Lincoln Laboratory

Lincoln Laboratory is a Department of Defense (DoD) federally funded research and development center operated by MIT. Under a prime contract with the Department of the Air Force, Lincoln Laboratory conducts research and development on behalf of the military services, the Office of the Secretary of Defense, the intelligence community, and other government agencies.

Lincoln Laboratory's mission is to develop technology in support of national security. Research and development (R&D) conducted at the laboratory covers a broad range of domains, including space systems and technology, air and missile defense technology, cyber security, communication systems, bioengineering, maritime defense technologies, microelectronics, air traffic control, weather sensing, environmental monitoring, and intelligence, surveillance, and reconnaissance (ISR). A principal activity of the technical mission is prototyping, which involves development of components and systems for experiments and tests under field operating conditions.

The laboratory's main facilities are in Lexington, MA, partly on Hanscom Air Force Base property. The laboratory operates a small fleet of testbed aircraft at Hanscom; radar facilities in Westford, MA; and a virtual reality environment in Billerica, MA. To facilitate interactions with government sponsors and in-field testing and evaluation of systems, Lincoln Laboratory has field offices in several locations around the United States, including Huntsville, AL; Fort Meade, MD; and Colorado Springs, CO.

In 2021, Lincoln Laboratory marked its 70th anniversary of developing advanced technology for national security. From the laboratory's early focus on a radar-based national air defense system to the current work in areas ranging from cyber security to biomedical applications, our talented staff members have brought much technical depth and field testing experience to bear on difficult problems. Throughout the Covid-19 pandemic, we sustained R&D through creative efforts to make remote and hybrid work productive.

The laboratory continues to evolve. This year, we established the Digital Engineering Center to incorporate new digital engineering approaches into building advanced prototypes. The focus is on developing an integrated process that includes the digital modeling/simulation and data processing required to realize modern hardware and software systems. Artificial intelligence (AI) continues to be a significant enabling technology in all mission areas. We are exploring the potential for AI to enhance decision support capabilities of the systems we develop. Over the past year, our centralized AI Technology Group conducted research to enhance the trustworthiness and mission readiness of AI systems.

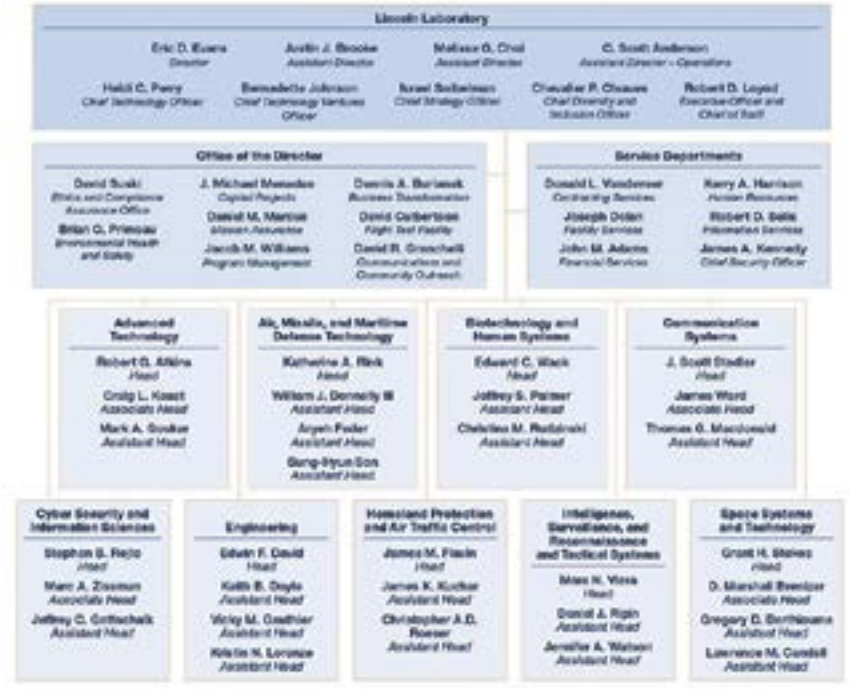
Our newest division, Biotechnology and Human Systems, formed in 2020, addresses emerging threats to global and national security. It is applying deep understanding of systems and architectures to develop advanced technologies designed to improve chemical and biological defense, human health and performance, and global resilience to climate change, conflict, and disasters. This division consolidates work that was previously spread across several technical groups. More examples of this year's R&D are presented in the section outlining technical program highlights.

Lincoln Laboratory broke ground on the new Compound Semi-conductor Laboratory Micro-electronics Integration Facility, the first new building of a long-term facility modernization program at Lincoln Laboratory. This approximately $300 million investment by the DoD will provide decades of advanced compound semi-conductor fabrication capability focused on national security. The facility is slated to be completed in 2025 and will be operated by Lincoln's Advanced Technology Division.

