



# Survivability Concepts

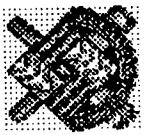
**Jerry L. Chapin**

**Director**

**Tank Automotive Research,  
Development and Engineering Center**

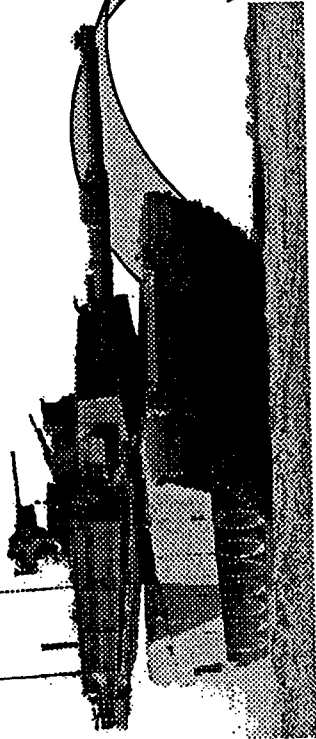
**DISTRIBUTION STATEMENT A**  
Approved for Public Release  
Distribution Unlimited

**20060824157**



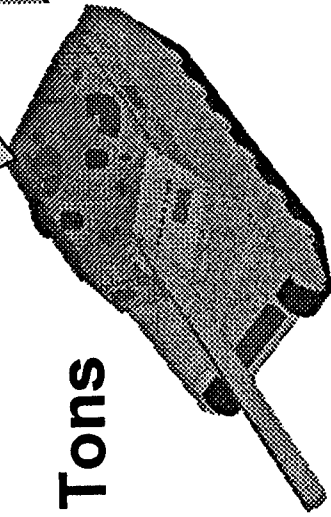
# The Survivability Challenge

70 Tons

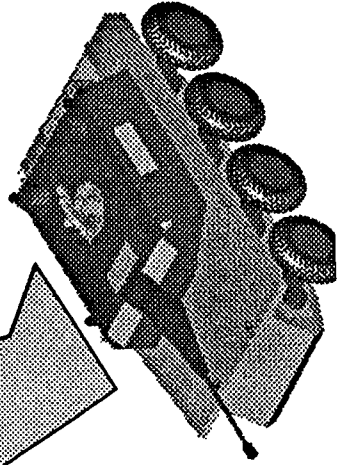


*How can we increase the  
deployability and  
sustainability of our forces  
without compromising  
survivability and lethality?*

