

High Voltage Hybrid Electric Propulsion Multilayered Functional Insulation System (MFIS) NASA-GRC

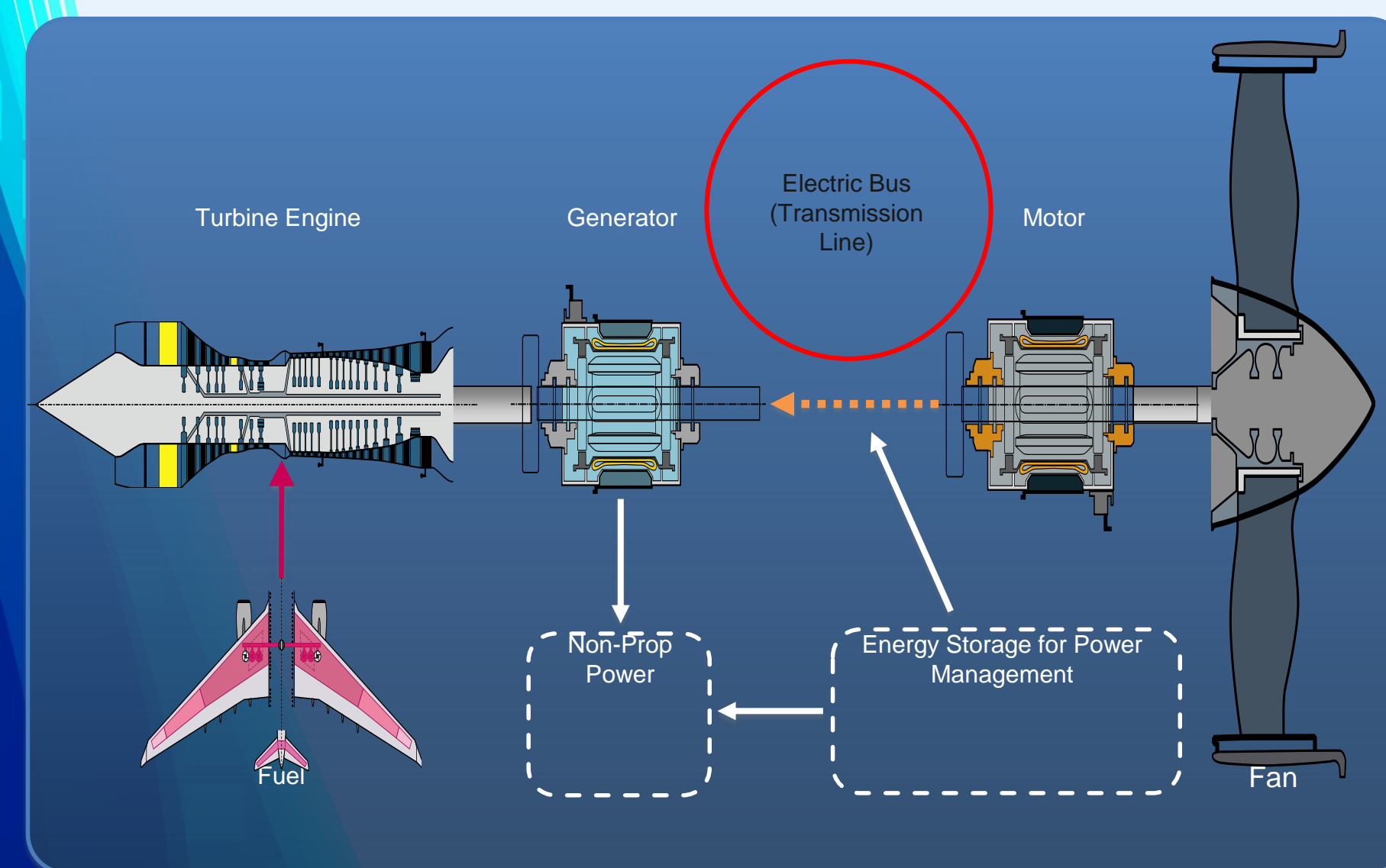
National Aeronautics and
Space Administration



