



7060 S US HWY 1

Grant-Valkaria, FL 32949

cmike@newteci.com

3D-Printed Electronics; Integrated Thermal Sensors Development and Digital Workflow for In- Situ Monitoring of Turbine Engine Systems

***Use-case digital thread for Additive Manufactured
Electronic (AME) Development that integrates mechanical
and electronic design.***

What we do.....

3D printed structural and conformal electronics

Cyberfacturing of high value

**Advanced Microelectronic Multifunctional
Packaging, Integration & Smart Systems**

DoD • Space • Medical

***Digitally defined scalable hybrid manufacturing –
Cyber**facturing*

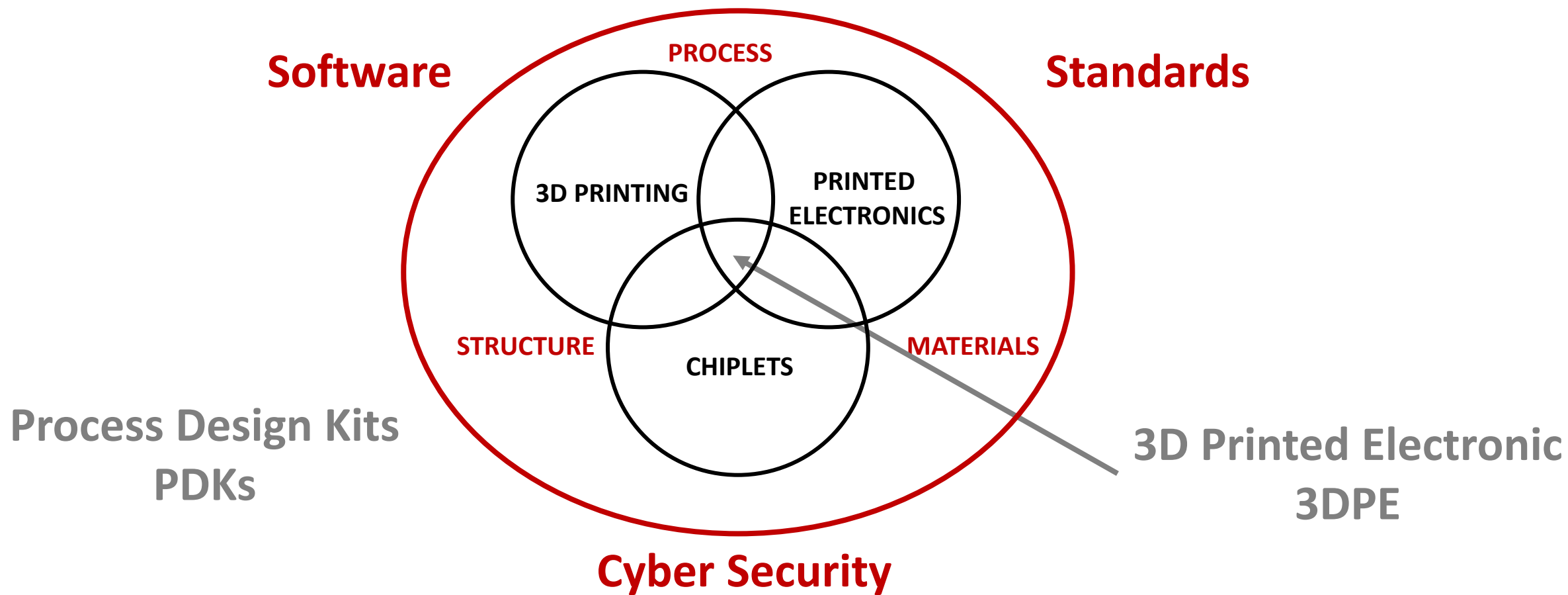
What we do..... Additive Manufactured Electronics (AME) Additive Manufactured Micro-Electronics (AMME)

Application driven technology integration that encompasses ideation through creation, virtual to physical fabricated using Digitally defined scalable hybrid manufacturing:

- Traditional printed circuit board (PCB)
- Flexible hybrid electronics (FHE) - Conformal
- **3D Printed Electronic (3DPE) - Structural**

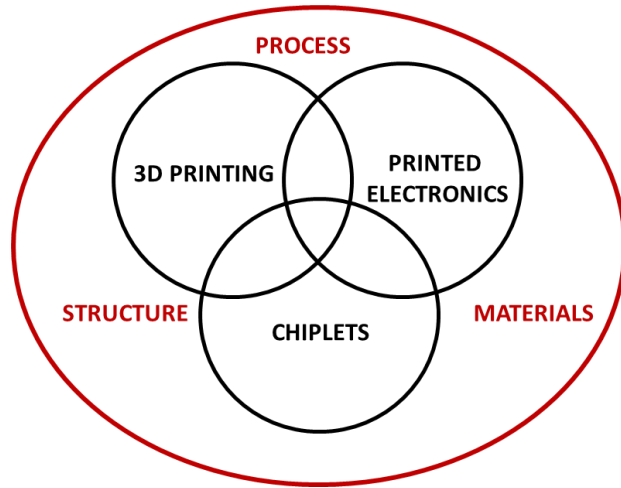
GOAL: Identifying gaps in the digital thread and developing baseline Process Development Kits (PDK's) in the targeted advanced electronic packaging technology areas.

