LINCOLN LABORATORY
COMMUNITY OUTREACH

MIT LINCOLN LABORATORY

2021 COMMUNITY INVOLVEMENT REPORT

Lincoln Laboratory outreach continues to be strong in the midst of a pandemic. We eagerly await the time when we can offer in-person events like those pictured above, but until then, we will carry on envisioning improvements in remote teaching and implementing practical ideas to inspire a younger generation of budding scientists.

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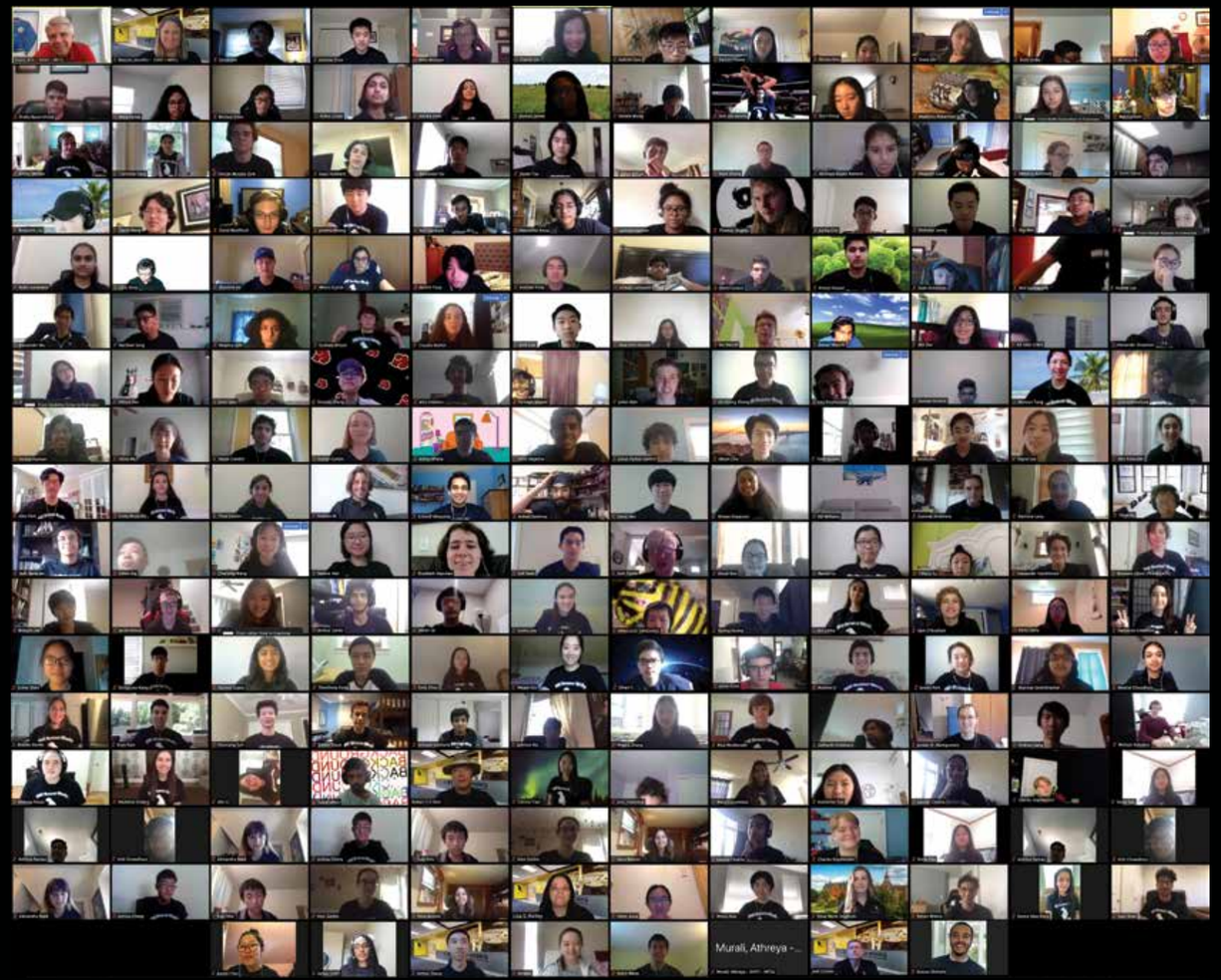


Director Eric Evans, upper left, addresses the BWSI (Beaver Works Summer Institute) students. Evans provided an overview of Lincoln Laboratory and described some of the interesting projects currently underway.

A Message

From the Director

Lincoln Laboratory has built a strong program of educational outreach activities that encourage students to explore science, technology, engineering, and mathematics (STEM). These programs foster an interest in STEM and help young people gain confidence in their ability to tackle technical challenges. We see this outreach as vital to our nation's technological future. Therefore, we continued our STEM outreach programs in the face of a global pandemic, converting in-person workshops to online classes.

Three of our most successful project-based summer programs—the Lincoln Laboratory Radar Introduction for Student Engineers (LLRISE), the Beaver Works Summer Institute (BWSI), and LLCipher—have together reached hundreds of high school students from across the country. The two-week LLRISE workshop has annually immersed up to 35 students in building and operating a small radar system. In 2021, the four-week BWSI program offered a record 350 students the chance to engage in one of 13 courses, ranging from sessions on programming robotic cars or autonomous quadrotors, to workshops on building small satellites. During an intensive week of classes, LLCipher introduced high school students to cryptography for secure computing. During the pandemic, our outreach programs were redesigned as virtual workshops, specifically keeping a hands-on element to promote experiential learning. In 2021, the online programs were improved upon and made more rigorous for more students.

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

Eric D. Evans
Director

01 EDUCATIONAL OUTREACH

Lincoln Laboratory takes pride in promoting science and engineering education for all grade levels in three main areas:

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

Lincoln Coders

The first Lincoln Coders educational outreach program for sixth- and seventh-grade students from middle schools in the nearby Lincoln, Massachusetts, and Hanscom Air Force Base took place in the spring. Thirteen program facilitators from the Laboratory's Recent College Graduates (RCG) employee resource group worked with 17 students on Saturdays for seven weeks to teach them how to code.

Each student chose to work in either Scratch, JavaScript, or Python. With the help of the facilitators, students built their own unique chatbots, fighting games, and chess in Python; meteor-catching games in JavaScript; and animations and interactive games in Scratch.

The program was originally intended to be specifically for girls, so the facilitators partnered with the Girls Who Code organization to develop the curriculum. After speaking with teachers from both middle schools, however, the group decided to open the program up to students of all genders, while keeping a focus on women in STEM.

Several classes included a short presentation about women in technology provided by Girls Who Code. Olivia Brown and Victoria Helus gave a brief presentation on artificial intelligence and machine learning, after which the students worked on their coding projects and then presented the progress they had made at the end of the class. The goal of the program was to teach the students to be brave, resilient, creative, and purposeful through coding.

After eight weeks of hard work, Hanscom and Lincoln Middle School students in our Lincoln Coders Club presented final projects, like this chess-game code. Laboratory staff mentoring students was key to the success of this new program.

"I didn't learn how to code until college, and having this kind of experience would have been so helpful and awesome at that age," said Adam Gjersvik, an RCG co-chair and a Lincoln Coders facilitator. "I loved being able to give students that opportunity, especially given the growing importance of knowing how to code in society today."

Other volunteers from Lincoln Laboratory included Kelsey Yee, Erin Mitchell, Steven Jorgenson, Adam Kern, Zachariah Trotz, Hannah Levin, Chelsea Peragallo, Ian Michaels, Carlyn Dougherty, Frank Schiavone, Bich Vu, and Harry Li. /

A mini seminar on LLCipher, at left, was provided at the request of an LLCipher alumnus. Thirty high school students from across the country, shown above, participated in LLCipher this year and learned course material from Laboratory staff.

Lincoln Laboratory Cipher

For seven years, Lincoln Laboratory has offered students interested in mathematics and cryptography a weeklong summer workshop called Lincoln Laboratory Cipher (LLCipher). In August, the program was held virtually for 30 high school students from across the country eager to learn advanced mathematics. Laboratory staff David Wilson, Nicholas Cunningham, Alice Lee, Parker Diamond, Ariel Hamlin, Noah Luther, Emily Shen, and Katherine Stowell volunteered as primary instructors and assisted students in understanding modern theoretical cryptography.

After learning the basics of cryptography, students learned how to build a secure encryption scheme and digital signature. Typically, the workshop curriculum includes hands-on demonstrations and interactive and small-group activities that reinforce basic lessons of classical and modern cryptography; however, this year, these activities were introduced online. Aspects of abstract algebra, number theory, and complexity theory were included in the curriculum, as well as topics of active research interest in cryptography, such as zero knowledge proofs, key exchange, pseudorandom generators, and multiparty computation.

In September, an LLCipher alumnus wanted to share his enthusiasm for LLCipher with a school he used to attend. He requested a seminar from Hamlin, who happily responded by presenting a cryptography overview webinar for eighth graders at Robert E. Ellis Middle School in Hendersonville, Tennessee. Hamlin covered the topics of multiparty computation and modular mathematics, and provided a concrete example of modern cryptography and its importance. Hamlin repeated this overview for a mini-LLCipher seminar in Tennessee at the request of an LLCipher alumnus. /

Cryptography Workshop

Ariel Hamlin presented a seminar on cryptography in December at Brookview House in Dorchester, Massachusetts. Brookview House caters to homeless women and children and provides services including educational support and youth programs in an effort to confront the root causes of homelessness and poverty. Hamlin explained cryptography to a curious group of children and described a few of the uses of cryptography in everyday life, like time stamping, authenticating a signature, or making a website secure. She explained why cryptography is useful and described what classes students should take to prepare for a career in cryptography. /

Smart Girls Workshop

In March, Laboratory scientists participated in a virtual panel as part of the 2021 Virtual SMART (Science Math And Relevant Technology) Girls Summit. The purpose of the SMART Girls Summit is to inspire middle school girls to envision wider career options for themselves, particularly in STEM fields, in which women are underrepresented. Bethany Huffman, Rebecca Keenan, Amy Chen, Ekaterina Sergan, Katarina Mango, Jessica Tame, and Chiamaka Agbasi-Porter all participated in the Career panel to share insight and information with middle school girls and support the members of Girls Inc., inspire their involvement in STEM, and lead them to post-secondary education and career readiness by exposing them to various careers and professional women in relevant fields. /

Tufts Coding Outreach

The Tufts Coding 101 program, a new Tufts University summer program teaching high school students about coding and careers in computer science, invited Lincoln Laboratory to host a panel as part of their program. Laboratory volunteers Kenneth Alperin, Mallory Nobles, Carmen Stowe, Harry Li, and Benjamin Blease hosted the virtual panel to share their educational experiences and answer questions the students had about careers in computer science and research.

The panel was very well received, and the volunteers realized that an important output of the Laboratory is not just technology but also knowledge. They enjoyed participating in this outreach; imparting knowledge and demonstrating potential paths to captivated high school students. /

At the 17th Annual SMART Girls Summit, girls enjoyed workshops in engineering, biology, astronomy, design, hydraulics, coding, marine science, environmental health, sustainability, and green chemistry. Middle school girls in greater Lynn learned about the full range of STEM career opportunities from female engineers from Lincoln Laboratory and other organizations.

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

G.I.R.L. AI/ML Workshop: Lynn

On December 30 2020, Laboratory staff members hosted a Girls' Innovation Research Lab (G.I.R.L.) workshop in which they partnered with Girls Inc. of Lynn, Massachusetts, to teach middle and high school girls the basics of artificial intelligence (AI) and machine learning.

G.I.R.L. is dedicated to inspiring girls to pursue careers in STEM through hands-on workshops and demonstrations. The workshops are geared toward middle school girls and girls in lower-income school districts, and they cover topics ranging from astronomy and space technology to cyber security and programming.

For this virtual workshop on artificial intelligence, Victoria Helus and Olivia Brown led the planning for the 20 attendees. Laboratory STEM coordinators Chiamaka Agbasi-Porter and DaphneAnn Vessiropoulos presented an overview of Lincoln Laboratory, explained the Laboratory's uses for AI, and gave a short history about women in the AI field.

> "It's exciting to share STEM with students who are less familiar with advanced technologies. We hope that we encouraged students to pursue engineering and science fields."
>
> — CHIAMAKA AGBASI-PORTER, COMMUNITY OUTREACH COORDINATOR AT LINCOLN LABORATORY AND CO-ORGANIZER OF THE WORKSHOP

Riley Martell, Amy Chen, and Bich Vu explained how AI and machine learning differ from standard computer programming, how to tell if a technology is using AI, and how AI algorithms are designed. "One unique aspect of our workshop is that it did not involve any computer programming," said Brown, who helped plan the event and teach the high school group. "By making the workshop completely code free, we allowed the girls to focus on learning the high-level concepts behind AI and discuss some of its benefits and challenges, rather than spending their time trying to get code to run."

The girls used candy to explore an algorithm design technique called a decision tree. Using different candies, the girls were tasked with sorting them by asking progressively more specific questions—such as, is the wrapper brown, does the candy contain chocolate, and does the candy contain nuts? The girls were encouraged to be creative and decide for themselves what features were important in organizing their "data."

Riley Martell described the ethical implications of AI, the problem of encoding biased assumptions into AI algorithms, and the uses of AI to address technical and social problems. "The girls were all so enthusiastic, innovative, and curious about the content of the event, which was really exciting to see," said Martell. "I hope that the girls left the event with a sense of confidence in their ability to be inquisitive and think critically about science and technology." Staff expressed the hope that these events will disrupt the notion that only certain people belong in science and instill confidence in the girls to pursue any field they want to, regardless of stereotypes and imposter syndrome.

Spotlight (continued)

At the virtual G.I.R.L. AI/ML Workshop for Girls Inc. of Lynn, 20 middle and high school girls were introduced to the concepts of artificial intelligence, machine learning, and programming.

G.I.R.L. AI/ML Workshop: Lowell

As proof of the success and popularity of the G.I.R.L. AI/ML Workshop for Girls Inc. of Lynn in December, the same workshop was presented by request to Girls Inc. of Lowell, Massachusetts, in April. Victoria Helus and Olivia Brown led the workshop, while Riley Martell and Yari Golden-Castano assisted with presentations. These volunteers shared their personal stories with the almost 20 girls, detailing what inspired them to follow a technical career path, what their current job entails, and why they love working in the AI/ML field.

G.I.R.L. AI/ML Workshop: Hanscom

A third workshop on AI/ML was held in June for seventh grade students in Hanscom Middle School. The 63 students listened to an explanation of what constitutes AI. They learned about decision trees and then practiced building their own decision trees. An important and timely addition was a discussion about biases in machine learning and the importance of being conscious of bias as engineers.

The lead presenters from Lincoln Laboratory were Victoria Helus and Olivia Brown. The event was organized by Yari Golden-Castano, who was assisted by volunteers Amy Chen, Cassian Corey, Peijun Shao, Adam Kern, Nathan Vaska, and Andrew Schoer.

