

Western Michigan University

Learner Centered • Discovery Driven • Globally Engaged



**Manufacturing Innovation Institute for
Flexible Hybrid Electronics (MII FHE)**

&

**Flexible Electronics Applications
& Technology (FEAT) Center**

**Dr. Dan Fleming
FEAT Faculty Member
2-3 December 2015**

- **National Network for Manufacturing Innovation (NNMI)**

1. Obama Administration program to create Manufacturing Innovation Institutes (MMI) to support growth of advanced manufacturing
2. Seventh MMI announced 28 Aug 15 for Flexible Hybrid Electronics

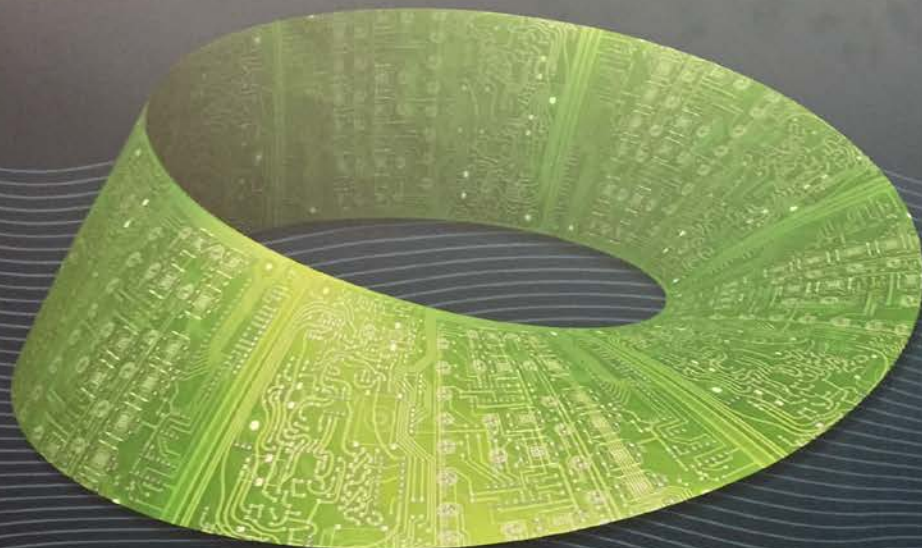
- **Manufacturing Innovation Institute for Flexible Hybrid Electronics (MII FHE)**

1. FlexTech is lead and Hub
2. Hub and Node structure
3. \$75 million Federal Funds
4. >\$96 million matching funds

- **Flexible Electronics Applications & Technology Center (FEAT)**

1. WMU center is Regional and Thematic node
2. Key player in evolution and award of the MII FHE
3. Recognized national leader
4. Collaboration with academia, industry, government
5. Projected \$5-6 million over 3 yrs. in project calls and support

