Lincoln Laboratory Community Outreach

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LINCOLN LABORATORY
COMMUNITY OUTREACH

MIT LINCOLN LABORATORY

COMMUNITY **INVOLVEMENT** 2012

OUTREACH // BY THE NUMBERS

Lincoln Laboratory Outreach

30
K–12 STEM educational outreach programs

37
High-school upperclassmen in programs that encourage STEM-based fields of study

80
Schools visited for classroom presentations

125
Laboratory scientists and engineers working with students

5,250
Volunteer hours per year supporting STEM programs

10,000+
Students participating in Laboratory STEM programs

2012 Growth in Programs

4
New giving programs

5
New K–12 STEM programs

20
Charities benefitted by community giving programs

A Message from the Director

Community outreach and education programs are an important component of the Laboratory's mission. From the beginning, our outreach initiatives have been inspired by employee desires to help people in need and to motivate student interest and participation in engineering and science. There are many opportunities to participate. The Laboratory's educational outreach initiatives offer the opportunity to provide in-classroom and Science on Saturday presentations to regional K–12 schools, to sponsor U.S. FIRST robotics programs, and to participate in mentor-based internships for college and graduate students preparing for science and technology careers. There are also opportunities to be a part of the Laboratory's volunteer base to serve as judges and advisors for local and regional science fairs and science-based activities. The Laboratory is committed to giving back to the community by sponsoring fund-raising and community service events in support of the United Way, the Alzheimer's Association, the Salvation Army, and other charitable organizations. The involvement of the entire Lincoln Laboratory community is encouraged and suggestions on how we might improve our outreach activities are welcomed.

At top, Eric Evans, the Director of Lincoln Laboratory, speaks with Bradley Perry about a student-built radar from Perry's "How to Build a Small Radar" course that developed into the LLRISE program. Below, Evans meets Jennifer Kong, a Laboratory intern in the Armed Forces Communications and Electronics Association (AFCEA) internship program.

Eric D. Evans
Director

LLCO is an initiative to promote K–12 STEM educational outreach and community involvement and giving in partnership with MIT's Office of Engineering Outreach Programs and the MIT Public Service Center.

Lincoln Laboratory takes pride in promoting science and engineering education for all grade levels, and supporting the community through giving programs. Outreach programs capitalize on the strengths of the Lincoln Laboratory scientific community and strive to integrate service with education and research. Lincoln Laboratory has a history of supporting educational outreach through three primary programs: Massachusetts Institute of Technology's (MIT) VI-A Master of Engineering program, Worcester Polytechnic Institute's (WPI) Major Qualifying Project, and the university cooperatives and summer intern program. However, since 2006, the Laboratory has increased its focus on educational outreach initiatives, spawning the Lincoln Laboratory Community Outreach committee, and cultivating the Laboratory's position to motivate interest and participation in science, technology, engineering, and math programs for K–12 students, develop a program to introduce minorities to engineering careers, and offer classroom presentations and science seminars targeted to specific ages. Lincoln Laboratory is pleased to have been named the 2012 Internship Employer of the Year by Stevens Institute of Technology.

MIT Lincoln Laboratory is a member of the National Defense Education Program (NDEP) which invests in science, engineering, and math education in K–12 programs and is supported by the Department of Defense Research & Engineering. NDEP's mission is to support a new generation of scientists and engineers who will apply their talents in the nation's defense laboratories. In 2012, the Communications and Community Outreach Office was pleased to add many new outreach programs, most notably, the CyberPatriot Program, Team America Rocketry Challenge, the Lincoln Laboratory Radar Introduction for Student Engineers, and installation of exhibits in the Museum of Science and the MIT Museum.

EDUCATIONAL **OUTREACH**

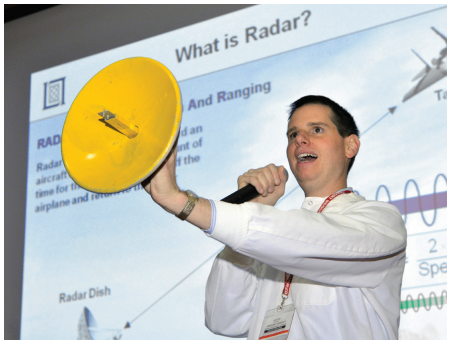
Most classroom presentations can be adapted to different lengths and different grade levels.

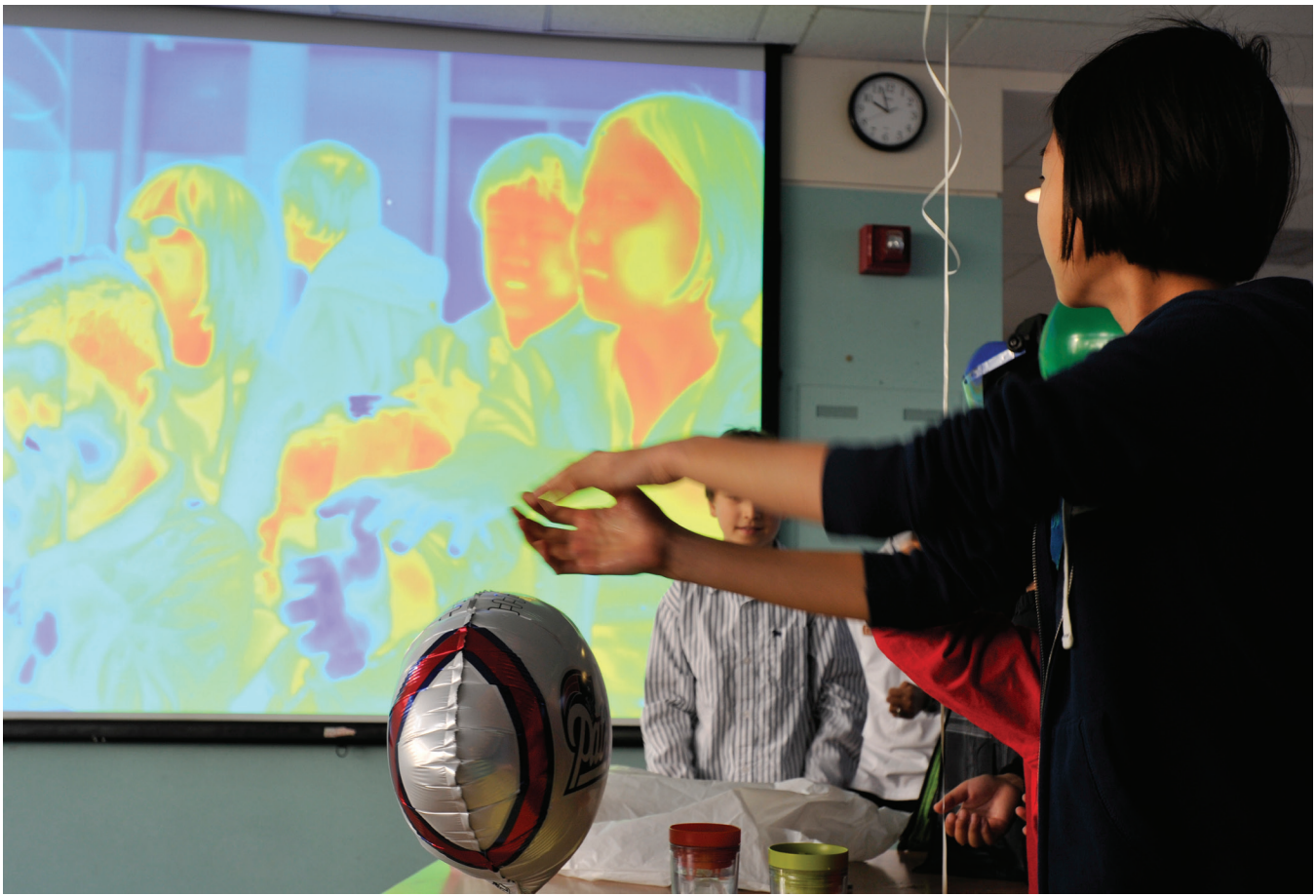
Classroom Presentations

In this program, Lincoln Laboratory technical staff members give free science presentations and lead hands-on activities in local K–12 classrooms. Over 40 presentations are available in fields including biology, chemistry, physics, earth science, engineering, archaeology, and math. Since the program's inception in 2005, our volunteers have visited schools from Rockport, Maine, to Fitchburg, Massachusetts, and from Nashua, New Hampshire, to Dover, Delaware. Each year, classroom presentations are given to approximately 7000 students. Volunteers also judge local science fairs and give teacher workshops. Laboratory employees interested in volunteering or schools interested in hosting a presentation should contact Todd Rider (thor@LL.mit.edu), who coordinates this program.

