Building Smart Super Vehicles

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MIT Lincoln Laboratory

5 March 2018

Leadership in AS for National Security

PEOPLE

1. Develop the workforce of the future

PROCESSES

2. Relieve the innovation backlog by accelerating the transition of cutting edge technology from the University to the warfighter

TECHNOLOGY

3. Make strategic investments in enabling technologies for autonomous systems

1. Building the Workforce of the Future

BWSI Class of 2017

2017 RACECAR Final Event

BWSI RACECAR
FINAL CHALLENGE

Autonomous RACECAR Grand Prix

Autonomous Air Vehicle Racing

Autonomous Cognitive Assistant

Data Science for Health & Medicine

Hack a 3D Printer

Embedded Security and Hardware Hacking

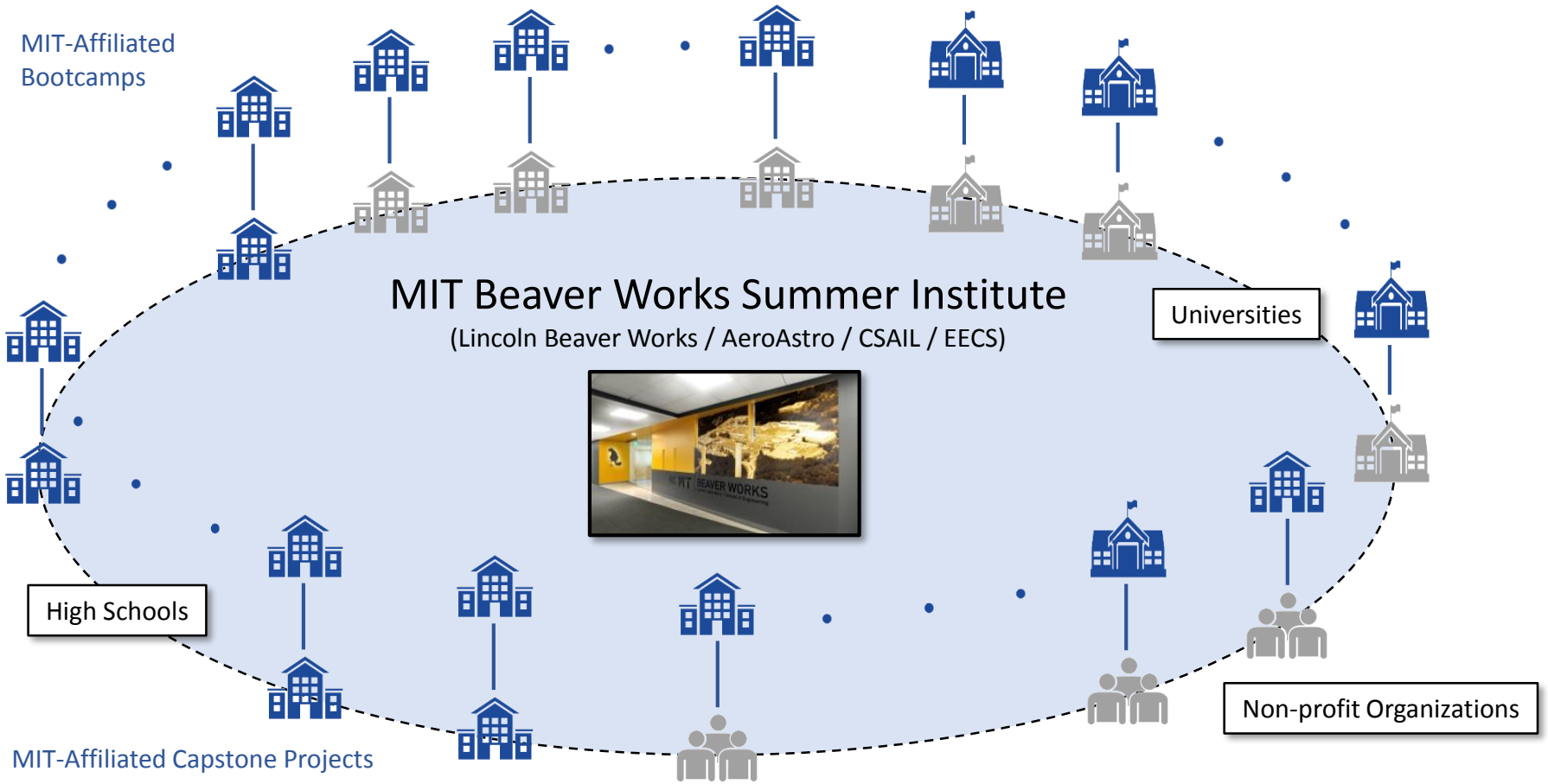
Build a CubeSat

UAS-SAR

Unreliable Media

1. Scaling up to a National Program

Collaboration with Affiliated High Schools and other Organizations

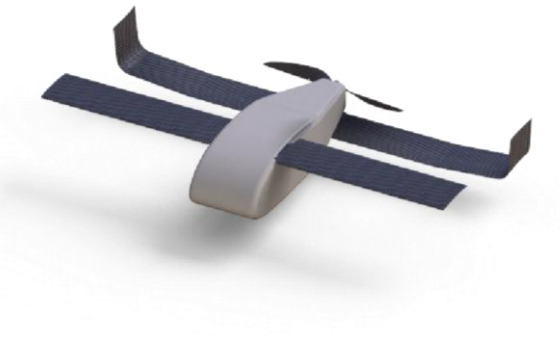


MIT-affiliated programs provide the same project-based learning experience to high school students by leveraging MIT Beaver Works Summer Institute projects