40 Tons



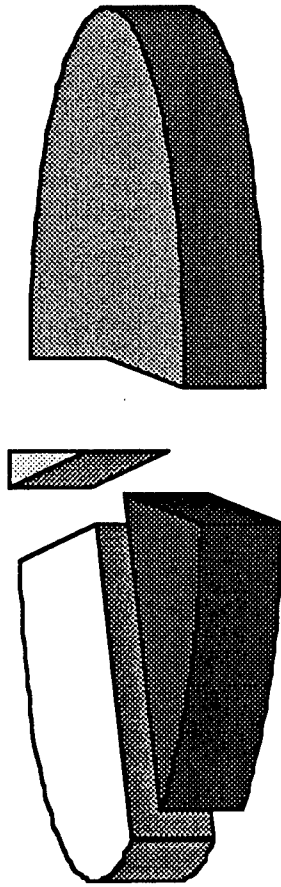
20 Tons



2

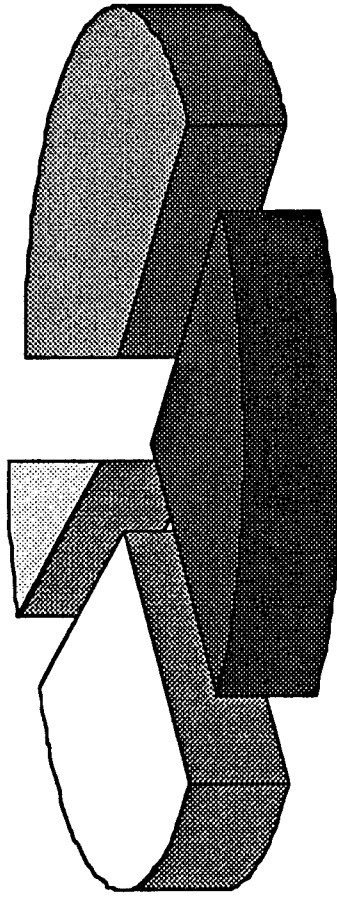


# Future Survivability must be Lighter!



70 ton vehicle--  
36 tons for structure  
& protection

- Structure & Protection
- Lethality
- Mobility
- Other



40 ton vehicle--  
15.5 tons for  
structure & protection



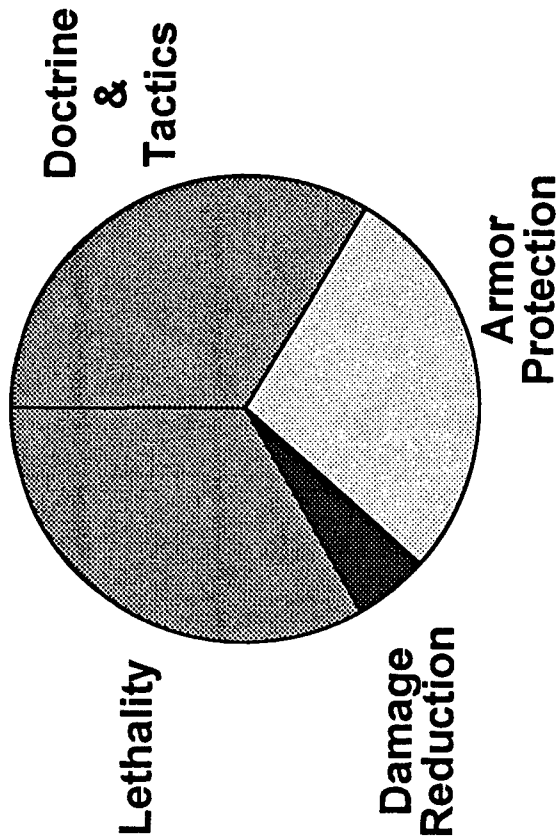
20 ton vehicle--  
8.6 tons for structure  
& protection!

