Local AIAA Saint Louis Section University Research Program Emphasis Relating to Aerospace

The content in this article is from a set of presentations that these universities made to our AIAA section on February 8, 2022.

Missouri Science & Technology

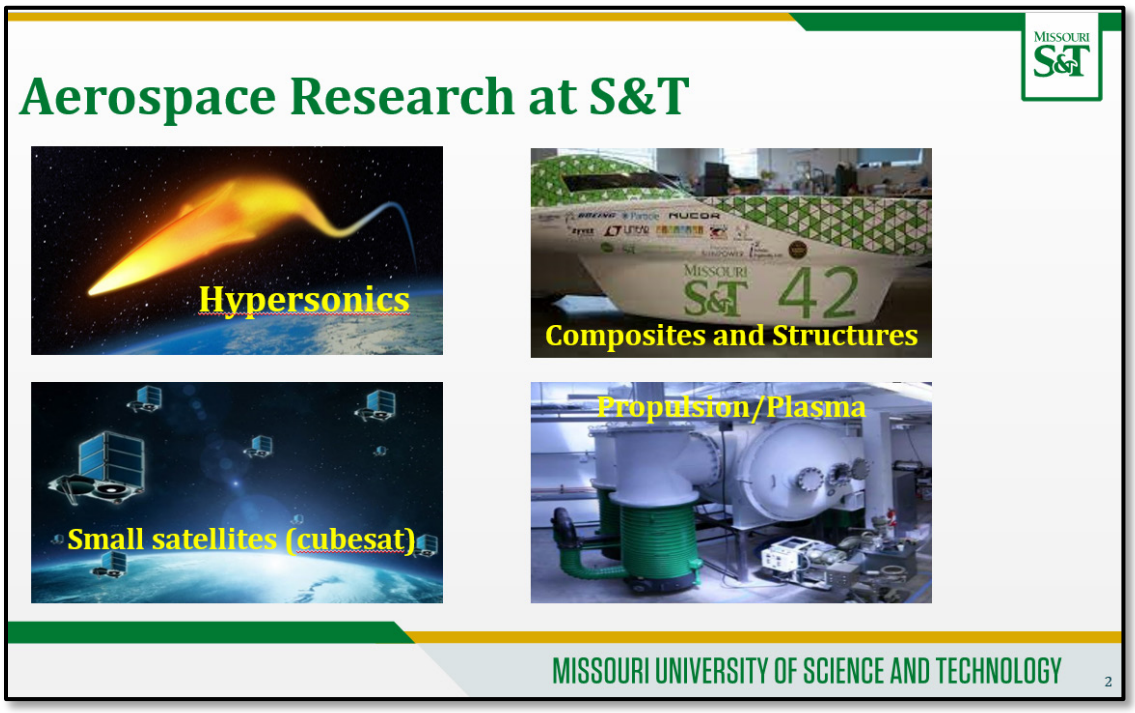

Figure 1 – MS&T Aerospace Research – Focus Areas

Figure 2 – Center for Aerospace Manufacturing Technology

Figure 3 – Missouri Manufacture Protoplex

