Technologies for Advanced Textile Systems

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SMART FABRICS Summit

ORGANIZED BY NC STATE UNIVERSITY Wilson College of Textiles IFAI

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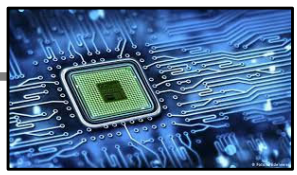
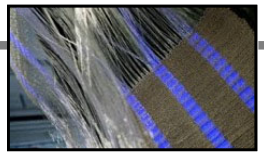
AFFOA Vision

Parts of Existing Textile Industry

Advanced Materials / Semiconductors / Software



Enable a Globally Competitive Domestic Advanced Functional Fiber & Fabric Industry



Commercial Applications

New markets & products

Defense Applications

Solving critical national security challenges

Inspired by:

- New Products in Market
- New Defense Systems Fielded
- New Businesses Launched
- New Jobs Created
- New Advanced Technologies Manufactured

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AFFOA Mission & Roles

Mission

Lead a nationwide advanced fiber & fabric technology development and manufacturing enterprise to rekindle the domestic textiles industry and deliver revolutionary system capabilities for national security and commercial markets

Key Roles

Establish Manufacturing Ecosystem for Advanced Products

Develop a multi-disciplinary domestic supply chain of the future to meet DoD and commercial needs with long-term strategic and rapid response capabilities

Develop and Transition Advanced Technology

Transform traditional fiber, yarns, and textiles into highly sophisticated, integrated, and networked devices and systems

Create Innovative Workforce of the Future

Inspire, prepare, and grow the workforce pipeline for the advanced textiles industry

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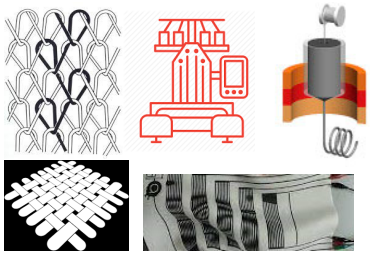
AFFOA Technology Maturation Models

Component Technology

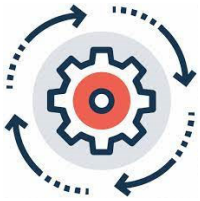


- Functional Fiber & Fabric Development
- Process development for power/data distribution
- Maturation of member technologies

System Integration

- System design incorporating internal & ecosystem technology
- E-Textile integration
- Prototype development
- System test
- Supply Chain identification

Program Management/ Technology Curation



- Direct funding to ecosystem members to develop relevant technologies
- Agency driven requests
- Project Calls, Workshops

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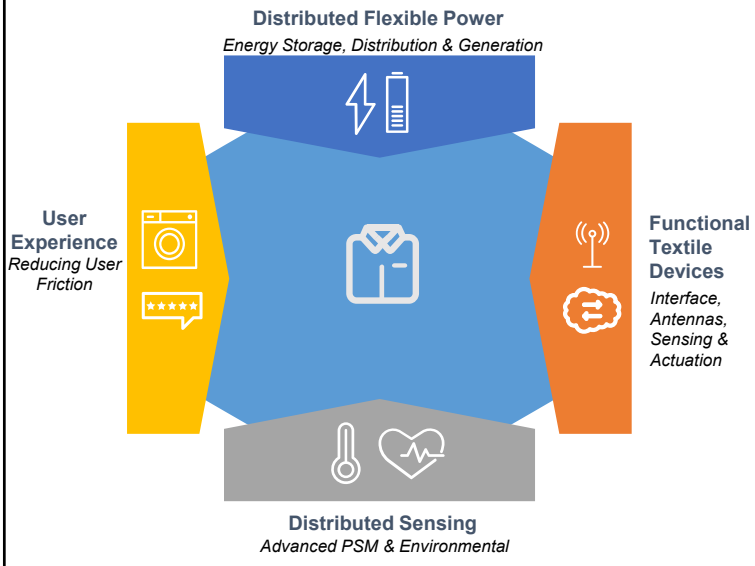
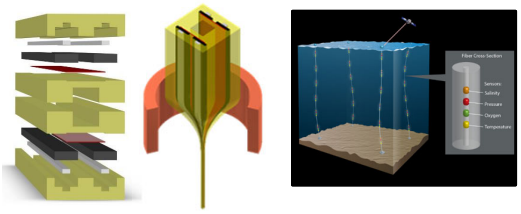
Development Thrusts