Lincoln Laboratory's fiscal year runs from October 1 to September 30. During the fiscal year ending in September 2021, the laboratory received approximately $1.141 billion in total funding to execute R&D on sponsored projects. While most of the research was sponsored by the DoD, funding was also received from the Department of Homeland Security, the Federal Aviation Administration (FAA), the National Aeronautics and Space Administration (NASA), and the National Oceanographic and Atmospheric Administration. In addition, Lincoln Laboratory carries out noncompetitive research with industry under approved cooperative research and development agreements and other collaborative activities with academic institutions.

Organization

Lincoln Laboratory's three-tiered organizational structure—Director's Office, divisions and groups, and departments—encourages interactions between staff and line management. Sponsor interest in conducting research and development of more complex, integrated systems has raised the level of collaboration between divisions. Service departments provide critical administrative and infrastructure support. The Safety and Mission Assurance Office and the Program Management Office enable cross-divisional research teams to manage the technical and programmatic challenges of large-scale developments. The laboratory's Technology Ventures Office (TVO) continues to make good progress on increasing the transfer of technology to industry. The laboratory recently established the Biotechnology and Human Systems Division and the Digital Engineering Center.



Lincoln Laboratory's organizational structure as of June 30, 2022.

Leadership Changes

- Heidi Perry was appointed as chief technology officer.
- John Adams joined the laboratory as director of finance and head of the Financial Services Department.
- Chelsea Curran was selected as associate technology officer for the Technology Office.
- Sung-Hyun Son was promoted to assistant head of the Air, Missile, and Maritime Defense Technology Division.
- Daniel Ripin was promoted to assistant head of the ISR and Tactical Systems Division.
- Gregory Berthiaume was promoted to assistant head of the Space Systems and Technology Division.
- Denise Fitzgerald was selected as leader of the Digital Engineering Center.
- Stephanie Sposato was promoted to associate leader of the Digital Engineering Center.
- Sarah Larson joined the laboratory as deputy director of talent management in the Human Resources Department.
- Brian Primeau was promoted to head of the Environmental, Health, and Safety Office.
- Kenneth Sims was promoted to assistant head of the Business Transformation Office.
- William Surrey joined the laboratory as assistant head of the Contracting Services Department.
- James Kennedy joined the laboratory as the chief security officer and head of the Security Services Department.
- Derek Jones was promoted to deputy chief security officer.
- Scott J. Mancini was promoted to deputy chief security officer.
- Jeremy Firth was promoted to assistant head within the Security Services Department.
- Todd Lardy was promoted to chief test pilot of the Flight Test Facility.
- Christa Frey was promoted to supervisor of flight test operations at the Flight Test Facility.

Technical Program Highlights

This year, Lincoln Laboratory worked on 694 programs ranging from large-scale hardware prototyping projects to small seedling initiatives. Notable highlights for each mission area are listed below.

Space Systems and Technology

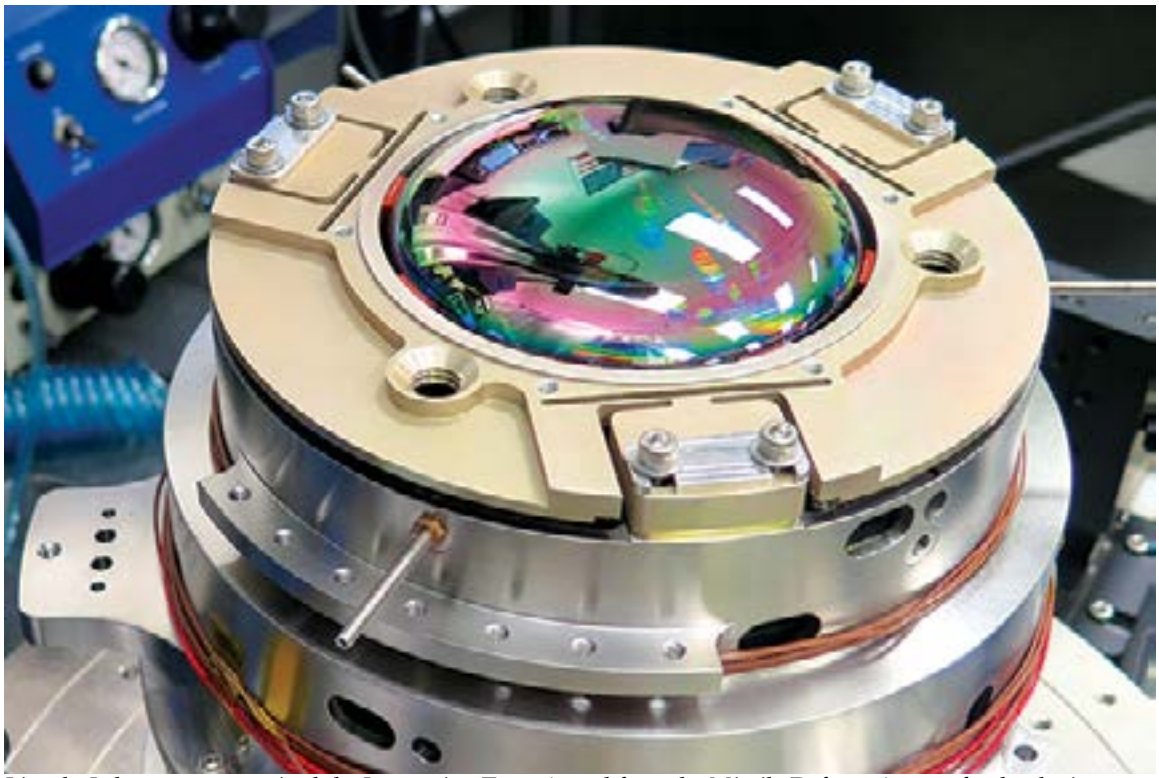
- Completed demonstration testing of the Space Surveillance Telescope in Australia in anticipation of becoming part of the US Space Force's network
- Completed assembly and testing of the engineering development units of hosted-payload space domain awareness sensors
- Continued to deliver critical space domain awareness information and tools to the National Space Defense Center and the Combined Space Operations Center
- Continued to promote new concepts leveraging advanced technologies, with several concepts prototyped, tested, and expected to deliver initial resilient space architectures in 2023

