America's Flexible Hybrid Electronics Manufacturing Institute

NextFlex Hybrid Electronics Manufacturing Roadmap Summary

2025 /2026

Rev 1.0

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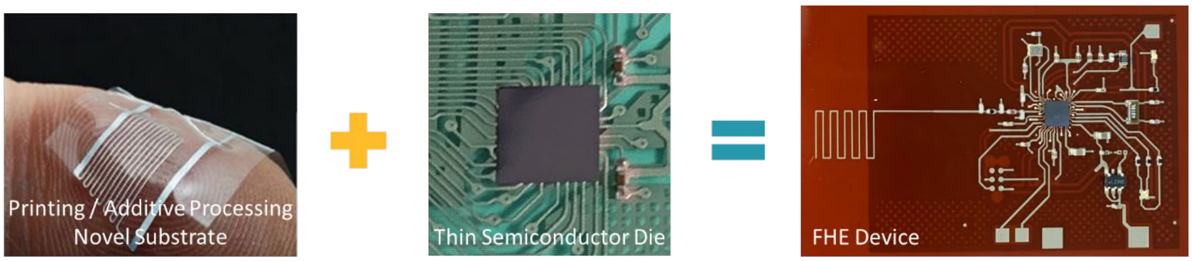
ABOUT NEXTFLEX

NextFlex is a consortium of American electronics companies, academic institutions, non-profits, state, local and federal government partners with the shared goal of advancing U.S. manufacturing of Hybrid Electronics (HE). Since its formation in 2015, the NextFlex community of technologists, educators, problem solvers, and manufacturers have come together to collectively facilitate HE innovation, narrow the advanced manufacturing workforce gap, and promote sustainable electronics manufacturing ecosystems.

WHAT ARE HYBRID ELECTRONICS?

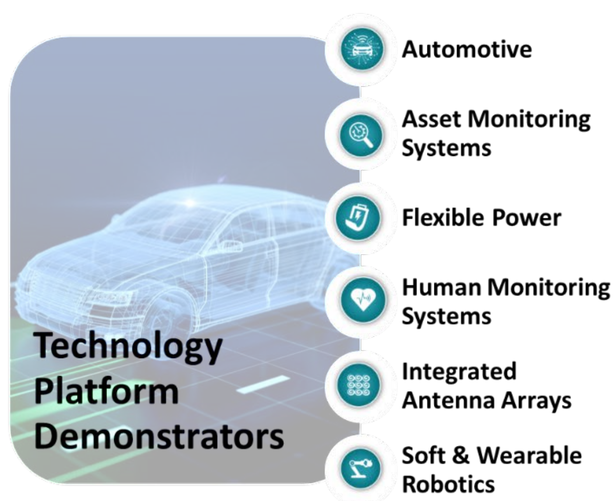
HE as defined by NextFlex is the field that exists at the intersection of printed and additively manufactured electronics with conventional semiconductor devices and discrete components. HE is broader, though, than is sometimes interpreted from this description, as HE also includes electronics that can stretch, bend and twist, those which are conformally built onto surfaces in three dimensions, and those which are additively manufactured in three dimensions, regardless of mechanical flexibility. Advanced semiconductor packaging and additive printed circuit board (PCB) manufacturing are areas of growing focus for NextFlex as novel additive techniques provide distinct capabilities on both flexible and rigid substrates.



Graphical representation of the field of Hybrid Electronics

TECHNICAL WORKING GROUPS

NextFlex Technical Working Groups (TWGs) are a devoted group of subject matter experts who collaborate through NextFlex on establishing HE manufacturing technology roadmaps to identify key technology gaps and technology planning requirements to advance the manufacturability of flexible hybrid electronics. There are currently eleven TWGs. These include six application areas called “Technology Platform Demonstrators,” and five that are called “Manufacturing Thrust Areas,”. Each TWG is led by a small team of “co-leads” from a balance of academia, government, and industry. Including the 35 co-leads, there are 250+ subject matter experts regularly convening to develop, expand, and refine the HE Technology Roadmaps.



HE TECHNOLOGY ROADMAPS

The HE Technology Roadmaps are narrative documents developed by the TWGs in each eleven of the technical areas of emphasis. These roadmaps are a critical asset to NextFlex members and contain significant detailed information on the current state of the art, market opportunities and needs, key stakeholders, a five-year forward-looking development roadmap, and prioritized technical gaps for each TWG.

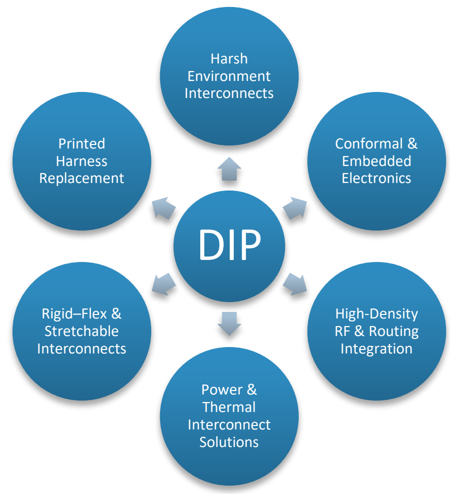
The following pages present single-page summaries of the full HE Technology Roadmaps available to NextFlex members.

DEVICE INTEGRATION & PACKAGING

SCOPE The focus of the Device Integration and Packaging Technical Working Group (DIP-TWG) is to establish manufacturing methods for preparation, placing, interconnecting, and protecting circuit components onto flexible substrates for the fabrication of fully flexible and/or conformal electronic circuits. The DIP-TWG plans integration methods for sensing, communication and computational elements that can adapt to a multitude of geometric and environmental constraints.

STATE OF THE ART

Component / Element	SOTA Specs
Circuit Layers	8
Via Diameter	100-250 µm
Dielectric Thickness	≥25 µm
Bend Radius	>6x thickness
Sheet-to-Sheet Lines & Spaces	50-200 µm
Roll-to-Roll Lines & Spaces	250 µm
Printed conductors	3-20x bulk resistivity
Components	SMTs with solder attach
Printed Resistors	±20% tolerance
Flip-Chip Attach to Flex	100 µm pitch
Die Size	<5 mm^2
Die Thickness	<250 µm
Die I/Os	<100
Pad Area	>75µm sq
Pitch	>150 µm