Use case Specific Wearable Platform



1D Sensing Platform



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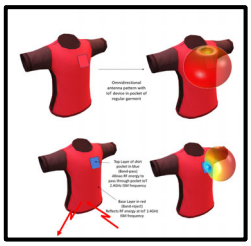
Wearables: Technology Advancements

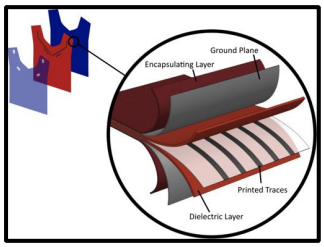
Tunable RF Metamaterial Fabrics



Signal Boosting Capabilities for Wearables

NOTCH UMASS

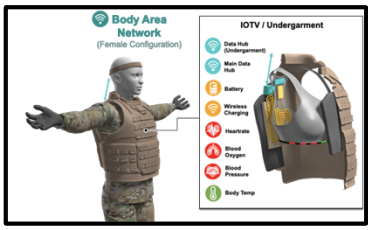
Fabric-Printed RF Transmission Lines



Enhanced Signal RF Transmission for High Frequency Communications

Vorbeck

Fabric Backplane for Integrated Soldier Wearables



Mission Specific Wearables Enhanced Signal Routing Within and Between Garments

pafdg NEXTFLEX MIT LINCOLN LABORATORY

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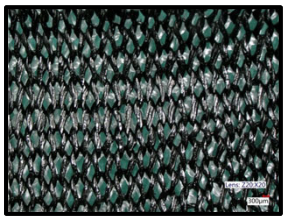
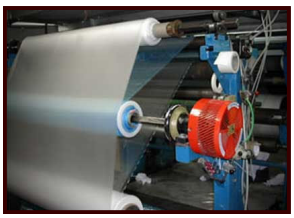
Advanced Textiles for Wearable Products

Carbon Nanotube Textile Advancements



CNT Development for High Energy Cathodes & Wearable Biopotential Sensors

FR Waterproof Breathable Fabric



Masterbatch Development for Lightweight Waterproof FR Nylon

Self Cooling Bioderived Textile

Bioderived PE and Synthesized Spider Silk Textiles

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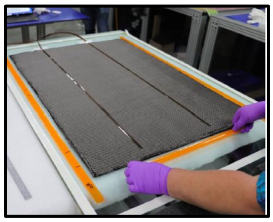
Functional Fiber for 1D Sensing

Composite Cure Monitoring

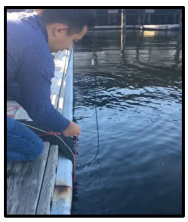


Use of Flexible Electronics and Fibers to Monitor Curing Profiles in Composites

Self Cleaning Textiles

Use of Integrated LED Fibers to Activate Photocatalytic Coatings to Breakdown Organic Materials

Undersea Sensing



Distributed Sensing up to 100m to Enable Environmental Monitoring

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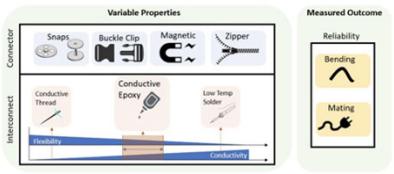
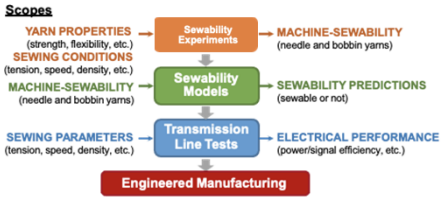
Advancing Industry Infrastructure for AFF