After the event, organizers from the Hanscom Middle School were grateful for the presentation and indicated that several of the students said it was the best thing they've done all year. The teachers enjoyed it too, and many commented that the piece on bias was not only helpful but valuable. /

ALICE LEE

EMPLOYEE SPOTLIGHT

What ERGs are you a part of? How does belonging to an ERG affect your work life?
I am in the New Employee Network and also the Women's Network. I am currently co-chair of the Pan Asian Laboratory Staff Network (PALS). Getting involved in my community has exposed me to more people whose experiences I can relate to at the Laboratory. I realized that PALS provides a platform for individuals to express themselves and to share relatable experiences. In my experience, diversity- and equity-based programs foster authenticity and a sense of belonging in the workplace.

Why should other people join an ERG?
There is nothing to lose by joining an ERG! They are designed to be inclusive and welcoming spaces for people to share ideas and learn from each other. Give it a try, and if you think it's not for you, then try a different one. ERGs provide a step toward making people feel like they can bring their authentic selves to work, while also making meaningful connections and friendships along the way.

What are your plans for future outreach or diversity efforts?
Leveraging people in power is how groups enact real changes. At the Lab, ERGs can influence workplace culture. PALS is working with HR to see if there are gaps in promotion or retention of our Asian American employee population. Data will help us see these gaps more clearly and bring them to the attention of leaders. We want to implement methods of accountability and transparency for pay and promotions. These are points of action that the Diversity and Inclusion Office can work with ERGs on in the future.

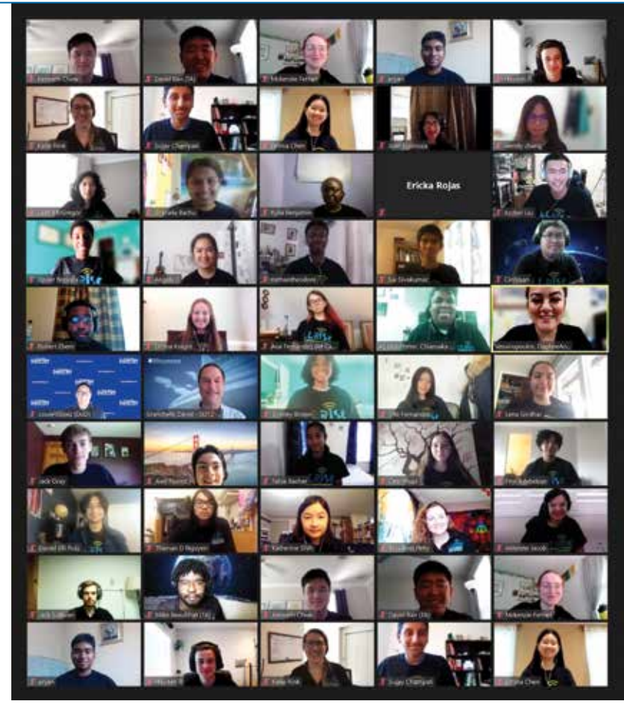
Lincoln Laboratory Radar Introduction for Student Engineers (LLRISE)

The tenth Lincoln Laboratory Radar Introduction for Student Engineers (LLRISE), a two-week program for 31 rising high school seniors, was held in July 2021. The program was offered in a virtual format, just as in 2020, and explained the basics of radar systems and three different radar modes: Doppler radar, pulsed coherent radar, and synthetic aperture radar. Laboratory staff volunteering their time to prepare and host the lectures included Ryan Bohler, David Brigada, Mark Jones, Aryk Ledet, David Maurer, David Scott, George Pantazis, and Andrew Volpe.

The students in the program came from a wide variety of backgrounds that are typically not well represented in STEM fields. These participants included students who will be first-generation college students, who are from low-income neighborhoods, and whose race is underrepresented in STEM. Although there was concern that the students would be more reserved because of the online format, the instructors found that the use of Discord, an online chatting platform, helped the students bond.

Prior to the course, the students were shipped a radar kit that they could use while building their own radar with the help of mentors and teaching assistants available via Zoom. The participants were provided with radar code, but they also learned basic coding in Python so that they could develop their own experiments and simulations using their kits. Many of the experiments involved using their radar to measure the distance from the radar or movement of objects. For example, one group of students measured the movement of a ball as it went down a staircase, and another measured the speed of a dog's tail wagging as different people it knew came home.

At the end of the program, students presented their group projects to Laboratory personnel as well as families, friends, and peers to demonstrate their new knowledge and to showcase their talents. /



LLRISE participants listened as Louie Lopez, Director of DoD STEM (sixth row down on the left) provided an overview of DoD STEM opportunities that students could consider in addition to opportunities at the college level.

TAME student Darian Hardin proudly displays his range radar during a Zoom presentation of his experiment and results with the radar.

> “There is a sense of pride when you see the students wrestle with complex topics, and eventually succeed.”
>
> — DAPHNEANN VESSIROPOULOS, STEM COORDINATOR

LLRISE: Texas Alliance for Minorities in Engineering (TAME)

In March, Lincoln Laboratory Outreach partnered with the Texas Alliance for Minorities in Engineering (TAME) to provide the Radar Introduction for Student Engineers course in a virtual setting to high school students from Texas during the spring break week.

TAME offers age-specific programs to spark and support student interest in the sciences and technological careers, professional development, and curriculum ideas for teachers to educate families about opportunities in STEM.

Lincoln Laboratory engineers taught 27 students from all over Texas the basics of radar. Students then used scientific problem-solving strategies to experiment with a range radar which they could keep. Participants were able to perform their own experiments with Doppler radar and listen to supplemental seminars in between lectures. The course was also offered to Texas educators who may choose to support an extracurricular radar workshop for their schools.

The students completing this shortened one-week workshop were also encouraged to apply for the full two-week radar summer workshop as well as the one-week cryptography program. /

LLRISE: TAME Continues

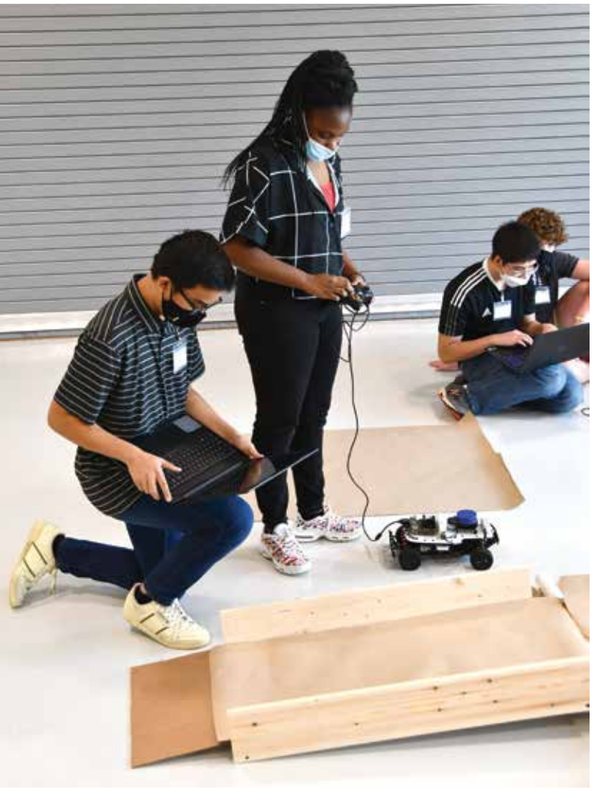
Dee Wallace, a former high school teacher and national Teacher-of-the-Year award recipient turned leader of Synergistic STEM Outreach Center in Houston, Texas, joined students in the LLRISE spring break workshop and conducted experiments with the mini-radar. She then encouraged two students to use what they learned in the LLRISE program to create respective experiments for a virtual science fair sponsored by the National Organization of Black Chemists and Chemical Engineers and the Synergistic STEM Outreach Center. Ahnyce Vasquez’s experiment, “Can It Still See Me?,” pitted a motion detector against the radar built by Vasquez during the LLRISE program. Christina Ko investigated how radar is applied for weather and ocean monitoring. Through her research, she determined that she would like to do more experiments with airplane radars and satellite radars to process weather patterns and monitor ocean movements. Ko won second place in the 6th–12th grade category, while Vasquez won third place in the same category. /

Dee Wallace, also known as “Dr. Dee,” organizes numerous science-related events in Houston. She participated in LLRISE for Teachers in order to understand how best to instruct students in the basics of radar systems and incorporate hands-on engineering tasks.

LLRISE Post-Program Involvement

Strong connections between teachers and students are formed during LLRISE. Often, an LLRISE alumnus reaches out to a particularly helpful LLRISE teacher or mentor to ask for a one-on-one collaboration or mentorship. Xavier Ngwala, now a senior at Charles Herbert Flowers High School in Springdale, Maryland, reached out to his LLRISE mentor Aryk Ledet for assistance in preparing a scientific paper for his class. Ledet helped Ngwala select a topic, collect data from third-party sources, and interpret data. /

Xavier Ngwala, shown here during a virtual LLCipher lecture, understood the importance of having a mentor. Lincoln Laboratory’s Aryk Ledet served as a mentor in LLCipher, and was later asked by Ngwala to assist him with topics for a research paper.



Students in the BWSI course in Huntsville work together to fine-tune the code telling a mini autonomous car how to proceed through a challenge course.

Beaver Works Summer Institute

This year's Beaver Works Summer Institute (BWSI) was held in a virtual format, enabling the program to include more students and more courses. The course offerings were increased from 9 to 13 classes, and a record 351 students were accepted compared to last year's 178 students! This year's class represented 29 states across the country. The classes presented this year were Autonomous RACECAR (Rapid Autonomous Complex Environment Competing Ackermann steeRing), Autonomous Air Vehicle Racing, Autonomous Underwater Vehicle Racing Challenge, Autonomous Cognitive Assistant, Unmanned Air System–Synthetic Aperture Radar, Data Science for Health and Medicine, Build a CubeSat, Embedded Security and Hardware Hacking, Remote Sensing, Serious Game Design and Development with AI, and new classes on Cyber Security for Software Intensive Systems, Quantum Software, and Assistive Technology.

All students received either prebuilt hardware or a kit of parts so that all courses still incorporated a strong hands-on engineering experience. "Bringing the BWSI program online has helped make the course materials available to many more people than we initially imagined," said Joel Grimm, a manager for Beaver Works. "We have increased the number of online prerequisite courses available and created asynchronous courses for learners. It is so much more accessible than we ever thought possible." As evidence, the live webcast of the RACECAR grand prix (the final event in the entire program) in Massachusetts was viewed by a record 8,000 people.

The BWSI program was offered not only in a virtual setting based in Massachusetts but also as an in-person course at two Lincoln Laboratory field sites (Huntsville, Alabama, and Kwajalein Atoll, Marshall Islands). Both in-person courses relied extensively on the online lesson plans. /

Students in the Hunstville BWSI course pose for a group photo on the final day of their summer RACECAR program.

BWSI: RACECAR in Huntsville

This summer, staff at the Laboratory's field site in Huntsville, Alabama, invited high school students from the local community to participate in an MIT BWSI RACECAR program for the first time. This program came about through the efforts of primary instructors Patrick O'Shea, Sarah Crews, and Justin Kizer, with some assistance from Tom Schwab and Kim Shepard of the MITRE Corporation. Huntsville BWSI participants came from local high schools, home school co-ops, and STEM magnet schools, such as the Alabama School of Cyber Technology and Engineering.

Throughout this intensive four-week course, six students worked individually and in teams to program physical and virtual autonomous vehicles. They gained experience programming in Python, working with advanced sensors including lidar and stereoscopic depth cameras, and solving navigation and identification problems. In addition to learning how autonomous technology works, the students visited Aerobotix, a local innovative robotics technology company, and viewed the launch of the Blue Origin Shepard Rocket at the U.S. Space and Rocket Center, a museum in Huntsville.

During the final week of the program, the field site teamed up with MITRE to build a grand prix racetrack at their Huntsville facility to test the students' skills navigating their robotic cars autonomously around a challenging course for the final event. The program culminated with a robotic car race through an obstacle course and a student team presentation. Keith Henderlong, Huntsville Field Site Lead, said "I have no doubt this STEM outreach program inspired and transformed the future for local Huntsville-area students." /

BWSI: RACECAR in Kwajalein Atoll

The BWSI sailed across the ocean in July to the Laboratory's Kwajalein field site in the Marshall Islands. From over a month of intense lessons, the Ebeye and Kwajalein high school students learned how to create programming code, develop algorithms, and use software to teach a miniature car navigation, mapping, and object detection.

Lincoln Laboratory program instructors Sarah Willis, Jon Schoenenberger, Karyn Lundberg, Thomas Sebastian, and Ranny Ranis helped the students understand the material. Willis explained the program outcomes and course technology while Ranny Ranis translated into Marshallese for some of the students.

In a team-based environment, the five teams of students learned to build, program, and drive small remote-controlled vehicles on a pint-sized challenge course. They increased technological know-how and confidence as they refined their computer coding skills to teach their vehicles to respond to specific directives: to move, avoid obstacles, navigate using a visual sensor, detect objects, and travel through different environments.

The grand prix served as the finale of the RACECAR program, with each team maneuvering its mini-car through obstacles and checkpoints on a small racetrack in an event that was well attended by teachers, parents, and children from the community, as well as leadership from the Marshall Islands, U.S. Army Garrison-Kwajalein Atoll, and the Ronald Reagan Ballistic Missile Defense Test Site.

"RACECAR was an ideal program for Kwajalein," said Willis. "It is easily adapted to different grade levels and provided numerous opportunities for students to develop prototyping skills while exploring autonomous machine learning. Plus, it's just generally fun driving mini-cars around."

The BWSI RACECAR 2021 program is the first BWSI outreach initiative to include students from Kwajalein and Ebeye in a live, synchronous learning environment. /

High school students review program code before the Beaver Works Summer Institute grand finale at the Ebeye Jabro Sports Complex. The students showcased their talents for family and friends after completing the multi-week intensive summer program.

> "All of the students grew more confident in their digital literacy skills and acquired practical technical knowledge that will enrich any computer or science-based project they undertake."
>
> — SARAH WILLIS, BWSI KWAJALEIN LEAD INSTRUCTOR

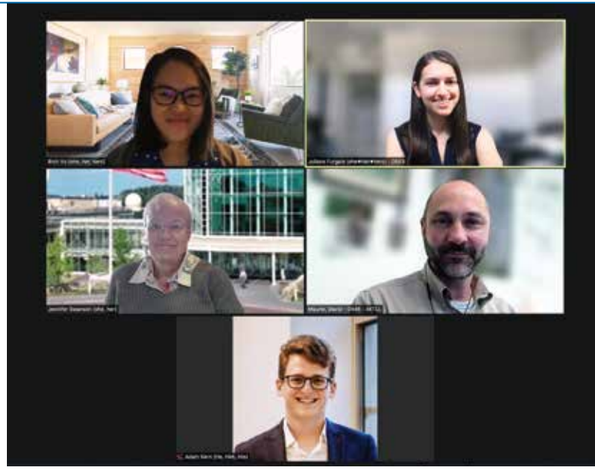
LL EduCATE

LL EduCATE (Lincoln Laboratory Courses for Accessible Technical Education) is a volunteer group that prepares "at the ready" lesson plans and experiments to be used for STEM outreach. Their first lesson is titled "Introduction to Engineering Concepts" and familiarizes students with the fundamentals of engineering through hands-on experimentation. Focused on a high school audience, the lesson also offers a brief overview of the engineering fields and possible career paths.

