



Working with MIT Lincoln Laboratory

Dr. Teresa Fazio, Ventures Officer

Industrial Liaison Program: MIT R&D Conference

16 November 2022

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Post WWII – MIT Lincoln Laboratory

- MIT Radiation Laboratory: October 1940 – December 1945



Mission: *Development of radar systems and technology*

Main projects: Surveillance radar
Fire control radar
Navigation systems

Designed half of all US WWII radars



- MIT Lincoln Laboratory in the 1950s



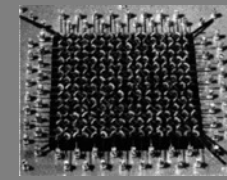
Established 1951: *Air defense and technology development*

Main projects: Semi-Automatic Ground Environment (SAGE)
- Spun-off Mitre in 1958 to operate SAGE

Major Innovations:



Real-Time Computing



Magnetic-core Memory



Light-pen CRT Interface



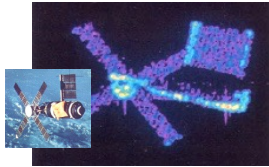
70 Years of Impact for the Nation

First Continental Air Defense System



Protected US from Soviet nuclear attack for 20 years

First RADAR-based Satellite Imaging



ALCOR radar located at Kwajalein

First Transmission of Packetized Speech



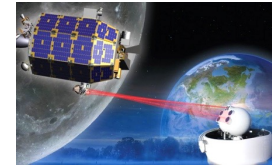
Forerunner of voice over internet protocol (VoIP)

Air Defense of the National Capital Region



Rapid deployment post 9/11

First Laser Communications from Lunar Orbit



622 Mbps downlink for 30 days with zero bit errors

Runway Status Lights (RWSL)



Improvement of runway safety

PACT(Private Automated Contact Tracing)



Augmenting contact tracing strategies to help slow COVID-19 pandemic

1950–1960s

1970–1980s

1990–2000s

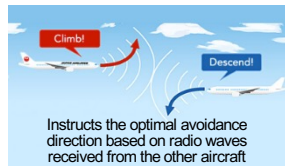
2010–Present

Used NASA'S Echo I Satellite



First Television Picture Transmission via Satellite

Installed on all planes with >19 passenger seats



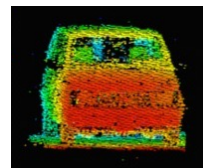
Airborne Collision Avoidance System

DSCS, MILSTAR, WGS, AEHF, MUOS



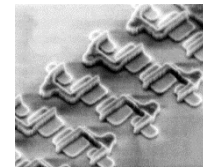
First Prototypes for All Military Comm. Satellites

Permits airborne 3D imaging through trees



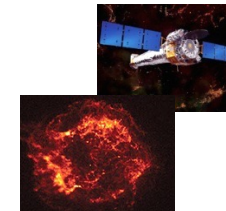
3-D Laser Imaging

Leap ahead in integrated circuit technology



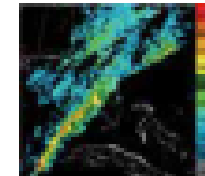
193nm Optical Lithography

Advanced CCD imaging spectrometer



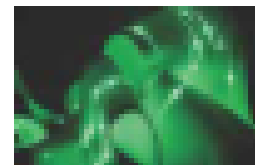
NASA Chandra X-Ray Observatory

Provides accurate and timely radar-like depictions of offshore and oceanic storms



Offshore Precipitation Capability

Fabrics with embedded microelectronics



Semiconductor Devices Embedded in Fibers



MIT Lincoln Laboratory Today



MIT: Cambridge, MA

Shared Values –
Technical excellence
Integrity



Lexington, MA



Kwajalein, Marshall Islands



Albuquerque, NM

DoD Federally Funded Research and Development Center
Systems architecture engineering
Long-term technology development
Rapid system prototyping and transition