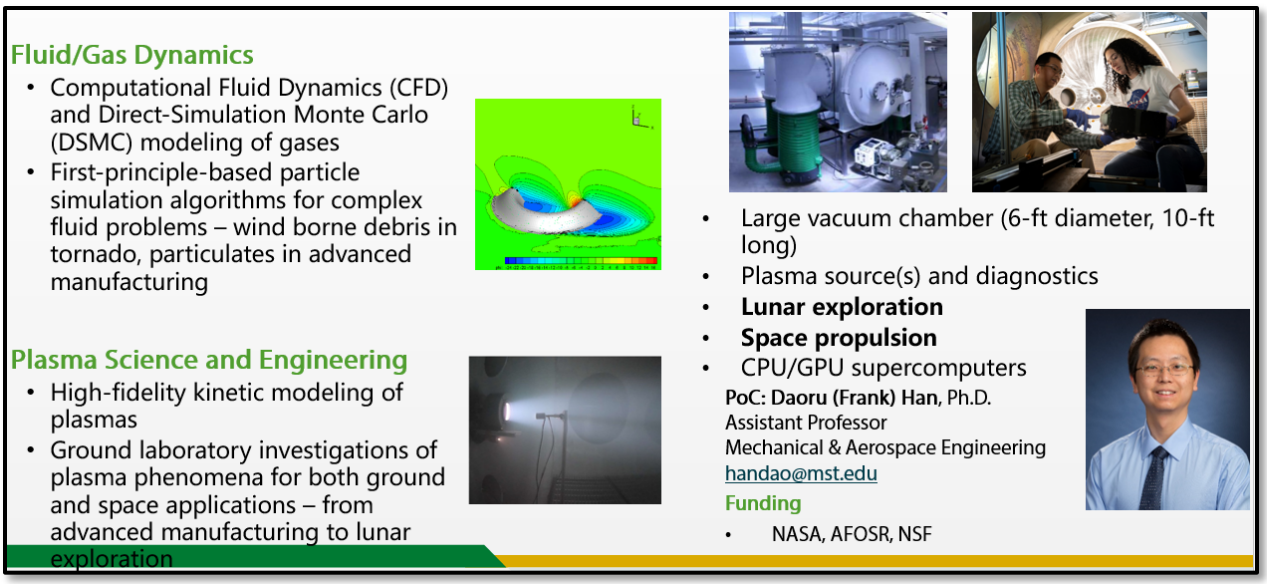

Figure 4 – Fluid/Gas/Plasma, Space Propulsion and Exploration Research

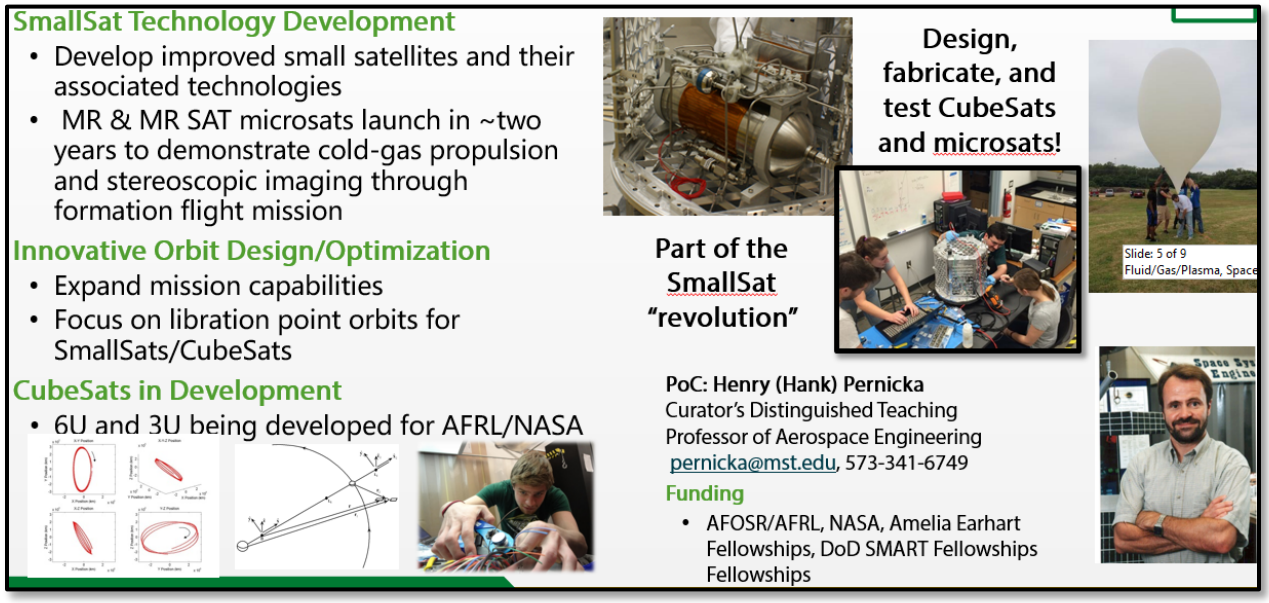

Figure 5 – Small Sats and Astrodynamics Research

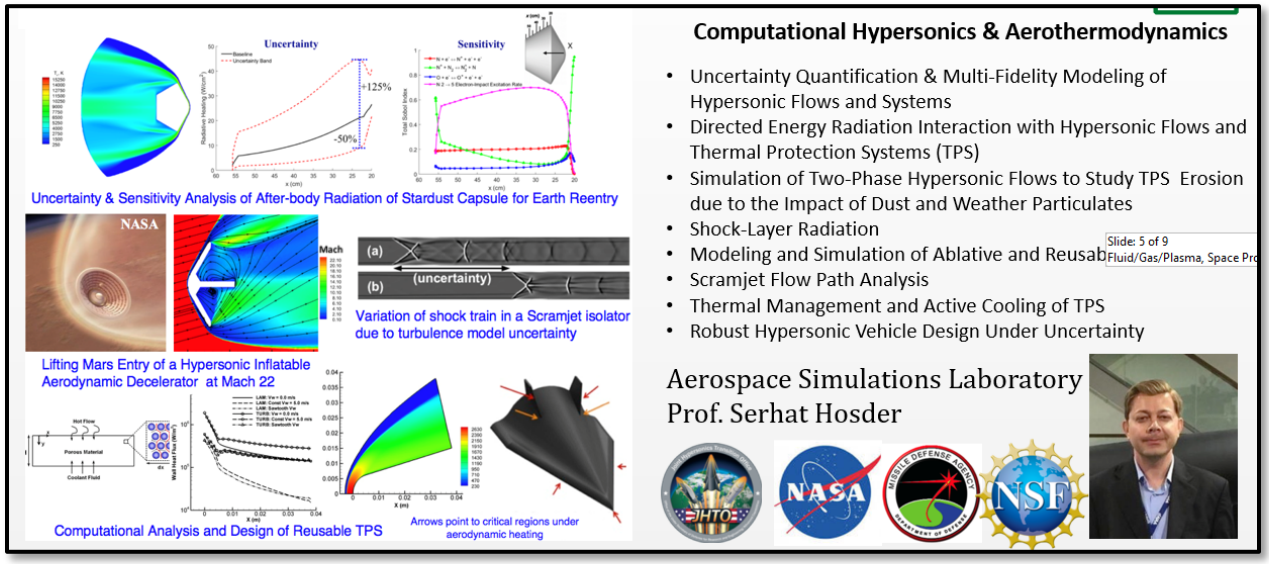

Figure 6 – Computational Hypersonics Research

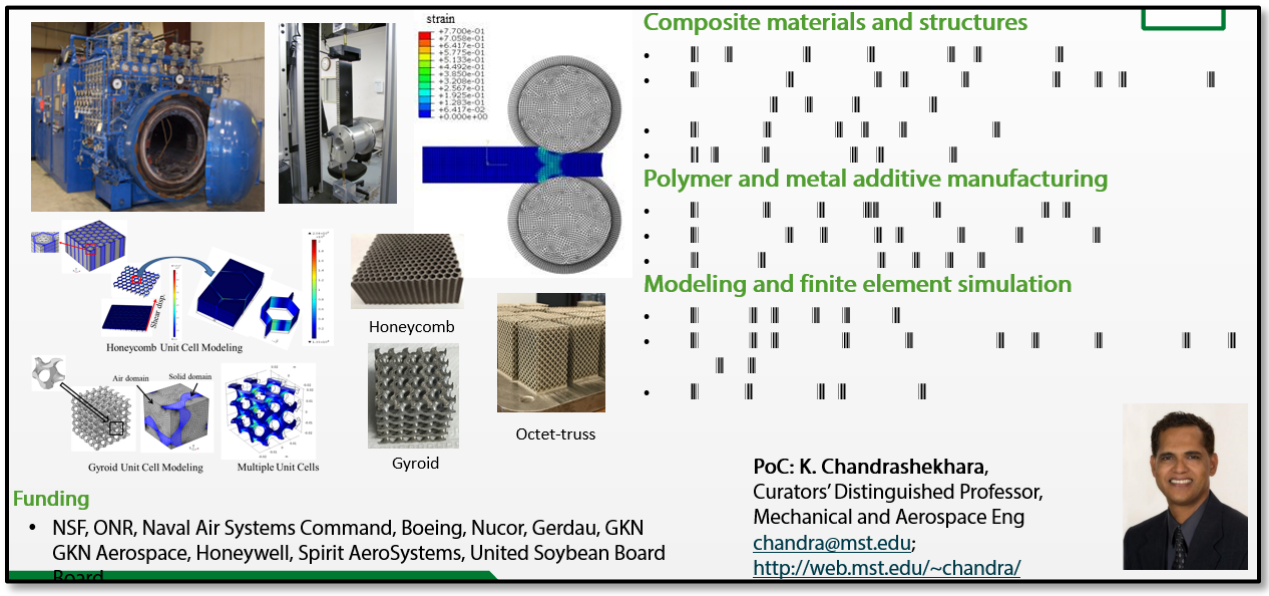

Figure 7 – Composite Materials and Structures Research

University of Missouri

Figure 8 – Electrowetting Research