3

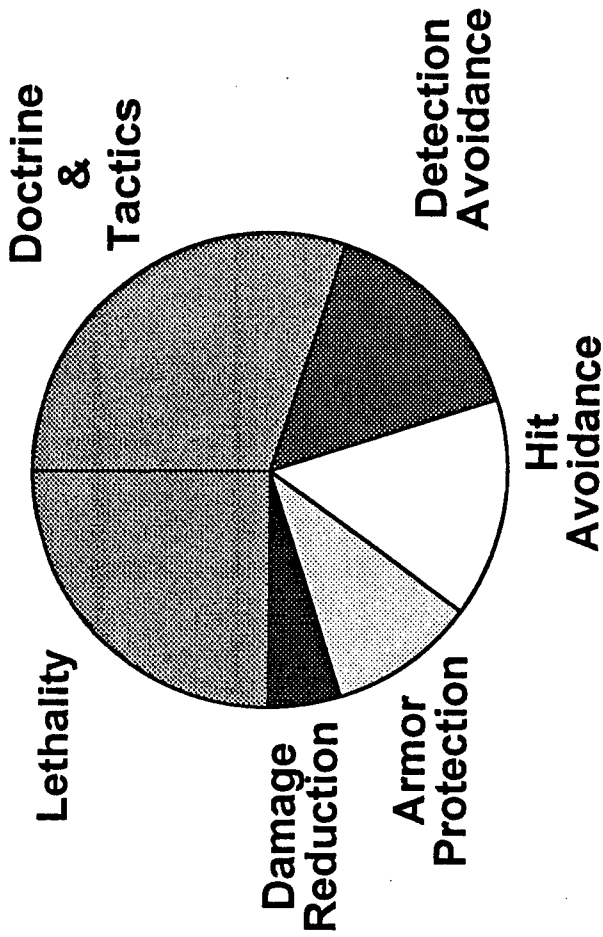


# *New Technologies must be used*

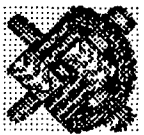
## The Past



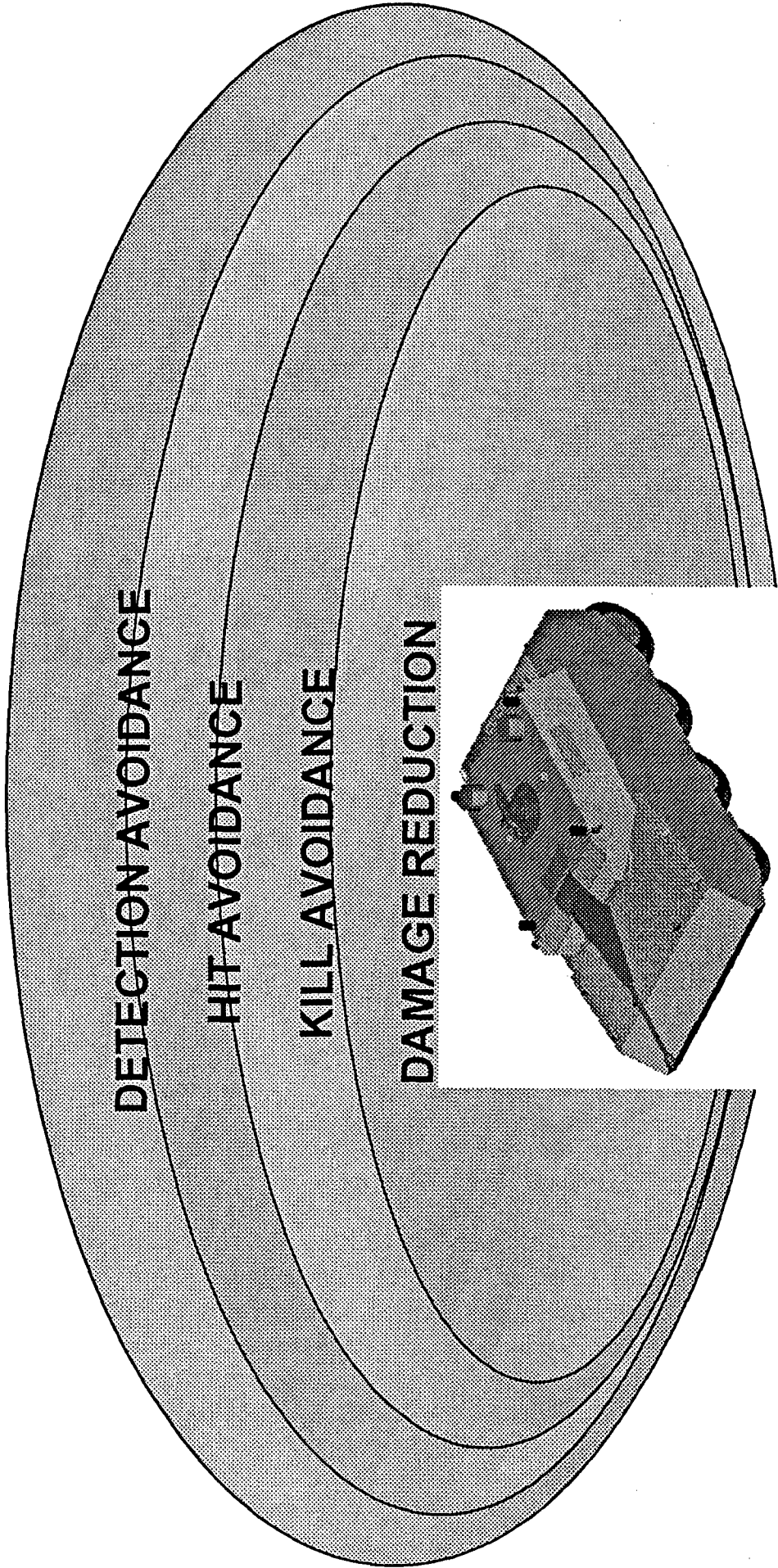
## The Future

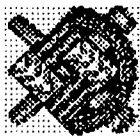


4



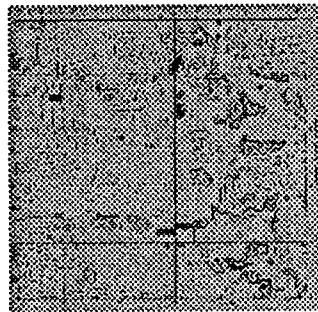
# A Balanced, Layered Approach



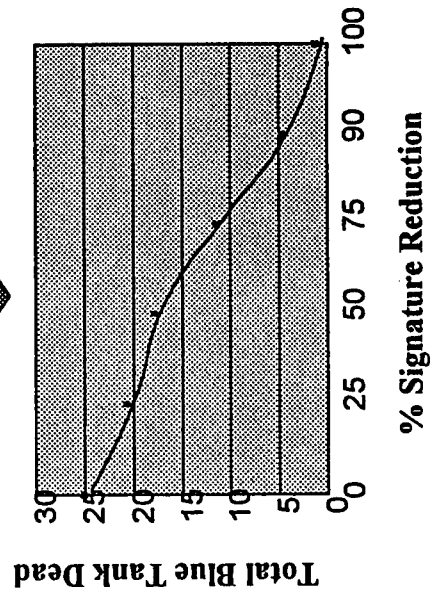
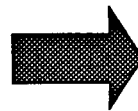


# The Contribution of Signature Management

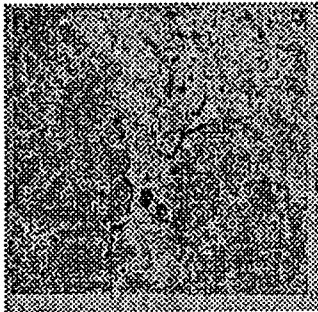
## HRS 29.6 SWA



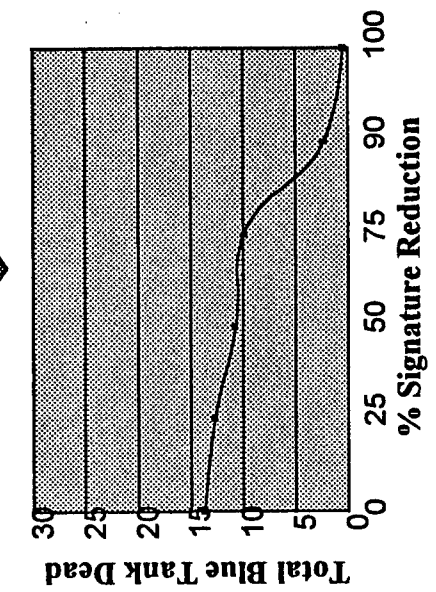
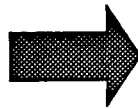
- Southwest Asia
- Meeting Engagement
- 1999 Blue Tank Hvy Brigade vs. 2004 Tank Bde
- Summer Day
- Visibility 10 km



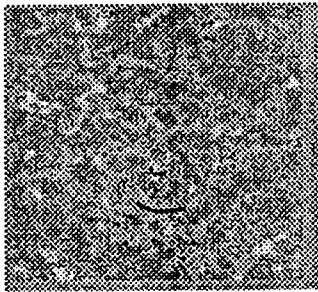
## HRS 31 NEA



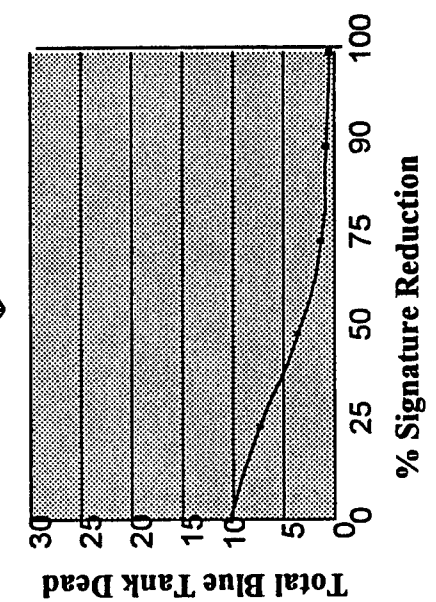
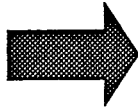
- North East Asia
- Hasty Blue Attack
- 1999 Blue Brigade vs. 2004 Armor Bde
- Winter Day
- Visibility Poor ~2km