~4000 employees
~\$1.1 B in FY21



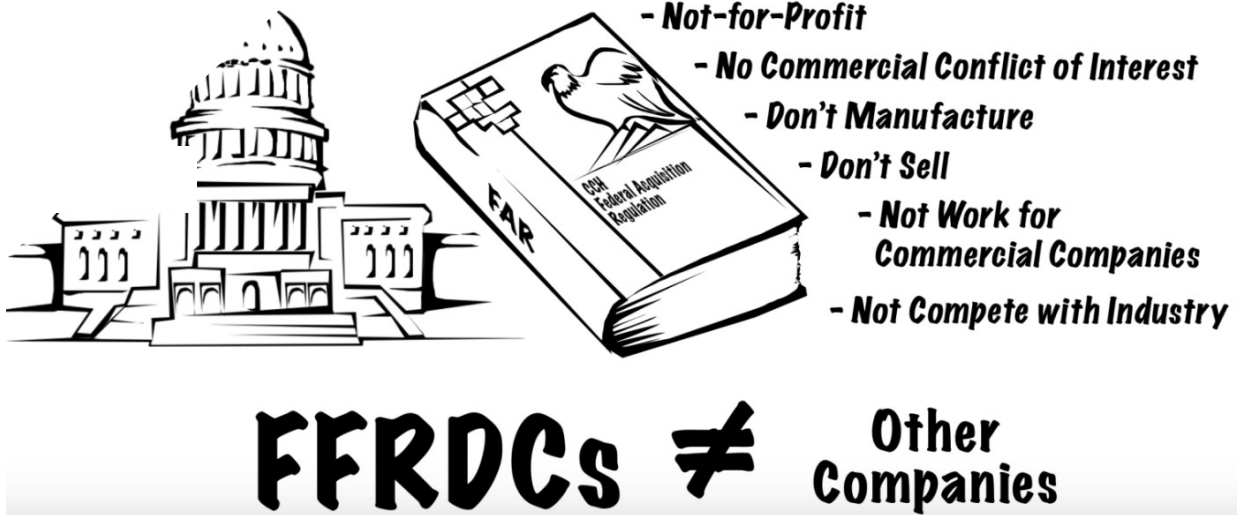
Socorro, NM



Westford, MA



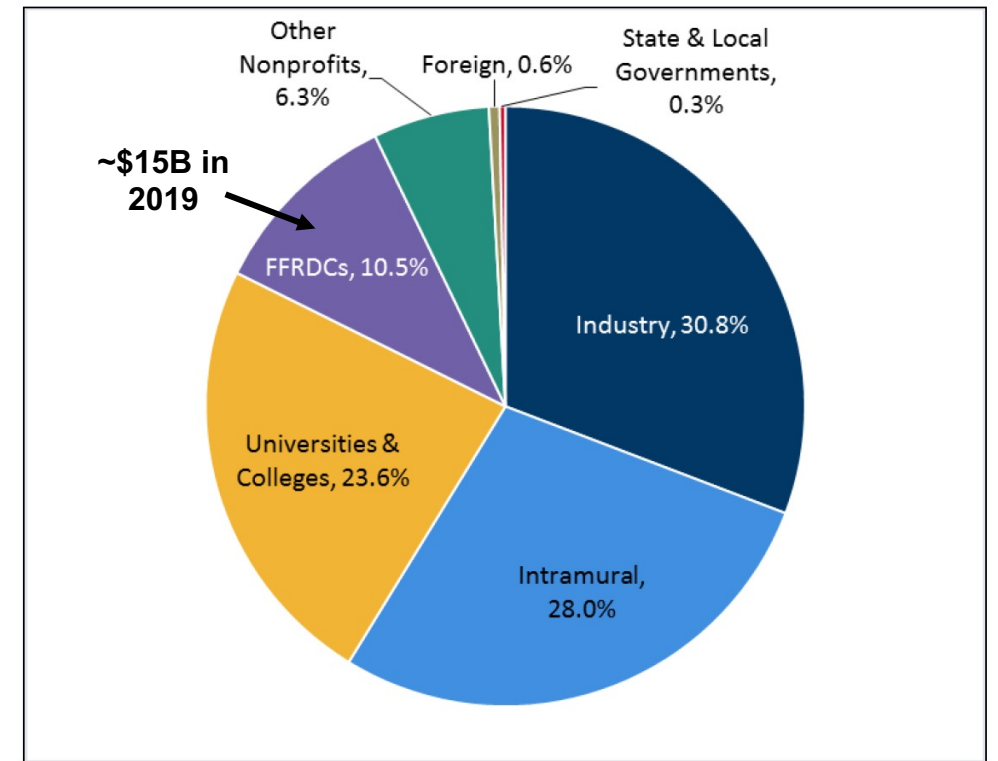
Federally Funded Research and Development Centers



From FFRDC Explainer Video: Mitre Corp.

"An FFRDC meets some specific long-term research or development need which cannot be met as effectively by existing in-house or contractor resources."
Federal Acquisition Regulation (FAR) Section 35.017(a)(2)

Figure 1. Share of Federal R&D Obligations by R&D Performer, FY2019

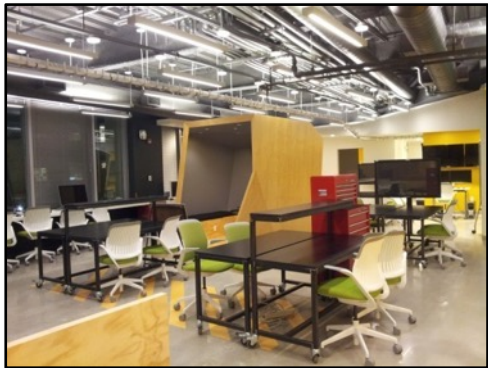


Source: CRS analysis of data from National Science Foundation, *Survey of Federal Funds for Research and Development, Fiscal Years 2018–19*, Table 8, <https://ncsesdata.nsf.gov/fedfunds/2018/index.html>.