Hosted on llx and MIT OpenCourseware, LL EduCATE's lessons will be accessible to students located anywhere and everywhere. By providing financial support on request, the aim of this program is to break the educational barriers of STEM funding and limited school budgets. The program is the brainchild of Juliana Furgala, who initially set about recruiting volunteers to gather information from across Lincoln Laboratory and aggregate content for a STEM lesson proposal. Over time, the focus of the group evolved to include the new goal of engaging students in underserved areas.

"At its heart, LL EduCATE seeks to connect," said Furgala. "We aim to empower students, particularly from underserved communities, by creating opportunities for them to apply STEM concepts to their everyday lives. In the process, LL EduCATE volunteers built connections across the Laboratory—ties which give the lessons an interdisciplinary perspective and allow us to showcase the Laboratory's research contributions."

The LL EduCATE volunteers Adam Kern, Amanda Prescott, Bich Vu, Cristina Gath, David Maurer, Jennifer Swanson, and Juliana Furgala collaborated with subject-matter experts from across the Lab to ensure that the lessons reflected the possibilities of STEM and that the experiments were intentionally relatable and accessible to students. Before publishing a lesson plan on multiple platforms for public use, volunteers will present the lesson to local students to test the material and refine the lesson plan.



The core LL EduCATE team (Bich Vu, Juliana Furgala, Jennifer Swanson, David Maurer, and Adam Kern shown here) met regularly to help organize and create lesson plans as well as identify subject-matter experts.

After a year and a half of planning and developing, the first LL EduCATE lesson plan will be tested in January for an Introduction to Engineering Concepts course at Bromley Heath Community Center in Jamaica Plain, Massachusetts. This eight-week course will cover three units, each introduced through a fireside chat with subject-matter experts, followed by the corresponding hands-on experiment based on a Laboratory research project. One experiment is a filtration project inspired by Lincoln Laboratory's study on viral spread in public transportation systems. The course plans to conclude with a virtual tour of Lincoln Laboratory's facilities. David Maurer, who has served for many years as an elected school committee member and served as an instructor for this course, said he thought that the LL EduCATE program will help bridge the gap between Lincoln Laboratory and students in need. Plans are underway to strengthen ties with like-minded people and groups across the Laboratory and to develop future courses that address community interest and need. /

Empower Yourself

An organization in Brockton, Massachusetts, whose mission is to provide year-round interactive and comprehensive educational programs for low- and middle-income students, Empower Yourself helps students develop the skills and experiences necessary to work in advanced economic and STEM fields. /

Become a Scientist. In summer 2021, Bethany Huffman gave a presentation to Empower Yourself students about what it means to be a scientist. She explained what her job entails and why she chose a technical career. Yari Golden-Castano, lead of the Laboratory's G.I.R.L. program, shared a presentation on space and astronomy with the children at Empower Yourself and told them her dream of becoming a settler on Mars and the journey she has gone through to prepare for it, despite many people telling her that she would not make it as an engineer. She also explained the Mars One project and led an open discussion with the students on why humans should explore Mars. The students learned the logistics involved in living on another planet, how rigorous equipment needs to be to survive in space, and the importance of science in our society. /

> "The best takeaway from my talk: 'Don't let anyone tell you that you can't do something.'
>
> — YARI GOLDEN-CASTANO, VOLUNTEER SPEAKER

Rituparna Basu and a gyroscope help a student learn how angular momentum can assist a spacecraft keep its direction as it travels, or keep track of which way is up.

Erin O'Connor explains to a young participant how a meteor impact might affect land when it hits Earth.

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.

The Science of Space. In November, Laboratory engineers led a one-day event for 33 Empower Yourself middle school students about the science of space. Volunteers including Erin O'Connor, Bich Vu, Jalyn Krause, William Gibbs, Peter Elia, Noah Gilbert, Victoria Helus, Rituparna Basu, Thomas Washington, Yari Golden-Castano, and Donato Kava offered interactive activities to help participants understand the concepts of star orientation, spacecraft dynamics, propulsion, inertia, gravity, orbits, and planetary surfaces. Students also learned how to construct a circuit by assembling their own lightsaber with popsicle sticks, copper tape, an LED bulb, and a battery. The primary goal of the workshop was to convey what topics and skillsets are needed to work in the space industry while getting children excited about seeing themselves in an aerospace-related career. To achieve this goal, staff hosted a career panel to provide answers to burning questions about working in the aerospace industry and pursuing a technical career. /

Laboratory engineers showed students how fun science can be during the Empower Yourself event about space science.

Capstone Mentoring at Greater Lawrence Technical School

Nineteen Lincoln Laboratory scientists and engineers worked with the Greater Lawrence Technical School (GLTS) to mentor student engineers for their junior and senior capstone projects. Volunteers virtually met with their mentees weekly, guiding and encouraging technical thinking. The capstone projects, offered each semester, took place over seven months. Past projects span a wide area of topics, such as using nanotechnology within environmental conservation and protection, writing science fiction novels involving genetically modified plants, investigating effects of mental health medication on the brain, and researching a variety of renewable energy solutions. This year, 11th grade students focused on health inequities worldwide and built prototypes that would solve this problem. Twelfth grade students worked on clean energy solutions for the future. In addition to working on capstone project work, mentorship includes discussions about resumes, college options, and technical career paths. /

Ocean Engineering

Every year, Andrew Mack partners with Kwajalein High School teachers to focus on marine biology, ocean ecology, and engineering activities that have students performing a variety of experiments with equipment they build in the classroom. Example projects include using a motion-sensing underwater camera to detect marine life; track coral growth; monitor ocean water for alkalinity, temperature, and salinity; and measure tides and waves.

This year, the students chose from the following projects: buoy satellite communication terminal, ocean water monitoring (alkalinity, temperature, salinity, etc.), wave measurement and tidal monitoring (buoy motion), or coral monitoring (imaging, water quality, etc.) and began building the necessary equipment for their experiments. Next spring, students will be able to field test their hardware in the ocean. /

Massachusetts State Science and Engineering Fair

Lincoln Laboratory has supported the Massachusetts State Science and Engineering Fair (MSSEF) by serving as a bronze donor to the event and awarding scholarships from the John Welch Memorial Fund to the second-place winners in the physics and engineering competitions. This fund, among others, is part of the MIT Lincoln Laboratory Giving Program.

Since 2000, Laboratory technical staff have been volunteering as judges for the MSSEF, usually held on the MIT campus in the Johnson Athletic Center. This year, judging at MSSEF was virtual, consisting of Zoom calls with exhibitors providing judges a venue by which to speak one on one with the young scientists and ask questions about their research.

Laboratory staff, including Kelly Beattie, Matthew Guyton, Kenneth Kolodziej, and Jean Eugene Piou, volunteered as judges in this 21st year of assisting in this statewide event. Beattie, who has routinely volunteered as a judge for this science fair, said she likes to see the enthusiasm of the young scientists. “It is inspiring to see how smart these young people are and how passionate they are about science,” said Beattie. “I highly recommend others take advantage of this chance to volunteer. For me, it was a great reminder why I got into science myself!” Every year, she is impressed with the quality of the projects and well-thought-out presentations. /

Gregory Spitz, supervisor of the Socorro field site, shown here supervising students during a hands-on engineering experiment, often serves as a “resident science expert” at Cottonwood Valley Charter School, and helped Cottonwood students to place third in a New Mexico Science Olympiad in 2019.

Cottonwood Valley Charter School

Science Fair. For the past six years, Gregory Spitz, who works at the Lincoln Laboratory field site in Socorro, New Mexico, has mentored middle school students at Cottonwood Valley Charter School to help them prepare for a regional science fair and a statewide science competition called the Science Olympiad, which is made up of build, study, and laboratory events.

Spitz assists 15–25 sixth through eighth graders with the build portion of the competition (which includes challenges such as making a bridge or tower, a mousetrap vehicle, a ping pong parachute or bottle rocket, a Rube Goldberg machine, and an air trajectory), as well as with any physics-related study or lab event. He then mentors the students over the fall and early winter as they develop their experiments and helps them learn about the scientific process, think critically to solve a problem, and understand and meet project design parameters. The final competition at the state level, the Science Olympiad, takes place in January. In the years that Spitz has mentored at this school, the students of Cottonwood Valley Charter School have placed among the top five teams in the state, and as high as second. This year, the students hope to win first place, which will qualify them to compete at the national level. Spitz enjoys serving as assistant coach for the Science Olympiad team. He said, “Helping kids learn the scientific process in a fun environment and seeing the students’ ideas and plans manifest into a completed project is a great experience.”

Sound of Music. Spitz also visited the school to help with a special “Sound of Music” event in which he explained the physics behind sound and helped students measure the frequency of sound waves. The event culminates with each student building a musical instrument that can play a whole musical scale. /

Ronald Reagan Ballistic Missile Defense Test Site headquarters hosted two RMI Lincoln Laboratory intern presentations in August. Back row: U.S. Army Garrison–Kwajalein Atoll Commander Col. Thomas Pugsley. From left: Thomas Sebastian, technical program advisor; Alesska Jacklick, program intern; Ranny Ranis, intern program instructor; Hideo Michael, program intern; Justin Stambaugh, site manager; Hilary Hosia, RMI liaison staff officer; Lt. Col. David Taylor, Reagan Test Site range director.

RMI Information Technology Internship

Due to COVID-19 restrictions in the Republic of Marshall Islands (RMI), Lincoln Laboratory's annual internship opportunity in 2020 was postponed. Fortunately, the Kwajalein field site was able to bring the program back for 2021.

This year's students, Alesska Jacklick and Hideo Michael, began their 10-week internship in June. The interns were taught by Ranny Ranis, who helped the candidates learn about information technology (IT) and networks. Ranis is one of the three staff members who developed this program, and as a Kwajalein native, he is a critical part of the success of this internship program.

After completing the crash course, the students started a project to install a backup server for Ebeye's Leroij Kitlang Memorial Health Center. In this work, they were mentored by Thomas Sebastian and John O'Rourke. The program included observations and field trips to departments around the garrison and focused on exercises in troubleshooting, as well as studying and building computers and networks that run on different operating systems. Upon program completion, the students were given an educational scholarship to pursue higher education in the field of information technology and volunteer to help the community with computer- and network-based issues. /

Pioneer Charter School Science Speaker Series

The Pioneer Charter Schools of Science in Everett and Saugus, Massachusetts, host a speaker series annually during Massachusetts STEM week, the third week of October. The theme for this year's speaker series was "See Yourself in STEM." Hour-long seminars with STEM professionals provided students the opportunity to engage with real scientists, engineers, and mathematicians from Boston University, Harvard Stem Cell Institute, Tufts University, Massachusetts Eye and Ear, and Lincoln Laboratory to learn what it is like to work in technical fields. Seven volunteers from Lincoln Laboratory each spoke with approximately 60 students about data science applications in COVID-19 prediction, aircraft collision avoidance, and machine learning. Volunteers included Hannah Wright, Rituparna Basu, Charlotte Shabarekh, Chelsea Lennartz, Randal Guendel, Victoria Helus, and Richard Kingsborough. The primary demographic for Pioneer Charter Schools is first-generation Americans who will progress to be first-generation college students.

Victoria Helus said of her experience as a science speaker, "I had a wonderful time volunteering as a speaker for PCSS. I'm strongly invested in STEM outreach and believe it is very important to encourage all students, especially underrepresented groups, to envision a future career in a STEM field. I also want to empower everybody to feel confident in pursuing STEM subjects especially as technology is increasingly integrated in our daily lives. PCSS administration not only gave me an avenue to do this, but their students were also engaged and enthusiastic during the discussions we had. I have continued contact with PCSS and hope to have other opportunities to volunteer and get as many kids exposed to STEM as possible." /

Hannah Wright, shown at the front of the gymnasium during her presentation, served as a science speaker to ninth and tenth grade students at Pioneer Charter School. Wright's talk was entitled, "Systematic Data Analysis and the Nonlinearity of a Successful Career."

> "Being an in-person speaker allowed me to share my experiences as a chemist while showing showing students areas of chemistry that they may not have known existed before. They were engaging and inquisitive, which made the experience all the more worthwhile."
>
> — RICHARD KINGSBOROUGH, SCIENCE SPEAKER

Spotlight:

Students Program for Success at STEM Lab

Elementary school-aged students are studying STEM in a new lab and makerspace at George Seitz Elementary School with the help of some big teamwork and little robots. This lab was the brainchild of math and science teacher, Misti French. French is excited to involve the island's technical experts in future activities.

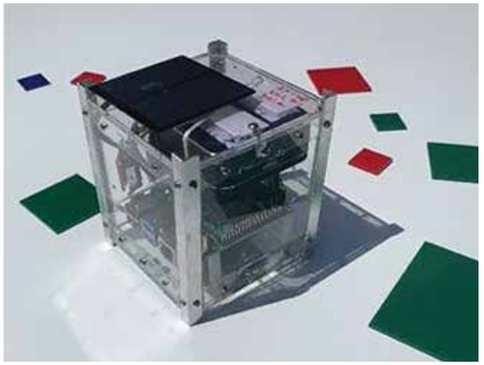
One volunteer, Lincoln Laboratory Scientific Advisor Karyn Lundberg, teamed up with French to challenge critical thinkers with a new activity: she started a robotics club. Currently, the students are building and training programmable robots to perform tasks. The materials were sourced by Lundberg and provided by the FIRST LEGO League program, an international STEM-based learning initiative. "I wanted to have a club where STEM-minded kids could challenge each other, as well as offer robotics exposure to the broader student community," Lundberg said.

During a September club meeting, student teams "dug right in," Lundberg said, and reviewed video instructions for programming their small robots to complete "Cargo Connect" challenges. They fastened sensors onto the small chassis to help the bots discern directives from audio and visual stimuli via a Bluetooth connection. "They're working toward completing any number of 16 missions with the theme of modernization of cargo transport," said Lundberg. "Their first goal is to learn to drive their robots to a central location on a large city map. Other challenges require different levels of dexterity. Tasks include teaching small robot vehicles to connect to other vehicles to build with blocks and to deliver packages."

To relate their robot tasks to the real world, students will take a tour of operations and logistics sites like Bucholz Army Airfield and Echo Pier. They plan to see how to coordinate offloading a payload, follow a route between checkpoints, and watch vehicles and work crews engaged in operations much like what they've programmed their robots to accomplish.

"We're going to seize on that energy in the community," said French. "Look at where we live. [It's] science island! Our parents are mathematicians and scientists. We will have the full advantage of the expertise and enthusiasm of our community and its members." /

Students check out robot antics after successfully programming the small device to move during a recent session of the George Seitz Elementary School STEM Club.



This operational CubeSat, built by a participant in the Build a CubeSat Challenge, can detect plastic ocean waste. It was built from a hardware kit of parts that was sent to each team of five students.

