LINCOLN LABORATORY
COMMUNITY OUTREACH

MIT LINCOLN LABORATORY

2020 COMMUNITY INVOLVEMENT REPORT

> Seeing a girl's face light up when she could identify with me, then having her gleefully talk about it with her parent was super rewarding. STEM events in underserved communities show how important representation is.
>
> – Consuelo Cuevas, assistant at a G.I.R.L. workshop on cybersecurity.

WHY I VOLUNTEER

> It was a pleasure to be involved with future engineers and scientists and see their confidence develop. It bodes well for the future of STEM in the U.S. and underscores the need for STEM programs to ensure that the next generation is given every advantage to maximize their success.
>
> – Amna Greaves, instructor for Serious Games course in BWSI.

> Every time there's an educational outreach event at Lincoln Laboratory, students are educated, inspired, and empowered. Volunteers get to re-experience the wonder of discovery, and everyone involved comes away a better person.
>
> – David Patterson, LLRISE teacher and Explorer Post mentor.

> I'm proud to be a part of STEM outreach for girls. It's of great importance to share the message that it's okay for women to pursue STEM fields. Boys and men should support and encourage women's growth in these fields.
>
> – Jarilyn Hernandez-Jimenez, volunteer at all-girls engineering workshop.

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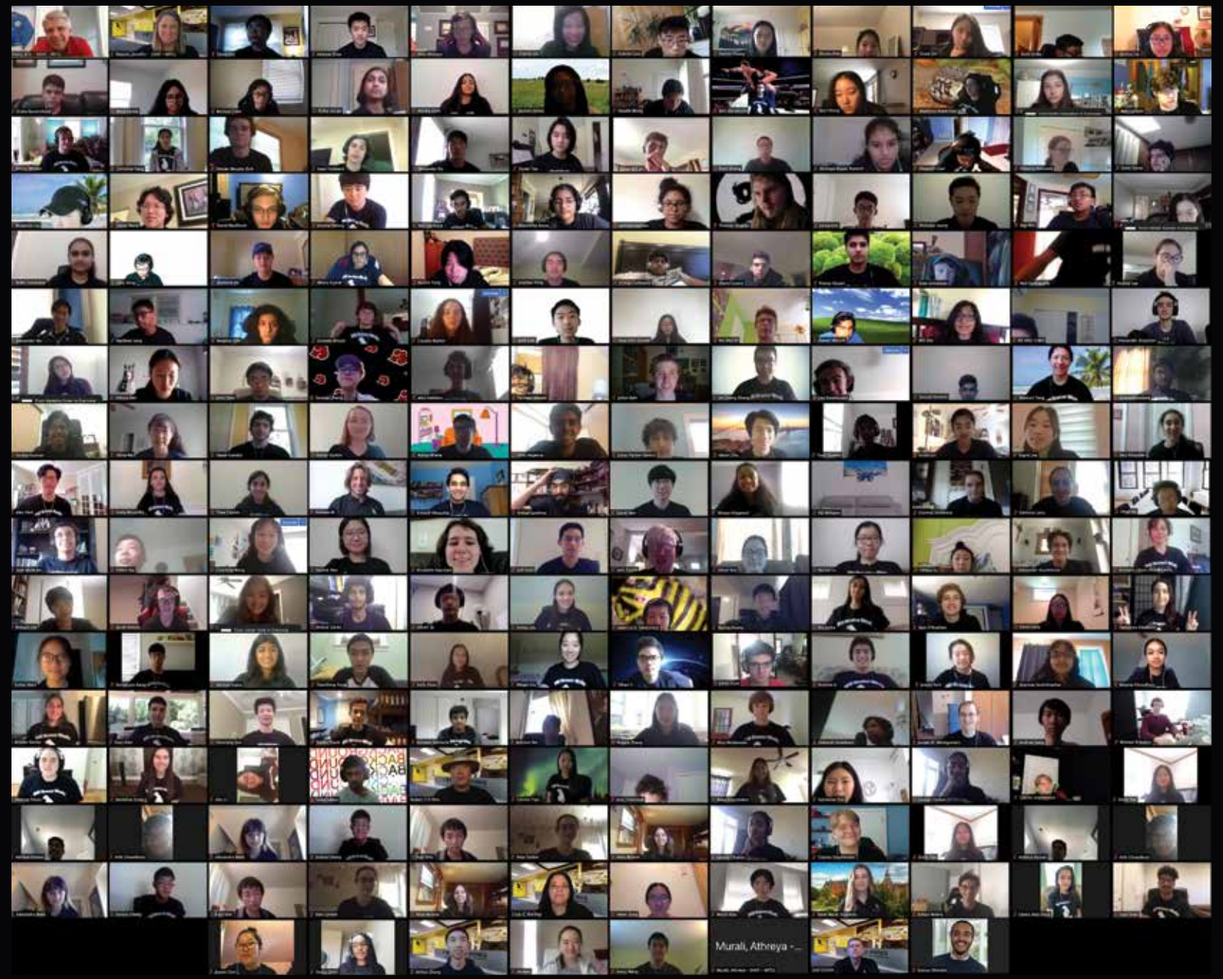


Director Eric Evans, upper left, addresses Beaver Works Summer Institute participants during its first-ever remote program. Evans explained the Laboratory's mission and some current interesting projects and encouraged students to follow a technical career path. Evans happily entertained many questions after the presentation.

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 24 students in building and operating a small radar system. During its fourth year in 2019, the four-week BWSI program offered 275 students the chance to engage in one of 10 courses, ranging from sessions on programming robotic cars or autonomous quadrotors, to workshops on building small satellites. During an intensive week of classes, LLCipher introduces high school students to cryptography for secure computing. For summer 2020, when most of the nation was sheltering at home, these programs were redesigned as virtual workshops that kept the hands-on element to promote experiential learning.

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

Laboratory volunteers help participants understand programming in the Scratch programming language.

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

The Girls' Innovation Research Lab (G.I.R.L.) is an outreach opportunity for young women to learn about careers related to science and engineering. This program holds workshops throughout the year to let girls in middle school and high school get hands-on practice in engineering.

In January, a team of Laboratory staff headed by Yari Golden-Castano offered a workshop for 40 young women to learn about programming and electronics. Participants learned about various electronic components while building their own circuits using MIT's Scratch programming language and a Makey Makey board. The course organizers and instructors helped girls understand the basic programming needed to enable piano keys to change sound, color, and position while responding to different commands. The Laboratory team plans to develop the experience into a standalone online workshop to introduce more girls to programming and engineering. /

LLCipher

In early August, 30 high school students from across the country attended the remote 2020 Lincoln Laboratory Cipher (LLCipher) workshop. This weeklong workshop offered students an introduction to theoretical cryptography while teaching them to build a secure encryption scheme and digital signature.

LLCipher was created in 2015 to provide learning opportunities for students who are advanced in mathematics—some even having completed calculus as early as eighth grade. "LLCipher offers an opportunity for bright high schoolers to learn the basics of an important area that we are enthusiastic about," said David Wilson, a lecturer for the LLCipher program. "It's received positive reviews from students in the past, so we wanted to run an online version of the course again this year if possible."

While the course traditionally is held at MIT's Beaver Works facility, this year LLCipher had to accommodate a virtual setting. Typically, the workshop's curriculum includes hands-on demonstrations and interactive, small-group activities that reinforce basic lessons of classical and modern cryptography; 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 and multiparty computation.

Leading up to the workshop, course organizers—including Chiamaka Agbasi-Porter and DaphneAnn Vessiropoulos—adapted the curriculum to be better suited for presentation over slides, whiteboards, and tablets. Although this year's workshop was missing some of the standard group interaction, it also benefited from the virtual format. Students appreciated the live chat room in which a second instructor was on hand to answer their questions. The chat room allowed students to ask simple questions without disrupting the lecture, and the second instructor could let the primary instructor know of important questions that could be answered more in-depth, said Wilson.

The students' feedback following the workshop was very positive. "Learning cryptography during this program was genuinely transformative—the way schools teach math kills a lot of the fun, but the way that math and theories were presented this week was fun and challenging," said one student who participated in this year's workshop. "I didn't expect to learn so much about cryptography, the math behind it, and its applications in one week, but I am even more excited to delve deeper into the topics that we went over this week! I really appreciate the time and effort the instructors and organizers put into making this program." /

Thirty high school students from across the country participated in LLCipher this year.