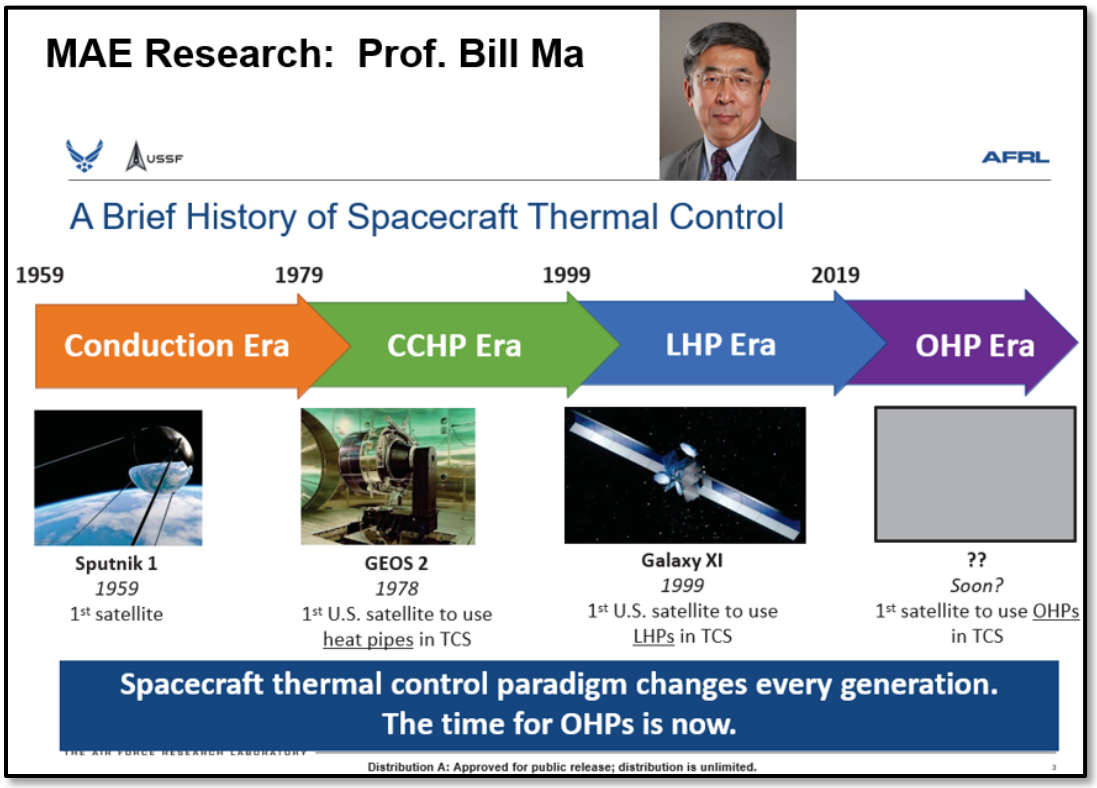

Figure 9 – Spacecraft Thermal Control Research

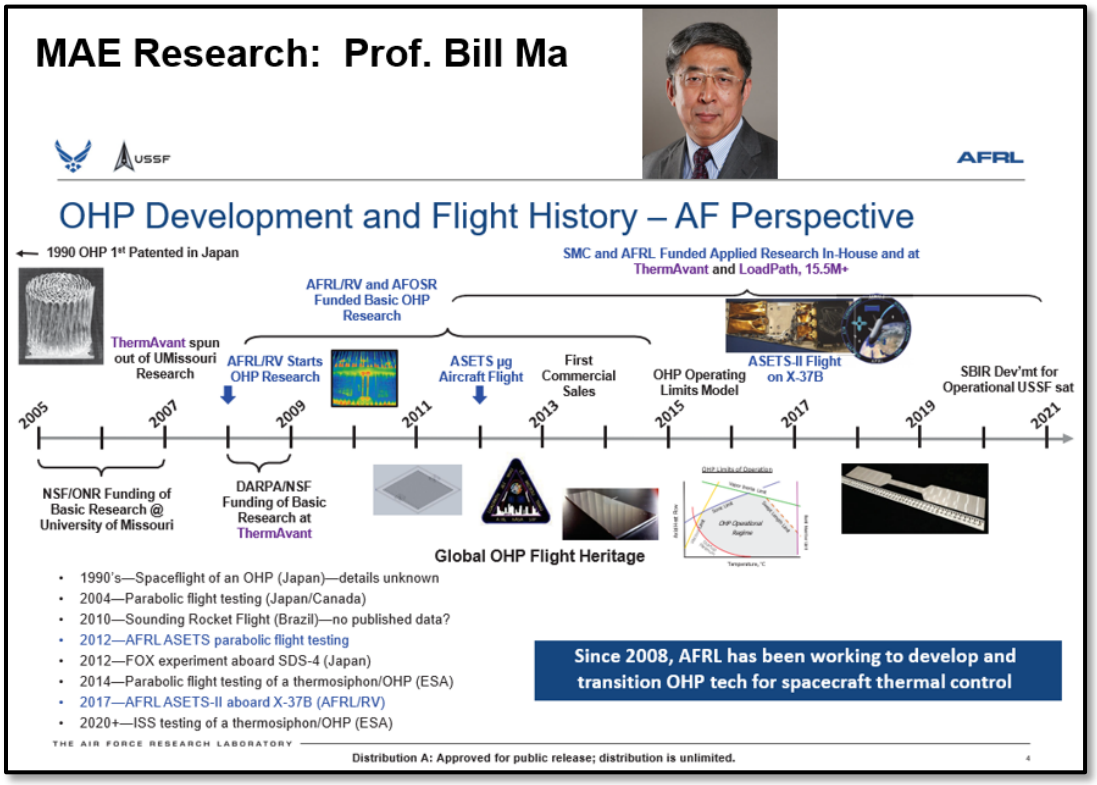

Figure 10 – OHP Development & Flight History

Figure 11 - Collaborative Autonomy and Safety for Teamed Human & Unmanned Aircraft Systems in Fast Evolving Wildfire Environment Research

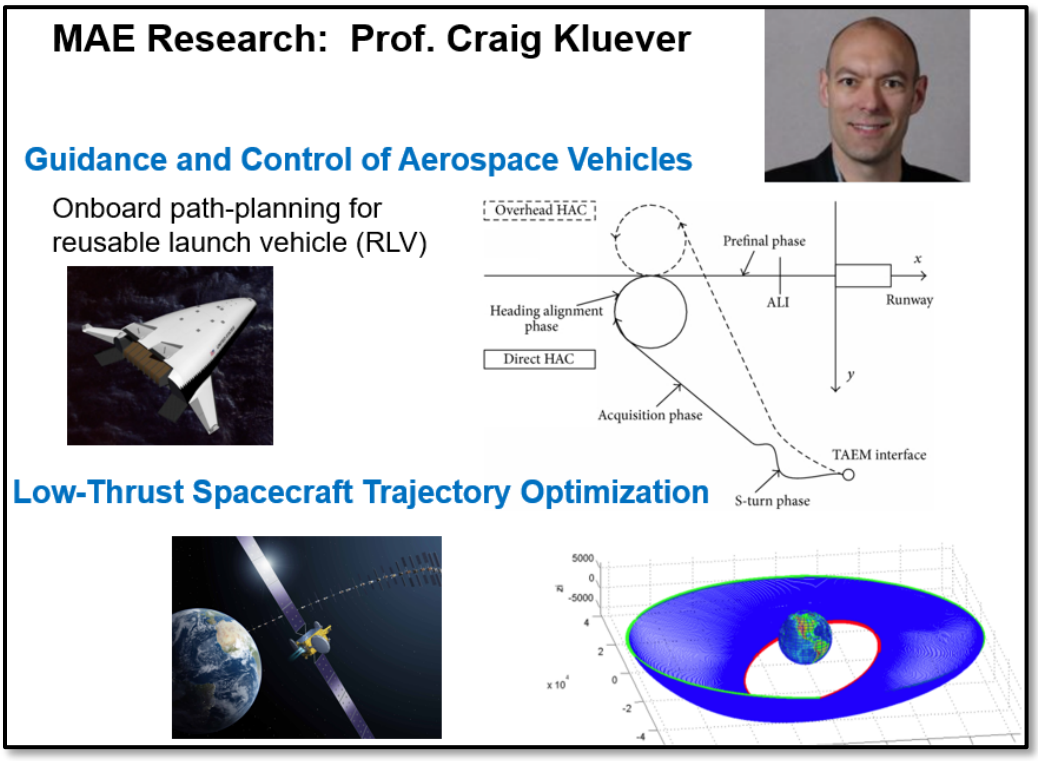

Figure 12 - Guidance & Control of Aerospace Vehicles and Low Energy Trajectory Optimization of Spacecraft Research