MIT LL is the largest DoD R&D FFRDC



MIT Campus Engagement



300 Technology Square



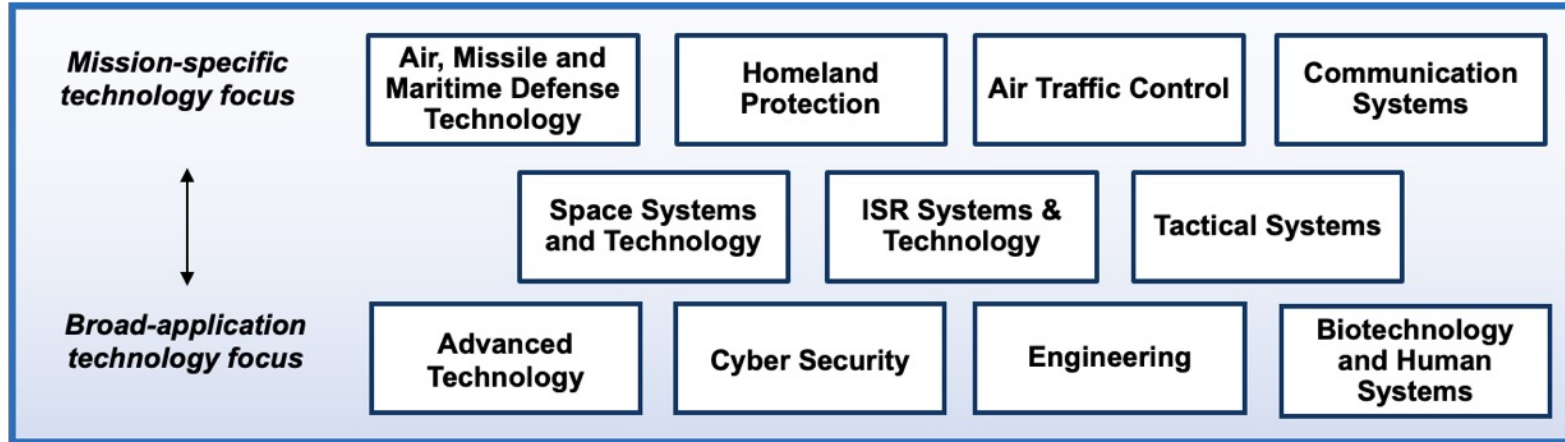
Building 31

- **Fundamental research**
 - Graduate student research & projects
 - Partnerships with CSAIL, RLE, ISN, AFFOA, and other Campus Centers & Labs
- **MIT Lincoln Laboratory Beaver Works**
 - 9,000 ft² of prototyping / research / classroom space across two buildings
 - Project-oriented capstone courses
 - Joint with School of Engineering & Aero-Astro
- **Academic teaching and joint appointments**
 - Courses in radar, electromagnetics, ...
 - IAP and Summer Institute courses
- **Student Engagement**
 - Summer Interns, Co-op Opportunities, UROPs

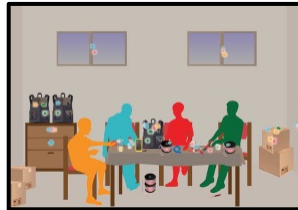


Structure of MIT LL and Range of Laboratory Programs

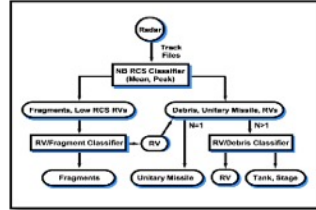
MIT Lincoln Laboratory Division Structure



