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U.S. DEPARTMENT OF EDUCATION
STEM RESOURCES
ed.gov/STEM
STRATEGY FOR AMERICAN LEADERSHIP IN ADVANCED MANUFACTURING

Technology  Workforce  Supply Chain
A Decline in US Manufacturing

**Domestic manufacturing employment dropped nearly 30% from 2000 to 2010...**

% of value-added in global manufacturing

Revitalizing domestic manufacturing is essential to national security, global competitiveness, and to a robust recovery from the COVID-19 crisis.

Distribution Statement A: Approved for public release. DOPSR case #21-S-0467 applies. Distribution is unlimited.
Industry 4.0 Technology Transformation

The world is undergoing a fourth industrial revolution

1st
- Mechanization
- Water power
- Steam power

2nd
- Mass production
- Assembly line
- Electricity

3rd
- Computers
- Automation

4th
- Cyber-Physical systems
- Big Data and ML
- Advanced automation

Advanced Manufacturing Technology presents an opportunity to build a technologically advanced manufacturing industry with a highly skilled, well paid workforce.
DoD Manufacturing Innovation Institutes
Current Network

Since Launching in 2012
- Committed Funding: $1.19B+ Federal and $1.96B+ Private/State Investments
- 1,510+ companies, universities, and non-profit members or partners
- DoD MIIs members across 49 states, Washington DC, and Puerto Rico

New DoD MII launched in October 2020

Distribution Statement A: Approved for public release. DOPSR case #21-S-0995 applies. Distribution is unlimited.
The Skills Gap

Before COVID-19, manufacturing growth was constrained by a shortfall of talent, with **2.4M unfilled jobs projected by 2028.**

- **Technology Transformation (Industry 4.0)**
  - Skill needs for industry 4.0 ≠ skills of the workforce pool
  - Labor market supply not meeting employer demand
  - Generational shift in workforce interests

- **Unresponsive Education and Workforce Systems**
  - Curriculum lagging rapid technology advances
  - Hybridization of skills needs across disciplines
  - Insufficient connectivity with industry
  - Industry 4.0 education inadequately resourced

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“The skills gap is upon us; it is the existential threat to our manufacturing economy.”

– Blake Moret, CEO, Rockwell Automation
Key Strategies

1. Modernize Manufacturing Education
   - Develop talent & technology concurrently
   - Employ disruptive innovations in learning tools, venues, and pathways in traditional education
   - Model Career and Technical Education modernization and expand non traditional learning models

2. Expand the Talent Acquisition Pool
   - Promote diversity, equity, inclusion, and economic mobility
   - Map adjacent skills across economic sectors
   - Upskill and reskill the incumbent workforce;

3. Drive Action Regionally
   - Engage workforce & economic development interests

Deploy via Localized, Demand-Driven Initiatives
CINDY WATERS, Ph.D.
The Department of Defense (DoD)’s Manufacturing Engineering Education Program (MEEP) Overview

Dr. Cindy Waters
- Lead Coordinator, DoD MEEP Program (under the DoD STEM Program in the Office of the Under Secretary of Defense for Research and Engineering)
- Senior Scientific Technical Manager, Advanced Manufacturing Materials, Naval Surface Warfare Center at Carderock

Advanced Manufacturing: Jobs of the Future
June 18, 2021
DoD STEM is inclusive of Department-wide efforts that address near- to mid-term (postsecondary) STEM workforce needs, and long-term (K-16 education & outreach) STEM talent development through a variety of educational and work-experiential opportunities across the K-20 continuum. The National Defense Education Program (NDEP) is one of the largest efforts under DoD STEM.
DoD STEM Strategy

VISION: A STEM talent pool with minds for innovation, diversity of thought, and technical agility to sustain the Department’s competitive edge.

MISSION: Attract, inspire, and develop exceptional STEM talent across the education continuum to enrich our current and future DoD workforce to meet defense technological challenges.

• COMMUNICATE the value and purpose of the DoD STEM Strategy and the need for engagement.

• INSPIRE youth and community engagement in K-12 STEM education and outreach by encouraging participation in DoD-sponsored STEM activities.

• CULTIVATE the future STEM talent pool through supporting and enhancing undergraduate and graduate students served by DoD-sponsored STEM programs.