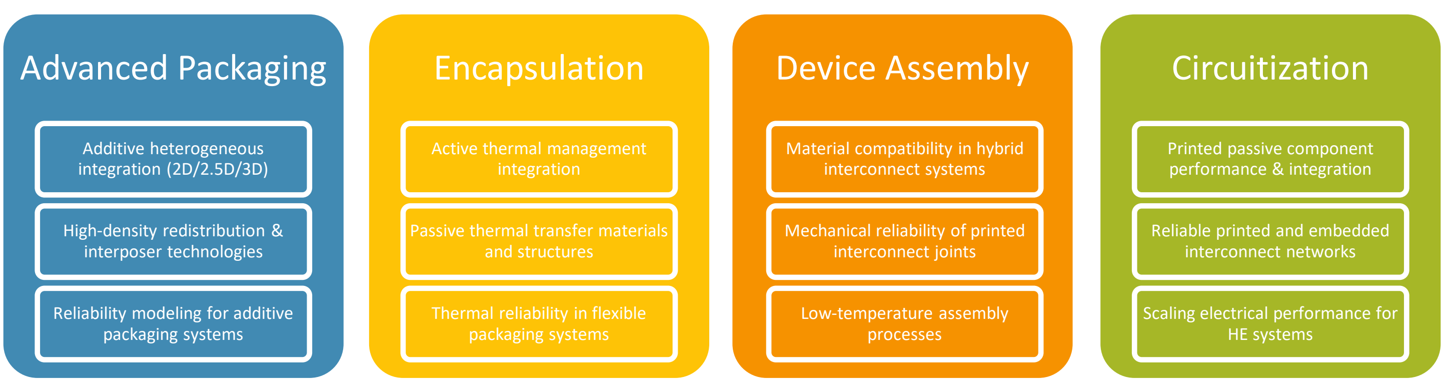


Application-driven alignment for the Device Integration & Packaging TWG with key technology transition opportunities.

KEY OPPORTUNITIES

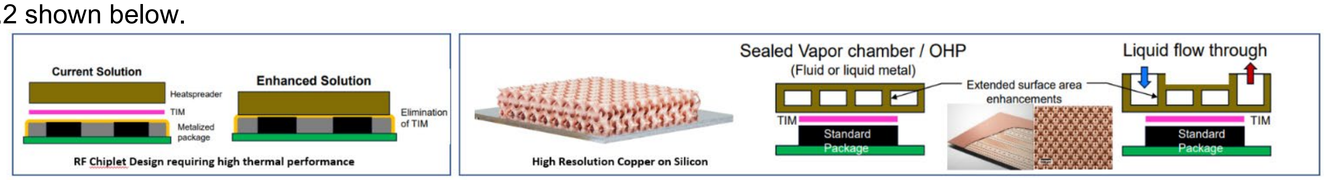
- Integrated, conformal electronic systems replacing discrete assemblies
- SWaP-C reduction through embedded interconnects and functionality
- Scalable manufacturing for hybrid additive electronics
- Electronics integrated directly into structures & surfaces
- Co-designed materials, devices, and packaging for improved performance
- On-demand, distributed manufacturing and repair

TECHNICAL ROADMAP TAXONOMIES AND GAP AREAS



PROJECT CALLS

To date, NextFlex has funded 47 projects that align to the Device Integration & Packaging Working Group, including PC9.2 shown below.



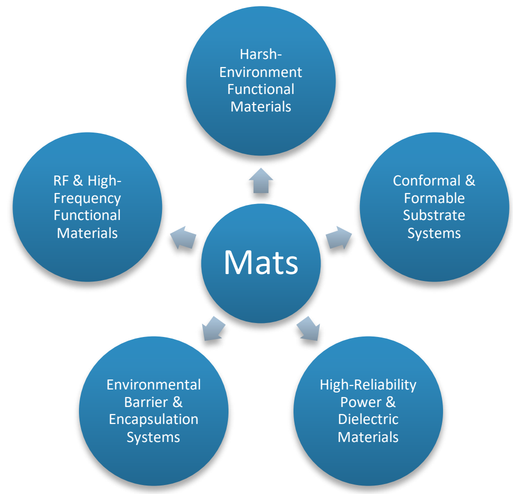
PC9.2: CuPID: direct Copper Printing on Integrated Die led by Lockheed Martin

MATERIALS

SCOPE Material properties and functionality are critical drivers for the technological development and performance of flexible hybrid electronic devices. Materials development is driven by the needs of the NextFlex community, but also by cross-fertilization from materials developments outside NextFlex.

STATE OF THE ART

Category	SOTA Materials
Substrates	Polymers, Glass, Thinned Silicon, TPUs, LCPs
Active Materials	Doped amorphous silicon, electro-fluorescent inks, doped CNTs, magnetic films, electro-active materials, PZTs
Passive Conductors	Ag inks (10-20% higher than bulk), Cu inks and pastes, graphene inks, highly doped carbon inks
Dielectrics & Encapsulants	Polymers with non-conjugated carbon backbone, metal-oxide, ceramic-bearing materials
Materials Processing	Photonic curing, magnetically aligned ECAs



Application-driven alignment for the Materials TWG with key technology transition opportunities.

KEY OPPORTUNITIES

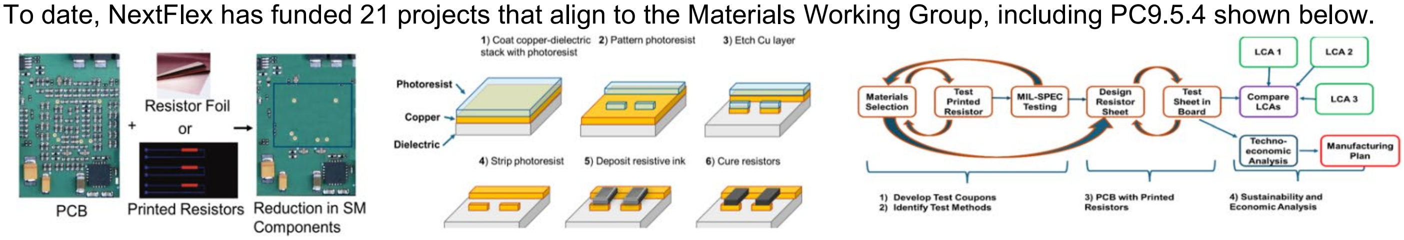
- High-performance materials enabling reliable operation in extreme thermal, mechanical, and chemical environments
- Multi-material material systems supporting integrated, conformal, and structurally embedded electronics
- Advanced materials for robust interconnects, power delivery, and thermal management in high-demand systems
- Stretchable, flexible, and bio-compatible materials for durable wearable and human-integrated electronics
- RF and dielectric materials enabling conformal, multi-band, and high-frequency electromagnetic systems
- Scalable, process-compatible materials designed for high-yield additive and hybrid manufacturing

TECHNICAL ROADMAP TAXONOMIES AND GAP AREAS

Active Materials	Substrates	Dielectrics	Conductive & Resistive Inks	Reducing Life Cycle Costs
High-stability functional sensing inks	Flexible and stretchable substrate platforms	High-k dielectric materials for RF applications	High-conductivity printed conductors	Moisture-barrier encapsulants for printed systems
Printable biochemical sensing materials	Harsh-environment and low-diffusion substrates	Tunable dielectric composites for embedded systems	Long-term ink stability and manufacturability	Chemically selective encapsulation materials
Scalable integration of active materials into HE systems	Strain-relief and thermal interface material integration	Stable dielectric performance across environments	Low-temperature interconnect compatibility	Sustainable and scalable material systems for HE

PROJECT CALLS

To date, NextFlex has funded 21 projects that align to the Materials Working Group, including PC9.5.4 shown below.



