MIT LINCOLN
LABORATORY

Facts 2013

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Comments and requests may be sent to llnews@ll.mit.edu.

MIT Lincoln Laboratory's fundamental mission is to apply science and advanced technology to critical problems of national security. To assure excellence in the fulfillment of this mission, the Laboratory is committed to fostering an environment that embraces and leverages diversity of thought, culture, and experience.

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Contents

Quick Facts

MIT Lincoln Laboratory is a Department of Defense federally funded research and development center.

Established
1951

Research areas
Sensors, data extraction (signal processing and embedded computing), communications, integrated sensing and decision support, advanced electronics, cyber security

Major sponsors
U.S. Air Force, U.S. Army, U.S. Navy, Missile Defense Agency, Defense Advanced Research Projects Agency, Office of the Secretary of Defense, NASA, Federal Aviation Administration

Director
Dr. Eric D. Evans

Personnel
1670 technical staff; 392 technical support staff; 584 technical and technical support subcontractors; 1067 support personnel; 3700 total personnel

Facility profile
28 buildings and structures—a total area of 2.1 million sq ft

Located on 3 sites—main facility in Lexington, Mass.; Flight and Antenna Test Facility on Hanscom Air Force Base in Bedford, Mass.; Millstone Hill radar complex in Westford, Mass.
Field Sites: 3
Field Offices: 8

U.S. patents issued to Lincoln Laboratory technical staff since 1951
710

Spin-off companies since 1951
95

Overview

MIT Lincoln Laboratory is a Department of Defense (DoD) federally funded research and development center working on problems critical to national security. The Laboratory's core competencies are in sensors, information extraction (signal processing and embedded computing), communications, cyber security, integrated sensing, and decision support.

Technology development is geared to the Laboratory's primary mission areas—space control; air and missile defense; communication systems; intelligence, surveillance, and reconnaissance systems; advanced electronics; tactical systems; homeland protection; cyber security; and air traffic control.

Two of the Laboratory's principal technical objectives are (1) the development of components and systems for experiments, engineering measurements, and tests under field operating conditions and (2) the dissemination of information to the government, academia, and industry.

Program activities extend from fundamental investigations through the design process and finally to field demonstrations of prototype systems. Emphasis is placed on transitioning systems and technology to industry.

As a DoD Research and Development Laboratory, Lincoln Laboratory focuses on developing and prototyping innovative technologies and enhanced capabilities to meet the evolving needs of the DoD.

Lincoln Laboratory also undertakes government-sponsored, nondefense projects in areas such as the development of systems the Federal Aviation Administration relies on to improve air traffic control and air safety, and systems that the National Oceanic and Atmospheric Administration uses in weather surveillance.

Historical Brief

Lincoln Laboratory was established in 1951 to develop an air defense system for the United States. The Laboratory's first building was completed in 1952 and four more buildings were completed by 1954. Today, the complex, located primarily on Hanscom Air Force Base, comprises 28 facilities, including a state-of-the-art Microelectronics Laboratory.

The first project of Lincoln Laboratory was the Semi-Automatic Ground Environment (SAGE) air defense system, which was developed to collect, analyze, and relay data from multiple radars quickly enough to initiate a response if an air attack were identified. The Whirlwind computer built at MIT was at the heart of this system; the Laboratory's second-generation Whirlwind enabled transmittal and interpretation of enormous amounts of data—virtually in real time. SAGE was the beginning of the Laboratory's long history of developing innovative technology.

In 2001, Lincoln Laboratory received the Secretary of Defense Medal for Outstanding Public Service in recognition of a half-century of technical innovation and scientific discoveries.

To learn more about Lincoln Laboratory's history, visit the web at http://www.ll.mit.edu/about/History/history.html.

Lincoln Laboratory Logo

The Lincoln Laboratory logo, which first appeared in February 1958 in the Lincoln Laboratory Bulletin, was conceived by Carl Overhage, the Laboratory's fourth director. Overhage drew a Lissajous figure based on the superposition of two simple harmonic vibrations and commissioned retired Brigadier General Robert Steinle and the firm Advertising Designers of Los Angeles to transform the Lissajous figure into an artistic image.

The two L's rotated 180 degrees with respect to each other stand for Lincoln Laboratory. They form a rectangle enclosing the Lissajous figure generated by the parametric equations $x = 3\sin(8\pi t/T)$ and $y = 4\sin(6\pi t/T)$. The figure is traced along the horizontal axis x and the vertical axis y as the variable t progresses from $t = 0$ to T.

The Lincoln Laboratory logo is an identifying symbol on Laboratory publications and its website. Because of its distinctive and striking appearance, the logo was included in the 1972 edition of *The Book of American Trademarks*, a compilation of the nation's most significant trademarks, logos, and corporate symbols.

Lissajous Figure

The Lissajous figure, familiar to most physical scientists and engineers, connotes harmony, order, and stability. The Lissajous figures, named for the French mathematician Jules-Antoine Lissajous, are also known as Bowditch curves after their discoverer, Nathaniel Bowditch, the mathematician from Salem, Massachusetts.

Directors of Lincoln Laboratory

11 **Eric D. Evans** 1 July 2006–present
10 **David L. Briggs** 1 July 1998–30 June 2006
9 **Walter E. Morrow** 1 April 1977–30 June 1998
8 **Gerald P. Dinneen** 1 June 1970–1 April 1977
7 **Milton U. Clauser** 1 January 1967–1 June 1970
6 **C. Robert Wieser** (Acting) 10 May 1966–1 January 1967
5 **William H. Radford** 1 February 1964–9 May 1966
4 **Carl F.J. Overhage** 1 February 1957–1 February 1964
3 **Marshall G. Holloway** 5 May 1955–1 February 1957
2 **Albert G. Hill** 9 July 1952–5 May 1955
1 **F. Wheeler Loomis** 26 July 1951–9 July 1952

Six Decades of Technical Achievements

1950s

- Semi-Automatic Ground Environment (SAGE) System
- Distant Early Warning Line
- Whirlwind computer magnetic-core memory and subsequent models—Whirlwind II and the AN/FSQs
- Ballistic Missile Early Warning System
- Millstone Hill Radar / Space Surveillance

1960s

- Lunar range-Doppler mapping
- First satellite television transmission
- Gallium arsenide semiconductor laser demonstrated
- Haystack Radar operations
- Lincoln Experimental Satellites 1 to 6
- Lunar mapping for Apollo landing

1970s

- Air Traffic Control program / Mode S airport surveillance
- ARPA-Lincoln C-band Observables Radar and TRADEX Radar S-band upgrade, Kwajalein Atoll
- Extremely high-frequency submarine communications demonstrated
- Lincoln Experimental Satellites 8 and 9

- Continuous-wave diode laser developed in InGaAsP/InP alloy
- Ground-based Electro-Optical Deep Space Surveillance system at Experimental Test Site in New Mexico
- Air vehicle survivability programs