Build a CubeSat Challenge

Lincoln Laboratory's and MIT School of Engineering's Beaver Works partnered with the American Institute of Aeronautics and Astronautics (AIAA) and the Patrick J. McGovern Foundation to provide a challenge for high school students interested in building a prototype satellite. Beginning in November, student teams met their Laboratory and MIT mentors to learn how to approach developing satellite subsystems that can power and support an optical payload while analyzing data and wirelessly transmitting the results to a ground station. The mission of this challenge was to build a CubeSat that can detect colored plastic in the ocean from space. The students worked throughout the end of the year, and the challenge will culminate in a final competition in February 2022.

In addition to access to the online course and mentoring support, each student team received a hardware kit that includes a Raspberry Pi flight computer with Bluetooth for wireless communication, a Raspberry Pi camera (payload for imaging mission), a battery, a solar panel, an acrylic and aluminum structure, white poster board and colored acrylic pieces to image, and tools used for building and testing. /

MIT aerospace engineer Kerri Cahoy designs mini satellites for weather monitoring and space exploration. She also shares her love of CubeSats with high school students in order to generate interest in the field.

> "It's fun to remind students how awesome they are, to encourage them in being creative and taking risks, and seeing what they come up with. But really, it's a mutual discovery. That's the best part of the job."
>
> — KERRI CAHOY, BUILD A CUBESAT CHALLENGE INSTRUCTOR

Two sophomores from Blackstone Valley Regional Vocational Technical High School participated in a Yes! You Can! course to learn more about robotics, engineering, and programming.

Yes! You Can!

Beaver Works offered spring two-week courses for ninth and tenth grade students in a variety of subjects, encouraging beginners to build, make, and learn. Yes! You Can! courses offered participants their choice to

Program Autonomous Cars

Hack and Code

Build a Synthetic Aperture Radar

Create Assistive Technology

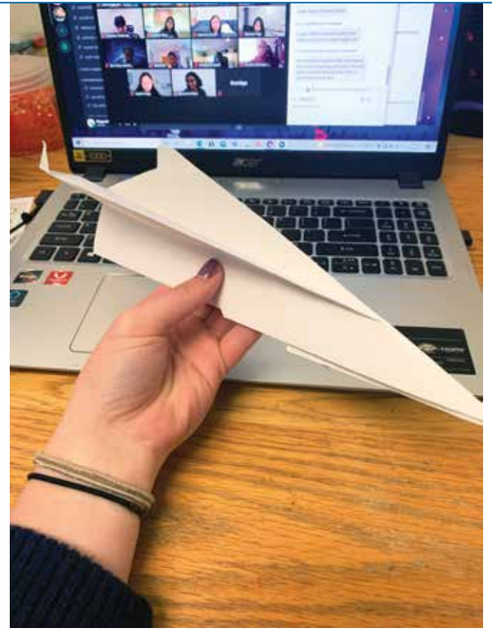
Design, Build, and Fly Model Aircraft

Create Accessible Resources for Education

Interested in learning more about coding, Sidney Laden from Blackstone Valley Regional Vocational Technical High School in Upton, Massachusetts, chose to enroll in Yes! You Can Hack and Code! "I was interested in every single course being offered. I decided on the Yes! You Can Hack and Code!–Embedded Security crash course as it mirrors my future career interests," said Laden. "I've now worked with Python, GitHub, and Security. It has been a great experience."

Kate Watchmaker chose to enroll in Yes! You Can Create Accessible Resources for Education! "Some of my closest childhood friends had physical limitations, which inspired my interest in assistive technology," said Watchmaker. "I want to help children with disabilities to build on their abilities with adaptive tools and technology. In this course, I have an opportunity to use computer-aided design to create a unique 3D-printed puzzle box that can help teach concepts to children who are blind, have learning disabilities, or enjoy learning with physical objects."

The students' experience in their respective Yes! You Can! courses encouraged them to apply for and be accepted to the four-week Beaver Works Summer Institute (BWSI) program. Laden enrolled in the Embedded Security and Hardware Hacking course, while Watchmaker enrolled in the Designing for Assistive Technologies course. Both girls gained an understanding of what it means to be an engineer. /



Eleventh grade girls test different engineering concepts to determine how to best design a paper airplane for increased flight distance.

Girls Who Can

In the fall, Laboratory volunteers collaborated with the MITRE Corporation and Harvey Mudd College to offer three virtual workshops to encourage high school girls to try engineering. On Saturdays from October through December, 66 11th grade girls participated in their choice of

Girls Who Program Autonomous Cars

Girls Who Hack Code

Girls Who Design, Build and Fly Model Aircraft

Girls Who Want to Learn Many Interesting Things

Girls Who Program Cognitive Assistants

These workshops were offered by the Beaver Works Summer Institute to provide crash courses just for girls. Lead instructors included Rebecca Arenson from Lincoln Laboratory, Gabriel Pascualy from MITRE, and Alina Saratova from Harvey Mudd College. Plans are underway to offer these courses next spring to underrepresented students from Boston and Cambridge, Massachusetts. /

Participants in the Girls Who Program Autonomous Cars course learned how to create code that tells a mini autonomous vehicle how to maneuver around an obstacle course.

Spotlight:
Students Learn They Can Build a CubeSat

Dozens of high school students learned how to build a micro:bit CubeSat made of cardboard during a course offered through Beaver Works in the spring. The eight-week CubeSat Crash Course developed by Rebecca Keenan was designed to introduce ninth and tenth grade students to Python programming. "I appreciate being able to offer a program that provides hands-on experience with hardware and allows students to work in an engineering environment," said Keenan.

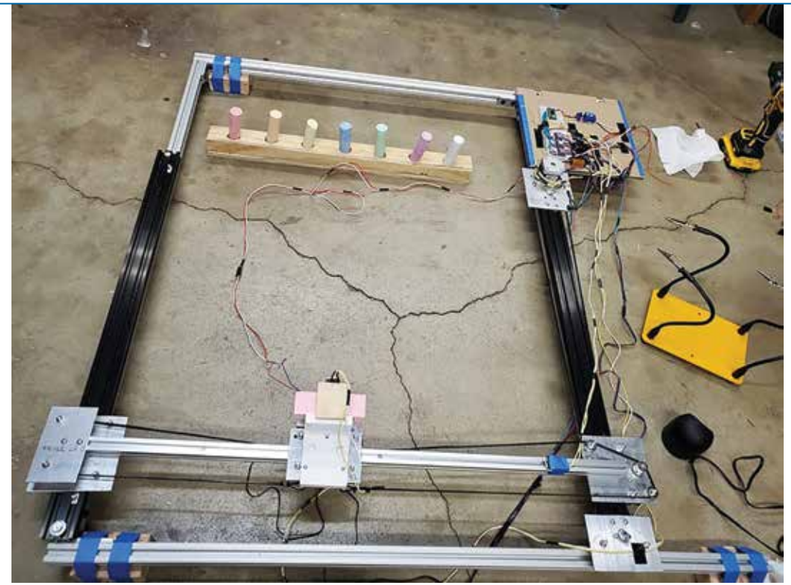
The course was taught by Andrew Dahir and Alan Smith with help from two teaching assistants. It closely mimicked the debut course from last year, when the course was taught by Keenan, who was supported by Paul Fucile from Woods Hole Oceanographic Institution.

Since the course was offered remotely, each of the students was sent a 4-inch cardboard cube with micro:bits, LED button lamps, batteries, rubber bands, and zip ties inside. The students learned how to assemble their own CubeSat devices and how to work with basic electronics and core subsystems of a satellite. The students used the light sensor to detect LEDs. They then reported the location of the LEDs by using the built-in magnetometer and wirelessly transmitted the data to their ground station micro:bit.

"In the midst of the pandemic, it was transformative to connect with girls from all over the country and learn about CubeSats," said one of the students. "It was humbling to see how such a small object can be so powerful in collecting data from space."

"Part of the Laboratory's (and Beaver Works') culture is making a difference, and there aren't many better ways to make a difference than teaching, particularly through MIT's project-based approach to students," said Lisa Kelly. "It's great to see these students become excited about topics that they can't learn about in their schools, and then see them develop the skills and confidence to develop solutions." /

Students display the cardboard CubeSat structures they built individually to house their micro:bit and battery pack.



With the help of Laboratory technical staff Benjamin Nahill, a team of students from the California Institute of Technology developed a machine that can write positive messages in chalk on the sidewalk to lift people's spirits.

MakeMIT Hackathon

MakeMIT is a two-week-long hardware hackathon for undergraduates from across the nation. Student teams design and make something of their own choosing. This annual event, held virtually this year, pairs well-established engineers with each team to help guide the students in the finer points of their design and implementation. Benjamin Nahill volunteered as a mentor, held virtual office hours, and answered questions on Slack. Nahill mentored a two-person team from the California Institute of Technology that designed a robot to write positive and inspirational messages in chalk on a community's sidewalk. Nahill, who discussed ideas and feasibility with several of the other teams as well, said, "Helping with hackathons is super fun and rewarding, but mentoring undergraduates in MakeMIT was like a refresher course on why I became an engineer... I wanted to build really cool machines!"

Other inventions at MakeMIT 2021 included a smart coilgun, a smart watch for freedivers, a curtain with an interactive light display, a mask manager to sense if you are wearing your mask when you step out of your room, and gloves that can interface with industrial warning systems to keep workers safe. /

Maine Indian Education

Beaver Works, operated in a partnership between Lincoln Laboratory and MIT, began a collaboration with Maine Indian Education following an inquiry to MIT for help. School administrators at Indian Township School, Sipayik Elementary School, and Indian Island School made large strides to acquire laptops and suitable internet service at these under-resourced schools to begin online outreach programs. Once the schools were equipped to access web-based tutorials, the program began in earnest. Approximately 62 seventh and eighth grade students learned about the electronics in the devices they use every day, and received basic instruction about electronics and programming to understand how an LED light can turn on and off at varying speeds. The hands-on portion of the workshop was led by Christian Cardozo, an MIT lecturer and software developer.

Cardozo has taught a freshman seminar course at MIT entitled Many Interesting Things. His course simplifies complex topics like computer science, engineering, and machine learning in a way that engages students and helps them embrace the science of fields that are often perceived as "too difficult." He used the same approach in this half-day workshop to introduce programming and electronics through the use of Arduino kits. Once Cardozo explained how to set up the kits, he let the students determine their interest and decide what they'd prefer to build. The students created their own projects according to their particular interests. The workshop also included virtual tours and demonstrations by the MIT Edgerton Center and MIT Technology Enabled Active Learning classrooms. /

At left, students worked with kits of parts to learn about circuitry, electronics, and programming. Christian Cardozo, above, taught seventh and eighth graders in Maine about coding with Arduino.

Local scouts build and launch rockets with guidance from Lincoln Laboratory mentors.

Scouting

A Cadette Girl Scout troop set out to earn the Space Science Researcher STEM badge during the spring with the help of Edward Lyvers. The badge challenges middle school scouts to perform experiments to deepen their understanding of the Sun, stars, and other objects in space. The troop decided to build and launch their own model rocket as one of the experiments. During this effort, Lyvers helped the scouts learn about the concepts of gravity, trajectory, and thrust and the principles of flight, aerodynamics, and Newton's Third Law of Motion.

Lyvers said that this was a confidence-building project and that students rarely get to build something like a model rocket in school. "They feel a big sense of accomplishment when the model rocket is built and successfully launched. They are able to use different rocket engines and see each one's effect on rocket apogee. This is very rewarding for both the students and the mentor." /

Carter Purple stands by a marker that he created to commemorate the history of the MIT Haystack Observatory and Millstone Hill Radar site.

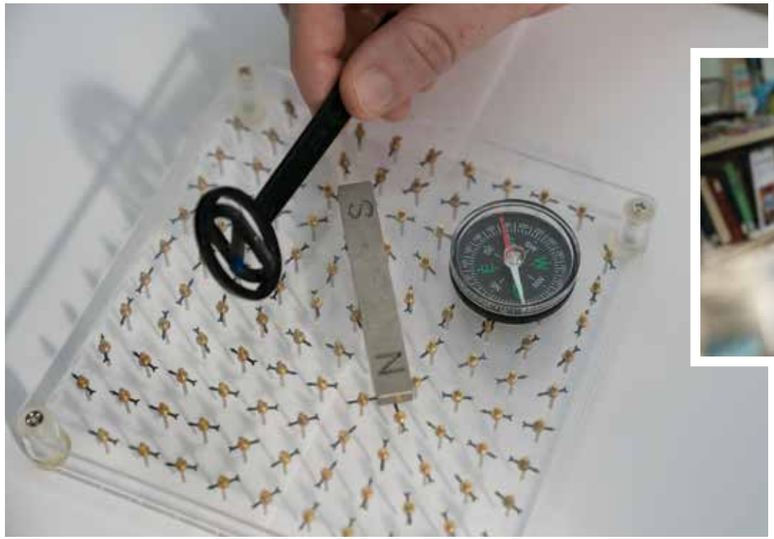
Scout Creates Historic Marker

In April, Carter Purple, a local Scout, installed a historic marker at the MIT Haystack Observatory and Millstone Hill Radar site to commemorate the construction of the facilities. The sign is a part of the Scout's Eagle Scout service project. Similar signs that include historic information and photos were also created for other historic points in the town of Westford, Massachusetts.

"I chose the Millstone site because I was trying to pick a site that was both interesting to me and relatively unknown to many people in Westford," said Carter Purple, the Scout behind the project. "Even though there's a bunch of stuff going on at the site, there are so many people in town who don't even know that all of this incredible research and science is going on right here in our backyard."

Jonathan Pitts, Jeff Dominick, and Nancy Kotary helped Purple create and install the sign. Pitts is also an advisor for Purple's Eagle Scout service project. "Carter is a great kid and has spent many months working hard on this," said Pitts. "It's a pretty neat project, and one that will help preserve the history of the site and make it easily accessible to MIT employees and the public."

Purple built the signposts, created the signs, and produced and directed the videos that the QR codes direct to, all as a part of his Eagle Scout service project. "I'm doing this project because I wanted to expose Westford citizens to the great history of our town," said Purple. /



The Space Weather Science on Saturday presentation by J. Brent Parham showed children how solar wind variations and geomagnetic storms can penetrate Earth's atmosphere and disrupt its magnetic field, temporarily threatening spacecraft, navigation systems, and power grids.

Science on Saturday

Lincoln Laboratory's Science on Saturday series resumed in a virtual format. The topics of interest reached from outer space to Earth's own airspace and back to outer space. The April event, Destination: Space Exploration, presented by Ariel Sandberg, investigated the ambitious missions launched in 2020 and 2021, including Perseverance and OSIRIS-Rex. Participants were treated to a behind-the-scenes look at the payloads created at Lincoln Laboratory, as well as a discussion of how the Laboratory builds items to withstand the space environment.

The Aviation Today Science on Saturday show in June was divided into two parts. In part one, Caroline Lamb explained which technologies used by NOAA, NASA, and the Air Force can trace their heritage to Lincoln Laboratory and MIT. She added descriptions of how Laboratory engineers modify aircraft to enable research. In part two, Mark Mazumder discussed the variety of ways the Autonomous Systems Development Facility at Lincoln Laboratory is used.