• PROMOTE increased participation of underserved groups in STEM

• ENHANCE the efficiency and effectiveness of STEM initiatives by gathering evidence using a systematic approach.
• **Purpose:**

- Congressionally added since 2017, the MEEP program establishes new or enhances existing programs (or collections of programs) to better position the current and next-generation manufacturing workforce to produce military systems and components that assure technological superiority for the DoD;
- The goal of these efforts is to target and provide opportunities to current and future workforce acquiring manufacturing skills, which are critical to sustaining the defense innovation base;
- DoD MEEP programs include education and outreach to middle school students up to workforce retraining, including a focus on military veterans.

• **Approach:**

- DoD STEM funds MEEP initiatives through Funding Opportunity Announcements (FOAs), in coordination with the Office of Naval Research;
- Awardees establish or expand educational opportunities for Americans to acquire manufacturing skills critical to sustaining the defense innovation base.
2017-2019 MEEP Grant Awards

13 awards presented to distinguished educational and industry partners totaling up to $50M over a 3-year period

- Battelle (Columbus, OH);
- Clemson University (Clemson, SC);
- Massachusetts Institute of Technology (Cambridge, MA);
- National Center for Defense Manufacturing & Machining (Blairsville, PA);
- Institute for Advanced Composites Manufacturing Innovation (Knoxville, TN);
- Lightweight Innovations for Tomorrow (Detroit, MI);
- Monroe Community College (Rochester, NY);
- Society of Manufacturing Engineers (Cleveland, OH);
- University of Texas, Rio Grande Valley (Edinburg, TX);
- Virginia Polytechnic Institute and State University (Blacksburg, VA);
- Lorain County Community College (Elyria, OH);
- NextFlex (San Jose, CA)
“Train the Trainer”
I-DREAM4D 2020 Summer Virtual Camp

Various MEEP Awardees
Compiled program updates…

Educator/student opportunities

• To learn more about our MEEP partners’ efforts, visit:

  https://www.cto.mil/dod-invests-42-million-to-mEEP/
  https://hume.vt.edu/research/mEEP.htm
  https://www.toolingu.com/
  https://cecas.clemson.edu/cucwd/educateworkforce/
  https://www.nextflex.us/learning-programs/flexfactor/
  https://iacmi.org/
  https://www.opnextjobs.com/
  https://lift.technology/our-work/
  https://www.utrgv.edu/newsroom/2020/08/25-i-dream4d-summer-engineering-camp-uses-online-format-to-teach-stem-skills.htm
EMILY McGRATH
NEXTFLEX LEARNING PROGRAMS

RECRUITMENT AND TRAINING FOR EMERGING TECHNOLOGIES & ADVANCED MANUFACTURING

2021
A national network of 16 Institutes, each with a specialized technology focus and three shared goals:

1. Advance the manufacturing & technology process to full scale production
2. Create a robust commercial ecosystem around the technology
3. Create the workforce needed by employers in this sector
FLEXIBLE HYBRID ELECTRONICS

FHE (Flexible Hybrid Electronics) combine the flexibility and low cost of printed plastic film substrates with the performance of semiconductor devices to create a new category of electronics.

- Flexible
- Transparent
- Stretchable
- Biocompatible
- Conformable
- Lightweight
APPLICATION SPACES FOR FHE

Flexible Wearables

Lightweight Aeronautics

Biocompatible Medical

Medical Wireless ECG

Medical Wound Management

Soft Robotics

System Infrastructure Monitors

Low Cost / IOT Pharma

NEXTFLEX CONFIDENTIAL JUNE 15, 2021 | PAGE 3
To effectively mature and commercialize a new technology, critical stakeholders including government, industry, and academia must work together to drive technology maturation and educate a skilled workforce in the necessary capabilities.

Government: Invest in fundamental research & early maturation

Academia: Provide training on new knowledge, skills, and abilities

Industry: Adopt and scale new technologies
FORECAST OF FHE-ENABLED PRODUCTS

Approximate TRL 9 turning point

- Transportation (Aeronautical/Automotive)
- Consumer Goods
- Wearable Healthcare/Wellness
- Industrial Monitoring
- Smart Packaging and Functional RFID

2025-2030: Widespread commercial adoption

Peak Market Penetration:
30% of rigid electronics may be FHE-enabled

Expect new application domains to emerge

Phase 1: Leading the proliferation of FHE through education and training

Phase 2: Meeting industry need for a trained workforce

*Source: IDTechEx Flexible Hybrid Electronics 2020-2030 Report. Timelines adjusted based on NextFlex outlook & informational interviews with member SMEs
Mission: Create the range of talent needed by the advanced manufacturing sector and FHE community