## HRS 35 EUR



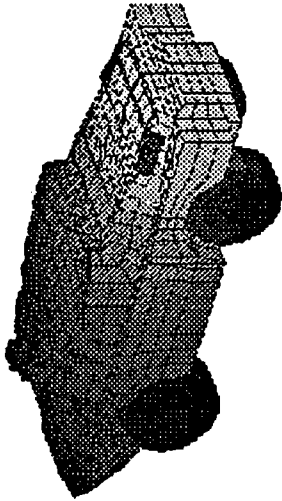
- Central Europe
- Deliberate Defense
- 1999 Blue Balanced Task Force vs. 2004 Tank Regiment
- Summer Day
- Visibility 7 km



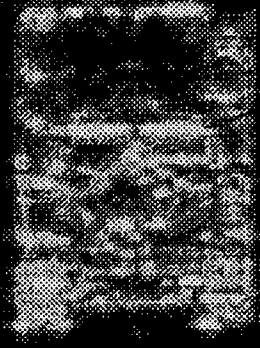


# Signature Management

Signature Modeling & Hardware Design

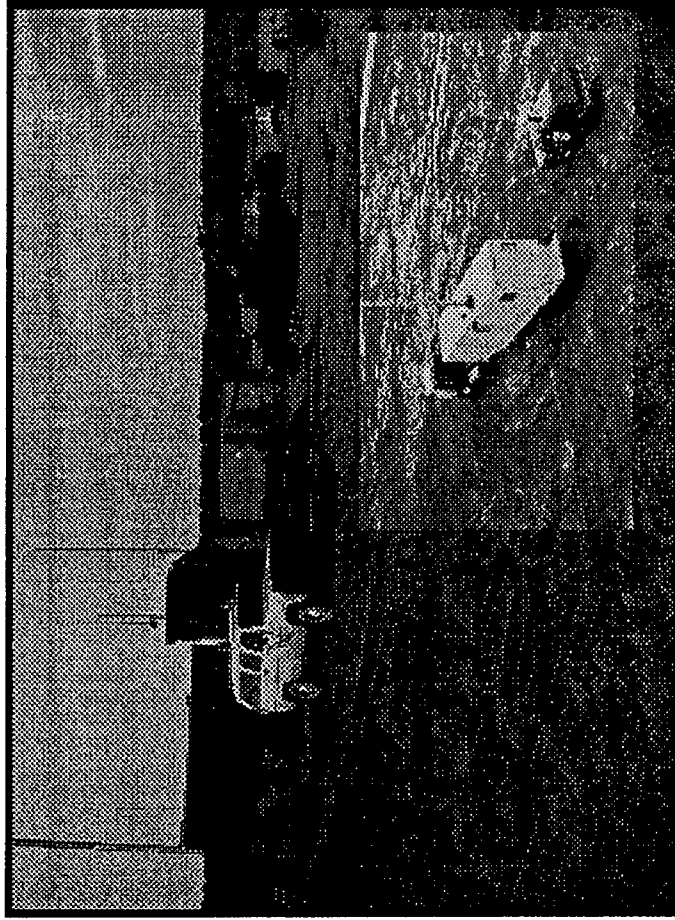


Thermal Predictive Modeling



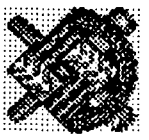
Radar Predictive Modeling

Hardware Performance Testing



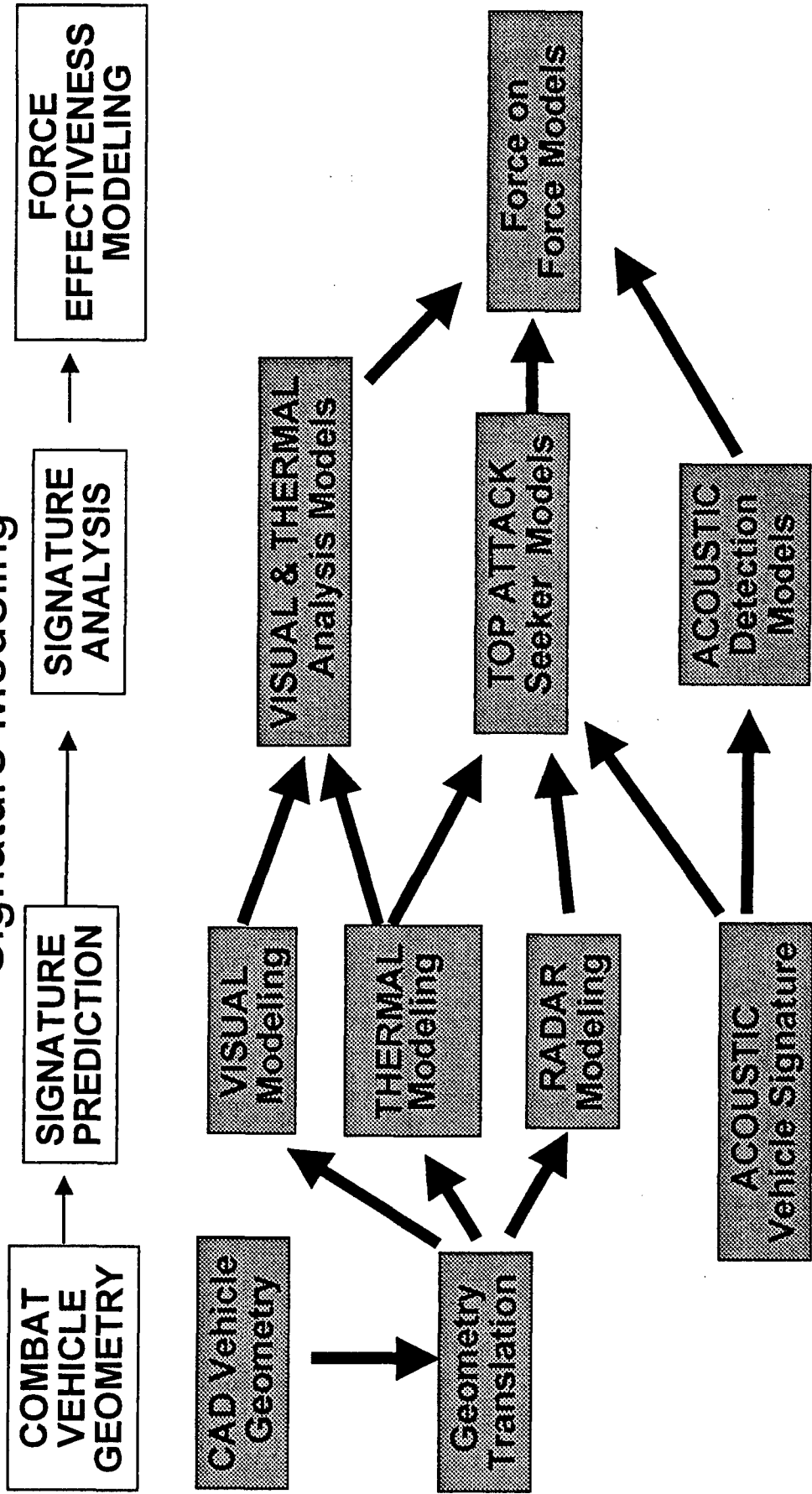