This year, 35 students participated in LLRISE virtually. Here, several students presented their final projects to family, friends, and Laboratory staff while demonstrating their new knowledge about radar.

Lincoln Laboratory Radar Introduction for Student Engineers

Now in its ninth year, the Lincoln Laboratory Radar Introduction for Student Engineers (LLRISE) summer course is a two-week radar workshop for rising high school seniors. Typically, participating students stay in dormitories at MIT campus while attending the course on Laboratory grounds, but this year the course was offered in an online format. "Our biggest obstacle this year was definitely trying to translate a program that is so reliant on interpersonal interactions into a virtual environment in a meaningful way," said DaphneAnn Vessiropoulos, who helped to organize the course. "We knew it would be difficult to implement, but LLRISE 2020 was always going to happen in our minds because it is such an impactful program."

The primary demographic for the Laboratory's educational outreach programs such as LLRISE is communities that are underserved and underrepresented in STEM. When reviewing applicants and planning the course content, LLRISE organizers aim to create equity in the classroom for students from different backgrounds. This year, they sent out a survey to see what resources students might need—such as WiFi and a laptop—so that they could work with students and their communities to obtain the equipment needed to excel in the course.

Typically, the students build a small radar. However, to limit the complexity of debugging the radars and for the safety of the students, this year they were sent a simpler radar that had been preassembled by staff. During the workshop, the students conducted hands-on experiments that demonstrated radar fundamentals. For example, one of the exercises required the students to create a small pendulum from an object and string. They let the pendulum swing in front of the radar and created Doppler spectrograms to trace out the speed of the pendulum, and then altered variables such as the length of the string and the height of the pendulum drop to see how the spectrogram changed.

Throughout the course, the students and 12 undergraduate teaching assistants used four primary communication platforms: Zoom for livestream lectures and office hours; the Laboratory's external edX instructional platform for lectures and supplemental material; Piazza as a forum for questions and answers, as well as interactive homework assignments; and Discord to enhance the social aspect of the program between students and the teaching assistants.

Vessiropoulos shared her motivation in organizing LLRISE this year: "There is a sense of pride when you see the students wrestle with complex topics, but eventually succeed. Every year, their final presentations get more creative and innovative! With these young adults performing at such a high level in high school, I can only imagine what brilliant things they'll achieve in their collegiate and professional careers." /

Spotlight:
Computer Science Workshop in Alabama

Students worked in teams to build their own robot during a STEM workshop at East Lawrence High School, Alabama.

Located about 40 miles from the Laboratory's field site in Huntsville, the East Lawrence High School in northern Alabama is an underserved school with limited STEM educational resources. The school has not been able to offer any kind of computer science classes since 2005.

In December 2019, 11 Laboratory staff set out to change that lack by providing an all-day STEM workshop at East Lawrence for students interested in computer science. "The goals of the STEM workshop were to increase student interest in STEM-related career fields; increase pride, communication, and critical-thinking skills; and help students learn coping skills by introducing them into an environment where failure and challenges can be overcome by innovation and determination," said Keith Henderlong, organizer of the workshop.

Henderlong presented the students with an overview of Lincoln Laboratory and its mission. Patrick O'Shea used an interactive trivia game to tell the students about the many STEM-related career opportunities available to the students in northern Alabama. He immediately gained feedback from students who said, "There's a lot more [STEM career] opportunities in my community than I realized."

Spotlight (continued)

Sarah Crews relayed a brief history of influential women in STEM and her own personal story. She was followed by Yari Golden-Castano who shared her personal journey to become a finalist for the Mars One mission.

Next, students and staff engaged in a conceptual activity called "Making a Peanut Butter and Jelly Sandwich," in which students learned about the importance of specifically and logically identifying steps with detail when coding. "This activity helped students learn about the necessity of thoroughness while programming and the concept of debugging through iterative attempts to 'program a computer' to make a sandwich," said Henderlong.

After being introduced to several computer science concepts, students were given a robotics building kit consisting of snap-together parts, digital servo motors, an infrared sensor, a programmable LED light, and a control box. Students programmed their robots either by using the Blockly coding platform or by creating entirely new, custom actions with the Press, Record, Play functions. Staff volunteers presented tips for building the robots, along with specific challenges for the students to work on in the future.

The students enjoyed the experience and were heard saying: "I enjoyed the hands-on aspect rather than the normal class setting"; and "I can't believe I'm actually building a robot"; "This is fun"; and "I can't wait to see our robot in action."

"It's exciting offering STEM instruction to students who have not been exposed to advanced technologies," said Henderlong. "It's our hope that we have encouraged students to pursue their interest in the engineering and science fields." /

Students used prebuilt code to test the movements of their robots.

> "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

G.I.R.L. Cyber Safety Workshop

At the G.I.R.L. Cyber Safety Workshop, middle school girls from Greater Boston met at MIT's Beaver Works facility on 29 February to learn about internet security. The course organizers and instructors—including nearly 20 Laboratory staff members—walked the girls through the fundamental technologies behind the internet, such as encrypted messages and network traffic, and taught them how to protect themselves online. As the event kicked off, the girls participated in a group demonstration that described how messages travel through a network of computers and routers.

They tackled an escape-room experience with four activities that each emphasized a different topic they had discussed earlier in the day: social engineering, lock picking, packet capture investigation, and encryption and code breaking.

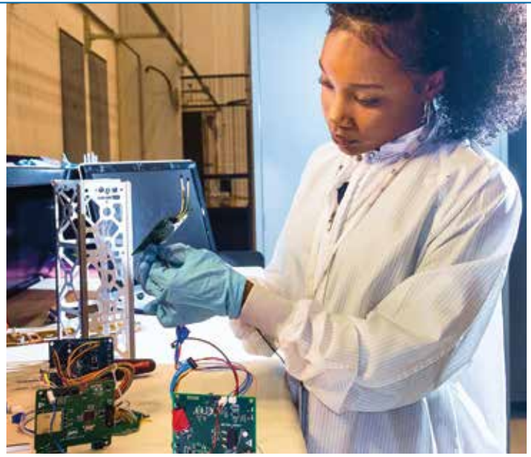
In the social engineering room, students were tasked with extracting information and retrieving sensitive data. They were also given tips to protect their identities on the internet. In the social engineering exercise, Harry Phan embedded a secret hyperlink in his online portfolio for the girls to find through a trail of clues. Each team was excited after discovering the hidden webpage. At the end, the students were humbled when reflecting on the volume of information you can glean about a person through the internet.

At the cyber safety workshop, 26 girls were introduced to an activity that demonstrates how cybersecurity work keeps sensitive data secure when people are communicating through the internet.

A second room contained an assortment of cyber locks of varying difficulties that the girls had to break open while following rules and guidelines of ethics. In the third room, the girls learned about network packet capture, IP addresses, and network traffic capture. To proceed through the room, they had to search packets for usernames and passwords, in the process learning how hackers use these skills to break into unsecured networks to retrieve personal information.

In the final escape room, students were given three riddles to decipher. The first was a message in Morse code that they had to decode; the second was a binary message that had to be converted into hexadecimal code and then into a readable format using an ASCII (American Standard Code for Information Interchange) table; and the third was a message that had to be unlocked using Caesar Cipher, a simple and well-known encryption system.

"The upcoming generations will have little to no say in their digital footprint, whether because of the normality of social media or the digitization of entertainment and media," said Hope Hong, who helped organize and create lesson plans for the workshop. "This makes it even more urgent that these girls grow aware of safe practices and the permanence, as well as the enormity, of the internet." /



High school girls gain hands-on engineering skills through the Girls Who Can program, one seminar of which offers girls the chance to build a CubeSat.

Girls Who Can

In the fall, Laboratory volunteers collaborated with MITRE and Harvey Mudd College to offer three virtual workshops to encourage high school girls to try engineering. On Saturdays from October through December, 66 junior girls learned how to build a CubeSat, how to program a mini autonomous racecar, or how to hack code while learning about embedded security. 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. /

In February, David Maurer led Stoneham Scout Troop 513 on a tour of the Laboratory's Haystack facility to complete the scouts' research into astronomy.

A Girl Scout learns how to file an axle for her self-built derby car while receiving assistance from Allison Norloff.