Twitter Tag = #FHEMII
@FlexHybridMII



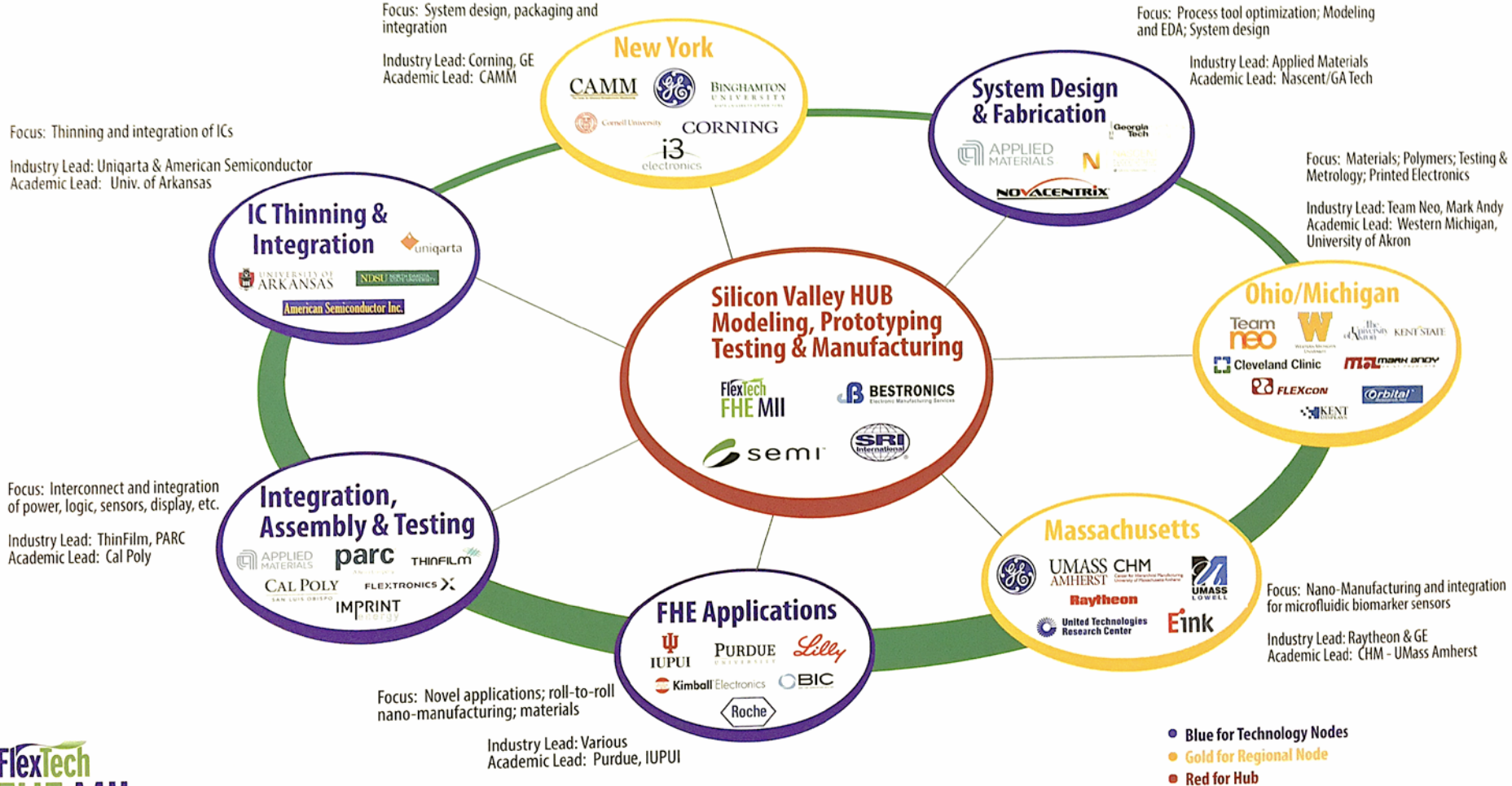
FLEXIBLE HYBRID ELECTRONICS MANUFACTURING INNOVATION INSTITUTE

**AWARD
ANNOUNCEMENT**
28 AUGUST 2015



FHE MII Hub & Node Structure Enables a Fast Start, Low Overhead and Inclusion of Existing Centers of Excellence