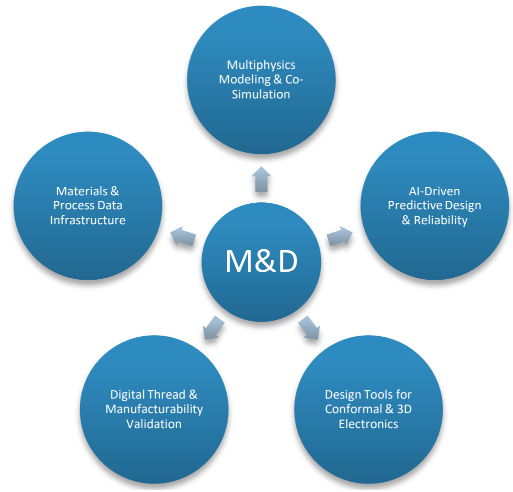
PC9.5.4: Printed Resistors for Low-Cost Sustainable, Semi-Additive PCBs led by UMass Lowell.

MODELING & DESIGN

SCOPE The objective of the Modeling & Design Technical Working Group is to identify the key gaps in computational methods and tools for flexible hybrid electronics product design and analysis. The technical fields include but are not limited to HE electrical design, manufacturing process modeling, reliability modeling, multi-physics modeling, and HE material database integration. Simulation software or computer-aided design tools to support the HE modeling and design needs are indirectly related to M&D-TWG roadmap.

STATE OF THE ART

- Existing process simulation and modeling software for 3D printing such as Additive Works and Simufact can possibly be used for HE additive-printing processes, although the simulation accuracy and compatibility with various HE printing processes are yet to be investigated.
- NextFlex has invested in an initial phase of HE-PDK development which lays the foundation of HE electrical simulations and device models based on actual HE device characterizations.

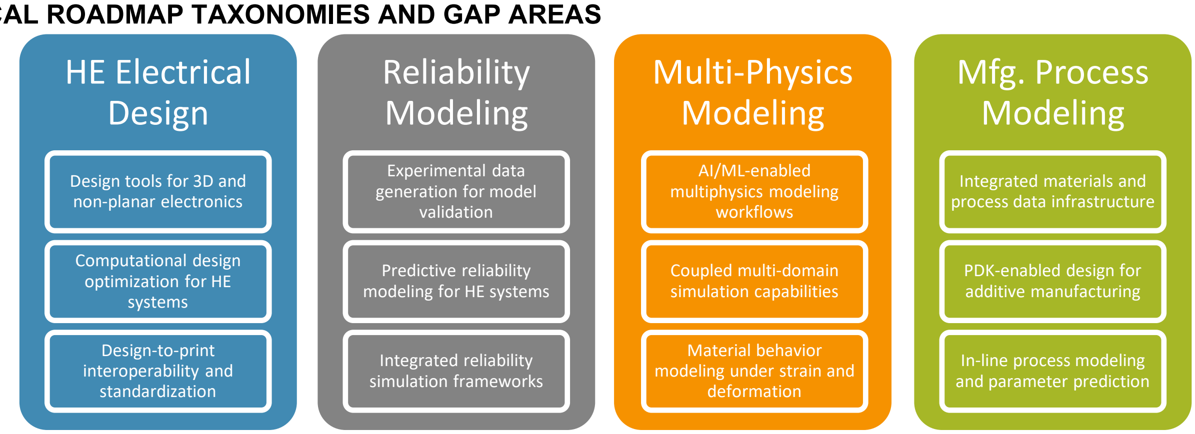


Application-driven alignment for the Materials TWG with key technology transition opportunities.

KEY OPPORTUNITIES

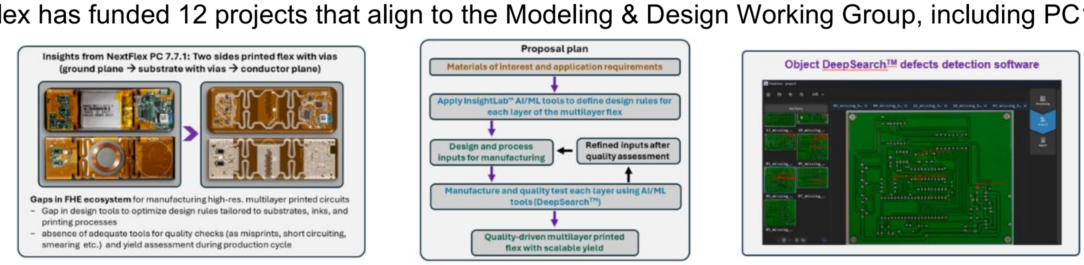
- Integrated design tools enabling seamless transition from concept to manufacturable HE systems
- Multi-physics modeling to accurately predict performance across electrical, mechanical, and thermal domains
- AI/ML-driven design optimization to accelerate development and improve system performance
- Design frameworks incorporating manufacturing constraints and process variability from the outset
- Standardized data, models, and workflows to enable interoperability across tools and stakeholders
- Predictive reliability modeling to inform design decisions and reduce testing burden

TECHNICAL ROADMAP TAXONOMIES AND GAP AREAS



PROJECT CALLS

To date, NextFlex has funded 12 projects that align to the Modeling & Design Working Group, including PC10.2 shown below.



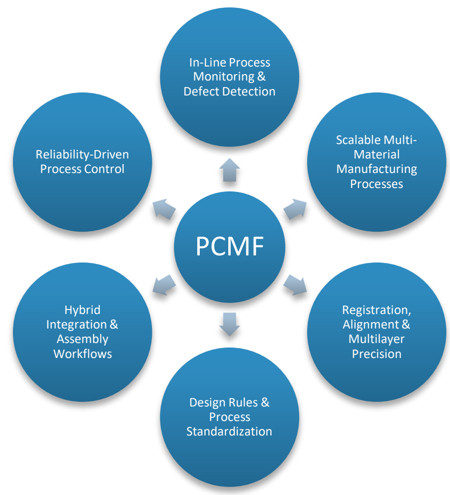
PC10.2: Enhancing FHE Design and Manufacturing with AI/ML tools led by GE Healthcare.

PRINTED COMPONENTS & MICROFLUIDICS

SCOPE The development of flexible hybrid electronic devices is dependent on material properties, printing processes, and microfluidic components. The materials primarily include functional inks and NextFlex is focused on (a) defining material properties to enable HE at low- and high-volume manufacturing, (b) expand material database inputs to include “real-world performance” data and (c) developing product design guides which define materials, printing processes, post-processing, and assembly methods.