Scouting

In February, Edward Lyvers and Allison Norloff volunteered to help a Girl Scout troop of Cadettes to build mini racecars for the Powderpuff Derby, the Girl Scout version of the Pinewood Derby. Lyvers and Norloff are preparing to help the troop with two STEM badges: Digital Game Design and Space Science Researcher, which will include building and flying model rockets. Further plans include coordinating a wearable electronics project for the troop. /

Kwajalein Educational Outreach

3D Printing Biocomposites Project

Thomas Sebastian is working with 5th and 6th grade students on a materials science project to develop a cheap method of turning raw coconut husks into a biocomposite material resembling particle board. He is helping young scientists determine the properties and characteristics of coconut husks, and then use the material to make a small model boat. He plans to adapt the process so that the material can be created with a 3D printer. /

Thomas Sebastian explains the process and capabilities of 3D printing to a captivated audience of elementary school students on Kwajalein Atoll.

Coral Reef Nursery

Thomas Sebastian, members of the local dive community, and Kwajalein High School students led by science teacher Matt Gerber are experimenting with coral reef rehabilitation. The centerpiece of the effort is a coral tree nursery they constructed, from which fragments of coral are suspended. The students use various testing methods to encourage new growth in hopes of growing stronger strains of coral. Fragments that demonstrate healthy regrowth will be transplanted to an existing damaged coral reef structure to assist in its recovery. Data-logging buoys (built with the help of Lincoln Laboratory volunteers) are being used to record information necessary to understand ideal coral reef growth conditions. /

Matt Gerber and Thomas Sebastian inspect the coral fragments to select which ones exhibit the best growth. A coral tree nursery project proved to be an innovative learning experience for high school students in an attempt to maintain healthy coral reefs.

Ocean Engineering

Andrew Mack partnered with Kwajalein High School teachers to focus on marine biology, ocean ecology, and engineering activities by having students create and build a data-logging buoy to use for a variety of experiments. Example projects include using a motion-sensing camera to conduct marine life detection; tracking coral growth; monitoring ocean water for alkalinity, temperature, and salinity; measuring tides and waves; and tracking weather patterns, including precipitation, wind speed, and air properties. /

School Lecture Series and Outreach

Laboratory staff also contribute their time and expertise to champion education via different school projects, such as scientific seminars and the Ebeye robotics club. Spencer Johnson leads the Lincoln Laboratory Kwajalein High School Lecture Series, coordinating staff volunteers to give one-hour STEM presentations to high school students. These lectures often pair with the students' current curriculum to provide an in-depth understanding of the real-world use of the scientific concept. /

Laboratory engineers helped high school students design, build, and test special buoys (like the one pictured) that record ocean data for future experiments. Students (at left) are assembling a 3D-printed support structure they designed to hold sensors inside the buoy enclosure.

BWSI student Minnie Snoddy presents her team's project proposal to the students at Kwajalein High School taking the Serious Games BWSI course.

Students from the Kwajalein BWSI 2020 program pose for a photo with instructors from Lincoln Laboratory's Kwajalein Field Site.

Beaver Works Summer Institute: Serious Games in Kwajalein Atoll

In July, the Beaver Works Summer Institute launched a class for high school students on Kwajalein Atoll. The course, Serious Game Development with Artificial Intelligence (AI) (modeled on the BWSI course taught in the virtual program), taught students how to address real-world problems by using game design and artificial intelligence.

Sarah Willis was the lead instructor for the program and explained that many families living at the U. S. Army Garrison-Kwajalein Atoll typically spend their summers traveling to the United States to visit family and take part in other educational programs. However, COVID-19 travel restrictions made it nearly impossible to travel off the island. "We realized at the end of May that we had a unique opportunity to take advantage of our isolation this summer to engage the island students with a rigorous STEM program," said WIllis.

Fourteen students enrolled in the program, which included in-person classes and virtual meetings with Laboratory staff and other instructors. At the completion of the program, the students presented their work at a live poster session. The session had 75 attendees and included friends and family as well as range and garrison leadership.

"On Kwajalein, BWSI provides students with a welcome semblance of normalcy, a unique bonding experience for an already tight-knit community, and an incredible opportunity to make academic advances and explore potential career fields that would otherwise never have been on their horizons," said Willis. "It's been amazing to work with these students and watch them transform and gain so much confidence." Willis and the other instructors plan to offer a BWSI course on Kwajalein again in summer 2021. /

Spotlight:
Beaver Works Summer Institute

This fifth year of the Beaver Works Summer Institute (BWSI)—a four-week hands-on STEM learning experience for rising high school seniors—carried on in a virtual format, offering seven classes to 178 students from 26 states across the country and Canada.

"Even with the virtual format, the students were energized, engaged, and truly committed to their projects," said Jennifer Watson, a coordinator for the program. "Many students not only enrolled in BWSI but also challenged themselves by taking on a new independent study project. We could see them transform into teams of confident, collegial students who were very proud to showcase their accomplishments during the final event."

The classes offered this year were Autonomous RACECAR, Autonomous Cognitive Assistant, Data Science for Health and Medicine, Build a CubeSat, Embedded Security and Hardware Hacking, Remote Sensing, and a new course called Serious Game Design and Development with Artificial Intelligence (AI). The program also offered its first-ever independent project, called pi-PACT, which engaged 176 of the students in developing solutions for automated contact tracing by using BWSI-provided Raspberry Pis.

Lisa Kelley, manager of the BWSI program, said that adapting the hands-on courses into an online format was a challenge. The RACECAR course, for example, delves into the complex field

> "The project has given me confidence that I can complete science experiments from start to finish, including publishing and presenting."
>
> — BWSI STUDENT

Each student in the RACECAR course received a RACECAR Model Nano (shown at left) sent to them with all the supplies needed for the course.

Spotlight (continued)

of autonomous navigation and challenges students to program and race MIT-designed robots. "Despite the course going virtual, hands-on learning remained a key component of the program," said Eyassu Shimelis, an instructor for the course. "Thankfully, a miniature version of the robotic car, called the RACECAR Model Nano, was designed and built with the same sensors and computing capabilities as the original car, and was sent to all 21 students in the course."

Two student interns supporting the program, Matthew Calligaro and Emi Suzuki, created a virtual environment to serve as an alternative in case of hardware difficulties or inadequate experiment space. The virtual environment mimics the hardware so that students could run their code simultaneously within the environment and with the physical cars. "RacecarSim will play a big role in improving the accessibility of our course," said Calligaro. "Students can now complete the entire curriculum with only a computer—greatly reducing a barrier to entry."

Jeffrey Liu taught the Remote Sensing course in which students explored the intersection of data science and disaster response. A field trip to the FEMA Massachusetts Task Force 1 (MA-TF1) Urban Search and Rescue team's facilities had to be rethought, but the team at MA-TF1 provided a virtual tour jam-packed with experts from FEMA and academic partners. Liu said, "We were even able to use a 3D lidar scan of the MA-TF1 field site to explore the facilities."

The new Serious Game Design and Development with AI course taught students how to use game design and artificial intelligence to address real-world problems: for example, a game about zombies could reveal the effects of public health policy

One team in the Serious Games course developed technology for a game that asked decision makers, "Which neighborhood requires the most government assistance during an outbreak?"

on chemical or biological threats. The students had an intuitive grasp of how and why the serious games approach is used, allowing the instructors to focus on the experimental design and translating that into code.

Robert Shin, director of the BWSI program, said that the push to bring the program online has opened up new avenues for making the course materials available to as many people as possible. The BWSI staff plan to package the lectures into bundles that schools and other programs can use and adapt for their own purposes.

"Our mission to teach technical skills as well as a project-based approach to learning made us commit early in the pandemic to run a program this year," said Joel Grimm, Beaver Works manager. "We now have a wealth of recordings that we can use to expand our online prerequisite courses, create asynchronous courses for learners, and expand the number of learners who can use the BWSI projects." /

Lincoln Laboratory scientist Jude Kelly shows children tuning in via Zoom what liquid nitrogen looks like and why it is important to Earth's atmosphere and ecosystem.

