



U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND – ARMY RESEARCH LABORATORY

DoD investment in Hybrid Electronics industrial base

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Essential Research Program Thrust Lead: Hybrid Electronics

Program Manager NextFlex | America's Flexible Hybrid Electronics Manufacturing Institute



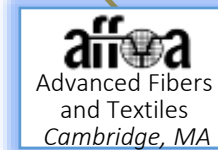
DoD Manufacturing Innovation Institutes Current Network



Since Launching in 2012

- Committed Funding: \$1.2B+ Federal and \$2B+ Private/State Investments
- 1,510+ companies, universities, and non-profit members or partners
- 49 states represented

*Data as of December 31, 2020





DoD MII Mission and Vision Chartering Principles



Advancing Research & Technology

**Partner with industry to
invest in applied research
and industrially-relevant
manufacturing technologies**

Establishing & Growing Manufacturing Ecosystems

**Establish regional
manufacturing hubs and
ecosystems for long-term,
national impact**

Securing Human Capital

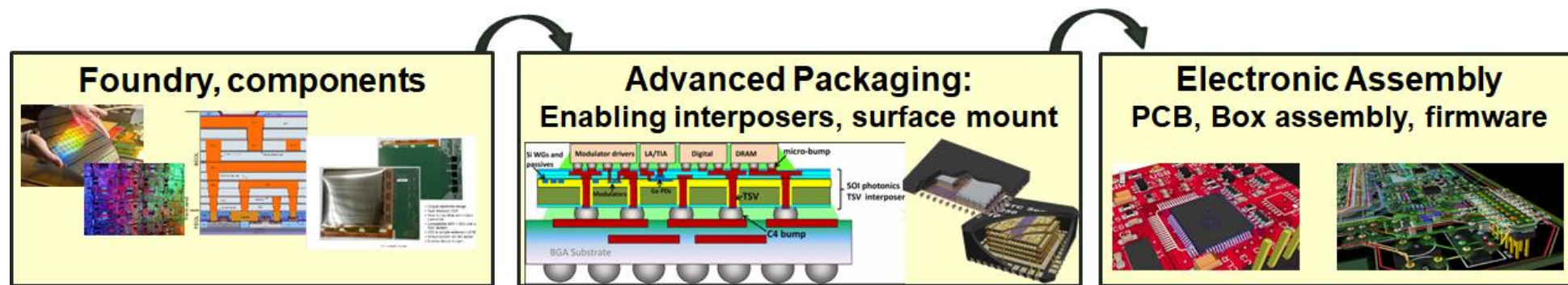
**Develop manufacturing-
specific education and
workforce development
resources to ensure
innovative technology is
manufacturable**

- Industry driven, public-private partnerships are a resource for the entire DoD and other Federal Agencies
- Principles support the OSD ManTech congressionally-mandated mission to support the Warfighter while enhancing the U.S. manufacturing base capabilities, expertise, and intellectual property (IP)



BACKGROUND: Hybrid Electronics Investment Strategy and Market Verticals

HYBRID ELECTRONIC MANUFACTURING FOCUS



Thin Die and Assembly
Novel Direct Die
Interconnects

Interface between PCB and Packaging
Organic Substrates
 - Larger Pitch but lower cost
 - Great Domestic access
Active Package Systems

Digital Circuitization
Printed Passives
Embedded components
Digital Die assembly
Digital Multi-layer

HYBRID ELECTRONIC EXAMPLE RELEVANT MARKET VERTICALS



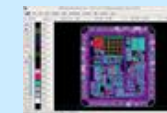


Hybrid Electronics Manufacturing Opportunity

Breaking Traditional Electronics Manufacturing Paradigms:

"Foundry to Optimized System Designs through Digital Manufacturing"

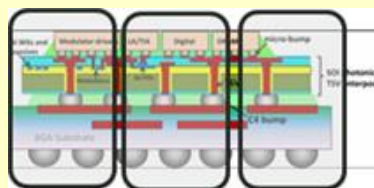
Electronic Design Automation tools (Digital Process Design Kit)