In the October event about Space Weather, J. Brent Parham talked about how plasma and radiation emissions from the Sun can hamper satellites, communications, and electrical grids. He further described how and why NOAA tracks the weather in space. Participants were intrigued to see evidence of the Sun's coronal eruptions and hear how drastically space weather can affect systems on earth. /

Kwajalein Astronomy Nights

Sarah Willis created and has helmed a community astronomy program for three years to share her love of astronomy and astrophotography. This Kwajalein community enrichment activity consists of guest speakers and celestial viewing through a Celestron CGX 1100 telescope. Special community viewing events included the great conjunction of Jupiter and Saturn in December 2020 and a total lunar eclipse in May 2021. The great conjunction event included a special public lecture on Emon Beach about how stars and solar systems form and evolve. More than 200 Kwajalein residents attended the public lecture to learn about and view the great conjunction.

Astronomy Nights are open to the entire Kwajalein community and are paired with "Ask an Astronomer" sessions for middle and high school students. Willis also offers an astronomy data collection project for interested students as they research variable stars.

Willis also hosted a quasi-open-air planetarium show under the main pavilion at Emon Beach on Kwajalein, attended by more than 75 island residents. The event was held on November 19 because of the nearly-total lunar eclipse.

Willis's presentation, Our Kwajalein Skies, described sights visible throughout the year on the atoll and included familiar sights visible from the northern hemisphere, such as Orion and the North Star, Polaris. She explained how cultural traditions impact the stories we tell about the objects we see in the sky. As an example, she pointed out that many cultures around the world refer to the Pleiades star cluster with names like "the seven sisters," but in the Marshall Islands, the traditional story is about a woman with 12 sons and the origin of the sail. The Pleaides represents just one of the 12 sons, while other constellations represent the remaining 11 sons. Willis described how some cultures' astronomy legends included not only stars but also the dark parts of the sky. A prominent dark cloud, called the Coal Sack Nebula in western traditions, is visible from equatorial regions and south and was seen as an eel by some indigenous Marshallese traditions.

The Astronomy Nights program also encouraged community participation in a citizens' science project to use tools developed by the Globe at Night initiative to measure the level of light pollution from November 25 through December 4. The unique spin in Kwajalein was to collect data at a microscopic scale across the island to record the impact of bright community lights and find a few dark spots that still provide great stargazing. This event was co-hosted by the on-island organization the Yokwe Yuk Welcome Club that champions educational initiatives through Micronesia.

Plans are underway to expand the astronomy outreach program to include a space-themed STEM event for island residents. Willis proposes to set up a scale model of the solar system for the Kwajalein community accompanied by activities and information for each planet. She plans to supplement the land-based activities with the world's first underwater scale model of the solar system, allowing snorkelers and divers to swim through a solar system tour as if they were a spaceship. /

Sarah Willis presented a talk about the night skies on Kwajalein at a community event for more than 75 people. Photos taken during the November Astronomy Nights event captured the moon during a nearly total lunar eclipse.

Spotlight:
Kiddo Byte Brings Coding to Underserved Kids

In 2020, high school junior Robbie Khazan, son of Laboratory staff member Roger Khazan, decided to make a difference. His idea was to bring computer science learning opportunities to underprivileged kids in the Greater Boston community. It started with a phone call and a single class taught at Brookview House—a nonprofit organization located in Dorchester, Massachusetts, that helps women and children experiencing homelessness—and has since expanded to 13 classes that have reached more than 130 students.

Khazan's program, called Kiddo Byte, has a goal that is twofold: "On the surface, we're here to teach computer programming, but on a more underlying level, we're trying to get kids excited about computer science so they will explore it on their own," Khazan said.

By teaching computer science to kids who might not otherwise have the opportunity and getting them excited about the possibilities, Khazan hopes to inspire them to explore future opportunities. Programmers are in high demand, and there are many jobs with good salaries hiring right out of college or other programs.

Currently, Kiddo Byte is teaching an introductory course on Scratch coding to elementary students and introductory courses on Python, Java, and 3D modeling to middle and high school students. Another aspect of the program is to donate computers for the kids to use while learning and afterwards. This aspect of the program is where Lincoln Laboratory got involved, so far funding nine laptop donations to students at Brookview House.

The Laboratory donated nine laptops to students at Brookview House to encourage their interest in computer science and STEM.

Spotlight (continued)

"Because students in transitional housing might not have computer access outside of class, a big part of the reason why we wanted to donate is to promote kids' exploration beyond the course," Khazan said. "That's a really big portion of where our funding goes."

Right now, Kiddo Byte is operated and taught entirely by high school students. It started with volunteers from Khazan's own school in Arlington and has expanded to include other high schoolers and recent graduates from across the country. Khazan hopes to keep expanding and also bring in professionals to talk about career paths and teach some of the classes. Lincoln Laboratory will encourage staff to volunteer as teachers and mentors while continuing to support computer donations.

"Part of MIT Lincoln Laboratory's goal is to introduce today's youth to national security technical challenges and inspire them through interaction with Laboratory staff who are working on those challenges," said Chiamaka Agbasi-Porter, who is a community outreach coordinator for the Laboratory. "We are committed to K–12 STEM education as an investment to develop the interest and talent needed for the future. So, partnering with Kiddo Byte makes sense as they have tapped into a group of students that Lincoln Laboratory has not pursued."

Robbie Khazan, son of staff member Roger Khazan, delivered laptops to Brookview House children, enabling them to learn about computer science with the help of Kiddo Bytes.

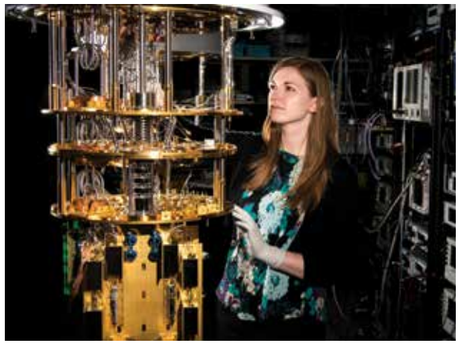
In February 2021, Kiddo Byte was officially registered as a nonprofit organization. In June, the program was featured in a segment on WCVB Channel 5 Boston. The program is thriving, and Khazan has no intention to slow down.

"Since the beginning, I never saw this as a side project," he said. "I want to use it to make a difference. Our goal is to make sure that computer science is accessible for all." /

Cambridge Science Festival: Meet an Engineer!

The Cambridge Science Festival is a month-long citywide event in Cambridge, Massachusetts, that offers hundreds of science-based demonstrations and activities to the Greater Boston area. With adjustments made to ensure safety from the coronavirus, this multifaceted event made science accessible virtually, inspiring participants to learn something new every day of the festival's 30 Days of Science challenge. Live events featured the science of illusion, space adventures, vernal pools, dopamine 3D design, genome editing, bridge design, paper chromatography, looking at strawberry DNA, and a virtual tour of how vaccines are made. Several Lincoln Laboratory engineers volunteered to present their work in the Cambridge Science Festival's "Meet an Engineer" series.

James Kurdzo, a radar meteorologist, presented his work studying tornadoes. He discussed how radar is used for tornado warnings and how we may be able to leverage technology to make warnings more accurate and timely. /



Bethany Huffman shared how a new kind of computer would take advantage of quantum physics in the way it does calculations. She explained her work using nanofabrication to make quantum computers into physical hardware.

J. Brent Parham discussed space weather: the plasma and radiation spewed out by the Sun that splatters against the Earth's magnetic field (mostly). He further explained how plasma can sometimes leak through the magnetic field and cause problems with satellites, communications, and electrical grids.

Catherine Cabrera led a presentation called "Engineer the Microbiome!" in which she explained how scientists are finding out more and more ways that microbiomes impact our health and our bodies, for example, the apparent link between the brain and the bacteria in the gut.

Thomas Sebastian joined the Cambridge Science Festival from the shores of Kwajalein Atoll in the Marshall Islands, where he observes satellites orbiting Earth and monitors the impacts of climate change on vulnerable reefs. Sebastian led a Zoom webinar from the Pacific to share how Lincoln Laboratory's prototyping-centered approach can be applied to vastly different domains.

James Kurdzo, a radar meteorologist, presented his work studying tornadoes. He discussed how radar is used for tornado warnings and how we may be able to leverage technology to make warnings more accurate and timely.

The Meet an Engineer series was hosted by MIT graduate student Fatima Husain during the Cambridge Science Festival's 30 Days of Science. Here, she is surprised to learn the dramatic ways that space weather can affect some systems on Earth.

02 EDUCATIONAL COLLABORATIONS

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

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

Summer Research Program

In summer 2021, 133 undergraduate and graduate students participated in Lincoln Laboratory's Summer Research Program, which offers students internships in technical groups. Because of the COVID-19 pandemic, 85% of the interns worked remotely in accordance with public health recommendations. Typically, students contribute to projects that complement their courses of study and have opportunities to interface with national experts in numerous fields of research, work with the Laboratory's state-of-the-art resources on real-world technical problems, and present the results of their research conclusions at the end of the summer.

During her internship at the Laboratory, Shannon Pinnell tested low-size, -weight, -power, and -cost Global Navigation Satellite System real-time kinematic positioning receivers with an innovative test bed which she named the "DataHelmet."

"One of my favorite experiences this summer was being able to see the [Lincoln Laboratory] 70th Anniversary Technology Expo. It was a window into so many different parts of the Lab and included some fascinating pieces of history," Pinnell said. /

Interns in the 2021 Summer Research Program gathered via Zoom for a group photo.

> "One of my highlights from this summer internship was touring the Hanscom Air Force base. I had never been inside a hangar before, and it was amazing to see the airborne test beds in person that the test engineers in the Lab operate!"
>
> — SAM POLK, SUMMER RESEARCH PROGRAM INTERN

Miles Smith was one of 22 interns who joined the Laboratory through the 2021 GEM fellowship program.

University Cooperative Education Program

Technical groups at Lincoln Laboratory employ students from area colleges and universities, such as Northeastern University and Wentworth Institute, under cooperative education agreements. The students work full time with mentors during the summer or work/study semesters and part time during academic terms. Around 66 co-op students from area schools are employed in technical divisions and service departments at the Laboratory each year. /

GEM Fellowship Program

After taking a break last year because of the COVID-19 pandemic, the GEM program resumed in 2021 with 22 fellows joining the Laboratory for the summer. GEM is a network of leading corporations, laboratories, and research institutions that enables qualified students from underrepresented communities to pursue graduate education in science and engineering.

GEM fellows work as summer interns while completing their studies and receive financial support that is often the deciding factor in their pursuing graduate education. The internship process also allows companies to access and recruit talented candidates that they may not find otherwise. GEM fellowships at the Laboratory offer the students numerous returns, from networking opportunities to high-level research experience.

GEM fellow Miles Smith worked in the Energy Systems Group to develop some of the battery state-of-health measurement techniques for a novel battery architecture that his supervisor is developing. “To do this, I am using a microcontroller to characterize the battery’s state-of-charge and then probing the system with various waveforms so that I can run electrochemical impedance spectroscopy tests on the battery system,” Smith said. “Through this research, we are hoping to develop noninvasive methods to characterize this new battery technology’s state of health at precise locations within the battery without disturbing the system.”

About his overall fellowship experience, Smith added, “I have had a very positive experience and have found the support at Lincoln Lab to be very nice at helping me feel connected within the Lab community.” /

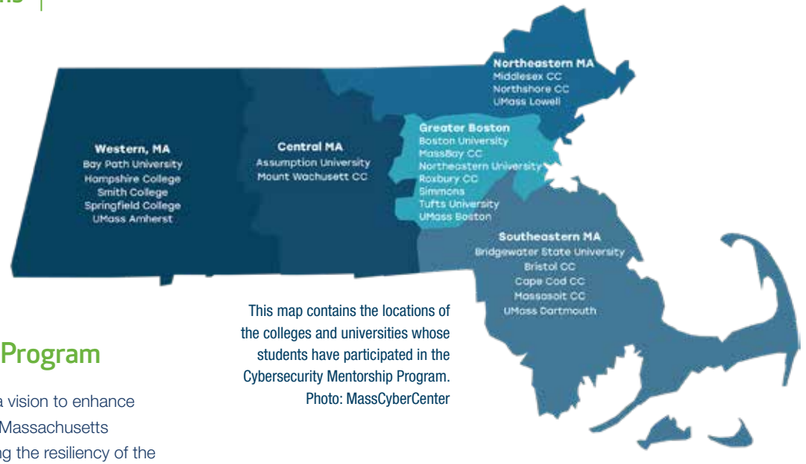
Activate Fellowship Program

In summer 2021, Lincoln Laboratory welcomed its second cohort of Activate fellows who are working alongside staff to develop and commercialize new technologies. The Activate fellowship is a two-year program that allows science and engineering entrepreneurs to embed with national organizations to learn the fundamentals of building a startup. The 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. Since its founding in 2015, the Activate program has supported 103 fellows and more than 74 startups.

Of the 24 fellows selected for the highly competitive fellowship program this year, four embedded at the Laboratory. Cohort 2021 joins five other Activate fellows who have been working at the Laboratory since summer 2020. During the first year of their fellowship, the 2020 fellows have made significant progress building their companies by establishing connections in industry and using Laboratory resources to realize novel technologies, including a scintillator for radioactive material detection and a laser-based navigation technology for autonomous systems. /

> “Given MIT Lincoln Laboratory’s long pedigree for developing advanced technologies such as radar systems and sensors, I’m not sure there is a better place to be incubating a lidar startup from a technology development perspective.”
>
> — THOMAS MAHONEY, COHORT 2020 ACTIVATE FELLOW AND CHIEF TECHNOLOGY OFFICER OF KYBER PHOTONICS

The 2021 Activate fellows (with their companies’ names) are, from left to right, Brendan Hermalyn (Pythagorean Applied Research), Jungah Lee (Aura Intelligent Systems), Andrew Stern (Coremeleon), and Mael Flament (Qunnect).



This map contains the locations of the colleges and universities whose students have participated in the Cybersecurity Mentorship Program. Photo: 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 at the MassTech Collaborative selected 35 students from 16 schools across Massachusetts to participate in the spring Cybersecurity Mentorship Program, offering students an opportunity to work together with industry leaders on real-world cybersecurity projects. A total of 25 undergraduate students from 14 different schools across the Commonwealth have been paired with 22 mentors from 14 different organizations.

The pilot of this mentorship program in fall 2020 confirmed that mentorship from industry professionals can play a powerful role in encouraging diverse student talent to enter the cybersecurity profession. In Massachusetts' technology and innovation ecosystem, which includes cybersecurity, only 5% of workers are Black, 7% are Hispanic, and one-third are women, according to the Massachusetts Technology Leadership Council.

Students met virtually with their mentors one on one throughout the program to discuss cybersecurity careers and to work together on cybersecurity-related projects. Some student projects included breaking and securing a virtual machine; evaluating a cybersecurity policy or procedure for a business; drafting a policy recommendation for the Commonwealth of Massachusetts; creating a cyber incident response plan; and developing a cyber education and awareness product.

"It was rewarding and worthwhile to be a mentor in the MassCyberCenter's Mentorship Program," said Jeffrey Gottschalk, one of the mentors from Lincoln Laboratory. "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 learning and progress during the program."

The program also included a webinar for the mentors and the mentees that focused on the soft skills required for a career in the cybersecurity industry. The mentorship program concluded six weeks later with a showcase event during which students present their completed projects. /

Spotlight:

Nathan Frey, MIT Postdoctoral Associate

Lincoln Laboratory Supercomputing Center and Artificial Intelligence Technology Group

Nathan Frey is an MIT postdoctoral associate working with supercomputing and artificial intelligence at Lincoln Laboratory.

