LINCOLN LABORATORY
COMMUNITY OUTREACH

MIT LINCOLN LABORATORY

2023 COMMUNITY INVOLVEMENT REPORT

“Community outreach and education programs are a critically important part of the Laboratory’s mission as we strive to inspire the next generation of STEM professionals.”

—Eric D. Evans, Director, Lincoln Laboratory

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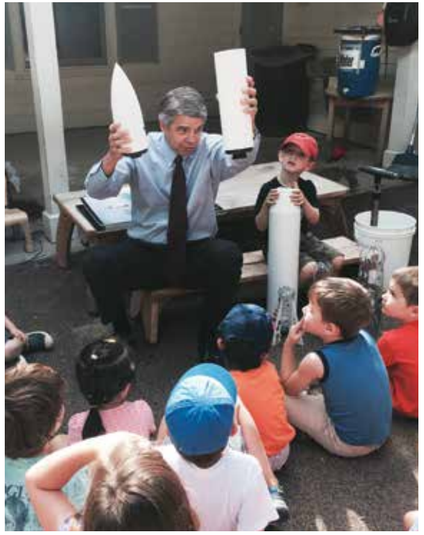


A Message

From the Director

As I prepare to step down as Director of Lincoln Laboratory on July 1, 2024, I reflect on the last 18 years of programs that emerged from one of our core strategic directions: enhancing science, technology, engineering, and mathematics (STEM) educational outreach and community service.

Our educational outreach programs encourage K–12 student interest and participation in STEM fields. Year after year, the Lincoln Laboratory Radar Introduction for Student Engineers, Beaver Works Summer Institute, and Lincoln Laboratory Cipher have proven to be among our most successful project-based summer programs. In general, our programs have reached more than 100,000 students nationwide, engaging them in hands-on experiential learning. We have refined and grown our portfolio of programs to maximize our impact and ultimately help prepare the next generation of STEM innovators to tackle pressing national security challenges. Every summer, we also open our doors to top-university undergraduate and graduate students, who complete internships complementing their courses of study. Participation in our Summer Research Program has continued to rise, with more than 200 students hired in recent summers; some interns have since become Laboratory staff.

To address the national need for more diverse talent capable of solving such challenges, Lincoln Laboratory began participating in 2006 in the National GEM Consortium, an organization that provides fellowships to underrepresented minorities pursuing graduate degrees in STEM fields. Through the efforts of many GEM volunteers and staff, the number of fellowships available at Lincoln Laboratory increased significantly through the years.

Recognizing that a diverse and inclusive workforce is crucial to solving problems more effectively, we also expanded opportunities for military officers. For more than two decades, the Laboratory has hosted a one-week Defense Technology Seminar designed to inform military officers about the latest defense capabilities. Each year, we extend full-time fellowships to military officers pursuing graduate degrees and summer internships to undergraduate students at U.S. service academies. The benefit is mutual: military officers witness the process of developing systems that directly impact national security, while the Laboratory gains insight into their operational needs.

I encourage you to read this booklet to learn more about the many programs we offer to students at every level of education and the various charitable events we contribute to, including the Ride and Walk to End Alzheimer's and the Jimmy Fund to support Boston's Dana-Farber Cancer Institute. I look forward to following the Laboratory's continued commitment to serve the nation and our local communities for decades to come.

Eric D. Evans
Director

01 EDUCATIONAL OUTREACH

The Communications and Community Outreach Office develops relationships with community organizations and members, specifically lower-income districts with a focus on engaging students in K–12 STEM 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

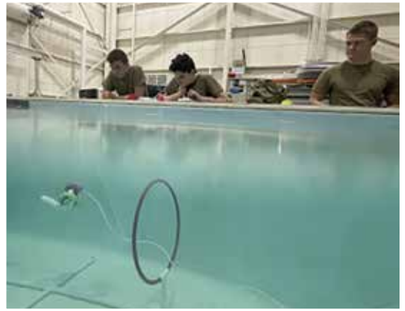
Five teams of cadets visited the Laboratory's test pool over several months to prepare for an international underwater robotics competition.

SeaPerch Underwater Robotics Competition

From November to May 2023, a group of high school cadets from the U.S. Naval Sea Cadet Corps Massachusetts Bay Division routinely visited the Laboratory's testing pool located on Hanscom Air Force Base in Lexington, Massachusetts. The cadets were preparing for an international underwater robotics competition called SeaPerch, which challenges participating teams to build an underwater vehicle with abilities that adhere to a specific theme. This year's theme was ocean exploration, and the teams built vehicles that could maneuver through an obstacle course and perform tasks such as moving objects and opening a door.

Ronald Ross connected the cadets with the Laboratory. He had been volunteering with the Bay Division for three years and jumped in to help when he heard the cadets were looking for a place to test and troubleshoot their builds. He and Laboratory colleagues Benjamin Evans and David Whelihan secured time at the pool for the students to visit once a month. For the most part, Ross said, the cadets were in charge of studying the supplied SeaPerch material and assembling and testing their vehicles. The Laboratory staff served as domain-expert advisors, assisting the cadets

> "The Sea Perch program has been a great means of developing my leadership and engineering skills. The engineering and physics concepts I gained will help me with my future career in biomedical engineering, and my experience leading the Sea Perch team is a great foundation for my future endeavors."
>
> — AKSHAYRAM SIVAKUMAR, SCIENCE PETTY OFFICER, NAVAL SEA CADET CORPS



Left, Two cadets mount a motor to their underwater vehicle. **Above**, At the Laboratory's testing pool, cadets practice driving their vehicles through hoops placed underwater.

in underwater physics and robotics engineering, and providing oversight to prevent safety issues.

According to Lt. Glenn Jones, executive science officer for the Bay Division, SeaPerch is one of many ways to bring STEM opportunities to his cadets. They had competed in previous years but struggled to find a suitable place to practice with their vehicles. "It was an extraordinary opportunity to come to the Lincoln Laboratory facility and get support and garner intellect from individuals like Ron," Jones said.

For cadet Seamus Pilette, who is on track to join the U.S. Marine Corps, participating in the event allowed him to make connections with others and gain a better understanding of all that goes into an engineering project: "This understanding will help me in my career to work better with my future colleagues, as the Marine Corps works closely with the U.S. Navy." Cadet Simon Jones joined to learn how to build something from the ground up: "I thought it would be fun and a good use of my time. I could learn how to follow a process to make something of my own using science and engineering."

Eleven teams of cadets prepared for the regional competition at the University of New Hampshire, and five teams placed to partake in the international competition at the University of Maryland, College Park, in May 2024. These five teams were the ones that visited the Laboratory to prepare.

"I spent 28 years as a career submariner operating in some challenging undersea environments, and a submariner's ability to operate in those harsh environments is enabled by sophisticated technology developed by engineers," Ross said. "This experience allowed me to witness young future engineers, and it was incredibly satisfying." The Massachusetts Bay Division cadets returned to the Laboratory in the fall to prepare for next year's competition. /

DAVID WHELIHAN

EMPLOYEE SPOTLIGHT

What STEM outreach activities have you participated in?
I helped out with the Beaver Works Summer Institute in 2021, the first year I was in the Advanced Undersea Systems and Technology Group. For that, I built a small, low-cost autonomous underwater vehicle that I can bring to places along with a small pool. I did a Science on Saturday session on undersea robotics last year. This year, I served as a technical mentor for the Boston-area U.S. Naval Sea Cadet SeaPerch team, helping them to build small remotely operated vehicles that compete to maneuver through an underwater obstacle course.

Why did you decide to volunteer?
I really like working with kids. You gain a lot of perspective when you have to pull yourself out of your everyday context and explain things in simple, relatable ways. Jargon is a no-no, and so to explain things, you have to decompose ideas down to their elements. I think you really have to know your stuff to do that well. It is a great challenge.

How do you benefit from these experiences?
I love watching people "get it," or seeing them walk away going, "I did that." I tend to be pretty positive and gung-ho, so if I can convince some of these kids to try something new or something that is intellectually a little scary, it is a good day.

Why should others consider getting involved in outreach?
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.

Do you have any advice for those who have an idea for a new outreach activity?
I have found that the Laboratory is very receptive to supporting these kinds of initiatives. For SeaPerch, getting 10-plus teenagers onto Hanscom Air Force Base and then into the Autonomous Systems Development Facility for multiple safe build events took some doing, but everyone—whether they were from the Environmental, Health and Safety Office; Security Services; or the Director's Office—was very helpful and encouraging. So, if you have an idea for an outreach effort, mention it to the Outreach Office.

Kwajalein Color and Light

Charles Wynn of Lincoln Laboratory's Kwajalein Field Site held a demonstration about light and color at George Seitz Elementary School. He was invited to share a fun presentation that supported a unit in their science class. "I love the energy of the kids. It's refreshing to work with them. My primary goal is to make sure they are excited about science. Hopefully they take away a few nuggets of information as well," Wynn said.

Wynn began by explaining that photons are the buildings blocks of light and described how color works. Wynn showed the students an up-close view of how white light can be decomposed into all the colors, which can then be recombined into white light.

Throughout his years at the Laboratory, Wynn has given this presentation in various settings and events, and it is always a crowd pleaser: "I've gone to many elementary schools and done some of the Family Day and Science on Saturday demonstrations. Because the elementary school talks are more interactive, I have the flexibility to let the demonstration go in different directions depending on students' questions and their interest and excitement. We can dig a little deeper on certain topics, which is great. I have to keep things a little more rigorous and planned when dealing with a bigger audience."

On the topic of accessible STEM outreach on Kwajalein, Wynn said, "Kwajalein is a very different place than many of us ever see. There are kids from the neighboring island of Ebeye, which is extremely poor, who attend school here on Kwajalein. It's great to give these kids a little boost and see them get excited about science. I feel lucky to be able to do my small part, along with many others from Lincoln Laboratory out here, to help young kids living under very challenging circumstances." /

Charles Wynn shows Kwajalein school students how light is a beam of particles by shining a flashlight on a radiometer, which rotates when struck by light.

Left, Hanscom Middle School students have fun building a color-changing light crystal during the Lights, Vision, and Spectra workshop. **Below**, A student in the Lights, Vision, and Spectra workshop at Bethany Hill learns a bit of circuitry for her project.

Lights, Vision, and Spectra

Hanscom Air Force Base Middle School. Bethany Huffman and Michelle George presented lectures at Hanscom Middle School in May. The students were excited about the Lights, Vision, and Spectra talk, which introduced the concepts of light reflection, color perception, and vision. Students particularly enjoyed a comparison between human and animal vision. A second day of the school's focus on light spectra entailed an in-depth discussion about color mixing, followed by a hands-on activity. Mentors from Lincoln Laboratory guided the students in building a color-mixing light-emitting diode (LED) crystal. This color-mixing activity allowed students to learn about simple circuitry and assess whether mixing colors of light works the same as mixing colors of paint. The students took great pride in building something on their own.

Bethany Hill Place. The Lights, Vision, and Spectra instructional program was repeated in Framingham, Massachusetts, on July 25 at Bethany Hill Place, a housing complex offering learning opportunities for children and adults who are homeless or low income. George led the lectures for students aged 8–17. She introduced the concepts of light spectra and light reflection, and described how the human eye interacts with light and how we perceive color. The students became more curious once George showed them some illusions that trick the mind about how it perceives color. Daphne Vessiropoulos, Yari Golden-Castano, and Victoria Loehle assisted a small group of students with the hands-on activity of building a color-mixing crystal. The workshop concluded with giving each participant light-diffraction glasses for viewing the light spectra of various light sources in the room, including the light crystal they had just built. George said, "One of the boys I was helping kept on saying how fun it was that we were doing this hands-on building; it was very sweet. Overall, I think all the kids had a good time and something fun to take home at the end." /

Many Lincoln Laboratory staff volunteer to help explain scientific principles to students in G.I.R.L. programs including a festival focusing on space science, a course on programming and circuits, and a forensics workshop.

Girls' Innovation Research Lab (G.I.R.L.)

For the past three years, Lincoln Laboratory's G.I.R.L. workshops have offered hands-on engineering workshops primarily for middle and high school girls at various schools and organizations in the larger Boston area. While G.I.R.L. prioritizes serving a female demographic and representing women in STEM through a female-heavy staff presence at events, the program also holds co-ed events serving all underrepresented populations. G.I.R.L. workshops were held at the Laboratory, at a makerspace, and at Brookview House for the students who live there. Located in Dorchester, Massachusetts, Brookview House provides affordable housing and support services for women and children experiencing homelessness. They strive to provide the resident children with hands-on educational support. All workshops at Brookview House and Bethany Hill Place used G.I.R.L. curricula taught by Laboratory staff. /

Mario Macera explains the science behind planetary orbits to festival attendees.

Space Science Festival

In May, Big Brothers Big Sisters of Central Mass and Metrowest and students from Bethany Hill Place gathered at Makerspace in Framingham to explore the science of space. Laboratory engineers led a day-long G.I.R.L. event filled with demonstrations, lectures, and interactive activities to inspire children about planets, stars, galaxies, and aerospace concepts. Daniel Birchall and Rituparna Basu described planetary orbits at one station, while Mario Macera, at a second station, explained why spacecraft dynamics are important. Leena Singh and a special guest, Sunila Singh (her mother), talked to the participants about star alignment, and Brian Lee and Yari Golden-Castano described how and why planetary surfaces can differ.

After the lectures, Daphne Vessiropoulos guided the students on how to use a Makey Makey kit to create a lightsaber using popsicle sticks, copper tape, an LED bulb, and a battery. The goal of the workshop was to convey the topics and skillsets needed to work in the space industry while enabling participants to picture themselves in an aerospace-related career. To achieve this goal, staff hosted a career panel to provide answers to questions about pursuing careers in technical fields. Chiamaka Agbasi-Porter and Daphne Vessiropoulos shared information about LLRISE, LLCipher, and other summer programs offered by Lincoln Laboratory Outreach. /

Lincoln Laboratory Cipher (LLCipher)

From July 31 to August 4, 21 high school students from across the United States occupied a conference room at the Laboratory's Forbes Road location, where they learned about cryptography through LLCipher. The goal of the program is for students to gain a solid understanding of the fundamentals of cryptography, starting with subjects such as modular arithmetic and the mathematical definitions of security and ending with examples of zero-knowledge proofs and multiparty computation.

Ariel Hamlin served as the lead instructor, supported by David Wilson, Noah Luther, Nicholas Cunningham, Parker Diamond, Hanson Duan, and Dhir Patel.

Jack Whitman—a high school student from Westford who plans to study computer engineering in college—found the LLCipher program while looking for an educational opportunity that was new but relevant to his future studies. "It's [cryptography] a field that I don't know much about, so it was really nice to be able to go from virtually zero knowledge to a point where I can explain it to others," he said.

For Annelise Gross, who is interested in mechanical engineering, cryptography was an entirely new subject. Gross found the program through the Girl Scouts website, which lists opportunities for women in engineering. "My favorite part was on the first day, working with a team to crack codes as fast as possible," she said. The activity was for students in teams of two to decipher an encrypted passage from "Alice in Wonderland."

"I love how enthusiastic the students are," said Nicholas Cunningham, who has been involved in LLCipher for six years. "So many of them are happy to learn the material and eager to ask lunchtime questions about cryptographic topics they've heard about in their personal lives."

At the end of the program, the students toured some of the Laboratory's facilities and asked the instructors final questions. "From the questions we got, I think a lot of them plan to keep learning more about the topic," said Cunningham. "I count that as a huge success!" /

> "As a mentor, you are helping one person in STEM, but this impact gets shared when that person goes back to school or their social network, so in the end you are helping many!"
>
> — KRISTAN TUTTLE, MENTOR, SUMMER HIGH SCHOOL INTERNSHIP PROGRAM

Ariel Hamlin teaches LLCipher students about modular arithmetic and group theory.

This year's LLCipher students, instructors, and coordinators take a group photo at the Laboratory's main location on Wood Street.

RITUPARNA BASU

EMPLOYEE SPOTLIGHT

What Laboratory outreach activities have you participated in?
I have assisted with several different outreach activities and enjoyed each one: G.I.R.L. Empower Yourself Science Fair, Pioneer Charter School STEM career talk for high school students, G.I.R.L. circuits and programming outreach event, space science fair, and STEM careers talk for middle and high school students.

What motivated you to become involved in these programs?
In this technological age, STEM careers are key to economic prosperity and social justice for many underrepresented groups in our community. Diversity, equity, and inclusion are much discussed these days, but as an engineer looking for ways to move toward a more equitable society, I believe outreach and awareness can help reinforce those messages and hopefully make students aware of prospective futures.

Has anything surprised you about helping kids understand engineering?
I have been surprised at how technology savvy kids are, even the younger kids. Maybe there is some benefit to Instagram after all!

Why should others consider engaging in STEM outreach?
Apart from the obvious altruistic reasons, you meet a lot of folks from other groups and get to hear about the innovative work they are doing. These interactions help increase my sense of belonging at the Laboratory.

What do you think other people should know about STEM outreach?
It is a convenient and easy way to give back. The Laboratory's outreach efforts are well organized and coordinated, so it is not a lot of work for a volunteer—you mainly show up and have fun. Also, you get to take home loads of freebies and t-shirts!

Ariel Hamlin sparks some interest in cryptography among Dedham students.

Introduction to Cryptography

In affiliation with the Achieve Program and Boston Public Schools, Lincoln Laboratory Outreach offered an Introduction to Cryptography workshop for middle school students in Dedham, Massachusetts. The Achieve Program is an afterschool academic program that provides transformative academic programming and enriching experiences for motivated students from 30 public schools in the Boston metropolitan area. Ariel Hamlin described a few uses of cryptography in everyday life—like time stamping, authenticating a signature, and making a website secure—and noted what classes students should take to prepare for a career in cryptography. /

Lincoln Laboratory Radar Introduction for Student Engineers (LLRISE)

LLRISE is a two-week summer program that challenges high school seniors to build their own small radar systems as they tackle college-level courses, tour lab facilities, and sample college life. The 26 high-achieving students, selected from across the nation, learn about physics, Doppler radar, pulse compression, signal processing, circuitry, and antennas. Then, they apply knowledge gained from lectures as they build their own radar while learning how to code in Python, use a soldering iron, and 3D print an antenna frame. After completing their radars, the students work in groups to develop and stage experiments. The workshop culminates with technology demonstrations of each group's experiment. At the program's end, one student said, "LLRISE taught me that collaboration is the most important soft skill for an engineer to learn."

Students stage experiments to detect targets with their newly built radars in preparation of presenting their findings in a technical demonstration.

LLRISE participants visit the Haystack radar after building their own radars.