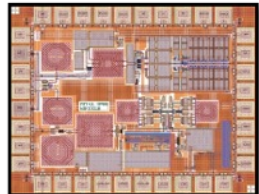
Enabling Technologies



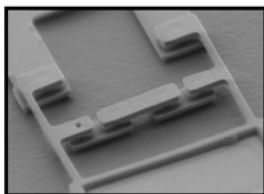
DNA Mixture Analysis



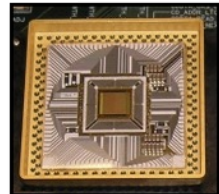
Decision Architectures



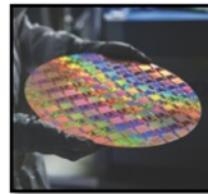
Miniature Low-Power Transceivers



Quantum Bits

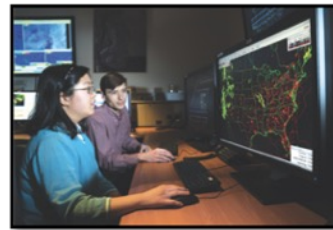


Avalanche Photo Diode Arrays



Advanced Focal Planes

Operational Prototypes



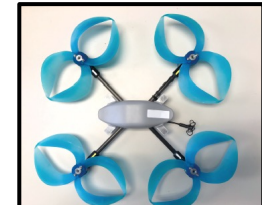
Aviation Weather Systems



MPAR (ATD)*



Lunar Laser Comm Ground Station



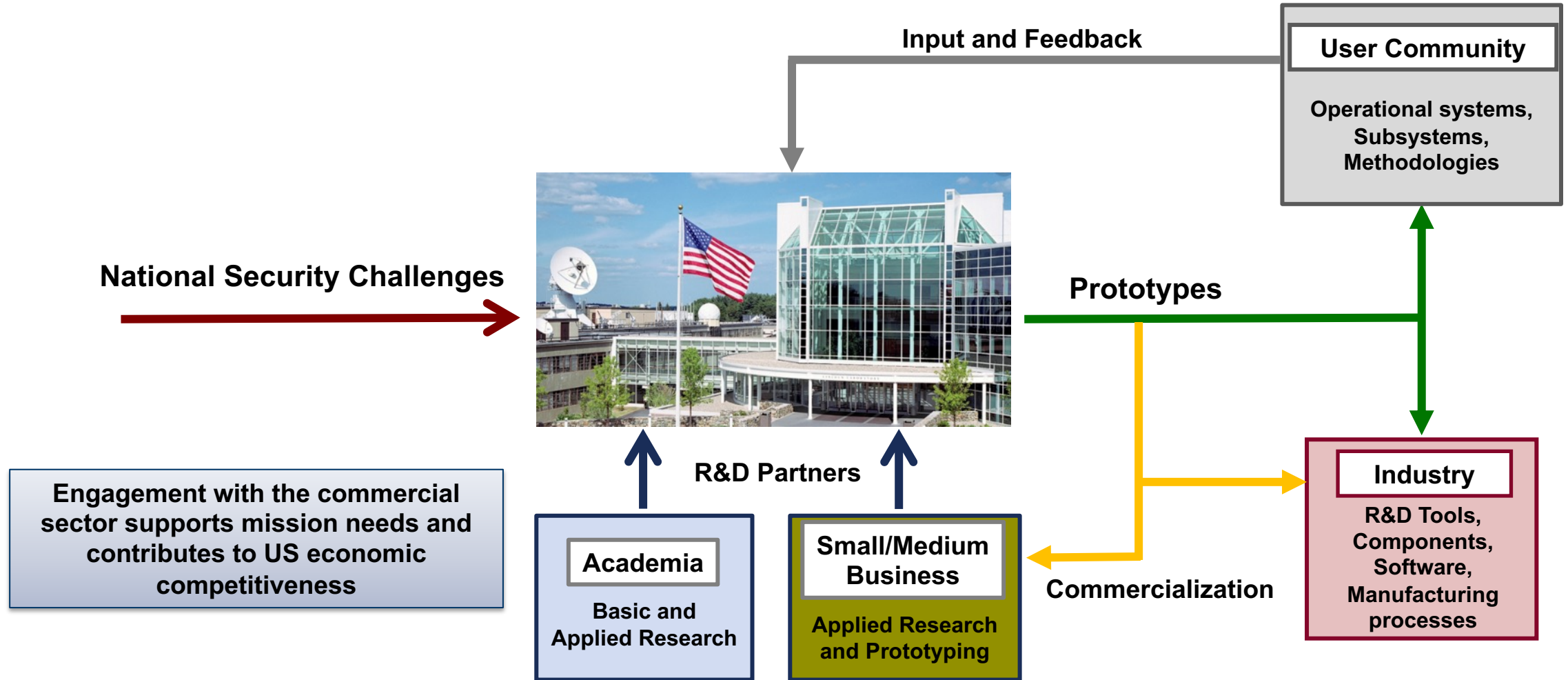
Toroidal Propeller



Space Surveillance Telescope



R&D-to-Prototype Pipeline at MIT Lincoln Laboratory

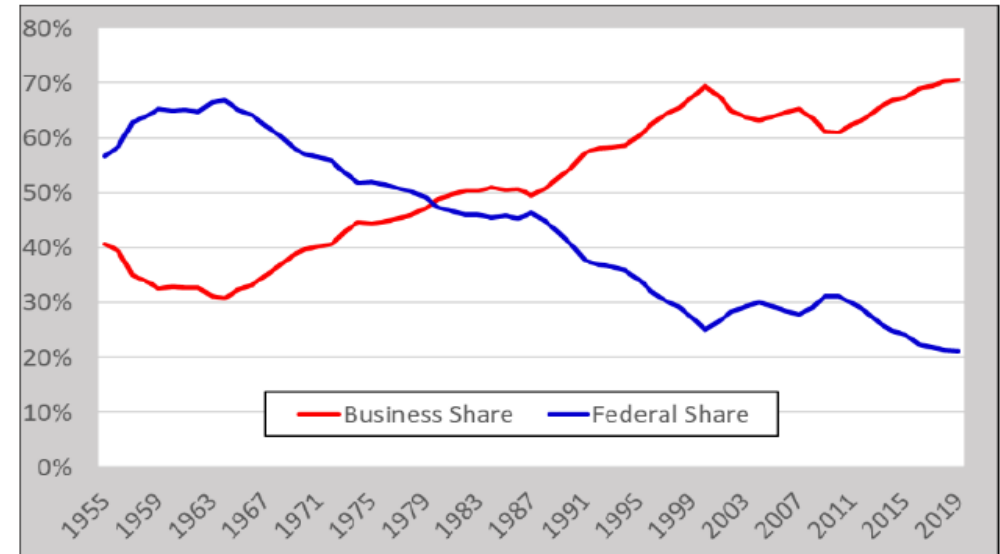




Why has the DoD Embraced Engaging with the Commercial Sector?