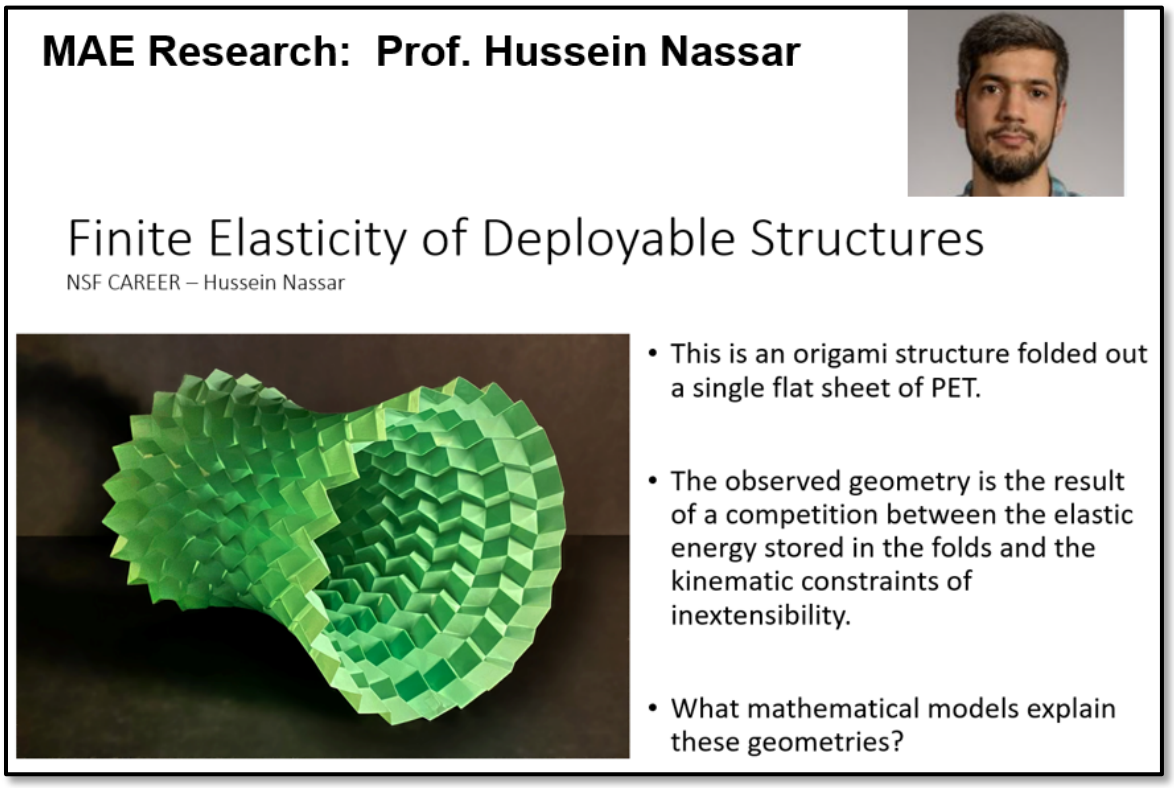

Figure 13 – Finite Elasticity of Deployable Structures Research

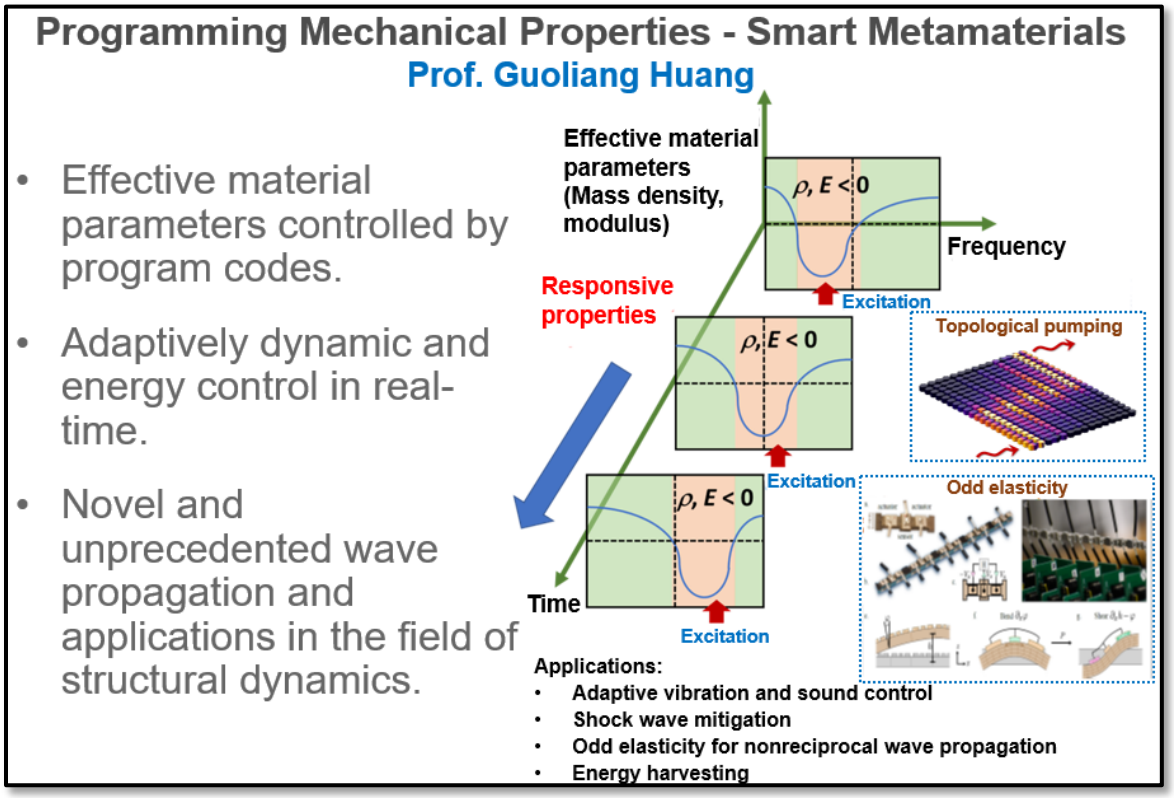

Figure 14 - Programming Material Properties & Smart MetaMaterials Research

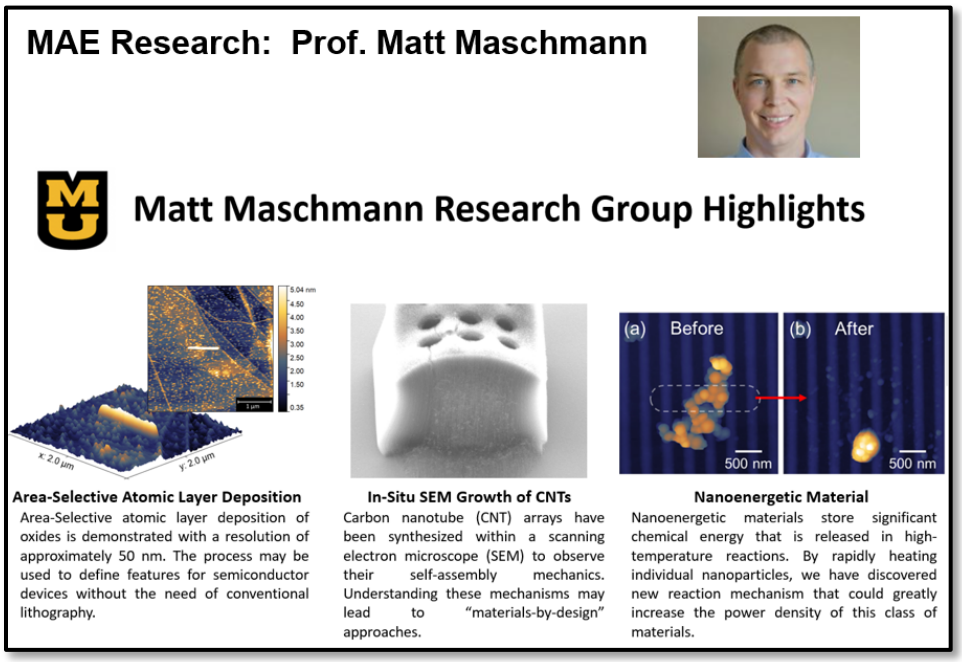

Figure 15 - Area Selective Atomic Layer Deposition, In-Situ SEM Growth of CNTs, & Nanoenergetic Material Research