The FHE MII expects to identify as many as 5 additional Nodes



- Blue for Technology Nodes
- Gold for Regional Node
- Red for Hub

FLEXIBLE HYBRID ELECTRONICS MANUFACTURING INNOVATION INSTITUTE

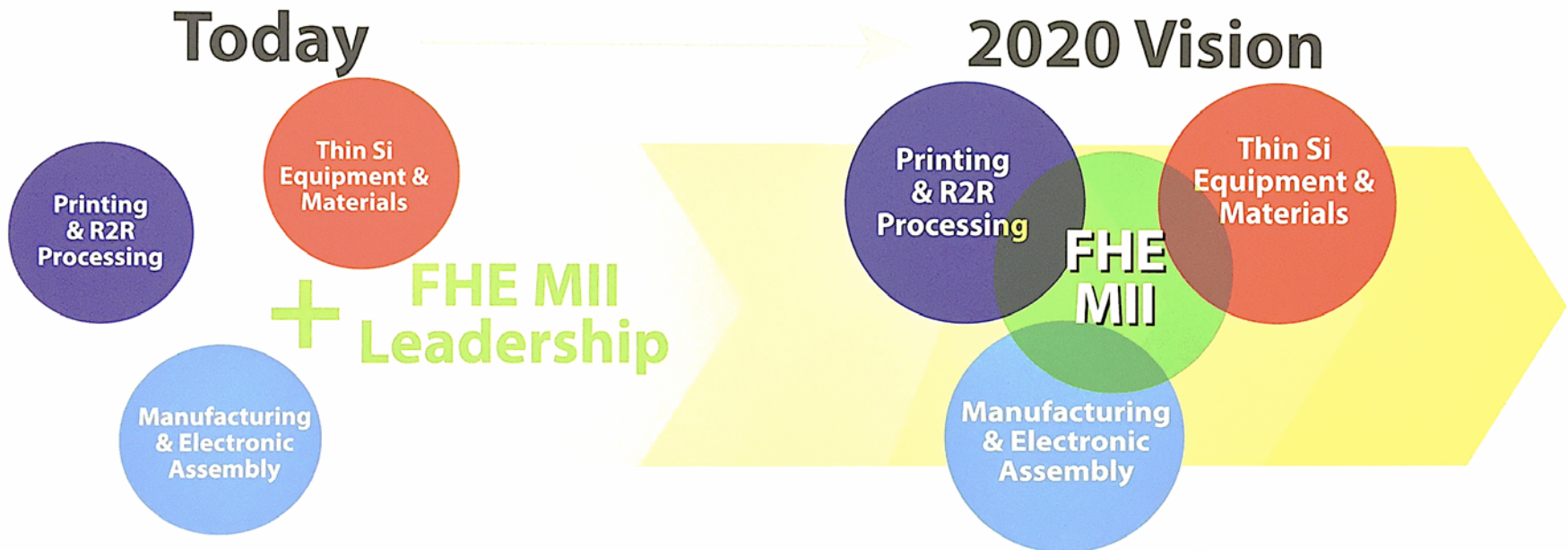


PARTICIPATING STATES



NIST

Building & Combining Disparate Technologies



Disparate FHE Capabilities

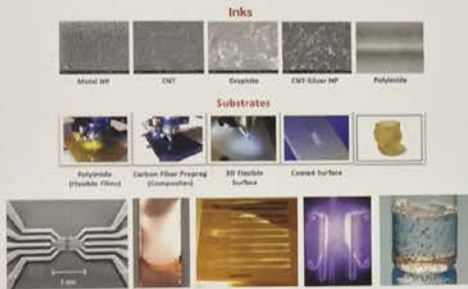
- Centers of excellence with world class capabilities; Project-based interaction
- Evolved out of established, once US-led technologies

MII Funding Helps Connect Manufacturing

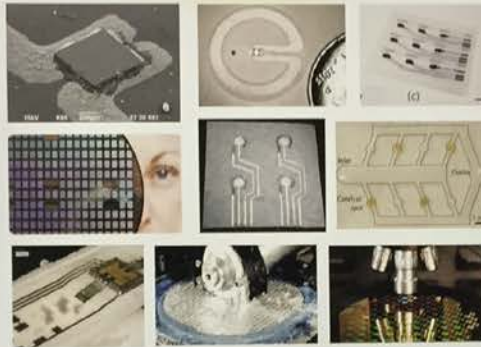
- Silicon Valley hub provides critical mass to 'pull' industries together
- Fills missing infrastructure in modeling, design, new assembly, and test
- Creates links between today's separate capabilities, existing assembly and end-user needs
- FHE leverages other industry eco-systems and marketing channels
- Relationships and communications ensures efficiencies in investments

Manufacturing Thrusts Identified For the FHE MII

1 Materials Scale-Up



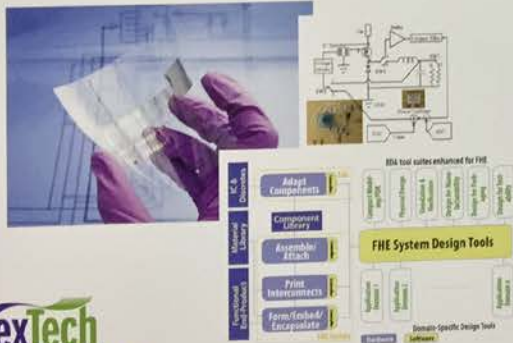
2 Thinned Device Processing



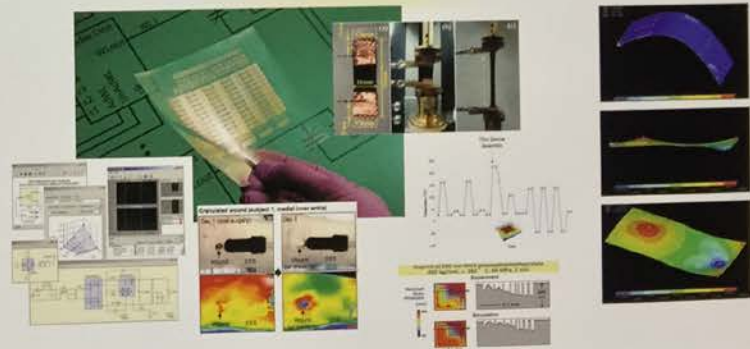
3 Device/Sensor Integrated Printing & Packaging



4 System Design Tools



5 Reliability, Testing & Modeling



Photos courtesy of Georgia Tech, UMass Amherst, Univ of Colorado - Boulder, UMass Lowell, PARC, Thin Film Electronics, Unigate, MT, Sygus Systems