Science on Saturday

This program features free science demonstrations by Lincoln Laboratory technical staff in our auditorium. More than 3500 local K–12 students, their parents, and teachers attend Science on Saturday events over the course of each school year. Since the program's origin in 2006, attendees have enjoyed watching and volunteering to assist with demonstrations on rockets, robotics, computers, acoustics, archaeology, lasers, thermal imaging, and many other topics. The upcoming 2012–2013 school year features presentations on dinosaurs, spy science, asteroids, radar, and our ever-popular chemistry show.





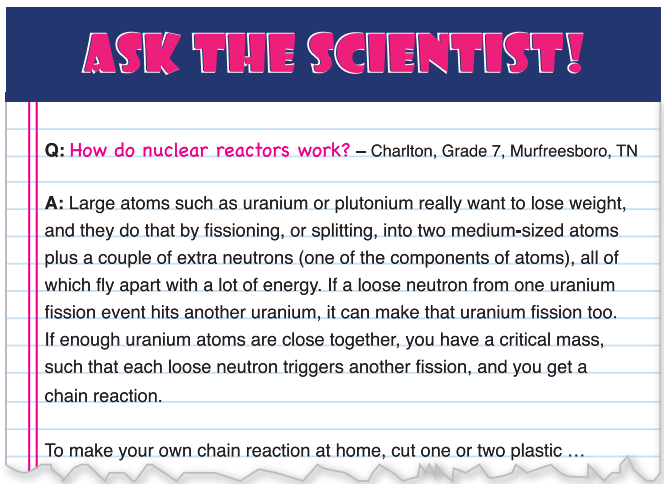
Ask the Scientist!

Last year, Lincoln Laboratory's external website featured a new page where K–12 children can submit science-related questions. Each month, a Laboratory scientist selects one question from the mailbox and posts an answer on the web page. This site routinely addresses questions from all ages of children, such as the inquiries below by an eighth grader, a twelfth grader, and a second grader, respectively.

- How do wingtip devices (winglets) improve the flight performance on an airplane?
- Can you see yourself in a projected hologram of a mirror?
- What part of the brain makes the electricity to zap the muscle?

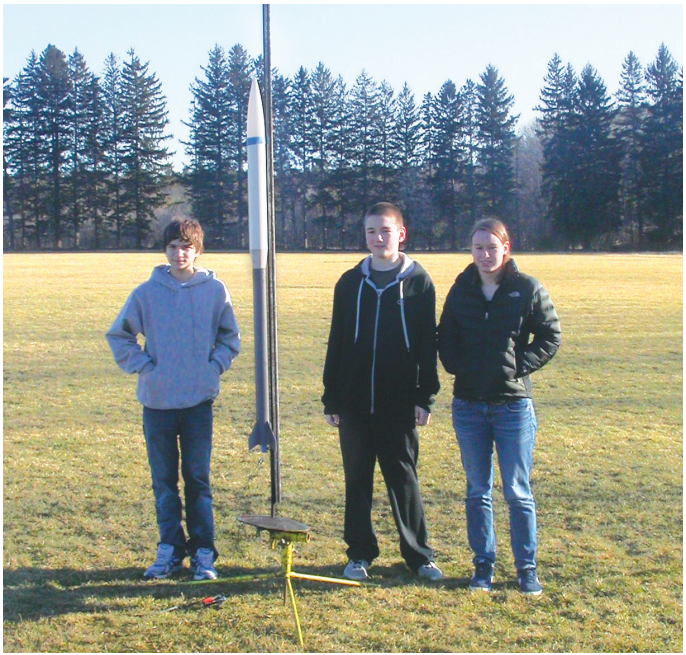
This website gains popularity each time it is mentioned during classroom visits and onsite science demonstrations.

Are you a K–12 student with a question about a science, technology, engineering, or math topic?



Science Kits

Approximately 2500 science kits were made and distributed for free to children last year at Lincoln Laboratory events and in schools. Each kit includes instructions and numerous components in a quart-sized plastic bag. The kits contain materials for 64 different experiments in aerospace engineering, archaeology, astronomy, biology, chemistry, electrical engineering, forensic science, geology, mathematics, mechanical engineering, meteorology, nuclear engineering, optics, paleontology, physics, and waves and acoustics. Laboratory volunteers manned an assembly line to stuff components into bags to produce the 2500 kits.



Team America Rocketry Challenge

Curtis Heisey of the Surveillance Systems Group and Francesca Lettang of the Active Optical Systems Group created and mentored a Lincoln Laboratory team of students for the Team America Rocketry Challenge (TARC) in 2012. The goal of TARC, an aerospace and engineering design competition for 7th through 12th graders, challenges teams to design, build, and fly rockets which can launch and recover an egg without breaking it. This year's challenge included reaching a target altitude of 750 feet and recovering an egg oriented horizontally within the rocket using a parachute no larger than 15 inches in diameter. This year's five-member team called Green Eggs and Bam designed a rocket that reached an altitude of 867 feet with a flight time of 47.6 seconds, turning in a score of 68.69, a perfect score being zero. The team performed well in trials and was one of 700 teams nationwide in the final challenge.

CyberPatriots

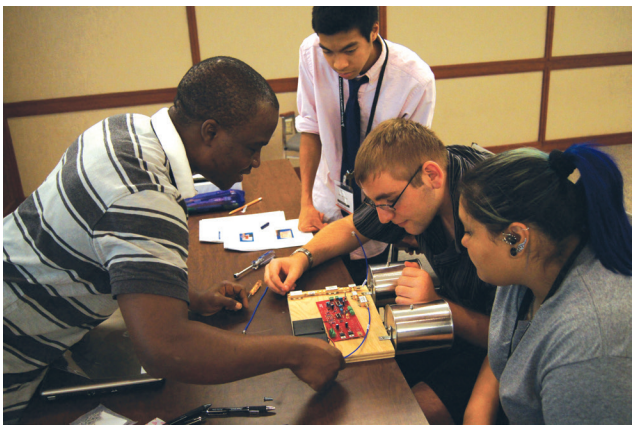
Five high-school students composing the Lincoln Laboratory team competed in the national championship round of CyberPatriot's unique competition that motivates teenagers to be the nation's next cyber defenders. The students learned how to defend a simulated corporate network from external hostile attacks. The team detected and corrected categories of vulnerabilities including: policy management, vulnerability management, patch management, configuration management, and third-party management. More than 1000 teams began in the first round of competitions nationwide.

Mentored by Michael Chaplin (Facility Services Department), Robert Cunningham (Cyber Systems and Technology), Joseph Werther (Cyber System Assessments), and Chiamaka Agbasi-Porter (Communications and Community Outreach Office), this rookie team became one of twelve finalists chosen for the national competition.

With help from the Paul Revere Chapter of the Air Force Association, the team was able to receive an all-expenses-paid trip to the National Finals competition in Washington D.C. For placing as a finalist, this rookie team received congratulatory letters from Governor Deval Patrick and from Congressman Edward Markey.

LLRISE

Lincoln Laboratory's first summer engineering workshop for high-school students, Lincoln Laboratory Radar Introduction for Student Engineers (LLRISE), was held in July. The radar technology program was based on a very popular three-week class offered by Laboratory technical staff to MIT undergraduates during the January intersession between academic semesters. The college course was modified to suit high-school students, yet provide the same depth of material and hands-on activities. While designed to provide an understanding of radar systems, the program is intended to foster a realization that engineering is about problem solving and applying knowledge in innovative ways. The two-week residential, project-based enrichment program was offered to outstanding students currently in their junior year in Boston, Cambridge, Lawrence, and Lowell high schools. Participants were challenged to build a Doppler and range radar by using creative problem-solving strategies while working in a state-of-the-art laboratory with highly talented scientists and engineers, and sampling dorm life at MIT. Chiamaka Agbasi-Porter of the Communications and Community Outreach Office coordinated the program and was supported by nine technical staff members, Mabel



Ramirez, Nestor Lopez, Shakti Davis, Raoul Ouedraogo, Shelley Scruggs, Wingyan Beverly Lykins, Gregory Ciccarelli, Bradley Perry, and Alan Fenn.

During the two-week period, the twelve high-school seniors attended college-level classes on topics such as physics, electromagnetics, mechanics of Doppler radar, modular radio-frequency design circuitry, Matlab, pulse compression, signal processing, and antennas. In addition to a presentation about career exploration, the students were shown an overview of Lincoln Laboratory and a tour of its facilities, including the Flight Facility, the Antenna Test Range, and a trip to Haystack Observatory in Westford, Massachusetts. In between instructional lectures and homework, the students toured MIT campus, the MIT Museum, and MIT's Financial Aid Office to learn about the college application process. The participants also received instruction on how to stage an experiment and how to present a project, preparing them for the final technology demonstrations scheduled for the end of the two-week period. Based on the overwhelming success of this program's debut, Lincoln Laboratory intends to continue to open the eligibility of this summer workshop in future years to the entire New England region, eventually doubling the number of students participating in the event.