Application Specific Electronic Packaging (ASEP)



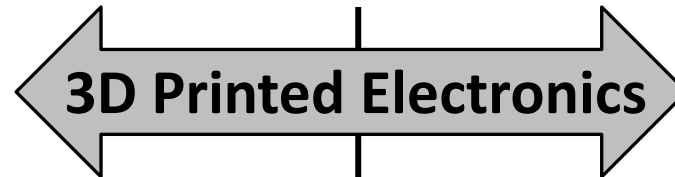
Challenges – Software

SOLID EDGE + PADS => 3DPE



SIEMENS
Ingenuity for Life

AME ~ 3D Printed Electronics



Mechanical Function

- Structural
- Fasteners
- Enclosures
- Etc.

Electronic Function

- Processors
- Memory
- Sensors
- Transmit/Receive

3DPE

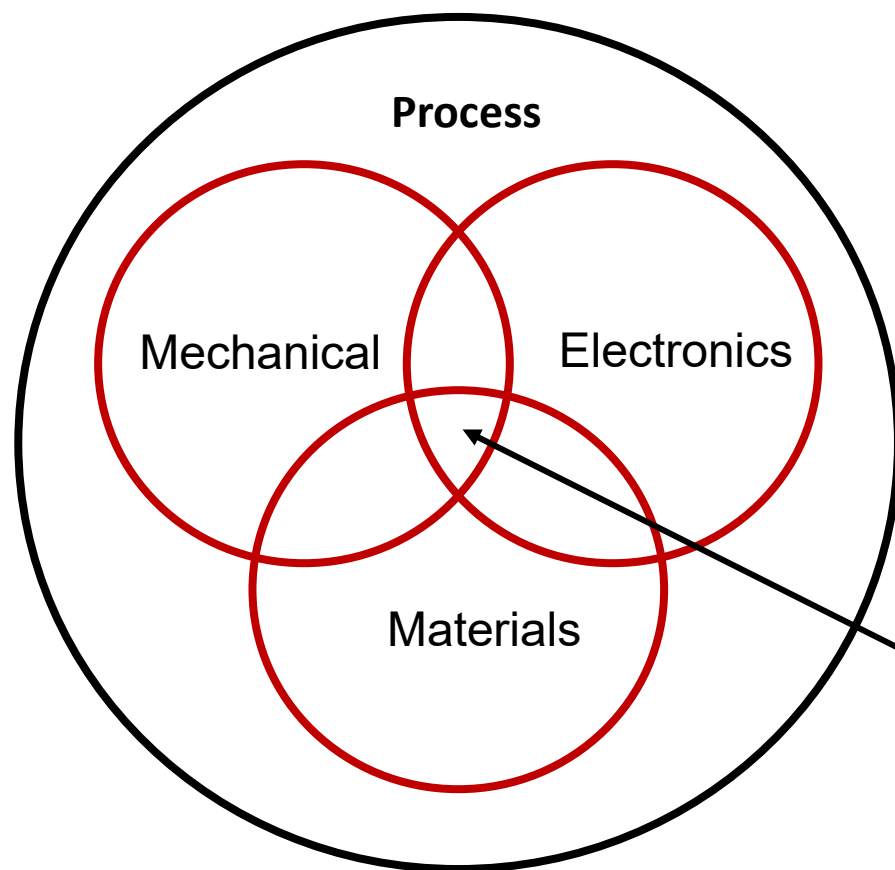
- Integrated/Interleaved
- Shape Agnostic
- Multi-Material / Multi-Functional
- Sensing & Actuation
- Functionally Gradient
- Volumetric Efficiency



3DPE: KEY GAPS and the Great Divide

Challenges – Test, Qual. and Standards

Structure + Electronics = Structural Defects



F42 – Additive Manufacturing Technology
ASTM & ANSI Collaboration
ISO/TC261 Additive Manufacturing
ASTM – Plastics
ASTM - Fiberglass (Carbon) Composites
ASTM F15XX Membrane Switch Standards
IEC TC 119 – Printed Electronics
IPC D60 – Printed Electronics
JEDEC – Microelectronics and Packaging
Multi-Chip Modules
IPC – Printed Circuit Board and Electronic
Manufacturing
Mil-Std-883 Hi-Rel Microelectronics

