



Research, Development & Engineering Command

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Lightweighting Issues

RDECOM TARDEC - Mr. Thomas Mathes



Technology to the Warfighter Quicker

"Need to be faster, more agile, less bureaucratic - Need to Fight this everyday"

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Tactical Vehicles

Current

- Tired and aging fleet
- Corrosion prone
- Cabs typically unarmored. Armoring via add-on-armor kits
- Reduced vehicle payload, maneuverability, reliability, safety, maintainability, and life expectancy
 - Increased wear and tear on vehicle components, fuel consumption, and life cycle costs
- Multiple original equipment manufacturers, little commonality
 - Designed for traditional role of logistics support

Future

- Recapitalization with appliqué armor (A-kit/B-kit)
- Be more survivable in mine blast events
- Component commonality (hardware, transparent armor, B-kit panels)
- Gun turret and advanced countermeasures
- Crew installable B-kit, with minimal tools
- Enhanced crew survivability to meet threat
- Increased system reliability
- Taking on more of an assault role





Combat Vehicles



Current

- Thick, heavy armor
- Structure as by-product of armor
- Inherently damage tolerant
- Arrive on ships
- Well understood materials and manufacturing practices
- Designed for force-on-force engagement
- Cumbersome logistics tail
- Basic situational awareness

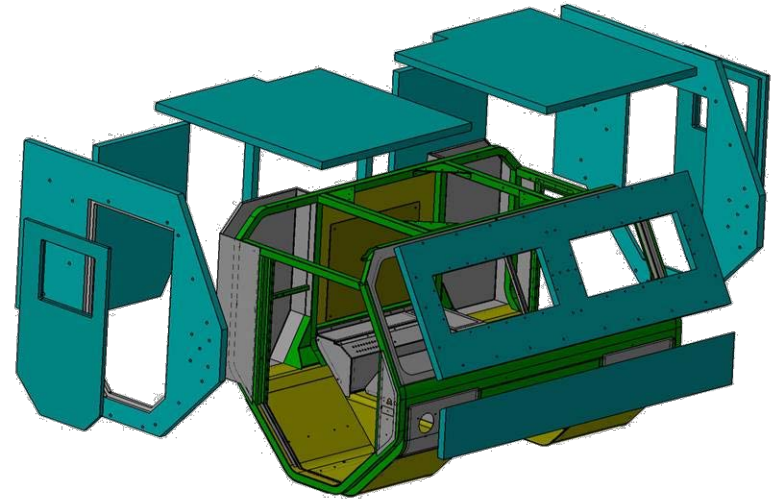
Future

- Lightweight armor
- Structure plus armor (A + B)
- Relatively damage intolerant
- Air transportable (C-130)
- Advanced ceramic armors, use of polymer composites and associated mfg. practices
- Designed for noncontiguous, non-linear, reorganizing battlefield
- Common components, reduction of logistics footprint
- Network centric, highly interdependent



Issues to lightweighting Tactical Vehicles

- Balancing material costs over a large vehicle fleet
- Integration of hybrid, advanced materials, and layered armor solutions
- A-frame with mounting points which allow for rapid addition/removal of B-kit, and spiral-in of emerging armor technologies
- Addressing seams and edges that result from modular armor
- Tile confinement for enhanced ceramic armor performance
- Improving armor multi-hit performance of advanced armors
- Opaque armors under 28 psf and transparent armors under 30 psf
- Keeping transparent armor thickness to a minimum
- Durability of advanced lightweight armors
- Health assessment of advance armors
- Improved modeling and simulation