1980s

- Airborne towed countermeasures
- Millimeter Wave Radar, Kwajalein Atoll
- Cobra Judy X-band system
- Kwajalein / Lexington Discrimination System
- Charge-coupled device for Short-Wavelength Adaptive Techniques program
- Airborne Seeker Test Bed
- Compact linear-predictive coding vocoder

1990s

- Firepond laser radar imaging demonstration
- Terminal Doppler Weather Radar deployed
- Traffic Alert and Collision Avoidance (TCAS) system
- Microelectronics Laboratory operational
- Earth Orbiting (EO)–1 Advanced Landsat Imager
- Fly-Along Sensor Package
- Cobra Gemini
- Space-Based Visible payload delivered
- Kwajalein Modernization and Remoting program
- Biological Agent Warning Sensor
- Theater Critical Measurements Program flight tests launched
- Lincoln Near-Earth Asteroid Research (LINEAR) program
- Chandra Observatory charge-coupled device camera

2000s

- NASA Earth Observation-1 launched
- Forward-Based Radar test bed for missile defense
- Geosynchronous Lightweight Integrated Technology Experiment

- Airport Surveillance Radar/Weather Systems Processor
- CANARY/PANTHER pathogen detection sensors
- Three-dimensional imaging
- Airborne Ladar Imaging Research Testbed
- Jigsaw 3D imaging laser radar
- Slab-coupled optical waveguide laser invented
- Orthogonal transfer arrays for wide-field camera
- Enhanced Regional Situation Awareness system
- LLGrid cluster computing
- Runway Status Lights system
- Extended Space Sensors Architecture
- Decision support architectures
- Nonlinear equalization for receiver dynamic range extension
- Wideband Global SATCOM system

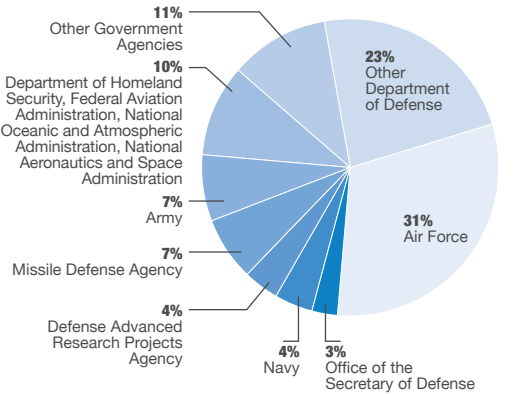
2010s

- Space Surveillance Telescope
- Millimeter Wave Radar upgrade
- Reagan Test Site Distributed Operations
- X-band Transportable Radar
- Missile Alternative Range Target Instrument payloads
- Geiger-mode avalanche photodiode focal plane arrays
- Digital focal plane arrays
- Graphene-on-insulator electronics
- Multi-Aperture Sparse Imager Video System
- Imaging System for Immersive Surveillance
- Lincoln Adaptable Real-time Information Assurance Testbed
- Graph detection algorithms
- Miniaturized radio-frequency receiver
- Next-Generation Incident Command System

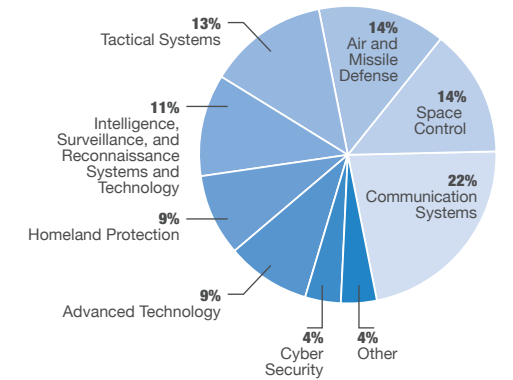
Funding

Lincoln Laboratory programs are funded by a number of DoD agencies through its prime contract with the Air Force.

Breakdown of Program Funding by Sponsor



Breakdown of Program Funding by Mission Area



Mission Areas and Research

Mission Areas

Space Control

Lincoln Laboratory develops technology that enables the nation's space surveillance system to meet the challenges of space situational awareness. The Laboratory works with systems to detect, track, and identify man-made satellites; collects orbital-debris detection data to support space-flight safety; performs satellite mission and payload assessment; and investigates technology to improve monitoring of the space environment, including space weather and atmospheric and ionospheric effects. The technology emphasis is the application of new components and algorithms to enable sensors with greatly enhanced capabilities and to support the development of netcentric processing systems for the nation's Space Surveillance Network.

Air and Missile Defense Technology

Lincoln Laboratory develops and assesses integrated systems for defense against ballistic missiles, cruise missiles, and air vehicles in tactical, regional, and homeland defense applications. Activities include the investigation of system architectures, development of advanced sensor and decision support technologies, development of flight-test hardware, extensive field measurements and data analysis, and the verification and assessment of deployed system capabilities. A strong emphasis is on rapidly prototyping sensor and system concepts and algorithms, and on transferring resulting technologies to government contractors responsible for developing operational systems.

Communication Systems

The Communication Systems mission works to enhance and protect the capabilities of the nation's global defense networks. Emphasis is placed on synthesizing system architectures, developing component technologies, building and demonstrating end-to-end system prototypes, and then transferring this technology to industry for deployment in operational systems. Current efforts span all network layers (from physical to application), with primary focuses on radio-frequency (RF) military satellite communications (MILSATCOM), netcentric operations, free-space laser communications, line-of-sight networking, and human language technology.

Cyber Security

Lincoln Laboratory conducts research, development, evaluation, and deployment of prototype components and systems designed to improve the security of computer networks, hosts, and applications. A particular focus is the intersection between the Laboratory's traditional mission areas and the cyber domain. Efforts include cyber analysis; creation and demonstration of robust architectures that can operate through cyber attacks; development of prototypes that demonstrate the practicality and value of new techniques for cryptography, cyber sensing, automated threat analysis, anti-tamper systems, and malicious code detection; demonstrations of the impact of cyber on traditional kinetic systems; quantitative, repeatable evaluation of these prototypes; and, where appropriate, deployment of prototype technology to national-level exercises and operations.

ISR Systems and Technology

To expand intelligence, surveillance, and reconnaissance (ISR) capabilities, Lincoln Laboratory conducts research and development in advanced sensing, signal and image processing, automatic target classification, decision support systems, and high-performance computing. By leveraging these disciplines, the Laboratory produces novel ISR system

concepts for both surface and undersea surveillance applications. Sensor technology for ISR includes passive and active electro-optical systems, surface surveillance radar, radio-frequency (RF) geolocation, and undersea acoustic surveillance. Increasingly, the work extends from sensors and sensor platforms to include the processing, exploitation, and dissemination architectures that connect sensors to operational users. Prototype ISR systems developed from successful concepts are then transitioned to industry and the user community.

Tactical Systems

In the Tactical Systems mission, Lincoln Laboratory assists the Department of Defense in improving the acquisition and employment of various tactical air and counterterrorism systems. The Laboratory does this by helping the U.S. military understand the operational utility and limitations of advanced technologies. Activities focus on a combination of systems analysis to assess technology impact in operationally relevant scenarios, rapid development and instrumentation of prototype U.S. and threat systems, and detailed, realistic instrumented testing. A tight coupling between the Laboratory's efforts and the DoD sponsors and warfighters involved in these efforts ensures that the analyses and prototype systems are relevant and beneficial to the warfighter.