STATE OF THE ART

	MRL 3	MRL 4	MRL 5	MRL 6	MRL7
Ink & Materials	Stretchable inks, washable inks	Conductive inks (Cu) Semiconductor inks	Dielectric inks	Substrates (Paper, TPU), Encapsulant inks	Substrates (Kapton, PET, textile) Conductive inks (Ag)
Printing	Via printing, High-speed insertion of components	In-line metrology, precise layer registration	R2R integration with controlled atmosphere	Multi-layer structures; Inline insertion of components	Printers with multiple deposition modes
Direct Writing	Design-to-Toolpath Generation	Single / Multi-material printing of devices	Single material printing at low-volume	-	-
Microfluidics	Hybrid HE/MF component, Stretchable microfluidics	Rigid MF elements for HE	Rigid MF elements	Rigid MF systems	Screen-printed, laminated materials for test-strips



Application-driven alignment for the Printed Components & Microfluidics TWG with key technology transition opportunities.

KEY OPPORTUNITIES

- Scalable, high-throughput additive manufacturing
- High-resolution, multilayer printing and registration
- Closed-loop process control for high yield
- Hybrid additive + conventional assembly
- Standardized materials and design rules
- Integrated microfluidics and multifunctional systems

TECHNICAL ROADMAP TAXONOMIES AND GAP AREAS

Digital Printing
- High-throughput, high-resolution additive printing
- Hybrid manufacturing integration for printed components
- Closed-loop process control and digital manufacturing workflows

Microfluidics
- Active fluid control and embedded fluidic logic
- Integrated microfluidics for thermal and functional systems
- Stretchable and conformal microfluidic architectures

Pattern Transfer Printing
- Reliability of hard–soft and hybrid interconnects
- Precision registration for multi-layer systems
- In-line metrology and process verification

Ink & Materials
- High-performance dielectric materials for multi-layer systems
- Ink/substrate compatibility and process standardization
- Multi-layer material system integration

PROJECT CALLS

To date, NextFlex has funded 33 projects that align to the Printed Components & Microfluidics Working Group, including PC10.4 shown below.

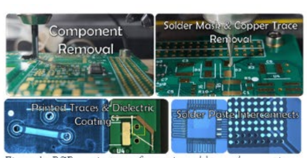


Figure 1. PCB repair steps of removing solder mask, removing components and adding conductive and dielectric for repair.

Figure 1. Copper-tin all metal filament with conductivities reaching 7x more resistive than bulk copper.

Figure 3. 3Dn300 system shown. The 3DnPRS will have a similar form factor.

PC10.4: Additive Manufacturing and Repair of Electronics in the Defense Industrial Base led by Sciperio.

STANDARDS, TEST & RELIABILITY

SCOPE The NextFlex Standards, Test & Reliability Technical Working Group (STR-TWG) establishes key goals with needs relevant to standards, test methods, guidelines and qualification programs for flexible hybrid printed electronics. The STR-TWG establishes these goals based on needs demonstrated by the other TWGs, thus making the STR-TWG a responsive group. Additionally, the STR-TWG will identify appropriate standards development organizations to address specific gaps.

EXISTING STANDARDS

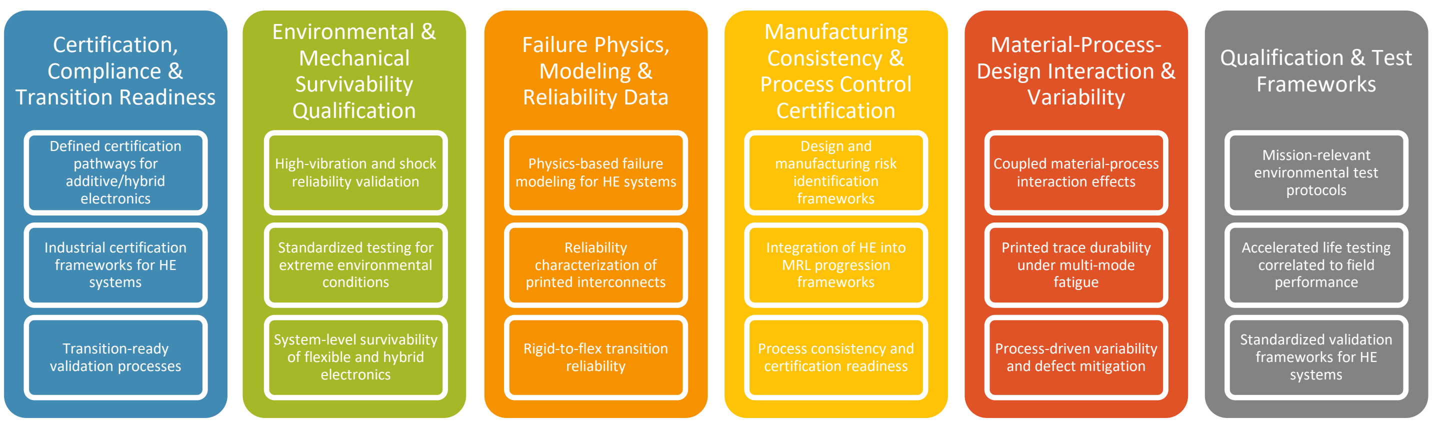
Area	Standard
Term & Definitions	IPC-6903A, SEMI 3D1-0912
Printed Conductive Inks	IPC-4591A
Substrates	IPC-4921A
Design	IPC-2292
Quality & Reliability	MIL-STD-810G, IPC-9204, ASTM D522-03a
Printed Dielectric Inks	-
Equipment	IPC-2591
Production & Process	IEC 62899-401

Application-driven alignment for the Standards, Test & Reliability TWG with key technology transition opportunities.

KEY OPPORTUNITIES

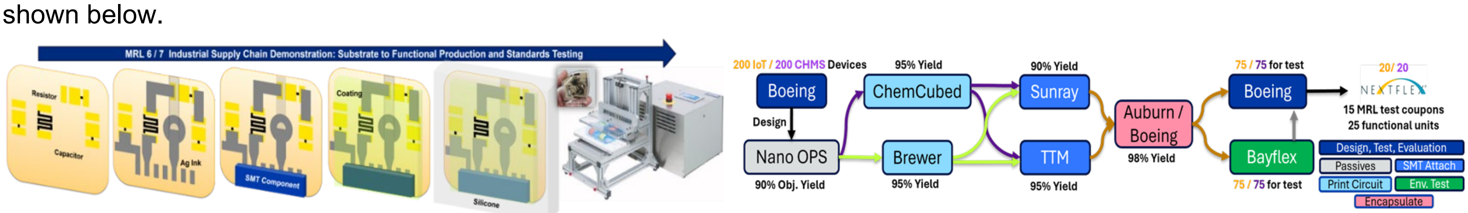
- Standardized qualification frameworks enabling certification and transition of FHE systems
- Mission-relevant testing protocols reflecting real-world environmental and operational conditions
- Predictive failure modeling and lifetime assessment to reduce testing burden and risk
- Reliability validation of interconnects, materials, and multi-material interfaces
- Characterization and control of process variability for consistent manufacturing outcomes
- Shock, vibration, and environmental survivability validation for deployed systems

TECHNICAL ROADMAP TAXONOMIES AND GAP AREAS



PROJECT CALL

To date, NextFlex has funded 13 projects that align to the Standards, Test & Reliability Working Group, including PC10.5. shown below.



