

Mission-Driven Microsystem Design and Validation

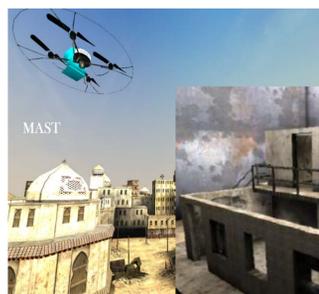


S&T Campaign: Sciences for Maneuver
Platform Mechanics: Platform Configuration Concepts

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Research Objective

- In-situ rapid manufacturing of unmanned aerial ISR platforms with minimal set of components
 - Enhance previously developed framework to speed design and analysis process from months to days
 - Explore how to scale a common vehicle platform and integrate with parts from small library to meet mission needs
 - Experimental verification of virtually designed vehicles



Virtual to Physical Experimentation

Challenges

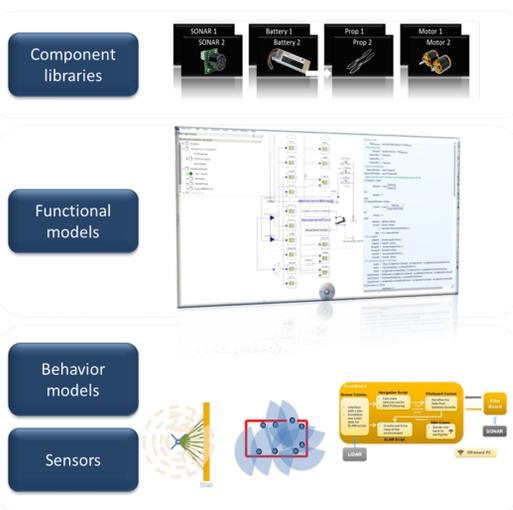
- Reduction of design process cycle time
- Validation of physics-based codes of small aerial vehicles with experimental data
- Lack of standardization across printers, materials, and manufacturing techniques

ARL Facilities and Capabilities Available to Support Collaborative Research

- Access to multi-fidelity microsystem conceptual design tools and techniques
- Access to microsystem rotorcraft and flapping wing technology subject matter experts
- Access to ARL Sensors and Autonomous Systems Experimental Facility
- **Status of effort**
 - An initial interactive systems engineering process and tool have been developed
 - Vehicle manufactured and flown based on output from design process
 - Initial experimentation completed
- **Related Publications and Presentations**
 - Roe RW, Ford ST, Cinar G, Mian Z, Mavris DN. A Multi-Disciplinary Integrated Design Environment for Requirements Development and Performance Evaluation of Autonomous Systems. 14th AIAA Aviation ATIO; June 16-20; Atlanta, GA: AIAA; 2014.
 - Mian Z. A Multidisciplinary Framework for Mission Effectiveness Quantification and Assessment of Micro Autonomous Systems and Technologies. Atlanta: Georgia Institute of Technology; 2013.
 - Mian Z, Mavris DN. Mission Effectiveness Quantification and Assessment of Micro Autonomous Systems and Technologies. IEEE Systems and Information Engineering Design Symposium; April 26; Charlottesville, VA: IEEE; 2013.

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Development of interactive, web-based applications
- Application of statistical techniques to quantify technology impacts based on empirical data
- Multi-stakeholder interactions and value negotiation
- Parameterization of CAD files
- Agent-based modeling and simulation
- Immersive, 3D representation of environment, physical objects, and microsystem vehicles
- Advanced technology modeling and representation techniques
- Department of Defense Architecture Framework (DoDAF)



Prototyping Vision: Components, Functions, and Behaviors Linked to Conceptual Design and Mission Modeling Tools