- **Commercial R&D investments are outpacing Federal R&D by > 3:1**
- **Relative Defense Industrial Base spending on R&D diminishing; as is number of companies**
- **Nontraditional companies do not always want or know how to do business with the government**
 - > \$50B R&D derives from companies with fewer than 500 people**
- **US Military often does not have rapid access to best available technology**
 - Adversaries do

Federal & Business Shares of US R&D Expenditures
1955 - 2019



Source: CRS analysis of National Science Foundation, *National Patterns of R&D Resources: 2018–19 Data Update*, NSF 21-325, Table 6, April 9, 2021, <https://nces.nsf.gov/pubs/nsf21325>.

Notes: 2019 data are preliminary and may be revised.



Technology Ventures Office (established 2018)

Mission

To facilitate the **rapid** transfer of advanced technology **into and out** of MIT Lincoln Laboratory for the benefit of national security in the broadest sense

Non-traditional Missions

Leverage non-Federal support to expand societal impact of MIT LL technologies



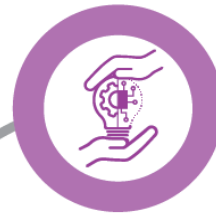
Commercial Engagement

Engage with small-to-medium-sized companies, especially non-traditional, to support our R&D and create transition pipelines



Intellectual Property

Develop a strategy for IP management appropriate for a Federal lab and make it easy for staff to participate



Sponsor-directed Transition

Facilitate sponsor-directed technology transfer through early-engagement and transfer-process management



(L to R) Teresa Fazio, Jennifer Falciglia, Bernadette Johnson, Jessica Wells, Lou Bellaire, Jordan Mizerak



Spectrum of Technology Transfer Benefits

Direct to USG Sponsor

**NASA: Laser Communications
Relay Demonstration (LCRD)**



*Essential data enabling
>1.0 Gbps on space missions²*

**Allows NASA to collect more
science data and to explore further**

¹ [FY21 United Launch Alliance Atlas V rocket](https://www.nasa.gov/press-release)
² <https://www.nasa.gov/press-release>

Direct to Partner*(s) at Sponsors' Direction

**SkyWater:
RadHard Electronics**



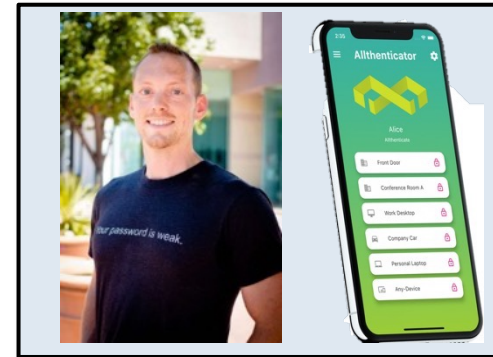
*Semiconductor electronics³ hardened
to withstand harsh environments*

**Builds industry base for critical
DoD microelectronic components**

³ [FDSOI CMOS = Fully Depleted Silicon on Insulator](#)
[Complementary Metal–Oxide–Semiconductors](#)

Direct to Commercialization

**Allthenticate⁴: VC-funded
secure authentication spinout**



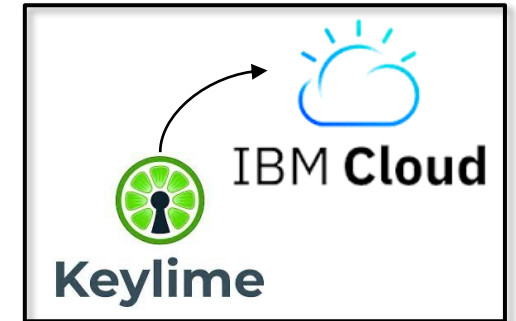
*Integrated authentication, asset
management, physical access control*

**Extends cyber-security services to
commercial users**

⁴ [Pacific Coast Business Times Aug 2020](#)

Open Source or Publication

**Keylime: Linux Operating
System Integration⁵**



*Enabling Trust in the Cloud,
Edge, IoT*

**Enables world-wide adoption and
extension of the security framework**

⁵ [IBM's integration of Keylime](#)



FY2022 IP Transfer Activity Metrics

FISCAL YEAR
2022

TECHNOLOGY TRANSFER BY THE NUMBERS

80

Articles in technical journals

75

Papers in published proceedings

42

Patents issued

19

Lincoln Laboratory - hosted conferences

91

Technology disclosures filed

6

R&D100 Awards

Sample Licensing Actions





Primary Collaborative Contracting Options

Project Type	Description
Cooperative Research and Development Agreement (CRADA)	Collaborative R&D with a commercial entity resulting in technology transfer to industry; funded by non-federal funds.
Small Business Innovation Research / Small Business Technology Transfer (SBIR/STTR)	Joint R&D efforts with a small business addressing a specific USG agency topic and solicitation.
Test Agreement	Allows private-sector organizations to test their technology in MIT LL's facilities on a reimbursable, non-interfering basis. (Not R&D)
Commercial Solutions Opening	Streamlined R&D subcontract designed for work with non-traditional defense contractors; statement of work is collaboratively defined.
R&D Subcontract	Standard subcontract issued to (typically) small-to-medium sized business to execute specific tasks or provide specific services