Science on Saturday

On 31 October, Lincoln Laboratory's Science on Saturday series resumed in a virtual format. The event, Our Amazing Atmosphere and its Gases, introduced the audience to the different gases that make up Earth's atmosphere and the roles they play. Through the Zoom interface, participants could watch while blocks of dry ice created a dense fog and liquid nitrogen froze common household items. A Laboratory scientist also demonstrated how cryogenically cooled superconductors make magnets levitate mid-air! Participants asked questions via the comments feature in Zoom and received answers from scientists in real time.

December's Science on Saturday event, Curious about COVID, was divided into two parts. In part one, Alan Hsu talked about an epidemiologist's job, explained popular terms used in discussing the coronavirus (such as pandemic, quarantine, herd immunity, and flatten the curve), and offered an online game to test participants' knowledge of coronavirus-related terms. In part two of the event, Lawrence Candell explained how Laboratory scientists quickly built a prototype to perform wide-area digital imaging of a crowd to scan for fevers, and how this prototype is used at the Lincoln Laboratory entrance instead of taking the temperature of each individual entering the building. /

Sarah Willis, Daniel DiBiase, and Jon Schoenenberger set up the MIT telescope on Kwajalein in hopes of capturing the NEOWISE comet. Using the photographic capability of the telescope, the volunteer astronomers were able to capture a photo of the NEOWISE comet as it crossed through the skies above Kwajalein.

Kwajalein Astronomy Nights

Laboratory staff at the Kwajalein Field Site created this program to introduce residents in the community to the wonders of astronomy and astrophotography. Using a Celestron CGX 1100 telescope, Laboratory technical staff have hosted a partial solar eclipse viewing party, community nights, "Ask an Astronomer" sessions with middle and high school students, and initial data collection efforts for a variable star project. /

> “It’s exciting to see students combine their desire to help those facing health inequities with their knowledge of science and engineering to prototype a device or system to help their communities.”
>
> — BETHANY HUFFMAN, HEALTH INEQUITY ENGINEERING PROJECT MENTOR

Capstone Mentoring Project

Lincoln Laboratory volunteers are working with the Greater Lawrence Technical School to mentor student engineers for their junior and senior capstone projects and junior health inequity engineering projects. Beginning in November, 20 mentors from all kinds of backgrounds at Lincoln Laboratory—electrical engineers, mechanical engineers, biotechnology specialists, chemists, business and financial staff—met virtually with students each week to provide guidance and encouragement on students’ projects.

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. Mentorship will continue through the end of May 2021, and the program will culminate in a presentation of the capstone projects. /

Lincoln Laboratory scientists volunteered at John D. O’Bryant’s Science Fair early in February to evaluate projects like the one shown above, investigating chemistry in robotics.

Science Fairs

Typically, Lincoln Laboratory technical staff members support several area high schools by volunteering as judges for each school’s science fair. Many schools were closed in the spring to protect children from the coronavirus; however, in early February, Aaron Rodriguez, Alice Lee, and Donato Kava assisted as judges for a science fair at the John D. O’Bryant School of Mathematics and Science in Roxbury, Massachusetts. /

Cardinal Works

Based on the Beaver Works program that offers a RACECAR course as part of its Beaver Works Summer Institute, the Cardinal Works Program at Madison Park Technical Vocational High School in Roxbury, Massachusetts, was developed and held in February. Sixteen students attended from Madison Park Technical Vocational High School and John D. O’Bryant School of Mathematics and Science, both in Roxbury, Massachusetts.

In the virtual course, students learned not only techniques to program a mini racecar, but also an important lesson in teamwork when a camera software problem outside the scope of the course was solved in real time by a community of software developers. Program coordinators learned that the students need to work more than once a week to retain and reinforce newly learned skills. However, the course was such a success that the school is planning to convert this Saturday course to an elective in the school’s curriculum and to host a course for middle school students in Roxbury. /

Cardinal Works’ virtual RACECAR course culminated in a summer outdoor race during which students verified the progress of their racecar via laptop.

Students in Roxbury schools built autonomous cars using complex engineering concepts. Once remote learning began, the students continued to help each other troubleshoot coding and building problems.

Spotlight:

WCVB-5 for Good: Boston students learn to program autonomous cars while remote learning

MIT helps Madison Park Technical Vocational High School with STEM curriculum

BOSTON, May 19, 2020— Michael Berger explained what it takes to get an autonomous vehicle moving.

"We have a little network," he said. "One computer, one router, one car."

Berger is a teacher at Boston's Madison Park Technical Vocational High School. He is planning a special delivery for students who are part of a STEM program at the school: small programmable cars.

"I'm going to be delivering the cars, and they'll be finishing the cars in the next two weeks," Berger said.

The students will be getting virtual lessons in how to write code to program the cars to run on their own and complete certain tasks.

Michael Berger, a teacher at Madison Park High School, helps students learn the basics of programming an autonomous system.

Spotlight (continued)

Kevin McCaskill, the executive director at Madison Park, described the benefits of students learning from hands-on engineering projects.

The STEM program started at the Massachusetts Institute of Technology as a summer course for high school kids five years ago. That program is part of the Beaver Works Summer Institute. Lisa Kelley helps run Beaver Works.

"If you play instruments or you're in sports, there are tons of programs out there," Kelley said. "If you're interested in STEM, there's not that many extracurricular activities."

After noticing less interest from local students in their summer program, Beaver Works started reaching out to Boston-area schools to encourage students of different backgrounds to engage in STEM learning.

Kevin McCaskill, the executive director at Madison Park, said he embraced the idea.

"Why not get our students involved in this emerging technology right in high school," McCaskill said. "I think this creates a great opportunity, especially for underserved populations that we serve."

Madison Park teachers were trained by the Beaver Works experts from MIT and in January started their own program at the high school. Just a couple of months later though, COVID-19 forced them to switch to remote learning.

"We really felt that there was enough interest from the student body as well as the staff to continue this and really see if we could grow it big," McCaskill said.

Once the students get their cars, they will be writing code to program them. Berger said his students have been successful so far.

"The most amazing thing that I've seen with this is that the kids teach each other," Berger said. "That kind of peer-to-peer learning is what we're looking for, and it can happen in a remote situation." /

> "The BWSI RACECAR program has proven to be an extremely effective way to teach complex engineering concepts. Students who complete the course are confident in their own ability to work with all the technology components used by an autonomous vehicle, from sensors to software."
>
> — JAMES SPROUL, TEACHER AT MADISON PARK TECHNICAL VOCATIONAL HIGH SCHOOL

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

> "I felt very supported and mentored at the Lab. My mentor, Tyler Kaczmarek, was always open to any research ideas that I had and allowed me to explore those ideas, which ultimately gave me confidence in myself as a researcher."
>
> — SHAMARIA ENGRAM, INTERN IN SECURE RESILIENT SYSTEMS AND TECHNOLOGY GROUP

Shamaria Engram, while a PhD candidate at the University of South Florida (USF), interned at the Laboratory through a National Science Foundation graduate research fellowship. In 2020, she made history as the first Black woman to graduate from USF's computer science and engineering doctoral program. Photo: WFLA.

Technical Group Internships

Each year, the Laboratory hires undergraduate and graduate students from top universities as interns in the Laboratory's technical groups. These internships allow students to work alongside experienced technical staff members and to immerse themselves in projects critical to national security. The interns gain practical experience and skills in their fields of interest, and many go on to be hired as full-time employees at the Laboratory. In 2020, the Laboratory hired 63 undergraduate and graduate students to work as interns. Because of the COVID-19 pandemic, the interns worked remotely in accordance with public health recommendations. /

> “Through Lincoln Laboratory, I’ve been able to learn so much! I’m excited to see what else I get to learn and experience.”
>
> — JOHN ALLING, FORMER LINCOLN LABORATORY CO-OP AND SUMMER INTERN

While an undergraduate student at Northeastern University, John Alling did two six-month co-ops and a summer internship at Lincoln Laboratory, working on air traffic control systems, navigation systems, and unmanned aerial vehicles.