Robotics Outreach is designed to help students experience how interesting and rewarding the life of engineers and researchers can be.

Robotics Outreach

Robotics Outreach at Lincoln Laboratory (ROLL) is an educational outreach program designed to stimulate youth interest in science and technology. ROLL uses hands-on activities to foster a sense of excitement that might drive the students towards math, science, and engineering. These activities include sponsoring robotic teams participating in regional and national competitions, hosting robotic workshops, and supporting local communities by supplying mentors to area groups. Staff volunteers mentor students at weekly sessions throughout the fall and winter. Children learn to program robots to complete challenges specified by FIRST (For Inspiration and Recognition of Science and Technology), working on a research topic, building teamwork, and developing gracious professionalism throughout the season.

FIRST Teams

FIRST competitors of high-school age join FIRST Technical Challenge (FTC) teams, while students in middle school and below join FIRST Lego League (FLL) teams. More than 30 staff members volunteer as coaches and mentors, some in their local schools.

The involvement for Lincoln Laboratory-sponsored teams participating in the 2011–2012 FIRST competition is

- Grades 3-8, competing in the "Food Factor" FLL challenge: 10 teams, 23 coaches, 73 students
- Grades 9-12, competing in the "Bowled Over" FTC challenge: 2 teams, 8 mentors, 17 students

Two Laboratory volunteers who mentor the high school robotics team became MA FTC affiliate partners. In doing so, they established an unveiling of this year's challenge, worked to increase the level of participation of students, helped regional teams determine best programming practices, and coordinated scrimmages in the local area.

ROLL ensures that these teams have adequate supplies, funds, and mentorship to design, build, and program their robot for competition.

Sister Robotics Teams

ROLL has a continuing collaboration with the John D. O'Bryant School in Roxbury, Massachusetts, mentoring two teams for the FIRST robotics competition. ROLL ensures that these teams have adequate supplies, funds, and mentorship to design, build, and program their robot for competition, and the Laboratory robotic teams assist their sister teams by staging scrimmages and sharing design concepts as well as computer programming tips. Teams in Waltham and Lexington receive funding from ROLL, and mentors are always available to any sister team. A student from Rivers School in Weston (pictured opposite, bottom right) said, "The robotics club drew quite a bit of an interest, especially because of the robot that Lincoln Laboratory lent us. We now have eleven enthusiastic members. We have been busy brainstorming design ideas and building is underway. With the financial support of Lincoln Laboratory, we were able to purchase additional kits and field parts needed to enter FIRST Tech Challenge."

New sister teams gained during this competition year include:

- Hanscom Air Force Base Middle School, Bedford, MA
- Shrewsbury High School, Shrewsbury, MA
- Manchester Essex Regional High School, Manchester-by-the-Sea, MA
- Rivers School from Weston, MA
- Athena's Warriors (an all-girl team) in Connecticut

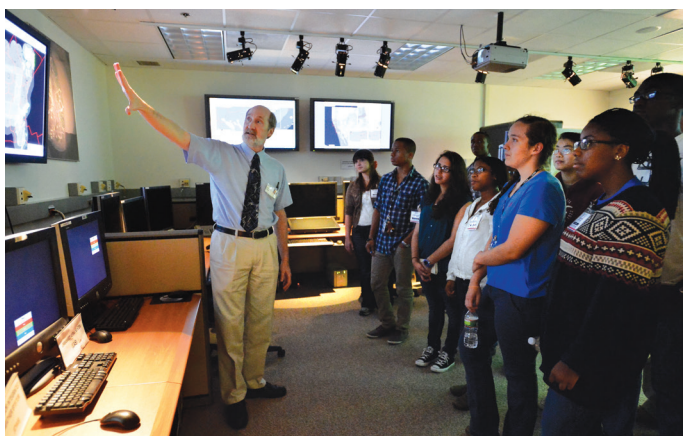

Flinn Scientific Periodic Table of the Elements

MIT Office of Engineering Outreach Programs (OEOP)

MIT's Department of Engineering's OEOP offers deserving students rigorous academic experiences that provide an understanding of how technical concepts relate to their everyday lives. Not only do OEOP programs encourage the pursuit of careers in technical careers, they also provide a hands-on curriculum that strengthens foundational math, science, and communication skills in a challenging learning environment with high expectations. Lincoln Laboratory plays a part in four OEOP programs: MITES, MSBP, SEED, STEM, and a new OEOP program, E2@MIT.

Minority Introduction to Engineering and Science (MITES) Program

This six-week residential summer program for top high-school students in the nation stresses the value and reward of pursuing advanced technical degrees and careers while developing the skills necessary to achieve success in science and engineering. This year, Lincoln Laboratory sponsored two students in the six-week summer program at MIT, and hosted 75 students enrolled in the MITES program for facility tours and career presentations by Doug Jones of the Human Language Technology Group, and Grace Kessenich of the Mechanical Engineering Group.



Saturday Engineering and Enrichment Discovery (SEED) Academy

The SEED Academy is a seven-semester technical career-exploration program for promising but traditionally underserved high-school students in Boston, Lawrence, and Cambridge, Massachusetts. In 2012, Lincoln Laboratory sponsored two students and an aeronautics/astrophysics course. In addition, Mabel Ramirez of the Intelligence, Test, & Evaluation Group and Erica Heffer of the Surveillance Systems Group presented talks on why they chose their careers.

MIT Science of Baseball Program (MSBP)

This four-week summer program for eighth-grade boys from Boston, Lawrence, and Cambridge featured an integrated academic and athletic curriculum to channel the students' enthusiasm for baseball into a renewed excitement for and increased proficiency in the math, science, and culture behind the game. Lincoln Laboratory partially sponsored one local middle-school student, offered tours of Laboratory facilities and presentations by Joel Walker of the Tactical Defense Systems Group. The highlight of this visit to the Laboratory is the "brains versus bats" softball game in which the students play against a team of scientists!

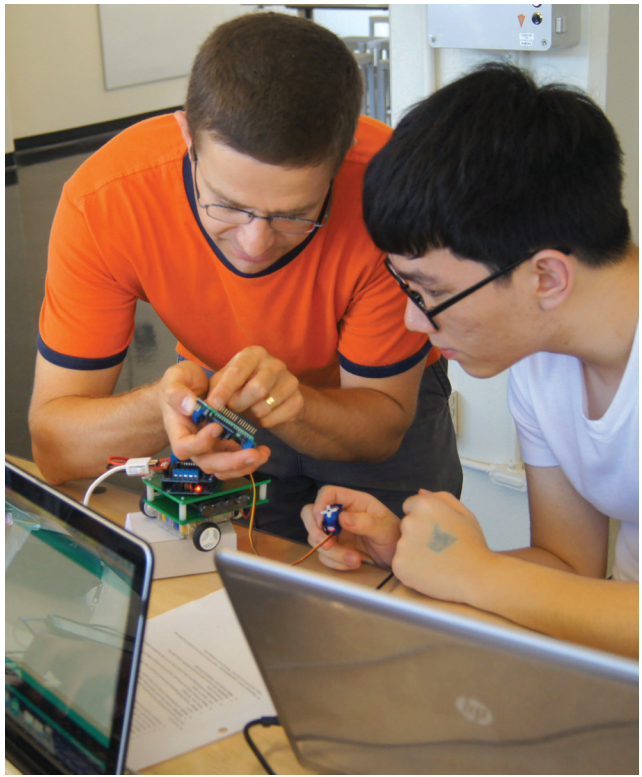
Science, Technology, Engineering, and Mathematics (STEM) Program

STEM is a year-round academic enrichment program including mentoring and a summer institute for middle-school students from Boston, Cambridge, and Lawrence, Massachusetts. The courses use lectures, projects, and experiments to help participants develop mathematical thinking and problem-solving abilities in preparation for high-school "gateway" math and science classes, ultimately attempting to increase the number of local students seeking careers in the technical workforce. Lincoln Laboratory sponsored a robotics course for 20+ students, provided tours of Laboratory facilities, and presented a Science on Saturday demonstration at a school location. At right, Loretta Bessette of the ISR Systems and Architectures Group and Jacob Huang of the Advanced Satcom Systems and Operations Group help students in the STEM Program operate robots around an obstacle course. Christy Cull of the Sensor Technology and System Applications Group and Larry Robinson of the Cyber Systems and Operations Group presented briefings on their educational and career choices.

The STEM Program helps middle-school students who want to get ahead in math and science.