Connectorization



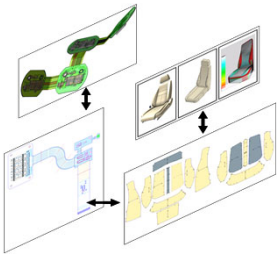
Wearable Connectors & Connectorization Techniques through Ultrasonics & Conductive Materials Development

Design Rules



Sewability Assessment of Conductive Yarns

CAD/CAM Design & Modeling Tool Chain



Mapping the Needed Digital Tool Chain for Design and Simulation of E-Textiles

AFF = Advanced Functional Fabrics

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Technology Innovations in AFF

Soft Robotics

Soft Robotic Glove for Hand Rehabilitation

Haptics

Wearable Device Enabling Music for the Deaf

Color Change

Photochromic Inks and Re-Printable Apparel

New Manufacturing Technology

3D Weaving

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Future Directions for AFFOA Tech Innovation

Sustainable Materials & Processing

Integrated methods for reducing carbon footprint of domestic textile supply chain

RFI Forthcoming

Technical Working Group Roadmaps

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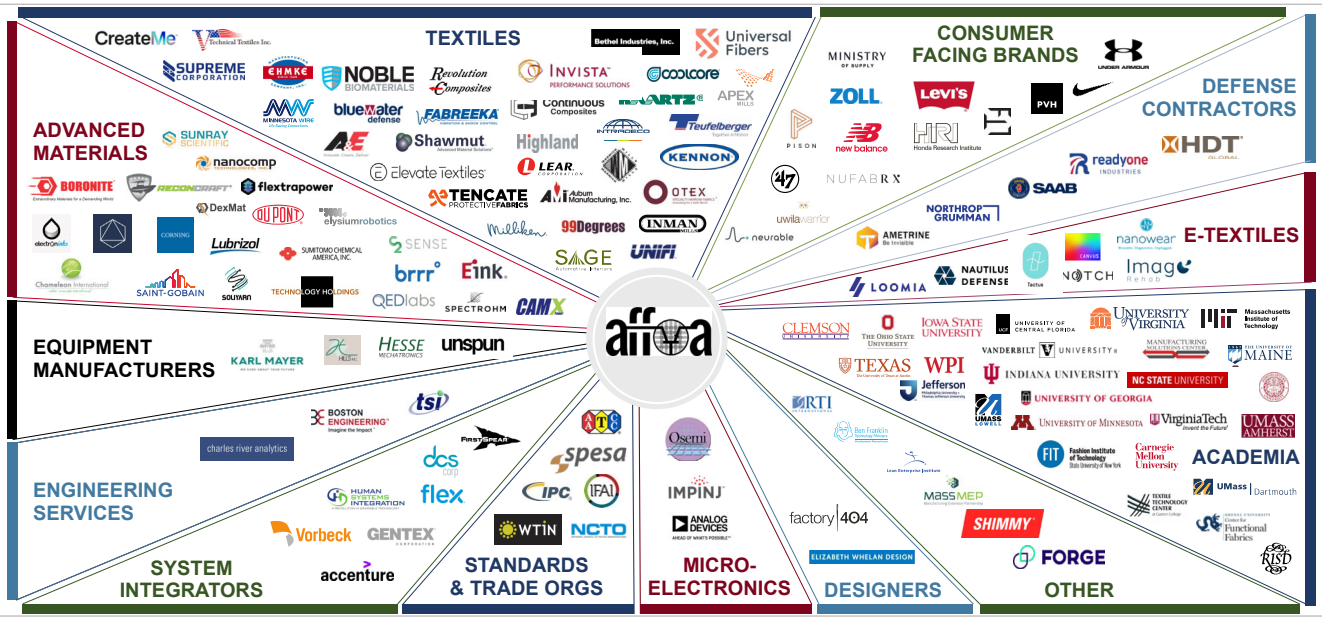
Fabric Innovation Network Capabilities



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