Worcester Polytechnic Institute Major Qualifying Project Program

Each year, students work as Laboratory interns under Worcester Polytechnic Institute’s Major Qualifying Project Program, which requires students to complete an undergraduate project equivalent to a senior thesis. Under this program, students participate in Laboratory work that is applicable to their senior projects, learning to apply their skills and knowledge to problems typical of those encountered in industry. /

University Cooperative Education Program

Technical groups at Lincoln Laboratory employ students from area colleges under cooperative education arrangements. The students work full time with mentors during the summer or work/study semesters and part time during academic terms. For the past 30 years, Lincoln Laboratory has had a partnership with Northeastern University, hiring more than two dozen students as interns during the summer and the school year. Students from the College of Computer and Information Science and from the College of Engineering gain valuable skills as they work with hardware, learn software, develop prototypes, and practice teamwork and communication while working on engineering projects and the administration of computer systems. /

Spotlight:

Northeastern University Co-op

Northeastern University School of Criminology and Criminal Justice | 10 October 2020

Danielle Mahn, a student at Northeastern University’s School of Criminology and Criminal Justice, worked at the Laboratory as a co-op in the Security Services Department.

Tell us about your co-op.
I’m a Security Services co-op at MIT Lincoln Laboratory located in Lexington, MA. My co-op is set up in a rotational schedule, where I work with different sectors of the Security Services Department, either performing administrative tasks or assisting employees with technical tasks. The co-op rotates around from Government Security (Visitor Services, Personnel Security), Physical Security (Alarm Control, Security Applications and Systems Team), Industrial Security, Information Security (Forensics Analysis Center), and Special Programs. All to say, my day-to-day varies and my entire job function changes every 5 weeks! I am given many side projects from all the functional areas, so I have time to perform independent work too in the afternoon. Mainly, these tasks come in the form of audits and whatever technical strengths and interests you have (PowerPoint, Excel, Linux, etc.). I enjoy this co-op immensely due to the career prospects, ever-changing environment, and positive culture, even during COVID!

The functions of the Lab’s technical departments are highly sensitive, so all security personnel (including the co-op!) have to maintain a government security clearance. This clearance stays with you for many years and can be transferred from the Lab to other government contractors, research centers, or agencies. Many agencies consider the clearance to be a major leg up in the job hunt, so it’s a huge plus. Still, tons of co-ops have pursued careers at the job, and I have worked with over 5 former co-ops since I started in July.

How has this co-op impacted you personally?
Since starting, I can honestly say this co-op has significantly altered what I want to do after graduation. I have learned a ton about government security and general security administration, how to become a cyber security professional without the bachelor’s degree, and so much more. I now am pursuing a summer job (2021) at the Lab in Information Systems Security, a field I never thought I’d go back to after disliking computer science at Northeastern.

What was your biggest takeaway from this co-op?
My biggest takeaway is that you don’t need to know exactly what job you want, but you should consider what you want to try in the next five years and go from there. I realized that there are thousands of jobs out there that could fit what you think you want to do, but you just don’t know about them yet. Once you break through to the field you feel is home, the possibilities are endless. /

Spotlight:

Researchers Partner with Penn State Students and Amazon to Tackle Disaster Response

It's easy to distinguish a lake from a flood. But when looking at an aerial photograph, factors like angle, altitude, cloud cover, and context can make the task more difficult. This is especially true when needing to identify 100,000 aerial images in order to give first responders the information they need to accelerate disaster response efforts.

With a constant supply of low-altitude disaster imagery and satellite imagery coming online, researchers are looking for faster and more affordable ways to label this content so that stakeholders such as first responders and state, local, and federal agencies can use it. Machine learning (ML) models that can automate image labeling (or annotation) are critical to bringing this data into a more usable state. However, in order to develop an effective ML model, researchers need labeled data sets that they can use to train it.

An array of organizations and agencies are developing solutions to this lack of data sets issue. One such project is being led by the Laboratory in partnership with Amazon and students from The Pennsylvania State University. They are developing a computer model that can improve the classification of disaster scene images and inform disaster response.

Labeling aerial photographs, like the one at left, is a critical process that aids disaster response. Penn State University students and Lincoln Laboratory researchers developed a computer model that improves the classification of disaster scene images. The photo below, consistently mislabeled by commercial computer vision services, shows severe flooding in the Midwest.

Spotlight (continued)

This project began with an analysis of imagery from the Low Altitude Disaster Imagery (LADI) data set, a collection of aerial images taken above disaster scenes since 2015. Based on work supported by the U.S. Air Force, the LADI data set was developed by the Laboratory and the New Jersey Office of Homeland Security and Preparedness, with support from the National Institute of Standards and Technology's Public Safety Innovation Accelerator Program (NIST PSIAP) and Amazon Web Services (AWS).

Following the release of the LADI data set, the researchers used Beaver Works funding to support a collaboration with Penn State senior capstone students in order to develop baseline classifiers and tutorials for the LADI data set. The students built computer vision models based on convolutional neural networks to classify images based on the LADI training data set. Their code and models are now being integrated into the open source LADI project as reference materials, which are available on GitHub.

"During a disaster, a lot of data can be collected very quickly," said Andrew Weinert of the Surveillance Systems Group who helped facilitate the project. "But collecting data and actually putting information together for decision makers is a very different thing."

Currently, the Laboratory and Amazon are working on further improving the performance of the classifiers built on the LADI data set. As one example, they were featured in the 2020 NIST TRECVID competition for the Disaster Scene Description and Indexing (DSDI) task, which Jeffrey Liu of the Humanitarian Assistance and Disaster Relief Systems Group helped to coordinate. For the task, nine teams from around the world were challenged to test the classifier using real-world, natural disaster data.

The motivation for co-organizing the task was to raise awareness of the LADI data set and the problem of disaster image identification from low-altitude aerial perspectives; to evaluate the performance of the current LADI data set to identify strengths and weaknesses to inform future versions; and to gather new ideas and community feedback for tools, models, and use cases for the data set.

"I feel like the task was very successful in accomplishing these goals," said Liu. "Teams from both academia and private industry participated and presented diverse approaches to the task. We learned that models built on the current version of LADI were capable of identifying water and flooding damage, buildings, and roads, with the winning teams achieving mean average precision scores above 94, 86, and 82 percent, respectively. There were also categories where performance was poor, indicating that the data set requires additional training data for those labels. Finally, we learned a lot from the various techniques, architectures, and resources that were used to improve the performance of the various submissions."

The Amazon and Laboratory team are also putting together a workshop that enables a broader group of researchers to leverage the LADI data set to train classifiers using Amazon's data-labeling service called SageMaker Ground Truth.

"We just finished up a two-day 'Data Lab' with AWS engineers on how to commercialize and design a deployable architecture that ingests new LADI data and runs an evolving computer vision classifier," said Weinert. "The workshop is still in the formulative stages, but the concept is to make available this complete architecture as a risk reduction for others to start working on the disaster response problem and LADI data set." *Originally published by Amazon Web Services and adapted for Laboratory use.*

MIT Independent Activities Period

Each January in the four weeks between academic semesters, MIT runs the Independent Activities Period (IAP), which is a program of for-credit classes for registered MIT students and non-credit activities open to all members of the MIT community. These IAP classes may span the full four weeks or a limited number of days, and range from academic classes to hands-on engineering projects to artistic pursuits. Lincoln Laboratory technical staff led the following activities offered during MIT's 2020 IAP:

Build a Small Radar System—In a hands-on workshop, participants created laptop-based radar systems capable of forming range, Doppler, and synthetic aperture images.

Free-Space Laser Communication—Students applied principles of lasers and optical components, communication link design, and analog and digital modulation to build their own free-space laser communication system.

Hands-on Holography—Participants learned the physics behind holographic images and produced both computer-generated and traditional optical holograms.

Mission-Driven Technology Transfer: Perspectives from MIT Lincoln Laboratory—The Laboratory's Chief Technology Ventures Officer led a discussion on the dynamics of transitioning technology developed for specific missions.

Practical High-Performance Computing: Scaling Beyond Your Laptop—With access to the MIT Supercloud, participants explored ways to utilize the high-performance computing environment.

Software-Defined Radio—After an introduction to the fundamentals of software radios, students undertook projects—for example, FM radio receivers and digital video transmission—that demonstrated the flexibility of software radios.

The IAP Build a Small Radar class is seen here with their instructors and the "coffee can" small radar systems they built and tested. In 2020, the course attracted its maximum enrollment of 30 participants.