For more information on contracting mechanisms, please visit: <https://www.ll.mit.edu/partner-us>



Cooperative R&D Agreement: CRADA

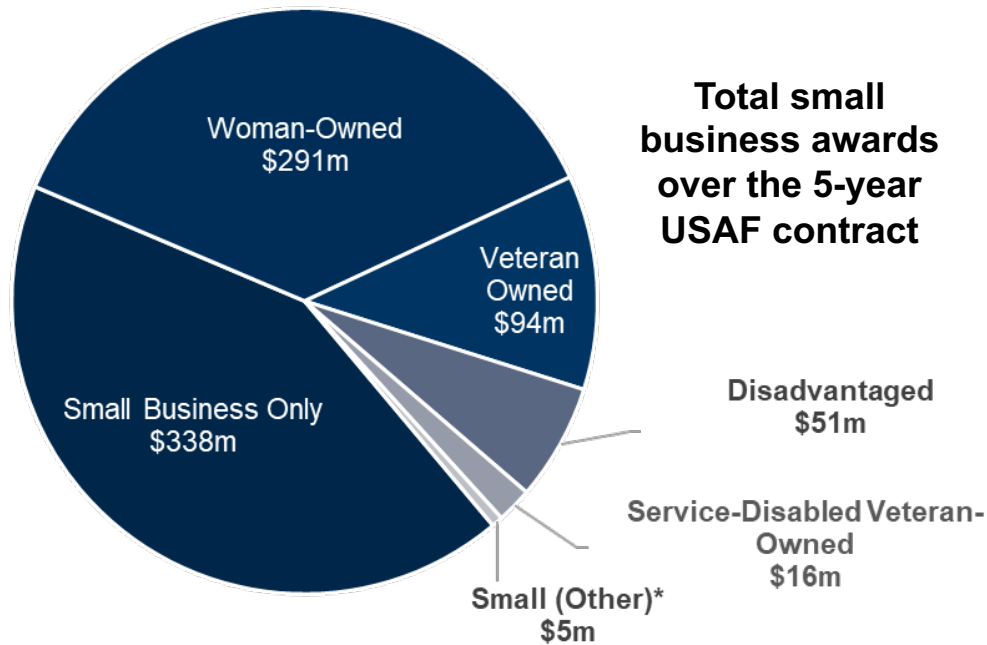
- **A legal instrument through which MIT Lincoln Laboratory transfers technology, processes, and technical know-how to the private sector**
 - Authorization derives from 1986 Federal Technology Transfer Act, 15 USC §3710a and 10 USC §4021
- **Pre-competitive, *collaborative* R&D consistent with MIT LL's major mission areas**
 - Not work for hire
- **Advances technical expertise not commercially available and which would benefit the US Government**
 - Cannot compete with industry
 - Cannot subcontract to a partner on a government contract or proposal
- **Preference for:**
 - US small businesses and businesses located in the US
 - Companies who agree that products embodying or using LL inventions will be substantially manufactured in the US

Lincoln Laboratory executed 48 CRADAs between 2019-2021



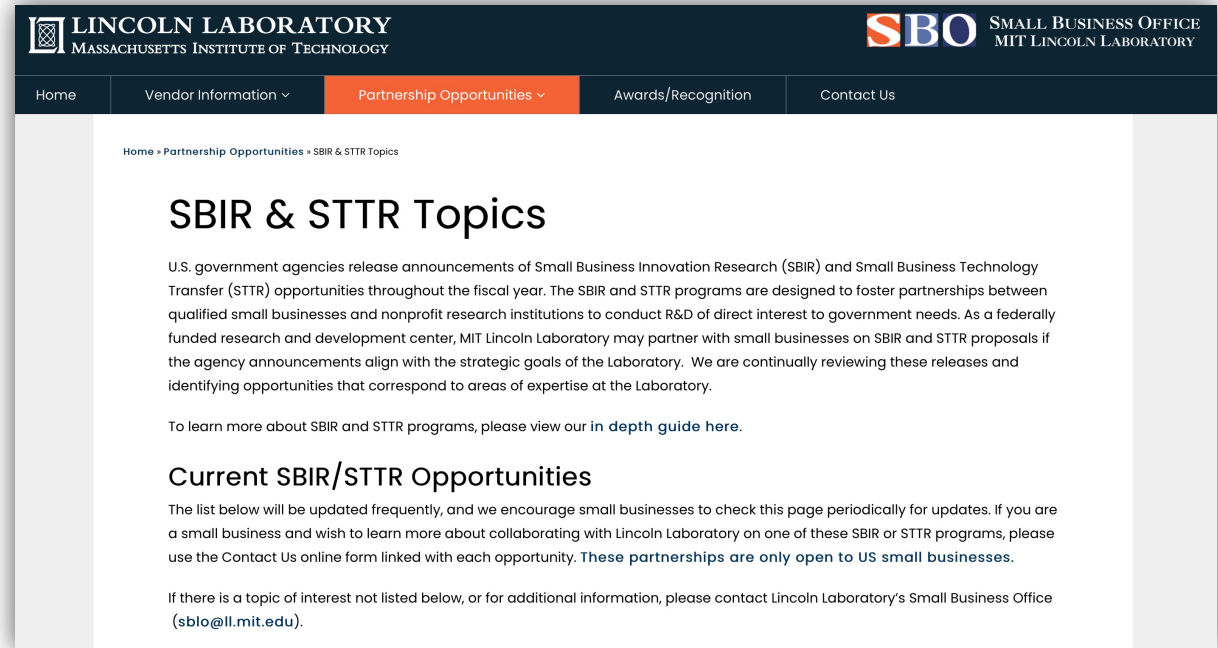
Small Business Liaison Office

- The Small Business Administration recognized MIT LL with a 2020 Dwight D. Eisenhower Award



