity Storage – Alex Vai

6G Cyber-Physical Continuum: Taking Digitalization to the Next Level – Magnus Frodigh

Replicability in Canine Behavioral Science: Lessons for Conducting Robust Research – Jeffrey Stevens

Designing Materials to Revolutionize and Engineer Our Future Program (DMREF) at the National Science Foundation – John Schlueter

Commonwealth Fusion Systems and the Path to Commercial Fusion Energy – Alex Creely ▸

Left to right, Amanda Prescott, Mohammad Pourgol (Schneider Electric), and Daniel Weidman are the 2025 chapter officers of the Boston Chapter of the IEEE Reliability Society.

IEEE Boston Reliability Chapter

The Laboratory encourages its employees to participate in professional societies. The Boston Chapter of the IEEE Reliability Society facilitates discussions of reliability engineering, a branch of engineering that seeks to measure and improve the probability of hardware, software, and processes working as intended for the required duration. In most months during the academic year, the chapter sponsors an event where engineers can discuss various aspects of reliability engineering, such as designing, manufacturing, and testing technology to meet reliability and lifetime requirements. These events provide time for networking and include a technical presentation covering topics such as aerospace, electronics, and semiconductors. Occasionally, the chapter holds a tour of a local company. Since 2012, the Laboratory has hosted more than 80 of the chapter's events. During the COVID-19 pandemic, the chapter met online, and it has since resumed in-person meetings through a hybrid format.

"I enjoy my involvement with the IEEE Boston Reliability Chapter as a fun way to connect with reliability engineers in the local area," said Daniel Weidman. "The main benefits have been getting to know reliability engineers and attending presentations where I learn technical information. As a chapter officer, I have the privilege of helping choose which speakers to invite and which topics are presented. On a more personal note, my involvement has allowed me to become more comfortable with public speaking. I occasionally tap into the expertise of this group for answers to reliability questions that I wouldn't be able to find elsewhere, such as the details of common practices at other organizations." ▸

03 COMMUNITY GIVING

Laboratory employees champion local and national causes each year, giving their time, talent, and funds. The Laboratory community generously supports two main giving categories:

- Helping Those in Need
- Helping Those Who Help Others

Sharon Tarby, right, delivers the first care basket from the LL Survivors group to Caryn Cassidy.

Lincoln Laboratory Survivors

Sharon Tarby formed the Lincoln Laboratory Survivors (LL Survivors) group to benefit Laboratory employees undergoing cancer treatment. The group fills gift baskets with donated comfort items, such as warm fuzzy socks, books, cocoa, tea, and small activity books, to help patients pass the time during chemotherapy sessions. Tarby said, "These baskets are meant to brighten a person's day and show that we support them." A bake sale helmed by Elizabeth Bernardo and Tarby raised funds for further basket donations.

The managers of LabAid—a platform that raises awareness of charitable opportunities for Laboratory community members experiencing hardship—are partnering with the LL Survivors group, so that employees who have cancer, or are caring for someone who has cancer, will be offered this service as part of their care. The first gift basket was delivered to Laboratory employee Caryn Cassidy in December, an effort Tarby said was "a beautiful surprise to Caryn. It was such a heartwarming show of support to a Laboratory colleague, and I hope we can continue to help many others experience a moment of joy in an otherwise difficult and challenging time." This group of helpers is open to anyone at Lincoln Laboratory as well as friends and family members. Tarby said, "We are always looking for donations and volunteers to create and deliver baskets." She added that people in the Laboratory community who might be eligible to receive a care basket should contact LL Survivors or LabAid.