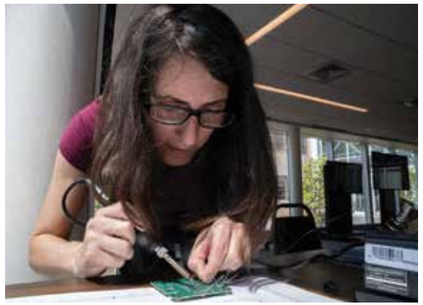
Instructors included Ryan Bohler, Julian Fontes, David Maurer, Allister Azagidi, David Brigada, Beverly Wong, and Spencer Johnson, many of whom annually assist with LLRISE.

"LLRISE incorporates project-based, hands-on learning opportunities," said Chiamaka Agbasi-Porter, Lincoln Laboratory's K–12 STEM outreach program manager, who created the LLRISE program more than 10 years ago. "The students accepted into this program learn about radar technology, but, more importantly, they gain an understanding of general engineering skills and what a possible career in a STEM field might look like for them." Bohler, who has served as an LLRISE instructor for seven years, maintains that LLRISE is "a good opportunity to help students trying to decide on their college and career plans." /

LLRISE for Teachers

Two secondary education teachers participated in LLRISE, learning the principles of radar and building their own radar systems. They plan to recreate the program at their own schools in Massachusetts and Texas. Monica Albuixech, an instructional technology specialist at Hanscom Middle School at Hanscom Air Force Base in Lexington, Massachusetts, appreciated the opportunity to attend LLRISE and learn course material with the students.

Albuixech, previously an Air Force Association Teacher of the Year, has set up a makerspace in her classroom to increase student access to STEM technologies. She would like to learn more about robotics, programming, and makerspace technology to create new curricula and increase STEM interest among her students, especially female and other underrepresented-minority students.



Left, Teachers Stephanie Mendoza of Raul Yzaguirre STEM Scholars Academy and Monica Albuixech of Hanscom Middle School participate in LLRISE to understand the program and determine how it may best fit within their respective curricula. **Above**, Monica Albuixech practices soldering a circuit board for her do-it-yourself radar so she can guide students through this step.

> “LLRISE was a transformative experience. It allowed me to build incredible relationships with people from communities different from mine and learn about real workplace skills. The hands-on activities helped me gain a more holistic understanding of science.”
>
> — A 2023 LLRISE STUDENT

Stephanie Mendoza from the Brownsville Raul Yzaguirre STEM Scholars Academy in Brownsville, Texas, where she serves as the 21st-century community learning coordinator, was excited by the prospect of bringing a hands-on engineering-based workshop to students. She strives to encourage women and students of Mexican descent to pursue careers in STEM. Agbasi-Porter said, “Including teachers in the program definitely lends a different dynamic in the classroom. It was great to see them enthusiastically building their radar and thinking about how to incorporate the LLRISE curriculum into their schools.” /

LLRISE: Spring Break

LLRISE: Spring Break offers an abridged version of the LLRISE summer program to students during their spring break week. This condensed program started virtually in 2021 through a partnership with the Texas Alliance for Minorities in Engineering (TAME), which offers age-specific programs to spark student interest in the sciences and technological careers. LLRISE: Spring Break moved back to an in-person format this year to facilitate recruitment from local schools and partner organizations (e.g., 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).

During LLRISE: Spring Break, held at Beaver Works in Cambridge, Massachusetts, 22 students used scientific problem-solving strategies to experiment with a range radar that they could keep. Participants performed their own experiments with Doppler radar and listened to supplemental seminars in between lectures. They received instruction and mentorship from Ryan Bohler, Julian Fontes, and David Maurer in radar basics, electromagnetic signal processing, radar hardware components, and Python fundamentals. Students practiced hands-on engineering skills by soldering radar antennas (assisted by Allister Azagidi) and assembling radars (assisted by Kevin Warner). David Brigada helped students create and conduct experiments using their self-built radars. After the students presented their experimental results to the class, Roberto Martinez provided tips for résumé writing and building a LinkedIn profile.

Like LLRISE for Teachers, LLRISE: Spring Break accommodates an educator to participate as a student in hopes of that educator subsequently offering the course locally as an extracurricular activity. Dajuan Riley, an educator from Empower Yourself in Brockton, Massachusetts, learned about radar operation and assembly. Riley also owns 3-2-1 Action Clubhouse, where he mentors Brockton youth. He plans to incorporate the LLRISE program at his organization and looks forward to offering it to aspiring makers and engineers.

All students completing the one-week LLRISE were encouraged to apply to participate in the full two-week LLRISE, as well as the Laboratory’s one-week cryptography program. Six of the 20 students in LLRISE: Spring Break applied for and were accepted into the LLRISE summer program. /

Chiamaka Agbasi-Porter explains to LLRISE: Spring Break students how to assemble and solder patch antennas for their radar.

Beyond LLRISE

It is not uncommon for an LLRISE student to find inspiration in the coursework and hands-on engineering portions of LLRISE. Each year, at least one student dreams up a way to extend their relationship with Lincoln Laboratory. In 2023, Amieya Cudjoe participated in LLRISE and a drone program in Brockton, Massachusetts, and had Lincoln Laboratory mentors in both programs. She sought the help of Lincoln Laboratory’s Outreach Office to help bring her idea for a summer project into fruition. Cudjoe wanted to modify the radar code from LLRISE as a math project. She was paired with Julian Fontes, who taught the Python lecture for both LLRISE: Spring Break and the summer LLRISE program in 2023. Fontes decided Cudjoe could collect data over a certain period of time, decide how to visualize it, and then potentially do some form of analysis. Ultimately, Cudjoe successfully presented this collection as a summer math project. Fontes described the mentorship as a fantastic opportunity: “Collaborating with Amieya was great! I’m proud I got the chance to help direct her ideas, overcome the many challenges she faced during the project, and ultimately pass down knowledge and teach her something new.” /

Aerospace Robotics

It Happens Here: Brockton High School's drone program breaking barriers in competition

By Levan Reid, CBS Boston, WBZ News

Amieya Cudjoe makes a few programming adjustments to the team's drone.

BROCKTON - There's a group of students at Brockton High that are flourishing in the school's drone program. The team's name is the Altitude Angels and they're all about shattering stereotypes.

They're getting ready for the New England Aerospace Robotics Competition. It's a contest that gives high school students the experience in building, programming, and flying drones on a competitive level. This group has been through this last year and took second place. They answered the question of diversity—there are not many teams of color in this competition.

The students are involved in the Empower Yourself non-profit, where the mission is to create critical thinkers for the future. When the drones arrive, they are in pieces. "I thought it was going to take me at least a month to do it but doing it now, it takes me almost a day to finish it," said 10th grader Marcelo Resende. (…) "We all work together so well and we manage to get stuff done," 11th grader Jamya Evans told WBZ-TV. (…) There are not many teams led by young women of color. "It feels empowering seeing people like me," said 11th grader Amieya Cudjoe.

The Brockton Drone team has the backing and the mentorship of MIT Lincoln Laboratory*. They encourage the students to push the envelope. So, if one of the drones breaks, no problem. They want the students to exhaust all their ideas. This is the future. Business and companies are in classrooms trying to find the newest and brightest minds, and in this Brockton classroom, the future is extremely bright.

** Johnny Worthy, Idahosa Osaretin, and Donato Kava (formerly of the Lincoln Laboratory) are Brockton alumni who have mentored the Brockton Drone team for two or more years. Under separate programs, Worthy, Osaretin, and Kava visited Brockton Middle School students to show them how to build and launch water rockets, and mentored Brockton High School students in programming mini racecars to follow a specified course.*

Left, Bich Vu shows girls in the forensics workshop how to identify substances. Using sugar, flour, and baking soda, participants used different solvents and observed the resulting chemical reaction. **Below**, Future forensic scientists investigate a strand of hair through a microscope.

Forensic Science

Through the G.I.R.L. program, Lincoln Laboratory hosted a one-day forensic science workshop to middle school sleuths in December. Fifty curious participants gathered in the cafeteria to learn about and practice forensics. With seven Laboratory staff members leading hands-on demonstrations and 18 others helping students, this workshop offered an instructive interactive program with a high mentor-to-student ratio.

The team developed a fun-filled and educational day of mystery solving with hands on activities that were both age appropriate and engaging. The students learned about fingerprinting, ink chromatography, handwriting analysis, unknown substance identification, and hair and fiber analysis, as depicted in popular police-based television shows. The workshop culminated in a fabricated crime scene in which participants got to practice everything they learned about forensics to catch a sneaky thief!

Emma Powers, John Yucak, and Yari Golden-Castano guided girls in a hands-on activity about fingerprinting; Marjorie Misasi and Teresa Fazio led the ink chromatography and handwriting analysis activity; and Donna-Ruth Yost and Hannah Stickler helped students understand how to perform hair and fiber analysis. Other volunteers included Amanda Prescott, Daniel Birchall, Rachel Nelson, Dorothy Febbi, Sheralyn Fallon, Rdan Golden-Castano, John Yirrell, Suzy Wang, Bich Vu, Peijun Shao, Todd Jackson, Qiana Curcuru, Skyla Agostino, Kristine Mackessy, Sara Canzano, Mario Macera, Allister Azagidi, and Rebecca Connor.

Organizers viewed this first-time program as a success, stating that the participants were curious to learn more about forensics and excited to do all the activities, especially looking up close at hair and fibers under the microscope.

Powers, lead for this effort, thought the forensics workshop was a wonderful experience. "It was inspirational to see so many young girls interested in such a complex topic. The girls were very inquisitive and the volunteers could see them start to develop deeper questions as the day went on," said Powers. Several participants mentioned that they now have a better understanding of what forensics is and the workshop helped them realize there's a lot more that goes into the science of forensics than what is shown in TV shows. Powers added, "If at least one girl who attended left now knowing that this is a career path she could take, we did our job well. Hopefully one of those young ladies will be a future forensic scientist!" /

Programming and Circuits

Students from Bethany Hill Place visited Framingham's Makerspace in March to learn how to perform basic programming in this G.I.R.L.-inspired workshop hosted in partnership with Big Brothers Big Sisters of Central Mass and Metrowest. The goals were to let kids try their hand at coding and engineering and to build their self-confidence in performing this type of work. Led by Yari Golden-Castano, the workshop introduced students to the concept of programming. The next portion of the workshop explained what a circuit board is and what it is used for, and shared examples of different types of circuits. The course was set up to pair programming and circuit building for a particularly meaningful learning tool. Basu said, "Sometimes kids code and you can see the [programming] changes in the virtual environment, but the hardware and circuitry section in this course was a great way to show the link between software and hardware. It was clear that the goal of the software was to make the hardware behave in a way that the programmer desires."

Using Makey Makey kits and Scratch, the students applied what they learned from the lectures and programmed an assortment of carrots, foam boards, and candy to play music. Basu and Bich Vu provided one-on-one guidance to help the children program, troubleshoot, and build a circuit board. Basu added, "I think the Mens et Manus MIT philosophy was manifested here with the circuit-building part focusing on the hand [manus] and the programming part focusing on the mind [mens]." /

A "Big Sister" and Rituparna Basu, right, stand by to help students program a Makey Makey kit to play music.

ADAM KERN

EMPLOYEE SPOTLIGHT

What outreach activities have you contributed to?
I've helped with Lincoln Coders, LL EduCATE, an artificial intelligence and machine learning workshop, and Kids Day, and served as a career panel speaker.

Why did you want to get involved in these programs?
I have always loved teaching, which is the central theme of my outreach efforts. I love seeing that spark of understanding and excitement when a student grasps a topic for the first time. And I really enjoy the challenge of reshaping educational material for each new audience and individual. I think these programs are particularly special because they bring Laboratory expertise and experience into the classroom to provide new perspectives.

Can you share an outreach moment you're proud of?
I think back to a remote series of Introduction to Engineering lessons that we ran at Jubilee Brownsville in Texas. I had worked heavily on the water filtration lab for the curriculum, and we got to do a multiday design and build, in which students conceptualized their designs one day and then built and tested them over the week. I was really touched—and a little surprised—by how enthusiastic the kids were about the lab and how much fun they seemed to be having. Plus, we got to see some really creative designs!

How does engaging in outreach affect your work life?
I think the most noticeable impact has been all of the Laboratory people I've met through outreach. It turns out that there are people in every group, division, and department doing outreach for the Laboratory, and it's great to start seeing friendly faces wherever I go.

How do you make time for volunteering?
Volunteering is a balancing act, like all priorities, and I admit it ebbs and flows depending on my workload and the volunteer effort required. The biggest enabler is working with a team. LL EduCATE only came together thanks to the tremendous efforts of Juliana Furgala and the other team members, who have kept me honest about deadlines and commitments and picked up slack. I also try to have fun with it; spending a little extra time is easier if you're writing a creative lesson plan or testing out a water filtration lab by making a mess in your kitchen.

What one thing would you like other people to know about volunteerism?
That it's worth the effort! I mean that in two senses: your work will positively impact people's lives (even when the work seems small), and the joy of helping others is worth the work it takes.

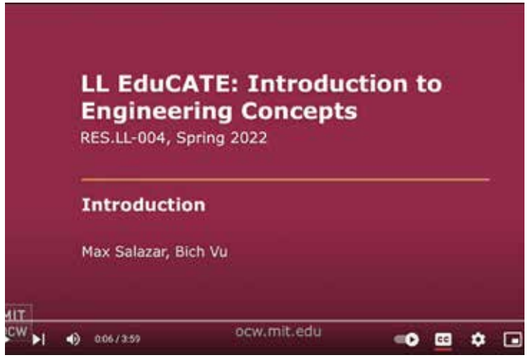
Lincoln Laboratory Courses for Accessible, Technical Education (LL EduCATE)

In 2022, the LL EduCATE team created educational content for an Introduction to Engineering Concepts course, featuring Lincoln Laboratory program–inspired labs in filtration, Clausewitzian chess, and Bluetooth technology to introduce STEM skills applicable over a variety of engineering disciplines. The course content was successfully tested in a pilot program for middle and high school students in Stoneham, Massachusetts. From August to December 2022, they ran the course remotely in an adapted semester-long format in a Brownsville, Texas, classroom.

In early 2023, the LL EduCATE team worked with MIT to make this course available on the MIT OpenCourseWare platform and the MIT YouTube channel, where it has already received more than 10,000 views. The team hopes that adding the video to the MIT site will increase viewership, spread awareness of what LL EduCATE can bring to students and educators, and offer a remote-learning option for the course.

In late 2023, the team began initial development of 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.

The LL EduCATE course on Clausewitzian chess was field tested in Huntsville, Alabama. Sarah Crews, right, helps a student consider strategies for her next move.



One LL EduCATE course has found a home on the MIT OpenCourseWare platform and MIT YouTube channel, where it will eventually be joined by future LL EduCATE courses with a remote-learning option to reach a wider audience.

Participants of the LL EduCATE course on Clausewitzian chess practiced problem-solving, spatial reasoning, and decision making.

Also this year, LL EduCATE field tested one predeveloped course in a new environment: Huntsville, Alabama. Sarah Crews, Tyler McCleery, Patrick O'Shea, and Justin Kizer at the Lincoln Laboratory field site in Huntsville were interested in conducting an outreach effort. They chose to adapt the course on the Clausewitzian chess model, a previously digital offering, to an entirely hands-on version for Huntsville through their local Boys and Girls Club. In an effort to incorporate as much hands-on play as possible, this course used physical chess boards and pieces. Participants learned different scientific strategies before beginning tournament-style play. The final week included playing the chess game on computers in order to combine all the teachings from the month-long class.

Juliana Furgala, who led the charge to develop LL EduCATE, talked about the success of the program so far and the way forward: "We're proud that our first course has proven so malleable. That really demonstrates how the course holds true to our goal of exploring a multiformat, accessible way of providing technical education. We've already adapted the course for week-long events, a semester-long class, and even one-off hands-on lab exercises. Going forward, this accessibility remains a core tenet of our mission, and we want to go one step further by having our future courses aligned with state standards and maybe even integrated into long-term curricula." /

Justin Kizer helped modify this four-week STEM outreach project to teach critical thinking skills through variations in strategy games like chess, tic tac toe, and battleship.

Kids in ROLL build their own robots, program them to perform specific tasks, and then test them on a competition playing field.

Robotics

Robotics Outreach at Lincoln Laboratory (ROLL)

After a two-year hiatus, ROLL began again in September 2023. The program enticed more than 40 children to discover the world of robotics by competing in FIRST (For Inspiration and Recognition of Science and Technology) LEGO League.

The FIRST Technical Challenge (FTC), open to students in grades 7–12, is more challenging and involves a more complex robot build. The Lincoln Laboratory team consisted of 11 students and eight coaches: Hemonth Rao, Elena Zorn, Atma Kanojia, Roger Khazan, Ritesh Patel, David Langus Rodriguez, James Sengthay, and Stephanie Sposato. ROLL has continuing collaborations with sister FTC robotics teams in neighboring towns and at Hanscom Air Force Base. ROLL ensures these teams have adequate supplies to build their robots and register for competitions. Sister teams stage scrimmages and share design concepts to ensure that they are ready for competition.

At the FIRST LEGO League (FLL) level, 30 students in grades 4–8 engaged in research, problem-solving, coding, and engineering to build and program a LEGO robot to navigate an obstacle course map of a robot game. Coaches for the four Laboratory FLL robotics teams in 2023 included Joseph Papp, James Sengthay, Ritesh Patel, Peijun Shao, Aditya Rao, Jesse Linnell, Bert Green, Arjun Parimi, Daniel Herring, Michael Vixamar, John Denny, and Christopher Struss. In December, local FLL teams participated in their first regional competition, the Massachusetts-West FLL Championship at Worcester Polytechnic Institute. This competition serves as a qualifying tournament for participation in the state championship, and the Lincoln Laboratory-affiliated teams had their first chance to play against other teams and see different robot configurations. One mentor said, “The tournament was chaotic but informative. Our kids noticed how experienced and serious the other teams were. We left Worcester determined to return to this competition next year and be better prepared.” /

Karyn Lundberg (center) stands with members of the Kwajalein Robotics Club as they prepare a game table for students to practice using self-built robots to complete timed missions.

Young students adjust their robot’s programming in order for the robot to complete obstacles on the game table.

Kwajalein Robotics Club

When Karyn Lundberg developed the Kwajalein Robotics Club in 2021, it was met with much community enthusiasm. Two years later, the club continues to grow. From January to May 2023, Lundberg used easy drag-and-drop codes and fun training guides to teach programming basics to 30 students in grades 5–6, advancing to harder code as their coding proficiency grew. The students programmed their robots to complete challenges from FIRST LEGO League’s City Shaper curriculum, which proposes a variety of missions related to city planning, architecture, and building. Teams choose their missions based on their ability to program a robot to perform many simple tasks quickly or to complete a more complex mission worth more points.

The Kwajalein Robotics Club received local support to build two competition-style tables (sized appropriately to accommodate a FIRST robotics game board) to better facilitate future robotics events within the Kwajalein and Ebeye communities.