Researchers prepare a situational awareness camera for thermal vacuum testing.

Air, Missile, and Maritime Defense Technology

- Defined an effective and survivable architecture for defending Guam against advanced threats in the Pacific theater
- Studied system requirements, evaluated operational site locations, and developed preliminary technical designs for advanced high-frequency over-the-horizon radar systems for homeland defense
- Applied AI systems expertise to Missile Defense System threat discrimination and established AI robustness as a key performance metric
- Improved sensing architectures, electronic warfare techniques, and signal processing capabilities and explored new integrated approaches leveraging AI to display, label, and classify sonar data
- Continued developing and testing a distributed multidomain radar capability and advanced signal processing techniques for eventual use by forward-deployed forces

- Developed an ocean state estimation system to provide nowcasts of temperature, salinity, and currents to undersea vehicles
- Collected radar data to validate advanced clutter-mitigation algorithms for radar maritime surveillance
- Prototyped and demonstrated a low-cost localization system with custom distributed, adaptable-response transponders for communications-constrained environments



Lincoln Laboratory co-received the Innovation Team Award from the Missile Defense Agency for developing an extremely wide field of view sensor. A prototype was transitioned to the US Army Aviation and Missile Center to undergo testing as a government reference sensor for future space programs.

Communication Systems

- Completed airborne demonstrations of scalable, resilient, line-of-sight networking techniques that enable DoD platforms to reliably connect and share data
- Experimented with network topologies for long-range, high-frequency links that can provide beyond-line-of-sight communications through ionospheric refraction without the need for satellites
- Demonstrated a prototype of a new communications capability that leverages airborne multifunction apertures to communicate to multiple users on low-size, low-weight, and low-power platforms
- Developed a novel pump-forwarding architecture for synchronization within quantum networks and validated its performance
- Demonstrated a prototype of a new content-aware network architecture to distribute a mission-tailored operational air picture to a ground station

- Demonstrated high-rate, blue-green optical communications through the air-water interface
- Developed optical receiver architectures that enable coherent processing of optical signals in the digital domain

The laboratory is developing two high-rate laser communication terminals for use in space. One terminal, shown here, will be flown on the NASA Artemis II mission, and the other will be deployed on the International Space Station.

Cyber Security and Information Sciences

- Produced an initial operational technology to analyze and identify software applications in encrypted network traffic
- Demonstrated an application for a cyber-resilient Magnetite operating system layer to enable software-based high-assurance cryptography in platforms constrained by size, weight, and power needs
- Advanced the state of the art in malware similarity analysis
- Added 40,000 processing cores and 10 petabytes of storage to the Supercomputing Center to sustain its world-leading interactive supercomputing capability
- Delivered an automated cyberthreat intelligence labeling and extraction system that labels indicators of compromise in unstructured threat reporting
- Developed automated machine learning tools that enable subject matter experts to create state-of-the-art predictive models without the aid of data scientists
- Delivered several versions of a key management system prototype to serve as a baseline for live capability
- Conducted adversarial vulnerability assessments of major weapon systems, leading to improvements in system survivability and mission assurance

Researchers showcased their automated waveform classification prototype, which uses generative and discriminative machine learning algorithms to detect and classify RF signals.

Intelligence, Surveillance, and Reconnaissance Systems and Technology

- Demonstrated a low-power, self-reconfigurable processor with built-in security for machine learning that minimizes power consumption by adapting resources depending on the necessary computations
- Led the initial airborne data collection campaign with an advanced, first-ever zoom-enabled Geiger-mode avalanche photodiode 3D lidar system
- Demonstrated a prototype open architecture to enable integrated coherent multisensor signal and AI processing for on-platform tactical-edge scenarios
- Continued to remotely enhance capabilities for the premier foliage-penetrating 3D imaging lidar system, including AI-based analysis tools to expand the capacity to interpret and utilize imagery
- Pursued techniques to improve the ranging precision of state-of-the-art Geiger-mode avalanche photodiode–based lidars and explored advanced electro-optical and radio frequency (RF) detection techniques based on quantum optical effects
- Completed design and component verification of a real-time high-resolution mapping lidar for deep-space landing missions in which sensor mass is extremely limited
- Used two versions of the Airborne Radar Testbed simultaneously to create a data set for developing and evaluating bistatic radar modes for ground moving target indication.