AME ~ 3D Printed Electronics

Cyberfacturing - E3DA

Electronic 3Design Automation

***Automated Innovation = Digital to Physical
(Human Machine Interface)***



IDEATE

***DTE**

CREATE

* Digital Twin Engine

The "fifth industrial revolution" (Industry 5.0) is a concept that builds on the fourth industrial revolution by focusing on a synergy between humans and advanced technology like AI, with a new emphasis on human-centeredness, sustainability, and resilience

***"Welcome to the Cyber-Industrial
Revolution"***

Industrial Revolution (IR)

1st Mechanization, Waterpower, Steam Power

2nd Mass Production, Assembly Line, Electricity

3rd Computer and Automation

Current IR 4th

***The age of purely mechanical industrialization
is over. Welcome to the new data-driven
electro-mechanical age.***

Emerging 5th IR = 4th + AI & AR

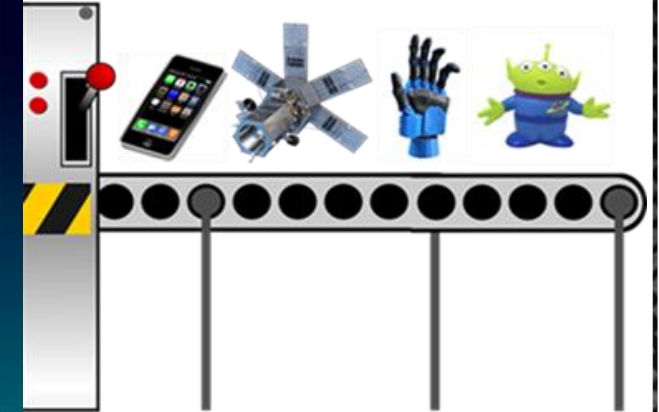
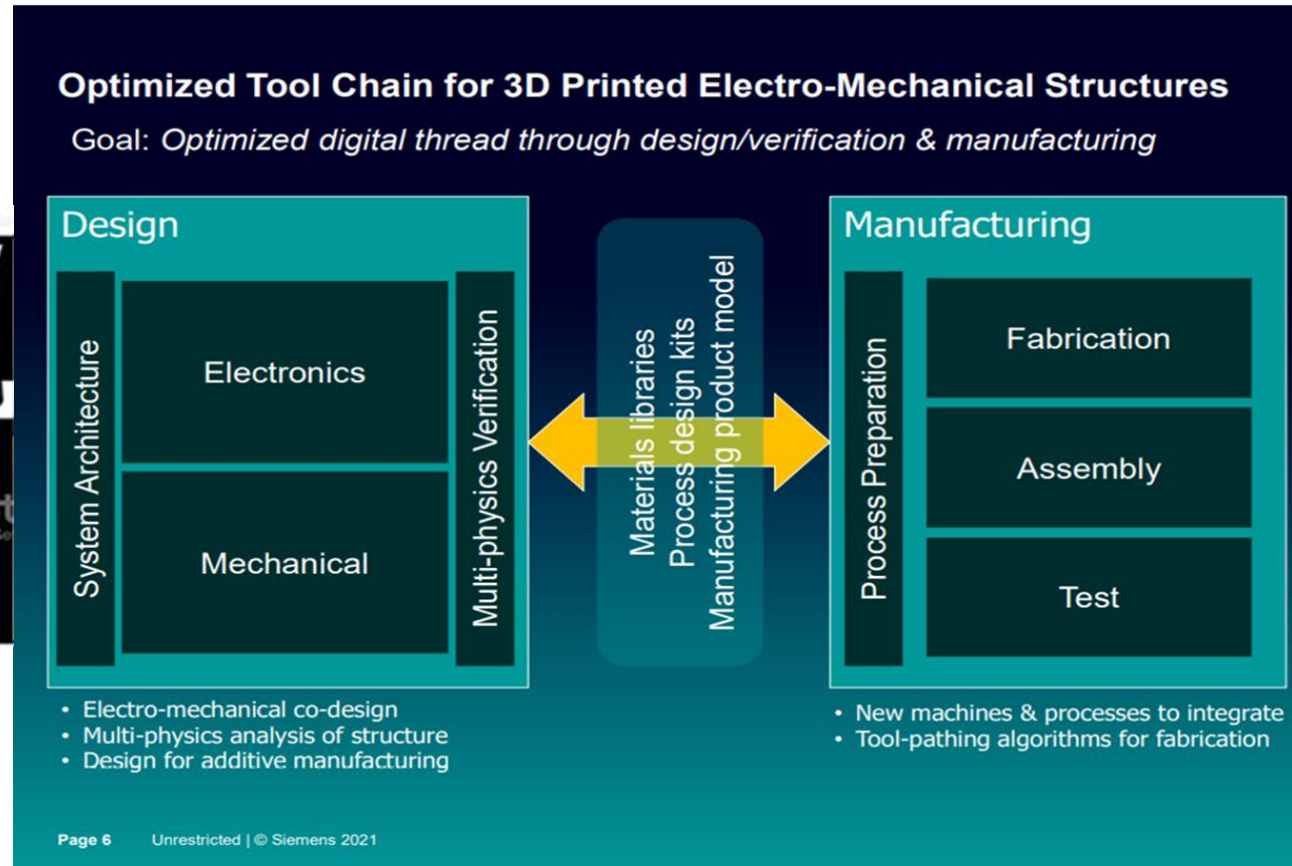
***3D Printed Electronics (3DPE)
Cyberfacturing - E3DA
Collaboration***