*Committed to Excellence*

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# Signature Management

## Signature Modeling



Committed to Excellence

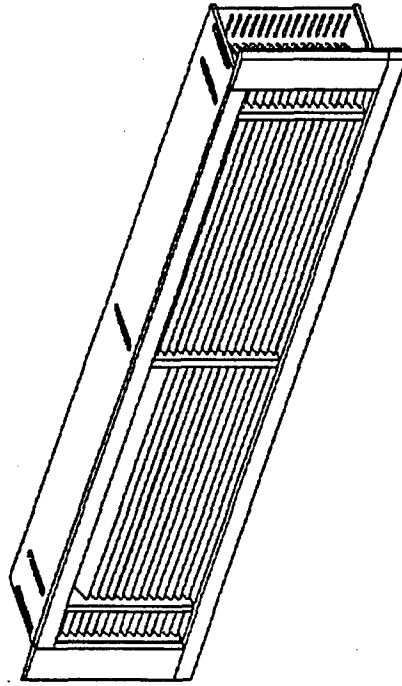




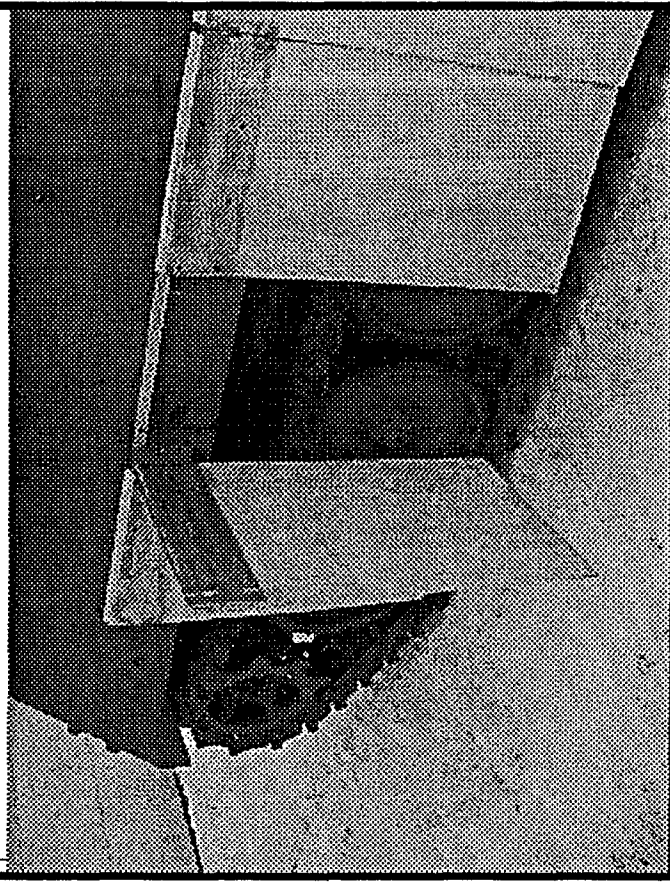
# Signature Management

## Hardware Integration

Ballistic Grilles with Signature  
Suppression

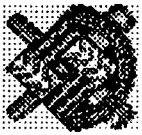


Track Skirt Designs



Committed to Excellence

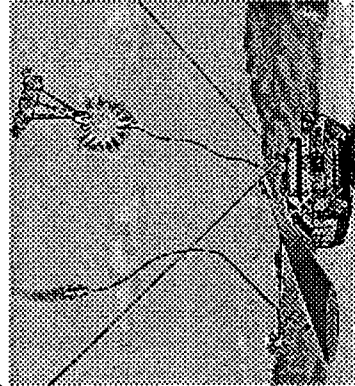
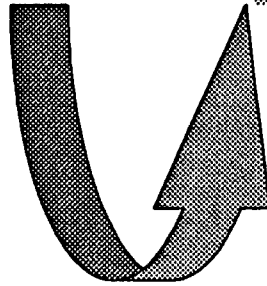
9