Through dynamic resource monitoring and allocation, this Lincoln Laboratory–developed reconfigurable processor enables very-low-power, secure edge computing for emerging artificial intelligence and machine learning tasks such as voice and image recognition.

Tactical Systems

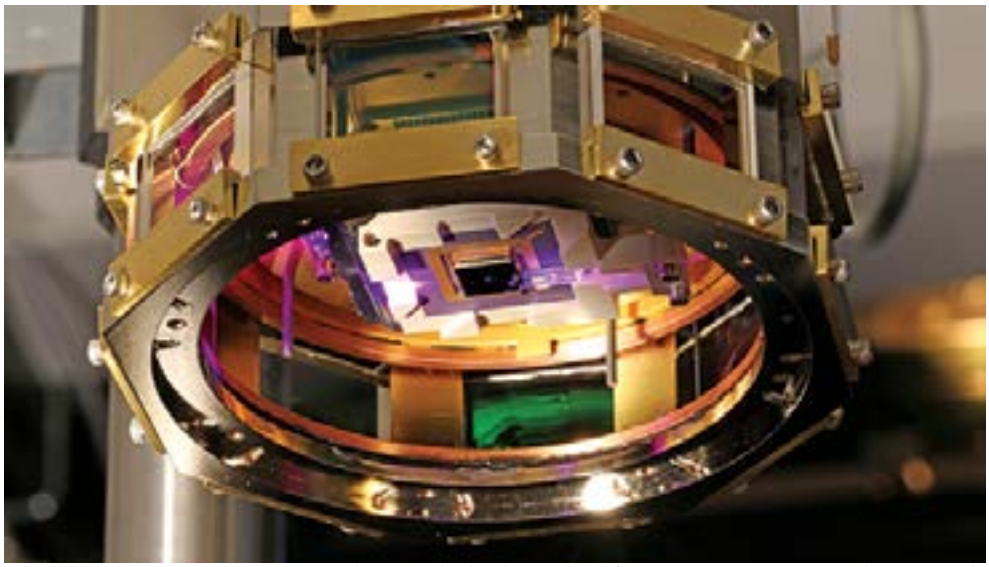
- Conducted system analyses, testing, and flight-system data collection to inform assessments of the performance and limitations of aircraft against current and future threats
- Assessed the Next Generation Air Dominance platform, focusing on identifying system requirements to counter evolving adversaries in a diverse mission set
- Completed studies informing the prototyping of novel camouflage, concealment, and decoy capabilities as well as rigorous test and measurement campaigns
- Expanded analysis efforts to incorporate autonomy and AI, including studies of novel teaming concepts for air superiority to support the nation's air defense and examination of adversary implementation of AI approaches to enhance sensing
- Demonstrated a grammar-based automatic speech recognition proof of concept that enables voice control of an Open Mission Systems–compliant subsystem
- Prototyped an unmanned aerial vehicle (UAV) to map a region in front of autonomous ground vehicles, allowing them to navigate off road and with real-time navigation assistance in challenging and contested environments

An ongoing project with the US Army pairs autonomous ground vehicles with autonomous UAVs to improve all-terrain vehicle off-road navigation.

Advanced Technology

- Fabricated an X-ray detector array for future NASA applications
- Developed a 3D-circuit fabrication approach for realizing complex superconducting qubit circuits
- Completed a demonstration of the standoff millimeter-wave imager for concealed weapons detection
- Realized an on-chip, low-noise laser that leverages stimulated Brillouin scattering optical gain in an ultralow-loss silicon-nitride waveguide

- Developed electrospray thrusters for propulsion of small-scale satellites in space
- Deployed high-frequency vector sensor instruments to investigate the impact on radio propagation of equatorial anomaly and the ionospheric phenomenon spread F



The laboratory continues to contribute to the leading edge of quantum computing. This trapped-ion system achieved the first demonstration of integrating laser signals, needed to control quantum bits, into a substrate that contains the ion-trap electrodes.

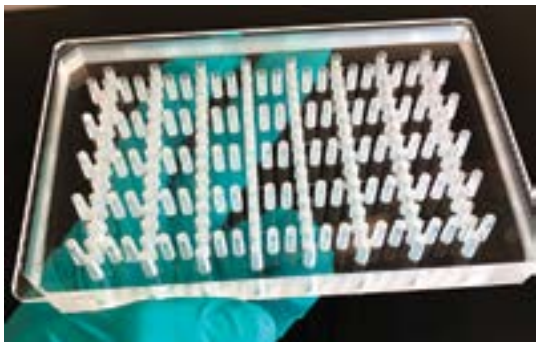
Homeland Protection

- Developed methods to improve the speed of Department of Homeland Security airport security screening
- Continued transitioning energy resilience technology to outside partners to increase mission readiness
- Continued to develop and deploy AI-enabled decision support systems for border security applications
- Integrated a highly sensitive radar system on an unmanned ground vehicle for detection of disaster survivors trapped under rubble
- Demonstrated a prototype multisensor air defense system for regional air defense
- Developed a multistatic receiver to mitigate the impact of wind farms located near joint-use air surveillance systems
- Developed and demonstrated an experimental framework and evaluation environment for measuring and building public resilience against hostile foreign influence operations
- Demonstrated new capabilities in natural language processing for identifying potential threat events, characterizing fake-news narratives, and increasing operational agility
- Improved a video analytics software tool to enhance security operations in critical infrastructure command centers and transitioned to private industry

Lincoln Laboratory has developed an airborne edge computing test bed to advance autonomous unmanned aircraft system functions for homeland security missions.