PC10.5: DoD Readiness Demonstration of Industrial Based Solutions (DIBs) led by Boeing.

ASSET MONITORING SYSTEMS

SCOPE Asset Monitoring System (AMS) devices enable monitoring of performance, status, and health of any item of interest for a user. AMS devices can provide functional capabilities such as condition-based maintenance, time critical monitoring, monitoring for compliance actions, anti-counterfeit, cyber security, active feedback for closed loop control to maximize performance, efficiency, life, remaining useful life and environmental status, as well as improvements in manufacturing quality, and throughput.

STATE OF THE ART

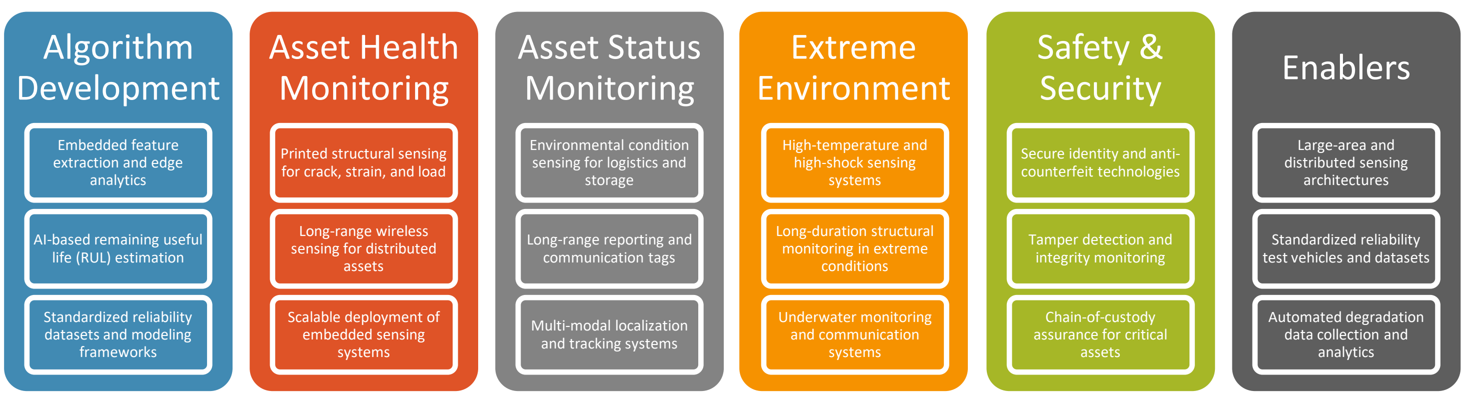
- Current AMS devices are predominately fabricated on rigid printed circuit boards and housed in assemblies connected to higher level systems through wired or wireless interfaces.
- Some RFID systems use printed antennas and interconnects, thinned components, flexible batteries, and integrated sensors, depending on type and number of sensors, power budget, and application.

Priority technology transition domains for the Asset Monitoring Systems TWG.

KEY OPPORTUNITIES

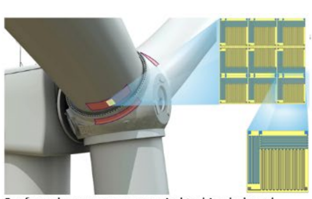
- Distributed sensing systems enabling continuous asset health, status, and environmental awareness
- Low-power, connected devices supporting persistent tracking across logistics and infrastructure
- Integrated sensing and analytics enabling condition-based maintenance and lifecycle optimization
- Robust monitoring solutions for operation in extreme and harsh environments
- Secure, tamper-aware systems ensuring chain-of-custody and asset integrity
- Scalable, low-cost sensor networks for large-area and high-volume deployment

TECHNICAL ROADMAP TAXONOMIES AND GAP AREAS

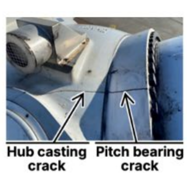


PROJECT CALLS

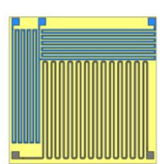
To date, NextFlex has funded 13 projects that align to the Asset Monitoring Working Group, including PC9.3 shown below.



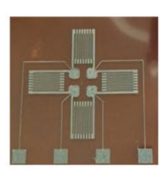
Conformal sensor arrays on wind turbine hub and blade roots



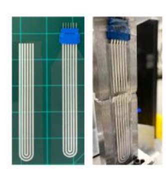
Examples of critical areas requiring monitoring



Sample bi-modal design:
- strain gauges (blue)
- crack detection sensor (grey)



Strain gauge sensor printed at BU



Crack detection sensor printed at GE Vernova

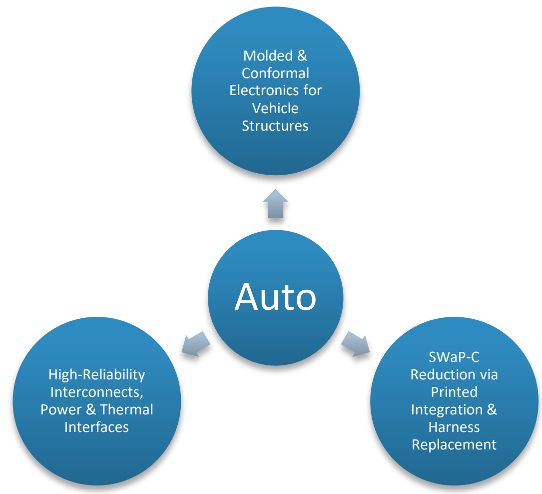
PC9.3: Development and characterization of stretchable high-strain gauges and crack detection sensors for large-area infrastructure monitoring in harsh environments led by GE Vernova.

AUTOMOTIVE

SCOPE The scope of the Automotive TWG includes Human Machine Interfacing (HMI), Antennas/Communications, Sensors, In-Mold Electronics (IME), Testing/Standards. Future scope of the automotive TWG may include Shape-Morphing and Adaptive Surfaces. Automotive platforms increasingly use electronics for several function-critical and safety critical functions including touch surfaces, acquisition of signals from sensors and systems, guidance, navigation, control, charging, sensing and operator interaction. The use of HE and additive technologies creates an opportunity to reduce the weight of the automobile through the use of printed electronics on structural plastic and flexible hybrid electronics.