M. Lizcano • NASA Glenn Research Center • Cleveland, Ohio

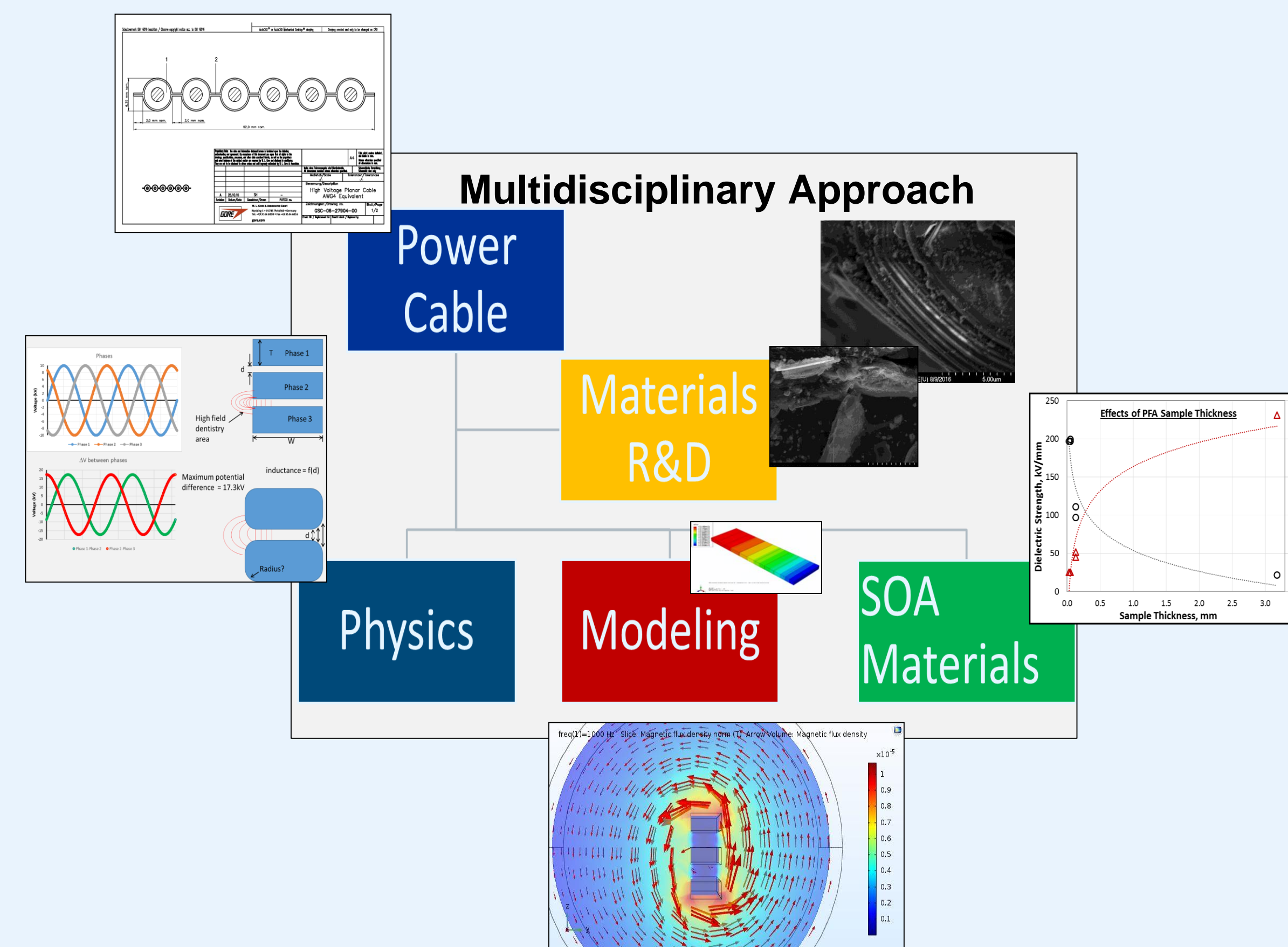
Overview

High power transmission cables pose a key challenge in future Hybrid Electric Propulsion Aircraft. The challenge arises in developing safe transmission lines that can withstand the unique environment found in aircraft while providing megawatts of power. High voltage A/C, variable frequency cables do not currently exist and present particular electrical insulation challenges since electrical arcing and high heating are more prevalent at higher voltages and frequencies. Identifying and *developing* materials that maintain their dielectric properties at high voltage and frequencies is crucial.



Benefits

- Enable mega-watt (10^6) power transmission capability
- Enable viable Hybrid Electric Propulsion concepts
- Development of Self-Healing Dielectric Insulator
- Development of new materials
- Builds relationship with industry



Partners

- NASA- LaRC
- W. L. Gore: Design/fab experimental power cable
- University of Arizona