E2@MIT

Lincoln Laboratory conducted a short robotics course as part of the curriculum for E2 (Engineering Experience) @MIT, a one-week, residential, summer program offered by MIT's OEOP to twelve high-school students entering their senior year. The course was taught by Sam Stambler, Joshua Manore, and Theodore Tzanetos of the Tactical Defense Systems Group and Tom Pasquini (shown at right), physics teacher at Kimball Union Academy in Meriden, New Hampshire. The students were introduced to microcontroller programming and reading/generating analog signals so that they can design and develop a mobile robot platform capable of autonomous or controlled operation. Aside from completing coursework as part of their program, students in E2@MIT attend admissions and financial aid sessions; tour labs; and meet with MIT faculty, students, and alumni. Michael Boulet of the Control Systems Engineering Group offered a robotics demonstration for the students during their tour of the Laboratory.



Ceres Connection

Under the Ceres Connection program, minor planets discovered by the Lincoln Near-Earth Asteroid Research program are named in honor of science students in grades 5–12 and their teachers. The honorees are selected through science competitions all over the world directed by the Science Education Department at the Society for Science & the Public. To date, approximately 3000 students and their teachers have been honored. Each year, the Ceres Connection program awards about 250 students with this honor.

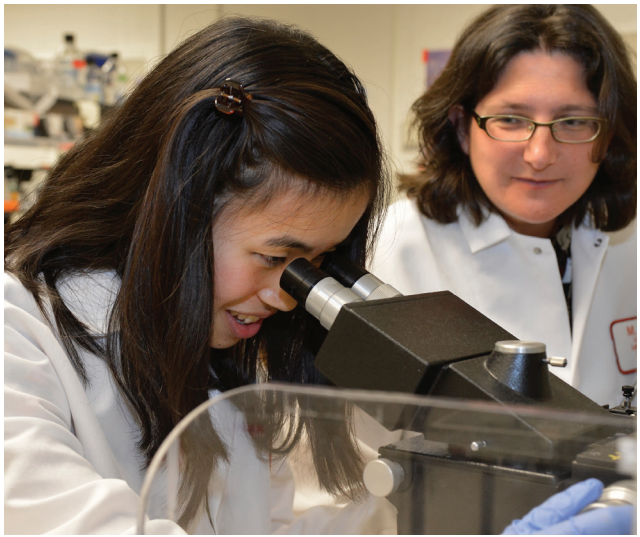
The Ceres Connection names minor planets in honor of students and their teachers.

Daughters and Sons Days

Lincoln Laboratory extends their outreach to the students of many local schools by way of the annual Daughters and Sons Days offered for employees' children. The 2012 event featured twelve activities designed to spark interest in science and technology, including hands-on demonstrations of robotics, space control, and flight simulation. Each day began with presentations by Elena Zorn, Caroline Lamb, and Mykel Kochenderfer, who described their paths to their current careers and explained interesting projects on which they work.

AFCEA International Program

The Laboratory hired three AFCEA (Armed Forces Communications and Electronics Association) interns from local Massachusetts towns in 2012. These interns assisted the Optical Systems Technology Group, the Tactical Defense Systems Group, and the Bioengineering Systems and Technologies Group. AFCEA arranges summer internship opportunities for graduating high-school seniors interested in STEM careers. While three to four students are offered Laboratory internships each summer, at least 40 students tour the Laboratory facilities, seeing the latest research performed at the Laboratory and learning about various career options in math and science.



Jennifer Kong interned under Catherine Cabrera, both at right, in the Bioengineering Systems and Technologies Group isolating DNA from a variety of plants. When asked about the benefits of her internship, Kong replied, “During my time here I have gained not only bench work skills, but appreciation for the innovative thinking, hard work, and patience that is required of biologists. Being at Lincoln Lab has also spurred my interest in computer programming and its role in biotechnology. Before this internship, I was unsure of whether or not I would pursue math/science in college. This experience, however, has inspired me to go for it despite the inevitably challenging nature of the work. Science is just too cool.”

Technical High School Student Internships

This cooperative internship program hires two students from the Minuteman Career and Technical High School and one student from Shawsheen Technical Vocational High School, and the students get hands-on experience in a real-world setting. This 20-week internship helps interns gain a perspective on the daily work of engineers and technicians. Anthony Carreon, student intern from Minuteman Career and Technical High School, worked with Mike Radoslovich of the Flight Facility Group, creating way-points in an airplane's GPS system, and helping the mechanics in the machine shop. Carreon said of his internship, "This has put me a step closer to my future goals and has shown me a clear path of what it is I want to do when I graduate college. "

John D. O'Bryant School of Math and Science Partnership

Students from the John D. O'Bryant School in Roxbury, Massachusetts, visit the Laboratory twice each year. Technical staff members provide insight to the inspirations that led them to STEM majors and careers. After hearing about the history and current research performed at the Laboratory, the students receive tours of the Flight and Antenna Test Facility. In 2012, the students listened to Carlos Aguilar of the Bioengineering Systems and Technologies Group explain how he chose his career. The tour included a roundtable on career exploration that included Lincoln Laboratory staff Bryan Reid, Jessica Brooks, Christy Cull, Ngaire Underhill, Colton Bennett, and Nwokedi Idika. Lincoln Laboratory also funds two robotics teams at the John D. O'Bryant School.

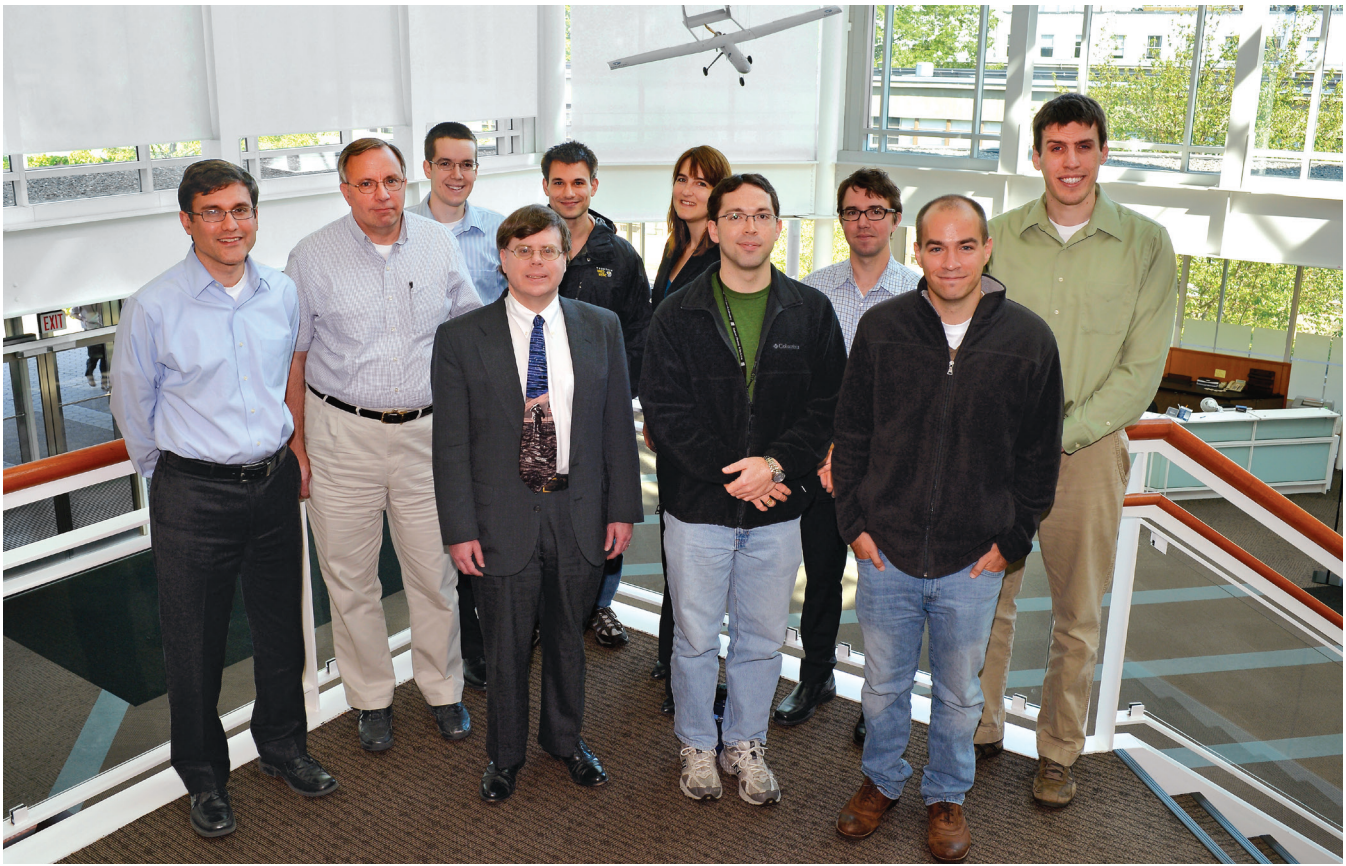
Fifteen Laboratory scientists participated in the Massachusetts State Science and Engineering Fair as judges.