Biotechnology and Human Systems

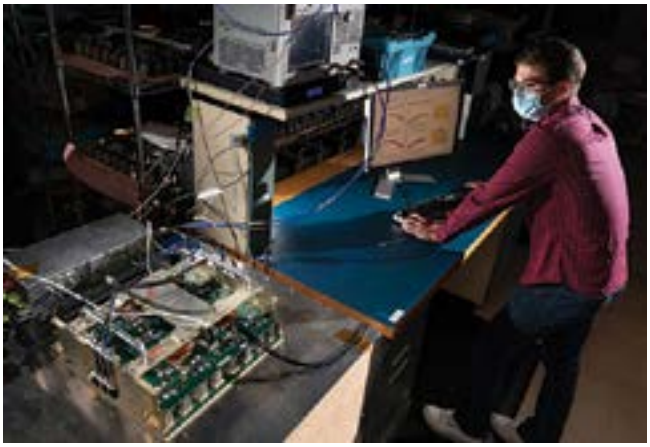
- Began developing a decision support architecture and software system to improve the efficiency of international humanitarian assistance through tracking and monitoring of food aid shipments
- Developed novel analytics that automate post-hurricane infrastructure damage assessments from remotely sensed data and can prioritize response efforts
- Deployed a national-scale model of demand for personal protective equipment
- Continued to develop chemical and biological defense systems, focusing on multiple test beds and data collection in New York City
- Began building a cloud-based platform for analyzing physiological data from wearable sensors that will enable novel algorithms for early warning of Covid-19 infections
- Began building a polymerase chain reaction–based sensor for use on unmanned systems to rapidly and accurately identify biological threats in the environment
- Prototyped a system for determining whether people should be evaluated for posttraumatic stress disorder using only their voice
- Created a semi-automated, large-scale brain mapping system to understand neuronal interactions associated with cognitive functions and disorders



Lincoln Laboratory is building organ-on-chip devices to investigate the dynamics of chemicals in relation to human health.

Air Traffic Control

- Continued technology transfer of the Small Airport Surveillance Sensor with the FAA
- Prepared the Airborne Collision Avoidance System X for large unmanned aircraft systems for worldwide deployment
- Conducted operations of the US Navy Triton unmanned aircraft system using an air traffic separation capability
- Finished design verification testing of the primary research asset for storm detection and tracking at the National Severe Storms Laboratory
- Supported FAA Next Generation Weather Systems acquisition, including rapid-update weather radar mosaics and storm prediction technology
- Tested the Global Synthetic Weather Radar at six US Air Force facilities
- Developed technologies for advanced aviation cyber threat assessment, detection, and mitigation
- Continued to develop tools to support mission planning, operational readiness, and health protection

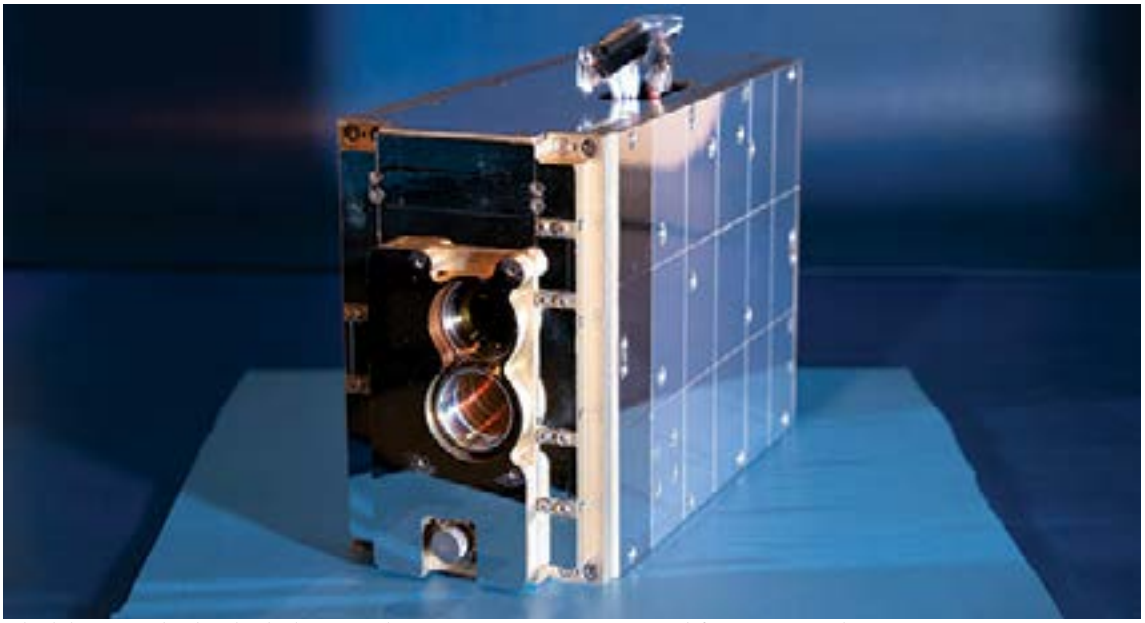


The Dual-Polarization Phased-Array Radar Advanced Technology Demonstrator is a 4-meter array consisting of 76 panels to evaluate improvements in rapid-update weather sensing.