Lundberg has since passed the torch to Sarah Willis, who will lead future Kwajalein Robotics Club efforts. /

Ebeye Robotics

The Kwajalein Robotics Club expanded its program to reach the island of Ebeye, roughly 4.5 miles away. Lincoln Laboratory volunteers worked with Ebeye Public Middle School to set up a robotics program. Several Kwajalein Beaver Works Summer Institute (BWSI) student alumni served as coaches, traveling by boat to Ebeye one afternoon per week to help mentor young students in robotics.

This school year, new teams were established at several private schools on Ebeye, and an entire cohort of BWSI alumni from Ebeye were trained to help with robotics instruction in Marshallese, thus offering STEM outreach to a larger percentage of children on the island. /

Karyn Lundberg helps Ebeye students build a robot from LEGO kits.

Individual Robotics Teams

When ROLL took a hiatus during the pandemic, Vitaliy Gleyzer successfully mentored a team for three years. That FIRST LEGO League team, The Gummy Bears, won the Massachusetts State Championship for robot design twice, and their team project addressing efficiency issues and environmental impacts of cargo delivery won second place in the Global Innovation Competition. Their awards propelled them two years in a row to the international-level competition in Houston, Texas—trips sponsored by the Laboratory—and they won the Robot Design Finalist Award at the World Festival in 2022.

Although his daughter and her teammates are officially graduating from FLL, they hosted a series of summer workshops to teach younger LEGO teams about robot programming, robot building, and competition strategy. When the new season of competition started in the fall, all the alumni from this winning team joined the FIRST Robotics Competition, which challenges teams of high school students to build industrial-size robots to play a difficult field game in alliance with other teams, under strict rules and with limited time and resources.

Gleyzer's son just started FLL in a team formed last year. His team learned a lot from teams of older kids, helping them achieve a lot in a short season. This young team also advanced to the state championship but didn't yet have enough experience to compete with the older kids; however, within a few seasons, they expect to do as well as The Gummy Bears have. /

Above, Students exploring planet surface types discover that some planets have a non-Newtonian surface that appears to be liquid, but reacts as a solid when struck by a meteor. **Right**, The Gummy Bears robotics team accepts their award for robot design.

Sixth-grade students at Ebeye Public Middle School gather in front of their robotics mentors and instructors as the robotics program began.

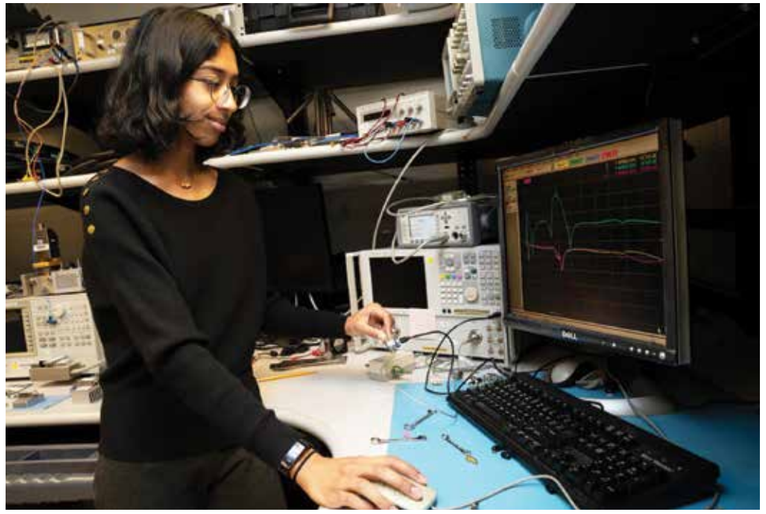
STEM Internships

Summer High School Internship Program

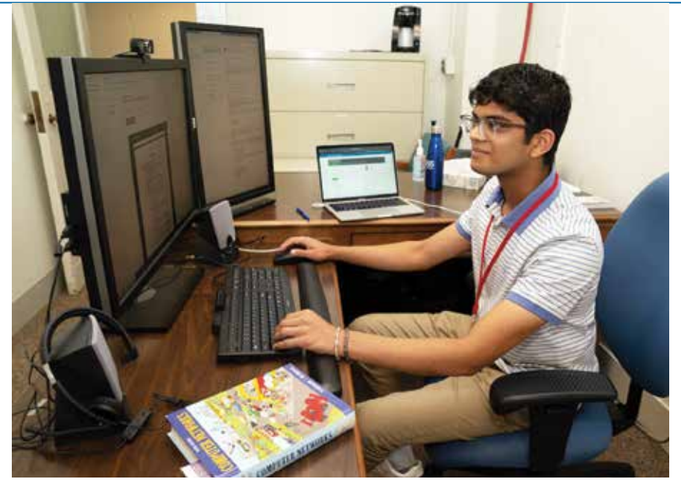
The Laboratory typically welcomes hundreds of undergraduate and graduate students every summer through internship programs. However, the Laboratory's Summer High School Internship Program, launched in 2022, is designed to give high school students the chance to do hands-on work at the Laboratory. This year, the program brought four local students to the Laboratory to intern in the Communication Systems Division and the Air, Missile, and Maritime Defense Technology Division.

"This program lets high school rising seniors experience and explore STEM careers before committing to an area of study in college," said Cheryl Bartolone, who helps organize the program. "Students benefit from exposure to careers in STEM during their six-week paid internship. Early engagement with young talent builds the Laboratory's recruiting pipeline."

Shreya Iyer explored her interest in electrical engineering, interning in the Advanced SATCOM Systems and Operations Group, with Richard Chen, John Newey, and Ryan Shoup serving as her mentors. Her project involved translating algorithms into MATLAB, selecting the algorithm most suitable to be translated in a hardware-compatible language, and using the translated algorithm to program a field-programmable gate array.



Divya Narayanan uses a network analyzer to characterize the frequency response of an amplifier.



> "Having interns here shows the impact and responsibility our Laboratory has in inspiring tomorrow's engineers."
>
> — EDWARD TANG, MENTOR, SUMMER HIGH SCHOOL INTERNSHIP PROGRAM

Lakshya Jain explores wireless communication and computer networks in order to build a channel emulator.

"Learning digital design allows me to have an unparalleled, fast-tracked, and customized learning experience that only the Laboratory can make possible," said Iyer. "This internship helped me further my interest in electrical engineering and gain more experience and exposure to a specialized aspect of it."

Divya Narayanan was hired as a summer intern in the Advanced Concepts and Technologies Group to conduct radio astronomy research under the mentorship of Kristan Tuttle and Philip Zurek. Narayanan collected and analyzed data on neutral hydrogen in the Milky Way—data that will help her map the galaxy's shape and spin. She enjoyed the hands-on experience of assembling an antenna and using a network analyzer. "After working with radio frequency and seeing the beauty and usefulness of applied math, I'm considering [studying] electrical engineering," said Narayanan. "I am also quite certain that I want to attend grad school, after seeing the importance of furthering my education and the passionate, driven people alongside whom I would work."

Ryan Wempen was accepted for a second high school internship with the Laboratory. Last year, he helped the Interceptor and Sensor Technology Group build a defensive end-to-end simulation tool. This year, Wempen added artificial intelligence and machine learning features to the tool and furthered his interest in rocket science: "My project was a computer simulation that fuses the operation and capabilities of various satellites, space- and ground-based sensors, and hypersonic vehicles with advanced artificial intelligence algorithms."

Wempen was mentored by Erik Rutyna and Edward Tang. "Ryan did seriously impressive cutting-edge work that wouldn't be out of place in an undergraduate-level research paper," said Tang. "Ryan was an incredible intern and is one of the most disciplined and ambitious students I've ever worked with," said Rutyna.

Lakshya Jain was introduced to the Laboratory though LLCipher and last year's MIT Blueprint hackathon. Assigned to the Tactical

Networks Group, he focused on wireless communication and computer networks, mentored by Allan Ko and Joseph Rottner. Jain learned about digital modulation schemes, MATLAB, noise in communication systems, and error detection and correction codes. He built a channel emulator and visualized data for a network optimization project. “Lakshya absorbed the material at an astonishing rate. We were very fortunate to have him helping us out this summer,” said Rottner.

Jain wanted to gain hands-on experience to figure out what to pursue after high school: “This internship opened my eyes to the fields of electrical engineering, mathematics, and programing. I now know that I want to enter engineering or computer science in college.”

The interns gain a lot from the experience, but the mentors also benefit. Many staff members helping with this program noted that they volunteered as mentors because they wanted to inspire the next generation of students. Others noted that being a mentor helped advance their own understanding of their field. “By revisiting the fundamentals of my field, I helped solidify my technical expertise. I was able to practice the invaluable skill of distilling technical jargon down to an accessible level,” said Rottner. “This program made me shore up on the fundamentals of my field and helped me realize how much I’ve learned during my time at the Laboratory,” added Chen. /

Armed Forces Communications and Electronics Association (AFCEA) Internship

AFCEA arranges summer internships for graduating high school seniors interested in STEM careers to gain practical experience before college. Each summer, one student is offered an internship at Lincoln Laboratory to learn about the latest research and career options in math and science. At least 40 AFCEA students from Middlesex County in Massachusetts are hired as paid, full-time summer interns by 12 technology organizations.

In 2023, high school senior May Ng, interested in applied engineering and surveillance systems, was selected for an AFCEA internship in Lincoln Laboratory’s Surveillance Systems Group, which accepts AFCEA interns every year.

Ng was mentored by Andrew Weinert to assist with the Uncrewed Aircraft Systems (UAS) Operational Capabilities program by developing and validating analytical tools, data, and processes to assess the safety of small UAS operations. AFCEA interns are typically exceptional students who surpass expectation. This case was no different, according to Weinert: “May was a key contributor to the development of a new Python package for the open-source airspace encounter models project, a software project focused on statistical models of aircraft behavior. Her excellent work effort will be reflected in future peer-reviewed articles and open-source software releases.”

At the end of her internship, Ng presented the results of her work to her peers and won AFCEA’s Gilbert A. Barrett Award. This $2,000 scholarship award recognizes a talented high school senior in AFCEA who is pursuing an undergraduate degree in a STEM discipline.

Other sponsors of the AFCEA internship program include Abacus Technology, Booz Allen Hamilton, DCS Corporation, Draper Laboratory, FishEye Software, General Dynamics, The MITRE Corporation, Oasis Systems, Raytheon, and Riverside Research. /

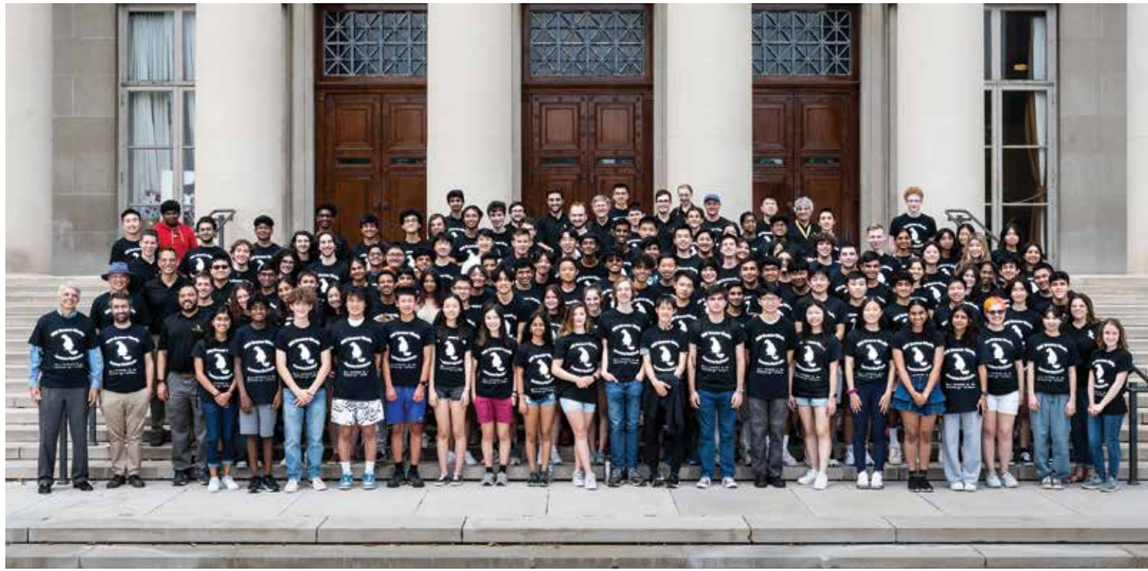
Beaver Works

The Beaver Works Center is jointly chartered by the MIT School of Engineering and MIT Lincoln Laboratory and is located in Cambridge, near MIT campus. The center is open to MIT students, faculty, and collaborators, and provides flexible architectural elements 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 workshops, brainstorming, classwork, and open collaboration; the remainder of the space supports hands-on, project-based educational initiatives and STEM workshops such as those listed below. /

Beaver Works Summer Institute (BWSI)

Now in its eighth year, BWSI offers hands-on STEM learning to rising high school seniors through project-based courses. In 2023, the program admitted the highest number of students to date: 370 students in the program at MIT and 30 students at Kwajalein.

Courses were conducted on MIT campus at the Beaver Works Center for four weeks and featured a daily speaker from a leader in the field. This year’s program featured 12 courses in person and 13 courses in a virtual format.



High school students from across the nation convene at the 2023 BWSI to explore engineering.

A student in the UAS-SAR course inspects their drone after it completed a radar-equipped flight to map a hidden area inside the MIT AeroAstro building.

Autonomous RACECAR (Rapid Autonomous Complex Environment Competing Ackermann-steering Robots) – Students learned how to program a small-scale, MIT-designed robotic system using knowledge gained in basic control systems, computer vision, sensing, perception, and elementary navigation and planning. Autonomous RACECAR was the flagship course for BWSI.

Autonomous Underwater Vehicles (AUV) Challenge – After an introduction to the topics of vehicle control, sensor integration, data analysis, image processing, and autonomy, students designed, built, and programmed an AUV to navigate an underwater obstacle course, applying real-time decision-making based on feedback from onboard sensors.

Autonomous Cognitive Assistant – Students learned about neural networks, natural language processing, audio data recognition, and coding to develop machine learning applications that leverage audio, visual, and linguistic data.

Medlytics: Data Science for Health and Medicine – This course provided hands-on experience applying advanced machine learning and data mining to solve real-world medical challenges. Students gained a solid foundation in probability, statistics, coding, and machine learning techniques and applied data analytics to structured data, physiological signals, and medical imagery.

Build a CubeSat – This course focused on systems engineering, programming, and spacecraft hardware assembly and testing. To build a working CubeSat, students learned about payloads, camera performance, power, subsystem integration, mission planning, attitude determination, and flight system debugging.

Microelectronics and Hardware Development – New this year, this course introduced students to the fundamentals of hardware system design. Students gained skills working with circuits, transistors, and digital logic while learning how semiconductors, lasers, and solar panels work.

Unmanned Air System (UAS)–Synthetic Aperture Radar (SAR) – Participants explored radar imaging by simulating a radar on a small UAS and using the simulated radar to image a virtual world. 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.

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).

Embedded Security and Hardware Hacking – Future security engineers learned the fundamentals of computer engineering, cryptography, and cybersecurity. Student teams designed and built a secure system in an attack-and-defense-style exercise, targeting other teams' designs once theirs was completed.

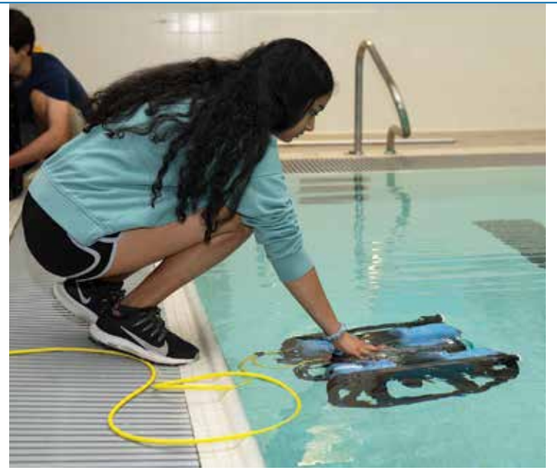
Cyber Operations – This program introduced students to techniques for conducting full-spectrum cyber operations, including networking, system administration, network defense, digital forensics, and malware analysis. Students engaged in a digital field training exercise consisting of several mystery tasks based on what they learned in the course.

Quantum Computing – The goal of this course was for students to develop the skills needed to implement and study quantum algorithms in software. Students learned the fundamentals of quantum computing through lectures and coding challenges. Teams of students designed their own software implementations of a quantum algorithm and developed a program using the algorithm.

Back to bASICs – In this new course on open-source semiconductor design and fabrication, students made their own semiconductors. Students designed semiconductors to 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.

Remote Sensing for Disaster Response – This course showed how to leverage open-source information and imagery collected from drones, airplanes, and satellites to generate actionable intelligence for disaster relief or humanitarian response. Students learned about remote sensing modalities, analysis techniques with artificial intelligence, and data-based decision-making.

Serious Game Design and Development with Artificial Intelligence – Offered only in a virtual format, this course dove into the key aspects of serious games, including experimental design and application development. Students were introduced to software development, user interface design, human factors engineering, game design, and artificial intelligence. /



A student in the AUV Challenge course submerses her programmed AUV to test its ability to navigate through an underwater obstacle field.

Teams of students in the Autonomous RACECAR course prepare to race autonomous racecars around an obstacle course in the MIT Johnson Ice Rink.

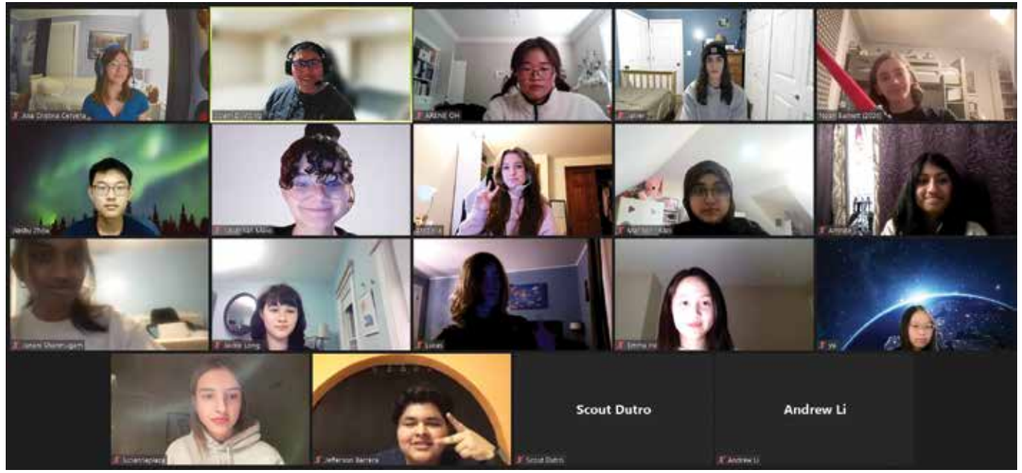
Laboratory STEM sponsor Louie Lopez visited BWSI in August to speak to students about STEM outreach opportunities and DoD STEM careers. As director of DoD STEM, Lopez manages DoD STEM efforts under the National Defense Education Program. His responsibilities include overseeing STEM education and outreach initiatives in collaboration with partners from academia and industry. He is further responsible for policy and coordination of STEM efforts across DoD components to ensure these efforts align with federal STEM strategic plans. Lopez funds Lincoln Laboratory's LLRISE and G.I.R.L. programs and partially funds BWSI.