Massachusetts State Science and Engineering Fair

Lincoln Laboratory technical staff have been volunteering as judges for the Massachusetts State Science and Engineering Fair since 2000, evaluating six to eight high-school projects. At the 2012 Massachusetts State Science and Engineering Fair, Lincoln Laboratory continued as a bronze donor of the event by sponsoring winners in the physics and engineering competitions. Fifteen Laboratory scientists participated in the science fair as judges. This year's judges (some of whom are shown at right) included Chris Anderson, Dennis Bechis, Shourov Chatterji, Claude French, Christopher Lloyd, Scott Philips, Alex Pina, Todd Rider, Zachary Weber, Robert DiPietro, Charles Rose, Alexandra Wright, Stephen Taylor, and Chirag Bhatt. Bernard Malouin volunteered as a judge for the state's middle-school science fair in Worcester. Lincoln Laboratory has also provided judges for InvenTeams competitions in which high-school teams from around the country send research proposals to MIT for judging and potential funding.

Local High School Science Fairs

In 2012, eleven technical staff (Zachary Weber, Christy Cull, Dan Weidman, Richard Marino, Garrett Bernstein, Eric Harkleroad, Steven Golowich, Alexander Broad, Chad Morris, and Gabriela Galaviz) from Lincoln Laboratory supported Lexington High School by volunteering as judges for the school's Science and Engineering Fair. For the first time, Lincoln Laboratory staff members assisted the Carlisle Public school system. Leonard Johnson, Vyshnavi Suntharalingam, Charles Meins, Deborah Cady, Siamak Dastangoo, and Marc Bernstein volunteered as judges for the Carlisle Middle School Science Fair.


EXIT

Other Science-Related Programs

In 2012, the Laboratory joined in several new programs at local schools. Staff members Richard Marino of the Active Optical Systems Group, James Waldrep of the Mechanical Engineering Group, and Yican Cao of the Cyber Systems and Operations Group took part in the first ever Minuteman Regional High School Freshman Career Day to discuss how they chose their career and explain their day-to-day work.

The Laboratory offered a volunteer judge for the Real World Design Challenge, an annual competition in which high-school students work on real engineering challenges in a team environment to address a challenge that confronts our nation's leading industries. This year, Phillip Evans of the Engineering Analysis and Testing Group volunteered as a judge at the state and the national competitions. Dennis Bechis (Airborne Radar Systems and Techniques

Group) served as a judge and organizer for the High School Science Olympiad for both Massachusetts and New Hampshire.

This year, Lincoln Laboratory also focused on Hanscom Air Force Base as a key audience for science outreach. The Laboratory joined Hanscom Air Force Base's STARBASE Program which aims to motivate fifth graders to explore science, technology, engineering, and math through an inquiry-based curriculum, hands-on activities, classroom visits from military and scientific personnel, and on-site tours in technological environments. Tom Sebastian, a staff member in the Engineering Analysis and Test Group, visited the elementary school on Base to help kids understand rocketry principles for Hanscom Air Force Base's Primary School Science Share Fair in April.

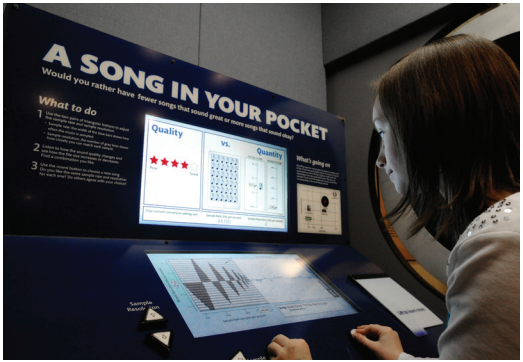
Cambridge Science Festival

In coordination with MIT, Lincoln Laboratory Community Outreach partnered with Robotics Outreach volunteers to man a booth in the Cambridge Science Festival, a week-long celebration showcasing Cambridge as an internationally recognized leader in science, technology, engineering, and math. Laboratory volunteers Kenneth Cole, Chiamaka Agbasi-Porter, Sarah Chmielewski, and Maria Picardi-Kuffner provided robotics demonstrations and hands-on activities such as helping robotic bugs swarm and controlling a robot to capture a ball as part of this citywide science festival, visited by 15,000 people from the New England region.

MIT Museum Exhibit on Interactive Radar

Kevin Fischer and Vinay Ramamesh took an IAP (Independent Activity Period) course offered by the Laboratory on the topic of How to Build Small Radars. Together, they built a radar and then shared their self-built radar with K–12 students at the MIT Museum during National Engineers Week.

The Cambridge Science Festival makes science accessible, interactive, and fun.



Museum of Science Exhibit

Early this year, a new partnership with the Museum of Science in Boston resulted in a Laboratory-designed exhibit featured at the museum—a first for the Laboratory. The exhibit, entitled "A Song in Your Pocket" offers visitors the chance to learn about sampling music for an MP3 player and choosing between the number of songs and the sound quality of the song, helping visitors understand the trade-off between the two. Staff from both Lincoln Laboratory and the Museum of Science (below) who developed this exhibit helped forge a partnership that will inspire future outreach opportunities.

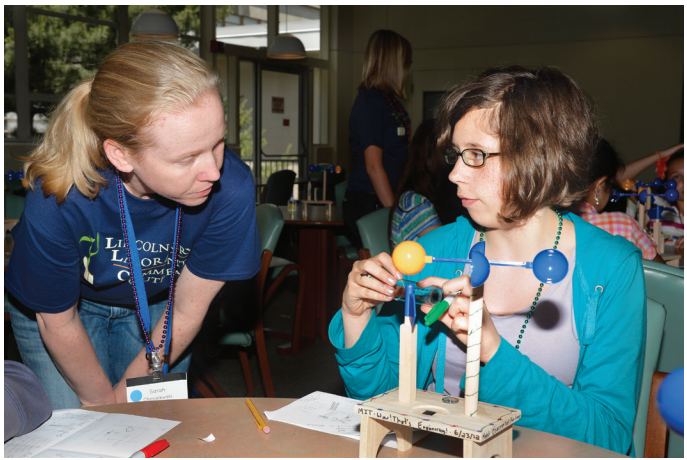
Story time at Boston Public Libraries

Lincoln Laboratory's Hispanic/Latino Network (LLHLN) members promote educational outreach by hosting a story time for preschool-aged and young school-aged children in all the branches of the Boston Public Library. Monthly visits are planned to promote reading and foster awareness of the rich Hispanic culture. Members visiting the Dudley Branch Library in October were Yari Rodriguez, Rodolfo Cuevas, Michelle Beard, Yajaira Gonzalez-Gonzalez, and Chiamaka Agbasi-Porter.


I'm a DOG!
Who am I?

Society of Women Engineers Workshops

Last year, Lincoln Laboratory began partnering with Boston Chapter of The Society of Women Engineers (SWE) to host outreach workshops for the community. “Wow! That’s Engineering!” was held for 100 girls in sixth through eighth grade with the help of Damaris Toepel of the Engineering Analysis and Testing Group and SWE volunteers. The goal was to “wow” girls by what they can accomplish and provide a better understanding of what it’s like to be an engineer. Toepel said “Targeting girls at this age range is so important. It’s when many girls lose their enthusiasm for science, or feel that science and technology fields are not for girls. We’re taking this opportunity to show them that engineering is a viable career choice for women.” Girls discovered reverse engineering by taking apart appliances and exploring the contents. At “The Lighthouse” station, volunteers helped participants discover the properties of light, reflection, refraction, and conversion of light rays. The “Newton’s Rocket Car” station featured a balloon-powered car, helping girls appreciate the importance of



axles, bearings, and symmetry. At “The Weather Station,” Sarah Chmielewski (above) of the Cyber System Assessments Group, helped girls build their own take-home weather station to track temperature, accumulated rainfall, wind direction, wind speed, and cloud formation. Finally, liquids, gases, and their relationships to different volumes and temperatures were featured in the always popular “Liquid Nitrogen Show.” This and other stations proved to be both educational and entertaining, best exemplified by a participant who said, “At first, I thought the day was going to be all lecture, like school, but it turned out to be so much fun!”