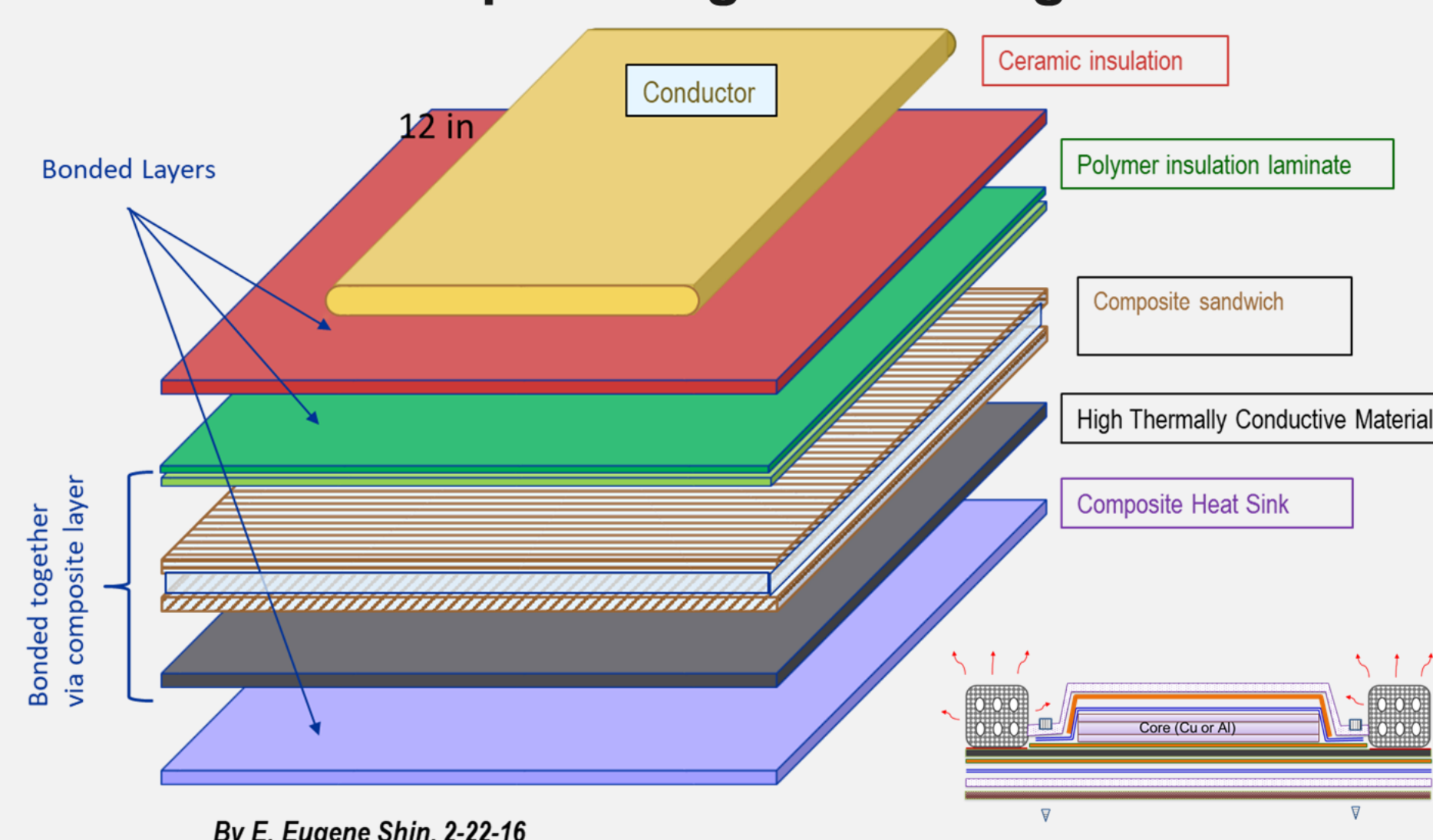
Status

- Visit with W.L. GORE purchased experimental SOA power cable.
- Developed an database of State-of-Art (SOA) insulation materials including critical properties, and screened candidate materials for the MFIS.
- Experimentally evaluated SOA electrical insulation materials
- Developed various concept power distribution designs for enhanced functionalities, such as high heat dissipation, EMI shielding, self-healing, or self-cooling utilizing SOA materials.
- Completed and tested fabricated MFIS subscale coupons
- Modeling estimation of AC/DC joule heating of conductors based on target power and current specifics.
- Submitted invention disclosures for insulation system and engineered composite
- Mentored 4 summer LERCIP interns Jeremy Walker (2016 UoH), Taylor Ceh (2016 OSU) Angel Chavez (2017 UoC-Irving), Jonathan Li (2017 Yale)
- Collaboration with Dr. Zhupanska and Victor Nguyen from the Univ. of Arizona on an Integrated Modeling Tool
- Established collaboration with Dr. Radovic (Texas A&M Univ.) lightweight shielding material.
- Visited Mersen (NY) to discuss power distribution busbar design
- Added Rapid Advanced Materials Screening (RAMS) capabilities
- Identified facility needs for system testing and completed an Environmental Test Chamber Design Study
- Established relationship with Ohio State Univ. High Voltage group
- Successfully demonstrated feasibility of higher voltage power transmission: In-house prototype showed significant increase of breakdown voltage and strength for equivalent thickness of commonly used insulation.
- Project transitioned into Transformational Tools and Technologies (TTT) under ARMD.

Next Steps

- Final Report
- Project planning under TTT
- FY18 Kick-off meeting

Multilayered Functional Insulation System Developed Integrated Design



High Voltage High Frequency Testbed Concept