MIT Undergraduate Research Opportunities and Practice Opportunities Programs

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

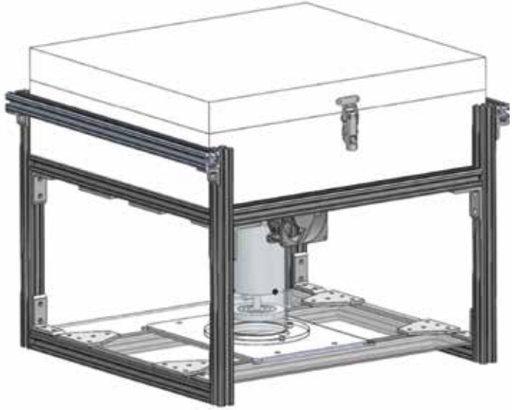
MIT Lincoln Laboratory Beaver Works

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.

Two unique capstone projects were undertaken by undergraduate students in the Engineering Systems Design and the Engineering Systems Development courses offered by the MIT Department of Mechanical Engineering in conjunction with Beaver Works. One team designed a variable-temperature cryo-cooler, and a second team developed a fast underwater glider.

The cryo-cooler addresses a need that medical facilities in remote locations face: how to keep biological samples collected onsite cold enough to preserve until they can be delivered for analysis in a fully equipped biolab. The team that designed the underwater glider was exploring a cost-effective method to collect water samples from beneath the sea's surface. Students in the 2020–2021 capstone course are currently working on developing a long-endurance system based on the glider team's design and concept. /



The illustration shows the basic design for the variable temperature cryo-cooler.

MIT 6-A Master of Engineering Thesis Program

Students in MIT's 6-A Master of Engineering Thesis Program spend two summers as paid interns at Lincoln Laboratory, contributing to projects related to their studies. Mentors are matched with students in order to relate the scientific and engineering principles from the classroom to engineering problems in industry. While working as research assistants, the students develop their Master of Engineering theses under the supervision of both Laboratory engineers and MIT faculty. In 2019–2020, eleven 6-A students participated in the program, gaining experience in design, development, research, and programming. /

MIT Assistive Technologies Hackathon

The MIT Assistive Technology Hackathon (ATHack) is an annual hackathon event that challenges participants to develop prototype assistive technologies. Community members living with disabilities (called co-designers) are paired with groups of students (called hackers) to design and build prototypes that each serve a specific purpose for the co-designer.

The hackathon was founded in 2014 by then MIT undergraduate students Jaya Narain, Ishwarya Ananthabhotla, and Abigail Klein, and Lincoln Laboratory staff are also involved in planning and supporting the event. The goal of the hackathon is to promote interest and innovation in assistive technology by building connections within the community and fostering collaborative projects to create inclusive technology.

Alex Rosenberg, a co-designer from Milton, Massachusetts, returned for his second year as a hackathon hacker to help his teammates build a heated blanket that would allow his co-designer to enjoy outside activities. Photo: MIT ATHack.

The 2020 ATHack drew 75 participants on 16 teams. Some of the innovative technologies developed for the hackathon included an anti-tipping wheelchair; a semiautomatic Braille embosser; a cane that uses LED lights for better visibility; an automated window jack; and a Bluetooth-enabled ukulele that can be played with one hand. Many teams continue to work on their initial designs after the hackathon, and some projects go on to become widely usable devices. One of this year's co-designers, Adriana Mallozzi, turned her project from the 2015 hackathon into a full-fledged assistive technology startup called Puffin Innovations. /

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. /

> "The goals of the program broadly are to spread awareness [about disabilities and assistive technology needs], foster connections, and provide students a new context in which they can apply their skills. We think that ATHack has gotten more students engaged in this space."
>
> — JAYA NARAIN, MIT ATHack CO-FOUNDER

Spotlight:

Lincoln Laboratory Staff Awarded West Point's Public Service Commendation | 5 June 2020

Edward Londner, an associate staff member at Lincoln Laboratory, instructed courses at the West Point military academy and helped cadets develop their skills and projects.

The United States Military Academy at West Point awarded Edward Londner, an associate staff member in the Laboratory's Air Traffic Control Systems Group, the Public Service Commendation Medal for having a lasting positive impact on the quality of systems engineering education at the academy.

Londner worked for West Point's Department of Systems Engineering from fall 2018 to spring 2020, where he taught two introductory courses and advised senior cadets on their capstone projects. He also worked on two projects designed to improve the quality of cadets' technical writing and presentation skills.

"The first project was to rewrite the department's technical communications guide, which was around 20 years old," Londner said. "A lot of the guidance I included in that document came from my experience writing papers and giving seminars at the Laboratory. The second project was to create a new communication assessment technique meant to help motivate cadets to improve their technical communication and to help instructors provide them with feedback."

Londner finished an experiment on that technique and is working with a team of instructors to publish the results. /

> "West Point is a fascinating and impressive place, and I am proud that I was able to make a positive difference there. I am also grateful that my department valued my contributions enough to recognize me for them. I hope that the Laboratory continues to send staff to West Point to gain teaching experience and learn about Army culture."
>
> — EDWARD LONDNER, TEACHER AT THE U.S. MILITARY ACADEMY AT WEST POINT

Military Fellows Program

Every year, the Military Fellows Program offers military officers pursuing graduate degrees or advanced education the unique opportunity to engage in R&D at the Laboratory. Fellows are directly involved in developing capabilities important to national security, and in turn, Laboratory staff benefit from the officers' unique insights. Since the program's start in 2010, more than 310 fellows have worked alongside Laboratory staff mentors. In fall 2020, the Laboratory welcomed 26 military officers from the U.S. Army, Navy, and Air Force.

Because of the COVID-19 pandemic, the program's 2020 cohort conducted their work remotely. "Most of the challenges to the Military Fellows Program this year fell on the Lincoln Laboratory supporting staff, who once again rose to the occasion by joining the fellows in a remote way and providing them with the tools and equipment they needed to function effectively," said Robert Loynd, Lincoln Laboratory Executive Officer and Chief of Staff.

Despite the program's modified work model, the fellows acquired valuable skills and experiences that they would not have been able to attain elsewhere. "I liked being able to get my hands on actual data because the data we get for homework and class assignments are already clean, which is unrealistic. Going through data processing with my group was a highly useful exercise as a result," said U.S. Army Second Lieutenant Charlson Ro, who worked on a part production scheduling project in the Laboratory's Air Traffic Control Systems Group. Ro hopes to transition to the Army's Functional Area 49, Operations Research/Systems Analysis, and said his time at the Laboratory would help him gain practical experience in using analytical tools vital to his job.

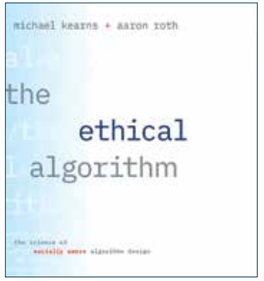
> "Knowing that I have only been exposed to a fraction of the Laboratory, I have gained a deeper appreciation for its mission and its people."
>
> — SECOND LIEUTENANT CHARLSON RO, MILITARY FELLOW

U.S. Army Second Lieutenant Charlson Ro, a student in the MIT Sloan School of Management, analyzed technology development timelines for the Air Traffic Control Systems Group.

> "While I am quite literally just starting my military career, I am sure that the education, technical expertise, and mentorship that I am receiving as part of this fellowship will be invaluable to me."
>
> — SECOND LIEUTENANT ALBERT THIEU, MILITARY FELLOW

U.S. Air Force Second Lieutenant Albert Thieu developed error mitigation procedures for the Agile Micro Satellite project in the Applied Space Systems Group.

U.S. Air Force Second Lieutenant Albert Thieu, an aerospace engineering student at MIT, contributed to the Agile Micro Satellite project, which aims to demonstrate a CubeSat's ability to change orbit. Successful demonstration of this capability would be a big step toward preventing satellite collisions and detection by adversaries, ultimately improving the survivability of satellites. Thieu not only was excited to work on a groundbreaking project, but also believed the Military Fellows Program would benefit his future as an Air Force pilot and the military service as a whole. "For the service, it provides more avenues for technical and organizational innovation at the lowest levels. For myself, I think it will provide me with the skills to contribute in Air Force and general scientific research both during and after my piloting assignments," he said. /



In July 2020, Michael Kearns (left), a professor in the Computer and Information Science Department at the University of Pennsylvania, presented a seminar about how to design algorithms that adhere to human ethics and social norms. Photo: University of Pennsylvania

Technology Office Seminars

The Technology Office directs a program of seminars presented at the Laboratory by both in-house speakers and researchers from universities and industry. The seminars are chosen to reflect current and leading-edge trends in today's technology. The speakers are renowned in their respective fields. All seminars are meant to spark curiosity, creativity, and collaboration.