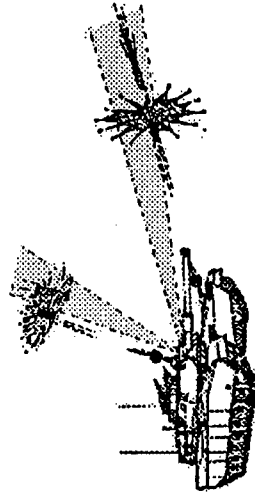
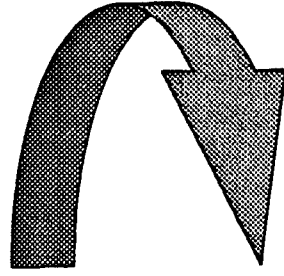
# *Hit Avoidance*

The role of Hit Avoidance is to degrade the performance and hit probability of the threat weapon. It includes both Electronic warfare and Active Protection elements.

## Hit Avoidance



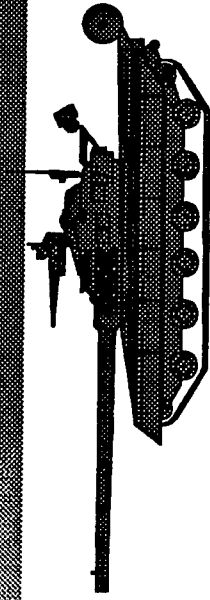
**Electronic Warfare**



**Active Protection**



# Generic Hit Avoidance



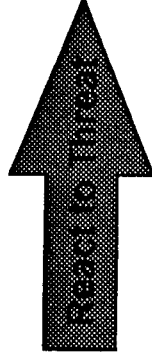
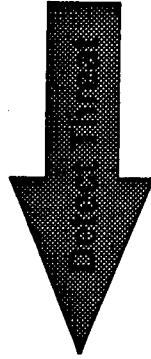
Threat

## Threat Actions

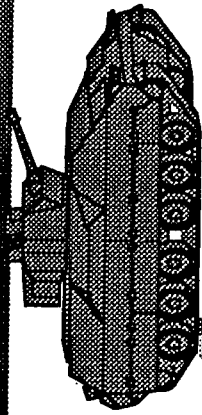
- Aim
- Track
- Fire
- Flyout

## Reactions

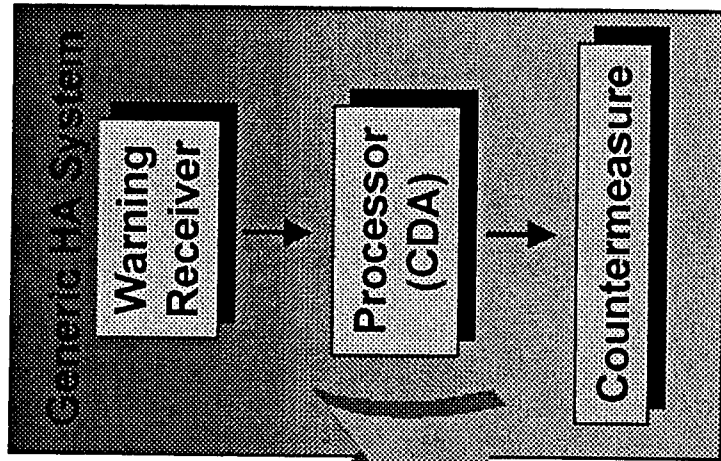
- Spoof
- Counterfire
- Jam
- decoy
- AP CM



**Increase vehicle survivability  
without using armor**



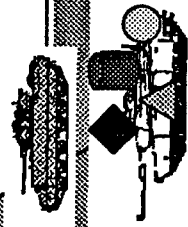
Target



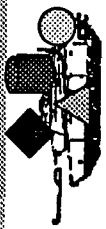
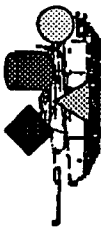
20 M



# Hit Avoidance Continuum



**SELECTED DEFENSE**  
Particular vehicle classes are provided self protection



**POINT DEFENSE**  
Each Vehicle provides its own protection

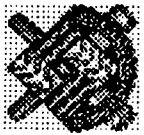


**DISTRIBUTED DEFENSE**  
HA assets are allocated throughout a battle unit to provide protection through communication

**AREA DEFENSE**

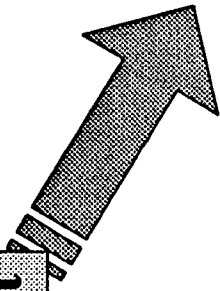
HA assets are allocated to a single vehicle to protect the battle unit

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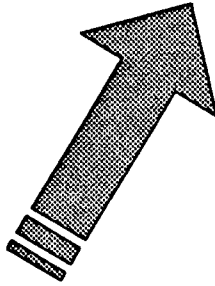
# *Hit Avoidance Study Process*