BWSI Spring and Fall Courses

Beaver Works offered a variety of courses encouraging beginners to build, make, and learn as a stepping stone to participation in BWSI. Each course emphasized that no prior experience was required; students would have the opportunity to explore a subject and build interest. 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. While all BWSI programs are open to eligible students of any gender identity, the fall program was designed to encourage and support female students in STEM and provide a virtual environment in which females could learn among their peers. A new spring course, Ham Radio 101, was offered in person. All other courses were conducted virtually.

Volunteers from Lincoln Laboratory, the U.S. Air Force, and students from Worcester Polytechnic Institute, California Polytechnic State University, Carnegie Mellon University, and MIT taught the courses. The courses are funded by a partnership between Lincoln Laboratory Outreach, DoD STEM, MITRE, MIT School of Engineering, and the Patrick J. McGovern Foundation. /

Applying what they learned about radio communications, students in the Ham Radio 101 build a weather balloon and track it as it travels up the Massachusetts coast and out to sea.



Participants in the "Yes! You Can Run Cyber Operations!" course meet virtually in the spring as they practiced system administration, network defense, digital forensics, and malware analysis.

Fall Courses

Girls Who Program Autonomous Cars
Girls Who Program Cognitive Assistants
Girls Who Want to Learn Many Interesting Things
Girls Who Design, Build, and Fly Model Aircraft
Girls Who Want to Learn Back to bASICs
Girls Who Program Racing Drones

"Yes! You Can!" and "Girls Who Can" courses were successful in achieving their goal of building interest in STEM fields, as evidenced by student feedback:

- "This program helped me understand a lot about AI [artificial intelligence]. It was a good first step to pursue my goals in this STEM field."
- "This course has given me insight into careers and fields of study that I wasn't aware of before. It encouraged me to pursue more STEM research in the future."
- "After my course in autonomous cars, I'm more interested in computer science!" /

Lincoln Laboratory staff and BWSI students commemorate the summer program on Kwajalein in July.

BWSI on Kwajalein

Sarah Willis, Jordan Montgomery, and Stephanie Fried of Lincoln Laboratory's Kwajalein Field Site organized and led the fourth installment of BWSI on Kwajalein Atoll. The two-week program provides a unique opportunity for students in a remote environment to explore project-based STEM learning.

Fourteen students participated in the RACECAR course to learn how to code in Python and program self-driving mini racecars to complete tasks on an obstacle course. The RACECAR course helps students gain a deep exposure to robotics, coding, and engineering. Sixteen students enrolled in the Atoll's first-ever BWSI Medlytics course, which introduces computer science and its application to the medical industry. Special guest U.S. Army Garrison-Kwajalein Atoll Commander Col. Drew Morgan visited the class to discuss his experience as an astronaut and the educational path required for such a career. Among the volunteers were five college-age dependents of island residents who served as teaching assistants and helped the instructors and visiting instructor Jordan Wynn support the students as they practiced engineering and computer science concepts. "With Jordan visiting, we were able to offer two classes on Kwajalein for the first time and increase the number of students we were able to teach. She excelled at bringing together the students from different backgrounds, which created a significantly more cohesive international team of students than in previous years," said Willis.

As in prior years, the program concluded with a celebration attended by the larger community of islanders, Lincoln Laboratory staff members, and Army personnel. The finale showcased the students' accomplishments by way of autonomous vehicle races and poster talks about data science in the medical industry. /

During the BWSI Kwajalein finale, students Talei Nakabea and Maji Langidrik share their poster about medical imaging with an enthusiastic young audience.

Build a CubeSat Challenge

In 2023, BWSI collaborated with the American Institute of Aeronautics and Astronautics to provide a Build A CubeSat Challenge for high school students interested in building a prototype satellite.

Rebecca Keenan served as the lead instructor for the 15-week course, showing teams of students from across the country how to design, build, and test a small satellite via rigorous online lessons. After completing lessons on orbital dynamics, the space environment, systems engineering, and satellite development tools, the students engaged in a series of hands-on projects, each of which helped them build a satellite prototype. Students were also visited by guest lecturers Kerri Cahoy, director of the MIT Space Telecommunications, Astronomy, and Radiation Lab, and Collin Ward, a scientist at Woods Hole Oceanographic Institution.

This year's mission was to create a CubeSat that can detect colored plastic in the ocean from space. Each team and its mentor received a hardware kit that contained everything needed to complete the lab coursework and to build their own CubeSat prototype, including a Raspberry Pi flight computer and camera, a battery, a solar panel, an acrylic and aluminum structure, a white poster board and colored acrylic pieces to image, and building and testing tools.

Students in this course research not only the science mission but also the sensors and equipment needed, and then build successively more complicated prototypes to ultimately build a flight-qualified unit.

David Arenson, chief engineer at Lockheed Martin, a sponsor of the Build a CubeSat Challenge, said, "Lockheed Martin is pleased to support this challenge and reach out to many talented high school students. As a space employee, I am very excited to encourage kids to consider a career in the space industry and help them learn about CubeSats!" /

Collin Ward, who studies plastic pollution in the ocean for Woods Hole Oceanographic Institution, speaks to students about the mission for this year's Build a CubeSat Challenge.

Spotlight:

CRE[AT]E: High school students build assistive technology for community members with disabilities

In late April, 30 teams of high school students from the United States and abroad gathered virtually to present technologies that they developed to help their community members with disabilities. They built their solutions as part of a newly launched assistive technology (AT) project-based class called CRE[AT]E, hosted by the Beaver Works Center. Their solutions ranged from a reading aid for a dyslexic student to an app for a memory-impaired elderly man to safely navigate on walks.

MIT staff member and volunteer Hosea Siu developed and led CRE[AT]E. He said it took inspiration from MIT's Design of Assistive Technology class, which he also co-developed and taught, and was adapted to an online and asynchronous schedule. Starting in December, the student teams took a self-paced online course while brainstorming and developing their technologies and working closely with community members who would be using these technologies.

The community members, or co-designers, are integral to the program. They or their caregivers work alongside the student teams, contributing ideas, testing the technologies, and providing detailed feedback. "It's a collaborative process," said Siu. "They are not designing something *for* someone but *with* someone." While the students gain experience in engineering and product design, the primary goals of the course, Siu said, are for them to practice caring for people in their communities and to understand the challenges they face because of their disabilities. "Even if the product doesn't end up working, [the students] can still make someone's day better by engaging with them."

The MassBuilders student team and their co-designer Caroline designed a technology to help her maneuver and see her rollator walker more easily in low-light conditions.

Spotlight (continued)

A team of high schoolers customized an Xbox controller for their co-designer Levi, who has cerebral palsy, to play the racing game "Forza."

Culminating the course was the CRE[AT]E Challenge, at which the MassBuilders team was recognized in the category of co-designer collaboration. Their technology was an autobraking and high-visibility rollator for their co-designer Caroline, who has mobility issues and reduced vision. One student designer on the team said, "The assistive technology challenge harnessed our shared experience in software and electrical engineering and robotics to build a viable product that can improve the quality of life for those with physical disabilities. Our time spent with Caroline was really rewarding, and we had a great time getting to know her and helping her." Although the challenge has concluded, the MassBuilders team plans to continue working on similar projects that utilize remote braking systems and safety equipment.

"The challenge and the class before it are so open ended that I was surprised by what the students were able to come up with," said Siu. "But what's particularly rewarding to see is students making connections between what they learn, things they can make by themselves, and what they can do for other people with that knowledge." /

Science on Saturday

In October, Jeff Roth presented a Science on Saturday demonstration to an audience curious about optics and lasers. He explained the different ways lasers are used in fiber optics, communications, and medicine, and showed the audience how light can refract, diffract, scatter, and reflect. He fielded questions from the audience and helped everyone understand why the sky is blue and how a rainbow is made. Roth has presented this demonstration in years past and stands by its success: “The light visuals inside the fog were a big hit and an effective way to explain how light can focus, bend, and diverge. Thank you so much to all the many people who helped out to prepare for this event!”

A Science on Saturday demonstration planned for spring 2024 will feature an in-depth look at the weather by James Kurdzo. He will explain how radar is used for tornado warnings and how we may be able to leverage artificial intelligence and predictive algorithms to make warnings more accurate and timely. Potential topics for next year’s Science on Saturday shows include aluminum reactions used in energy-saving technology, and small-satellite constellations that provide rapid views of tropical storms. /

Jeff Roth and two participants stretch a slinky across the stage to help the audience visualize a light wave.

Jeff Roth explains how a laser can be focused using a lens and shows that the converging beam is visible in fog.

Kids Day

Kids Day provides an opportunity for young people to see STEM in action. On April 19 and 20, during the Massachusetts public school systems' spring break week, children accompanied their parent(s) to experience a typical workday and enjoy hands-on science and engineering demonstrations. These two days are designed to help children advance their interest in career opportunities that they may not otherwise consider. Members of the Lincoln Laboratory community planned fun, thought-provoking demonstrations to explore satellites, space lasers, smart fabrics, phased arrays, and more.

More than 25 demonstrations showcased technologies including an aircraft collision-avoidance simulator, a phased array visualizer, a virtual reality–based imager for inspecting disaster damage, an auditory situational awareness tool, and do-it-yourself water rockets. Speakers Jennifer Watson, Charlotte Shabarekh, Shamaria Engram, Adam Kern, and Ariel Sandberg shared their career paths and current roles. Tours of the Microelectronics Laboratory, Environmental Testing Laboratory, Aviation Weather Systems Laboratory, Defense Fabric Discovery Center, and Whisper Chamber were available to the 300 kids attending each day. /

Scouting

Lincoln Laboratory Outreach develops program plans and tours for local scout groups to round out scouting STEM badgework and increase program participation in the coming years. In 2023, Lincoln Laboratory Outreach supported a Carlisle, Massachusetts, Boy Scout troop by arranging a visit from "Spot," the dog-like robot from Boston Dynamics. Daniel Griffith, Eric Cristofalo, and Matthew Trang explained how Spot works and gave examples of the different robotics technologies developed at the Laboratory. The goal of the meeting was to inspire the next generation of young scientists to find out more about artificial intelligence and robotics.

Young scouts enjoy seeing the variety of ways a robot can be designed to move to perform different tasks. Photo: Boston Dynamics

Cristofalo, who, along with Griffith and Trang, creates technologies that can be used in tandem with Spot and other applications, gave scouts an up-close view of the robot. "The kids were certainly excited about Spot! We explained different aspects of the robot and then showed some algorithms running. We barely made it through the first half of the talk because of their excitement, so we transitioned to just answering questions, which was fun!" he said. The budding young robotics engineers had many questions about Spot's capabilities, like "Can it walk over this?" or "Can it pick up that?" They also asked specific questions about where Spot could be used. One participant considering the best way a robot could be used said, "I think I could use Spot to pick up and put away things in my room."

As the outreach effort concluded, Cristofalo reflected on the experience: "I was impressed that some of them had already been exposed to software and programming and understood the difficulties of working with a robot like this. I think it was a great experience for all of us!" /

SARAH WILLIS

EMPLOYEE SPOTLIGHT

Why is STEM outreach on Kwajalein Atoll important?
The Lab has been physically present on Kwajalein for the last 60 years, but, over the past decade, we've increased our focus on what we can do to improve the daily life of everyone, including our partners and host nation. Out here, climate change is a very real experience—we're lying on an island only six feet above sea level. An outward migration is continuing at a brisk rate, and few opportunities exist here for students to get STEM exposure like they do in the states. The Lab's programs are equipping students with STEM skills and career awareness so that they're able to pursue a broad variety of careers, whether they remain here or move elsewhere as some of the world's first climate change refugees.

Are you involved in any outreach?
I built an astronomy outreach program that organizes telescope-viewing events, public astronomy talks, and "live-air planetarium shows." We've recently extended this program to Ebeye and have translated a talk into Marshallese. The talk explained how astronomy has impacted Marshallese culture with stories of great voyages and exploring the solar system.

I've helped lead Beaver Works project-based courses on Kwajalein, namely Serious Games and Artificial Intelligence, Mini-RACECAR (programming self-driving model cars), and Medlytics (intersection of data science and medicine). Offering two courses in 2023 was made possible in part by recruiting Jordan Wynn, a staff member from the states, to spend four weeks on Kwajalein as an instructor. Since its inception, the program has grown to 30 students.

I also lead a LEGO robotics program initiated by another staff member, Karyn Lundberg, on Kwajalein and expanded it to Ebeye. The best part is that Beaver Works alumni are now mentors and coaches for the students involved in LEGO robotics.

Left, A photo background of the solar system was just one of the activities for the more than 100 people who attended the eclipse celebration on Kwajalein to watch the livestream from Exmouth, Australia, as the maximum eclipse passed. **Above,** Wearing Laboratory-provided solar-safe glasses, students in Majuro view the eclipse.

Kwajalein Astronomy

For five years, the Kwajalein community has enjoyed the benefits of an astronomy enrichment program hosted by Lincoln Laboratory staff residing on the island. Sarah Willis created this program to share her love of astronomy and astrophotography. Guest speakers are invited, and celestial viewing is offered through a Celestron CGX 1100 telescope. Community viewing events this year included an "Observe the Moon" night in October and a special "Talk on the Rock" in November on the subject of great voyages. Lincoln Laboratory staff hosted this event on the island of Ebeye to view the moon, Saturn, Jupiter, and the Pleiades, which have a special cultural significance in Marshallese traditional stories. With the help of the local Yokwe Yuk Womens Club, the talk was translated into Marshallese so all members of the community could enjoy learning about their night sky.

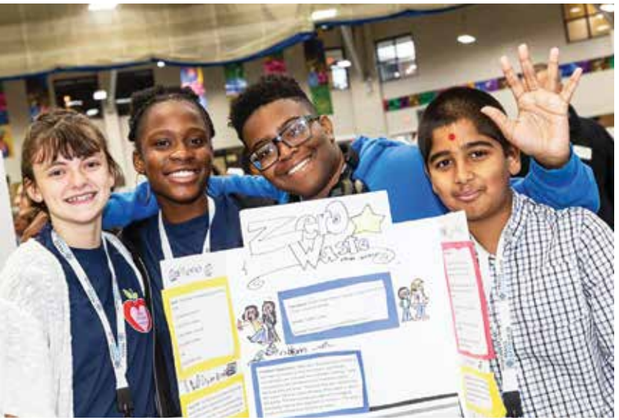
A highlight of the Kwajalein astronomy outreach program was the solar eclipse on April 20. The eclipse was visible in the South Pacific Ocean, just grazing a narrow portion of the Marshall Islands. Kwajalein was expected to have rainy weather and a thick cloud layer, so Laboratory volunteers hosted a carnival-like eclipse viewing party with games, activities, and a livestream from Exmouth, Australia (home to Lincoln Laboratory space sensors), which lays in the path of totality, experiencing 62 seconds of total darkness.

Laboratory astronomy fans also partnered with a school in Majuro, another atoll in the Marshall Islands, where perfect weather conditions were expected for in-person eclipse viewing. With solar-safe glasses supplied by the Laboratory, Majuro students could all safely watch the eclipse. /

Science Fairs

Pioneer Charter School Science Fair

The Pioneer Charter School of Science I in Everett, Massachusetts and the Pioneer Charter School of Science II in Saugus, Massachusetts, host an annual science fair in February. Lincoln Laboratory supports this science fair by providing judges who review science projects independently and without bias. Projects for this year's two-day fair followed the theme "Reimaging Your Daily Life." Laboratory staff serving as judges included Charlotte Shabarekh, Enya Mulroy, Andrew Heir, Joel Grimm, and Richard Kingsborough. Shabarekh, who routinely volunteers for local science fairs, shared these thoughts about the experience: "As a science fair judge, I had the opportunity to review science projects for middle and high school students. Projects ranged from computer science to electrical engineering. Judges were provided with a rubric to grade students against, and the emphasis was to provide constructive feedback. I was impressed by the breadth and depth of students' knowledge and their analytical reasoning skills. Last year, I served as judge for this same event, which was held over Zoom. I was waiting all year to do it in person in 2023!" /



Students competing in the Mass STEM Hub Applied Learning Student Showcase selected their science projects based on a current problem, question, or invention, and relied on feedback from industry experts to improve their projects. Photo: Mass STEM Hub

Mass STEM Hub Applied Learning Student Showcase

On May 19, more than 1,000 students from across the state gathered at Reggie Lewis Track and Athletic Center in Boston, Massachusetts, to present their science projects at the Mass STEM Hub Applied Learning Student Showcase. Mass STEM Hub (now One8 Applied Learning Hub) aims to provide schools with access and support for STEM education. They work to help educators and inspire students with innovative, engaging ways to approach subject matter and STEM programs with proven results in classrooms across Massachusetts.

Three volunteers from Lincoln Laboratory—Dominick Pipitone, Phillip Tomezsko, and Charlotte Shabarekh—served as judges to critique a portion of 550 STEM-based projects representing a variety of disciplines. Because of the wide age range of students, projects varied in sophistication from middle school core science concepts to senior capstone projects displaying engineering or biomedical innovation. Volunteers engaged with student teams, suggested how to improve projects, and shared insight about careers and future opportunities. /

Brian Kavanagh helps a student discover engineering as he creates music with a Makey Makey board.