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St Louis University

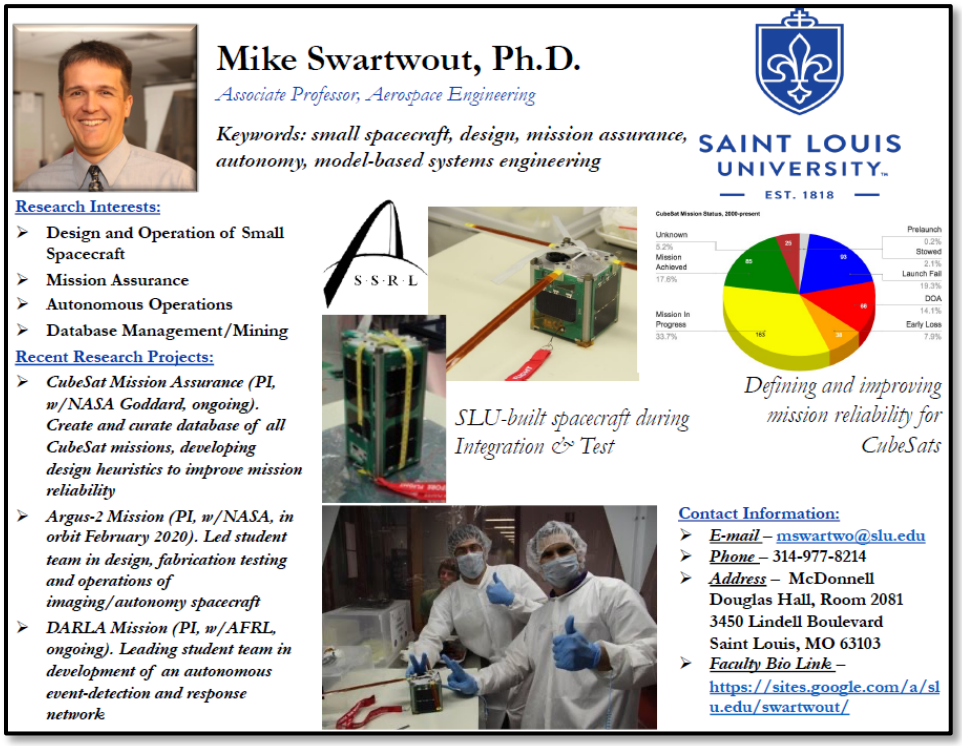


Figure 16 - Small Aircraft, Design, Mission Assurance, Autonomy & Model-Based Systems Engineering

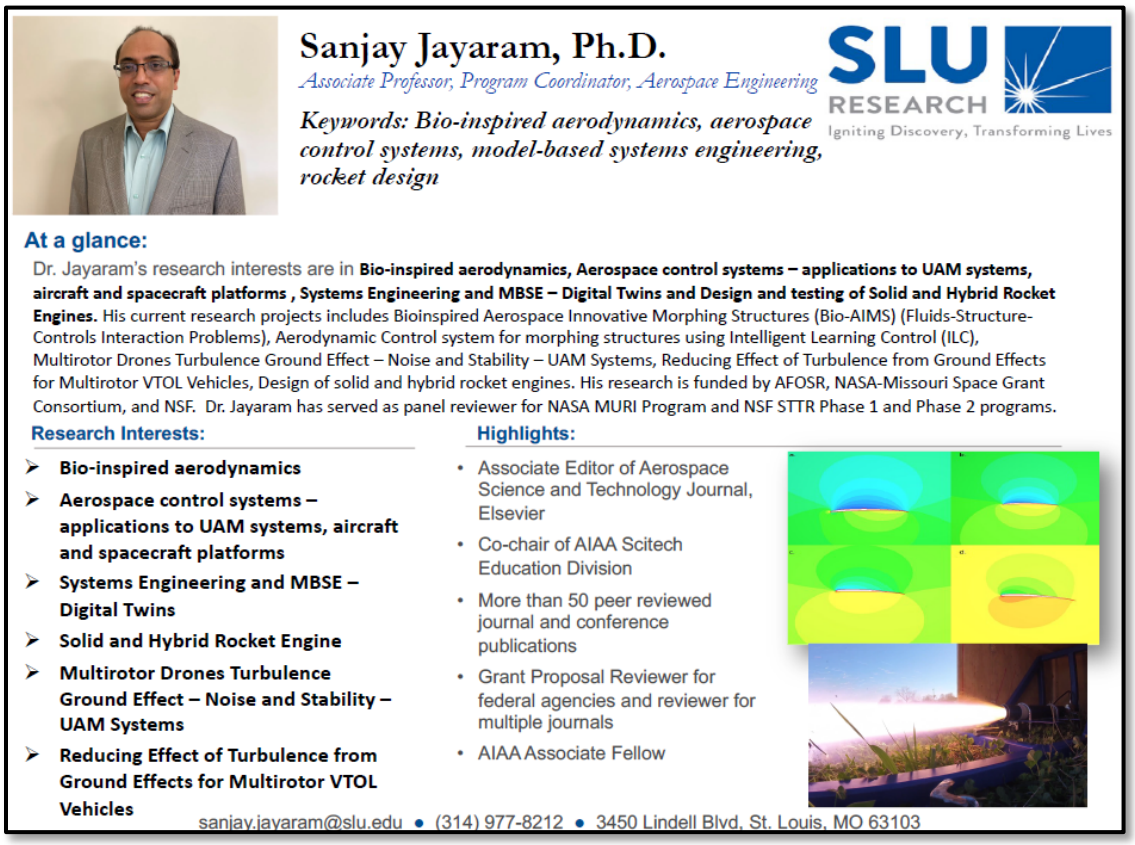


Figure 17 - Bio-Inspired Aerodynamics, Aerospace Control Systems, Model Based Systems Engineering & Rocket Design Research