Dr. Anand Kulkarni

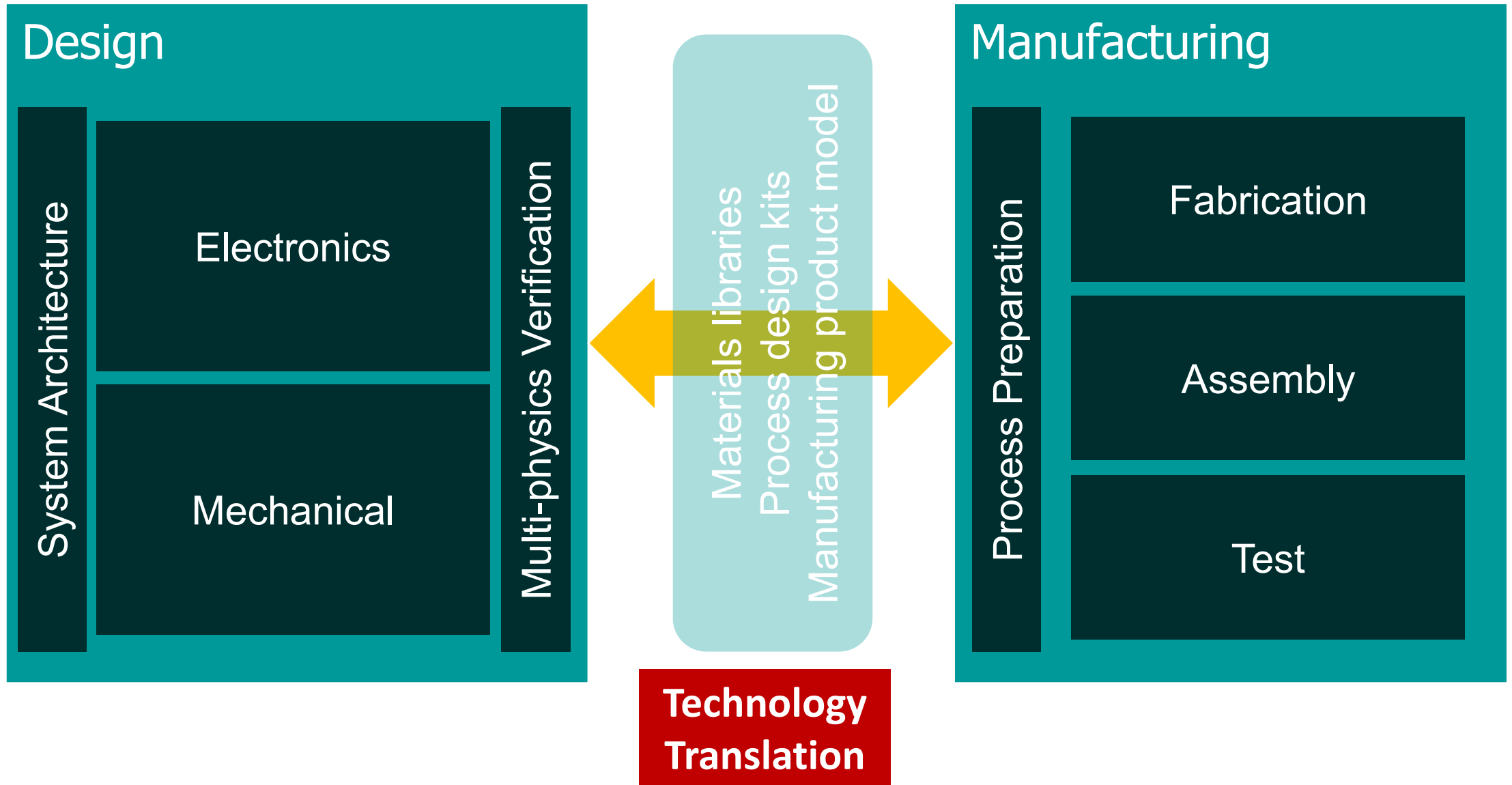
*R&D Director for Advanced Manufacturing
and Circularity, Siemens Corporation*