Advanced Technology

Research and development in Advanced Technology support the entire Laboratory by identifying new phenomenologies that can be exploited in novel system applications and by developing revolutionary advances in subsystem and component technologies that enable new system capabilities. This work is highly multidisciplinary, leveraging solid-state electronic and electro-optical technologies, innovative chemistry, and advanced radio-frequency (RF) technology. Recent developments include

world-class imagers and detectors, novel three-dimensional electronic-photonic integration techniques, unique digital and quantum information systems technology, novel engineered materials, chemical-agent sensors, state-of-the-art lasers and photonic devices, and advanced antenna arrays and RF transceivers.

Homeland Protection

The Homeland Protection mission supports the nation's security by innovating technology and architectures to help prevent terrorist attacks within the United States, to reduce the vulnerability of the nation to terrorism, to minimize the damage from terrorist attacks, and to facilitate recovery from either man-made or natural disasters. Recent efforts include architecture studies for the defense of civilians and facilities, new microfluidic technologies for DNA assembly and transformation and for gene synthesis, development of the Enhanced Regional Situation Awareness system for the National Capital Region, the assessment of technologies for border and maritime security, and the development of architectures and systems for disaster response.

Air Traffic Control

Since 1971, Lincoln Laboratory has supported the Federal Aviation Administration (FAA) in the development of new technology for air traffic control. This work initially focused on aircraft surveillance and weather sensing, collision avoidance, and air-ground data-link communication. Today, the program has evolved to include a rich set of safety applications, decision support services, and air traffic management automation tools. A focus of the current program is support for the FAA's Next Generation Air Transportation System (NextGen). Key activities include the operation of a national-scale integrated weather-sensing and decision support prototype; testing and technology transfer of a runway incursion-prevention system; development of an improved air traffic collision avoidance

system; and development of a net-centric, system-wide, information management system.

Engineering

Fundamental to the success of Lincoln Laboratory is the ability to build hardware systems incorporating advanced technology. These systems are used as platforms for testing new concepts, as prototypes for demonstrating new capabilities, and as operational systems for addressing warfighter needs. To construct the variety of systems used in programs across all mission areas, the Laboratory relies on its extensive capabilities in mechanical design and analysis, optical system design and analysis, aerodynamic analysis, mechanical fabrication, electronics design and assembly, control system development, system integration, and environmental testing. These capabilities are centered in the Laboratory's Engineering Division, which is an important contributor to many of the Laboratory's most successful efforts.

For more about the Laboratory's mission areas, visit the web at http://www.ll.mit.edu/mission/index.html.

Major Capabilities of Lincoln Laboratory

- Adaptive signal processing
- Advanced imaging
- Advanced microelectronics and microsystems
- Advanced radar technology
- Advanced RF technology
- Biological/chemical agent detection and identification
- Communication systems
- Cyber security
- Decision support technologies
- Environmental monitoring
- High-performance computing
- Homeland protection systems
- Human language technologies
- Laser communications
- Net-centric architectures

- Open systems architectures
- Optics and laser systems
- Rapid prototyping
- Space situational awareness
- Systems analysis
- Threat assessment
- Weather sensing

Research Initiatives

Internal research and development at Lincoln Laboratory are supported through a congressionally appropriated source of funding that is administered by the office of the Assistant Secretary of Defense for Research and Engineering. This funding supports the long-term strategic technology capabilities of existing and envisioned mission areas. Research projects focus on addressing technology gaps in critical problems facing national security.

This funding plays a critical role in fostering innovative research and development that often lead to further sponsored program development. It supports mission-specific research needs and the development of new initiatives. In addition, this funding is used to finance a limited portfolio of collaborative academic research with universities. Through these collaborations, the Laboratory gains access to cutting-edge research pertinent to mission-area needs and emerging technology initiatives, and university students have the opportunity to work on timely and relevant problems.

In 2012–2013, the Laboratory is funding novel work in advanced ISR systems, cyber security, communications, advanced electronics technology, air and missile defense, and space control to support work in its core missions. Research initiatives focused on emerging technologies include projects in biomedicine, autonomous systems, quantum information sciences, net-centric operations, and information, computation, and exploitation sciences.

Organization

Lincoln Laboratory is led by the Director, Associate Director, and Assistant Director for Operations in conjunction with a Steering Committee consisting of the Director's Office and the heads of the technical divisions. The Laboratory reports to the MIT Office of the President. An annual review of Lincoln Laboratory is conducted by a Joint Advisory Committee composed of the Laboratory's major sponsors and led by the Assistant Secretary of Defense for Research and Engineering.

Lincoln Laboratory's eight technical divisions contain work-specific groups. Projects within the ten core mission areas are often multidisciplinary, involving interdivisional collaborations. The technical work of the Laboratory is supported by six service departments.

Technical Divisions

Division 3–Air and Missile Defense Technology
Division 4–Homeland Protection and Air Traffic Control
Division 5–Cyber Security and Information Sciences
Division 6–Communication Systems
Division 7–Engineering
Division 8–Advanced Technology
Division 9–Aerospace
Division 10–Intelligence, Surveillance, and Reconnaissance and Tactical Systems

Service Departments

Contracting Services, Facility Services, Financial Services, Human Resources, Information Services, Security Services

Working at Lincoln Laboratory

Lincoln Laboratory's reputation has been built on the strength and quality of its technical staff. Approximately 1670 professional technical staff members work on research, prototype building, and field demonstrations. The technical staff come from a broad range of scientific and engineering fields. Two-thirds of this professional staff hold advanced degrees.

The Laboratory also employs about the same number of people to provide the strong infrastructure and administrative functions that support the research and demonstration activities behind the development of new devices and technologies.

Technical Positions

Lincoln Laboratory technical staff members come from many scientific and engineering fields; electrical engineering, physics, and computer science are three of the most common disciplines represented at the Laboratory.

Positions filled by engineers and scientists at Lincoln Laboratory require problem-solving ability, analytical skills, and creativity.

Representative Technical Positions

- Aerospace engineer
- Applications engineer
- Bioengineer
- Biologist

- Communications systems engineer
- Computer scientist
- Cyber security analyst
- Data analyst
- Data fusion engineer/scientist
- Electro-optical device developer
- Electro-optical systems developer
- Electronics hardware engineer
- Integrated circuit architect/designer
- Laser applications engineer
- Mechanical/Optomechanical engineer
- Meteorologist
- Mission assurance engineer
- Network engineer
- Optical image analyst
- Optical system designer
- Radar systems analyst
- Radar systems engineer
- RF engineer
- Scientific programmer
- Signal processing engineer/analyst
- Software developer/programmer
- Software engineer
- Systems analyst
- Systems engineer
- System integrator and test engineer

For information on available positions at Lincoln Laboratory, visit the web at http://www.ll.mit.edu/employment/jobs.html.