Marshallese Outreach

The Laboratory operates a field site on Kwajalein Atoll in the Marshall Islands, where fewer than 30 staff members serve two- to three-year assignments. The amicable relationship enjoyed by the Laboratory staff and the local community prompted the initiation of an outreach program to enrich the educational experiences of Marshallese students. Laboratory staff stationed at the Kwajalein Atoll Field Site donate their time and money throughout the year to both the local Kwajalein community and the larger Marshallese community. Staff participate in the following activities throughout the year:

- **Mentoring Boy Scouts, Girl Scouts, and robotics clubs**
- **Selling Micronesian handicrafts**
- **Donating items such as electronic equipment and school supplies to Marshallese schools**
- **Donating school supplies and boxed lunches for Ebeye students attending school on Kwajalein Atoll**

Top: Jordan Wynn, creator of the Kwajalein Shoe Drive, sees her plan come to fruition as she helps an Ebeye child find the perfect shoes. **Left:** Adam Gjersvik, Jordan Wynn, and Maria Gjersvik load boxes of shoes onto the ferry from Kwajalein to Ebeye. **Right:** Adam Gjersvik helps a young Ebeye resident get fitted for a new pair of shoes.

Lincoln Laboratory staff on Kwajalein distribute more than 650 shoes at a school on Ebeye.

Other forms of outreach arise from year to year, such as upgrading the computer system at the local hospital, selling Marshallese crafts, or hosting beach cleanup days. This year featured a shoe drive for the children of Kwajalein and Ebeye.

Shoe Drive for Marshallese Children

Jordan Wynn visited Kwajalein Atoll in the Marshall Islands in 2023 to help teach a Beaver Works Summer Institute course to local high school students. While she was there, she and her sister, Hannah, developed and provided a basketball clinic for the children of the neighboring island of Ebeye. Through their efforts, 200 children learned new basketball moves. While some of the children wore new athletic shoes and socks donated by Wynn's former school teammates, many had to play barefoot. Wynn said, "The kids were always full of smiles and willing to share shoes with each other. This spirit of selflessness and gratitude deeply inspired us, and we felt compelled to make more of an impact on the Ebeye community."

In 2024, Wynn partnered with Samaritan's Feet, a nonprofit organization that works to provide shoes to children around the world. From March through May, she collected donations of new shoes from Laboratory community members, who deposited them at collection boxes. A link was provided for those who preferred the simplicity of a monetary donation. For every $25 donated, Samaritan's Feet provided a pair of shoes and socks to a child in need. All shoes were delivered in late December to children on Ebeye by the Wynn and Gjersvik families, currently residing on Kwajalein. The generosity and support of the Laboratory community raised more than $6,700 towards the $10,000 goal. Wynn was pleased with the results, saying, "Thanks to the funds we raised, we were able to purchase 637 pairs of shoes and socks through the organization, and we also received 30 additional pairs through generous donations."

Wynn thought the effort was a resounding success. She said, "It was a very special experience to get to spread holiday cheer to the children, and we are grateful for everyone who donated to make this event possible."

The LabAid Committee includes, from left to right, Roslyn Wesley, Gerald Augeri, and Allison MacDonald.

LabAid

This initiative established by a subcommittee of the Professional and Community Enhancement (PACE) Health and Wellness group provides a platform for Laboratory community members who want to help colleagues going through serious hardships. LabAid standardizes the traditionally informal giving process that has existed at the Laboratory for decades. "During the pandemic, Laboratory-wide collections weren't possible, and even group collections were difficult because we weren't all together," said Allison MacDonald, who helms LabAid with Roslyn Wesley and Gerald Augeri. "We thought it would be great to have a way for us to offer this kind of support, no matter where we are."

LabAid is an opt-in, personalized program. Services offered vary on a case-by-case basis. For example, some people may seek financial assistance, while others may simply want cards with encouraging words from their colleagues. "We might have 20 people nominate someone to receive support, but it would be that person's decision whether or not to participate," said Augeri. "We would talk to them to determine if they want support and, if they do, what kind of support they want. LabAid is a very personal and personalized service—one in which we respect people's privacy and preferences."

Members of the Lincoln Laboratory community share volunteerism and camaraderie at the Greater Boston Food Bank.

