



U.S. Army Tactical Wheeled Vehicle Vulnerability Test and Evaluation Methodology

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Army TWV T&E Methodology

Introduction

Traditional Ballistic Vulnerability Candidates



Heavily Armored Combat Vehicles

OEF/OIF Ballistic Vulnerability Candidates



Unarmored TWV\$

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Agenda



- Phase 1: Coupon Testing
- Phase 2: Component/Subsystem Testing
- Phase 3: Exploitation Testing
- Phase 4: System Level Testing





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Phase 1: Coupon Testing

Coupon testing provides a quick and cost effective means to determine the capabilities of an armor solution.

- A coupon is a 2 x 2 foot piece of the complete armor recipe.
- A coupon test involves testing against various ballistic threats.
- Three phases of coupon testing.
 - V_{50}
 - Requirement
 - Armor Characterization



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Phase 1: Coupon Testing



V₅₀ coupon testing determines whether or not an armor recipe is worthy of further investigation.

- A V_{50} is the velocity where a complete penetration and partial penetration are equally likely for the threat under consideration.
- The V_{50} is calculated by taking the mean of an equal number of highest partial and lowest complete penetrations.
- The V_{50} for a certain armor recipe is compared to other recipes to determine the performance capabilities.

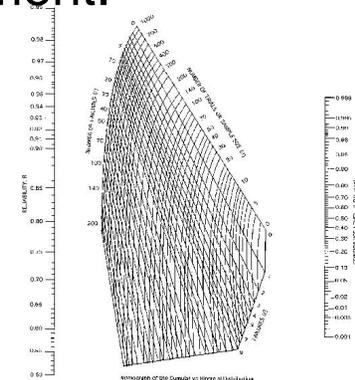


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Phase 1: Coupon Testing

Requirements coupon testing determines whether or not an armor recipe meets specific requirements.

- Example requirement: The armor must provide an X% probability of protection against a threat fired at a velocity with a Y% confidence level.
- The cumulative binomial distribution is used to determine the number of partial impacts required to meet the requirement.
- Coupon testing is then conducted.



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Phase 1: Coupon Testing



Armor characterization coupon testing primarily supports modeling and simulation efforts.

- Penetration Algorithm Development
- Behind Armor Debris (BAD) Characterization

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Phase 2: Component/Subsystem Testing

Component/Subsystem testing determines the affect of certain system components/subsystems on the survivability of the crew.

- Typical combat vehicle evaluations focused heavily on component/subsystem testing to determine the survivability of the system as a whole.
- TWVs are only required to provide crew protection so those components/subsystem that could affect the survivability of the crew are tested.
 - Fuel Cells
 - Automatic Fire Extinguishing Systems (AFES)

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Phase 3: Exploitation Testing

Exploitation testing determines the ballistic vulnerabilities of the integrated armor.

- Exploitation testing addresses the ability of certain projectiles to penetrate vulnerable areas of the armor package as installed on the cab.

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Phase 4: System Level Testing

System level testing determines the overall protection provided to the crew of the vehicle under consideration.

- System level testing focuses on addressing crew vulnerabilities against threats that can not be addressed in the other three phases.
 - Typically focuses on blast-type threats.
- System level testing also provides insight into battle damage and repair capabilities.

Event	Location	Test Condition
1. Mine	Under Wheel	Running vehicle, Stowage, <u>Heated Fuel</u>
2. Mine	Underbody	Running vehicle, Stowage, <u>Heated Fuel</u>
3. Fragmenting Round	Side of Vehicle	Not Running, Stowage, <u>Simulated Fuel Tank Weight</u>

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Conclusion



The TWV ballistic vulnerability methodology is a detailed, flexible, and judicious building block approach to test and evaluation.

- Phase 1: Coupon Testing
- Phase 2: Component/Subsystem Testing
- Phase 3: Exploitation Testing
- Phase 4: System Level Testing



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Questions