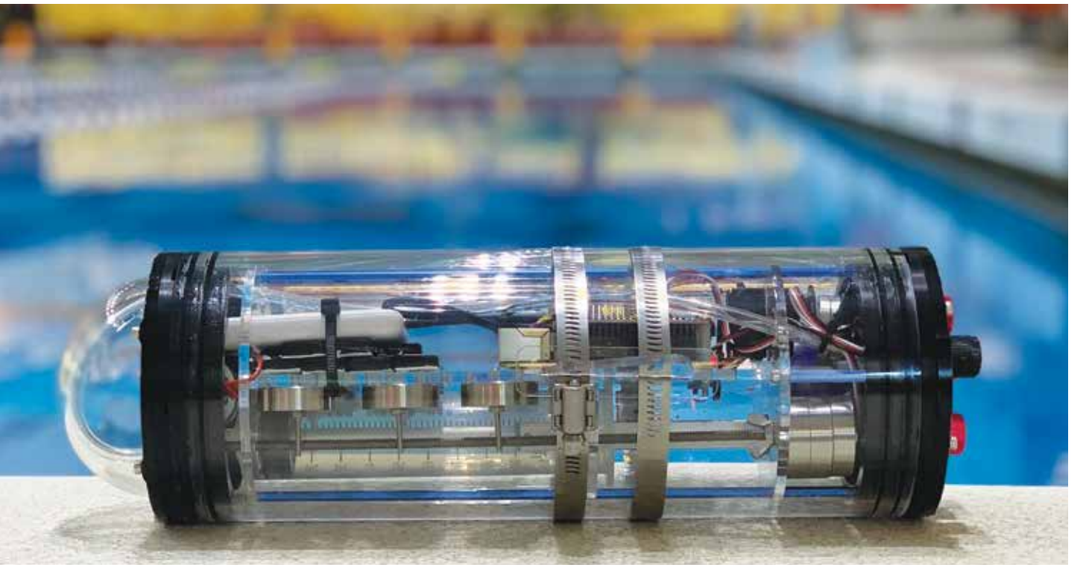
Where did you work before Lincoln Laboratory?
I received bachelor's and master's degrees in physics, and then attended the University of Pennsylvania, where I received a PhD in materials science and engineering. During graduate school, I was an affiliate scientist with the Materials Project at Berkeley Lab and a developer for DeepChem, an open-source deep-learning library for the sciences. Now, I'm a postdoctoral associate with the Lincoln Laboratory Supercomputing Center and Artificial Intelligence (AI) Technology Group.

What do you work on?
I do research at the intersection of supercomputing, AI, and materials design. I use AI and physics-based modeling to understand materials and molecules and engineer new forms of matter to solve pressing challenges across energy, climate, and human health.

Describe your experience at the Lab.
The Lab provides the perfect opportunity and environment to do the kind of interdisciplinary research that I'm interested in. Everyone has been extremely welcoming and supportive, helping me get up to speed on ongoing projects and start new ones.

Tell us about a personal accomplishment you're proud of.
I've mentored undergraduate researchers through programs like NSF REU and Google Summer of Code and I'm proud of any impact I've been able to have, helping them discover exciting research areas, and making science more inclusive and welcoming.

What is something you'd like to accomplish in the future?
I'd like to contribute to an end-to-end design problem – where a new material or molecule is designed from scratch and brought to market in a product. Today, this process usually takes 10–20 years, but hopefully, we can make it much faster with supercomputing and AI! /



A low-cost, highly configurable mini ocean glider for underwater data collection was developed as part of the 2021 Beaver Works capstone program.

MIT Lincoln Laboratory Beaver Works

Beaver Works, an initiative between Lincoln Laboratory and the MIT School of Engineering, 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 technology that solves a real-world problem. During two or three semesters, the students 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. In 2021, students in the MIT Department of Mechanical Engineering worked on developing and evaluating advanced concepts for extending the endurance of unmanned underwater vehicles. /

MIT Professional Education

Lincoln Laboratory collaborates with MIT faculty to offer courses through MIT's Professional Education Short Programs. These professional education courses attract participants from industry and business to the 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. /

MIT 6-A Master of Engineering Thesis Program

Lincoln Laboratory offers a variety of research and internship opportunities to university students. Candidates in MIT's 6-A Master of Engineering Thesis Program may spend two summers as paid Laboratory interns, participating in projects related to their fields. Then, the students work as research assistants while developing their theses under the supervision of both Laboratory engineers and MIT faculty. In 2021, six students chose to do their thesis research at Lincoln Laboratory. The Laboratory also typically employs about a dozen other research assistants from across MIT's engineering departments. /

> "The computational resources available through the Lab have allowed me to work on interesting and cutting-edge machine learning research related to action recognition. It allowed me to better understand technical problems related to national security."
>
> — MATTHEW HUTCHINSON, FORMER MIT 6-A MASTER OF ENGINEERING THESIS PROGRAM INTERN AT LINCOLN LABORATORY

MIT Independent Activities Period

Lincoln Laboratory technical staff lead activities offered during MIT's Independent Activities Period (IAP), a four-week period during MIT's January semester break. Under the IAP program, for-credit classes are available for registered MIT students, and non-credit activities, which may span the full four weeks or a limited number of days, are open to all members of the MIT community. IAP offerings range from academic classes to hands-on engineering projects to artistic pursuits. Lincoln Laboratory members instructed courses for the 2021 IAP including AIChallenge—Developing the Next Generation of AI Challenge Problems, Mission-driven Technology Transfer: Perspectives from MIT Lincoln Laboratory, and Practical High Performance Computing: Scaling Beyond the Laptop. /

Left: Robert Loynd, Executive Officer to the Director and Chief of Staff at Lincoln Laboratory, introduces the military fellows to U.S. Deputy Secretary of Defense Kathleen Hicks. **Right:** Robert Loynd greets Deputy Secretary Hicks outside of the Beaver Works Center in Cambridge, Massachusetts. **Below:** The Lincoln Laboratory military fellows are pictured with Deputy Secretary Hicks, center.

Military Fellows Program

The Military Fellows Program is an annual program that offers military officers pursuing graduate degrees or advanced education the chance 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.

In July, eight of the Laboratory's military fellows had the opportunity to meet U.S Deputy Secretary of Defense Kathleen Hicks at the Beaver Works Center in Cambridge, Massachusetts, for a discussion about current technology development focus areas and modernization efforts at the Laboratory and the Department of Defense (DoD).

"Deputy Secretary Hicks was very interested in learning about the fellows' individual research areas in both their Lincoln Laboratory work as well as their studies on campus. I'm very glad that the Deputy Secretary was able to meet these talented officers and see how they are contributing to the Laboratory's mission and our nation's defense in the research and engineering domain," said Executive Officer to the Director and Chief of Staff Robert Loynd.

The Beaver Works Center was one stop on a tour of New England the Deputy Secretary embarked on to assess current technologies being used by the military and its modernization efforts. During their discussion, the fellows shared with Deputy Secretary Hicks the projects they worked on at the Laboratory, which span a variety of areas including machine learning for cybersecurity and defense technologies. Deputy Secretary Hicks then briefed the group on the DoD's efforts to modernize its systems—especially through the use of AI—and the challenges of modernization, including how to maximize the fuel efficiency of systems while minimizing their climate impacts.

"The most encouraging takeaway from our discussion with the Deputy Secretary of Defense is hearing that the DoD leadership's priorities are aligning with the current assignments of the Lincoln Laboratory military fellows, whether they be hybrid warfare, cybersecurity, or hypersonics," said U.S. Army Second Lieutenant Victor Kao, a military fellow. Kao works in the Systems and Architectures Group on research related to the Army's Strategic Long-Range Cannon.

"It was exciting and invigorating to hear from Deputy Secretary Hicks about the priorities in today's DoD to modernize the joint forces for near-term and long-term competition with peer adversaries and to better utilize the talents of the men and women working in the [defense] department," said U.S. Air Force Second Lieutenant Michael Geraghty, who works in the Laser Technology and Applications Group developing test setups for efficient testing of high-energy fiber-amplified lasers. He added, "It was clear that Dr. Hicks appreciated the Laboratory's efforts toward these priorities."

The fellows saw the meeting as an opportunity to help the DoD see the value the young officers and their experiences will bring to solving questions within the forces. "I hope the DoD will recognize the talents that young junior officers bring with their passion, military awareness, and academic disciplines and will develop the military fellows program further," Kao said. /

Naval War College AI Course

In 2021, Laboratory staff supported the U.S. Naval War College as they offered their first-ever AI elective course: "AI for Strategic Leadership: Unpacking the Black Box." The course consisted of 10 weekly lessons—held from November through February—that featured prerecorded tutorial videos from Laboratory staff and other naval affiliates. Military officers from across the services attended the course and studied leadership aspects of a variety of topics of mission relevance, including AI fundamentals, computer vision, natural language processing, robustness, and human machine teaming.

The course was co-led by William Streilein, who was, at the time, a principal staff member in the Biotechnology and Human Systems Division, and Dennis Ross, an associate group leader in the AI Technology and Systems Group. Nine other Laboratory staff members were also involved as AI subject-matter experts, including Julie Mullen of the Supercomputing Center, who enabled use of the Laboratory's LLX platform to host the prerecorded materials. The teaching team hopes to offer the course again in the future.

"It was a pleasure working with the Laboratory," said John Hanus, a Naval War College professor. "I received quite a bit of positive feedback, and much of it was due to the expertise provided by the Laboratory. Out of all the electives I've taught with the Laboratory, this may have been the best, especially since it was a new course." /

Shown above is a screen capture of military officers and Laboratory staff participating in the U.S. Naval War College's AI course.

ARIEL SANDBERG

EMPLOYEE SPOTLIGHT

What community outreach or volunteering efforts are you involved in?
I am passionate about making the aerospace industry accessible and interesting to students that may be intimidated by the "rocket scientist" mythos of the field. My dream of working on space missions was brought to fruition only through extensive tutoring and passionate mentors. I want students with potentially similar non-standard skill sets or backgrounds to realize that there is not only a place, but a need for them in this industry.

As a preteen, I volunteered in the space exhibit at the Denver Museum of Nature and Science. That experience introduced me to the communication gap that exists between the general public and technical community. I realized that many community members were excited to learn about the field, but unsure of where to begin.

Today, I speak to audiences across the country about the space industry and how we design and test spacecraft. Recently, I delivered a Science on Saturday talk and spoke with students at Brockton Middle School through the Girls' Innovation Research Lab program.

How does volunteering affect you personally?
Space exploration is a multidisciplinary effort that draws on interests and skills from every corner of human achievement. My goal is to empower people to see themselves as infinitely capable of contributing to this field, just as my early mentors did for me.

Though I find my technical engineering work very gratifying, volunteering scratches a different itch. I want to be able to pay forward all of the formative experiences, advice, and opportunities that empowered me in my early career and education; it is invigorating to engage with these community members' curiosity and joy.

What would you like people to know about volunteering and giving back?
It can often feel daunting to volunteer, especially when it is adding to your work off-hours; however, I find that it pays many times over for the work you invest. The energy I feel from working with students helps to amplify my own excitement for the work that I do on a daily basis and keeps me grounded in the big picture of why it's important.

Spotlight:

Anna DeVries, Military Fellow

Northeastern University, M.S., Electrical and Computer Engineering

> “This experience broadened my outlook on cybersecurity in the Department of Defense, helping me become a better leader as I return to the Army.”
>
> — ANNA DEVRIES, SECURE RESILIENT SYSTEMS AND TECHNOLOGY GROUP

How would you summarize your experience in the MIT Lincoln Laboratory Military Fellows Program?
This fellowship provided me with a unique, hands-on experience that applied my graduate school education to real-world applications. I worked alongside Lincoln Lab employees, learning tips of the trade and a new perspective on cybersecurity. This experience broadened my outlook on cybersecurity in the DoD, helping me become a better leader as I return to the Army.

What has surprised you most about your experience or research at Lincoln Laboratory or specifically in your group?
The DoD is traditionally risk averse, so I was surprised to work with a team that embraced risk. My group supported failure as a vector for learning, seeing high reward and capability for growth in otherwise avoided avenues of approach.

As you move on from the Military Fellows Program to your next venture, what are some of the key takeaways from your time at the Lab?
My key takeaway from the Lab is the importance in learning to adapt. The DoD’s landscape is constantly changing, especially from rapid technology advancements. Leaders must learn to adapt to these changing conditions and overcome their associated challenges. /

An airman uses an AI–enabled software program developed as part of the AI Accelerator to schedule C-17 aircrews.

A research team from the AI Accelerator is pictured inside the cockpit of a C-17 aircraft.

Air Force-MIT AI Accelerator Program

The AI Accelerator is a joint effort between MIT and the Department of the Air Force to conduct R&D related to the ethical application of AI algorithms and systems to advance the Air Force and society in general. In January 2020, the AI Accelerator launched 10 interdisciplinary projects involving researchers from MIT campus, Lincoln Laboratory, and the Air Force. The three-year-long projects, which encompass a total of 15 research workstreams, advance AI research in a broad range of areas, including weather modeling and visualization, optimization of training schedules, and autonomy for augmenting and amplifying human decision making. /

JOHNNY WORTHY

EMPLOYEE SPOTLIGHT

What employee resource groups (ERGs) did you join and why?
I joined Lincoln Employees' African American Network (LEAN) because I remembered the LEAN cookouts from when I was an intern. My GEM mentor was in LEAN, and I wanted to serve as a mentor as well. This past year, with all of the great collaborations between ERGs and more virtual programming, I've gotten to participate in the Hispanic/Latinx and New Employee Networks' events as well.

What activities does your ERG engage in, and how has the pandemic affected this aspect?
I think the big outreach event for LEAN is the Dr. Martin Luther King Jr. celebration event in the winter, but LEAN also volunteers at local schools, helps with recruiting at conferences like the National Society of Black Engineers, and hosts (during a normal year) a wonderful cookout in the summer that promotes other mentoring and volunteering opportunities in the community. The pandemic has certainly reduced engagement with some of these events, but there have been some innovative virtual activities like trivia or cooking demonstrations that have been very effective.

Do you recommend any particular outreach activity to others?
Working with younger students can be pretty rewarding. Sometimes I think our own technical expertise and knowledge can stifle some of the more creative ways to look at problems, and it is refreshing to see how a high school student looks at a technical problem.

What would you say to someone who might be hesitant to join in an outreach activity?
I would ask them to think back to when they were a student signed up to participate in some STEM program and imagine the kind of person they would have liked to have as a mentor or coach. There are tons of students out there right now imagining someone just like you to help them out or just to motivate them to continue on.

Cadets listen in at the kickoff event for SOCOM Ignite, an event that encourages military students to innovate technological solutions for military-related challenges.