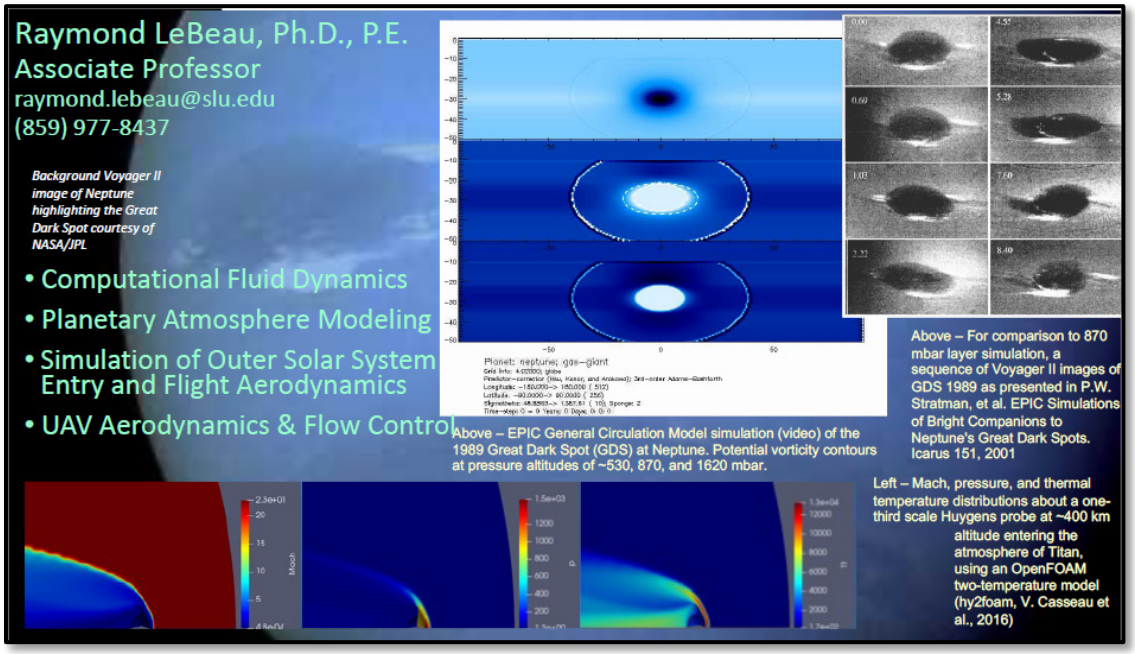


Figure 18 - Computational Fluid Dynamics, Planetary Atmospheric Modeling, Simulation of Outer Solar System Entry and Flight Aerodynamics, UAV Aerodynamics & Flow Control Research

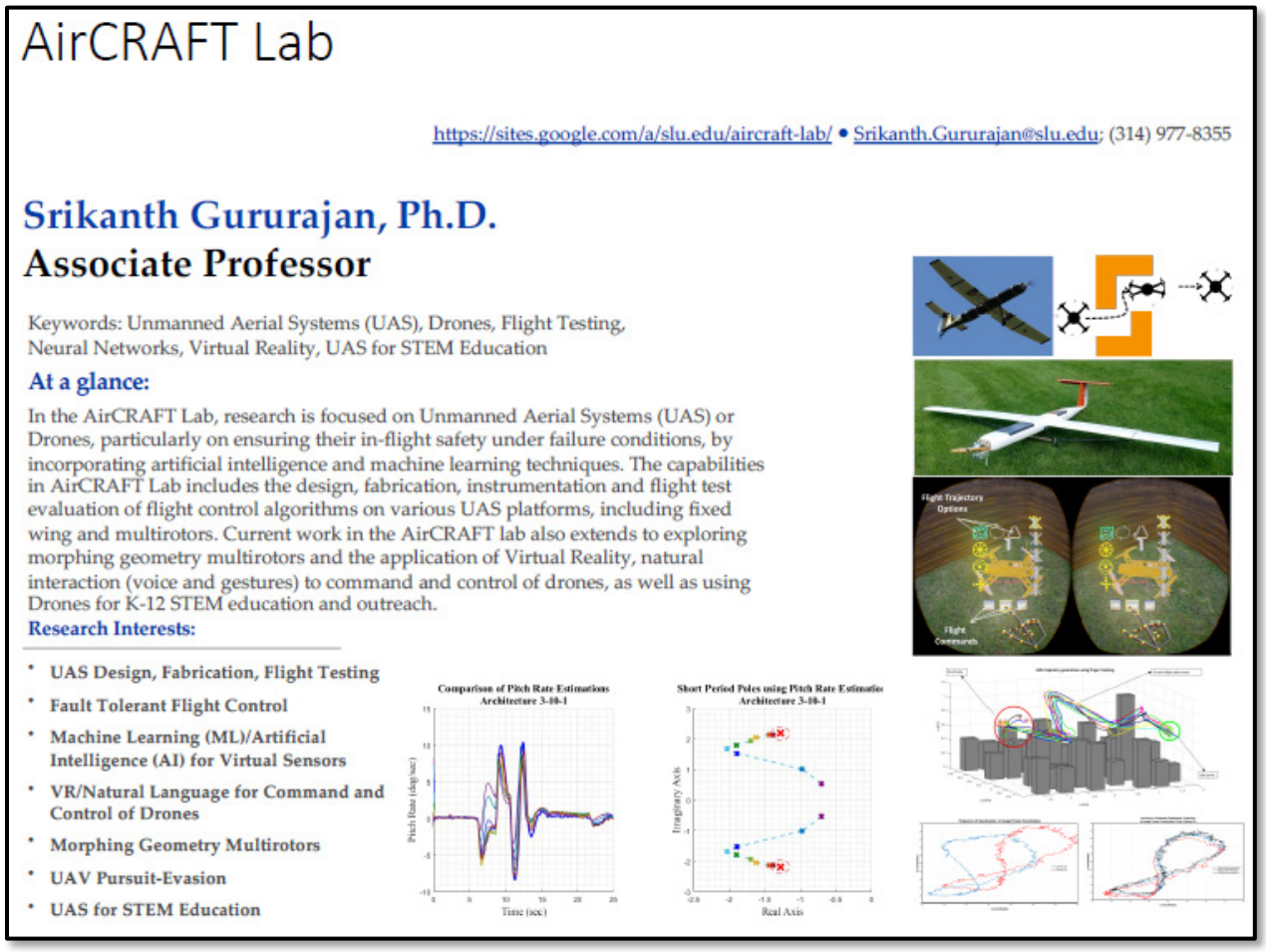


Figure 19 - Unmanned Aerial Systems (UAS), Drones, Flight Testing, Neural Networks, Virtual Reality & UAS for STEM Education Research

Mark McQuilling, Ph.D.

Professor, Program Coordinator, Mechanical Engineering

Keywords: fluid physics, wind tunnels, computational fluid dynamics, shock waves, turbomachinery, dentofacial and cardiothoracic fluid dynamics

SAINT LOUIS UNIVERSITY

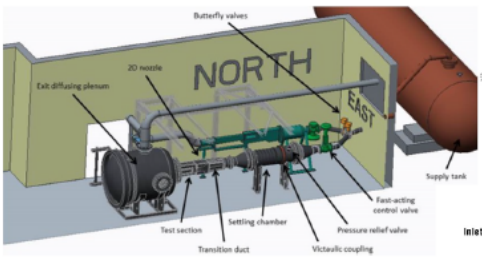
PARKS COLLEGE OF ENGINEERING, AVIATION AND TECHNOLOGY

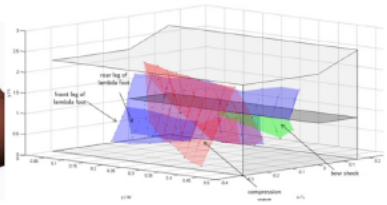
Research Interests:

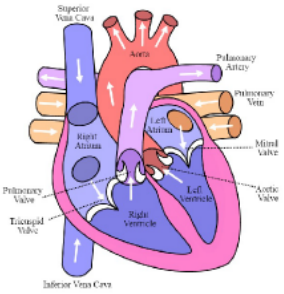
- Experimental and computational fluid mechanics
- Shock wave - boundary layer interaction
- Turbomachinery aerothermodynamics
- Biofluid mechanics
- Airdrop system aerodynamics

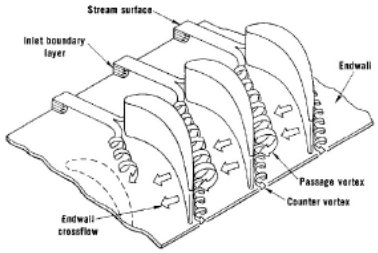
Recent Research Projects:

- ***"Advanced Flow Control for Shock Wave – Boundary Layer Interaction"*** **with The Boeing Company**
- ***"Airfoil Exit Mixing Loss Investigation"*** **with Honeywell Aerospace**
- ***"Advanced CFD Simulations of Cardiovascular Configurations Relevant to the Aorta and Aortic Valve"*** **with Dr. Dawn Hui, (former) SLU Cardiac Surgeon**









- Research funding awarded by The Boeing Company, Honeywell Aerospace, Air Energy Global, US Army Natick Soldier RDEC, US Army Aviation and Missile RDEC
- Currently mentoring 2 MS theses (3 PhD, 8 MS alumni)
- Member of AIAA, ASME, ASEE
- Over 95 research publications and presentations

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Figure 20 - Fluid Physics, Windtunnels, Computational Fluid Dynamics, Shock Waves, Turbomachinery, Dentofacial & Cardiothoracic Fluid Dynamics Research

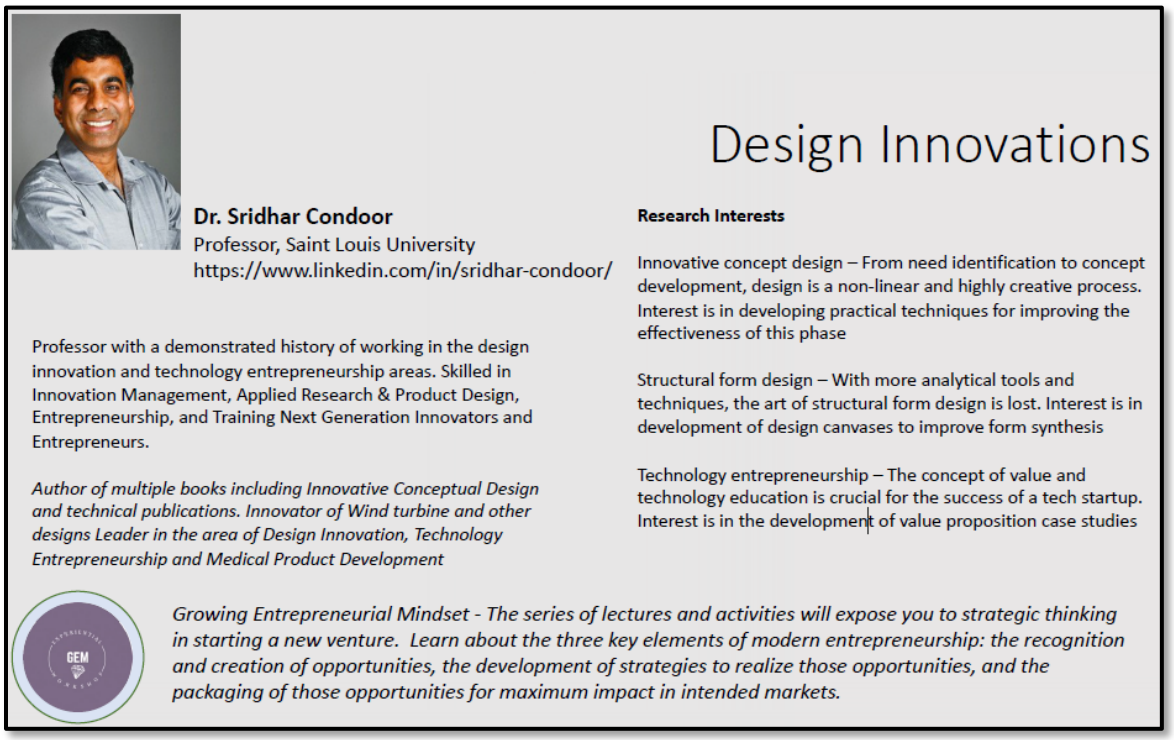

Figure 21 - Design Innovations research: specifically Innovative Concept Design, Structural Form Design & Technology Entrepreneurship

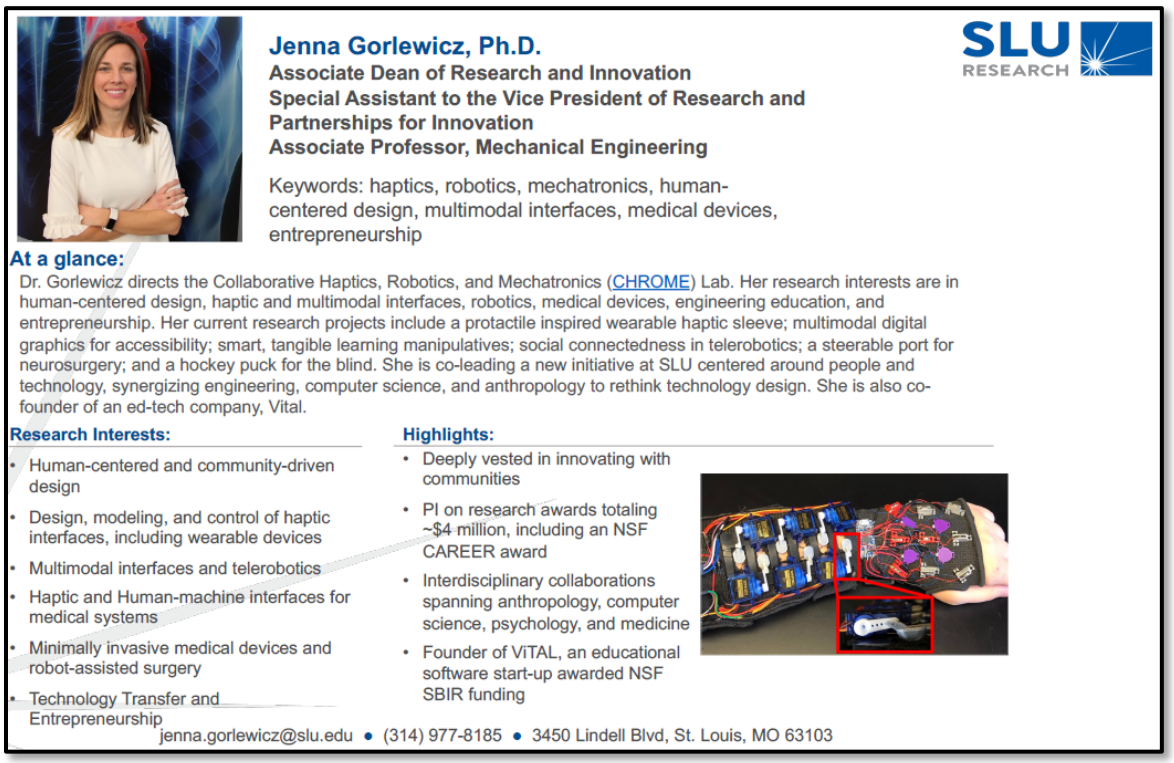

Figure 22 - Haptics, Robotics, Mechatronics, Human-Centered Design, Multi-Modal Interfaces, Medical Devices and Entrepreneurship Research