Career Panels

Career Exploration Day

Jeremiah E. Burke Academy, a Boston collegiate charter school in Dorchester, Massachusetts, hosted Career Exploration Day so that students could peek into different careers. Lincoln Laboratory staff visited classrooms and offered students a hands-on activity as a means to try engineering and programming. The goal was for students to gain STEM-related skills, build their confidence, and help them see themselves in STEM careers. Yari Golden-Castano, Brian Kavanagh, Chiamaka Agbasi-Porter, and Daphne Vessiropoulos helped middle school students understand the basics of electrical current and circuitry to create and program a piano keyboard using a Makey Makey board as the controller and candy or carrots as the instrument. The pairing of programming and circuitry was a key element in helping children understand the relationship between software and hardware. This event marked Lincoln Laboratory's first outreach effort with Jeremiah E. Burke Academy. Its success ensured that the Burke Academy will be included in our future outreach efforts. /

Career Panel at Veterans Memorial High School

Eduardo Murillo, a 2022 LLRISE and LLRISE Spring Break alumnus, reached out to Lincoln Laboratory to request speakers for a career panel discussion about STEM educational pathways, work experience, and internship opportunities. On January 25, Adam Kern and Daphne Vessiropoulos accommodated Murillo's request by giving a virtual presentation to 60 students from Veterans Memorial High School in Corpus Christi, Texas (specifically, members of the school's Engineering Club, National Honor Society, and Workforce Industry Training Club). Both Kern and Vessiropoulos explained their respective careers at Lincoln Laboratory, the benefits of a technical career path, and the Laboratory's outreach programs for high school students. Kern enjoyed speaking with the students and indicated he learned a few things himself: "Honestly, I think I took away as much from the Q&A as the kids did. Being relatively young, I only have the perspective of my own journey to STEM. It was great to hear about how the other panelists ended up in their respective careers; I hope it impressed upon the kids that there are a million ways to end up in a technical field and a million things to do in those fields." /

Empower Yourself Symposium

Empower Yourself provides year-round interactive educational programs focusing on financial and economic literacy, life skills, and STEM exploration for under-resourced students in urban communities around Massachusetts. Empower Yourself believes that exposure to various technical fields can help students realize

Jennifer Falciglia hosts a career day in person in New Jersey while other Lincoln Laboratory volunteers participate virtually.

options for their future. Lincoln Laboratory Outreach has partnered with Empower Yourself for various workshops and career panels over the past three years.

Lincoln Laboratory volunteers visited Empower Yourself in March to provide a career panel for 50 local-area students. Victoria Helus, Rituparna Basu, and Julian Fontes described their roles at Lincoln Laboratory and discussed not only the different types of technical careers available but also the classes to take in high school and college to build a path leading to such careers. /

Career Day

In April, Lincoln Laboratory Outreach extended to a new location, Eastside High School in Paterson, New Jersey—a school where students are struggling academically. Two teachers at Eastside High School planned a day for their students to learn about various careers and invited Lincoln Laboratory to join the planning process early on. Jennifer Falciglia, whose sister is a teacher at Eastside High School, helped coordinate the event, which developed into a career talk by Lincoln Laboratory staff with three 40-minute sessions, each attended by 50 students.

Falciglia visited the school in person to serve as a moderator. She gave an overview of the Laboratory and introduced the panelists. Brian Lee, Tara Canny, Victoria Loehle, and Ryan Bohler attended virtually to explain their workdays as engineers, programmers, mathematicians, and analysts. Falciglia facilitated questions about engineers' salaries, and the courses and grades required to be an engineer. She concluded the event by showing 3D-printed objects produced in the Technology Office Innovation Laboratory. "The students thought the 3D-printed items were cool! They were excited to have representatives from Lincoln Laboratory motivate them toward a bright future," Falciglia said.

When asked why she participated in this outreach effort, Falciglia said, "Students face many economic challenges in their community that hamper their ability to succeed. They live in a world where their potential is defined even before they've proven to themselves what they are made of. If I get an opportunity to tell them that we care about their interests in pursuing and succeeding in a STEM field, then I'll do it." /

Kwajalein Career Fair

Lincoln Laboratory staff annually participate in the Kwajalein Career Fair. College recruiters don't travel to the Marshall Islands, so the Kwajalein Career Fair runs in a different format than those on the mainland. During the fair, staff answer questions about their alma maters, technical fields of study, and engineering in general. The main point of the fair is to engage with students and help them navigate their way through college selection, application, and acceptance while they learn about various STEM career options. /

STEM Pathway Talk

Raymundo Moya is originally from a predominantly Mexican-American area near Brownsville, Texas, known as the Rio Grande Valley. When Moya planned to return to Texas for a vacation in September, he took the opportunity to visit local schools and talk to students about STEM careers.

Moya met with 35 students in grades 5–8 at the Raul Yzaguirre STEM Scholars Academy in Brownsville and 55 students in grades 9–12 at Jubilee Academy in Brownsville. At each school, Lincoln Laboratory Outreach leveraged a contact, specifically a teacher who participated in LLRISE for Teachers. Stephanie Mendoza from the Raul Yzaguirre STEM Scholars Academy participated in LLRISE for Teachers in 2023, and Esmeralda Hernandez from the Jubilee Academy participated in LLRISE for Teachers in 2022. Each school has several students who have attended or will attend the LLRISE summer program.

In his presentation to the students at both schools, Moya shared his personal story about growing up in the area, being a first-generation college student, attending Rice University, and earning his PhD at MIT. He also discussed his research with lasers and other cool aspects of working at Lincoln Laboratory, and described a variety of science careers and the types of work one can pursue with a STEM-based degree.

Lincoln Laboratory staff discuss engineering while sharing some laughs at the Kwajalein Career Fair.

When asked why he chose to engage in this outreach effort, Moya said, "Like myself, these kids are mostly from historically underserved communities, so I wanted to share my story and show them one path to success. I knew my talk resonated with the kids when they started asking lots of questions." The questions Moya fielded concerned financial aid, the difficulty of college-level classes, and general aspects of science and engineering jobs. Moya inspired the students to imagine themselves living outside of Brownsville, as evidenced by their questions: "How do you deal with being away from home?" "How is the Mexican food in New England?" "What is snow like?" /

> “I wanted to become a mentor to give young students the passion to pursue scientific fundamentals, so as to experience the magical feeling of understanding how the world around us works.”
>
> — PHILIP ZUREK, MENTOR, SUMMER HIGH SCHOOL INTERNSHIP PROGRAM

Informational Fairs

Lincoln Laboratory Outreach staff routinely attend informational fairs in hopes of raising awareness of the Laboratory’s STEM programs. Fairs such as the ones listed below allow us to showcase the Laboratory’s culture and values; moreover, they offer a chance to target new regions or industries that, like Lincoln Laboratory, place an emphasis on reaching the next generation of scientists and building interest in STEM. /

Aviation and Maritime STEM Education Expo

On May 9 in the Delta Airlines hangar at Boston’s Logan International Airport, more than 1,000 students from 44 Greater Boston schools attended the annual Aviation and Maritime STEM Education Expo. This event gathers experts in maritime, aviation, and transportation industries and representatives from government and academic institutions to build student interest in STEM careers in aviation-related industries. The expo started in 1994 as a collaborative effort sponsored by the Federal Aviation Administration (FAA) and Massport.

At the expo, Lincoln Laboratory highlighted the correlation between education and careers by sharing career descriptions, educational literature, and intern and employment opportunities. Thomas Reynolds engaged students with a hands-on air traffic control demonstration, while Daphne Vessiropoulos showcased a student-built radar as an example of what a student can build in one of the Laboratory’s summer outreach programs.

In addition to several Massport departments, exhibitors included the Museum of Science, FAA, National Oceanic and Atmospheric Administration, U.S. Coast Guard, U.S. Customs and Border Protection, Mass Maritime Academy, Massachusetts Air and Space Museum, Massachusetts State Police, Boston MedFlight, and Transportation Security Administration.

Approximately 50 exhibits and information booths representing various aspects of the industries served as the backdrop for the event at the Delta hangar. More than 34 aircraft and other equipment were also on display, including a Super Seawind 3000 from the Experimental Aircraft Association, Young Eagles Chapter 106; a FedEx Airbus A300; a critical-care MedFlight jet; a State Police bomb squad vehicle and bomb detection robot; and electrical vehicles from Hertz and Massport facilities.

“Hundreds of careers at our airports were represented today,” said Massport Director of Aviation Edward Freni. “We rely on the engineers who design and build the planes, the pilots who fly them, the electricians who keep radars working properly, the air traffic controllers who make sure aircraft travel safely in the sky, and many more. Showcasing the various career paths at the STEM Expo will hopefully encourage these young people to one day have a STEM-based career in a transportation-related industry.” /

DoD STEM Technical Exchange

In late February, Chiamaka Agbasi-Porter represented Lincoln Laboratory in the DoD STEM Technical Exchange, which gathers experts in STEM education and the DoD workforce to share innovative practices for inspiring the next generation of STEM leaders. DoD STEM supports after-school programs, competitions, and internships for students to promote interest in technical careers and training for educators.

At the exchange, Agbasi-Porter led a panel titled “Sparking Imagination: Providing Early Access to STEM Pathways.” She explained the DoD’s critical areas of technology and ways to raise student interest in them. Her presentation acknowledged Lincoln Laboratory’s relationship with MIT and detailed how this collaboration helps expose students to exceptional engineering facilities and technical curricula in fields such as aerospace, engineering, autonomous systems, programming, and energy systems. Agbasi-Porter’s impression of the workshop was positive: “Presenting at the DoD STEM Technical Exchange was an eye-opening experience, where collaboration and sharing of ideas were at the forefront of the conference. It was a celebration of exploring innovative ways to develop STEM talent and inspire our youth to imagine the impossible.”

Agbasi-Porter also outlined resources for developing critical thinking, promoting STEM mindsets, and creating equitable access to STEM. She further illustrated best practices in hands-on STEM workshops for underrepresented students and provided examples that included Lincoln Laboratory Outreach workshops in circuitry, remotely operated vehicles, and programming. /

At the DoD STEM Technical Exchange, Chiamaka Agbasi-Porter delivered a briefing on real-world results of STEM programs that inspire students to enter technical careers.

Science on State Street 2023

Every Earth Day at Framingham State University, the Christa McAuliffe Center welcomes Science on State Street. This annual community-wide science festival offers free interactive activities, demonstrations, and planetarium programs held in collaboration with MetroWest STEM Education. Science on State Street focuses on themes relating to planet Earth, sustainability, and environmental science but also branches into space science. One of the highlights of this year's festival was the kiosk for the Center for Astrophysics—a collaboration between the Smithsonian Astrophysical Observatory and Harvard College Observatory—that offered participants the opportunity to take, create, and share space images while they learned about imaging technologies. Representatives from Framingham State University's Department of Environment, Society, and Sustainability; Biology Department; Campus Sustainability Office; and Green Initiative Club guided participants through explorations of Earth and sustainable environments. The Lincoln Laboratory booth featured a hands-on activity in which volunteers Bich Vu and Daphne Vessiropoulos led participants in building a mini lightsaber. Children learned how to connect a circuit to conduct electricity from a battery through copper tape to light up an LED the size of a popsicle stick. Vessiropoulos said, "The activity was not only the perfect choice for this Earth- and space-related festival but also a great way to drum up interest in the Laboratory!" /

Thousands of community members flocked to Framingham to explore how STEM can support Earth and space research. Photo: Framingham State University

Daphne Vessiropoulos fields questions from curious high schoolers about the Laboratory's summer programs.

MIT Blueprint Hackathon

Each February, HackMIT, an MIT student organization, hosts MIT Blueprint, a weekend-long hackathon for high school students. The goal of Blueprint is to set up attendees with the resources needed to successfully compete in a hackathon project, hopefully serving as a starting point for further participation in hackathons and programming at large. For instance, first-time coders spend one day in classes and workshops to learn about coding and computer science. They spend their second day in a hackathon competition with more than 200 students. Four different tracks were available to students depending on their interests: hacking, hardware, mobile development, and web development.

Lincoln Laboratory Outreach participated in the event's Organization Fair, which highlighted companies and organizations that promote computer science careers. "Interacting with the students and seeing their enthusiasm for continued learning is what I enjoyed most," said Daphne Vessiropoulos, K–12 STEM outreach assistant program manager. Vessiropoulos attended the event on behalf of the Laboratory with Richard Fletcher, who presented a talk about how computer science can support projects in medicine (global health in developing countries), public health (e.g., drug addiction), and mobile apps for mental health. /

New England Unmanned Aircraft System (UAS) and Advanced Air Mobility (AAM) Summit

Northeastern University hosted the New England UAS and AAM Summit in October to provide a venue for government, industry, and academic leaders from across the country to discuss UAS and AAM progress, opportunities, and obstacles.

"This event provided an excellent opportunity to target organizations that want to get students interested in uncrewed aircraft. Partnering with different organizations helps us cast a wider net to raise awareness about our outreach programs," said David Granchelli, manager of the Laboratory's Communications and Community Outreach Office. Laboratory outreach manager Chiamaka Agbasi-Porter showcased radars that students created

in the LLRISE summer outreach program, while Beaver Works managers Joel Grimm and Lisa Kelley discussed the mini autonomous racecars students built and programmed during BWSI.

"The New England UAS and AAM Summit was new for us! It provided an excellent opportunity to meet and connect with regional leaders in aviation. High school students from Brockton and Boston also attended. This audience gave the Outreach Office and Beaver Works an opportunity to share our outreach efforts and discuss how schools can collaborate with Lincoln Laboratory. Attendees seemed interested and impressed with the hands-on portions of the Laboratory's outreach programs, and a significant percentage wanted to see the student-built radars and mini cars," said Agbasi-Porter. /

Massachusetts Manufacturing Mash-Up

On September 19 at Polar Park in Worcester, Massachusetts, Joel Grimm, Lisa Kelley, and Chiamaka Agbasi-Porter connected with the more than 1,500 people attending the third annual Massachusetts Manufacturing Mash-Up, a conference that draws people and manufacturing business together to solve challenges impacting the manufacturing industry. Organized by a collaboration between the Center for Advanced Manufacturing at the MassTech Collaborative, MassHire, MassRobotics, FORGE, Massachusetts Manufacturing Extension Partnership, and Worcester Polytechnic Institute, the conference includes sessions related to cybersecurity, robotics, workforce development, and working with the DoD. While attending the conference, Laboratory staff networked with industry leaders, teachers, and students, and shared information about the Laboratory's various STEM programs that help students gain hands-on experience in engineering and manufacturing. Outreach staff highlighted our most popular STEM programs in hope of attracting more students from the Worcester area. /

Laboratory staff network with industry leaders, teachers, and students.

Chiamaka Agbasi-Porter, Lisa Kelley, and Daphne Vessiropoulos prepare to show kids at the JA Inspire Conference how to explore math by folding a triflexahexagon.

Excel Academy Charter School Summer Opportunities Fair

Lincoln Laboratory Outreach participated in the Summer Opportunities Fair at Excel Academy Charter School in East Boston, Massachusetts. Fostering high academic achievement and creative expression, this college preparatory high school holds a fair every March to raise student awareness of courses and internships providing hands-on trials of STEM-related careers.

Chiamaka Agbasi-Porter and Daphne Vessiropoulos shared information about the Laboratory's various STEM-based opportunities for high school students in a broad range of topics, including engineering, radar, programming, cyber, and cryptology. The Lincoln Laboratory booth featured a student-built radar as an example of what a student can build in one of the Laboratory's summer outreach programs. /

Junior Achievement Inspire Conference

In December at Hynes Convention Center in Boston, STEM organization representatives from across New England gathered at Junior Achievement (JA) Inspire. This conference seeks to raise awareness of educational programs and help 8th graders throughout New England—but mainly in the Massachusetts cities of Lowell, Lawrence, Chelsea, and Boston—explore career options. In partnership with local organizations and businesses representing various industries, JA Inspire encourages students to start exploring careers early through dynamic interactions, activities, and booth presentations.

Margarete Groll shows MITES students a few examples of uncrewed air vehicles and explains their uses.

Chiamaka Agbasi-Porter and Daphne Vessiropoulos shared information about Lincoln Laboratory outreach programs like LLRISE, LL EduCATE, and LLCipher, while Joel Grimm and Lisa Kelley explained the Laboratory's BWSI program.

To further pique interest in STEM, the students were invited to participate in hands-on demonstrations. Vessiropoulos and Agbasi-Porter taught students how to create flexahexagons, which are flat paper models that can be folded in certain ways to reveal additional hidden sides within the shape. "Our booth activity featured the simplest version of a flexahexagon, the kind with three faces. It's called a triflexahexagon. It's a creative way to explore geometry," said Vessiropoulos. In addition to folding their own flexahexagons, students decorated one face and explored how their initial pattern changed as they folded, teaching them about directionality and chirality. /

Tours

Lincoln Laboratory Outreach offers annual Laboratory facility tours for a number of groups and classes. These tours give students a glimpse into performing technical work and expose them to cutting-edge technologies, thereby motivating student interest and participation in STEM. /

Tour for MITES Students

Lincoln Laboratory opened its doors to Minority Introduction to Engineering and Science (MITES) students for a technology tour in June. The MITES program at MIT immerses high school seniors in college-level courses in math, physics, life sciences, engineering, and humanities. The program stresses the value of pursuing advanced technical degrees and helps students develop skills to achieve success in science and engineering. The students received a behind-the-scenes look at state-of-the-art technology in aviation weather systems and aircraft collision avoidance as Bradley Crowe and Margarete Groll explained how such systems work. Andrew Kopanski provided a tour of the Fabrication Laboratory, and Brian Fandel offered a tour of the machine shop. David Scott and Andrew Volpe showed the students all kinds of items created in the Technology Office Innovation Laboratory, and Stephen Margiotta guided a walk through the Microelectronics Laboratory with an explanation of the types of projects done in each location. Plans are in place for Laboratory staff to join the roster of speakers for MITES and MITES Summer starting next year. /

David Culbertson shares the history, purpose, and inventory of the Flight Facility to many groups throughout the year, like in the LLRISE program, **left**, and Hanscom Middle School students **above**.

Tour for Hanscom AFB Middle School Students

Middle school students from Hanscom Air Force Base (AFB) toured the Flight Facility twice in June to see Lincoln Laboratory's fleet of aircraft and learn how test aircraft are used to evaluate new technology like antennas, imagers for airborne surveillance, aircraft collision-avoidance tools, and long-range radio-frequency (RF) and laser communication systems. The students also walked through the RF Systems Test Facility to see the six anechoic chambers specially outfitted with noise-suppression material capable of absorbing microwaves and isolating external signals that could interfere with testing. The chambers allow for antenna, radar cross section, electromagnetic interference, and system tests and measurements over a wide frequency range. This facility features a rapid-prototyping machine shop with a variety of machining tools to fabricate antennas, target-mounting fixtures, and other mechanical pieces needed for testing. /

Other Visitors

Organized tours give visitors a behind-the-scenes view of work areas such as the Microelectronics Laboratory, Air Traffic Management Laboratory, Rapid Hardware Integration Facility, RF Systems Test Facility, and Flight Test Facility. In 2023, tours were given to several groups:

- **MIT Sloan School of Management staff**
- **MIT Office of the General Counsel staff**
- **Boston-area military fellows**
- **U.S. Naval Sea Cadet Corps youths**
- **MIT technology ventures leaders**
- **Carnegie Mellon University staff**
- **U.S. Military Academy at West Point cadets**
- **National Academy of Engineering members**
- **MIT Leader to Leader participants**
- **Bedford High School 1720 Club members**
- **Hanscom AFB commanders**
- **Air Force Materiel Command Civic Leader Program participants**
- **Downing Scholars**
- **Committee on Intelligence Congressional Delegation members /**

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 2023 Summer Research Program convene in the Laboratory lobby.