Threat  
Assessment



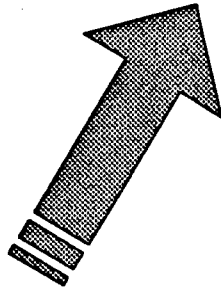
Operational  
Considerations

Combat  
Effectiveness



Cost Analysis

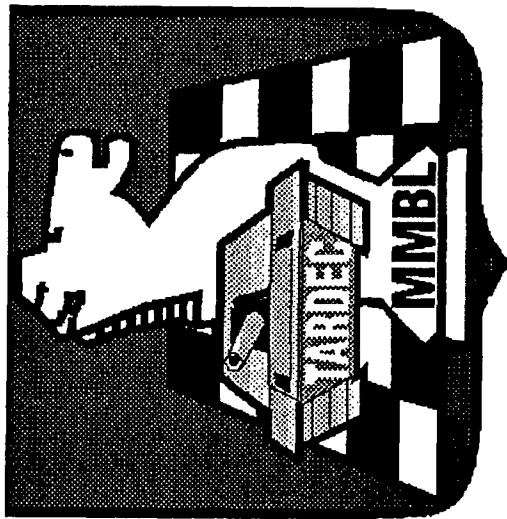
Risk Assessment



Hit Avoidance  
Focused Technologies



# Hit Avoidance Affordability



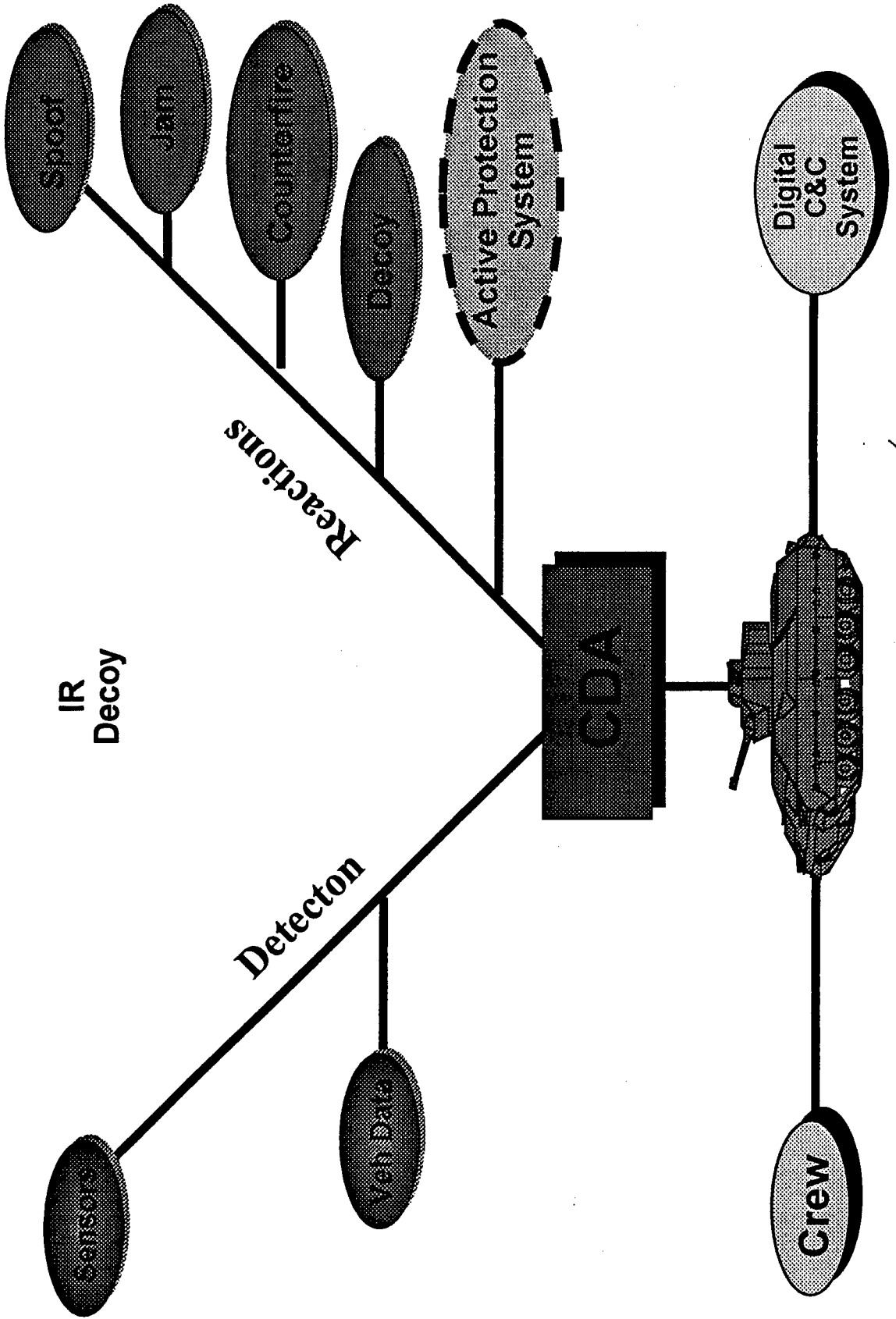
- Combat Worth
- Cost
- Risk



- EW has the potential ~~Focus on Recommendation~~ investment
- AP provides protection at an affordable cost



