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Optimizing the Survivability of the Light Armored Vehicle with Modeling and Simulation

Tony R. McKheen, U.S. Army TARDEC

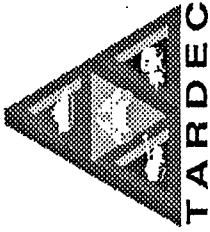
Rod Peterson and Mylene Ouimette, NSWWC-CD

Kent Pankratz, Booz-Allen & Hamilton, Inc.

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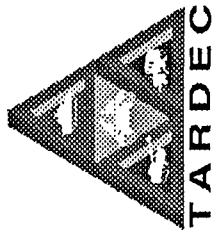


Background



- LAV is entering a Service Life Extension Program (SLEP) to ensure that it will remain a viable weapon platform through 2015
- Survivability is one of the main concerns
- Requirements stated in vague terms
- Cost and weight must be kept to a minimum
- Why M&S?

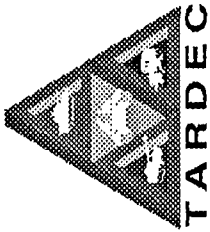
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Models Used



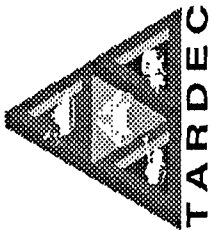
- TOSOM
- CASTFOREM
- Groundwars
- GENESIS
- NVESD Model



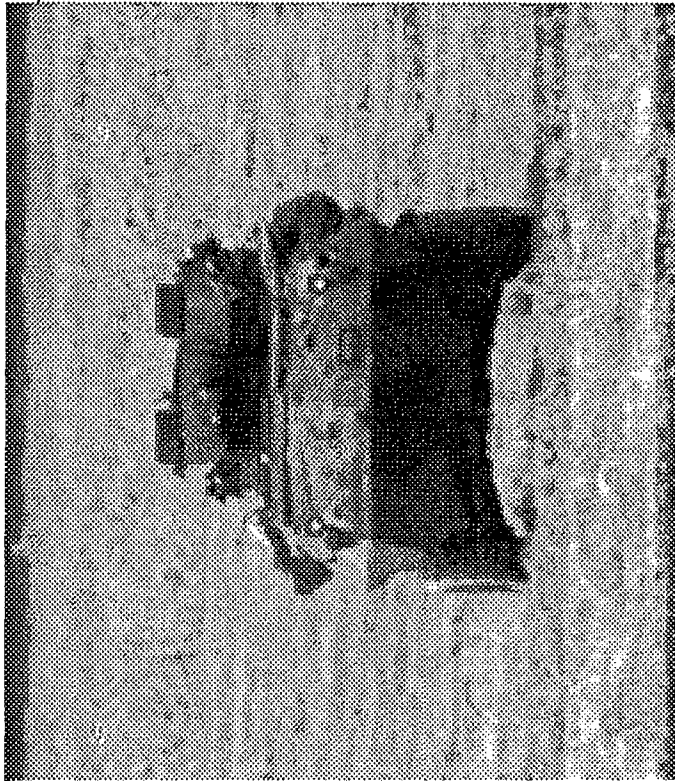
LAV Baseline



- NSWC-CD and ATC created a database of LAV baseline signatures to include:
 - Thermal (3-5 and 8-12 μm)
 - Near Infrared
 - Visible
 - Radar
- Imagery includes at range, diurnal, and turntable
- Provides input data for modeling