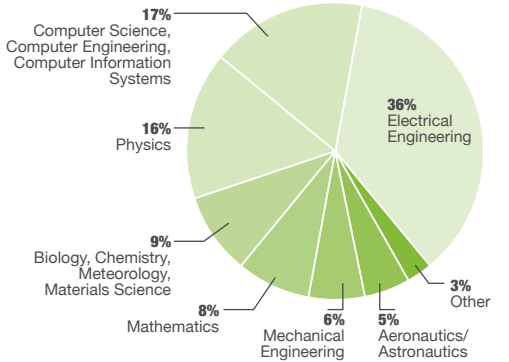
Professional Development

Lincoln Laboratory's commitment to the professional development of its staff is founded on the recognition that the Laboratory's extensive research and development contributions are made possible through the staff's continuing excellence and accomplishments.

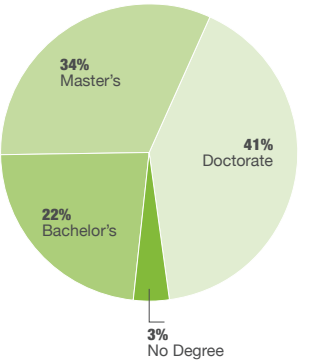
Continues on page 18

Profile of Professional Technical Staff

Academic Discipline



Academic Degree



To encourage professional development, the Laboratory supports a variety of opportunities for employees:

- Tuition assistance program
- The competitive Lincoln Scholars Program to enable the pursuit of advanced degrees on a full-time basis
- Distance learning programs with Carnegie Mellon University and Pennsylvania State University
- In-house Technical Education Program
- In-house training in computer applications; seminars on topics in management
- Collaborative technical seminar series with MIT, Northeastern University, and other universities
- Technical seminars on innovative work, given weekly by staff members

Support for professional activities is strong. The Laboratory encourages staff to publish in technical journals, attend conferences, and participate in activities of their professional societies. In addition, interdisciplinary projects allow staff to grow professionally.

The onsite library offers a highly focused, comprehensive collection of technical books, reports, and electronic journals and databases in all Laboratory technology areas. In addition, the resources of the main MIT library system are available to staff.

Diversity and Inclusion

Lincoln Laboratory is committed to diversity and inclusion in the workforce. The Laboratory recognizes that its continuing success is achieved through the appreciation and support of the diverse talents, ideas, cultures, and experiences of its employees.

The Diversity and Inclusion Office seeks to

- Recruit the best technical and support talent from the diverse national pool of candidates

- Foster a work environment built on trust and inclusion
- Develop all aspects of the Laboratory community through improved mentorship, networking, and staff development
- Adapt training and development approaches to ensure the professional growth of the Laboratory's diverse staff
- Build external and internal relationships that align with the Laboratory's diversity initiatives

Diversity and Inclusion Initiatives

- Recruiting efforts and outreach to minority student organizations have been enhanced to increase the hiring of highly qualified women and minority technical professionals.
- Networking groups help new employees transition to the Laboratory, promote professional development, and encourage involvement in the community. The Lincoln Laboratory New Employee Network, Technical Women's Network, Hispanic and Latino Network, and Veterans Network are fostering an inclusive environment.
- Lincoln Laboratory's four formal mentorship programs complement efforts to create an inclusive community. The New Employee Guides program focuses on acquainting employees with their groups, divisions, or departments during their early months at the Laboratory. Staff can later choose to participate in more specialized mentoring programs:
  - Early Career Mentoring provides one-on-one mentorship to help technical and administrative professionals with early career development.
  - Circle Mentoring small discussion groups are led by experienced employees and address topics relevant to professional growth.
  - By partnering a new assistant group leader with an experienced group leader, the New Assistant Group Leader Mentoring helps technical staff members transition into their new responsibilities

Work–Life Balance

Lincoln Laboratory recognizes that a balance between work and personal life is essential for employees' well being. The Laboratory offers a number of services to assist employees in maintaining such a balance, as well as offering flexible work schedules, part-time employment, and telecommuting opportunities.

Child Care

The Technology Children's Center facility in Lexington (TCC Lincoln Laboratory) is just 1.3 miles from the Laboratory and provides developmentally based infant, toddler, and preschool programs for children from 8 weeks to 5–6 years old. Technology Children's Centers are managed by Bright Horizons and overseen by the MIT Center for Work, Family & Personal Life.

Health and Wellness Center

The Health and Wellness Center houses a medical facility operated by MIT Medical and a fitness center. The medical center offers primary care services for members of the MIT Health Plan and brief medical assistance for employees. The Fitness Center, which all employees are eligible to join, is run by the MIT Athletic Department.

MIT Activities Committee (MITAC)

MITAC promotes the enjoyment of Boston-area cultural and recreational activities by offering opportunities for or discount tickets to everything from hayrides to NYC shopping sprees to ski getaways, as well as to various sporting events, exhibitions, theater, and musical performances.

MIT Federal Credit Union

All Lincoln Laboratory employees may become members of the MIT Federal Credit Union, which offers savings plans and low-interest loans.

Professional and Community Enhancement (PACE) Committee

The PACE Committee assists the Director to ensure that Lincoln Laboratory provides a productive workplace and a supportive and diverse community. The PACE Committee helps with decisions about the child-care facility, professional development opportunities, mentoring, and other workplace concerns.

Commuter Services

Lincoln Laboratory encourages sharing transportation to work and using public transportation through several programs that offer employees assistance with commuting:

- Hitch-a-Ride Matching Service
- Rideshare Program
- Guaranteed Ride Home Program
- MBTA Pass Program

Brown Bag Seminars

The Human Resources Department at Lincoln Laboratory offers a wide range of seminars, free of charge to employees. Held about once a month and called Brown Bag Seminars because they are advertised as "bring your lunch" events, the seminars are presented by community experts on topics such as parenting, communication, elder care, and managing finances.

The Ombudspersons Program

The Lincoln Laboratory ombudspersons are employees who have been appointed by the Director to help resolve employee concerns. Ombudspersons provide informal, impartial assistance that may facilitate fair and equitable resolutions of problems or disputes. Ombudspersons do not represent anyone; they act as neutral parties and respect the rights of privacy of individuals they are helping.

Facilities and Field Sites

Facilities

Microelectronics Laboratory

The Lincoln Laboratory Microelectronics Laboratory is a state-of-the-art semiconductor research and fabrication facility supporting a wide range of Lincoln Laboratory programs. The 70,000 sq ft facility has 8100 sq ft of class-10 and 10,000 sq ft of class-100 cleanroom areas.

The equipment set in this laboratory is continually updated and includes a production-class complementary metal-oxide semiconductor (CMOS) toolset with angled ion-implantation, cluster-metallization, and dry-etch equipment; chemical-mechanical planarization equipment; and rapid thermal processing and advanced lithography capabilities. A molecular-beam epitaxy system is used to provide high sensitivity and highly stable back-illuminated devices in the ultraviolet and extreme ultraviolet ranges. In addition, the Microelectronics Laboratory supports advanced packaging with a precision multichip module technology and an advanced three-dimensional circuit-stacking technology.