Group Tours

As part of the Lincoln Laboratory Community Outreach Program, tours of Laboratory facilities, such as the Microelectronics Laboratory, Air Traffic Control Laboratory, and Flight and Antenna Test Facility, are given annually to a number of groups such as the following:

- New Jersey Institute of Technology Cadets
- The Carroll School of Lexington, Massachusetts
- DARPA Program Managers
- Air Force Cadets
- USAFMC
- MIT Minority Engineering Interphase Group
- Army Test and Evaluation Command
- U.S. Army Natick Laboratory
- West Point Cadets
- Stevens Research Institute
- Student interns from the Graduate Degrees for Minorities in Engineering and Science Program
- National Reconnaissance Office Fellows
- Leader-to-Leader Group
- Armed Forces Communications and Electronics Association
- ESC Hanscom Air Force Base personnel

EDUCATIONAL **COLLABORATIONS**

Lincoln Laboratory's status as a research and development center of MIT promotes educational and research collaborations, knowledge exchange, and staff development. The MIT Office of the Provost and the Laboratory Director's Office strongly support Lincoln and Campus interactions.

Technical Staff Seminars

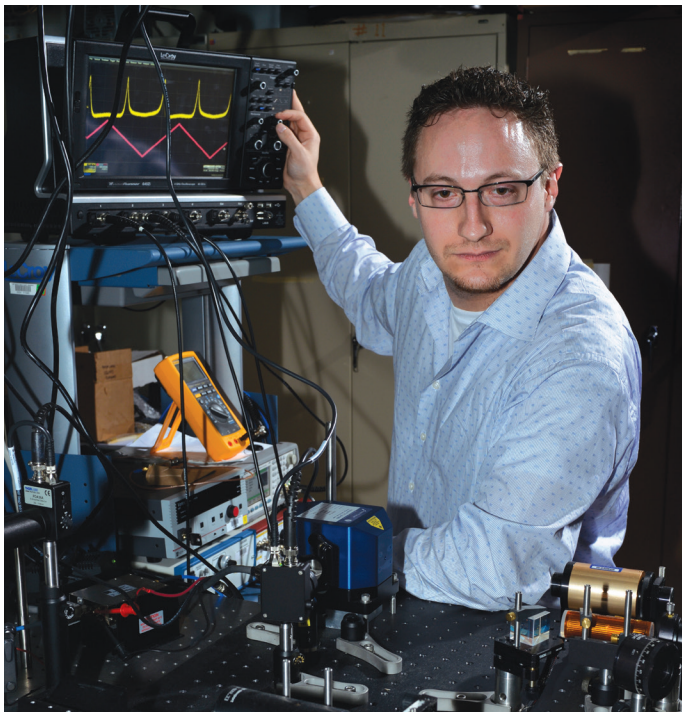
The technical staff stay current in their field by presenting technical seminars at area universities and hosting technical seminars at Lincoln Laboratory. Seminar series are built to motivate and inspire while facilitating working relationships. The Technology Office coordinates a series of seminars in which invited lecturers discuss results and implications of their innovative research or offer insights on new technologies. Seminar series are conducted with researchers at MIT, Northeastern University, Cornell University, Harvard University, Princeton University, and sometimes esteemed researchers from leading corporations, such as Google. New this year, the Technology Office began a series focusing on the use of technology in the entertainment industry, inviting speakers from ESPN, Harmonix Music, and the Creative Industries in the College of Arts, Media, and Design. Lincoln Laboratory also has an in-house education program that offers courses in technical subjects such as electro-optics, classes in software applications, one-day technical seminars, and workshops in leadership and business skills. In 2012, nineteen such courses were offered to all staff.

Graduate Fellowship Program

Lincoln Laboratory offers a limited number of graduate fellowships to science and engineering students pursuing MS or PhD degrees at partner universities. The fellowship program awards funds to support a fellow's stipend, supplement a graduate assistantship, or subsidize other direct research expenses during a student's thesis research. In 2012, this program awarded grants to fifteen students.

Lincoln Scholars Program

Currently, 33 technical staff members are enrolled in the Lincoln Scholars Program, a competitive program for which technical staff are eligible to apply and under which participants are funded by the Laboratory for full-time pursuit of an advanced degree at MIT or another local university. Over the past 16 months, four staff members earned doctorates and seven earned master's degrees through the program.



Lincoln Scholar Chris Sataline of the Active Optical Systems Group (at right) is investigating atomic-optical magnetometry using frequency-modulated laser spectroscopy techniques. Sataline said, "The Lincoln Scholars Program is not just for the immediate satisfaction of earning an advanced degree. Tackling steep learning curves and problem-solving are some of the best professional development methods out there."

MIT Professional Education – Short Programs

Lincoln Laboratory is collaborating on three courses offered through MIT's Professional Education Short Programs. Short Programs draw participants from industry, government, and business to the campus for week-long courses to expand familiarity with emerging technologies. In June 2012, Drs. Alan Fenn and Bradley Perry joined Michael Watts, an associate professor in MIT's Department of Electrical Engineering and Computer Science, to conduct "Build a Small Radar System," and in August, the three led "Build a Small Phased Array Radar Sensor." Drs. Kevin Holman and Jane Luu collaborated in July with Prof. Jeffrey Shapiro, Professor of Engineering at MIT, to present "Build a Laser Radar: Design Principles, Technologies, and Applications."

Northeastern University Gordon Engineering Leadership Program

Emily Anesta of the Advanced Concepts and Technologies Group spoke at Lincoln Laboratory about Northeastern University's Gordon Engineering Leadership Program and her experience as a graduate of the program. The Laboratory supports rising leaders to expand their leadership abilities by attending this program, which is a transformational graduate curriculum offered through the College of Engineering. Each year a select number of highly qualified candidates pursue the program as part of a master of science degree in a range of engineering disciplines or as a standalone Certificate in Engineering Leadership. Graduates of the program emerge with the capabilities and confidence to lead the engineering breakthroughs of tomorrow.

Military Fellows Program

The Military Fellows Program supports graduate education by awarding fellowships to officers who are fulfilling requirements either for programs at senior professional military schools or for advanced degrees at MIT. Military fellows conduct research on Laboratory-sponsored programs and provide a critical user aspect to all programs on which they work. Four officers are returning from last year and fourteen new officers are assigned this year. Fifteen of the Fellows are receiving advanced degrees at MIT and Harvard University and doing sponsored research at the Laboratory. The Laboratory has sponsored numerous military officers from the Navy, Army, Coast Guard, Marines, and Air Force, including master's-degree students from all of the military academies, training with industry officers, Senior Service School attendees, and Service Academy summer students.

Summer Research Program

Lincoln Laboratory offers undergraduate and graduate students the unique opportunity to gain hands-on experience in a leading-edge research environment. Program participants contribute to projects and gain experience that complements their courses of study. The Laboratory typically hires 100 students from top universities every summer to participate in Summer Research Program internships. However, in 2012, 159 students from 64 colleges and universities were hired to assist in Laboratory research during their summer break from universities and colleges across the nation. They are pictured on page 36.

Undergraduate Diversity Awards

Lincoln Laboratory established the Undergraduate Diversity Awards to expand opportunities for women and minorities pursuing bachelor's degrees in engineering and science at selected colleges and universities. The award is typically in the form of tuition assistance, support for technical paper presentations, or funds for independent research projects. Awards are provided each year at colleges and universities where Lincoln Laboratory has little or no presence, such as Bryn Mawr College, Howard University, Mount Holyoke College, New Mexico State University, North Carolina Agricultural and Technical University, Smith College, Spelman College, Stevens Institute of Technology, the University of Puerto Rico, and Wellesley College.

Military University Electives

Lincoln Laboratory staff teach electives at the Naval War College. This course, co-taught by Laboratory staff from the Cyber Systems and Operations Group and Tufts University, helps officers explore the critical technologies and policy issues relating to cybersecurity and homeland security. Similar courses are taught in Space Technology and Policy, and Ballistic Missile Defense. Based on the popularity of this course, Lincoln Laboratory also offers a similar elective at the Air Force Center for Professional Military Education.

Laboratory staff are actively engaged with faculty and cadets of the United States Military Academy at West Point, making two satellite payloads. The Black Knight 1, initiated by Kenneth Chadwick and led by Christopher Semisch, is a cube satellite to perform on-orbit experiments of passive attitude control and friction based damping system. The RCS calibration payload project, led by Joshua Wilson and Bruce Bray, is under design as a new source of grand radar metric and signature calibration. In its first semester, cadets are determining material selection and characterization.

The Laser Technology and Applications Group supplied two real-world problems for an experimental physics class at West Point: a fieldable weather-proof housing for a Yb:YAG laser and a smartphone perimeter surveillance project. Juan Ochoa served as a guest lecturer for the class.