MIT LL develops strong partnerships with small businesses to complete federal R&D programs

- US Government SBIR/STTR grants offer a nondilutive means of collaborating with MIT LL
- Check to see SBIR/STTR proposal topics which technical staff are interested in participating: <https://smallbusiness.ll.mit.edu>





Commercial Solutions Openings (CSO)

Selection Process

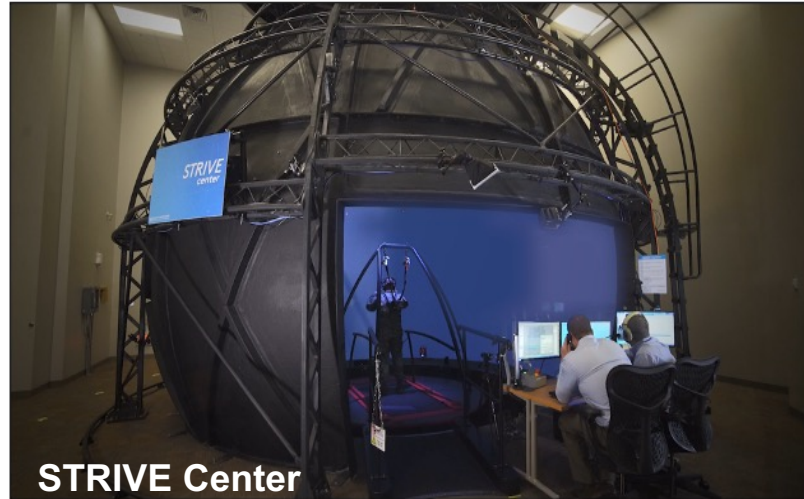
- Phase 1** Solicit proposals in response to a problem statement posted on MIT LL's website
- Phase 2** Evaluate proposals and invite a short list of responders to deliver Zoom or in-person pitch
- Phase 3** Select contract awardee/s and negotiate agreement

- Periodically, Lincoln Lab seeks solutions to technical challenges from small/medium businesses and nontraditional defense contractors
- Recent CSOs have included energy grid, alternative energy, and AI-related projects
- Streamlined concept paper, pitch, and contracting process
- To sign up for notification of Commercial Solutions Openings and SBIR/STTR interest, please register here:

<https://www.ll.mit.edu/business-opportunity-signup>



Test Agreements: Lincoln Laboratory R&D Facilities

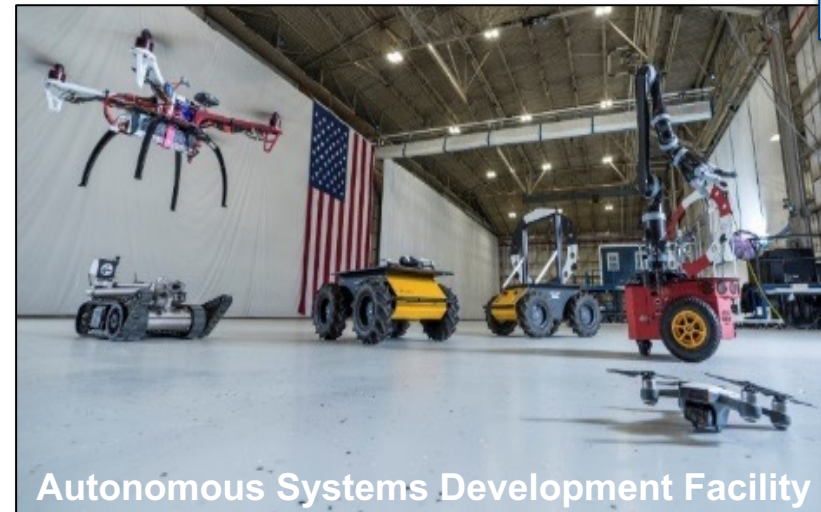


STRIVE Center

- Specialized facilities for advanced research, technology development & prototyping
- Available for use by U.S. industry, universities, governments on a non-interference basis when similar test facilities are unavailable in the private sector