Lincoln Space Surveillance Complex

The Lincoln Space Surveillance Complex in Westford, Massachusetts, has played a key role in space situational awareness and the Laboratory's overall space surveillance mission. The site comprises three major radars—Millstone Deep-Space Tracking Radar (L band), Haystack Long-Range Imaging Radar (X band), and the Haystack Auxiliary Radar (Ku band).

The Millstone Hill Radar is used for tracking space vehicles and space debris. Like Millstone, Haystack is also a contributing sensor to the U.S. Space Surveillance Network, collecting radar data on space objects.

RF System Test Facility

The antenna and radar cross-section measurements facility, constructed at Lincoln Laboratory on Hanscom Air Force Base, was designed with a rapid prototyping focus for radar and communication systems development.

There are five indoor test ranges: a small shielded chamber for electromagnetic induction measurements; two small utility ranges consisting of a tapered anechoic chamber and a millimeter-wave anechoic chamber; a compact range; and a systems development chamber that works in conjunction with an instrumentation laboratory. In addition to the chambers, multipurpose signal generation, data acquisition, and control and recording instrumentation in a systems integration laboratory provide a supporting role in the rapid prototyping of RF systems. A high-bay staging area and machine shop support the development of rapid prototype antennas. Antennas and subsystems are tested in an integrated RF system in the compact range and system test chambers.

Rapid Hardware Integration Facility

Lincoln Laboratory's 3900-square-foot hardware-integration facility supports the rapid integration and fielding of specialized systems. It was designed to accommodate an increased emphasis on rapid prototyping projects by providing the appropriate tools, collaborative environment, and required infrastructure. This facility, spread over two floors, maximizes collaboration between team members and minimizes the time to iterate through the design-build-test cycle by collocating spaces for fabrication and integration. The facility is divided into areas for system

integration, electronic assembly, additive manufacturing (3D printing), and conventional machining. It can accommodate the development of about five to eight systems, all with concept-to-system delivery timelines of less than 12 months.

Airborne Test Bed Facility

The Laboratory operates the main hangar on the Hanscom Air Force Base flight line. This ~93,000 sq ft building accommodates the Laboratory's airborne test bed and a complex of state-of-the-art antenna test chambers. The facility houses several Lincoln Laboratory–operated aircraft.

Lincoln Laboratory Grid

The Lincoln Laboratory Grid is an interactive, on-demand parallel computing system that uses a large computing cluster to enable Laboratory researchers to augment the processing power of desktop systems with high-performance computational cluster nodes to process large sets of sensor data, create high-fidelity simulations, and develop entirely new algorithms.

Optical Systems Test Facility

The Optical Systems Test Facility was established at Lincoln Laboratory to support a broad scope of program areas, encompassing tactical ground-based sensors through strategic space-based sensors.

The Optical Systems Test Facility comprises several separate ranges developed as a coordinated set of test sites at the Laboratory. Currently, four separate ranges are housed in the facility: an active range (Laser Radar Test Facility), a passive range (Seeker Experimental System), an aerosol range (Standoff Aerosol Active Signature Testbed), and an optical material measurements range.

Environmental Test Laboratory

The Environmental Test Laboratory is one of the Engineering Division's facilities used by coalition project teams for demonstrating novel ground-based, sea-based, airborne, and space-based systems. This laboratory supports both small rapid development efforts and large systems development. The laboratory's vibration systems are used for sinusoidal, random vibration, and shock-response testing. The vacuum systems test high-altitude and satellite hardware. Thermal chambers test hardware limits at hot and cold temperatures.

Polymer Laboratory

The Engineering Division's Polymer Laboratory supports Lincoln Laboratory's prototype building efforts. It is used for composite assemblies, adhesives and elastomeric molding, priming and painting, circuit board conformal coating, material property testing, heat treatment, and vacuum bagging.

Netcentric and Cyber Center

The Netcentric and Cyber Center, used by researchers in multiple mission areas, is a facility that enables rapid deployment and demonstrations of network-centric and cyber architectures.

Lincoln Research Network Operations Center

The Lincoln Research Network Operations Center (LRNOC) is used to develop prototype cyber analysis tools by processing the Laboratory's own operational network traffic, security system alerts, information technology system logs, and configuration data. The LRNOC serves as a test bed for exploring and evaluating new techniques prior to prototype deployment on Department of Defense networks.

Air Traffic Management Laboratory

The Air Traffic Management (ATM) Laboratory is used to test and demonstrate a variety of air traffic surveillance, aviation weather, and decision support systems. Systems currently integrated in the ATM Lab include the Corridor Integrated Weather System, the Enhanced Regional Situation Awareness system, a Runway Status Lights system, and the Enhanced Traffic Management System. Each of these systems is connected to live data from various field sites and national systems.

Integrated Weather and Air Traffic Test Facility

The Integrated Weather and Air Traffic Test Facility supports the Laboratory's work on improvements in flight safety and efficiency. Among the facility's resources is a real-time operations center for various live prototype tests, including tests of the Federal Aviation Administration's (FAA) Corridor Integrated Weather System. The facility is also connected to the FAA's Enhanced Traffic Management System, which supplies flight track information for all aircraft in the country. The facility's computer room houses a 200+-node computer cluster and 300 terabytes of data storage used to keep the real-time systems running, as well as a large complement of computers used for analysis.

Decision Support Laboratories

The Decision Support Laboratories provide development, evaluation, and visualization capabilities for decision support activities in a number of areas, including intelligence, surveillance, and reconnaissance; integrated sensing; space situational awareness; air traffic management; and air and missile defense.

Field Sites

Reagan Test Site, Kwajalein Atoll, Marshall Islands

Lincoln Laboratory serves as the scientific advisor to the Reagan Test Site at the U.S. Army Kwajalein Atoll

installation located about 2500 miles WSW of Hawaii. Twenty staff members work at this site, serving two- to three-year tours of duty. The site's radars and optical and telemetry sensors support ballistic missile defense testing and space surveillance. The Laboratory also supports upgrades to the command-and-control infrastructure of the range to include applications of real-time discrimination and decision aids developed as a result of research at the Laboratory.

Experimental Test Site, White Sands Missile Range, New Mexico

The Experimental Test Site (ETS) is an electro-optical test facility located on the grounds of the White Sands Missile Range in Socorro, New Mexico. Situated next to the U.S. Air Force's Ground-based Electro-Optical Deep Space Surveillance field site, the ETS is operated by the Laboratory for the Air Force. The principal mission of the ETS is the development, evaluation, and transfer of advanced electro-optical space surveillance technologies. It is a national resource that supports measurements and operational surveillance tasking for programs such as those involving near-Earth and deep-space objects.

Pacific Missile Range Facility, Kauai, Hawaii

The Pacific Missile Range Facility (PMRF) on the Hawaiian island of Kauai is one of the Pacific ranges supporting experimental and developmental testing of the Ballistic Missile Defense System. Lincoln Laboratory personnel at PMRF provide technical advice, consultation, and analysis support as requested by government leadership at the Range. The Laboratory has provided significant inputs into sensor designs and implementations for PMRF.