Greater Boston Food Bank

Members of the Lincoln Laboratory community played a crucial role in February in helping address hunger in Eastern Massachusetts. Chiamaka Agbasi-Porter, William Gibbs, and Spencer Johnson organized a volunteer day to help the Greater Boston Food Bank (GBFB) in Boston, Massachusetts. One of the largest food banks in the country, GBFB provides healthy food and resources to those in need, to community meal programs, and to local food pantries.

Volunteers helped sort, inventory, and pack donated food items, ensuring that they were properly organized and ready for distribution, and stocked shelves in the warehouse. Lincoln Laboratory volunteers included Amanda Martinez, Thomas Washington, Julian Fontes, William Gibbs, Colleen Cooney, Bridget Sheldon, Stacy Doyle, Uchendu Uchendu, Dominique Edgerson, Noah Yared, and Chiamaka Agbasi-Porter.

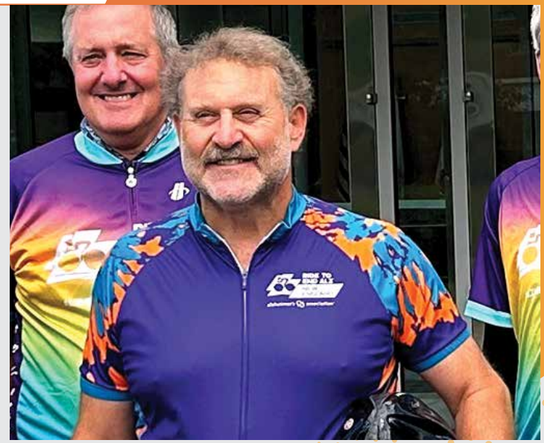
Seedling Giveaway

LLGrows held its fourth-annual seedling giveaway in May to help staff become interested in gardening. Seeds were started inside the Laboratory under grow lights and then moved to visible locations in sunny public spaces within the Laboratory. Employees noticed plants growing throughout March, April, and May. Joan Boegel, chairperson of LLGrows, said, "Every time I took care of the seedlings, employees would ask about the plants and we'd chat about home gardening efforts. This visibility built up a lot of excitement and anticipation about the seedling giveaway."

Finally, in late May, 500 plants were lined up on tables, destined for new homes. A dedicated team of LLGrows members had established several varieties of tomatoes, sweet peppers, hot peppers, cucumbers, summer squash, and kale for the event.

Because May is Asian American, Native Hawaiian, and Pacific Islander Heritage Month, members of the Pan-Asian Laboratory Staff Network (PALS) had planned and cultivated Asian-specific vegetable and herb seedlings including Thai sweet basil, Korean put gochu peppers, Asian cucumbers, and shishito peppers. Members of LLGrows offered handouts on plant care and explained to each recipient how to care for their new plant, while members of PALS shared a website full of plant care instructions, the country of origin for each plant variety, and recipes that use each type of plant. When noting the success of the giveaway, Boegel said, "I'm especially gratified when an employee tells me that the plant they picked up at the giveaway is thriving. It's nice to know that LLGrows has an impact beyond our little community garden here at the Laboratory."

Members of LLGrows stand at the ready to cultivate new gardeners by giving away more than 500 plant seedlings.



DAVID CAPLAN

EMPLOYEE SPOTLIGHT

What are the duties of the team captain for the Ride to End Alzheimer's team?
My role is to organize the team, enlist new riders, raise funds, spread awareness about the event and the goals of the Alzheimer's Association, and of course participate in the Ride!

I inherited the reins of the team from John Kaufmann after he retired. John knew all the ins and outs of running the team, and was exceptional at fundraising. Though he retired, he continued to contribute to the team that he started over a decade ago—and his guidance made my role much easier. Sadly, John passed away in July 2024 after battling long COVID. Despite chronic fatigue, he continued to actively fundraise from the sidelines, and was once again Team Lincoln's top fundraiser. For those that didn't know him, he was a real gem and he will be missed.