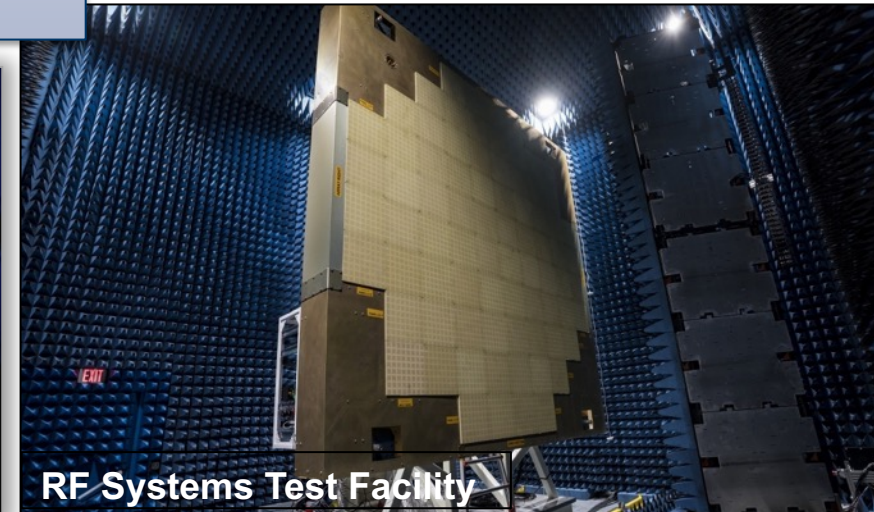
LL Supercomputing Center



Autonomous Systems Development Facility



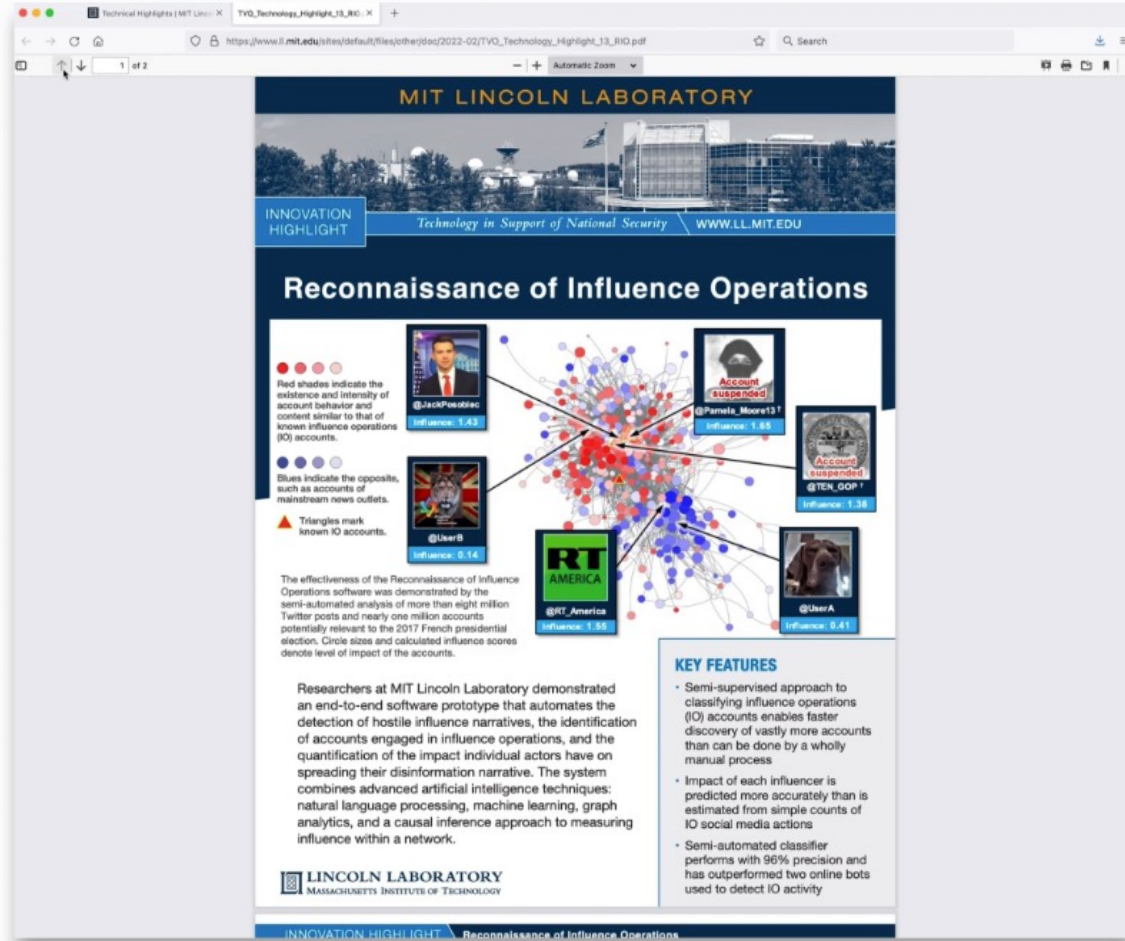
Microelectronics Laboratory



RF Systems Test Facility



Publication of MIT LL Technology Highlights



Expanding visibility of mature Lincoln Laboratory technology, collaborative R&D, and licensing opportunities

Dozens of Technology Highlights in 9 Innovation Areas

Summarizing:

- Commercial applications
- Key product features
- Patent numbers
- Publications
- Unclassified, publicly released

<https://www.ll.mit.edu/partner-us/technology-transfer>



For more information, please contact TVO@ll.mit.edu