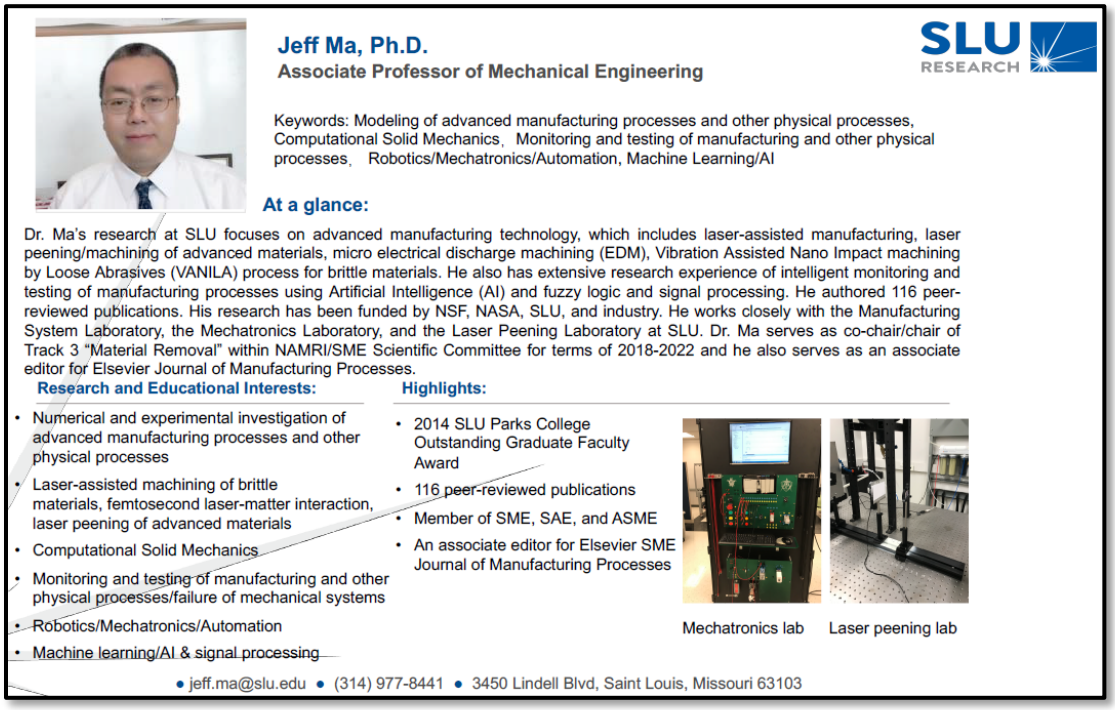

Figure 23 - Modeling of Advanced Manufacturing Processes and Other Physical Processes, Computational Solid Mechanics, Modeling and Testing of Manufacturing and Other Physical Processes, Robotics / Mechtronics / Automation and Machine Learning / AI Research

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Washington University

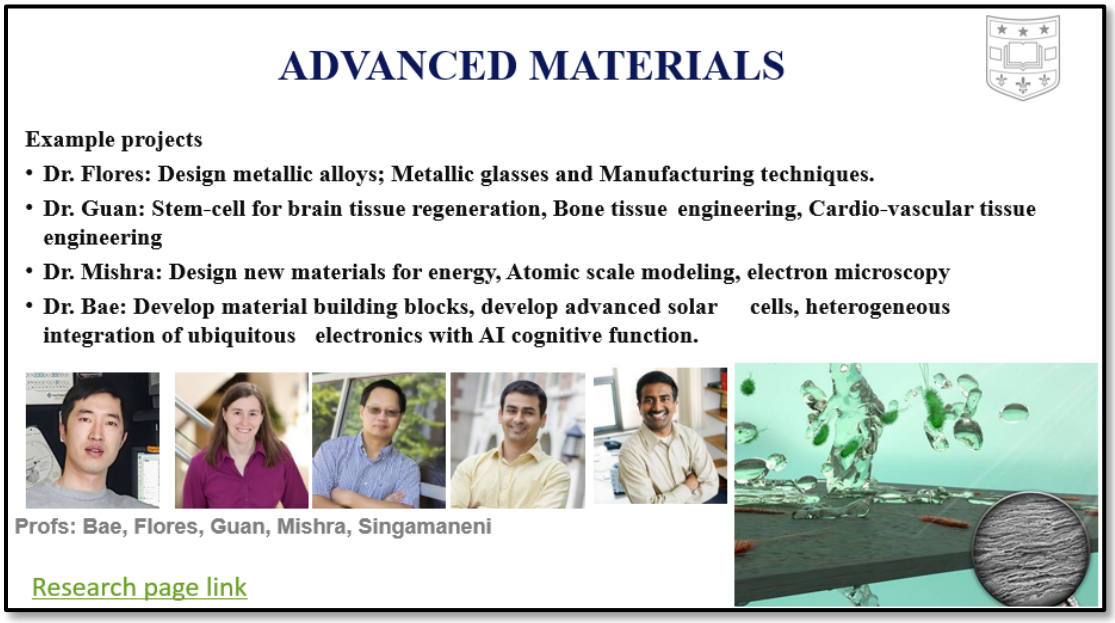

Figure 24 – Advanced Materials Research

BIOMECHANICS & MECHANOBIOLOGY

Example projects

- **Dr. Bayly: Develops imaging methods to study Biomechanics from cell motility to traumatic brain injury.**
- **Dr. Genin: Interface between tissues at the attachment of tendon to bones**
- **Dr. Wagenseil: Cardio-vascular biomechanics and Mechanobiology**
- **Dr. Lake: Orthopedic soft tissues**
- **Dr. Pathak: Mechanobiology of Cancer metastasis.**
- **Dr. Bersi: Role of immune system in hypertension, Cardiac Fibrosis**

Profs. Bayly, Bersi, Genin, Lake, Pathak, Wagenseil

Research page link

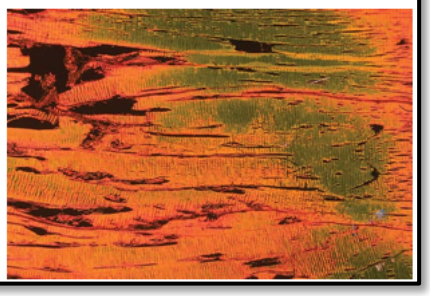

Figure 25 - Biomechanics and Mechanobiology Research

THERMAL – FLUIDS IN ENERGY

Example projects

- **Dr. Agonafer: Develop 3-D electrodes for energy storage devices, Thermo-Chemical / Electro Chemical energy storage, Micro/Nano Fluidics**
- **Dr. Meacham: Micro Fluidics, Micro Electro Mechanical systems.**
- **Dr. Weisensee: Heat transfer and Fluid dynamics in multi phase systems for energy and manufacturing applications**

Profs. Agonafer, Meacham, Weisensee

Research page link

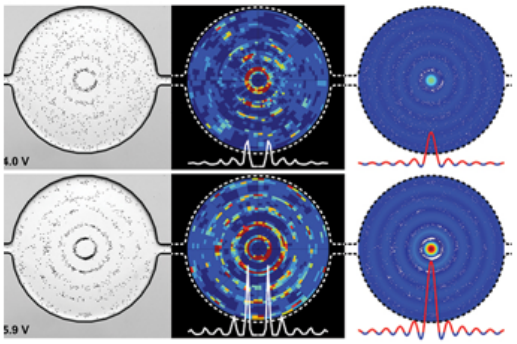

Figure 26 - Thermal - Fluids in Energy Research

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AEROSPACE

Example projects

- **Dr. Peters: Dynamics, Vibration, Aeroelasticity, Applied Aerodynamics, and Rotary-Wing systems**
- **Dr. Agarwal: CFD, Ground effect aerodynamics, Flow control, and Hypersonic flow**
- **Dr. Sastry: Material selection in engineering design, Deformation and Fracture of engineering materials.**
- **Dr. Jakiela: Design, Optimization, and Manufacturing**

Profs. Agarwal, Peters

Figure 27 – Aerospace Research