Field Offices

- Crystal City Field Site, Arlington, Virginia
- Aviation Liaison Office, Washington, D.C.
- Colorado Springs Field Site, Colorado Springs, Colorado

- Ground-based Electro-Optical Deep Space Surveillance and Space Surveillance Telescope Field Sites, Socorro, New Mexico
- Huntsville Field Site, Huntsville, Alabama
- Nevada Field Site, Henderson, Nevada
- Space and Missile Systems Center Liaison Office, El Segundo, California
- Vandenberg Air Force Base Field Office, Vandenberg Air Force Base, California

Technology Transfer

Lincoln Laboratory has a long history of promoting technology transfer for application in the defense and the civil sectors. Many technologies initially developed to meet defense requirements have been re-adapted for commercial use. For example, under the U.S. Air Force's Semi-Automatic Ground Environment air defense program of the 1950s, Lincoln Laboratory's expansion of the capabilities of MIT's Whirlwind computer, the first to operate in real time and to use video displays for output, led to the development of the IBM 704 business computer. Subsequent developments led to minicomputers in the 1960s.

Lincoln Laboratory's focus on adapting and demonstrating new, advanced capabilities to enhance existing systems results in important technology transfer opportunities. A common strategy for achieving transition is to share the "architectural recipe" and work with commercial component and subsystem suppliers to assure that technology advances demonstrated by the Laboratory can be duplicated by industry.

One reason for the Laboratory's success in transferring technology is its participation in sponsor-supported programs with industry. Such programs complement the Laboratory's work on developing and prototyping new device concepts.

Transfer of technology is accomplished in several ways as circumstances allow:

- Direct transfer of designs and specifications
- Funded industrial development of Lincoln Laboratory–designed subsystems

- One-on-one technical meetings
- Open technical seminars
- Industry-wide workshops in areas of the Laboratory's expertise
- Establishment of advanced test bed systems against which industry can develop systems and verify performance

Spin-off Companies

One measure of the Laboratory's contribution to the nation's economy is its success in transferring technology to spin-off companies. Since the Laboratory's inception, 95 high-technology companies have evolved from the Laboratory's technology development. These companies' services and products range from multimedia software services to advanced semiconductor lithography. The spin-off companies are large organizations such as MITRE, a not-for-profit research and development corporation, and small businesses such as TeK Associates, a software consulting firm, and are found not only in Massachusetts but also in states beyond.

Notable Spin-off Companies

MITRE Corporation
Digital Equipment Corporation
American Power Conversion Corporation
Applicon, Inc.
Arcon Corporation
Axsun Technologies, Inc.
Centocor, Inc.
Computer Corporation of America
HighPoint Systems, Inc.
Innovative Biosensors, Inc.
Kenet, Inc.
Kopin Corporation
Lasertron, Inc.
LightLab Imaging LLC

Metric Systems Corporation
Photon, Inc.
TeK Associates
Saperix Technologies
Telenet Communications, Inc.
TeraDiode
Tyco Laboratories, Inc.
XonTech, Inc.

Patents

Lincoln Laboratory has contributed to the nation's and the world's technical knowledge base through the U.S. patents issued for its technologies. Laboratory technical innovations licensed to industry have enabled many commercial-sector applications, from air traffic management systems to semiconductor processing to biological-agent sensors. In the last 61 years, approximately 710 U.S. patents have been issued for advancements and inventions developed by Lincoln Laboratory researchers.

Subcontracts with Business and Universities

Lincoln Laboratory contracts with companies to design and fabricate developmental hardware and material. The technical expertise developed by companies during the Laboratory-funded proof-of-concept phase is carried forward to the production phase. Often, this prototype work results in business for companies who later produce the hardware/material commercially. The Laboratory also contracts with universities for basic and applied research; the collaborations forged through these partnerships also promote the exchange of technology and knowledge.

Cooperative Research & Development Agreements and the Small Business Technology Transfer Program

Lincoln Laboratory engages in a limited number of Cooperative Research and Development Agreements (CRADAs) and Small Business Technology Transfer

Program (STTR) arrangements. Both these arrangements are mechanisms for increasing interactions with industry, thus promoting mutual knowledge exchange and technology transfer, and benefiting both partners by providing them with R&D they might not readily accomplish within their budgets and facilities.

Technologies investigated through these arrangements are those consistent with the Laboratory's defined mission areas and are frequently ones that enable advancements to processes and devices.

Small Business Office

Lincoln Laboratory has a strong program designed to afford small business concerns, as defined by the U.S. government, the maximum opportunity to compete for purchase orders. The Small Business Office (SBO) ensures that small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and woman-owned small business concerns, as well as historically black colleges or universities or minority institutions, are given the maximum possible opportunity to participate in Laboratory acquisitions.

The Lincoln Laboratory SBO can be reached at SBLO@ll.mit.edu or 781-981-SBLO (781-981-7256).

For more information on the SBO, visit the web at http://www.ll.mit.edu/about/SmallBusiness/smallbusiness.html.

Collaborations with MIT Campus and Other Universities

Programs

Advanced Concepts Committee

The Lincoln Laboratory Advanced Concepts Committee (ACC) supports the development of innovative concepts that address important technical problems of national interest. Collaborative efforts between Lincoln Laboratory and research universities are encouraged. The ACC provides seed funding, as well as technical and programmatic support, to investigators with new technology ideas.

Integrated Photonics Initiative

A unique collaboration between Lincoln Laboratory and the MIT campus is the Integrated Photonics Initiative (IPI), a multiyear, Laboratory-funded effort that enhances the research experience for PhD candidates working on integrated photonics devices and subsystems for potential insertion into advanced communications systems. The Laboratory's specialized facilities and expertise in applied research add another dimension to the students' thesis development. Monthly IPI status meetings rotating between the Laboratory and the campus foster interaction between the students, Laboratory staff, and campus faculty.

New Technology Initiatives Program

The New Technology Initiatives Program (NTIP) supports initiatives that significantly extend the application of new technologies and approaches to our nation's current and future problems. The NTIP works with the

Laboratory community and outside resources to identify user needs, capability drivers, and enabling technologies.

Technical Seminar Series

Members of the technical staff at Lincoln Laboratory present seminars to interested college and university groups. The 56 currently available seminars from which interested university groups can choose include ones in air traffic control, solid-state devices and materials, communications systems, and space control technology.

Visit the web at http://www.ll.mit.edu/college/techseminars.html to see a complete list of available seminars.

MIT Independent Activities Period Courses

Lincoln Laboratory technical staff develop and lead activities offered during MIT's Independent Activity Period (IAP), a four-week term spanning the January semester break. Under the IAP program, for-credit classes are available for registered MIT students, and non-credit activities are open to all members of the MIT community. IAP offerings range from academic seminars to hands-on engineering projects to artistic pursuits. The activities are, as the IAP website states, "distinguished by their variety, innovative spirit, and fusion of fun and learning." Lincoln Laboratory staff have offered courses in radar design, robotics, and imaging technologies.

