

Extremely Lightweight, Adaptive, Durable, Damage Tolerant Structures

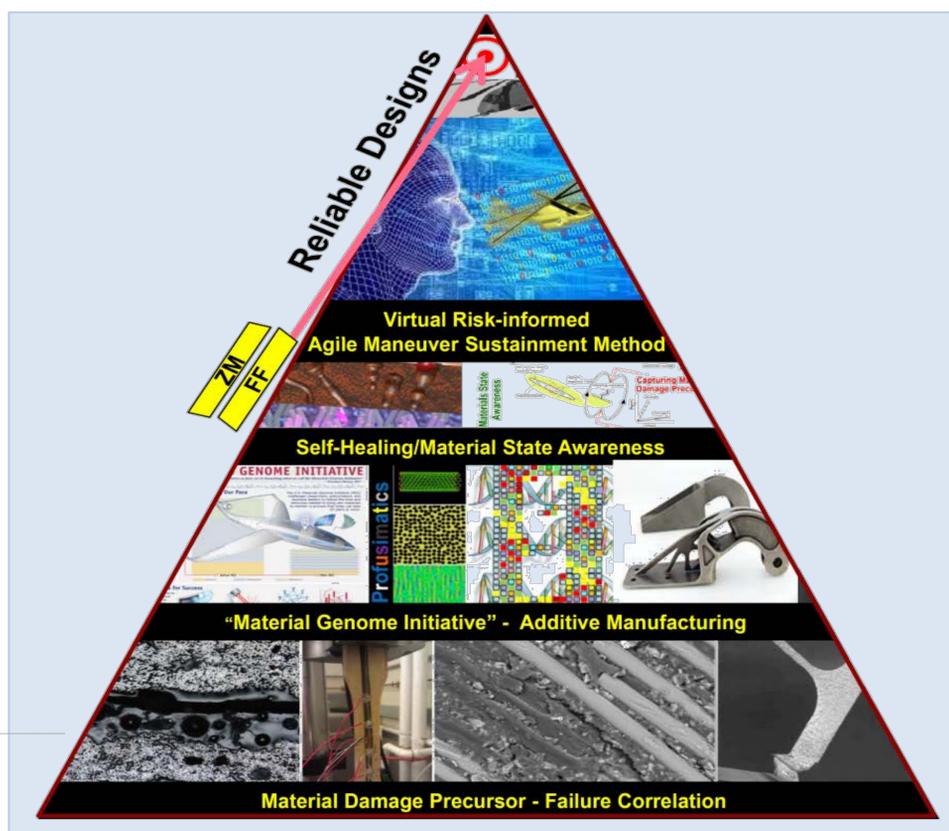


S&T Campaign: Sciences for Maneuver Logistics and Sustainability

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Research Objective

- Establish and mature extremely lightweight, adaptive, durable, damage tolerant structures to enable “fatigue-free” operation of Army Future Vertical Lift.
- ARL is engaged in discovery of novel concepts and physics-based models to improve fatigue resistance for enhanced structural reliability and durability .

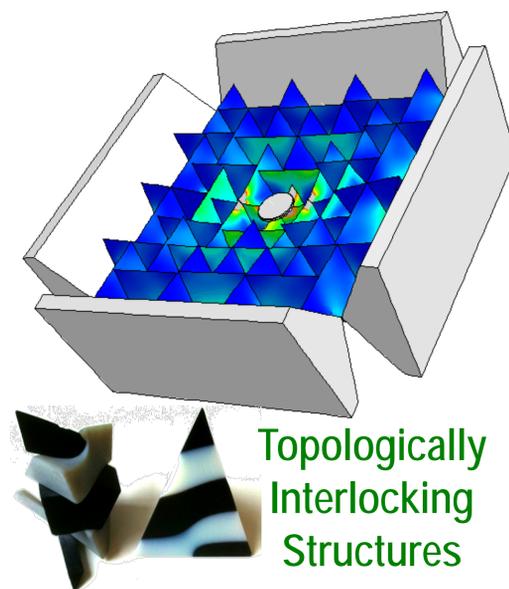


ARL Facilities and Capabilities Available to Support Collaborative Research

- Quasi-static, fatigue, and “high cycle fatigue” testing capability including 100-kN servo-hydraulic mechanical testing machines; 1-kHz, 22-kN servo-hydraulic mechanical testing machine; and 5-kN electromechanical testing machine with environmental chamber
- ASTM test fixtures for tension, compression, and bending tests of metals and composites
- Temperature and humidity chamber for accelerated aging experiments
- Dimension Elite and Replicator 2X for 3D printing multifunctional structural components



Durable Hybrid Composites



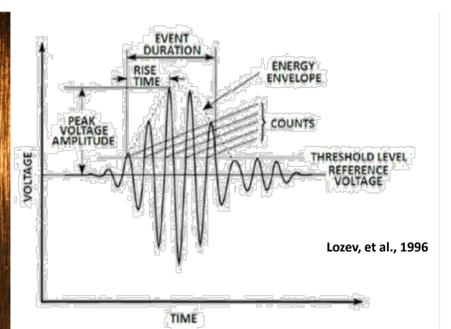
Topologically Interlocking Structures

Challenges

- Lightweight, high strength, composite/metallic and multifunctional structural configurations and designs are sought to increase damage tolerance
- Advancing probabilistic algorithms for fatigue life management by increasing prediction accuracy and reducing computational time
- Additive manufacturing of multifunctional fatigue-resistant lightweight structural components



Fatigue-Resistant Structures



Lozev, et al., 1996



Next-Generation Rotorcraft Concept

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Advanced characterization and modeling of precursors to damage with particular emphasis on fatigue failure initiation
- Advances to enable the next generation of self-healing structures
- Hybridization of materials and processes for 3D printing multifunctional structural nanocomposites with hierarchical ordering