C. Mike Newton

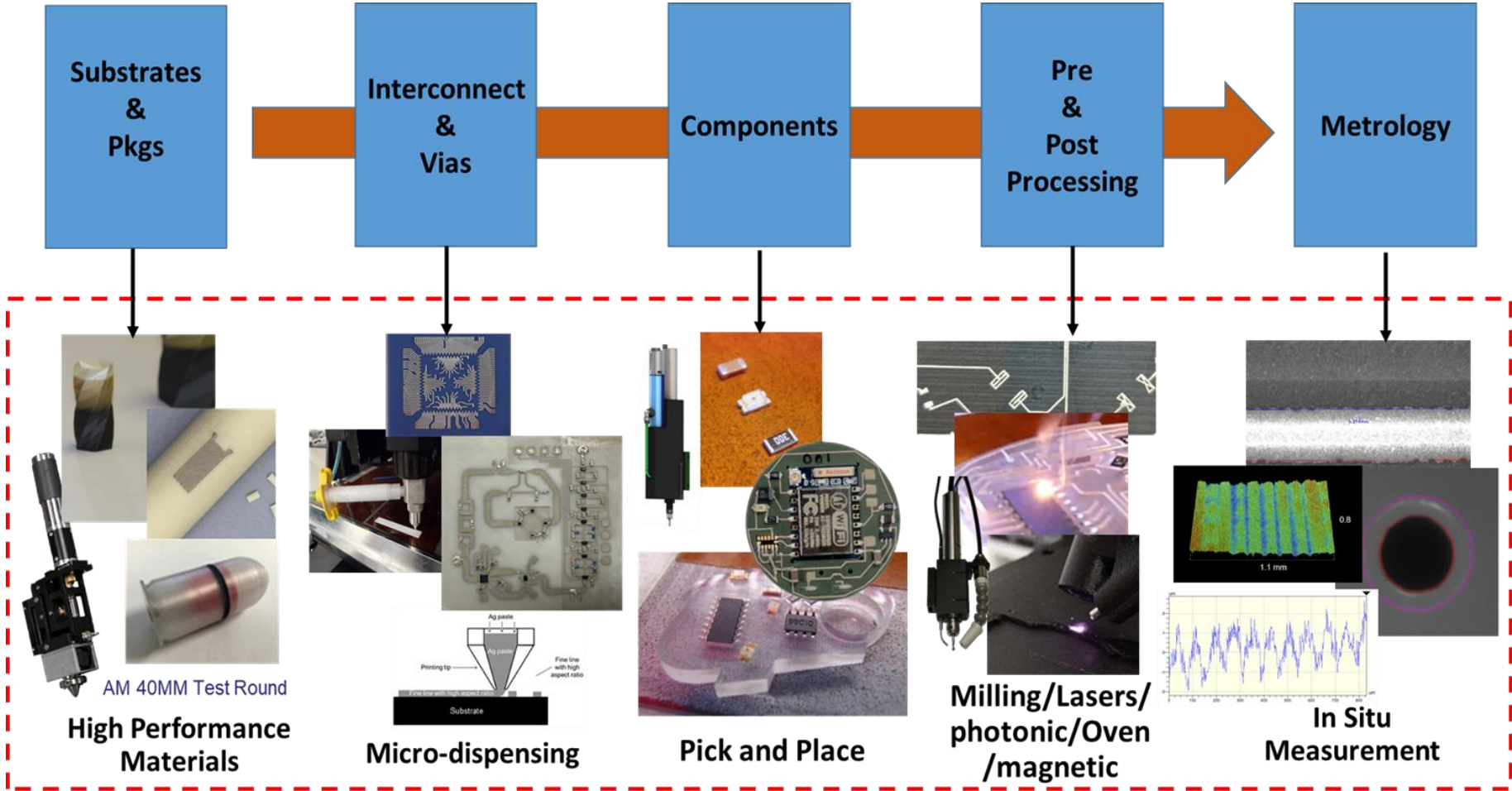
*Co-Founder/Managing Partner
NewTec Initiatives, LLC*



Cyberfacturing - E3DA: Application Specific Electronic Packaging (ASEP)



Digital Process Flow



SCRIPT

vertex
APPLIED INNOVATION HUB FLORIDA TECH

In Collaboration With Dr. Anand Kulkarni

***3D Printed Electronics (3DPE)
Cyberfacturing - E3DA***

***Use Case - Hypersonics
3DPE Thermal Sensor Demonstration***

C. Mike Newton

Thermal Test Platform

The General Electric J85 is a small single-shaft turbojet engine. Military versions produce up to 3,500 lbf (16 kN) of thrust dry; afterburning variants can reach up to 5,000 lbf (22 kN).