MIT Professional Education—Short Programs

Lincoln Laboratory is collaborating on courses offered through MIT's Professional Education Short Programs. Short Programs usually run during the summer and bring participants from industry, government, and business to the campus for intensive, week-long courses designed to expand participants' familiarity with emerging technologies. Through this recent partnership, technical staff members from the Laboratory have co-led courses on radar and laser radar design.

Student Programs

MIT Undergraduate Research Opportunities Program

Lincoln Laboratory is one of the centers with which undergraduates may partner under MIT's Undergraduate Research Opportunities Program (UROP). UROP cultivates research partnerships between MIT undergraduates and faculty, offering students the chance to work on cutting-edge research and participate in each phase of standard research activity.

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 the workplace skills that complement students' academic training. An important facet of the program is a 10- to 12-week summer internship in industry, government, or a nonprofit institution. As a UPOP partner, the Laboratory offers a limited number of such internships.

MIT Educational Collaborations through Capstone Projects

Through coalitions with departments and centers at MIT, the Laboratory provides project-based educational experiences to undergraduate and graduate engineering students. Capstone projects, often the core activity for MIT engineering courses, afford students a year-long involvement in the research, design, fabrication, and test phases of developing a prototype system. The program leverages the technical staff's expertise and the Laboratory's prototyping resources to "scale up" campus-led projects, and draws on campus expertise to develop new Laboratory-led projects. This collaborative effort generates innovative solutions in areas as diverse as unmanned aerial vehicles, cyber security, supercomputing, energy systems, imaging sciences, and signal processing.

MIT VI-A Master of Engineering Thesis Program

Lincoln Laboratory is a partner of MIT's Department of Electrical Engineering and Computer Science VI-A

Master of Engineering Thesis Program, which matches industry mentors with undergraduate students. Students in the VI-A program spend two summers as paid interns, participating in projects related to their fields. Then, the students move on to developing their master of engineering theses under the supervision of both Laboratory engineers and MIT faculty.

MIT Research Assistants

As part of the research collaboration between MIT campus and Lincoln Laboratory, MIT graduate students are supported as research assistants while working on Laboratory programs.

University Cooperative Education Program

Technical groups at Lincoln Laboratory employ students from MIT, Northeastern University, and other area colleges as co-ops working full time with mentors during the summer or work/study semesters and part time during academic terms.

Summer Research Program

Lincoln Laboratory offers undergraduate and graduate students the 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. Each summer, the Laboratory hires, on average, approximately 100 paid interns from top universities.

WPI Major Qualifying Project Program

Lincoln Laboratory collaborates with Worcester Polytechnic Institute (WPI) in its Major Qualifying Project (MQP) program, which requires students to complete an undergraduate project equivalent to a senior thesis. Students participating in the program spend nine weeks during the fall term working on their projects full time at Lincoln Laboratory.

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. The award, as determined by the recipient's college, is typically in the form of tuition assistance, support for technical paper presentations, or funds for independent research projects.

For more information on student programs, visit the web at http://www.ll.mit.edu/college/studentprograms.html.

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 the final phases of students' thesis research.

Military Fellows Programs

Lincoln Laboratory provides fellowships to active-duty U.S. military officers who are enrolled in a graduate school program, often at MIT, or are completing requirements for advanced education at Senior Service Schools or the U.S. Army's Training with Industry (TWI) program. For graduate students, the military fellowships cover tuition and fees, and require that the students perform thesis research at Lincoln Laboratory. Officers enrolled in a Service School program do research at the Laboratory while taking courses in national security management at MIT. Officers in the TWI program work full time in a Lincoln Laboratory group that specializes in areas that complement the officers' careers.

For more information on fellowship programs, visit the web at http://www.ll.mit.edu/college/fellowsprograms.html.

Workshops and Technical Education

Lincoln Laboratory hosts annual conferences, workshops, and seminars that bring together members of technical and defense communities to share advancements and ideas. These events foster a continuing dialogue that enhances technology development and provides direction for future research.

Workshops and Seminars

Advanced Technology (AT) Workshop

The AT Workshop provides an overview of the broad array of efforts within the Advanced Technology Division.

Air Vehicle Survivability (AVS) Workshop

The AVS Workshop presents the air vehicle survivability community with an update on recent analysis and testing, and provides a forum for relevant briefings from the community.

Air and Missile Defense Technology Workshop

The Air and Missile Defense Technology Workshop provides an overview of current developments in areas such as air and missile defense elements, air and missile defense architectures, advanced concepts and technology, test infrastructures, and intelligence capabilities.

Cyber and Netcentric Workshop

The Cyber and Netcentric Workshop focuses on cyber security and netcentric operations. The workshop provides the user, acquisition, research, and developer communities

with discussions on lessons learned, current trends, technical challenges, and the road ahead.

Defense Technology Seminar (DTS)

The DTS focuses on technologies for the warfighter. Major sessions are devoted to air defense and space situational awareness. New national security challenges in counterinsurgency warfare, homeland security, and network-centric operations are part of the discussion.

Mechanical Engineering Technology Symposium

The Mechanical Engineering Technology Symposium is an opportunity for engineers and system developers to discuss developments in advanced electronic packaging; mechanical, optical, and aeronautical modeling; and advanced materials.

Homeland Protection Workshop Series

The Homeland Protection Workshop Series provides the latest technological developments in homeland air defense, border security, critical infrastructure protection, disaster management, surveillance and detection of chemical and biological agents, and screening systems.

Intelligence, Surveillance, and Reconnaissance (ISR) Workshop

The ISR Workshop is a national forum to present and discuss technology developments and new system concepts in intelligence, surveillance, and reconnaissance.

Lincoln Laboratory Communications Conference

The two-day Communications Conference offers users, developers, and researchers of Department of Defense (DoD) communication systems the opportunity to exchange ideas on current trends and technical challenges in developing future DoD communication architectures.

Space Control Conference

The Space Control Conference brings together the space control community to address current capabilities, future needs, and technology development.

Attendance at workshops and seminars at Lincoln Laboratory is by invitation; participants must complete and submit the Laboratory's security authorization form.

For more information on workshops, seminars, and conferences held at Lincoln Laboratory, visit the web at http://www.ll.mit.edu/workshops/index.html.

Technical Education Courses—Invited

Lincoln Laboratory presents technical courses designed for military personnel and government-employed civilians. These by-invitation courses typically run from three to five days and include seminars and tours at the Laboratory's specialized facilities.

Ballistic Missile Defense (BMD) Technology

The BMD Technology course provides an understanding of BMD systems concepts and technologies to military officers and DoD civilians involved in BMD systems development and acquisition.

Technology for Intelligence, Surveillance, and Reconnaissance (ISR)

This course introduces Department of Defense civilians and military officers to the fundamentals of ISR systems and platforms, and data processing, exploitation, and dissemination. The three-day course was developed in response to the critical role ISR plays in military conflicts abroad and homeland defense.

Networking and Communications

Through lectures, demonstrations, and tours, the Networking and Communications course provides fundamentals and advanced concepts of networks and communications systems for military officers and DoD civilians.