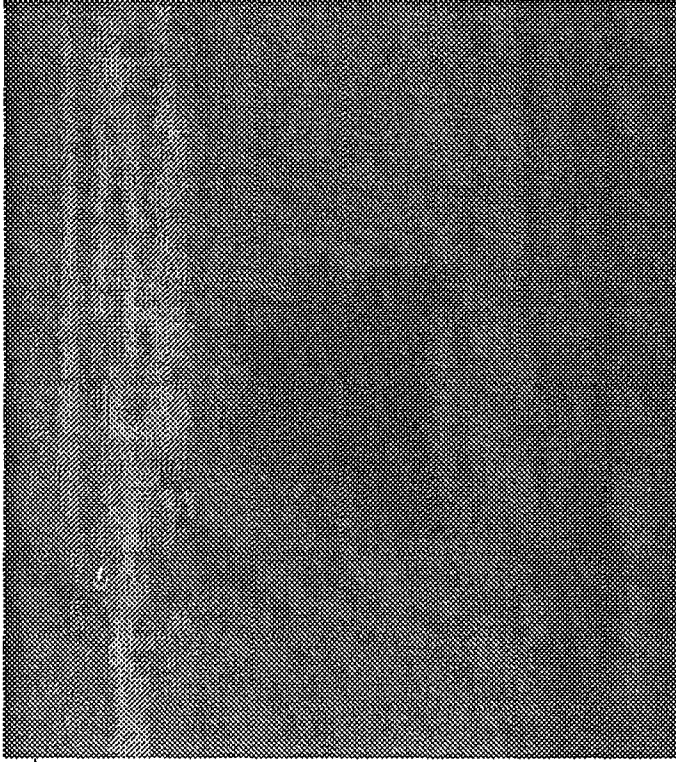


Imagery Examples



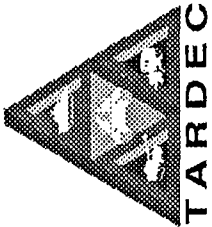
Visible

Imagery was collected by Aberdeen Test Center at Aberdeen Proving Ground, MD.



NIR

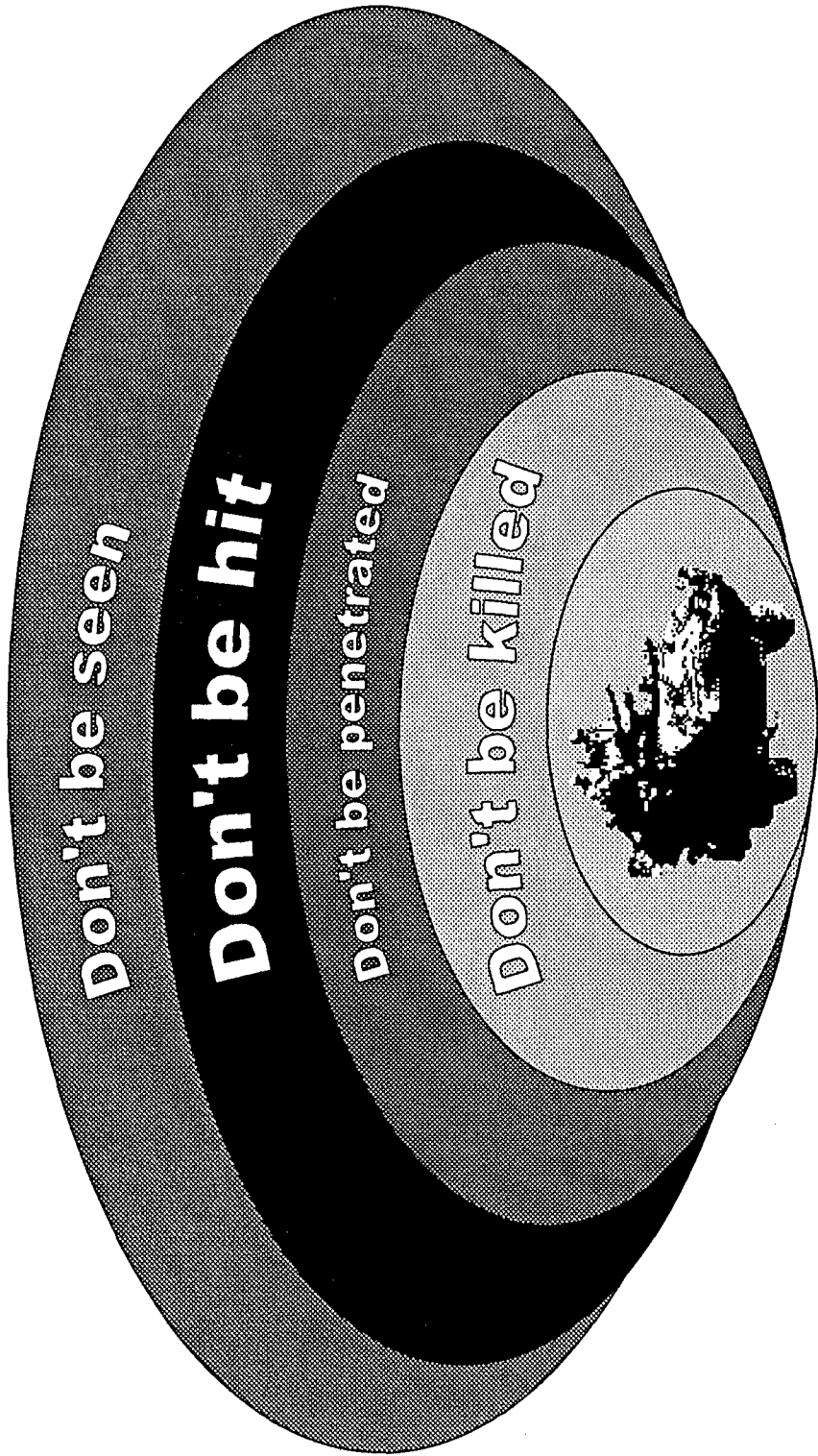
At range imagery examples. Images were also taken from turntable and diurnal.