Highlights of the 2019–2020 program include the following seminars:

"Active Learning in Risky Environments: Exploring Deep Sea Volcanoes and Ocean Worlds," Prof. Brian Williams, MIT CSAIL

"Image-to-Image Translation," Dr. Jan Kautz, VP of Learning and Perception Research, NVIDIA

"Elections Security," Prof. Ron Rivest, Institute Professor, MIT

"Swarms of Small, Flying Robots," Vijay Kumar, University of Pennsylvania

"Mars Cube One," Dr. Andrew Klesh, NASA Jet Propulsion Laboratory

"Solar Climate Intervention," Kelly Wanser, Executive Director, SilverLining

"The Ethical Algorithm," Prof. Michael Kearns, University of Pennsylvania

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 2019 through 2020, 17 employees participated in the program. /

Part-Time Master in Business Administration Program

The Part-Time Master in Business Administration (MBA) Program was established by a team of Laboratory senior business leaders in 2017. The creation of the program was prompted by the need to develop stronger business leaders who can bring insight to the Laboratory in the areas of finance, program planning and analysis, financial reporting, and management. Participants continue to work at the Laboratory while pursuing their MBAs in a shortened time frame and with financial support. In 2020, three Laboratory employees participated in the MBA program. /

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. In 2020, 14 staff members were enrolled in the program. Almost 200 staff members have pursued full-time technical graduate work through the Lincoln Scholars Program. /

IEEE Boston Reliability Chapter

The Laboratory encourages its employees to participate in professional societies. The Boston Chapter of the IEEE Reliability Society holds events yearlong to let members discuss aspects of reliability engineering, such as technology design, manufacturing, and testing. Every month during the academic year, the chapter coordinates a networking event with presentations about topics in engineering, and once or twice a year, it holds a tour of a local company. Since 2012, the Laboratory has hosted most of the chapter's monthly meetings. Because of the COVID-19 pandemic, the chapter continued to hold its meetings online throughout 2020. The attendance levels at these meetings were the same as—and sometimes even exceeded—those of pre-pandemic, in-person meetings. /

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.

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

Gregory Spitz, site manager at the Experimental Test Site, looks on as students identify parts of a donated computer.

Socorro High School Computer Donation

Laboratory staff from the Experimental Test Site (ETS), located on the White Sands Missile Range—which operates multiple telescopes for Laboratory technology demonstrations and experiments—are donating outdated, surplus equipment, including computers and monitors, to the nearby Socorro High School in Socorro, New Mexico. The goal of the donation is to help remediate the lack of adequate computer equipment in the school and, ultimately, to improve the students' proficiency in computer science, math, and science. Students in the Socorro schools are now using the donated computers and monitors to access the internet and augment class instruction. Older computers are being disassembled and used in electronics classes.

These donations, in addition to helping the local educational system, save the Laboratory money in shipping and storage costs associated with traditional surplusing of equipment, which used to be done through Lexington.

"Many public schools, particularly in small towns, have limited budgets to provide modern computer hardware for robotics, information technology, computer science, etc.," said ETS site manager Gregory Spitz. "Some students have never seen the inside of a computer. The experience can be very enlightening for them and sometimes can even create a spark. That's what we're hoping for." /

Spotlight:

Kwajalein and COVID-19

Telehealth Support for Ebeye

One of the many ways COVID-19 has had an impact on life on the Marshall Islands is access to healthcare. The Ebeye Hospital has limited medical specialist capabilities. Travel restrictions caused by COVID-19 have inhibited medical missions and training opportunities for the foreseeable future.

A research and outreach team led by Thomas Sebastian believes that providing telemedicine and remote training may significantly improve healthcare access and quality for the Marshall Islands. The team thinks that cellular devices paired with tablet devices could enable secure and reliable medical consultation and training with specialists outside of the Marshall Islands. The team plans to use this project as a pathfinder effort linking MIT Medical and other medical staff with Ebeye Hospital to provide remote support and explore the distribution of capability to other islands.

Health services in the Marshall Islands could be greatly improved by Laboratory engineers' installation of telemedicine capabilities at the hospital in Ebeye.

Spotlight (continued)

Island COVID-19 Prevention and Seamstress Training

In August, the Laboratory donated sewing equipment and materials to residents of Ebeye Island in the Kwajalein Atoll to make face masks to help with COVID-19 prevention. The donation is the first step in a program designed to equip women with vocational training opportunities while promoting health on Ebeye.

Thomas Sebastian, coordinator of this project, said, "We wanted to do something to invest in the people of the Marshall Islands." Sebastian spoke to local seamstresses and then developed a solution to increase efficiency in sewing masks. He 3D-printed sewing machine jigs to hold fabric pleats in place while others produced the masks.

Upon hearing that Ebeye could not get materials to make masks, Sebastian donated large boxes containing rotary cutters, fabric-cutting boards, elastic straps, and enough bolts of high-quality fabric suitable for making more than 4,000 masks. /

> "There is a focus here [with seamstress training] on female empowerment. This project has the potential to become something good."
>
> — THOMAS SEBASTIAN, SCIENTIST/OUTREACH ORGANIZER

Ebeye residents joined a training session to learn how to sew face masks. The session was part of a larger program to give vocational training opportunities to women while also promoting health. Photo: Jessica Dambruch

From left to right, Lisa Basile, Scott Hamilton, and Graham Baker represent Lincoln Laboratory at the Lexington Education Foundation's annual Trivia Bee, while subtly recommending a technical career path.

Lexington Education Foundation

In November 2019, a team from the Laboratory participated in Lexington Education Foundation's (LEF) 24th annual Trivia Bee held at Lexington High School. The team, called Bee an Engineer, included Graham Baker, Lisa Basile, and Scott Hamilton. Farzana Khatri served as a judge and wrote questions for the science and technology categories.

For the event, 43 teams were grouped into six "swarms" and the teams in each swarm were challenged to answer six questions. The winning team from each swarm participated in a final round to claim the "Master of Trivia" title and trophy. The teams consisted of members from the community, including teachers, school and central office administrators, parents, local business owners and employees, volunteers, and high school students.

"Our team answered five out of six questions correctly, but unfortunately did not advance to the final round," said Basile, "but we had fun representing the Laboratory at the Trivia Bee."

This was the team's second year participating in the event, and they look forward to competing next time the event is held. This year, the event raised more than $12,000 to support grants for Lexington Public School educators that enable innovation in teaching and learning. /

Sean Gibbons (left) and Christopher Gibbons (right) hold armfuls of donated coats and scarves to benefit shelters for the homeless in Boston.

Warm Hands/Warm Hearts Winter Clothing Drive

To help the most vulnerable members of our community, Christopher Gibbons started a "Warm Hands, Warm Hearts" winter apparel and accessories drive in October. "The value of a clean, warm pair of socks is often overlooked, but to Boston's homeless population this item is a luxury," said Gibbons. Warm Hands, Warm Hearts is an easy and affordable way to provide safety, comfort, and dignity to Boston's homeless during challenging times and weather. The donations were distributed through Friends of Boston's Homeless, an organization that conducts many outreach opportunities directly benefiting Boston's shelters. /

Heart Walk

All year long, the Laboratory's Heart Walk team, helmed by Susan Curry and Sandra McLellan, holds a variety of fundraisers to support the American Heart Association's Heart Walk. Through several bake sales, yard sales, and craft sales, the five-person team raised $2,485. Because almost half of those hospitalized with COVID-19 are stroke survivors or people with heart disease, the American Heart Association is using the funds raised in this year's Boston Heart Walk Digital Experience to fast track research and train frontline workers while continuing the fight against heart disease and stroke. /

Sandra McLellan, Susan Curry, and Evelyn Mann joined each other for the Boston Heart Walk Digital Experience, in which participants walked locally during October 19–24, joining one million walks from across the nation in spirit.

Terri Welch, center, takes a break with her family while participating in the virtual Walk to End Alzheimer's. The Welch family chose to walk at Horn Pond in Woburn, Massachusetts.