STATE OF THE ART

Function	Where in vehicle?	What is being done?	Current Status	SOTA
Human Machine Interface	Console	Display	Commercial	Touchscreen With Display, ITO
	Console	Non-Display Touch, Backlight, Fingerprint Sensor	Commercial	Capacitive Touch, LED Lamination, PDOT/PSS, Silver Traces
Connectivity	Vehicle to reader (toll/RFID)	Tag / Windshield	Commercial	Silicon with etched aluminum
External	Windshield	De Ice Heater	Commercial	Copper Traces
	Headlamps Rear Lights	De Ice Heater	Prototype	Direct Printed Heater, In-mold

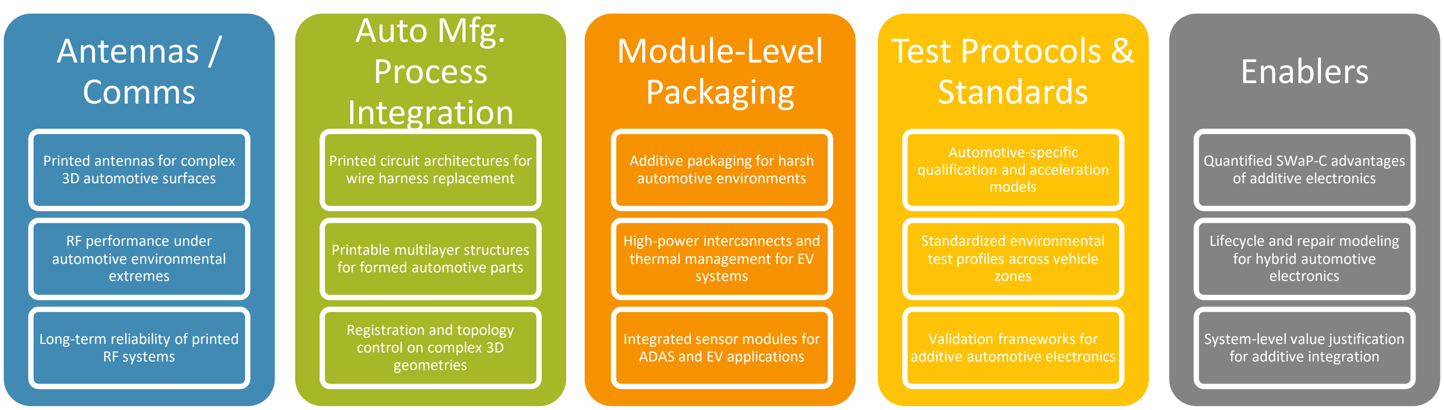


Priority technology transition domains for the Automotive TWG.

KEY OPPORTUNITIES

- Conformal electronics integrated into vehicle structures and surfaces
- Printed interconnects enabling wire harness reduction
- Embedded sensing & RF for vehicle functionality
- High-reliability electronics for EV power & thermal management
- SWaP-C optimized electronic architectures for mobility platforms

TECHNICAL ROADMAP TAXONOMIES AND GAP AREAS



PROJECT CALLS

To date, NextFlex has funded 6 projects that align to the Automotive Working Group, including PC7.6 shown below.

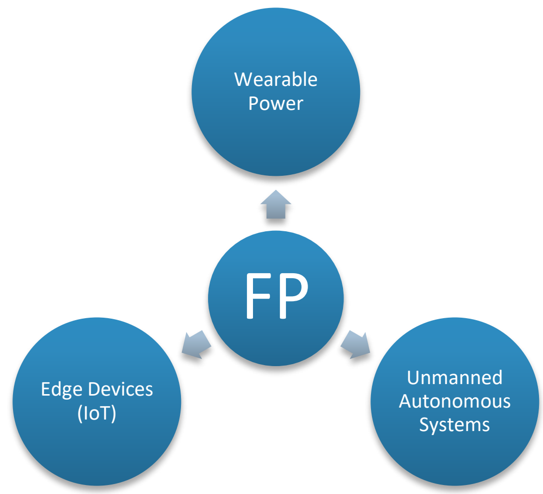
PC7.6: In-Mold Electronics interconnection and thermoforming for 3D-integrated applications led by Auburn University

FLEXIBLE POWER

SCOPE The Flexible Power TWG scope covers energy supply for HE and the integration of power systems with TPDs and HE products. Power and energy supply are at the core of all HE product functionality. Capabilities such as wireless communication or information display are power-intensive and combined with use case needs such as continuous sensor data recording or long sleep times, means that the power system can limit a product's usable lifetime.

STATE OF THE ART

- Capacity/area acceptable given large areas available for most applications
- Peak power/area acceptable for some technologies
- Flexibility (dynamic cycling): insufficient relevant data
- Thickness is a fundamental limit for flexibility and integration in many HE applications
- Interconnects and integration achieving electrical and mechanical reliability: insufficient data
- Environmental testing: insufficient data
- EH&WC cycle lifetime combined with flex: insufficient data



Priority technology transition domains for the Flexible Power TWG.

KEY OPPORTUNITIES

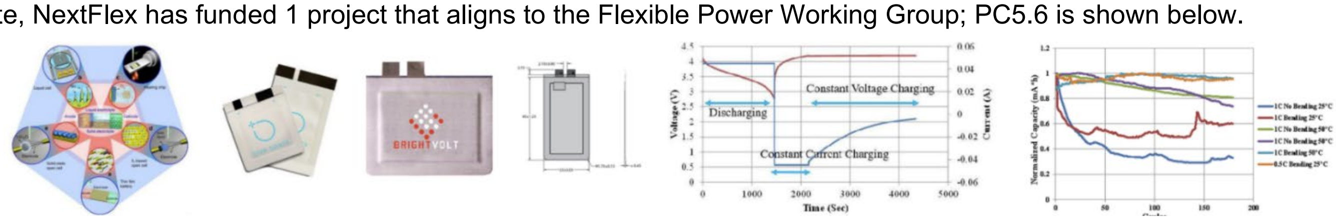
- Flexible / conformal power sources for distributed systems
- Integrated energy harvesting, storage, and power management
- Lightweight, low-profile power for wearable and portable devices
- Structurally embedded power for vehicles and autonomous systems
- Reliable power systems for long-duration, low-maintenance operation
- Scalable manufacturing of flexible batteries and energy devices

TECHNICAL ROADMAP TAXONOMIES AND GAP AREAS

Alternative Power Sources	Core Power Storage Technologies	Edge Devices	Unmanned & Autonomous Systems	Wearable Power Systems	Enablers
Flexible energy harvesting across multiple modalities	Next-generation flexible and non-lithium battery chemistries	Ultra-low power consumption and self-discharge systems	High-peak power delivery for pulsed and dynamic loads	Ultra-thin, conformal flexible battery architectures	Scalable manufacturing for additive power devices
Printed rectification and power conditioning	Printed primary cells and distributed energy storage	Energy-aware power management architectures	Hybrid battery-capacitor energy storage systems	Durable, washable, and strain-tolerant power modules	**Uniformity and quality control of printed electrodes**
Integration of flexible power management electronics	High-density capacitors and supercapacitors for power buffering	Integrated low-power energy systems for edge electronics	Structurally embedded power systems with environmental robustness	Encapsulation and mechanical isolation for wearable reliability	Low-temperature processing for material compatibility

PROJECT CALLS

To date, NextFlex has funded 1 project that aligns to the Flexible Power Working Group; PC5.6 is shown below.