Engineering

- Adopted a lean operations strategy to enhance fabrication of mechanical and electrical parts
- Enhanced development of future hypersonic interceptors and systems via unique modeling and design techniques
- Created flight software and firmware to accelerate the development of UAVs
- Increased the resolution of optical systems through the use of freeform designs
- Increased usage of augmented and mixed reality technologies to enhance remote collaboration on projects, enabling accelerated development of prototype hardware

- Performed readiness assessments for technologies including inventory drones, automated storage, and autonomous materiel handling to help organizations with warehouse modernization and automation



The laboratory built a high-data-rate laser communication terminal for NASA to demonstrate transmission from low-Earth orbit to a ground station at 200 gigabits per second. This 3U CubeSat terminal weighs 3 kilograms, has 2 terabytes of storage, and requires 100 watts of power to operate.

Technology Transfer

A core mission of Lincoln Laboratory is the development of advanced prototype technologies and their transfer to the government and industry. These transfers include the delivery of hardware, software, algorithms, designs, or other technical data to government sponsors, to the commercial sector, and to other not-for-profits, national laboratories, and universities for research purposes. The Technology Ventures Office was established in 2018 to provide strategic coordination of technology transfer–related activities at the laboratory. TVO works to promote the broadest possible impact of Lincoln Laboratory innovation by facilitating the inflow and outflow of advanced technology. Working with MIT's Technology Licensing Office, TVO has developed a rich patent portfolio and works to broadly license dual-use technologies for the benefit of government sponsors and for the economic benefit of the United States.

Technology transfers by mechanism in FY2021 were as follows.

- Articles in technical journals: 103
- Papers in published proceedings: 65
- R&D 100 Awards: 9
- Lincoln Laboratory–hosted conferences: 19
- Technology disclosures: 104
- US patents: 54

Partnering with industry can create new value and new markets as federally funded capabilities are adapted to private-sector needs and vice versa. During the past year, the laboratory conducted collaborative R&D with 16 companies under cooperative research and development agreements. The laboratory also executed 23 collaboration agreements with not-for-profit institutions and an additional 25 research collaborations directly with MIT faculty and research staff.

One important form of commercial engagement is the laboratory's direct partnerships with qualified small businesses to conduct R&D that addresses specific government needs. During the past year, Lincoln Laboratory executed 16 small business innovation research (SBIR) and small business technology transfer (STTR) projects under sponsorship from government agencies. The laboratory continues to directly support small businesses through R&D subcontracting and a customized variant of Commercial Solutions Openings (CSOs). Two CSOs were completed in FY2021, both in the energy sector. The "Partner with Us" portal on the Lincoln Laboratory website allows a company to view standard contractual agreements, explore mechanisms for collaborative engagements, and browse SBIR/STTR collaboration topics that align with areas of laboratory expertise. The laboratory is growing outreach activities by participating in industry-focused events, including those directed at small businesses, and publicizing on the website dual-use technologies available for licensing or further development.

Technical Workshops

Dissemination of information to the government, academia, and industry is a principal activity of Lincoln Laboratory's technical mission. One way this aim is achieved is through annual workshops and seminars that bring together members of technical and defense communities. These events foster a continuing dialogue that enhances technology development and provides direction for future research. Over the past year, more than 24 workshops were held spanning the range of laboratory technology and mission areas.

The Technology Office hosts seminars that reflect leading-edge trends in technology such as AI in decision making, cyber operations, and ethical computing.

Publications

Between July 1, 2021, and June 30, 2022, Lincoln Laboratory staff published 98 papers in proceedings from conferences, 85 articles in technical journals, 21 self-published e-prints of technical articles, and eight major technical reports available through the Defense Technical Information Center.

Research Collaborations

Technical staff at Lincoln Laboratory collaborate on projects with faculty and scientists at universities throughout the country; most collaborations are with researchers from MIT. In 2021, the Advanced Concepts Committee funded nine collaborations ranging from wearable stem cell scaffolds for expedited tissue regeneration to in-space additive manufacturing of large, still, and thermally stable structures.

Military Fellows Program

The Military Fellows Program offers military officers pursuing graduate degrees or advanced education the chance to engage in R&D at the laboratory. Since the program's start in 2010, more than 300 fellows have worked alongside laboratory staff mentors. In July 2021, eight of the laboratory's military fellows had the opportunity to meet US Deputy Secretary of Defense Kathleen Hicks at the Beaver Works Center in Cambridge for a discussion about current technology development focus areas and modernization efforts at the laboratory and the DoD.