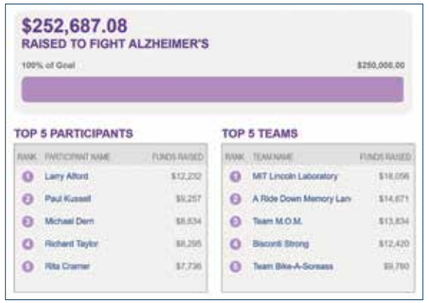
Walk to End Alzheimer's

Lincoln Laboratory has participated in the Walk to End Alzheimer's for 12 years, but this year marked the first time the event was held virtually. On 27 September, the 15 members of the Alzheimer's team walked locally and then convened online to raise $21,036, placing the team third in the regional fundraisers. /

> "This year, the Walk was everywhere — every sidewalk, track, and trail. While we couldn't gather at a large in-person event, I walked in my neighborhood, while others walked in theirs. We still supported each other, albeit apart."
>
> — TERRI WELCH, CO-ORGANIZER OF THE LABORATORY'S WALK TO END ALZHEIMER'S TEAM

Ride to End Alzheimer's

Like the Walk to End Alzheimer's, this year's Ride to End Alzheimer's was virtual. In place of the official ride that would have taken place in Rye, New Hampshire, team members did individual bike rides on their own in a location of their choice. The nine-member Lincoln Laboratory team raised $18,056, exceeding its goal of $15,000. The overall Ride to End Alzheimer's event raised more than $250,000 for the Massachusetts and New Hampshire region. /



Lincoln Laboratory's Ride to End Alzheimer's team was the top fundraiser for the event.

Shelly Hazard organized a bake sale to help fund the Torch Foundation in their mission to transform teens into self-confident leaders.

> "The current class of 13 students represented 7 countries, 5 languages, and 6 time zones! This center is truly unique in what it achieves and is transformational."
>
> — SHELLEY HAZARD, BAKE SALE ORGANIZER, TORCH FOUNDATION SUPPORTER

Torch Foundation

In February, Shelley Hazard hosted a bake sale to support the efforts of the Torch Foundation, which supports teens by teaching them self-awareness, confidence, resilience, and responsibility through the structure of transformational leadership training based in emotional intelligence practices. The Torch Foundation receives clients through businesses, therapists, and family members who want to help a person work through what is holding them back from moving their life to the next level. The $428 raised will help educate teens about healthy ways to handle their emotions and will provide them with dedicated coaches and a team of peers to support them in building stronger, healthy relationships and success in their lives. /

Autumn Escape Bike Trek

The Autumn Escape Bike Trek—typically a one- to three-day tour across Cape Cod, Massachusetts—was virtual this year, but the six team members rode the Cape Cod rail trail while wearing masks and practicing social distancing. Participants of the Autumn Escape Bike Trek were challenged to ride either 35 or 60 miles between 21 and 27 September. The Lincoln Laboratory team ranked #5 in the top fundraising teams for raising $5,292 that will be used to research ways to combat diseases such as lung cancer and asthma. /

Cyclists from Lincoln Laboratory participated in the Autumn Escape Bike Trek to support the American Lung Association.

Hunstville Holiday Outreach

This year, the staff at the Lincoln Laboratory field site in Huntsville, Alabama, supported the Kids to Love Foundation over the holiday season. The Kids to Love Foundation is dedicated to meeting the immediate needs of foster children. The foundation fills more than 1,700 Christmas lists for foster children in South Tennessee and North Alabama. The Huntsville staff raised $400 and collected donations so that specifically requested items could be purchased for foster children in the area. /

> “Each year, we try to find ways to give back to our community. Even though we are a small group, there is so much we can do to help our local community!”
>
> — DENISE DECOSTER, HUNTSVILLE FIELD SITE STAFF MEMBER

TeamWalk for CancerCare

Each spring, a team of Laboratory staff and friends walk three to six miles in downtown Lowell, Massachusetts, to support Lowell General Hospital’s TeamWalk for CancerCare. This tenth year was held virtually so that funds could be raised to support local cancer patients and their families, yet keep all participants safe and healthy. The 12 team members all walked at different times with their families in order to adhere to social distancing guidelines. Team Nick, led by Julie Arloro-Mehta, after whose father the team is named, raised $2,300 to help those stricken with cancer. /

Many people from the region chose to participate in TeamWalk for CancerCare in spite of the pandemic, and walked at a time and location of their choice.

Toys for Tots

The Toys for Tots donation drive has been a fixture at Lincoln Laboratory for more than 20 years, and the volunteers organizing this toy drive were determined to host it this year as well. “Giving this holiday season is even more important now, with so many people in our community affected by the pandemic,” said Susan Curry. She and Karen Grasso, Guadalupe Cabrera, and the entire Enterprise Applications Team gather donations of toys from the Laboratory community and deliver them to distribution centers in Middlesex and Essex Counties. There, local organizations pick up the toys and take them where donations are needed most. After a big donation was picked up, Susan Curry said, “Not only was I surprised by the amount of toys for this year, but people working remotely donated $600 to a web page for the cause. The Laboratory community is the best!” /

Many boxes of toys were donated this year for children who would not receive a present otherwise.

Pan-Mass Challenge

Lincoln Laboratory has participated in the Pan-Mass Challenge (PMC) for seven years, and this year was no exception. The annual event was dubbed "PMC Reimagined," as it was redesigned to accommodate social distancing during the pandemic. Participants were asked to honor PMC2020 however they could: indoors, outdoors, solo, or as a group. Kim Hebert, who has participated in the event for 13 years, said, "We missed the camaraderie and support of everyone along the way, but it was important to retain this fundraiser to fund the fight against cancer." The three team members, who included Joseph Connors, Kim Hebert, and Craig Perini, separately rode their own respective routes, but rode hundreds of miles combined, and, in doing so, raised $17,870. /

The COVID-19 pandemic did not stop the Laboratory team from participating in the Pan-Mass Challenge. This dedicated group rode their required miles at their own time and location in order to ensure everyone's safety.

Emily Hayner, daughter of a Lincoln Laboratory employee, organized a fundraiser specifically for COVID-19 affected families in her local area. The Laboratory community helped raise funds for this Eagle Scout project.

Eagle Scout Award

Emily Hayner is a member of a Boy Scout troop that is open to all genders. As her Eagle Scout Project, the Laboratory community helped Emily raise $7,750 to help buy holiday gifts for families affected by COVID-19. She wanted to help Leominster, Massachusetts families who have lost jobs, contracted the coronavirus, or lost a loved one. She worked in cooperation with a church and a team of her friends in buying and organizing presents and gift cards, and distributing them to families identified by the church as being in need. /

Support Our Troops

After taking a short break at the beginning of the pandemic, Lincoln Laboratory's Support Our Troops program continued operations mid-year after it was confirmed that health and safety guidelines for shipments were being met. Soldiers stationed overseas were also affected by the worldwide pandemic, and needed cleaning and sanitizing supplies just as people did here at home. After initial shipments of supplies needed to keep troops safe from the coronavirus, the organizers of the Support Our Troops program continued the annual shipment of Halloween candy, followed by holiday cards, seasonal items, and letters of support.

The Laboratory's team members were very happy to help the 5,500 sailors aboard the USS *Abraham Lincoln*, who were discouraged by more than four consecutive month-long delays in their homecoming date, and ended up docking at an under-construction port of call in a small town. The sailors were confined to the pier with very limited resources or ability to restock needed supplies. After publicizing a cry for help, Navy chiefs and American citizens, including the Lincoln Laboratory community, responded within days. The sailors were overwhelmed to receive approximately 1,000 care packages. Each and every sailor on board received all kinds of perishables, toiletries, and entertainment for a welcome morale boost. Faced with the atypical situation of having more supplies than needed, the crew donated extra supplies to the homeless once the USS *Abraham Lincoln* eventually reached its home port. /

The USS *Abraham Lincoln* received many care packages when troop support was clearly needed.

One of the recipients of a Lincoln Laboratory care package confirmed there were "smiles all around" upon opening a box from Support Our Troops.

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
Avon Walk for Breast Cancer
Boston Children's Hospital Walk for Kids
Burlington People Helping People Pantry
Epilepsy Foundation
MIT COVID-19 Neighborhood Response Fund
NAACP Legal Defense Fund
Trevor Project
Watertown High School Engineering Technology Program

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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