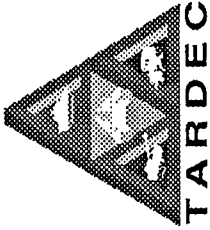
TOSOM Analysis



Where do we put the \$\$?



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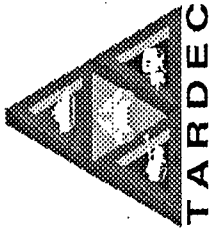


TOSOM Analysis

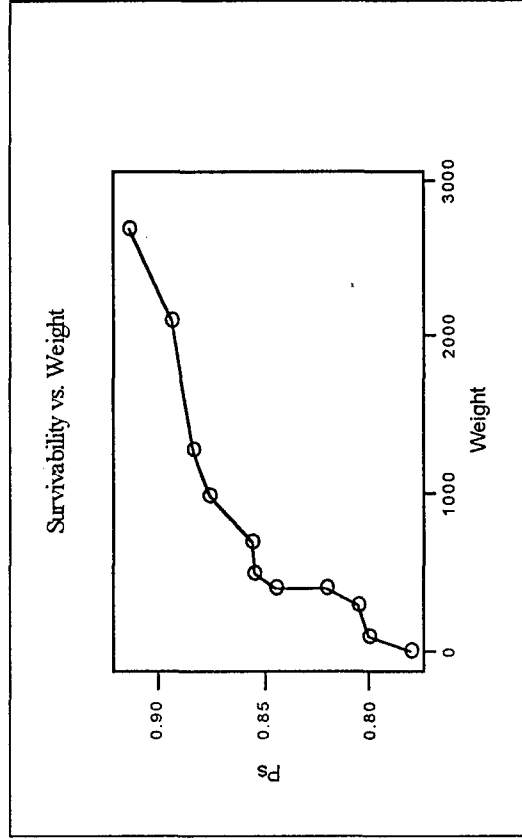
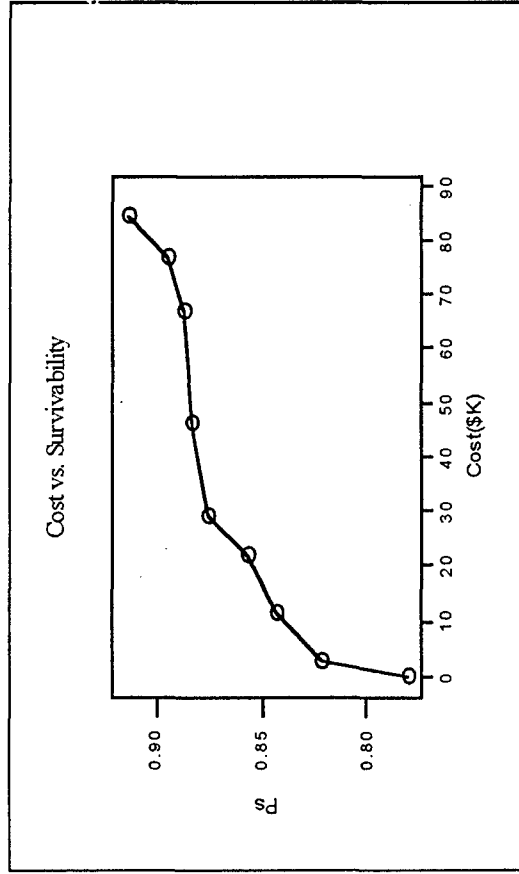