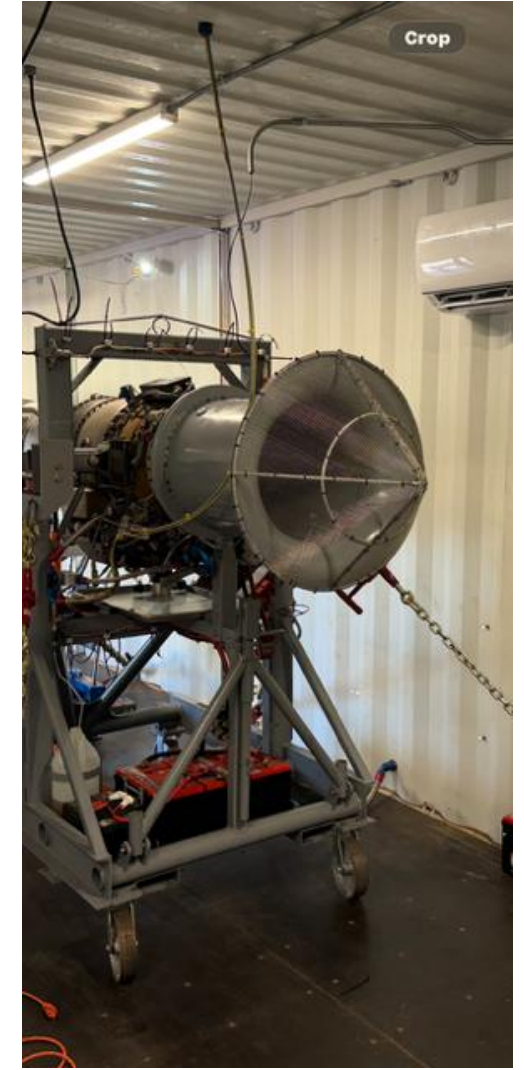
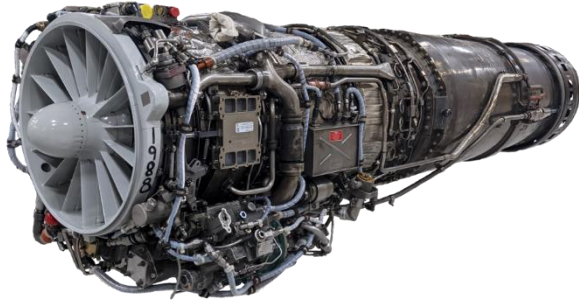


USAF F-5F with AIM-9J Sidewinder, AGM-65 Maverick missiles and auxiliary fuel tanks over Edwards Air Force Base, 1976.



The T-38 is considered an excellent advanced trainer for USAF pilots. It is supersonic with a maximum speed of Mach 1.24

Thermal Test Platform – J85 Test Cell



ATG
AEROSPACE
TECHNOLOGY
GROUP



Hyper Aware Systems Integration Printed Sensor Demonstration

SIEMENS

Ingenuity for life

Test Vehicles (TV)