Summer Research Program

Each year, through its Summer Research Program, the Laboratory offers undergraduate, graduate, and military students hands-on research experience. Typically, students contribute to projects that complement their courses of study, and they have opportunities to interface with national experts in numerous STEM fields, work with the Laboratory's state-of-the-art resources and knowledgeable staff on real-world technical problems, and present their research results at the end of the summer. In 2023, 254 students participated in the Summer Research Program, making this year's cohort one of the largest in the program's history. /

In July, visitors to the I3C Poster Challenge learn about technology innovations envisioned by teams of interns.

Intern Innovative Idea Challenge (I3C)

Offered to Laboratory interns as part of the Summer Research Program, I3C is an annual engineering challenge hosted in a competitive yet cooperative and enriching environment. Interns form teams of three to four members and propose a real-world problem they want to solve—such as how to monitor wildfires or how to clean up space debris—and apply knowledge acquired during their internship to design a technology that could solve this problem.

Each team showcases their project to fellow interns and Laboratory employees at the I3C Poster Challenge. Visitors to this poster display can then vote for their favorite projects through an online portal. Six teams picked by the 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 present their ideas to a panel of judges called "sharks." Similarly to the show, Interns vs. Sharks invites I3C's six finalist teams to present their projects to the sharks—in this case, members of Lincoln Laboratory's leadership. This year, the I3C first-place award went to FOAM: Fungus Optimized Alternative Materials. The team behind FOAM tackled the problem of Styrofoam, a common and nonbiodegradable material that, when discarded, has a seriously detrimental effect on the environment and natural ecosystems. They proposed an innovative idea to replace Styrofoam with biodegradable "biofoam" synthesized from agricultural waste with the help of the fungus *Pycnoporus sanguineus.* /

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 2023, more than 60 co-op students from area schools were employed in technical divisions and service departments at the Laboratory. /

A group of co-op students gathers for tours of the Laboratory's Flight Test Facility and Radio-Frequency Systems Test Facility.

The Harvey Mudd Clinic Program student team—from left to right, Miles Cook, Harvey Mudd Professor Matthew Spencer, Ava Fascetti, Kip Macsai-Goren, Martin Susanto, and Melis Baltan-Brunet—pose with their prototype UAVs.

Harvey Mudd Clinic Program

The Laboratory has an ongoing collaboration with Harvey Mudd College's Clinic Program, which seeks to provide the college's juniors and seniors with opportunities to solve technical problems for organizations. Teams of four to five students complete projects in areas such as computer science, engineering, mathematics, or physics as a capstone experience to complement their academic studies. The goal of the program is to help students see the impact of their work on society while applying their skills to real-world situations and developing valuable technologies.

In 2021, a team of Harvey Mudd students set out to develop a system that could detect radio-frequency signals from an uncrewed aerial vehicle (UAV). The team worked with Laboratory staff and Harvey Mudd professors to build a working system that could be transferred to industry. The students developed a prototype UAV, which is currently undergoing testing, and will demonstrate the finished prototype to their Laboratory staff contact and professors in the spring.

"It is important for the Laboratory to participate in programs like the Harvey Mudd Clinic so we can continue to build the relationship between the burgeoning talent base of young engineers and federally funded research and development centers like Lincoln Laboratory," said Joey Botero, the Laboratory staff contact. "Through collaboration on projects like this one, we can show the students opportunities for employment that exist outside of the traditional paths of academia or industry. Furthermore, the students and program sponsor can both walk away knowing that the technology developed will be immediately impactful." /

The Laboratory's 2023 GEM Fellows gather for a group photo with Lincoln Laboratory Director Eric Evans (front row, far left) and members of the Laboratory's Office of Diversity and Inclusion.

GEM Fellowship Program

A network of leading corporations, laboratories, and research institutions, GEM enables qualified students to pursue graduate education in science and engineering. Lincoln Laboratory has had a committed partnership with GEM for the last 10 years. So far, the Laboratory has supported 154 MS and PhD Fellows, representing a direct investment in critical mentoring and sponsorship. Lincoln Laboratory Director Eric Evans served as the GEM board chairman for two consecutive terms.

GEM Fellows complete internships that provide companies opportunities to access and recruit talented candidates who they may not find otherwise. GEM offers programming on the importance of graduate school and tools for access and successful matriculation. It also produces publications for graduate and undergraduate students, and university and industry administrators to assist in the education process of how to obtain a graduate STEM education. GEM Fellowships at the Laboratory offer students numerous returns, from networking opportunities to high-level research experience. Among the Fellows who have previously interned at the Laboratory, some have become first-generation graduate school students and others full-time Lincoln Laboratory employees. /

Spotlight:

STRIVE Center Hosts University of Michigan for Exoskeleton Study

By Riley Brunner, Lincoln Laboratory Technical Communications Group

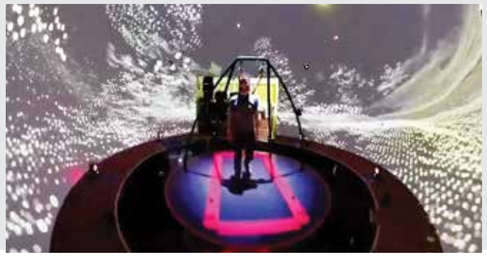
Lincoln Laboratory's Sensorimotor Technology Realization in Immersive Virtual Environments (STRIVE) Center is a 4,000-square-foot facility that houses technology that can be used to simulate environments for studies of human motion. In addition to supporting collaboration between Laboratory groups, the center can also be used for collaboration with other research teams.

Caleb Jeanniton, a second-year PhD student at the University of Michigan, was tasked by his advisor, Leia Stirling, to run a series of human-factors tests using a powered exoskeleton and the motion-capture capabilities of the Laboratory's STRIVE Center. The STRIVE Center has worked with Stirling for many years, and this most recent study is a continuation of their combined research on the impacts of wearing an exoskeleton.

There are three pillars of human-factors testing: the human, the environment, and the technology. The volunteer subjects of this study were immersed in a 360-degree virtual environment with a simulated intersection generated by the STRIVE Center's Computer Assisted Rehabilitation Environment (CAREN) system. Participants walked through the city scene on a force-measuring treadmill while wearing the exoskeleton. Data were also recorded in the same situation without the exoskeleton for a control data set.

This study aims to answer the question: How does the use of an exoskeleton impact one's decision to cross a street during a yellow light? The quantitative data from the motion capture system and the qualitative data from a questionnaire are shedding light on this question, but still need to be thoroughly analyzed at the University of Michigan. "These results will have broader implications related to how human-machine interfaces influence decision making and task performance," says Brian Baum, the STRIVE Center's research manager.

The STRIVE Center staff helped guide the use of the technology and the data collection throughout Jeanniton's time at the facility. "The main means for collecting data in this study are the motion-capture markers," says Harvey Edwards, operations manager at the STRIVE Center. "So, after we get done collecting, we can reconstruct those markers and determine joint forces, angles, and where the person is looking in real time, and help determine what factors were involved in making their decisions."



Lincoln Laboratory and the University of Michigan are conducting a human-factors study using an exoskeleton and the 3D immersive environment of the STRIVE Center.

Buddy Program

The Buddy Program, overseen by Human Resources in partnership with the Office of Diversity and Inclusion (ODI), was launched in 2021 and has been jointly coordinated by two Laboratory employee resources groups, the Hispanic Latinx Network and the Black Experience and Cultural Organization Network.

In summer 2023, 40 students opted into the Buddy Program. More than 30 Laboratory staff representing a broad range of groups and departments volunteered to serve as buddies. Matched with one or more interns, each buddy provides professional and developmental support for their assigned interns. Buddies also function as a source of knowledge about Laboratory culture; foster a sense of belonging and community; check in regularly with the intern; and serve as a liaison between the intern and Laboratory resources such as Human Resources, the ODI, and MyLife Services. A former intern described the Buddy Program as "a great support system that helped me feel more connected to the Lab." /

Interns and Laboratory staff participating in the 2023 Buddy Program commemorate their time together with a photo.

Terence Davidovits, a member of Activate Boston's 2022 cohort, is the most recent Activate Fellow to join Lincoln Laboratory. He will continue working at the Laboratory through 2024. Photo: Activate

Activate Fellowship Program

The two-year Activate Fellowship allows science and engineering entrepreneurs to embed with national organizations to learn the fundamentals of building a startup. Fellows are funded by the Defense Advanced Research Projects Agency and are managed by Activate, a nonprofit organization that works with government, philanthropic, and industry partners to support scientists and engineers as they advance hard technologies. Activate Fellows embedded at the Laboratory have access to state-of-the-art facilities and equipment, expert staff, and networking opportunities that will help them build their companies. In 2022, five Activate Fellows concluded their two-year fellowship period and graduated from the program, while four Fellows continued to work at the Laboratory until the end of 2023. Cohort 2022 Activate Fellow Terence Davidovits, founder and chief executive officer of ThermoBionics, will continue his fellowship at the Laboratory through 2024. Companies developed by Lincoln Laboratory Activate Fellows include

Sync Computing: Using novel mathematical algorithms to instantly and optimally provision cloud resources for today's largest computing workloads.

Irradiant Technologies: Harnessing light to print optics that will transform how people and machines see the world.

Aura Intelligent Systems: Developing a high-resolution imaging radar for automotive safety and automation with patented digital technology.

Coremeleon: Building simple and secure key management and recovery infrastructure to help provide resilient digital-asset ownership.

Qunnect: Building hardware to transform telecommunications infrastructure into scalable quantum networks.

ThermoBionics: Developing ultralight wearable cooling mechanisms that can work outdoors.

Thalo Labs: Building hardware that can measure and significantly reduce greenhouse gas emissions of buildings. /

The MMIP brings students to the Laboratory to work in its semiconductor facilities.

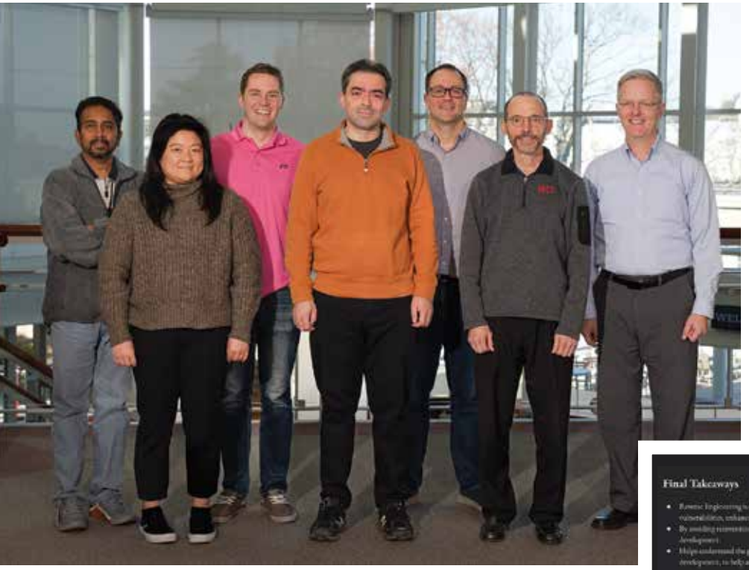
Massachusetts Microelectronics Internship Program (MMIP)

Freshmen and sophomores registered at Massachusetts universities can participate in MMIP, a 10-week, full-time internship opportunity in microelectronics. The program's goal is to incentivize more students to consider a career in semiconductors and microelectronics and promote growth in the U.S. microelectronics workforce. This summer, in the program's second season, 12 students spent the summer interning at the Laboratory, home to the Microelectronics Laboratory (ML), the U.S. government's most capable semiconductor research and fabrication facility. They conducted experiments to improve fabrication processes in the ML and learned how to use the machinery in the Laboratory's Compound Semiconductor Laboratory, a facility that specializes in growing semiconductors made of different elements.

"Having a hands-on job that taught me so much and gave me priceless experiences made me feel more confident in making the decision to pursue a career in microelectronics," said Kara Stratton, an MMIP intern studying at Boston University. "Lincoln Laboratory and specifically the ML foster an inclusive and innovative community of employees who were always willing to help me learn new things." /

MassCyberCenter Cybersecurity Mentorship Program

The MassCyberCenter was launched with a vision to enhance opportunities and increase diversity for the Massachusetts cybersecurity ecosystem while strengthening the resiliency of the Commonwealth's public and private communities. The MassCyberCenter created the Cybersecurity Mentorship Program for diverse undergraduate college students in Massachusetts to learn about cybersecurity careers and develop professional networks through direct engagement with



From left to right, Ashok Kumar, Alice Lee, Ryan Burrow, Sean O'Melia, Ryan Noonan, Marc Zissman, and Jeffrey Gottschalk served as mentors for undergraduate students during the spring 2023 MassCyberCenter Cybersecurity Mentorship Program.

Cybersecurity Mentorship Program participant Athul Ashok presents his project on the importance of reverse engineering for cybersecurity.

industry professionals. The goal of the Cybersecurity Mentorship Program is to encourage diverse undergraduate students to continue pursuing careers in cybersecurity, ultimately promoting diversity within the cybersecurity workforce in Massachusetts. Since fall 2020, the program has supported 215 students from 38 schools across Massachusetts, connecting them with professional mentors to discuss cybersecurity careers and work together on cybersecurity-related projects. Lincoln Laboratory is one of 55 participating organizations whose staff volunteer as mentors for the program. Laboratory mentors for the spring 2023 program represented several groups within the Cyber Security and Information Sciences Division.

"It is rewarding and worthwhile to be a mentor in the MassCyberCenter's Cybersecurity Mentorship Program," said Jeff Gottschalk, assistant division head of Lincoln Laboratory's Cyber Security and Information Sciences Division. "Students from a diverse set of backgrounds are exposed to and interested in cybersecurity, with topics ranging from operational cybersecurity planning and cybersecurity policy to prototyping and hands-on cybersecurity projects. The program has much promise to address the unmet demand for cybersecurity professionals in the Commonwealth. And it was really great to work with a student and see their progress during the program." /

Beaver Works

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

The main Beaver Works collaboration is the capstone course, an MIT engineering class in which students develop technologies that solve real-world problems. During two or three semesters, students from MIT's 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 and provide expertise in engineering design and fabrication of proof-of-concept models built by the students. Technologies developed through the capstone course have included an aluminum-fuel energy source, autonomous underwater vehicles, and cost-efficient microsatellites that NASA launched into space. /

MIT students in the Beaver Works capstone course developed and tested this autonomous underwater vehicle.

David Martinez—who taught the course "AI Strategies and Roadmap: Systems Engineering Approach to AI Development and Deployment" for the 2023 MIT Professional Education program—gives a presentation at the Recent Advances in AI for National Security conference.

MIT Professional Education

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, 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 2023, David Martinez led the five-day course "AI [Artificial Intelligence] Strategies and Roadmap: Systems Engineering Approach to AI Development and Deployment." The course aimed to teach participants how to lead, develop, and deploy AI systems in responsible ways that augment human capabilities. /

MIT Internships

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 a UROP or UPOP assignment may choose to do a research project for course credit or accept a paid internship. Most participants at the Laboratory are interns working under the direct supervision of technical staff members. The students engage in every aspect of onsite research—developing research proposals, performing experiments, analyzing data, and presenting research results. In summer 2023, 13 students interned at the Laboratory through UPOP and UROP. Another student came to the Laboratory under the MIT 6-A Master of Engineering (MEng) Thesis Program, through which students apply work completed at a partnering organization to their MEng thesis. /

Defense Technology Seminar

The Defense Technology Seminar (DTS) is an event originally designed as a one-day seminar for students attending the U.S. Military Academy at West Point in New York. After going on hiatus because of the COVID-19 pandemic, DTS returned in 2023 as a weeklong event from March 27–31. The 87 military service members and civilian defense employees in attendance listened to technical talks given by Laboratory speakers to learn about the Laboratory's mission areas and R&D. They also toured the Laboratory's Westford, Massachusetts, facility housing the Haystack Ultrawideband Satellite Imaging Radar. The later portion of DTS featured a banquet for attendees and keynote speeches presented by guests that included Tufts University professor Christopher Miller, White House Office of Science and Technology Policy member Matthew Daniels, Harvard University professor Alexandra Vacroux, Tufts University professor Sulmaan Khan, and 10th Vice Chairman of the Joint Chiefs of Staff Gen. Paul Silva. /

The 87 attendees of the 2023 Defense Technology Seminar gather in the Laboratory's auditorium.

Military Fellow Sam Karlson presents his work on nitrogen-vacancy diamond magnetometry at a luncheon for participants in the Laboratory's educational programs.

Military Fellows Program

Every year, the Military Fellows Program offers military officers pursuing graduate degrees or advanced education the unique opportunity to engage in R&D at the Laboratory. Fellows are directly involved in developing capabilities important to national security, and, in turn, Laboratory staff benefit from the officers' unique insights. Since the program's start in 2010, more than 300 Fellows have worked alongside Laboratory staff mentors. Twenty-three Fellows worked at the Laboratory for the 2022–2023 session of the program, and 20 Fellows are continuing their research at the Laboratory from 2023 to 2024.

Military Fellow and MIT student Sam Karlson worked with the Laboratory's Quantum Information and Integrated Nanosystems Group on nitrogen-vacancy diamond magnetometry. In May, he presented his research to attendees during an appreciation luncheon for Military Fellows, Lincoln Scholars, and their mentors.

"Working here has been a great opportunity. My supervisors have been very helpful integrating me into the group research projects, and the Lincoln Laboratory setup makes it really easy to collaborate and network with different researchers in different groups. Working here has exposed me to lots of the amazing research projects going on," Karlson said.

The Military Fellows Program seeks to provide hands-on experiences that augment the skills Fellows have gained in the classroom and in the military. Nolan Pearce is a Military Fellow pursuing a master's degree at Northeastern University in electrical and computer engineering, specializing in wireless communications. He worked in the Laboratory's Tactical Networks Group on R&D related to low-probability-of-intercept and low-probability-of-detection waveforms. Pearce described his work at Lincoln Laboratory as an excellent complement to his graduate school studies in engineering: "I can work on cutting-edge applications here and supplement them with theory that I learn at school. Often, the topics that I research at Lincoln Laboratory are based on fundamental classes I'm taking simultaneously. Balancing school and research is hard, but it offers a great advantage to grasp the basics while seeing advanced applications. The mentorship and opportunities available through the Laboratory also offer another avenue for exploring options within military life."

An equally important component of the Military Fellows Program is the interpersonal aspect, with Fellows forming connections with their Laboratory staff colleagues and mentors. Fellows gain valuable insight and experience working and interacting with subject-matter experts, and their Laboratory colleagues can offer a glimpse into what a career in the Fellow's field of interest could look like.