Why did you start participating in this event?
John Kaufmann said he was riding to honor the memory of his mom, and asked me if I would like to ride with the team. It was easy saying yes to getting some fresh air and exercise while contributing to the worthy cause of trying to end this debilitating disease.

What motivates you to keep volunteering year after year?
I enjoy participating with hundreds of other riders—young and old—all enthusiastically supporting the same good cause. For my first several years of the ride, I participated with my son, Jay. As a 14-year-old, he was intimidated by a 30-mile ride, so it became an opportunity for us to train together. After his first ride, he saw that with proper preparation, this "long" ride wasn't so challenging after all. In subsequent years, we increased our training and moved up to the 62-mile ride. Now a recent college graduate and back in the area, Jay is hoping to join me in next year's ride, when we will ride to honor the memory of John Kaufmann, the team founder and former captain, continuing what he started over a decade ago.

How do you find time to volunteer?
This is always a challenge but it helps that the Lab encourages this kind of charitable activity that benefits the broader community. The spirit of what we do at the Lab often requires us to go above and beyond, and my efforts with the Ride-to-End ALZ team fall into that bucket. This has also become more of a fun family activity of sorts—often riding with my son, my wife Rose volunteering to work at the event, and my daughters Reena and Thea joining in the annual ride festivities and cheering on the riders.

What is the most rewarding part of your involvement with this effort?
I get a real sense of accomplishment from the Ride, which I suspect is related to how much you put into it. But the larger objective is to raise funding to end Alzheimer's and other forms of dementia.

Terri Welch, Alzheimer's Support Community member and co-captain of the Laboratory's Walk to End Alzheimer's team, hosts a table at the Lincoln Cares Fair to help people understand the issues surrounding Alzheimer's disease.

Alzheimer's Association

Walk to End Alzheimer's. The Laboratory Alzheimer's Support Community supports the goal of ending Alzheimer's disease by raising funds for the Alzheimer's Association. The Laboratory's cycling and walking teams have raised more than $630,000 toward the cause since 2009. Catherine Lockton and Terri Welch served as co-captains of Lincoln Laboratory's team in the 2024 Greater Boston Walk to End Alzheimer's in Cambridge, Massachusetts. Held in late October, the 1.5-to-3-mile walk raises funds for the Alzheimer's Association, the largest nonprofit in the world for Alzheimer's research and supporting programs for patients and their loved ones. The Laboratory's Alzheimer's Support team has a strong following at the Laboratory and formed a 16-person team for the walk. Through several bake sales, craft fairs, and generous donors throughout the Laboratory community, the team raised almost $17,000. Of all event proceeds, 79% goes directly to research. The remaining funds support fundraising, administration, and Alzheimer's Association efforts to provide support and resources to families impacted by the disease. If you'd like more information about how to participate in this event or how the Laboratory's Alzheimer's Support Community can help you, please contact alzheimers@ll.mit.edu.

Three members of Lincoln Laboratory's Ride to End Alzheimer's team meet in Hampton, New Hampshire, for the start of the event.

Ride to End Alzheimer's. In addition to its annual walk, the Alzheimer's Association holds an annual Ride to End Alzheimer's. For the thirteenth year, the Lincoln Laboratory Alzheimer's Support Community invited cyclists of all abilities to ride in the 2024 Ride to End Alzheimer's in Hampton, New Hampshire. David Caplan, the Lincoln Laboratory team captain, said, "For those who aren't familiar, the Ride to End ALZ is an established charitable event that has raised over $900k this year, adding to the more than $9 million raised over its 28-year history to directly advance Alzheimer's treatments and research. While our individual contributions are relatively small, they add up: since 2012, Team Lincoln has raised over $200k for this worthy cause. And these long-term investments are now leading to solutions as new FDA-approved treatments that slow cognitive decline in early-stage cases emerge."