***ATG Turbine Test Cell**

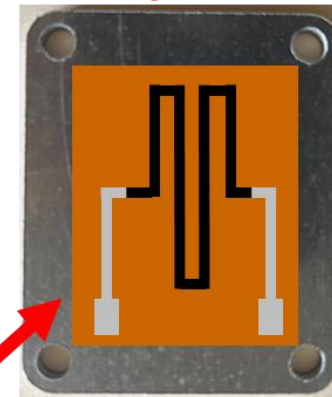


**Aluminum
Bleed Air
Block-Off
Cover Plate**

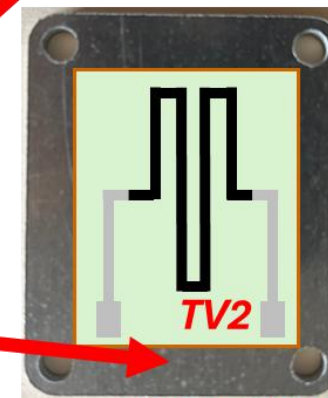


* Or Siemens Supplied Cover Plate

**TV1 - KAPTON Applique'
Printed Temperature Sensor**



FTRI Printed Sensor Design

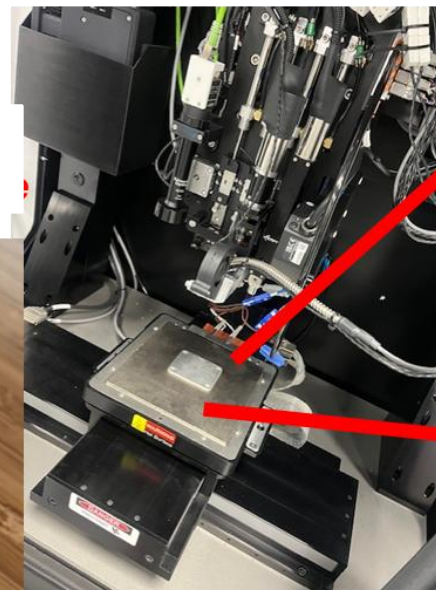


TV2a - Integrated

**3D Printed Temperature Sensor on COTS
Cover Plate**

TV2b Integrated

**3D Printed Temperature Sensor on 3D
Printed Metal Cover Plate**

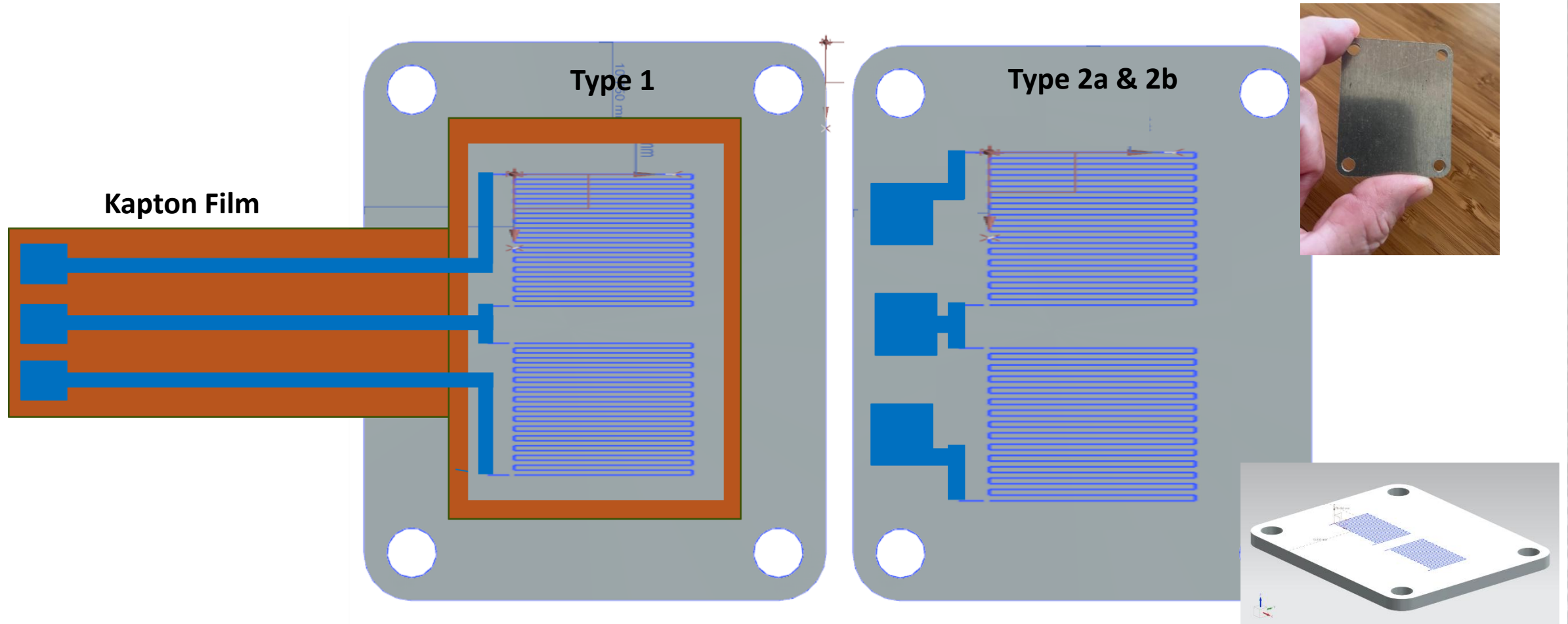


COMPANY PRIVATE

Siemens Software FHE & 3DPE Use Case In Situ Thermal Sensor Demonstration

3 Test Vehicles

250° C Max. Op. Temp.