- Threat database developed by Teledyne Brown Engineering and approved by MCIA
- Three different threat scenarios
- Considered a total of ten survivability improvements
- Exhaustive enumeration method was used for the analysis

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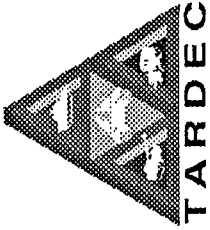


Sample Results



•Used TOSOM to optimize survivability with cost and weight at manageable risk

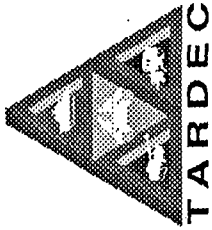
•Results



CASTFOREM



- TRAC-WSMR was tasked by NSWC-CD and MCSC-AWT to perform a CASTFOREM analysis
- This effort included incorporating signature data into the analysis
- Considered two types of scenarios
- Analysis considered different armaments, sensors, and survivability levels on the LAV

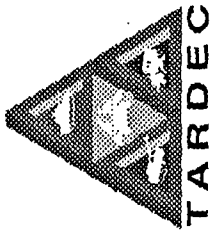


CASTFOREM

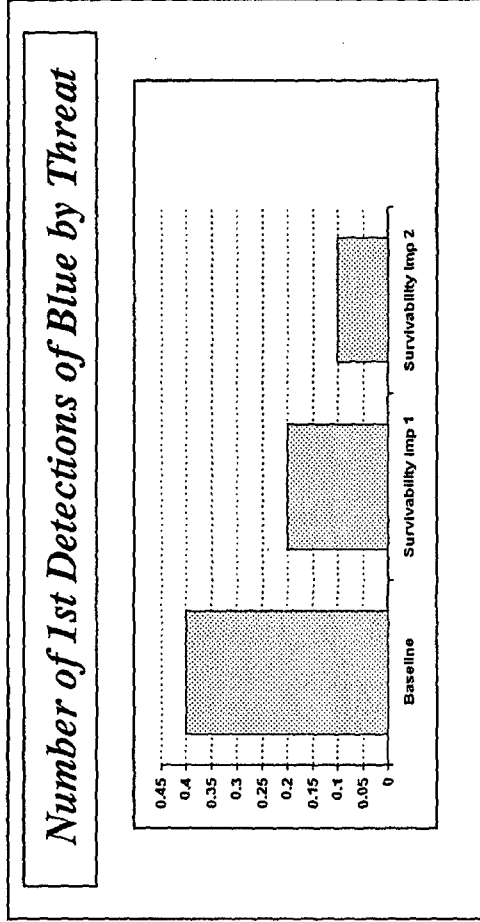
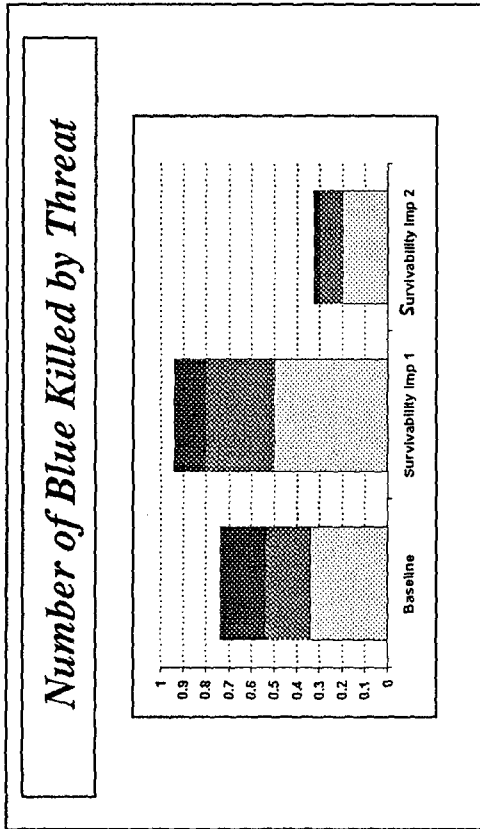