When asked why others should join the Ride to End Alzheimer's team, Caplan said, "If you like fresh air and sunshine, and an excuse to bike with new friends and family for a good cause, I'd highly recommend giving it a try—we're eager to have new riders! Next year's ride is on Saturday, June 7, 2025, starting at the beautiful Hampton Beach State Park with routes along 14 miles of scenic oceanfront." This event is unique in that it features a post-ride beach bash with live music, barbecue, and dips in the ocean to celebrate this event's collective impact on the quest for a cure. Caplan added, "If you haven't done the Ride to End Alzheimer's before, there are four ride options: 30, 62, or 100 miles, and virtual rider (distance of your choice). For those who don't like to ride but are interested in volunteering, there are plenty of opportunities to support the event."

Run to Home Base

On Saturday, July 27, the 15th annual Run to Home Base was held at historic Fenway Park. It was the most successful Run to Home Base event yet, as more than 2,750 in-person and virtual runners and walkers, including 1,030 members of our armed forces and military community, helped raise nearly $3.4 million to heal the invisible wounds of war for veterans, service members, military families, and families of the fallen.

The Run to Home Base offers a unique opportunity to participate in a 9K run or 5K run/walk while fundraising to support veterans and their families. The race weaves through some of Boston's most scenic neighborhoods and ends with participants crossing home plate at Fenway Park. For the last 16 years, the Run to Home Base event has provided vital funds for the clinical care and support for 40,000 veterans impacted by the invisible wounds of service.

With a history of running for charitable causes, Pamela Taylor participates in this and several other events annually. She said, "This year's event was really fun, especially since I placed first in my age group, but any runner would enjoy this event. The speeches and energy at Fenway Park each year are inspiring." Taylor added, "The number one reason for my participation is to help wounded vets in memory of my dad, Dr. Henry T. Taylor, who crossed the English Channel on D-Day, so thanks go to Lincoln Laboratory friends and family who helped me donate to this worthy cause. I raised double my goal of $600, and was able to give $1250 toward wounded veterans."

> "Caring for others makes all the difference…bringing people together to help each other: that's where the magic happens! The power of personal connection inspires others to get involved."
>
> — KIT HOLLAND, ALZHEIMER'S SUPPORT COMMUNITY

From left to right, Lisa Basile, Timothy Hall, and Graham Baker participate in the Lexington Education Foundation's annual Trivia Bee under the team name "Bee an Engineer" to raise awareness of STEM career pathways.

Trivia Bee and Fundraiser

Every November, a team from the Laboratory participates in the Lexington Education Foundation's (LEF) annual Trivia Bee held at Lexington High School. This year's team, called Bee an Engineer, included Graham Baker, Lisa Basile, and Timothy Hall. For the event, teams were grouped into six "swarms" and the teams in each swarm were challenged to answer six questions. The winning team from each swarm participated in a final round to claim the "Master of Trivia" title and trophy. The teams consisted of members from the community, including teachers, school and central office administrators, parents, local business owners and employees, volunteers, and high school students. "We look forward to this event every year," Basile said. "The team has fun representing the Laboratory and raising money for educational grants for Lexington Public School educators that enable innovation in teaching and learning."

Amanda Wait enjoys a celebratory photo with her family after finishing her 18th Jimmy Walk.

Bake Sale for Jimmy Fund Walk

A proud annual participant in the Jimmy Fund Walk in Boston, Massachusetts, Amanda Wait hosted a bake sale at Lincoln Laboratory to raise money for the Jimmy Fund. One of the nation's oldest and largest charities, the Jimmy Fund provides research funding to help save lives and reduce the burden of cancer on patients and their families worldwide.

The 26.2-mile walk features a finish line at Copley Square in Boston. Participants can also choose to do a half-marathon walk, starting from Wellesley, Massachusetts; a 10K walk, starting from Newton, Massachusetts; or a 5K walk, starting from the Yawkey Center for Cancer Care at Dana-Farber Cancer Institute in Boston.