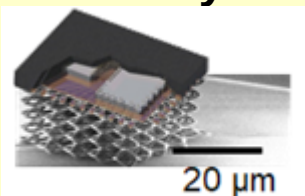
Foundry, components



Advanced Hybrid Packaging: Package can become the system



*Local-heterogeneous interposer
Optimize performance*



*Active Additive
Electronic packages*

Hybrid Electronic Assembly Digital processing, die assembly



*Direct Thin die, sensors,
components on flexible substrates*



*Optimized
applications*

Assembled into a Optimized System



*Radar
comms*

*Autonomous
vehicles*



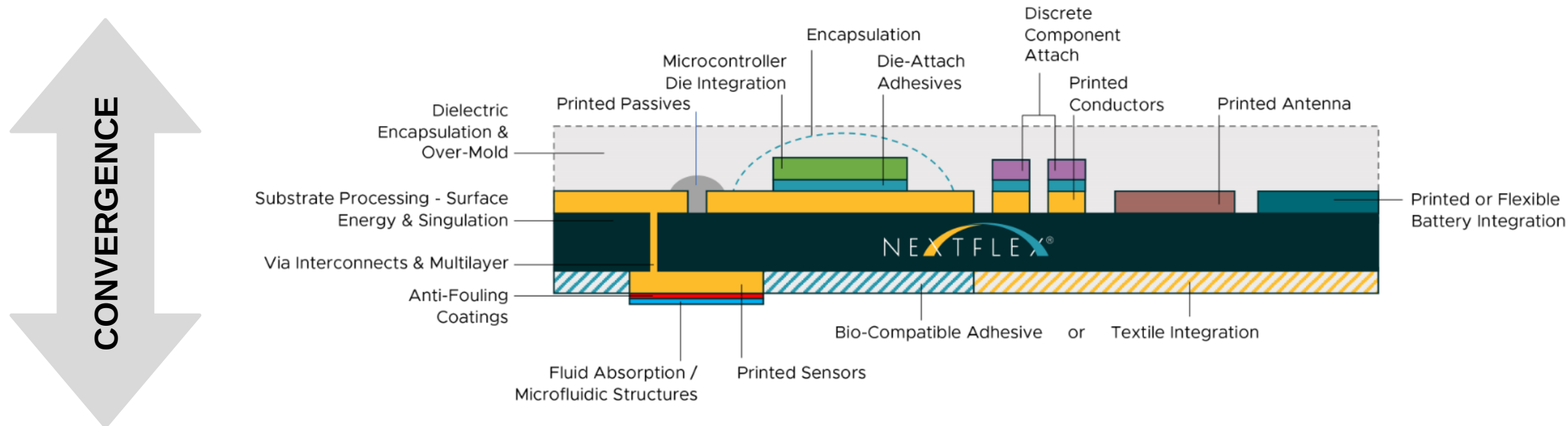
*Sensors,
Tables,
smart
phones*



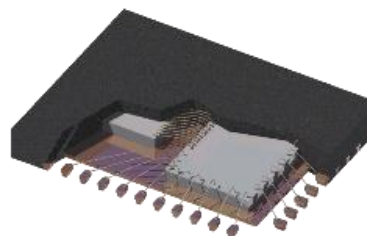
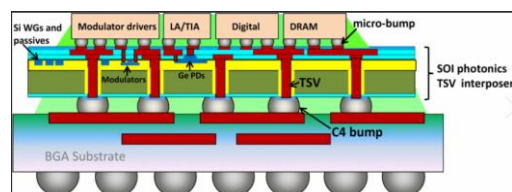
NEXTFLEX: EMERGING ADVANCED ELECTRONICS MANUFACTURING



TYPICAL NEXTFLEX FHE CROSS - SECTION



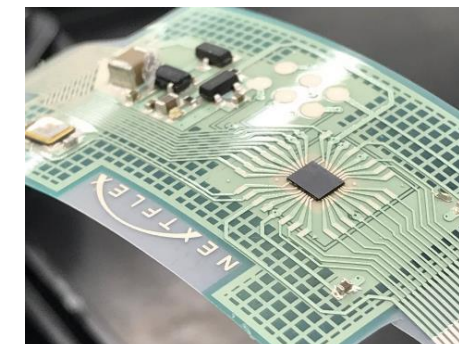
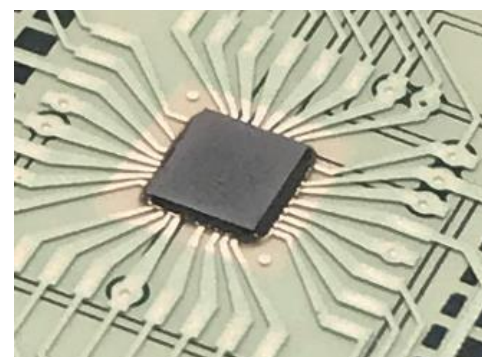
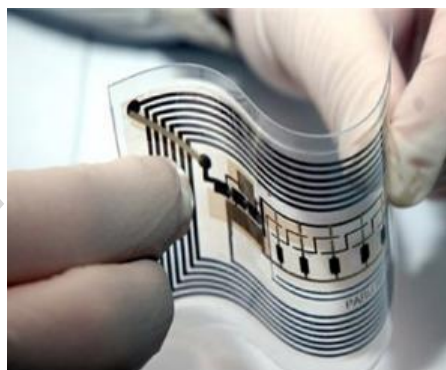
TYPICAL ADVANCED PACKAGE CROSS - SECTION





NEXTFLEX: EMERGING FHE MANUFACTURING

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.



**Traditional Printed
Circuit Boards**

Thin Flexible Bare Silicon Die

- Flexible
- Stretchable
- Conformable
- Transparent
- Biocompatible
- Lightweight