Courses for External Audiences

Lincoln Laboratory hosts a number of multiday courses for user communities with which the laboratory interacts. Courses include Introduction to Radar Systems, Networking and Communications, and ISR Systems and Technology. In addition, staff present courses on cyber security, space technology, ballistic missile defense, and artificial intelligence at the Naval War College. Staff also lead courses on high-performance computing, AI, and big data during MIT's Independent Activities Period.

2021 R&D 100 Awards

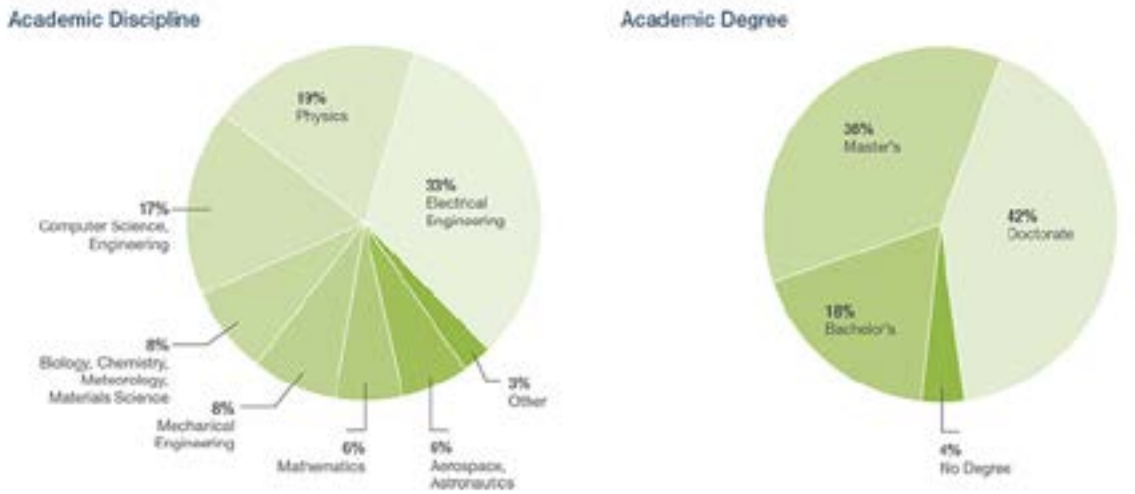
R&D World magazine presented 2021 R&D 100 Awards to nine technologies developed by Lincoln Laboratory researchers. These awards recognize 100 groundbreaking technological innovations developed by research institutes and companies worldwide.

- Field-Programmable Imaging Array
- Free-space Quantum Network Link Architecture
- Global Synthetic Weather Radar
- Guided Ultrasound Intervention Device
- Microhydraulic Motors
- Monolithic Fiber Array Launcher
- Motion Under Rubble Measured Using Radar
- Spectrally Efficient Digital Logic
- Traffic Flow Impact Tool

Staff

Seventy percent of the laboratory's new technical staff are hired directly from the nation's leading technical universities. The laboratory recruits at an ever-broadening range of colleges and universities nationwide.

The total number of laboratory employees is 4,128, with 1,806 technical staff, 1,836 support staff (including technical support personnel), and 486 subcontractors.



Composition of Lincoln Laboratory's professional technical staff.

Awards and Recognition

During the past year, several staff members were recognized for achievements in their fields and their commitment to professional activities:

- Cheryl Sorace-Agaskar and James Kurdzo received the 2021 Lincoln Laboratory Early Career Technical Achievement Award.
- David Caplan was elevated to a 2022 Optica Fellow for pioneering contributions to optical transceivers for laser communications.
- James Kuchar and Grant Stokes were named 2022 fellows of the American Institute of Aeronautics and Astronautics.
- William Blackwell, James McIntire, and Mark Silver were named associate fellows of the American Institute for Aeronautics and Astronautics.
- Robert Boston won the MIT Excellence Award in the Bringing out the Best category; Curran Schiefelbein won in the Innovative Solutions category; Ngaire Underhill and Ryan Burrow won in the Embracing Diversity, Equity, and Inclusion category; and Johnnie Woo won in the Serving Our Community category.
- Cultivating Leadership, Achievement, and Success Career Development Symposium Awards were bestowed upon Ryan Burrow for employee resource group excellence, to Jeremy Coombs for advancing organizational culture, to Chiamaka Agbasi-Porter for championing equity, and to Robert Morrison for outstanding mentorship. Shireen Warnock won the Peer Award for Cultural Impact. The Strength in Unity Award was presented to the members of the Hispanic Latinx Network.
- Patricia Perry and Will Bartlett received 2022 MIT Lincoln Laboratory Support Excellence Awards, and Pamela Weldon and Joseph King III received 2022 MIT Lincoln Laboratory Administrative Excellence Awards.