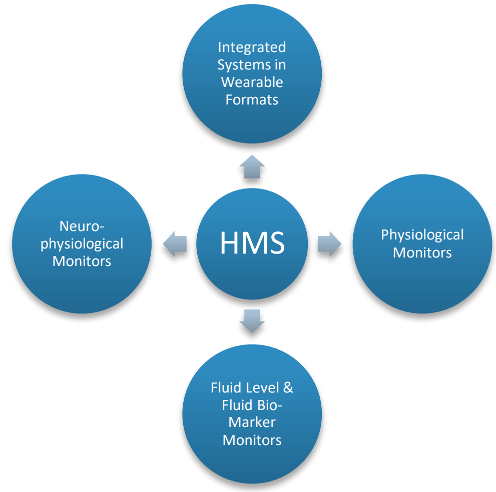
PC5.6: Accelerated Testing and Degradation Mechanisms for Flexible Batteries to Enable Selection-Guidelines Comparing Performance and Reliability led by Auburn University.

HUMAN MONITORING SYSTEMS

SCOPE Human monitoring systems (HMS) are emerging technologies that allow for on-demand and often wireless tracking of information of physiological, cognitive, biological, and situational states of humans with the objective of providing new capabilities, such as medical diagnosis and therapy, increased safety, injury prevention and performance augmentation capabilities.

STATE OF THE ART

- Proliferation of tattoo-like bio-electronic devices that exhibit similar mechanical compliance as the human tissue
- Wearable non-invasive / minimally invasive fluid-based biomarker sensing devices, particularly for electrolyte and metabolite monitoring
- Environmentally friendly biodegradable/transient electronics
- Broader acceptance and real-world implementations of flexible wearable and implantable electronics devices
- Advances in scalable and low-cost manufacturing to simultaneously achieve wearable high performance, low footprint, low power consuming devices with strong connectivity



Priority technology transition domains for the Human Monitoring Systems TWG.

KEY OPPORTUNITIES

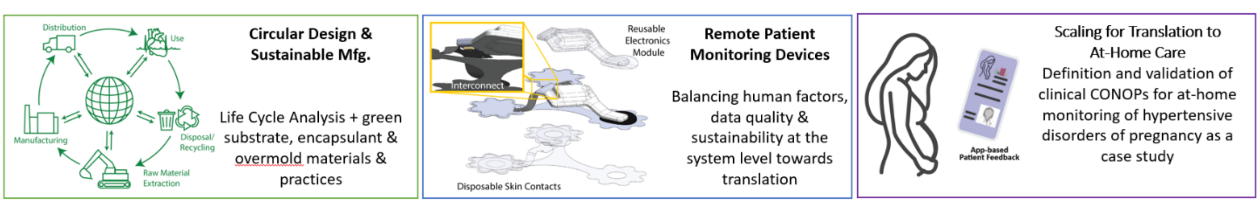
- Wearable systems for continuous physiological and cognitive monitoring
- Body-conformal sensors for non-invasive health tracking
- Integrated multi-sensor platforms for real-time insights
- Low-cost, scalable solutions for disposable devices
- Durable systems for long-duration, real-world use
- Advanced sensing for neurophysiological monitoring

TECHNICAL ROADMAP TAXONOMIES AND GAP AREAS

Fluid Level & Bio-Marker Monitors	Integrated Systems in Wearable Formats	Neurophysiological Systems	Physiological Monitoring	Enablers
Flexible microfluidic systems for biomarker sensing	Stretchable conductors and soft electronic integration	Printed dry electrodes for electrophysiological sensing	Validated accuracy and calibration across wearable sensors	Regulatory pathways for medical and non-medical devices
Printed electrochemical interfaces for bio-detection	Multi-day wearable power and energy harvesting systems	Multi-modal sensor fusion for cognitive state assessment	Low-cost, scalable manufacturing of physiological monitors	Scalable manufacturing and cost reduction strategies
Continuous and distributed biomarker monitoring platforms	Integrated thermal management and active heating elements	Wearable systems for cognitive monitoring and augmentation	Wearable vital sign monitoring and diagnostic patches	Standardized process qualification and cost modeling

PROJECT CALLS

To date, NextFlex has funded 17 projects that align to the Human Monitoring Systems Working Group, including PC9.5.1 shown below.



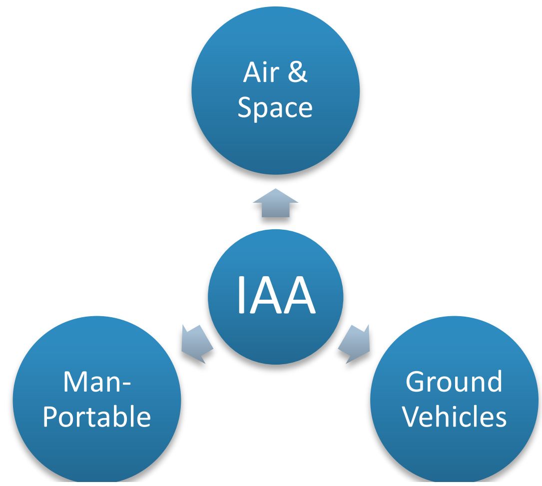
PC9.5.1: Sustainable Manufacturing of Wearable Medical Devices led by GE Healthcare.

INTEGRATED ANTENNA ARRAYS

SCOPE An Integrated Antenna Array (IAA) is defined as the combination of (a) physically reconfigurable flexible antennas, and/or (b) the processing of conformal (non-planar) antennas, (c) through the support of RF compatible materials and the integration of electronics. The IAA working group seeks to demonstrate manufacturing capability rather than develop new antennas. The three types of IAA systems that have been defined to demonstrate the HE technologies are (a) 2D Flex Hybrid Array Antenna, (b) 2.5D Conformal, High Performance Phased Array with Integrated Electronics, and (c) 3D Integration of 2D/3D Antenna Systems with Embedded Electronics and Sensors.

STATE OF THE ART

- A number of conformal / flexible antenna architectures have been developed and are well documented in the literature. Typical examples are patch antennas and arrays, printed dipoles, wraparound antennas and arrays, substrate integrated waveguide antennas, spirals, and others.
- Recent advances in additive manufacturing technology have enabled new means to produce conformal antennas. Enabling technologies include 2D, 2.5D, and 3D printing.
- Truly flexible antenna systems have been produced using modified inkjet printers to deposit flexible conductive inks on flexible substrates such as Kapton and Corning Willow Glass



Priority technology transition domains for the Integrated Antenna Arrays TWG.