WPI Major Qualifying Program

Thirteen students were accepted in 2012 as Laboratory interns under the Worcester Polytechnic Institute's (WPI) Major Qualifying Project (MQP) Program, which requires students to complete an undergraduate project equivalent to a senior thesis. The MQP program allows students to demonstrate the application of skills, methods, and knowledge to problems typical of those encountered in industry.

WPI undergraduates in electrical engineering, mechanical engineering, computer science, and physics presented their capstone projects completed at Lincoln Laboratory over a nine-week period. Project topics include: "Mobile WiFi DoS Attack on Analog RF Channel Simulator" (Wideband Tactical Networking Group), "Engineering Tests and Analyses of a Nano-Positioning Stage" (Engineering Analysis and Testing Group), "Investigation into the Root Causes of O-ring Adhesion in Deployable Mechanisms for Space Flight Payloads" (Optical Systems Engineering Group), "Modeling Maritime Radar Scattering" (Airborne Radar Systems and Techniques Group), and "Phase Interferometry Direction Finding" (Tactical Defense Systems Group). At right, Ron Efromson of the Engineering Analysis and Testing Group serves as a mentor to a WPI student.

University Cooperative Education Studies

Technical groups at Lincoln Laboratory hire students from area colleges as co-ops working full time with mentors during the summer and part time during the academic term. Co-ops can become significant contributors to project teams as they build prototypes, help solve problems, assist in research activities, and test applications in the field. During the first semester of 2012, 41 co-ops were working in divisions and departments in the Laboratory. John Stewart (standing, at right) of the Mechanical Engineering Group serves as a mentor for a co-op student every year. Colleges and universities that regularly send co-ops to Lincoln Laboratory are Northeastern University, Wentworth Institute of Technology, University of Massachusetts at Lowell, Boston Architectural College, and Rochester Institute of Technology.

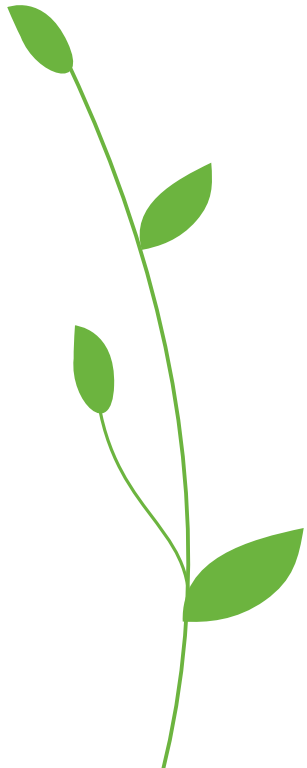
The synergy between the campus focus on basic research and the Laboratory knowledge of defense applications has benefited both communities.

MIT Undergraduate Research Opportunities Program

Twelve undergraduates were hired in the summer in 2012 as part of the MIT Undergraduate Research Opportunities Program (UROP), which allows students to participate in every aspect of onsite research. Students develop research plans, write proposals, perform experiments, analyze data, and present research results.

MIT Undergraduate Practice Opportunities Program

Lincoln Laboratory participates in MIT's Undergraduate Practice Opportunities Program (UPOP). This full-year program for MIT sophomores is an introduction to workplace skills that complement students' academic training. An important facet of the program is a summer internship in industry, government, of a nonprofit institution. As a UPOP partner, the Laboratory offers internships during which the MIT students use the lessons learned from both academic courses and career coaching experiences. In summer 2012, four UPOP students worked at the Laboratory.



MIT Department of Aeronautics and Astronautics

MIT Lincoln Laboratory helps students in MIT's Department of Aeronautics and Astronautics receive an introduction into the world of satellite engineering. Each year, a Laboratory project gives aeronautics and astronautics students a real-world experience to develop a product that meets customer specifications. This year, students built a microsatellite that will be launched from a NASA vehicle scheduled for flight in 2014. The students developed the Micro-sized Microwave Atmospheric Satellite (or MicroMAS), a three-unit miniaturized satellite designed for providing observations of hurricane dynamics and severe storms. The students can work on multiple facets of the project such as structural development, spinner assembly design, attitude determination and control subsystem design, or other systems engineering. Professor Kerri Cahoy (3rd from left in the photo) worked with students on the development of the MicroMAS.

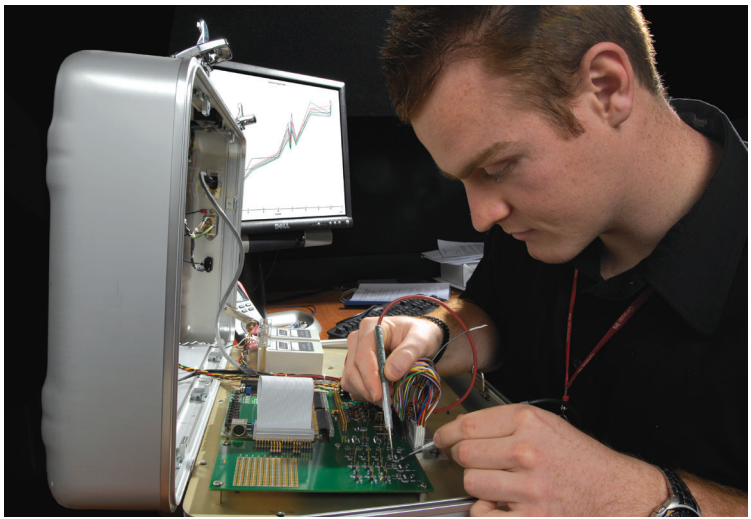
The MicroMAS project came from the Sensor Technology and System Applications Group's assistant leader and principal investigator of the MicroMAS project, William Blackwell. "One bonus in enlisting students to design the mechanism," said Blackwell, "is that they are full of ideas. They bring a fresh perspective unencumbered by conventional wisdom." Several students have been inspired to look toward Lincoln Laboratory for internships after graduation, which mutually benefits the student and the Laboratory.

MIT Independent Activities Period

Lincoln Laboratory technical staff developed and led five activities offered during MIT's Independent Activity Period (IAP), a four-week term spanning the January semester break. The non-credit activities cosponsored by Lincoln Laboratory and the MIT Department of Electrical Engineering and Computer Science include "3D Manipulation of 2D Images," by Peter Cho and Alexandru Vasile, "Build a Holographic Recording and Reconstruction System," by Robert Freking, Christy Cull, and Evan Cull, "Build a Small Phased Array Radar System Capable of Imaging Moving Targets," by Bradley Perry, Patrick Bell, Alan Fenn, Jeffrey Herd, and Jonathan Paul Kitchens (shown at left), "Build A Small Radar System Capable of Sensing Range, Doppler, and Synthetic Aperture Radar Imaging," by Bradley Perry, Alan Fenn, Jeffrey Herd, Jonathan Paul Kitchens, and Melissa Meyer, and "Open Robotics Laboratory," by Michael Boulet, Kenneth Cole, Nicholas Armstrong-Crews, Mark Donahue, Aaron Enes, W. Nicholas Greene, Keith Ruenheck, and John Rogers.

MIT VI-A Master of Engineering Thesis Program

Five MIT students in MIT's Department of Electrical Engineering and Computer Science VI-A Master of Engineering Thesis Program were hired in 2012 to work with a Laboratory mentor while acquiring experience in testing, design, development, research, and programming. The students spend two summers as paid interns, participating in projects related to their fields. Then the students are paid as research assistants while developing their thesis research at Lincoln Laboratory. Three VI-A interns, not at the Lab this summer, completed their theses in May 2012.



MIT Research Assistantships

Lincoln Laboratory annually employs research assistants from MIT (shown above). Working with engineers and scientists, the assistants contribute to programs while investigating the questions that evolve into their doctoral theses. These facilities, research thrusts, and reputations of staff members are prime inducements behind the graduate students' decision to spend three to five years as a research assistant in a Laboratory group. Currently 18 research assistants are working in various divisions.

COMMUNITY **GIVING**

LLCO strives to raise awareness of local needs by organizing fundraising and outreach events that support selected charitable organizations.

Lincoln Laboratory employees are actively engaged in many activities supporting worthy causes contributing to the overall quality of life within and outside of our community. LLCO strives to raise awareness of local needs by organizing fundraising and outreach events that support selected charitable organizations. A diverse range of opportunities is provided for employees to volunteer their time and resources.

American Heart Association Heart Walk

Lincoln Laboratory's participation in the American Heart Association's Heart Walk in Boston was new in 2012. The six-member MIT LL Team (pictured at right) walked to support the American Heart Association in their efforts to prevent, treat, and defeat cardiovascular disease and stroke. Team captains Susan Curry and Sandra McLellan raised $3,800, promoting healthier lives and physical activity.