"The walk was great this year and the weather could not have been better," Wait said. "I walked with my husband and two boys as part of the Ovarian Cancer Brigade. Our entire team is just 23 people but this year we have raised almost $63,000. My sister and I started doing the walk about 18 years ago after losing our aunt to ovarian cancer. Since then, we have lost both of my husband's parents to cancer and many other loved ones. I'm excited that my kids look forward to the walk every year!"

Wait added that her successful fundraising is due in part to Lincoln Laboratory. "The bake sale at the Laboratory was a huge success, raising just over $1,300. It is always humbling to hear the personal stories and witness the generosity of so many across the Laboratory community. I would have never thought that a small bake sale could make such a big difference."

Toys for Tots

Toys for Tots, founded in 1947 and run by the U.S. Marine Corps Reserve, delivers toys to children whose parents or guardians may not be able to buy them gifts for Christmas. According to the Marine Corps, "local Toys for Tots campaigns are the heart and soul of the Marines' Toys for Tots Program." Every year at the Laboratory, volunteers work together to wrap brown cardboard boxes with cheerful holiday paper and large bows. The boxes are then placed strategically throughout the Laboratory, kicking off the giving opportunities.

Susan Curry and Karen Grasso gather donations of toys from the Laboratory community and take them to distribution centers located in Middlesex and Essex counties. There, local organizations pick up the toys and take them where they are needed most. Most of the children who receive presents through Toys for Tots would not receive presents otherwise.

MIT Community Giving

MIT has a long tradition of looking outward to serve the nation and the world, but it is also dedicated to making an impact locally. For more than five decades, the MIT Community Service Fund (CSF) has helped turn the generosity of the Institute community into positive impact for its neighbors in Cambridge and Greater Boston. Working hand in hand to support local organizations, MIT community members (faculty, students, staff, and the entirety of Lincoln Laboratory) turn great ideas into lasting, community-led change. The MIT Community Service Fund team shares two of its donation drives with Lincoln Laboratory: gifts for Santa for Seniors and Community Art Center.

Santa for Seniors

Community Giving at MIT partnered with the Cambridge Police Department (CPD) to brighten the holiday season for Cambridge senior citizens engaged with city services. More than 20 departments across campus and Lincoln Laboratory participated in this holiday tradition and donated an abundance of tasty treats, blankets, sweaters, coats, hats, gloves, socks, and books for Cambridge neighbors. On Christmas Eve morning, the CPD, along with volunteers, delivered more than 450 gift bags filled with love to neighborhood elderly. Many gifts were personally matched with the seniors to ensure that they would receive items they most needed.

Cambridge Police Sgt. Susan Kale thanked MIT donors for their tremendous kindness: "Without your generous support, we would not have been able to run this program to accommodate all the requests we received." In a note expressing his gratitude, a senior wrote, "Thank you all so very, very much for that huge bag full of goodies! I love the warm scarf, the socks, and the hot chocolate mix with marshmallows. I feel happy and lucky to be a senior citizen in Cambridge."

Community Art Center Gifts

The Community Art Center in Cambridge, Massachusetts, provides a supportive family-like environment with intensive social, emotional, and academic help structures. They offer children opportunities to draw, write, and dance, as well as learn photography, pottery, and film making. The center strives to cultivate engaged youth whose powerful artistic voices transform their lives, their neighborhoods, and their worlds.

Each year, the Community Art Center hosts a holiday gift drive for the kids in their programs. MIT CSF shares an online wish list with Lincoln Laboratory so that desired gifts can be purchased and sent directly to the center to be delivered to families in need.

Hildebrand Homeless Service

Hildebrand Family Self Help is a nonprofit organization that provides shelter, case management, permanent housing, and stabilization services to families experiencing homelessness. To break the cycle of homelessness, they offer training, life skill development, and work-readiness programs. MIT CSF supports the Hildebrand winter holiday drive to collect new gifts for children and winter items for families. Members of the Lincoln Laboratory community donated online and in person to help keep families safe and warm.

