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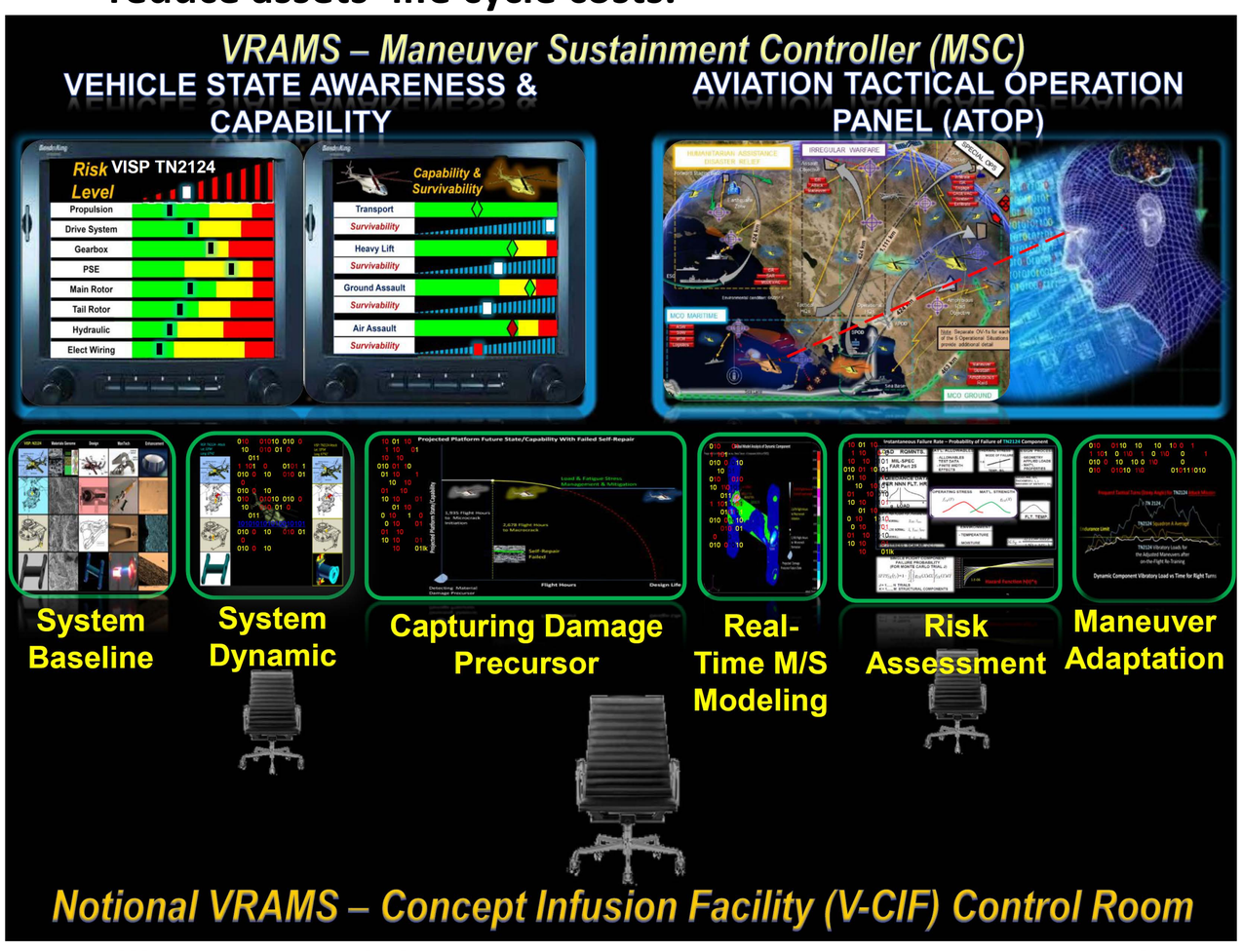
Virtual Risk-informed Agile Maneuver Sustainment (VRAMS)