SOCOM Ignite

U.S. Special Operations Command (SOCOM) operators face a wide range of challenges in the field that require innovative solutions in order to complete their missions. To develop technologies to address these challenges, the Laboratory hosted the SOCOM Ignite hackathon event, now in its second year. The event works directly with SOCOM operators to identify challenges and present them to military students from around the country. These students develop a proposal together in teams and then work on their project before eventually demonstrating it. The event was inspired by the Intern Innovative Idea Challenge (I3C), an event the Laboratory held annually that is on hold due to the pandemic. The difference between the programs is that while I3C was developed for Laboratory interns, SOCOM Ignite is for military students who are not already working at the Laboratory.

Students submitted their ideas and concepts, and the event is continuing through April 2022 as the teams further develop their projects. The challenges identified by SOCOM operators for this year's SOCOM Ignite are in the areas of autonomy, sensor fusion, data fusion, information overwatch, and jumpable e-bikes.

"Life as a military cadet in college is extremely busy, and it is amazing how far some of these teams go to solve the challenges," said Tony Ingano, Group Executive Officer of the Advanced Sensors and Technologies Group, who helped with the event. "The cadets get to use their skills to develop cool products, meet SOCOM operators, and potentially earn an internship at SOCOM or a military fellowship at the Laboratory."/

The Lincoln Laboratory–based I-Corps program teaches entrepreneurial skills to Laboratory staff members.

Lincoln Laboratory I-Corps Program

The National Science Foundation (NSF) I-Corps program helps scientists and engineers accelerate the translation of their research into practical applications. Through I-Corps, participants acquire and then apply entrepreneurial skills through multiple customer interviews with the support of innovative business leaders. The I-Corps Spark program at MIT, an initiative of MIT's Venture Mentoring Service, serves as an NSF regional hub providing training across New England. In collaboration with the Lincoln Laboratory Technology Ventures Office, MIT established a custom I-Corps program for the Laboratory. As of 2021, more than 115 Laboratory staff members have graduated from the I-Corps program. /

Technical Education Committee Onsite Courses

Lincoln Laboratory offers technical education programs designed to help employees expand their knowledge and versatility in areas across the Laboratory. The programs offer short-term and semester-length courses taught by Laboratory technical staff or outside experts. The courses have featured topics such as mathematics of big data, high performance computing, electromagnetics, and amateur radio, among many more. /

Lincoln Scholars Program

The Lincoln Scholars Program supports Laboratory staff graduate education in areas of strategic importance to the Laboratory. The program promotes the recruitment and retention of talented technical staff, enhances the technical capabilities of Laboratory staff, and improves relationships with local university research faculty in fields relevant to the Laboratory. The 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. From 2020 to 2021, 11 staff members were enrolled in the program. Almost 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 (PGS) 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 continuing to work at the Laboratory full time. The program objective is to provide developmental opportunities to highly motivated employees to the joint benefit of the Laboratory, its sponsors, and the employee. From 2020 to 2021, 20 employees participated in the program. /

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 2020–2021 program included the following seminars:

A Deep Dive in the Deep Web: Insights from Eight Years of Online Anonymous Marketplace Measurements

Biology & AI: Trends and Implications for U.S. National Security

Design and Economics of the Climate Observing System of the Future

Quantum Engineering of Superconducting Qubits and Quantum Computers

Brain Inspired Research: Understanding Liquid Time-Constant Networks

Human-Machine Teaming at the Heart of Vehicle Production: The Future of Flexible Automation – Factory 56

Graphcore Colossus Mk2 IPU & M2000 Machine

Harnessing the Random Properties of Resistive Memory Technologies through Bayesian Machine Learning

The (Far) Future of Human-Machine Teaming: A Sci-Fi Futurist Perspective

The Technology Office also offered special interest group seminars on Machine Learning, Science, Cyber Operations, Climate/Environmental Science, and Perspectives on Computing, as well as timely discussions on Coded Bias; COVID-19 and the Future of International Conflict; and The Capitol Riot and the Threat of Domestic Terrorism. /

Daniel Weidman (top row, center), 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 the chapter's regularly held Advisory Committee meeting at which members plan future meetings and other chapter activities.

IEEE Boston Reliability Chapter

The Laboratory encourages employees to participate in professional societies. The Boston Chapter of the IEEE Reliability Society holds events throughout each year 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 and continued to do so in 2021. /

03 COMMUNITY GIVING

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

- Helping Those in Need
- Helping Those Who Help Others
- Supporting Local Communities

Last year, Laboratory members contributed **$128,081** to Community Giving, out of which **$12,277** was donated specifically to the MIT Community Service Fund.

Santo Lucente and Marilyn Rosado happily donate boxes of new clothing for veterans to personnel from the Veterans Affairs Medical Center in Bedford, Massachusetts.

Clothing Drives

Boston Medical Center

To help those most vulnerable members of our community, Christopher Gibbons started a winter apparel and accessories drive in October. The drive benefited Boston Medical Center, which maintains a clothing bank to distribute clothes to patients in need and a Child Life program that collects small inexpensive toys for in-patient kids at the center. He organized his first clothing drive last year to collect warm coats, hats, scarves, and gloves for the homeless in Boston. “Both patients and staff at area hospitals need a boost in spirit,” said Gibbons. “Boston Medical Center’s in-kind donation program is an efficient way to distribute the generosity of the Lincoln community to those most in need of support.” /

Bedford Veterans Affairs Medical Center

Santo Lucente and Marilyn Rosado created a year-round donation drive so that local veterans residing at the Bedford Veterans Affairs Medical Center would receive new necessities, such as t-shirts, socks, undergarments, slippers, and sneakers. Lucente, a member of Lincoln Laboratory’s LLVETS employee resource group, likes to support veteran groups. He said, “The Bedford Center has facilities for homeless veterans, who often need all kinds of basic necessities when they arrive. As a veteran myself, I want to do my part in helping them get what they need.” /

Spotlight:
Digging Deep with Team Rubicon

After Hurricane Ida barreled through Louisiana, residents were left to pick up the pieces. Trees split homes in half and roofs were torn away. Thousands of homeowners needed help, and Paul Metzger's job was to figure out which ones he and 44 fellow volunteers with Team Rubicon could serve.

Donning a grey t-shirt, the equalizing uniform of Team Rubicon members, Metzger joined the call for volunteers, temporarily swapping his role as leader of Lincoln Laboratory's AI Software Architectures and Algorithms Group for one managing crisis-cleanup teams. This would be Metzger's fourth deployment with the non-profit organization, whose mission is to provide relief to underserved communities after disasters.

"My eyes had really been opened as to how much people tend to be on their own after a major disaster," Metzger says, recounting his first deployment with Team Rubicon. In 2017, Hurricane Harvey brought an unprecedented flood to Texas. The magnitude of the devastation moved him to sign up.

Team Rubicon helps homeowners immediately deal with damage to their homes. This service is often desperately needed when FEMA is too overwhelmed to help and insurance checks are still far off. The team sets up forward operating bases (in places like gymnasiums) and sends out survey teams to homes that have requested help. Depending on the damage they find, Rubicon will then send out crews

Team Rubicon volunteers from across the nation gathered to help clean up after Hurricane Ida.

Spotlight (continued)

to bulldoze, chainsaw, tarp, or haul out anything wet from homes. The organization is primarily made up of veterans and first responders, "and a few of what Team Rubicon calls 'kick-ass civilians,'" Metzger adds, with a smile. He falls into the last category.

About a year after his first deployment to Texas, Metzger next went to North Carolina for Hurricane Florence. His job was to dredge out sodden insulation from crawlspaces before black mold could take hold. He even rescued a bass fish from under a house, still alive in a mud puddle weeks after the storm.

Weeks later in Florida after Hurricane Michael, Metzger took on the more logistical job of situation unit leader. Only then did he realize the sheer volume of requests that come in. "We were overwhelmed. There was just too much data to manually sift through," he says. "I wanted to be in more of a position where I could bring experience to bear," he says. Metzger trained to become a planning section chief, a leadership role at the helm of analyzing requests and recommending which ones to take.

Fast forward to September, and Metzger would be in this role for the first time in Louisiana. When he arrived with the third wave of volunteers, nearly 10,000 requests lay waiting after Hurricane Ida. To seek help with this massive triaging task, Metzger reached back to his colleagues at the Laboratory. Jo Kurucar, a software engineer who also volunteers with Team Rubicon, stepped up to support remotely, implementing code to run prioritization algorithms through the database. "It is truly a herculean task without computer help," Metzger says.

Paul Metzger volunteered with the nonprofit organization Team Rubicon in Hammond, Louisiana, after Hurricane Ida.

In just over 10 years, Team Rubicon has flourished from a handful of people to more than 100,000 U.S. volunteers. "The growth is amazing. In the bigger picture, these sorts of large storms just keep getting bigger, they keep getting more frequent," Metzger says. "The more people ready to respond, the better. Absolutely." /

Kathleen Hart packs up warm clothing donations ready to be delivered to refugees arriving in New Jersey.

Afghan Refugees

As 9,500 Afghan refugees started entering the country in October, Ryan Cunningham, a Lincoln Laboratory security officer and National Guard member stationed in Joint Base McGuire-Dix-Lakehurst in New Jersey, realized many of them had arrived with nothing. He saw an immediate need for appropriate clothing for the coming cold weather. Cunningham contacted Kathleen Hart, a fellow Laboratory security officer and past Troop Support lead, for her help in setting up a quick-turnaround donation project. The effort was adopted by LLVETS hoping to use Cunningham as their New Jersey contact to provide a coat to as many refugees as possible upon arrival. With the help of project leads Matthew DeWitt and Daniel Burns-McKernan, stacks and stacks of winter coats, scarves, gloves, hats, sweaters, socks, and boots were donated and quickly packed and shipped in the weeks that followed.

"When the first box of donations was delivered," said Cunningham, "I was so proud to say I work for Lincoln Laboratory. The car was brimming with donations, ready to help people entering the United States." Once the donations were handed out at Joint Base McGuire-Dix-Lakehurst, Cunningham noted it was apparent that each and every item donated was appreciated. "It was great to see these people who were completely unprepared for winter weather be so thankful for any kindness shown to them." /

The Huntsville Field Site staff collectively acquired the most needed items for teachers in their local area.

School Supply Donation

Staff in the Huntsville Field Site in Huntsville, Alabama gathered school supplies for the students and teachers of Blue Springs Elementary School in Limestone County, Alabama. The Blue Springs school teachers have a limited budget and many students fall into the underprivileged category. Denise DeCoster reached out to the educators there and asked them which items were the most needed. Huntsville staff responded by collecting all kinds of items as requested to help teachers have proper amounts of supplies for all their classes. /

JONATHAN SU

EMPLOYEE SPOTLIGHT

Why do you choose to participate in the Walk to End Alzheimer's?
My family and the families of some of my friends have experienced the slow, relentless, merciless devastation that these diseases cause. I was touched by the immediate welcome and understanding I received from the Laboratory's Alzheimer's Support Community (ASC) and it has been rewarding to have this avenue to contribute to research that can help conquer these afflictions.

What types of things did you do to raise funds this year?
I have participated in the Walk to End Alzheimer's for a number of years. As in past years, I contacted my extended family, friends, and acquaintances. It is remarkable and uplifting how many people respond with a donation---often people that I only know tangentially; it speaks to the reach of Alzheimer's disease and other dementias and to the kindness of many individuals. This year, our team has raised more than $27,500 finding a cure.

Why should others join your cause?
Sadly, Alzheimer's and other dementias will affect millions of people, their loved ones, or their friends. These diseases can be misunderstood and stigmatized; people should know that they do not have to face the challenge alone, that the ASC and the Alzheimer's Association are available to help them and support them. On the medical side, we need to make advances like the ones that have been made against heart disease and cancer. On the economic and policy side, we need to recognize that these diseases cost our nation hundreds of billions of dollars annually, so progress will pay dividends beyond the medical domain.

Lincoln Laboratory's Alzheimer's team members from both Massachusetts and Alabama participated in their local Walk to End Alzheimer's and helped raise almost $27,500.

> "The ASC is a great resource for anyone whose life is being affected by Alzheimer's disease or other dementia."
>
> — JONATHAN SU, ASC MEMBER

Alzheimer's Awareness and Outreach

This year, Lincoln Laboratory celebrates its 13th anniversary of participating in the Walk to End Alzheimer's. Because of COVID-19, the walk took place virtually on September 26, anywhere and everywhere that participants chose to walk. The 11 team members walked individually on sidewalks, tracks, and trails to participate in this year's event. Team members included co-captains Terri Welch and Sheila Chabot, who were joined by Janet Taylor, Kathleen Cable, Catherine Holland, Jimmy Welch, Sandra McLellan, Peter Priestner, Jill Kirchoff, John Kaufmann, and Jonathan Su. The team raised almost $25,000. Since 2009, the Lincoln Laboratory Walk and Ride teams have donated more than $450,000 to the Alzheimer's Association to further research, awareness, education, and services. "The Laboratory's Alzheimer's Support Community is a great resource for anyone whose life is being affected by Alzheimer's disease or other dementia," said Jonathan Su, a participant in the Laboratory team for the Walk to End Alzheimer's.

In Huntsville, Alabama, nine people from the Laboratory's Huntsville Field Site gathered on October 9 to walk together and raise funds for Alzheimer's research. The team enjoys participating in this event not only to help fight Alzheimer's disease, but also because it helps them feel a kinship with the main Laboratory in Massachusetts since they are participating in the same national event, albeit on different days and in different locations. The event consisted of each participant's choice of either 1.5 or 3.5 miles. This much shorter distance than other fundraisers allows families to participate. It is not uncommon to see three generations — parents, children, and grandparents — participating as a team, or to see someone walking with an individual in the early stages of disease. /

Richard Taylor set off to participate in the Ride to End Alzheimer's. Taylor contributed $7,620 to the team's total of $22,600 raised for research in Alzheimer's disease.

Ride to End Alzheimer's

For the tenth year, the Lincoln Laboratory Alzheimer's Support Community invited cyclists of all abilities to ride in the 2021 Ride to End Alzheimer's. Riders from across the country participated in the 30-, 62-, or 100-mile rides, or in the short Family Ride (about 2 miles), departing from and finishing at the Seacoast Science Center in Rye, New Hampshire. The ride is sponsored by the Alzheimer's Association, the world's largest nonprofit organization for Alzheimer's care, support, and research. Ninety percent of donations to the ride go directly toward Alzheimer's disease research. From its inception, the ride has raised more than $7 million to fund critical research through the Alzheimer's Association's research grants program.