SUPPLY

FlexFactor

Interest & Awareness Gap

Un-Engaged Talent

K-12

SKILL PROVIDING INSTITUTIONS

FlexU

Engaged Talent

Colleges; Universities

DEMAND

Flex2Future

Skills & Capabilities Gap

FlexPro

Skilled Talent

Industry
Overview
FlexFactor is a project-based learning program designed to inform, inspire, attract, and recruit the next generation workforce.

Throughout the program, small teams of students are challenged to
1. **Identify a real-world problem**
2. **Conceptualize a hardware device to address the issue**
3. **Build a business model around the product**
4. **Pitch the project to a panel of representatives including members of industry, academia, and government.**
TECHNICAL TRAINING IN FHE

FHE training programs are not widely accessible due to the emerging state of the technology, but in partnership with research universities and ManTech NextFlex is creating an online, asynchronous learning program designed to build the skills and capabilities necessary to design and manufacture FHE – enabled devices. Estimated program launch is late fall 2021.
THANK YOU

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ALEXIS VOGT, Ph.D.
Studying Optics at MCC: The Field of the Future

18 June 2021
US Dept. of Education STEM Webinar
Alexis Vogt, PhD
Endowed Chair & Professor, Optical Systems Technology
Monroe Community College; Rochester, NY
Optics Applications in National Defense

turret windows, debris shields

missile nose cones

night vision goggles for military operations

remote sensing, heads-up displays, weapon-mounted scopes

rovers
Current Marketplace Demands

Optics technicians are needed to manufacture **ALL** of these products.
Who is an Optics Technician?

• Works with scientists & engineers in research, development, design, manufacturing & quality control

• Manufactures optics

• Performs testing & evaluation of optical components & systems
Current Marketplace Demands

We have a **worldwide shortage** of optics technicians!
Current Marketplace Demands

20% of experienced technicians & engineers are approaching retirement nationwide

>550 skilled optics technician job openings go unfilled annually in Western NY

75% of small & medium-sized German companies report the shortage of skilled workers impairs their innovation activities
Current Marketplace Demands

Monroe Community College is the world’s only college awarding associate degrees in precision optics.
Optical Systems Technology Programs

• 1-year Certificate

• 2-year Associate of Applied Science (AAS) Degree

• 2+2 transfer program:
  ▪ University of Rochester – Institute of Optics
  ▪ RIT – Center for Imaging Science
  ▪ University of Arizona – College of Optical Sciences
Optical Systems Technology @ MCC

THORLABS
$200,000

SYDOR OPTICS
$250,000

CORNING
$1.26M

NSF
$550,000

Office of Naval Research
$4.4M
Problem to be Solved:
The Department of Defense precision optical systems supply chain is facing a crisis – a workforce shortage. Monroe Community College, the nation’s only college awarding associate degrees in precision optics, does not produce enough precision optics graduates to meet the annual demand.

Program Objective and Goals:
Strengthen and expand the national precision optics workforce to ensure technological superiority for the Department of Defense.

- Goal 1: Extensively enhance precision optics technician training with innovative approaches that meet the needs of the optics industry & students
- Goal 2: Increase the number and diversity of optics technicians nationwide
- Goal 3: Establish opportunities for student and faculty engagement with the optics industry
Precision Optics Manufacturing Apprenticeship

Structured earn & learn program: on the job training + related technical instruction
State-of-the-art Equipment

• New 1,400 square-foot lab
• Over $1.5 M in new advanced manufacturing equipment installed
Expanding Pre-Collegiate Partnerships
Internships, Dual Enrollment & Outreach

• 13 optics dual enrollment high schools
• 1,000+ students have participated in the last 5 years
• Paid internships
Industry Partnerships

• Optics advisory board
• Industry-validated curriculum
  • Stackable credentials and micro-credentials
• All 12 faculty/adjuncts come from the optics industry
We Need…

to join us at MCC!
THANK YOU

www.monroecc.edu/go/optics

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RESOURCES

- Manufacturing.gov
- ManufacturingUSA.com
- Out of School Time Career Pathway
- AM Apprenticeships
- AM Competencies