KEY OPPORTUNITIES

- Conformal, integrated antenna systems for UAS platforms
- Multi-band, high-frequency RF performance on flexible and non-planar surfaces
- Embedded RF systems enabling reduced signature and improved platform integration
- Scalable manufacturing of lightweight, low-profile antenna arrays for UAS and mobile systems
- Robust RF performance under mechanical deformation and harsh environments
- Advanced materials and design enabling next-generation electromagnetic systems

TECHNICAL ROADMAP TAXONOMIES AND GAP AREAS

Radiating Elements & Aperture Architectures
- Conformal radiating elements and integrated feed networks
- Additively manufactured frequency selective surfaces and metastructures
- AI-enabled design optimization for advanced antenna arrays

RF Materials & Substrates
- Low-loss printed dielectrics and defect-controlled RF substrates
- Broadband RF material characterization and property extraction
- Environment-dependent RF material modeling

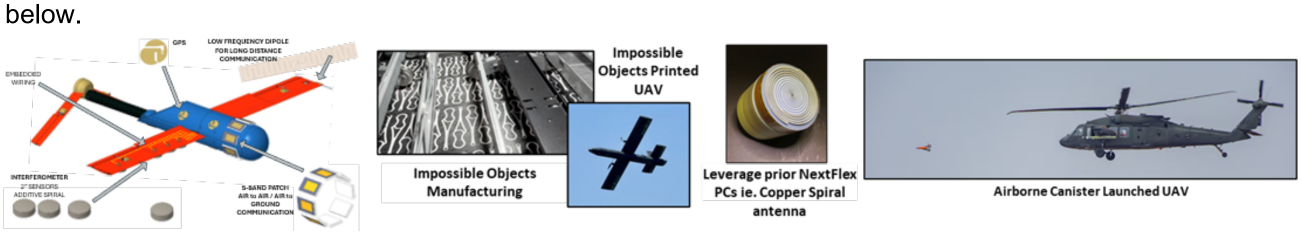
RF Packaging & System Interconnects
- High-frequency-compatible joining and die integration
- Low-loss transitions between printed and conventional RF systems
- Mechanically robust interconnects for hybrid RF architectures

Harsh Environment RF Performance
- Environmental protection for RF stability and durability
- Mitigation of noise, parasitics, and signal degradation
- Reliable RF performance across operational environments

Enablers
- Process–property–performance relationships for printed RF systems
- RF-aware design tools and simulation for conformal systems
- Standardized RF test methods and reliability frameworks

PROJECT CALLS

To date, NextFlex has funded 25 projects that align to the Integrated Antenna Arrays Working Group, including PC10.3 shown below.



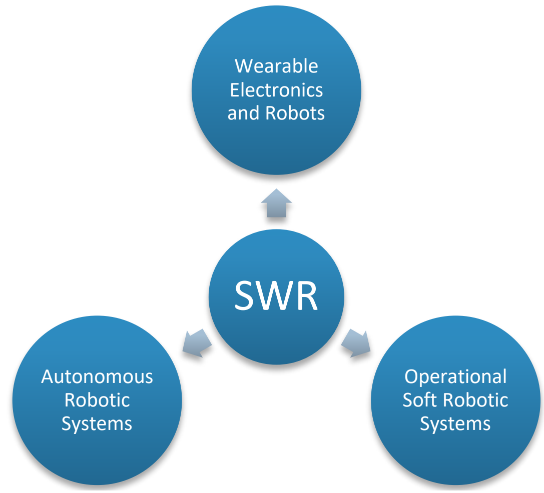
PC10.3: Canister Launched High Volume Additively Manufactured Printed Antenna UAV Demonstrator (CHAMP) led by Lockheed Martin.

SOFT & WEARABLE ROBOTICS

SCOPE Soft and wearable robotics considers technologies comprised of composites of soft materials that, when integrated as a system, perform at least two of the basic functions of a robotic system at TRL 3/4: 1) “sense,” measure or detect some salient characteristic or aspect of the operating environment; 2) “decide,” make decisions based on that sensed information; and 3) “act,” physically modify its own state or the environment in some manner based on the decision.

STATE OF THE ART

	Pneumatic Artificial Muscles	Electroactive Polymers	Shape Memory Polymers
Component Assembly	MRL 5	MRL 4	MRL 3
Molding	MRL 6	MRL 4	MRL 3
3D Printing	MRL 5	MRL 3	MRL 3

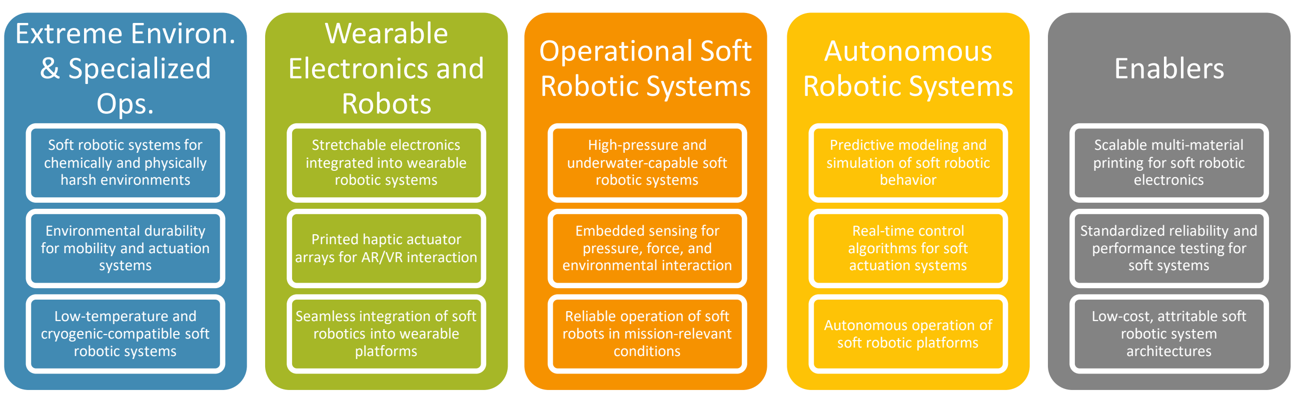


Priority technology transition domains for the Soft & Wearable Robotics TWG.

KEY OPPORTUNITIES

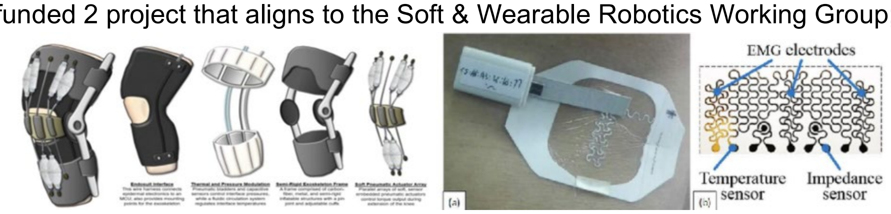
- Soft robotic systems enabling sensing, actuation, and mobility for sustainment and inspection applications
- Stretchable electronics for wearable and human-integrated robotic systems
- Conformal electronics embedded in soft–rigid robotic structures and skins
- Low-cost, scalable manufacturing of soft and wearable robotic systems
- Robust performance in extreme, variable, and unstructured environments
- Integrated sensing and control for autonomous soft robotic operation

TECHNICAL ROADMAP TAXONOMIES AND GAP AREAS



PROJECT CALLS

To date, NextFlex has funded 2 project that aligns to the Soft & Wearable Robotics Working Group; PC3.6 is shown below.



PC3.6: Flexible Skin Sensing for Soft Robotic Exoskeleton Knee led by Lockheed Martin & Georgia Tech.

For More Information

To learn more about HE, the full HE Technology Roadmaps, NextFlex, and becoming a NextFlex Member, please visit www.nextflex.us or email info@nextflex.us.

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