This year's team included team captain John Kaufmann, Bruce Bray, Arnold Buck, Kathleen Cable, David Caplan and his son, Jay, Stephen Conrad, Matthew Grein, Paul Lawson, Jon Schoenberg's family, Richard Taylor, Alicia Volpicelli, and Matthew Willis. The team raised $22,600, surpassing their goal of $20,000. This amount ranked the team the fourth highest fundraiser in the region. This year's Ride to End Alzheimer's in New Hampshire raised $416,750 overall. /

New England Tour De Cure

For the second year, Dana Boisvert participated in the New England Tour de Cure. On August 22, he served as co-captain of a 12-person team riding virtually year round to address the vital need to spread awareness about diabetes. The team raised $21,180 to fund life-saving research into a cure for diabetes, $900 of which was raised by Boisvert with the help of generous donations from the Lincoln Laboratory community. “I couldn’t have done it without the support of the Laboratory,” said Boisvert. “Lincoln employees love a good cause and have always come through when donations are needed.” The American Diabetes Association has used funds raised through Tour de Cure not only to support research but also to provide educational programming and advocate for fairness in insulin pricing and health insurance rules. /

Stop Hate Community Bake Sale

Victoria Helus led an individual effort to offer bake sales to combat hate against minorities at the height of the COVID-19 pandemic. During the pandemic, when most bake sales disappeared, Helus offered a clever menu of bakery items to pre-order, then baked desserts such as baklava, Bundt cakes, key lime pie, and English toffee, and then arranged touch-free delivery/pick-up at Lincoln Laboratory. She raised $1,030 in June 2020 and donated it equally among the American Civil Liberties Union, the Innocence Project, and Black Women’s Blueprint. In March 2021, she repeated the effort, raised $1,200, and split the proceeds equally between Stop Asian American Pacific Islander Hate, the Asian American Legal Defense Fund, and the Asian Pacific Fund. Helus further matched all profits up to $300. Helus encouraged others to help bring about positive change by spreading awareness, educating others, speaking up, and showing support. /

Boisvert rode far and wide in the New England Tour de Cure. He is pictured here crossing the Piscataqua River before entering Maine.

Laboratory volunteers help Gaining Ground Farm harvest butternut squash for delivery to local food banks.

Gaining Ground Farm

This year, the Professional and Community Enhancement (PACE) Health and Wellness subcommittee organized three volunteer work sessions at Gaining Ground Farm, held in June, September, and October. The work was enjoyable and productive, as they harvested 3,000 pounds of squash and cleared the field for next year’s plantings.

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

The Laboratory’s volunteer days were organized by Joan Boegel, who said, “I learned a lot about butternut squash and really enjoyed working alongside farmers and chatting with all the other volunteers.” Boegel was joined by James Streitman, Kayla Cruz Jimenez, Margaret Boning, Emily Voytek, and Katherine Barlett. The Laboratory volunteer farm group also applied for and received a grant from the MIT Community Giving Fund to support their volunteer work, enabling them to contribute a $500 donation to Gaining Ground Farm to help the organization continue to help neighbors in need. /

> "My father was treated for cancer. While he could afford treatment and had a lot of support from family and friends, we saw so many who did not. TeamWalk provides grants, assistance with wigs, transportation, and payments that are not covered under insurance for a community that has many individuals in need."
>
> —JULIE ARLORO-MEHTA, TEAMWALK PARTICIPANT SINCE 2010

Julie Arloro-Mehta and her family have participated in TeamWalk for CancerCare for 11 years.

TeamWalk for CancerCare

Cancer doesn't go away in a pandemic, and neither does Lowell General Hospital's commitment to supporting cancer patients in need. For 11 years, a team of Laboratory staff and friends have participated in Lowell General Hospital's TeamWalk for CancerCare. Each spring, participants walk three to six miles to raise funds to support local cancer patients and their families. The event is typically held in Lowell, Massachusetts, starting at the Tsongas Arena and ending alongside the river. This year, the event was held virtually to keep all participants safe and healthy. The Lincoln Laboratory team of six people and two dogs walked a route of their choice at a time of their choosing. The team leader, Julie Arloro-Mehta, and her family decided on a six-mile hike and raised $1,800 to help those stricken with cancer. Many of those dollars came from the Laboratory community, which has always donated generously to this event.

Since 2000, TeamWalk has raised more than $13 million and touched the lives of more than 34,000 cancer patients and their families. Every dollar raised goes to help patients at the Cancer Center at Lowell General Hospital and throughout the Merrimack Valley with the things insurance doesn't cover—an overdue bill, a prescription co-pay, a wig, transportation to and from treatment, or integrative therapies to aid recovery. /

American Lung Association Autumn Bike Trek

A Lincoln Laboratory team participated in the Cycle for Air Autumn Escape Bike Trek on September 25 and 26. Making Camp Burgess in Sandwich, Massachusetts, home base, the cyclists rode westward on a 55-mile loop on the first day, and eastward on a 44-mile loop on the second day. They rode through mist, pouring rain, and sweltering sun to raise funds for the American Lung Association (ALA). The ALA usually researches many different lung diseases, but for the past two years, they have been concentrating on researching COVID-19 to better defeat its effects on people. The Lincoln Laboratory team, made up of Ned Rothstein, Jennifer Weis-Rothstein, and their friends, supports this event year after year because they have relatives with asthma, chronic obstructive pulmonary disease (COPD), or lung cancer. They continue to ride to help aid the ALA's research to make lives better for those with lung disease. Many members of the Laboratory community supported this team monetarily and helped the team raise $7,800, an amount which ranked them the fifth highest-earning team in this regional event. /

Lincoln Laboratory employees participating in the Cycle for Air Autumn Escape Bike Trek make their way toward Bourne Bridge as they approach Sandwich, Massachusetts.

KENDRICK CANCIO

EMPLOYEE SPOTLIGHT

Are you involved in an ERG or volunteering?
I have been a member of the Hispanic/Latinx Network (HLN) for three and a half years. I served as co-chair for the first two and now serve as part of the HLN committee.

Why do you think this ERG is important?
HLN serves as a focal point for Hispanic/Latinx employees. We strive to use that platform to cultivate a community that supports and reinforces our sense of belonging at the Lab. Because we are closely tied with the community, HLN also serves as an ear to the ground with respect to issues affecting our community.

What one thing would you like other people to know about volunteering?
Volunteering can be very fulfilling, but burn-out can be real when you take on too much. Luckily, you don't have to do a lot in order to make a difference. Even a small force applied over a long time can generate a lot of momentum.

Do you participate in outreach activities through your ERG?
Outreach through HLN takes many forms. Part of the work we do is through recruiting candidates at conferences for underrepresented minorities. Through HLN, I organized a mentorship program for GEM fellows to connect with employee mentors that share a similar background or interest. Outside of HLN, I served as lead instructor for the Autonomous UAV course for the MIT Beaver Works Summer Institute which offers free summer courses to advanced high schoolers. That's fun because the students' enthusiasm is infectious!

Why should other people consider engaging in outreach?
I think each of us has the responsibility as scientists and researchers to catalyze interest and trust in science. Part of our job is to communicate our findings to our peers, but it should also include the general public. When we make our methodology and results engaging and universally accessible, we make science more equitable across all demographics.

Craig Perini, a long-time participant of the Pan-Mass Challenge, rode 308 miles over three days for the 2021 PMC event.

Pan-Mass Challenge

The pandemic forced the Pan Mass Challenge (PMC) riders to reimagine the two-day bike fundraising event. However, the PMC mission of fundraising to support Dana Farber's cancer research and patient care is as critical as ever, even in the face of COVID-19. The Lincoln Laboratory cyclists rode their personal routes to raise funds. Most chose to do long, solo rides each weekend.

Kim Hebert, who has participated in this event for 14 years, rode 70 miles with 1,600 feet of elevation gain on two scorching hot days and raised $2,775. Craig Perini, a rider for 12 years, surpassed his goal of $8,000 and raised $9,575. Joseph LaCroix reimagined his ride and pieced together a two-day ride in the mountains of New Hampshire, Vermont, and Maine. He rode over 212 miles with 12,000 feet of climbing and raised $9,380. "I get on my bike year after year to train because this is what I can do," said LaCroix. "I'm not a doctor, scientist, or researcher, but I can ride my bike and fundraise to fuel one of the best cancer institutes in the world. PMC is an outlet for so many to feel powerful in a fight that otherwise makes them feel powerless." While employed at the Laboratory on an internship, Sam Polk rode 50 miles in his third PMC ride and raised $3,485. Together, these Laboratory staff members collectively earned $25,215 with the help and support of the Laboratory community and cycled over 500 miles in the New England area. /

Support Our Troops

Support Our Troops® Care Packages raise the morale and well-being of deployed troops worldwide, providing boxes full of items they specifically request. Throughout the year, Laboratory volunteers meet to sort through materials like toiletries, socks, gloves, candy, and other nonperishable items donated by staff. Then, they pick up mailing boxes and customs forms and hold a packing party. It makes no difference if the packing party consists of two people or 20; the care boxes are packed, taped, and shipped to soldiers eager to open a box of goodies. Once delivered, the care package is opened and the contents are shared among the troops. Every single item is distributed and accepted with appreciation. Military veteran and Laboratory employee Kathleen Hart helped coordinate boxes to overseas soldiers throughout the year, even throughout the pandemic. "Being a veteran myself, I remember how it felt to get a package from back home. Being involved in this program allows me to help give that same feeling to someone else," said Hart. /

Troops in Afghanistan were eagerly expecting our annual shipment of candy.

Kwajalein Giving Projects

Boy and Girl Scout Donation

Kwajalein Outreach has always supported the scout troops on the island in many ways, but during the pandemic, when the scouts can't rely on their normal fundraisers, like selling Christmas trees and wreaths during the holiday season, the Laboratory staff provide the Boy and Girl Scout Troops of Kwajalein a monetary donation of $1,000 to help the troops continue their regular activities. /

Kwajalein High School Scholarship

MIT Lincoln Laboratory has routinely selected a Kwajalein High School student who has shown curiosity and knowledge in science and mathematics to receive a scholarship to study a STEM-related field at the college or university of their choice. In June, Mackenzie Gowans was the recipient for the FY21 MIT Lincoln Laboratory Scholarship of $3,000. She is currently attending the University of Massachusetts, Amherst. This year, Kwajalein Outreach offered unused outreach funds as a scholarship for two additional graduating seniors interested in a STEM major. Megan Aljure received $2,000 and is currently attending Rice University in Houston, Texas. Ashley Homuth received $1,000 and is attending California Polytechnic State University in San Luis Obispo, California. /

Ri-Katak Lunch Program

MIT Lincoln Laboratory has a close rapport with the Marshallese islanders and the local community, and has supported the Ri-Katak lunch program ever since Lincoln Laboratory has had a presence in Kwajalein Atoll. The Laboratory annually donates $2,500 to the Ri-Katak program that provides lunch to the Marshallese children attending Kwajalein schools. New this year, the government of the Republic of the Marshall Islands has agreed to fund this lunch program, and therefore this will be the last year the Laboratory will need to support it. /

Lincoln Laboratory staff participate in supporting the Kwajalein community, helping Islanders in need, and growing educational opportunities available at the field site and on neighboring islands. Here, Laboratory engineers demonstrate autonomous systems at an elementary school science fair.

The Toys for Tots holiday drive has always resulted in overflowing boxes of donations ready to give to local children.

Holiday Giving

Toys for Tots

Toys for Tots, run by the U.S. Marine Corps Reserve, delivers toys to children whose parents may not be able to buy them gifts for Christmas. According to the group, "Local Toys for Tots campaigns are the heart and soul of the Marines' Toys for Tots Program." Laboratory volunteers worked together to wrap brown cardboard boxes with cheerful holiday paper and large bows, placing the donation boxes strategically throughout the Laboratory, kicking off the giving opportunities.

Susan Curry and Karen Grasso gathered donations of toys from the Laboratory community and took them to a distribution center located within the local Middlesex and Essex Counties. The local organizations picked up the toys and delivered them where they were needed most. Most of the children who receive presents through Toys for Tots would not receive presents otherwise. "Toys for Tots has been a tradition at the Laboratory for many years," said Curry. "I took up this cause to keep that tradition alive, so children can have toys for the holidays. Something has to be under the tree. The Laboratory community can be proud of making all those kids happy!" /

The annual Giving Tree provides an opportunity to select the specific items and age group for which to shop. All gifts go to the needy to make their holiday a bit merrier.

Giving Tree

Every Thanksgiving, ornamental giving trees decorated with nametags appear in the Laboratory's atrium and cafeteria areas. Through the Somebody Cares charity, Laboratory staff member Paula Mason gathers names of local families and veterans in need, and lists their names and wishes on the giving trees' tags.

The giving trees offer the Laboratory community an opportunity to bless people with the gifts they need for the holiday season. Each year, the Laboratory community gives two giving trees' worth of gifts to people in the Billerica and Lowell, Massachusetts, communities."Thirty years ago, I was single with five children," said Mason, "when members of a local church came to my home and gave gifts to not only my children, but to me, also. I have never forgotten their generosity. That is why I organize this giving tree every year." /

Students and teachers of the Ebeye Deaf Education Center gathered outside the school to collectively sign "I love you" as a way to thank those who installed computers and new technology.

Ebeye Deaf Education Center

In a multi-year effort, John O'Rourke has been helping improve the equipment and connectivity of Ebeye Deaf Education Center (EDEC) in the Marshall Islands while the school transitions from an old school building to a new one. In 2020, O'Rourke installed ceiling-mounted projectors to support the EDEC teachers and enable visual learning for the students. Further Laboratory funds helped provide five computer workstations that can each be selectively controlled by the teacher to project the computer display on the classroom screen. He also acquired and installed a digital visual display camera to show documents or objects for an entire classroom or audience to see. Work in the first year of this project was completed with the inclusion of a new whiteboard.

This year, the new installations mimicked those of the first year, but in a new building that will be used simultaneously with the old school. More work is planned for the future as there is much room for improvement. "When I first started helping the School for the Deaf, there was absolutely nothing in the classroom; no computers, desks, or anything," said O'Rourke. "I hope that with this technology they can get a better education and become more technologically savvy." When asked why he chooses to help this particular school, he replied, "I just wanted to help our host country in some way. It does not take too long to see a need, dive in, and help out. I really want to thank Lincoln Laboratory for providing the funds for this wonderful program that allows me to help." /

Ebeye Hospital

The effort to upgrade Ebeye Hospital's network capabilities began four years ago when medical data was routinely lost and information technology (IT) equipment was not secure. In 2018, John O'Rourke and local Lincoln Laboratory interns installed a central equipment rack with battery backup. This solved the problem of data being spread around in multiple rooms and on multiple machines. With a central server rack, all the data could be stored in a secured room, protected by a backup system, and would be in a temperature-controlled environment. In 2019, installing the central server allowed all the data to reside on one machine configured with a system that protects data in case of hard drive failures. All remote computers were connected to the central server, ensuring that all files were in one place and could be easily retrieved. This year, a backup system was installed, allowing the hospital to back up their data offline to a newly-installed tape system. Backups are now performed automatically, further securing all files and data are never lost, increasing work efficiency at Ebeye Hospital. /

Lincoln Laboratory interns, assisted by Ranny Ranis (far right) completed installation of a server rack as a first step to improve data storage and retrieval at the Ebeye Hospital.

Other Community Outreach Events

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 or events on their own time, including

American Civil Liberties Union
American Red Cross
Beth Israel Deaconess Medical Center
Boston Children's Hospital Walk for Kids
Burlington People Helping People Pantry
Epilepsy Foundation
Harbor to the Bay
Jimmy Fund
Lazarus House
Lowell Humane Society
MIT COVID-19 Neighborhood Response Fund
NAACP Legal Defense Fund
Trevor Project
Walk for Hunger

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.

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 for community outreach

John Welch Memorial Fund for educational outreach

The Barbara P. James Fund for general support

The Lincoln Laboratory Director's Fund for STEM education

The Carl E. Nielsen Jr. Family Fund for MIT graduate students in electrical engineering and computer science

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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