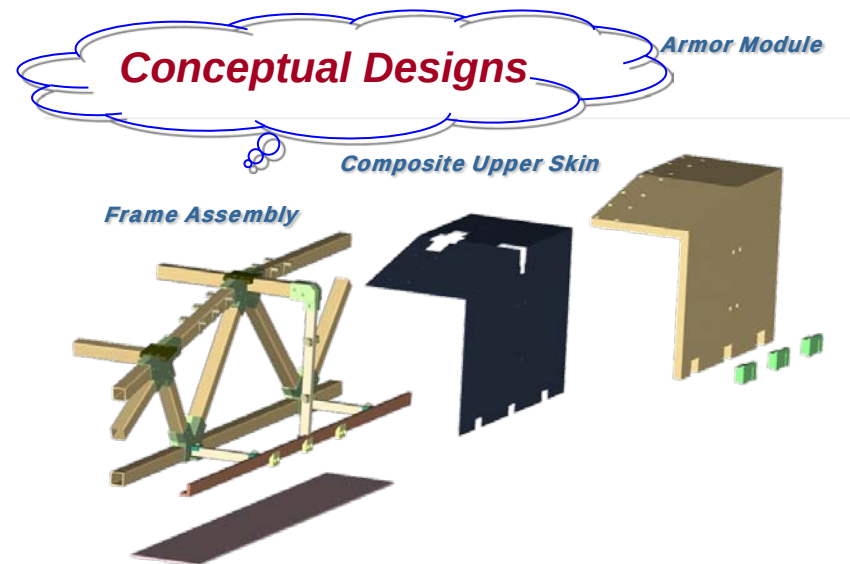
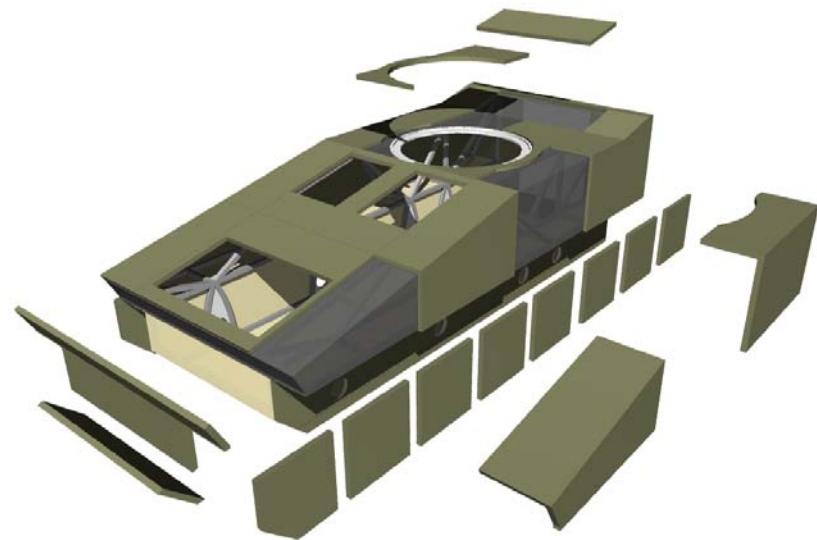


A-Kit/B Kit Concept



Issues to Lightweighting Combat Vehicles

- Development of survivable vehicle systems while keeping to C-130 transport weight 18.5 Tons
- Attachment methodologies for A + B armor concept, appurtenances
- Joining and fastening technologies (dissimilar materials), adhesives
- Balancing interior volume against the use of less efficient structural material solutions
- Signature management, electromagnetic shielding over potentially non-metallic surfaces
- Diagnostics & prognostics for structural health assessment
- Material costs and improving multi-hit performance
- Advanced structures offer part consolidation necessitating development of high yield mfg. processes
- Inspection and repair of advanced armor systems
- Improved modeling and simulation





Lightweighting Programs at TARDEC

- **Vehicle Armor Technology***
 - Purpose: Develop lightweight passive armors, and verify advanced analytical and numerical models that can be added to FCS for defeat of medium caliber automatic cannon, heavy machine gun, artillery fragments, Explosive Devices, rocket propelled grenades and bomblets. Provide alternatives to active protection systems in urban environments. Provide design guidance for ground vehicles for mine blast protection
 - Payoff: Improved mobility and crew survivability for future force vehicles against RPG, medium caliber cannon threats HMG, IED fragments, AT mines, and bomblets with reduced weight. Enables freedom of maneuver with increased survivability.
- **Advanced Structures Program***
 - Purpose: Demonstrate a space frame structure
 - Payoff: Provide convincing proof of the merits of a space frame structure
- **Army Lightweight Structures Initiative****
 - Purpose: Design optimum weight solutions to HEMTT A3, Non Line of Sight Canon by transitioning Alcoa's proven lightweighting manufacturing technology to Army ground vehicle OEMs
 - Payoff: An Army ground vehicle industrial base with more tools for lightweighting (technology was already transitioned to auto industry)
- **All Composite Military Vehicle****
 - Purpose: Develop and demonstrate an all-composite military vehicle that is analogous to the HMMWV
 - Payoff: A HMMWV with increased payload/mobility and composites proven as viable option to large scale use in vehicle structures
- **Composite Vehicle Research****
 - Purpose: Conduct RD&E on advanced materials and process technologies such as Friction Stir Welding to reduce the weight of combat vehicle structures such as the FCS Non Line of Sight, Top Plate
 - Payoff: Reducing weight in combat vehicles
- **Composite Body Parts Program****
 - Purpose: Transition of composite technologies into the military ground vehicle industrial base. Develop lightweight components that do not corrode.
 - Payoff: More composites tools for the industrial base and cheaper composites manufacturing processes
- **Armor-Ready Composite Cab****
 - Purpose: Develop lightweight composite armored cab systems for tactical vehicles such as the HEMTT A3
 - Payoff: Lighter weight cabs that can accept more robust B-kits
- **Center for Innovative Materials Research****
 - Purpose: Establish the Center for Innovative Material Research and to fully develop ductile hybrid fabric composite grids, and graphite bars.
 - Payoff: High temp research facility and materials for infrastructure and combat vehicle protection.

* TARDEC Science and Technology

** Congressional Funding

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