S&T Campaign: Sciences for Maneuver
Logistics and Sustainability

Ed Habtour, (410) 278-8041
ed.m.habtour.civ@mail.mil

Research Objective

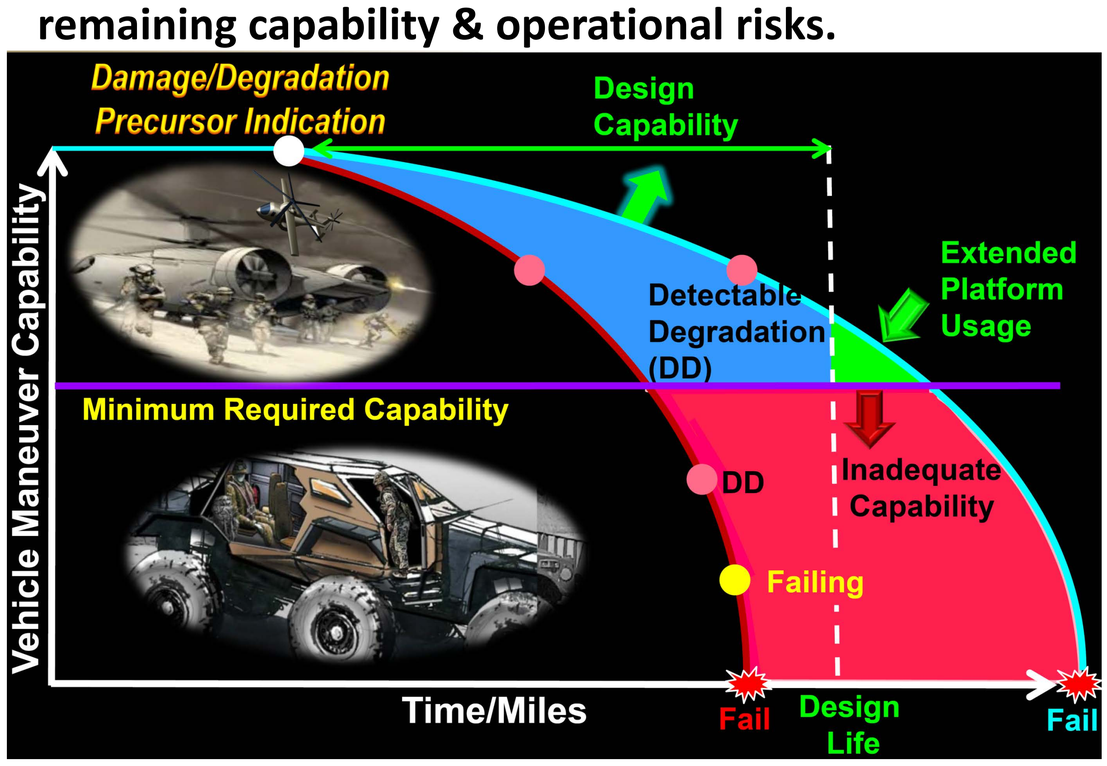
- Enable an integrated capability embedded within vehicles (air, ground, and autonomous systems) to automatically gauge changes in their functional state, assess that functionality in the context of upcoming or even ongoing missions, and react accordingly to achieve mission requirements; increase materiel availability; and reduce assets' life cycle costs.



Intelligent Materials State Awareness System Core Engine

Challenges

- Abilities to detect micro/macrocracks when not under load. In situ detection is extremely challenging. Today, technologies do not exist to detect damage precursors.
- Multiscale physics-based modeling & risk assessment to project evolution of damage, in real time, to determine remaining capability & operational risks.



Early Damage Detection Impact on Mission Capability

ARL Facilities and Capabilities Available to Support Collaborative Research

- Prognostics & Diagnostics, hover cage/stand, full-size air/ground vehicle transmission diagnostics, and outdoor vehicle fatigue and combat damage assessment facilities. Notional VRAMS Concept Infusion Facility (V-CIF) and High Performing Computing.
- Acoustic emission, electromagnetic and piezoelectric shaker system for vibration generation.
- Fatigue testing, failure analysis, seeded fault diagnostics and flight test evaluation, Health and Usage Monitoring System (HUMS), Structural Health Monitoring (SHM), and damage detection & data collection system.

Holistic Approach for Sustaining Future Vehicles and Capabilities Taking into Account Vehicle Fatigue and Combat Damage

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Multiaxial/multiscale, physics-based damage modeling
- Fatigue and fracture, materials genome, multifunctional and adaptive structures
- Structural remaining useful life
- Intelligent built-in sensing network, advanced data/information fusion
- Probabilistic & risk assessment
- Damage-based flight controls
- Virtual reality

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