"The staff in the Advanced SATCOM Systems and Operations Group has been incredibly helpful, kind, and knowledgeable and has helped expand my view of the field of communications, especially in space. People have dropped what they are doing to help me or explain concepts to me, and that sort of mentorship has really inspired me to learn more in the field. I have a new appreciation for the technologies that Lincoln Laboratory develops," said Jon Copley, a Military Fellow who processed and analyzed data collections from satellites.

Copley's experience was shared by Military Fellow Noah Jones, who appreciated the connection he made with his mentor in the Control and Autonomous Systems Engineering Group. "The absolute highlight of my time at Lincoln Laboratory so far has been the interactions with my mentor, Trevor Ashley," Jones said. "He's helped me put together a curriculum that is both relevant and rewarding, and our weekly check-ins usually turn into me having my mind blown by some new thing he taught me. I've also loved attending a wide array of seminars and briefings by experts in their fields, and I've made valuable connections for my future assignments." /

Military Summer Intern Program

Military interns spend three to five weeks of their summer working at Lincoln Laboratory under the Service Academy Research Program. The interns represent the service academies and the U.S. Army Reserve Officers' Training Corps program. The Laboratory started hosting military summer interns in 2012 to expose them to technical programs on national security. In summer 2023, 25 interns participated in the program. /

Military officers participating in the military summer intern program pose outside the Laboratory with Director Eric Evans, far right.

Spotlight:

Military Students Innovate Technology Solutions for U.S. Special Operations Command

By Kylie Foy, Lincoln Laboratory Communications and Community Outreach Office

All eyes were on the robot-dog pacing the hangar on Hanscom Air Force Base. The robot was just one technology, among small drones, autonomous-mapping vehicles, and virtual-environment simulators, set up for military cadets to interact with. The goal was to open cadets' minds to possibilities. Over the next year, they will be applying such technologies to challenges facing the U.S. Special Operations Command (USSOCOM) for a program called SOCOM Ignite.

SOCOM Ignite connects military students with research scientists and special operations forces to address SOCOM's pressing technology challenges, while ushering in new generations of technology-savvy officers and operators. Now in its fourth year, the program invites cadets from across the nation's military academies and Reserve Officers' Training Corps (ROTC) programs to participate.

"We started as just a two-day hackathon having less than 10 cadets, and now we are a year-long program with more than 80 cadets from more than 19 different universities, representing the Army, Navy, and Air Force. We hope to extend to the Marines and any other group out there," says Raoul Ouedraogo, who helped establish the program and is a leader within Lincoln Laboratory's Homeland Sensors and Analytics Group.

Lincoln Laboratory researchers serve as the technical mentors in the program. To start the program this year, they offered new "innovation incubators," or crash-courses on the basics of machine learning and autonomy, two topics of high interest to SOCOM. Following those sessions, a formal kick-off ceremony brought in SOCOM leaders to explain the impact of the program for the command's mission. SOCOM is the nation's only unified combatant command that oversees special operations forces across all branches of the armed services.

"What makes SOCOM so important to the Department of Defense is that we are pathfinders. We look at advanced concepts, take those visions and dreams, and make them real," said SOCOM Senior Enlisted Leader (Retired) Greg Smith.

"We have a mix of academy cadets and ROTC students, providing diverse perspectives. We have access to users in the SOCOM community, whose time is precious, and to technology mentors, who do this for a living. Those three things make this a unique program," Lisa Sanders, director of science and technology for Special Operations Forces, Acquisition, Technology, and Logistics, USSOCOM, said at the ceremony. "SOCOM also has acquisition authority—people who get ideas on the market. The ideas that you come up with will make a meaningful difference."

After the opening ceremonies, the cadets traveled to MIT campus for a weekend-long hackathon, which took place from September 16 to 17. At the hackathon, SOCOM operators presented more than a dozen Ignite challenges to the cadets. Cadets then formed teams to begin brainstorming concepts, working firsthand with special operations forces and Laboratory technical experts to refine their ideas.

Spotlight (continued)

The challenges are diverse in their needs. One challenge is to develop a non-RF means of communicating within a squad. Another is seeking algorithms and hardware to enhance autonomous UAV flight and mapping indoors. New this year, a biotechnology challenge calls for methods to improve the storage and delivery of blood in a tactical environment.

"The hackathon experience was inspiring. It was great to see such a large number of cadets coming from different institutions attend and have a desire to conduct meaningful research," says Jack Perreault, a recent West Point graduate whose team is applying computer vision and speech recognition to the process of reporting and triaging casualties. "Getting insight on how our technical skills can help enable operators achieve their missions has left the greatest impact on me overall."

The cadets will continue working on their concepts and receive funding to build prototypes throughout the school year. Over the winter, some might visit Fort Liberty, which houses the headquarters of the U.S. Army Special Operations Command, to showcase their solutions to users and update SOCOM leaders on their progress. In the spring, they'll return to Lincoln Laboratory for final presentations. After that, Lincoln Laboratory and various SOCOM components will take on some cadets as interns or military fellows to continue their research. Perreault is one such military fellow, developing his SOCOM solution at the Laboratory while pursuing a master's degree at Boston University.

Military students are developing technology solutions to U.S. Special Operations Command challenges. Here, U.S. Air Force and Army cadets learn about robotic systems in the Laboratory's Autonomous Systems Development Facility.

U.S. Air Force cadet Christopher Christmas is also continuing his work as a research assistant at the Laboratory. A third-time SOCOM Ignite participant, he is pursuing a system that can ingest data from distributed sensors and generate useful information, sending it to the right people and in a scalable way.

Christmas recommends SOCOM Ignite to any cadet looking for an opportunity to make an impact. "It's an excellent leadership experience, exposing cadets to unique career fields and officers of various ranks. It has completely altered the trajectory of my life in the best way possible." /

Entrepreneurial Outreach Programs

The Laboratory participates in multiple programs and events to promote entrepreneurial education among Laboratory staff members. One such program is I-Corps Spark, MIT's version of the National Science Foundation's Innovation Corps (I-Corps), an entrepreneurial training program that helps scientists and engineers quickly translate their research into practical applications. In 2019, MIT began offering a customized version of the Spark Program to Lincoln Laboratory employees. By taking I-Corps–inspired courses, Laboratory employees grow their entrepreneurial skills and explore technology transfer opportunities.

The Laboratory has also established a presence at The Engine, a "tough tech" accelerator spun out of MIT. Tough tech refers to technology that attempts to solve society's most challenging problems. At The Engine, Laboratory staff engage with entrepreneurs, scientists, engineers, leaders in academia and business, and investors to broaden the availability of tough-tech solutions. The Laboratory's expertise in sensors, microelectronics, and data analysis can lead to beneficial partnerships with member companies working in The Engine's focus areas—climate change, human health, and advanced systems and infrastructure. /

Lincoln Laboratory collaborated with MIT's The Engine to host OUTbio's November 2023 social event, bringing together biotech professionals from around Boston to provide networking opportunities and share the Laboratory's technical work.

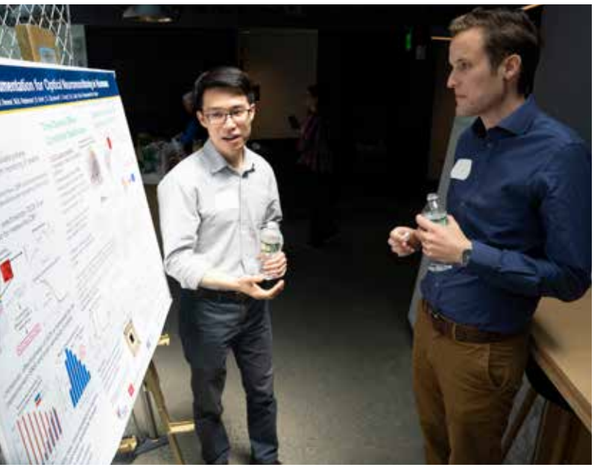
Participants listen to a lecture given as part of the technical storytelling course offered by the Technical Education Committee.

Technical Education Committee 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 2023 Technical Education Committee program included courses covering topics such as AI, electronic warfare, space engineering, electromagnetics and antenna sensing, high-performance computing, holography, technical storytelling, and infrared technology.

The technical storytelling course, led by Systems and Architectures Group Leader Jonathan Gans, taught 60 attendees how to create a captivating story and communicate points effectively. Informational lectures were supplemented with in-class exercises and guest speakers from the entertainment and media industries, including CNN reporter Meg Tirrell, YouTube content creator Destin Sandlin, and Hollywood producer Kelly McCormick.

"The course helped reinforce that there are multiple ways to convey an idea and many ways to muddle it up," said storytelling course participant Brent Parham. "I left with a better appreciation that, while some basic structures help you think through a story, the important part is to consider who you are talking to and cater to that relationship. Cool technology alone can't speak for itself; it needs a good advocate who can both engage with the audience and listen." /



Lincoln Scholar Tom Cheng, left, presents his work on brain-imaging technology at a poster session. Cheng's work is part of a larger Laboratory program to build a portable cap that can measure blood-flow fluctuations in the brain.

"The technical aspects of Laboratory programs made me want to delve further into fundamental research, and the Lincoln Scholars program allowed me to pursue independent research for graduate school. The program helped me to understand the state of the art in the literature, ask the right questions to identify gaps, and formulate methods to solve those problems. These skills are all well aligned with the mission of Lincoln Laboratory, and I look forward to supporting new and existing programs and guiding the future vision for the Laboratory," says Dan Jang, a Lincoln scholar and associate staff member in the Space Systems Analysis and Test Group. /

Lincoln Scholars Program

The Lincoln Scholars Program supports graduate education for staff members in areas of strategic importance to the Laboratory. The program promotes the recruitment and retention of talented technical staff, enhances the technical capabilities of staff, and improves relationships with local-university research faculty in fields relevant to the Laboratory. Students work at the Laboratory in between semesters and make substantial technical contributions to the Laboratory. Each scholar is paired with a mentor throughout the program. Scholars work full time at the Laboratory for two years after ending their studies. In fall 2023, six scholars graduated from the program; eight scholars continued their studies through the year, and six new scholars joined the program in 2023. More than 200 staff members have pursued full-time technical graduate work through the Lincoln Scholars Program.

Part-Time Graduate Studies Program

The Part-Time Graduate Studies Program enables motivated and talented staff members to pursue a master's degree part time, via distance learning or at local universities, in areas of importance to the Laboratory while they continue to work at the Laboratory full time. The program objective is to provide developmental opportunities to employees to the joint benefit of the Laboratory, Laboratory sponsors, and the employee. As of fall 2023, 26 Laboratory staff members are participating in the program. /

Retired U.S. Air Force Major General Robert Behler gives a presentation to Laboratory employees about the SR-71 aircraft and its unique characteristics.

Technology Office Seminars

Technical talks motivate and inspire staff while facilitating working relationships. The Technology Office directs a program of 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 2023 Technology Office seminar program included the following presentations:

Silicon Photonics for LiDAR, Augmented Reality, Biophotonics, Quantum Engineering, and Beyond by Jelena Notaros

Flying the SR-71 in Extreme Environments
by the Honorable Robert F. Behler

Not Such a Waste After All: How Wastewater Intelligence Can Help Get Us Ahead of the Next Big Public Health Crisis
by Mariana Matus

Better at the Bottom: 21st-Century Millitesla MRI
by Matt Rosen

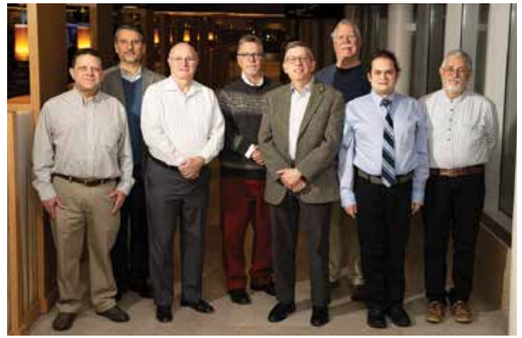
Navigating the Frontiers: Ensuring Space Security in the 21st Century by Moriba Jah

A Fruitful Reciprocity: The Neuroscience-AI Connection
by Daniel Yamins

Global by Design: Leveraging Engineering Science for Global Development by Amos Winter /

IEEE Boston Reliability Chapter

The Laboratory encourages employees to participate in professional societies. The Boston Chapter of the IEEE Reliability Society holds events yearlong to let members discuss aspects of reliability engineering, such as technology design, manufacturing, and testing. Every month during the academic year, the chapter coordinates a networking event with presentations about topics in engineering, and once or twice a year, it holds a tour of a local company. Since 2012, the Laboratory has hosted most of the chapter's monthly meetings. Because of the COVID-19 pandemic, the chapter started to hold its meetings online in 2020. The chapter has resumed holding some meetings in person as hybrid meetings in addition to holding online-only meetings. /



Dan Weidman (fourth from right), a technical staff member in the Laboratory's Mission Assurance Office, is shown with members of the Boston Chapter of the IEEE Reliability Society at one of the chapter's regularly held technical presentations. IEEE members and nonmembers can attend these presentations.

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

Donations of medicine, tourniquets, bandages, disinfectants, gel burn dressings, and splints were sent from Jamaica Plain, Massachusetts, to east and south Ukraine.

Ukrainian Supplies Drive

After seeing images of destruction in Ukraine in 2022, people around the world—especially those with a Ukrainian background—wanted to help. Two such Laboratory employees set up fundraisers to assist Ukrainian citizens.

David Pronchick urged the Laboratory community to contribute lifesaving resources by donating medical and tactical supplies for Ukrainian people and soldiers. Ukraine-relief donation boxes were set up at the Laboratory and stayed in place for more than a year. A list of some needed items ranging from bandages to drones was posted with a link to a complete inventory of items that could be ordered online and shipped directly.

Pronchick worked in tandem with the Ukrainian Catholic Church in Jamaica Plain, Massachusetts, to support Ukraine Forward, an initiative established by the Ukrainian American Educational Center of Boston. Through Ukraine Forward, all donations from the Laboratory are sent to a local company that ships them to the Poland-Ukraine border. From there, items are distributed to various areas in Ukraine where the need is greatest.

In 2022, Daniel Dumanis established a GoFundMe site, raising $31,808 (more than $3,000 of which came from the Laboratory community) and sending more than 125 boxes of aid assisting refugees throughout Ukraine. Though donations are no longer being taken, Dumanis is now sponsoring a GoFundMe site for his nephews and niece who became orphans this year in Ukraine.

"The response from Laboratory folks was great; everybody wants to help!" said Dumanis. "It's amazing how our community can pull together to help people half a world away. We sometimes question whether or not we can do anything impactful, but then you talk to the people there and hear their stories, and we really are making a difference in people's lives."

As they continue to help Ukrainians impacted by war, Pronchick and Dumanis thank the Lincoln Laboratory community for its ongoing support. /

Top, Ukrainian-aid donation boxes set up by David Pronchick are available throughout the Laboratory for medical and tactical items to be shipped overseas. **At left**, Daniel Dumanis (kneeling behind flag) gathers a team to help sort through donations and ship them to Ukraine. **Above**, For more than a year, the Dumanis family organized boxes of donations in their house and garage before shipping them overseas.

Bake Sales

International Transgender Day of Visibility

On March 31, International Transgender Day of Visibility, Lincoln Laboratory's Out and Proud Employee Network (OPEN) hosted a bake sale to raise money for the Trevor Project. OPEN is an employee resource group (ERG) that seeks to provide a forum for members of the Lincoln Laboratory community who identify as lesbian, gay, bisexual, transgender, and queer (LGBTQ) or other gender minorities, and their supporters. The Trevor Project is a nonprofit organization whose mission is to end suicide among LGBTQ+ youth through crisis support, research, public education, and advocacy.

"2023 was an exceptionally great year to support the Trevor Project cause because of how many anti-LGBTQ and anti-transgender bills have been passed and how they have particularly affected youths. I think that made our fundraiser all the timelier," said Sara Canzano, a co-chair of OPEN.

The bake sale started with a fundraising goal of $250, which was surpassed within the first hour. The sale raised a total of $1,782, breaking OPEN's previous bake sale record of $1,050.

For bake sale visitors, OPEN created and distributed pamphlets that described the Trevor Project's work and provided a link to its donation page. The pamphlet also explained the significance of International Transgender Day of Visibility, an event established to celebrate transgender people while raising awareness of the discrimination they face in society.

"One big thing that OPEN tries to do is offer educational and social touchpoints," said Canzano. "I think this bake sale was a great opportunity for people from across the Lab to enjoy. People learned about a cause that they could refer to others. Seeing people excited about what we were doing was really touching."/

Members of OPEN raise funds for young LGBTQ+ people in crisis by hosting a bake sale featuring many delicacies, including homemade lollipops.

Standing at a table filled with bake-sale classics and Hispanic treats, OPEN and HLN members are ready to raise funds for GLAAD.

National Coming Out Day and National Hispanic Heritage Month

In observance of both National Coming Out Day on October 11 and National Hispanic Heritage Month from September 15 to October 15, members of the Hispanic/Latinx Network (HLN) and OPEN partnered to raise funds for the Gay and Lesbian Alliance Against Defamation (GLAAD). OPEN co-chairs Sara Canzano and Emily-Anne Genova-Cruz and HLN co-chairs Alfredo Martinez and Elena Zorn collaborated with the Laboratory's Concert Committee to coincide the bake sale with a concert by Veronica Robles and her all-women mariachi band. The Laboratory community was invited to buy a treat and enjoy their purchase while listening to the band. This event raised $1,079, and many Laboratory employees left well fed, both literally and culturally. Zorn was happy with the results of the bake sale and said, "It's great when ERGs work together toward a common goal, and even better when baked goods and music are involved!" /

Toys for Tots

For more than 25 years, Lincoln Laboratory has participated in the Toys for Tots donation drive from late November through early December. Susan Curry and Jeffrey Matthews gathered donations of toys from the Laboratory community and organized their delivery to a distribution center affiliated with the U.S. Marine Corps Reserve, the organization that has conducted this nationwide toy collection for 75 years. All donated toys are offered as holiday gifts to needy children in the area.

Employees contributed hundreds of new unwrapped toys to the Toys for Tots collection boxes in the MIT Federal Credit Union lobby and Forbes Road Cafeteria. This year, Curry set up an additional location for donations outside her office. The Space Systems Analysis and Test Group contributed a significant portion of the toys donated, causing the in-person donations to be greater than expected. Curry said, "You can always count on the Laboratory community for its generosity. It is wonderful that we can guarantee a happy holiday for local children." /

More than 12 boxes full of donated toys await pick up by the Hanscom Air Force Base local organizers of the annual Toys for Tots drive.

Kwajalein students from Ebeye receive boxed lunches, as they cannot return home for lunch during the school day. Lincoln Laboratory donations help fund this program to ensure that no student goes hungry.