- Gregory Hogan was appointed to the North Atlantic Treaty Organization (NATO) Sensor and Electronics Technology Panel, part of NATO's Science and Technology Organization.
- Lincoln Laboratory was selected by the Federal Laboratory Consortium as the northeast region's winner of its Excellence in Technology Transfer Award. The award recognized two laboratory technologies: Keylime, a software program that increases security in the cloud, and Forensic Video Exploitation and Analysis, a suite of analytic tools that makes it easier to review surveillance video footage.
- Vincent Orlando received the 2021 Walter Baginhi Award from the International Civil Aviation Organization for his contributions to international aviation.
- At the North American Human Resources Executive Summit, Lincoln Laboratory was honored with the 2021 Excellence in Diversity and Inclusion Award for exceptional efforts to build equality and openness among its workforce.
- Chevalier Cleaves was presented the 2021 Massachusetts Technology Leadership Council Mosaic Award; the award recognizes exemplary leadership in the development of a more diverse workforce.
- Stephen Uftring was presented a Patriotic Employer Award by the DoD for his commitment to employing and supporting veterans.

Professional Development

We offer diverse opportunities for professional development including workshops on increasing effectiveness and seminars to help produce a respectful workplace. For many years, we have offered several continuing education programs: the Lincoln Scholars program, which supports full-time pursuit of advanced degrees; the Part-Time Graduate Studies program, which enables staff members to obtain an advanced degree while still working; the MBA Part-Time program, which allows staff members to expand their business skills; and a technical education program for short-term courses. All courses have been offered online, and a number have been held in person and in a hybrid format.

Diversity and Inclusion

The laboratory workplace supports the perspectives of its staff. Recruitment at a broad range of universities, programs in mentoring, and employee resource groups contribute to the hiring and retaining of a more diverse workforce.

The Research. Educate. Empathize. Act. Transform (RE^2AcT) initiative continues to develop relational equity, increase familiarity with new concepts and vocabulary, foster greater cultural fluency, identify challenging areas that require an increased focus, and cultivate strategic resilience.

In 2021, Lincoln Laboratory hired 22 Graduate Education for Minorities (GEM) Fellows as interns. The GEM Consortium provides support to underrepresented students who seek advanced science, technology, engineering, and math (STEM) degrees.

Efficient Operations

In 2021–2022, Lincoln Laboratory continued to simplify processes, build capabilities, and modernize technology to enable employees to excel in the business of research. Upgrades continued to support employees working remotely amid the pandemic. The Information Services Department implemented key initiatives such as health and safety applications, information technology enhancements, workforce management improvements, and infrastructure augmentations. The Business Transformation Office continues to lead a multiyear digital enterprise transformation, initiating finance modernization and external workforce service improvements.

Community Outreach

Recognizing the importance of preparing young people for careers in STEM, Lincoln Laboratory continued many K–12 outreach programs, including those outlined below.

- Beaver Works Summer Institute: a four-week program for 178 high school seniors to engage in hands-on engineering courses in autonomous vehicles, data science, remote sensing, embedded security, hardware hacking, and game design.
- Lincoln Coders: an eight-week course for middle school students to become familiar with coding by building their own games.
- LLRISE: a two-week immersive course for 35 high school seniors to build their own small radar system as they learn about physics, electromagnetics, signal processing, antennas, and circuitry.
- LLCipher: a weeklong workshop introducing 30 high school students to theoretical cryptography.
- Girls' Innovation Research Lab: an initiative that inspires girls through workshops and demonstrations. This year's focus was on artificial intelligence and machine learning.
- Yes! You Can!: a series of two-week courses to encourage ninth and 10th graders to learn a variety of subjects including coding, radar, assistive technology, aircraft design, and autonomous vehicles.

Our educational collaborations with MIT focus efforts on capstone projects at Beaver Works. Over the past year, six candidates in MIT's 6-A Thesis Program did research at Lincoln Laboratory. A dozen other research assistants from across MIT's engineering departments are typically employed at the laboratory.

Each summer, students from top universities are hired as interns in technical groups where they contribute to real-world projects in a meaningful way. In summer 2022, the laboratory hired 180 summer interns and co-op students from area colleges.

Community Service

Laboratory employees donate funds annually to the Walk to End Alzheimer's, Toys for Tots, Boston Children's Hospital, the Jimmy Fund, Bedford Veterans Hospital, the Pan-Mass Challenge, and Coats for Kids. New efforts (e.g., Gaining Ground Farm and a clothing drive for Afghan refugees) are supported each year.

Summary

Lincoln Laboratory's portfolio of technology R&D programs continues to grow and is strategically balanced with programs that conduct large-scale system development, that perform rapid prototyping of new systems, and that involve innovative, often multidisciplinary, research projects. Mission areas across the laboratory are pursuing answers to new challenges created by today's reliance on big data, cyber security, satellites, and artificial intelligence.

The laboratory continues to transition technologies to its government sponsors, industry, and the research community to help ensure that the US military has access to leading-edge systems and that US industries remain international leaders in defense technology.

Ongoing improvements to administration and infrastructure, a strong professional development program, a commitment to outreach and giving, and continued promotion of an inclusive workplace are enabling the laboratory to maintain technical excellence in its work and its status as a desirable employer.

Eric D. Evans
Director