Alternative	LAV-25			LAV-AT			LAV-M		
	Armament	Survivability	Sensor	Armament	Survivability	Sensor	Armament	Survivability	Sensor
Baseline	25mm	Baseline	X	TOW II	Baseline	X	81mm mortar	Baseline	Y
Survivability 1	25mm	Survivability 1	X	TOW II	Survivability 1	X	81mm mortar	Survivability 1	Y
Survivability 2	25mm	Survivability 2	X	TOW II	Survivability 2	X	81mm mortar	Survivability 2	Y

- Example of alternatives used in the analysis
- Different survivability levels on different variants



Sample Results

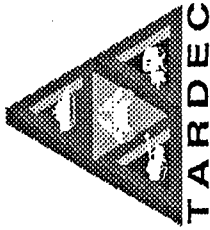


- CASTFOREM provided information about the combat effectiveness of survivability improvements as well as several other modifications

- Results



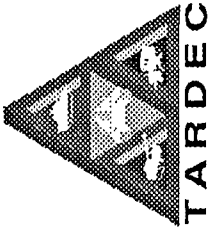
TRAC-WSMR POC Mr. David Kelly



Groundwars



- Analysis conducted by Booz-Allen & Hamilton
- Army-approved AMSAA Model, Version 5.33
- Modified to examine aspect-wise signatures
- Few-on-Few, Stochastic Model
- Scenario:
 - LAV fights for information during a zone recon
 - SWA Terrain
 - 8 Blue versus 8 Red for initial run matrix
 - Similar sensor capabilities for Red and Blue
 - Alternatives examine LAV with survivability improvements

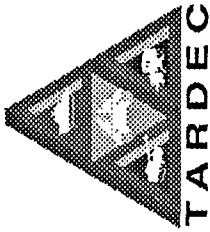


Sample Results



	<u>Base</u>	<u>S1</u>	<u>S2</u>	<u>S3</u>
Red Losses	W	X	Y	Z
Blue Losses	A	B	C	D
SER	W/A	X/B	Y/C	Z/D

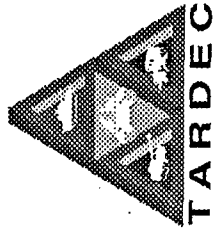
- Combat effectiveness of signature improvements in terms of System Exchange Ratio (SER)
- LAV detectability for different signature improvements



Other Models



- GENESIS
 - Prepared for AMSAA's Smart Weapons Management Office by the Illinois Institute of Technology Research Institute (IITRI)
 - Used to evaluate the effectiveness of smart munitions
- NVEDS Model
 - Instrumental in determining technical specification development and test requirements
 - Uses AMSAA/NVEDS provided data
 - Two scenarios used



Conclusions



- Modeling and simulation aided in:
 - determining where to put the money
 - effectiveness of solutions
 - technical specification development
 - identification of vulnerabilities
 - basis for decision-making in selecting survivability technologies

OPSEC REVIEW CERTIFICATION

(AR 530-1, Operations Security)

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Description of Information Reviewed

Title: " Optimizing the Survivability of the LAV with Modeling and Simulation"

Author/Originator(s): Tony McKheen, Rod Peterson, Mylene Ouimette, Kent Pankratz

Publication/Presentation/Release Date: Publication and Presentation August 1999.

Purpose of Release: Proceedings of the TARDEC Ground Target Modeling & Validation Conference.

An abstract, summary, or copy of the information reviewed is attached for review.

Reviewer's Determination (check one):

1. Unclassified Unlimited. *The presentation is a generic description of the use of survivability optimization models. Only the models and methodology are detailed and no specific results are presented. The Marine Corp LAV office coauthored the presentation and along with the author, support unclassified, unlimited release. I also have technically reviewed the presentation and support an unclassified, unlimited release at the conference. W. Muck 12 Aug 99*

2. Unclassified Limited, Dissemination Restrictions IAW _____

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I am aware that there is foreign intelligence interest in open source publications. I have sufficient technical expertise in the subject matter of this paper to make a determination that the net benefit of this public release outweighs any potential damage.

Reviewer: Wallace R. Muck GS-14 Mechanical Engineer, Acting Team Leader
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Public Affairs Office (AMSTA-CS-CT): Concur/ Nonconcur
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