Marshallese Outreach

The U.S. Army's Reagan Test Site (RTS) is located approximately 2,300 miles west-southwest of Hawaii on Kwajalein Atoll in the Marshall Islands. As the scientific advisor to RTS, Lincoln Laboratory supports operations at the range and conducts upgrades to the sensors and command-and-control infrastructure. A resident team of Laboratory staff are stationed on Kwajalein Atoll at any given time, serving two- to five-year tours before returning to the Laboratory's main campus in Lexington, Massachusetts. While residing on Kwajalein, Laboratory staff have a synergistic relationship with the islanders, supporting each other in different ways, one of which is through the sale and purchase of Marshallese handicrafts.

As part of Lincoln Laboratory's Marshallese outreach effort, sales of Micronesian handicrafts are held throughout the year. Handwoven baskets and wood-carved sea creatures are purchased through the Micronesian Handicraft Shop—operated entirely by volunteers from the Yokwe Yuk Women's Club (YYWC)—on Kwajalein Atoll and sent to Lincoln Laboratory for sale.

The shop features goods from many islands in the Marshall Islands and the Federated States of Micronesia. Volunteer buyers develop relationships with craftspeople throughout the islands and receive goods for shipment. Purchases support artisans who have limited outlets for selling their goods. The goal of the shop is to provide a market that will encourage artisans to continue producing their crafts and pass on their skills to the next generation. However, the benefits extend beyond this goal; the shop marks up each item for sale to create a profit, which is then distributed via educational grants to schools throughout the Marshall Islands and Micronesia.

The needs of the island schools are great. Frequently, these schools lack textbooks, chalkboards, and desks. On Kwajalein's neighboring island of Ebeye, only half of the 7,000 school-aged children are accommodated in local schools, many of which could not function without the contributions from the YYWC. Lincoln Laboratory is proud to have its field-site staff on Kwajalein Atoll participate in the YYWC. The Lincoln community plays an important part in supporting schools through the purchase of goods from islanders. /

Laboratory employees can shop a selection of Marshallese crafts including ornaments, necklaces, woven baskets, wall hangings, and intricately carved sculptures. Purchases of these imported goods support Marshallese artisans and Micronesian schools.

Spotlight:

Basketball Clinic Bridges U.S.-Marshallese Relations

After assisting with the Beaver Works Summer Institute on Kwajalein, Jordan Wynn, a Lincoln Laboratory staff member, and her sister, Hannah, created a basketball clinic for the children of Ebeye while staying with their parents, Chuck and Susan Wynn, on Kwajalein during summer break. The clinic taught boys and girls new strategies and useful skills for basketball, and delivered new shoes and basketballs to the Marshallese community.

The Wynn sisters have a history of playing and teaching people to play basketball, and they heard how much the islanders love to play, so they thought holding a clinic would be a great way to bring people together. Hannah realized that her school, Dennison University, had the resources to help: "Our team gets new shoes every year, so by your senior year, you have at least four pairs of basketball shoes." Hannah graduated in May and encouraged her team to contribute their shoes to this cause. Donations from Dennison University and from Laboratory staff on Kwajalein resulted in 30 pairs of adult shoes, 30 new basketballs, and a variety of shoes and socks for children.

This event came to fruition after multiple planning trips to Ebeye to meet with community leaders, and with the help of many Kwajalein volunteers who managed learning stations and distributed shoes at the event. Close to 200 kids showed up for the basketball clinic, which started with a group stretch and then broke out into five stations. Adam Gjersvik and Chuck Wynn both led a basketball skills station and helped with shoe distribution logistics. Mariah Gjersvik served as the photographer for the day and gave a lot of high-fives and fist-bumps to the kids. "Having Sammy Juda there as a translator was indispensable. We couldn't have done it without him," said Jordan. "The kids definitely learned new things. We showed them new shooting techniques and offered an activity in which we tossed them a tennis ball while they practiced dribbling, which proved to be a lot of fun," said Hannah.

Reflecting on the event, Jordan said, "One of the most rewarding parts was getting the girls to join in. All of them were initially standing around the perimeter to watch as the boys played. One of the mothers told me that the girls didn't feel comfortable mixing with the boys. I promised that we would have a girls-only group, which incentivized the girls to join. As the day went on, more and more girls [20 total] came out to play and show off their skills. It was heartwarming, especially given that girls were only allowed to play basketball here on island starting as little as three years ago."

Mark Smith, Kwajalein site leader, said, "The Ebeye basketball clinic that Jordan and Hannah organized required quite a bit of foresight and planning. They went above and beyond to help foster good relationships with our host nation, which is very important for the U.S. presence here. The event was amazingly well received by the community. I want to express appreciation for all of Jordan's contributions this summer and hope that she can join us again in the future."

Jordan enjoyed the experience and added that she was thankful to help: "I am very grateful to Sarah Willis for allowing me to spend a few weeks in Kwajalein, where I was able to spread my passions and serve as a mentor to the next generation of STEM students and ballers."

Spotlight (continued)

Photos: Mariah Gjersvik

Walk to End Alzheimer's

Each year, the Alzheimer's Support Group at Lincoln Laboratory invites all employees, friends, and families to join their team or support them as they participate in the Walk to End Alzheimer's in Greater Boston.

The Lincoln Laboratory team has supported this event since 2009. This year, for the first in-person walk since 2020, the 32-member team raised $34,391, ranking them the top fundraising team out of 416 teams in the Greater Boston Walk. Participants in this year's team included Terri Welch and family, Kit Holland, Kathleen Cable and family, Maria Nicholson and family, Lisa Renzullo, Jonathan Su, Eleanor Downing and family, Steven Feinstein, Catherine Lockton and family, Jessica Johnson, McKenzie Ward and family, Deborah Surtees, Merrianne Terranova, Carly Seguin, Sandra McLellan, Peter Priestner, Tom Crane, Michael Nicholson, Michael Medlock, John Kaufmann, Susan Marcone, and Katherine Russo.

Inspired by the Lincoln Laboratory community's action in this charity, staff at the Huntsville Field Site joined in the Walk to End Alzheimer's in Northern Alabama beginning in 2019. This year, led by Denise DeCoster, the team donated $2,184 toward combatting Alzheimer's disease. "We saw what the Massachusetts Laboratory employees were doing, and we wanted to mirror that in Huntsville," said DeCoster. /

Since 2009, the Laboratory's Walk and Ride teams have donated more than **$610,000** to the Alzheimer's Association to further research, awareness, education, and services.

Top, Huntsville Field Site staff join friends and family to participate in the Walk to End Alzheimer's in Northern Alabama for the fifth year. **Right**, The Lincoln Laboratory Walk to End Alzheimer's Team had 32 members, 12 of whom were first-time participants. The Lincoln Laboratory team was the top fundraising team in the Greater Boston Walk.

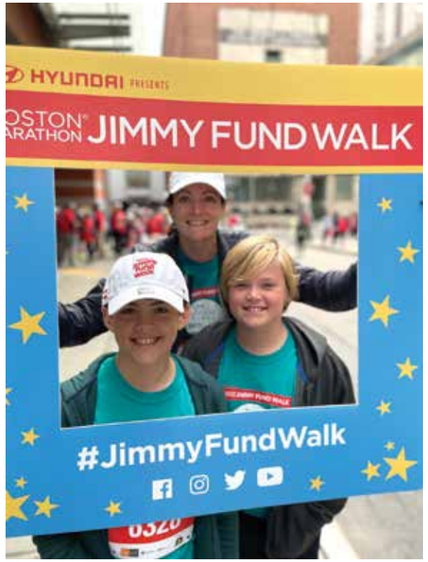
Ride to End Alzheimer's

The 2023 Ride to End Alzheimer's New England was scheduled for June 3 but was canceled because of rainy weather. The event changed to a virtual option, which enabled cyclists to ride any distance on any path, trail, or road of their own choosing. Five members of Team Lincoln took part in the virtual ride in August. They rode a 30-mile route from Lincoln Laboratory to Alewife Station in Cambridge, Massachusetts, via the Minuteman Bikeway and back to the Laboratory, stopping at the Old North Bridge in Concord, Massachusetts.

Team Lincoln raised $21,135. David Caplan led the team that included Nathan Miller, Heather Morris, Eden Price, John Kaufmann, Steve Bedrosian, Leena Singh, Philip Maynard, Jeffrey Palmer, and Lance Page. Referring to the virtual ride, Caplan said, "It was a nearly perfect day with blue skies. A mostly shaded Minuteman Bikeway made for a comfortable ride, despite a blown tire that needed to be fixed en route."

"The Ride to End Alzheimer's gives cyclists the opportunity to challenge themselves while riding toward the same goal: funding critical studies for Alzheimer's research. The experience is truly a unique and inspiring one, bringing together a dedicated community of riders to provide hope to the millions who are living with, caring for, or have lost a loved one to this disease," said Charlene Bemis, director of special events for the Alzheimer's Association Massachusetts/New Hampshire Chapter. Thanks to the passion, dedication, and perseverance of all of the participants and donors, this year's event raised $454,840, which will support the discovery of methods of treatment and prevention for Alzheimer's and other dementias. /

Team Lincoln pauses at the Old North Bridge in Concord, Massachusetts, during the virtual Ride to End Alzheimer's.



With her children, Amanda Wait celebrates her finish of the Jimmy Fund Walk in Boston, Massachusetts.

Jimmy Fund Walk

Amanda Wait annually engages in fundraising for The Jimmy Fund, which supports the fight against cancer at Boston's Dana-Farber Cancer Institute by raising funds for adult and pediatric cancer care and research to improve the chances of survival for cancer patients around the world. The 26.2-mile Jimmy Fund Walk features a finish line at Copley Square in Boston, Massachusetts. Participants can instead 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.

Wait's fundraising activities included a bake sale at Lincoln Laboratory. Among the specialties sold were cookies that looked like the Lincoln Laboratory logo and cookies that looked like cancer awareness ribbons. Wait was humbled to meet people at the Laboratory who shared personal stories of illness and survival. Donations from the bake sale totaled just over $1,100, enabling Wait to participate in the Jimmy Fund Walk in person in October, which required a $330 registration fee. Her aim was to defy cancer while walking the iconic Boston Marathon route. Wait's team raised $909, almost doubling their goal of $500. "I have been doing the Jimmy Fund Walk for more than 15 years," Wait said. "Hosting a bake sale at the Laboratory has become an integral part of my participation. I couldn't do it without the generosity of the Laboratory community." /

Eight thousand walkers raised funds to support the Dana-Farber Cancer Institute and the Jimmy Fund in 2023.

Scott Hamilton, Lisa Basile, and Graham Baker represent the Laboratory in their trivia team "Bee an Engineer" to raise funds for the Lexington Education Foundation and interest in engineering.

Lexington Education Foundation

A three-member Lincoln Laboratory team successfully represented the Laboratory at the annual trivia bee benefiting the Lexington Education Foundation. The trivia bee provides a chance to support a worthy nonprofit organization, engage in STEM outreach, and build public relations for the Laboratory. This team has competed in the trivia bee in years past; however, for the first time, they advanced to the finals. Team members Graham Baker, Lisa Basile, and Scott Hamilton came close to winning the whole trivia bee but were caught off guard by a question about hockey.

In 2022, the Lexington Education Foundation awarded $273,867 for 30 teacher-initiated grants to foster community; invest in reading and writing support; build new skills; promote joy in learning; advance social and restorative justice; and establish diversity, equity, and inclusion throughout Lexington Public Schools. The annual trivia bee helps provide a portion of those funds each year to Lexington Public Schools teachers and administrators. /

Left, Left to right, Michelle Lloyd, Sharon Clarke, and Kyle Denney collect holiday cards for veterans at the VA Hospital in Bedford, Massachusetts. **Above**, Laboratory employees sign holiday cards for local veterans to provide cheer, encouragement, and appreciation.

Holiday Cards for Veterans

In December, Lincoln Laboratory Access (LLACCESS), an employee resource group emphasizing accessibility for all in the workplace, partnered with the Lincoln Laboratory Veterans Network (LLVETS) to plan an opportunity for the Laboratory community to sign holiday greeting cards for veterans at the Veterans Administration (VA) Hospital in Bedford, Massachusetts. Magdaline Bathory, the communications manager of LLACCESS, said, "Many veterans at the hospital spend the holidays away from loved ones. We want to encourage them and let them know someone is thinking of them." The group's goal was to collect enough cards so that each veteran at the facility could receive one. When asked why this effort is important, Bathory said, "We need to recognize and celebrate our veterans who make a difference in our world because we owe them so much. They have risked everything to protect our freedom and democracy. For their sacrifices, we want to share our lasting gratitude." Those taking part in this effort included Bathory, Sharon Clarke, Kyle Denney, and Michelle Lloyd from LLACCESS and Ronald Ross and Mathew Mills from LLVETS. Organizers of the event collected 80 signed cards to deliver to local veterans. /

Laboratory volunteers help keep the oceans around the atoll clean.

Kwajalein Beach Cleanup

As tropical storms roll across Kwajalein Atoll, they leave behind plastic debris. To help combat this pollution, Laboratory staff adopted a beach on the northern tip of the atoll. Twice each year, several dedicated volunteers collect at least six large garbage bags full of trash, all from a one-eighth mile of shoreline. The 2023 cleanup crew included Sarah Willis, Andrew Dahir, Jon Wentworth, Mara Wentworth, Jon Schoenenberger, Luke Letter, Suzy Riccardi, Susan Wynn, Mariah Gjersvik, and Adam Gjersvik. "Marine litter and plastic pollution are a massive problem for our oceans, but even small actions can make a big difference. That's why we choose to undertake this effort every year," said Mariah Gjersvik. /

Seedling Giveaway

LLGrows held its third annual seedling giveaway in May to help staff grow an interest in gardening or get started on the spring planting season. This year was the first time the event was co-hosted with another group. Boegel explained the partnership: "It was really exciting when PALS [the Pan-Asian Laboratory Staff network] reached out in February to ask if they could join us for the seedling giveaway. From March through May, we collaborated on the seed-starting effort and shared supplies and advice. We had a few lunchtime work sessions to plant seeds, re-pot the growing seedlings, and finally replant the seedlings into individually labeled cups for the giveaway. PALS really helped with publicity for the event."

Helping Those Who Help Others

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. “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,” said Boegel.

Finally, in late May, the S-Building patio was filled with more than 500 plants destined for new homes. A dedicated team of LLGrows members had established several varieties of tomatoes, sweet peppers, hot peppers, cucumbers, summer squash, kale, Genovese basil, and eggplant for the event. Because May is Asian American, Native Hawaiian, and Pacific Islander Heritage Month, PALS members had planned and cultivated Asian-specific vegetable and herb seedlings including Thai sweet basil, Thai red holy basil, Thai bird’s eye chili peppers, Korean perilla, cilantro, and shishito peppers.

Members of LLGrows offered handouts on plant care and explained to each recipient how to care for their new plant, hoping to cultivate new gardeners in the process. 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. “I’m especially gratified when an employee stops me in the hall to tell me that the tomato or basil 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,” said Boegel.

The culmination of four months of planning, three months of seed growing, and two groups collaborating was a resounding success. “We will definitely join forces with PALS again in 2024 and may also invite other ERGs to participate, sharing favorite veggies, herbs, and recipes from their cultures,” said Boegel. /

Above, Kristi Wakeham cultivates new gardeners while giving away more than 500 seedlings. **Right**, Joan Boegel helps employees identify the different plant varieties available during the seedling giveaway.

Gaining Ground farm welcomes volunteers to help them grow and harvest vegetables for food pantries throughout Eastern Massachusetts. Twice per year, LLGrows organizes a volunteer day for members of the Lincoln Laboratory community.

Gaining Ground Farm

Lincoln Laboratory Grows (LLGrows), a Professional and Community Enhancement (PACE) subcommittee with a gardening interest, organized two volunteer work sessions at Gaining Ground farm in Concord, Massachusetts, in 2023. Community volunteers assist with ground work at this nonprofit organic farm, which grows fruits and vegetables for organizations that assist people experiencing food insecurity. Resulting produce is donated to 17 meal programs and food pantries in the area, like East Boston Community Soup Kitchen and House of Hope in Lowell, Massachusetts. Most of the produce—approximately 120,000 pounds of fresh organic vegetables and fruit per growing season—is distributed within 20 miles of the farm and within 24 hours of harvest. In a year when many Massachusetts farmers experienced significant crop loss, Gaining Ground was fortunate to have the third most productive season in its 29-year history.

This year, Laboratory employees contributed 50 volunteer hours to the farm. They spent a beautiful Saturday in June spreading compost on a field to prepare it for planting. In September, the team harvested eggplant and then dug up the plant remnants, transported them to the compost area by wheelbarrow, and prepared the field for planting a winter cover crop to create healthy soil and a harmonious ecosystem. “I’m passionate about supporting local agriculture. I really enjoyed working alongside Laboratory colleagues while learning from the expert farm manager and field crew about this small organic farm and its nonprofit mission,” said volunteer and LLGrows chair Joan Boegel.

Other Laboratory volunteers included Katherine Barlett, James Streitman, Nina Shamsi, Joy Falls, Debra Hamilton, Cheryl O’Keefe, Stephen O’Keefe, Emily Voytek, Sara Canzano, Yari Golden-Castano, Coralys Colon-Morales, and Jackson Steilberg, plus a few friends and family members. /

The MIT Community Service Fund collects donations from Lincoln Laboratory, ensuring that the entire MIT community enjoys the opportunity to help the Cambridge Police Department give presents to senior citizens in the area.

Secret Santa for Seniors

The MIT Community Service Fund has an 18-year history of partnering with the Police Department in Cambridge, Massachusetts, to donate gifts for senior citizens in public housing who may not have friends or family close by during the holidays. Lincoln Laboratory has been a part of this collection drive for six years, collecting all sorts of small gifts to donate: books, coffee, tea, scarves, gloves, hats, dish towels, robes, blankets, chocolates, jams, and crackers. The Cambridge Police Department gathers the donations in November and December and delivers them to Cambridge senior citizens on December 24. Through this charitable giving effort and many others, the MIT Community Service Fund team has more than 55 years of experience turning the generosity of the greater MIT community into real-world impact that helps neighbors throughout Greater Boston. /

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

American Red Cross
EPIC: Exceptional People in the Community
Avon Walk for Breast Cancer
Walk for Hunger
Pan-Mass Challenge
The Trevor Project
TeamWalk for CancerCare
American Lung Association Autumn Escape Bike Trek
American Heart Association

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.

If you would like to support STEM outreach, visit the Laboratory's external homepage, choose the Outreach section, and then click Community Giving. You can contribute to any of the following funds:

Roger W. Sudbury Memorial Fund
John Welch Memorial Fund
The Barbara P. James Fund
The Lincoln Laboratory Director's Fund
The Carl E. Nielsen Jr. Family Fund

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. Contributions in any form sustain efforts to motivate and prepare students to become the next generation of scientists and engineers.

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