Support the Troops Program

Lincoln Laboratory runs an ongoing campaign of support for deployed U.S. troops. Donations of food, books, games, and toiletries are collected daily, boxed by volunteers, and mailed weekly to military personnel serving in Iraq and Afghanistan. Each year, Laboratory Security Guard Katie Hart coordinates packing and shipping more than 200 care packages to approximately 37 troops overseas. Lincoln Laboratory Troop Support provides extra support to the soldiers around the holidays by hosting a "Crafting for a Cause" event. Profits from the craft sales go toward holiday items to be sent to the troops. Many soldiers, like the Laboratory's own Heriberto Garcia (below, bottom right) of the BMDS Integration Group, who served with USAFCENT in Oman, United Arab Emirates, thank Lincoln Laboratory Troop Support for sending a "little piece of home." Troop Support hosted a packing party in the summer, resulting in 90 boxes ready to send overseas. One of the recipients, JP Antonio, replied, "I would like to say thank you to LL-MIT for your Troop Support Program. I have received 2 packages from your program and opened them up and shared them until the box was empty, which only took a few minutes. Keep up your fine work and hopefully someday I will be able to join you and your 'troops' at LL-MIT."

Veterans Network

Lincoln Laboratory's Veterans Network (LLVETS) was established last year. This year, LLVETS participated in a Veteran's Day Fun Run hosted by the Veterans Administration. Twenty-nine runners raised $870.00 for the Veteran's Administration Medical Center in Bedford, Massachusetts. Daniel O'Shea of the Infrastructure and Operations Group is shown in the photo above handing the check to the Air Force Association Paul Revere Chapter President and the Acting Director of the Bedford VA Medical Center.

Run to Home Base

A new program supported by LLVETS was the 2012 Run to Home Base Event at Fenway Park. Derrick Cullen and Norm Peterson, both of the Security Services Department, participated in the Fun Run featuring a finish line right at home plate at Fenway Park. Together, these LLVETS members ran 9K and raised $1435 to help support veterans returning from Afghanistan and Iraq with traumatic brain injuries and/or combat stress.

This year's Walk to End Alzheimer's team raised more than $24,750, ranking them as the #2 top fundraising team in the Boston area.

Walk to End Alzheimer's

The MIT Lincoln Laboratory Alzheimer's Awareness and Outreach Team is committed to providing support and information to those in the Laboratory community who have been impacted by Alzheimer's. The outreach team has also participated in the Greater Boston Walk to End Alzheimer's for three years. 2012 marked a banner year for the MIT LL Team in the Walk to End Alzheimer's. The team almost doubled its size to include 30 members, and the team raised more than $24,750, surpassing their goal of $20K, to benefit the regional chapter of the Alzheimer's Association, ranking the team as the #2 top fundraising team in the Boston area. One Laboratory team member also participated in the 30-mile Memory Ride for cyclists. The annual "Purple for a Purpose" event promotes awareness of Alzheimer's disease, inviting all those in the Laboratory community who know someone afflicted with Alzheimer's to wear purple. This gathering fostered support for one another as caregivers and provided the opportunity to stand together to fight the disease.

Multiple Sclerosis Society Bike and Hike

A Lincoln Laboratory team participates in the annual "Bike and Hike the Berkshires" event to raise funds for the Multiple Sclerosis Society. The most recent hiking and cycling teams totaled 15 members and raised more than $10,635 for the Multiple Sclerosis Society. The team ranked fifth in top fundraisers taking part in this event. For the first time, the Minuteman Ride, a summer bike-a-thon through Concord, Massachusetts, was added to the team's roster in order to increase participation and be able to support the MS Society's goal more fully. Ten cyclists raised almost $4,000 to fund more research for multiple sclerosis.

Habitat for Humanity

Lincoln Laboratory's Technical Women's Network supported Habitat for Humanity in 2012 by helping to build an affordable house in Lowell, Massachusetts for a needy family. In October, eight volunteers joined together to install insulation and wall board in the basement, and to landscape the back yard. Smaller projects were to dismantle a grill and wash windows.

Individuals volunteering for this event included Elisabeth Daley, Benjamin Grazier, Katherine Hollister, Linda Kukolich, Sophia Yuditskaya, Teresa Hall, Melinda Deramo, and Rebecca Busacker. The Laboratory is happy to aid Habitat for Humanity in its mission to provide safe, healthy living conditions while strengthening community ties.

Toys for Tots

The MIT Credit Union in Lincoln Laboratory serves as a drop-off point for Toys for Tots holiday toy drive, providing toys for needy families. Each December, more than 300 toys are generously donated by Laboratory employees and distributed to local children.

Used-Book Drive

In coordination with the MIT Community Giving Fund, Lincoln Laboratory holds an annual used-book drive each February. Proceeds support the MIT Community Service Fund, which offers grants to charities in Boston and Cambridge. In 2012, the book drive raised $3200, almost triple its usual amount, and provided plenty of new reading material for all patrons.

Boston Food Pantry

Lincoln Laboratory's Hispanic/Latino Network (LLHLN) fosters diversity and inclusion by enhancing awareness of the Hispanic culture, supporting professional development, and promoting educational outreach. In 2012, LLHLN contributed to community giving by helping at the Boston Food Pantry, donating canned goods, distributing bags of food, and translating for Spanish-speaking clients of the food pantry. The Communications and Community Outreach Office supports a variety of local food pantries as items are donated and as supplies are needed.

Laboratory participation in the Giving Tree collects gifts annually for more than 350 people who would otherwise go without a gift.

Giving Tree

Paula Mason of the Advanced Concepts and Technologies Group organizes a "giving tree" during the holidays to respond to specific holiday wishes from local families in need. This program is paired with a food drive, so that each recipient receives a requested gift and a food Item for the holidays. In 2011, the giving tree items were given to the Billerica Council on Aging. The volunteers who delivered the gifts reported how happy the senior citizens were to be remembered. Laboratory participation in this program helps collect gifts annually for more than 350 people who would otherwise go without a gift of any kind.

Coats for Kids

Lincoln Laboratory participates each winter in the Coats for Kids drive. The Laboratory collects warm coats for all ages and delivers them to Anton's Cleaners. All coats are cleaned free of charge and given to those in need through an extensive distribution partnership. The Coats for Kids program provides 60,000 coats in the greater Boston area to needy families. Lincoln Laboratory annually donates more than 500 coats each December.

United Way

In coordination with MIT, Lincoln Laboratory sponsors an annual campaign to donate to United Way through paycheck donation or a direct one-time contribution to the United Way charity of the employee's choice. The United Way helps human service agencies respond to urgent needs in the community and builds a brighter future for those in need.

Marshallese Island Outreach

Lincoln Laboratory operates a field site at the U.S. Army Kwajalein Atoll located about 2500 miles WSW of Hawaii. Twenty staff members work at this site, serving two- to three-year tours of duty. The amiable relationship enjoyed by the Laboratory staff and the local community prompted the initiation of the Marshallese Outreach program, developed to enrich educational and life experiences of the Marshallese people. Each summer, two Marshallese college students are supported for ten weeks as interns at a Laboratory facility. The internship provides mentoring, resources, and assistance in an effort to encourage interns to pursue further education and subsequent employment in the Marshall Islands, while they contribute to the Reagan Test Site information technology needs. At right, Bobby Andrew and Richard Reyes, two students from the College of the Marshall Islands in Majuro, participated in the internship program and toured the ALTAIR radar on Roi-Namur. Other forms of outreach at Kwajalein include a scholarship awarded each fall to a local student choosing a career in science, technology, engineering, or math. Laboratory staff at Kwajalein also sell wooden and woven Marshallese handcrafts and send the profits back to the Islanders to help provide lunch funds for school children on the island.

Other Community Outreach Events

The Laboratory encourages its staff to support a variety of causes on their own and to join colleagues in their charitable efforts. In the past year, Lincoln Laboratory staff members have supported the following causes:

- PanMass Challenge
- Project Bread's Walk for Hunger
- TeamWalk for CancerCare
- Great Strides for Cystic Fibrosis
- Just Understand My Potential Hiking & Leadership Outreach Program
- Be The Match donor registration program
- Bedford Special Education Fun Run
- Pie in the Sky
- Free to Breathe 5K Fun Run for the National Lung Cancer Partnership

Marshallese student interns are mentored at a Laboratory facility and encouraged to pursue further education.

About Our Volunteers

The Laboratory congratulates those who have offered their time, talents, and support this past year. Volunteerism among Laboratory employees has grown steadily each year. The involvement of the entire Lincoln Laboratory community is encouraged, as Lincoln Laboratory Community Outreach Committee will continue to offer many opportunities to participate in educational and giving outreach events.


greatstrides