Flex School

A National Workforce Strategy Providing A Knowledge, Technology & Workforce Interface to the FHE MII

- 1 Education
- 2 Workforce Development
- 3 Knowledge & Technology Coordination

Delivery Platforms

- Science Museums
- Popular Media
- Multimedia Modules
- Summer School
- Massive Open Online Courses (MOOCs)
- Curriculum Courses
- Certifications
- Internships
- Apprenticeships
- Degree Programs
- Lab Experiments
- Research Experiences
- Publications
- Conferences
- CEUs

Target Audiences

- K-6
- 7-12
- Veterans Services
- Community Colleges
- Technical Schools
- Universities & Colleges
- Masters Programs
- Continuing Education

Activities

- Semi-annual meetings for/with educators
- Career Showcases
- Short Courses
- Cohort Workshops
- Research Reviews

Audience Multipliers

- Academic Partners
- NSF ATEs
- Professional Societies
- Trade Associations
- Industry Partners



Photos Courtesy of Indiana

WMU Midwest Node

Focus: Materials; Polymers; Testing & Metrology; Printed Electronics

Industry Lead: Team Neo, Mark Andy
Academic Lead: Western Michigan, University of Akron



FEAT Components

- **Education** –
 - Keep WMU at the forefront of U.S. PE education for both students and professionals (faculty, industry).
 - Offer hands-on training with the high-tech, electronics printing press, enabling Michigan firms to integrate FHE into *their* core products and/or to transition production ready processes and products to a third party manufacturer.
- **Research** – WMU faculty will leverage FEAT to maintain WMU's leadership in PE and FHE research, generating regular intellectual property (IP) along the way.
- **Start-up Companies** – New IP creates opportunity for start-up and spin-out companies. FEAT will serve as a source for innovation and opportunities for technology commercialization.



Action Plan for Establishing FEAT

Task Description	2015			2016						
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July
Resources On-Hand for Project Start	█									
Facility Prep - Welborn Center	█	█	█							
Press Installation			█	█	█					
Class 1000 Cleanroom Install					█	█	█			
Qualifying runs - Press Processes							█	█	█	
Class 10,000 Cleanroom Install					█	█				
Move Equipment from CEAS							█	█		
Qualifying runs - CEAS Tools								█	█	



Cost for Establishing FEAT

\$2.1 million in non-recurring costs is required for facility and equipment preparation, establishing systems with a market value of \$3.2 million. The FEAT team has achieved both time and discounted terms on key equipment with resources required for the first three years to be limited to approximately \$1.4 million, \$480,000, and \$220,000 respectively. Key expenditures are

- Production Quality Printing Press (Mark Andy Corporation) \$650,000
- Class 1,000 Clean-room to enclose Press \$550,000
- Class 10,000 Clean-room for smaller printing support tools \$ 90,000
- Facility Improvements (Entrance, Conf Room, Gen. clean-up) \$150,000
- Sheet-fed Press (GTW of Germany, prototyping) \$240,000
- Software for Platemaking (DuPont and Esko) \$150,000
- Various other smaller tools \$270,000
- Total NRE \$2,100,000



Funding Sources

- **Costs substantially supplemented** by other funding sources well in excess of start-up costs.
- **FHE MII:** WMU is a key part of a successful nationwide team for a \$75 million **federal initiative** in Flexible Hybrid Electronics. WMU's funding is a **projected \$5-6 million over the first three years** in project calls and support dollars, though this is not a guaranteed funding amount.
- **Matching Funds:** As part of this DoD proposal effort, the FEAT team garnered an additional **\$4.6 million** in matching dollars from suppliers, and from industrial and academic partners. These support dollars would aid equipment purchase, maintenance and technology engineering in the coming years.
- **Industrial Membership:** FEAT team has engaged with several Michigan firms in varied markets including Gentex (automotive), Amway (consumer goods), Kellogg (food), Dow (chemicals), General Dynamics (Defense), and Stryker (biomedical), with hundreds of additional companies to engage. All firms have an interest in some type of fee-based membership to (a) help them keep engaged with the printed electronics industry and (b) to help them develop new products leveraging flexible electronics via the FEAT Center.



Government: Other states are supporting. Need to re-engage Michigan.

Foundations and Donations: To jump start center establishment.

Next Steps

- Review FHE MII Award provisions with Hub
- Review FEAT Plans and Budgets
- Submit proposals to FHE MII
- Engage funding sources



Questions?