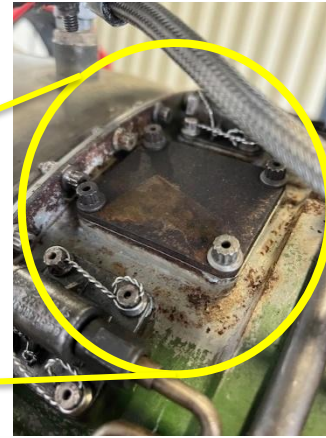
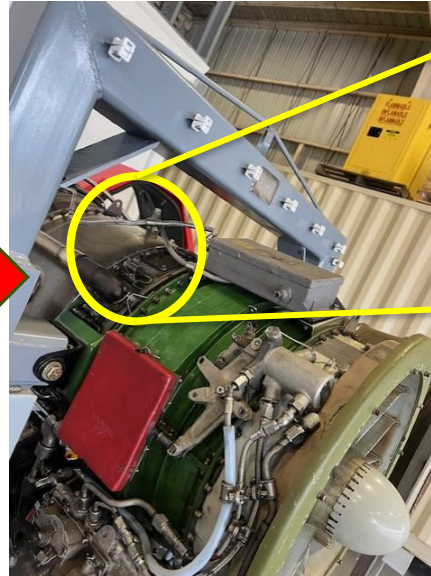
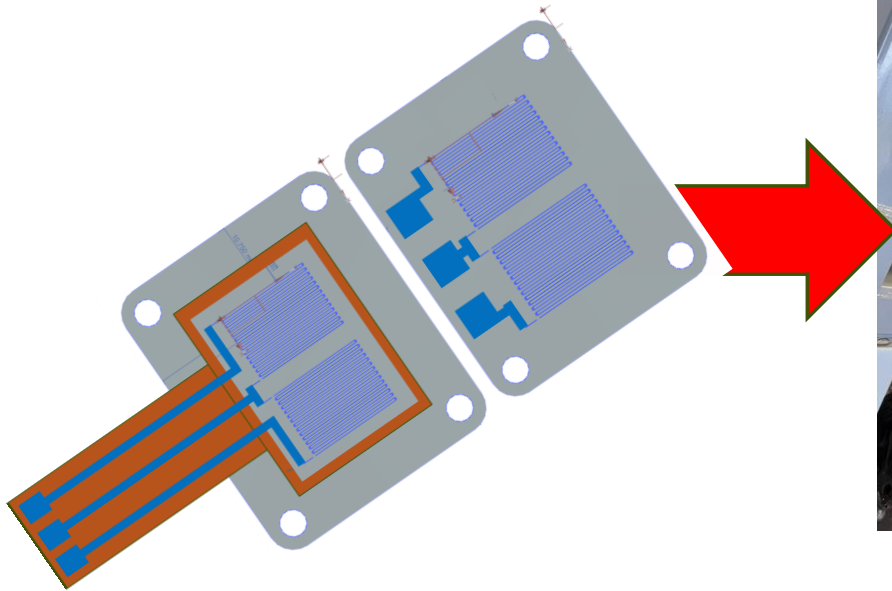
**Flexible Hybrid Electronic (FHE)
Temp Sensor**

**3D Printed Electronic (3DPE)
Temp Sensor**

Test Conditions

- Turbine Sensor Location: Bleed Air Block-Off Plate
- Plate is attached with 4 10-32 Thread Bolts on the mainframe of the engine.
- Measure In-Situ plate Temperature: 250 °C
- Pressure: 70-80 PSIG at full throttle

*Turbine Engine Bleed Air
Block-off plate w/
Integrated Sensor*



In collaboration with Chris Larsen

Future Plans:

Dual Use and Test Bed – Gen 6 Jet Car & Digital Twin



Instead of building something new in NX, six FIT interns, along with LMS staff and a few Northrop Grumman mentors, reverse-engineered the preexisting Generation Six Jet Dragster, using the software to tweak, test and perfect version two.



Modalities:

- Human Factors
- Low G – Forces (up to 3 G's)
- Shock
- Vibration
- Acoustic
- **Temperature (up to 2200C/4000F)**
- More.....Proof of Concept

3:1 Power to Weight Ratio

QUESTIONS?



C. Mike Newton

Co-Founder and Managing Partner

321.315.1137

cmike@newteci.com



IMAPS – Fellow of the Society

C. Mike Newton has over 48 years' experience in the areas of advanced microelectronics and microsystems technologies. He has built and managed several fabrication and research labs serving both commercial and government markets. He has scaled up microelectronic and ceramic multichip modules, products, and manufacturing for both the commercial and DoD industries. He currently has over 50 patents in advanced electronic packaging technologies throughout his career. Mr. Newton has written and presented on the topics of advanced microelectronic packaging, Flexible Hybrid Electronics (FHE) and 3D printed electronics (3DPE).

- Co-Founder and Managing Partner for NewTec Initiatives a consulting and emerging technology development firm.
- Served as Director of Strategic Technologies at Florida Tech Research Institute.
- Served as Chief Technologist – Microsystems at Harris Corporation leading advanced technology pursuits into the DoD, National Labs and DARPA. Established Ceramic Multi-Chip Module R&D Labs.
- Served as Director of Technology and Transition with Sciperio, nScrypt's parent company, leading strategic technology pursuits, SBIR/STTR and technology transition/Commercialization efforts.
- He has served as nScrypt's Director of Electronic Packaging, the focus is in developing total solutions in micro-dispensing, wafer scale packaging and direct digital manufacturing for the microelectronics, 3D Printed Electronics, Flexible Hybrid Electronics (FHE) and PCB markets.

Currently Serves as Florida IMAPS (International Microelectronics, Assembly and Packaging Society) Chapter President and has previously served on the Executive Council as VP of Technology for IMAPS. Awarded Fellow of the Society in 2025.