Operation Delta Dog

For its annual donation drive, the Student Veteran Success group at MIT chose to raise funds for Operation Delta Dog, an organization that supports veterans by training service dogs and pairing them with veterans living with post-traumatic stress disorder or traumatic brain injury. The service dogs provide invaluable support to their veterans by providing retrieving items, interrupting nightmares, and alerting of oncoming panic attacks. Lincoln Laboratory happily provided monetary donations to this charity.

Left: Gardeners from across the Laboratory bring friends and family to Gaining Ground Farm for a volunteer work day in September. **Above:** Laboratory volunteers help Gaining Ground Farm by spreading compost on a field in June.

Gaining Ground Farm

The PACE Health and Wellness subcommittee organized two work sessions, held in June and September, at Gaining Ground Farm. The work was enjoyable and productive, as Laboratory volunteers pulled weeds from a field in June and cleared a cabbage field in September, preparing the fields for upcoming plantings.

Gaining Ground Farm is a nonprofit organic farm in Concord, Massachusetts, that grows fruits and vegetables for statewide organizations that assist people experiencing food insecurity. Several thousand community volunteers perform the ground work at the farm, which donates all its fresh food to 17 area meal programs and food pantries, including East Boston Community Soup Kitchen and House of Hope in Lowell, Massachusetts. Most of their produce is distributed within 20 miles of their farm and within 24 hours of harvest.

In June, a team of 12 people helped prepare a field for butternut squash by weeding and spreading compost. Volunteers included Bich Vu, Connor Willison, Ngaire Underhill, Debra Hamilton, Philip Werth, Joan Boegel, Katherine Barlett, and friends and family.

Thirteen Lincoln Laboratory employees volunteered in September, plus three friends and family members. Boegel was joined by Allison MacDonald, Niamh Kelly, Alexis Holohan, Benjamin Streigel, Cheryl and Stephen O'Keefe, Chayil Timmerman, Charlotte Fitzgerald, Matthew Drew, Catherine Feldman, Anna Apilado, and Katherine Barlett.

The Laboratory's volunteer days were organized by Joan Boegel, who said after the September work day, "I really enjoyed working alongside farmers and chatting with all the other volunteers. We accomplished a lot in a couple of hours: clearing the cabbage field and weeding so that a cover crop could be planted. It was a good workout and we got plenty of sunshine." The group plans to continue helping Gaining Ground Farm in its mission to donate organic produce for hunger relief.

Other Community Outreach

The Laboratory encourages its staff to support a variety of personal causes and to join colleagues in charitable efforts. The Laboratory community has supported several charities and events on their own time, including

AFCEA 5K Run for STEM
American Heart Association
American Lung Association
American Red Cross
Avon Walk for Breast Cancer
Pan-Mass Challenge
TeamWalk for CancerCare
Walk for Hunger
And many others

About Our Volunteers

The Laboratory thanks those who have offered their time, talents, and support this past year. We are proud to say that volunteerism among Laboratory employees grows each year. The Lincoln Laboratory Community Outreach Committee will continue to offer many opportunities for employees to participate in educational outreach and community giving events. The involvement of the entire Lincoln Laboratory community is encouraged. If you engage in outreach or are interested in starting a new outreach program, please contact the Communications and Community Outreach Office at ccoo@ll.mit.edu.

About Our Programs

MIT Lincoln Laboratory Giving supports activities directed by the Laboratory's Communications and Community Outreach Office, funding for special STEM events and workshops offered at the Laboratory, and grants to participants in programs run by MIT. These endowed and expendable funds enable the Laboratory to back programs that complement its mission of developing technology in support of national security by helping ensure that the U.S. workforce remains preeminent in technology. New this year, the Lincoln Laboratory Internship Fund has been established in the name of Eric Evans, director of MIT Lincoln Laboratory from 2006 to 2024, to support highly qualified undergraduate interns at the Laboratory.

If you would like to support STEM outreach, visit **www.ll.mit.edu/outreach/community-giving** and click **Give to MIT** to support outreach in a way that works best for you.

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