Introduction to Radar Systems

This course has been developed to provide an understanding of radar system concepts and technologies to military officers and DoD civilians involved in radar system development and acquisition.

Technical Education—Online Courses

Lincoln Laboratory online courses consist of video lectures and accompanying PowerPoint lecture notes and charts.

Introduction to Radar Systems

This ten-lecture video course was excerpted from the three-day radar course listed above.

Adaptive Antennas and Phased Arrays

The 16 lectures in this course cover both theory and experiments; lectures 1 to 7 discuss adaptive antennas, and the remaining nine lectures are on phased arrays.

To learn more about the video courses, visit the web at http://www.ll.mit.edu/workshops/education/videocourses/.

Community Outreach

Lincoln Laboratory Community Outreach (LLCO) encourages community service and promotes K–12 education through a variety of initiatives, many in cooperation with the MIT Public Service Center.

Educational Outreach

Lincoln Laboratory Educational Outreach by the Numbers (2012)

30	125	5250	10,000+
K–12 STEM programs	Scientists and engineers volunteering as mentors, speakers, or tour guides	Hours per year supporting STEM programs	Students seeing STEM demonstrations at Lincoln Laboratory and in area schools

Science on Saturday

Laboratory technical staff give lively, interactive demonstrations for local-area students, their parents, and teachers. These popular events have ranged from hands-on engineering activities, such as building gumdrop towers, to demonstrations on the "magic" of chemistry, lasers and optics, and computers. Annually, 3500 people attend these sessions.

Classroom Presentations

Lincoln Laboratory technical staff members visit local area schools to give presentations and conduct hands-on activities. Since the program's inception in 2007, more than 13,000 students in grades K to 12 have enjoyed

presentations on topics such as cryogenics, archaeology, fossils, aerodynamics, chemistry, and physics.

Robotics Outreach at Lincoln Laboratory (ROLL)

ROLL takes advantage of the current popularity of robotics to interest K–12 students in science and technology. ROLL is sponsoring teams in the FIRST (For Inspiration and Recognition of Science and Technology) competitions, hosting robotics workshops at the Laboratory, and providing technical mentors to local-area schools and groups. In 2012, Lincoln Laboratory is mentoring 15 teams.

Ceres Connection

Since 2003, Lincoln Laboratory, in partnership with the Society for Science & the Public, has promoted science education through its Ceres Connection program, which names minor planets in honor of students in fifth through twelfth grades and their teachers. Each year approximately 250 students and teachers are selected through the science competitions sponsored by the Society for Science & the Public.

MIT Office of Engineering Outreach Programs

Lincoln Laboratory is collaborating with MIT's Office of Engineering Outreach Programs (OEOP), which runs four enrichment programs for either middle- or high-school students. These programs are aimed at encouraging students, particularly in underserved populations, to pursue careers in science, technology, engineering, and math.

Leadership Initiatives for Teaching and Technology (LIFT^2) Teacher Externships

For six years, Lincoln Laboratory has participated in the LIFT^2 program run by the Metro South/West Regional Employment Board. This professional development program provides middle- and high-school science, technology, and math teachers with workplace experiences they can use to relate classroom theory to practical applications.

Armed Forces Communications and Electronics Association (AFCEA) International Program

Lincoln Laboratory participates in an AFCEA educational program by providing summer employment internships for graduating high-school seniors interested in science, technology, math, and engineering.

High School Internship Programs

Lincoln Laboratory has established learning affiliations with Minuteman Regional High School and Shawsheen Technical Vocational High School. Under these programs, Lincoln Laboratory annually will make available one-semester internships for high-school seniors from the schools.

CyberPatriot

Lincoln Laboratory sponsors and coaches a team that participates in the Air Force Association's CyberPatriot competitions. Under this national program, teams of high-school students are challenged to detect and clear cyber vulnerabilities on virtual machines. Teams who detect the most vulnerabilities advance through three rounds of these "cyber games" to reach the National Championship round in Washington, D.C.

Wow! That's Engineering!®

The Society of Women Engineers (SWE) promotes education in science, technology, engineering, and math through its Wow! That's Engineering! events run by individual SWE chapters. Volunteers from Lincoln Laboratory's technical staff and from the Boston chapter of SWE direct all-day, engineering immersion workshops for 100 middle-school-age girls.

Ask the Scientist

On Lincoln Laboratory's Ask the Scientist website, researchers answer questions posed by students on a wide range of technology and science topics. Each week, a featured question is answered and is expanded upon through

links to other online resources. Recent questions have been on earthquakes, radar, biology, and holograms.

Lincoln Laboratory Radar Introduction for Student Engineers

Lincoln Laboratory Radar Introduction for Student Engineers (LLRISE) is a two-week residential program for high-school students entering their senior year. The program includes instructional sessions on the basics of radar systems and radar imaging; workshops to build radar systems that can perform range-Doppler imaging; and hands-on exercises using the radars built in the workshops. During the two weeks, students are housed in a dormitory at MIT and attend sessions on campus to learn more about the college application and financial aid processes.

Community Service and Giving

Lincoln Laboratory Giving by the Numbers (2012 Totals)

20	Charities benefited from giving programs
200	"Care" packages sent to deployed troops
500	Toys donated to Toys for Tots drive
500	Coats collected in the Coats for Kids drive
$3020	Raised at a used-book sale to support educational programs and Community Giving at MIT
$13,780	Raised for the Multiple Sclerosis Society in the Bike & Hike the Berkshires fundraiser
$23,600	Raised at the annual Alzheimer's Association Memory Walk

Food and Clothing Drives

The LLCO runs food and clothing drives that support local charities. Food items are distributed to food pantries in the area, and clothing is given to a number of shelters and the Salvation Army.

Support Our Troops

Lincoln Laboratory runs an ongoing campaign of support for deployed U.S. troops. Donations of food, toiletries, books, and games are collected daily, boxed by volunteers, and mailed weekly. In addition, the program has sent care packages to the children of villages in Afghanistan and Iraq where U.S. troops are serving.

Bike and Hike the Berkshires

The annual fall Bike and Hike the Berkshires event benefits the National Multiple Sclerosis Society Central New England chapter. Teams of bicyclists and walkers gather pledges for completing one of three distance courses up Mount Greylock in western Massachusetts.

Used-Book Drive and Sale

Proceeds from the sale of books and media donated by Laboratory employees are given to Community Giving at MIT to support local charities and to Lincoln Laboratory Community Outreach to fund future educational outreach programs.

The Holiday Giving Tree

During the winter holiday season, Laboratory employees donate gifts to area residents affected by the economic downturn. The gifts are distributed by Somebody Cares, a national charitable organization with affiliates in the region.

Marshallese Outreach

The Marshallese Outreach program was developed to enrich educational and life experiences of the people of the Marshall Islands, particularly those from Kwajalein Atoll, where Lincoln Laboratory staff work as scientific advisors to the Reagan Test Site located there.

For more about the educational and community service programs of the LLCO, visit the web at http://www.ll.mit.edu/outreach/index.html.

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