2. Beaver Works Concept Demonstration

MIT Aero/Astro Department Capstone Course: 16.82

- High-altitude deployment for atmospheric monitoring
  - Fit into standard flare dispenser
  - Deploy at 3,000 ft
  - Persistent operations for 30+ minutes
  - Station keeping under typical head winds



  - Open architectures payload
    - 15 g, max range configuration
    - 100 g with reduced flight time
    - Multi-band communications
    - Integrated GPS, INS and autopilot
  - Low unit production cost (< $2,000)

- Fall 2010 design: 26 undergraduate, 5 graduate, 3 faculty
- Spring 2011 build: 6 undergraduate, 2 graduate, 3 faculty

2. Nine Month UAV Development

Campus UAV Development

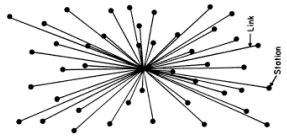
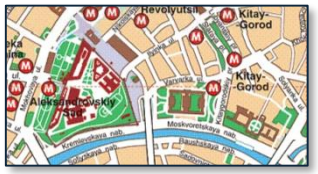
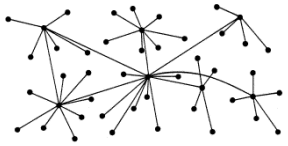
2. From Beaver Works to Tactical Applications

MICRO-UAV HIGH SPEED DEPLOYMENT DEMONSTRATION

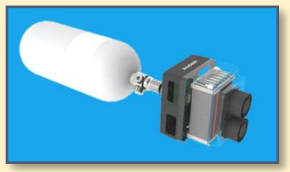
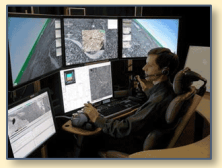
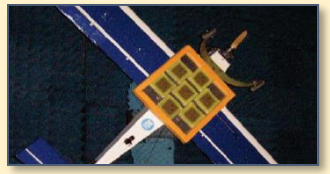
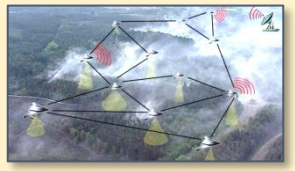
DEPLOYMENT FROM AN F-16 AT 430 MPH
AND 2,000 FT ABOVE GROUND LEVEL
EDWARDS AIR FORCE BASE - SEPTEMBER 12, 2014

SPONSORED BY THE STRATEGIC CAPABILITIES OFFICE

3. Technology Challenges and Investments

	Communication	Mission Duration/Size	Environment	Autonomy
CURRENT				
	Centralized	30 min / 1 sq. km	Benign	Pre-planned
NEEDED				
	Decentralized	Persistent /100 sq. mi.	Complex	Dynamic

Enabling Technology Areas

Energy	Autonomy	Sensors	Communication	Airframe	Launch & Recovery
					

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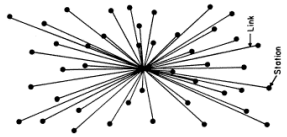
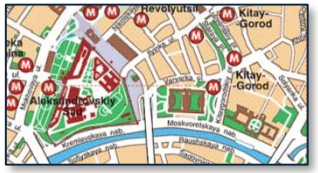
CURRENT				
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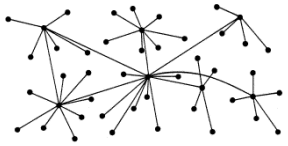
NEEDED				
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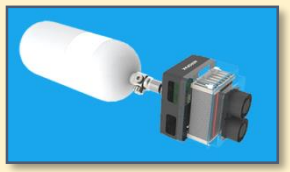
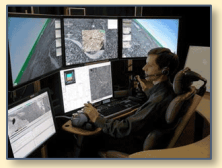
Enabling Technology Areas

Focus of our Upcoming Presentations

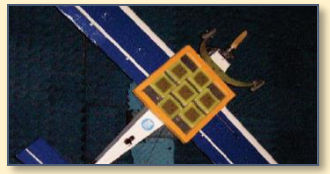
Energy



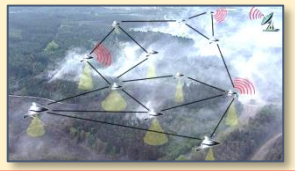
Autonomy



Sensors



Communication



Airframe

Launch & Recovery

Summary

- Maintaining our leadership in Autonomous Systems will require investments in people, processes, and technology
  - Train the workforce of the future
  - Bride the innovation gap between Universities, small businesses, and the military
  - Invest in key technologies

- Our next speakers will highlight several enabling technologies for future smart vehicles
  - Professor John Hansman – a rocket propelled small UAV
  - Professor Doug Hart – aluminum fuel for long endurance undersea vehicles
  - Dr. Scott Hamilton – high bandwidth undersea laser communications
  - Professor Sertac Karaman – training future autonomous systems using VR/AR