# The "Full" EW Suite



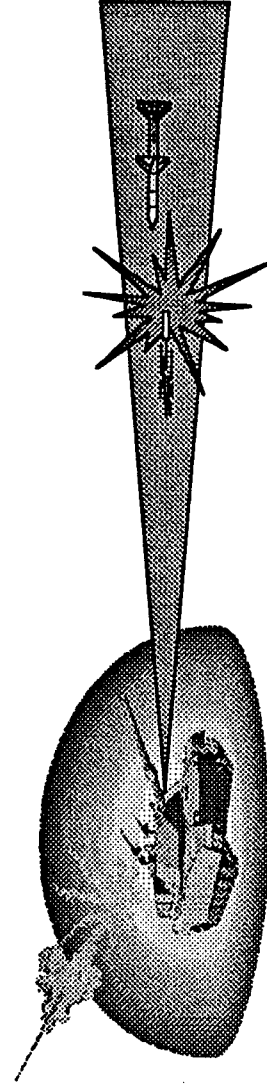
15



# *Hit Avoidance Active Protection Investigation*

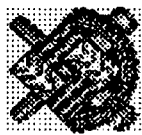
Kill Mechanisms Identified:

- Fuel Air Explosive
- Fragmentation
- Net
- Airbag



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# *Integration Issues*

Affordability  
Optimal Suites  
Cost & Operational Effectiveness

Component Integration  
Field of View/Regard  
Multisensor Correlation  
Vehicle Interface

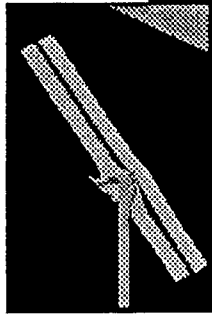
Fratricide / Collateral Damage

Signature / Armor Integration



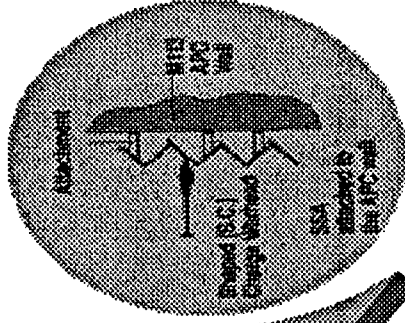
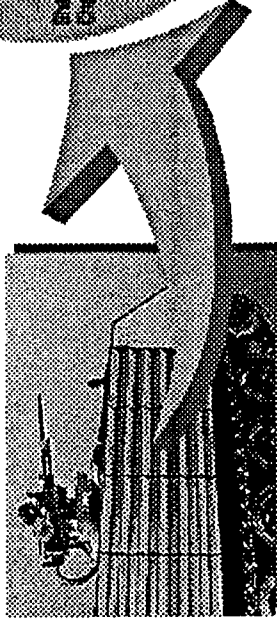
# ARMOR TECHNOLOGIES

## EXPLOSIVE REACTIVE ARMORS



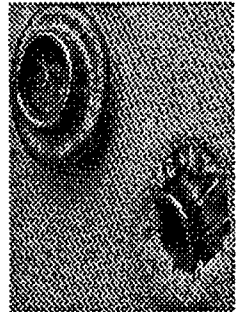
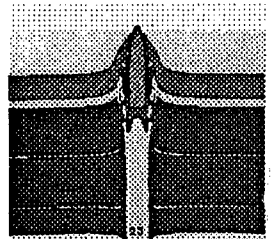
## SPACED ARMORS

- Metal Plates
- Tipping Plates

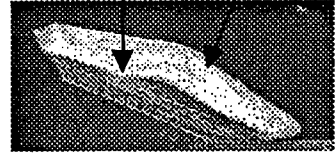


## COMPOSITE ARMORS

- Metal Laminates
- Ceramic/Metal Composites
- Ceramic/Glass RP Composites



## FRAGMENTATION PROTECTION ARMORS

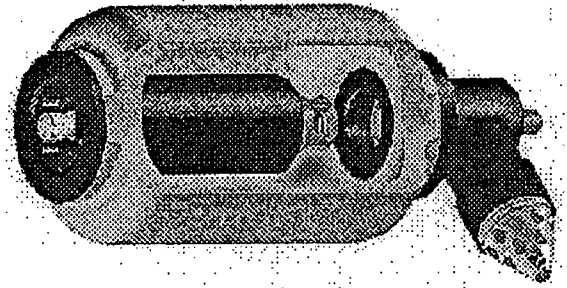
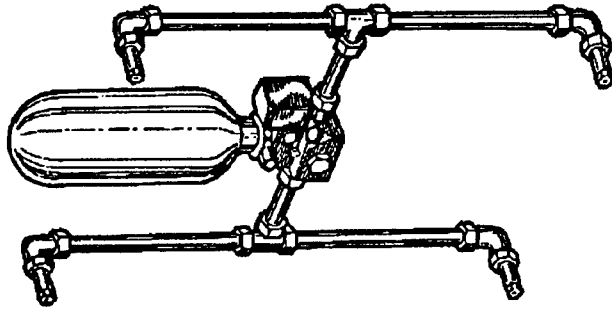


ASTM 44103C Stainless Steel,  
(0.10 inch thick), Rockwell Hardness 50,  
wrapped in 3 layers of lightweight ballistic  
nylon

23 layers Lightweight  
Ballistic Nylon (MIL-C-12369F)



# Damage Reduction/Fire Suppression



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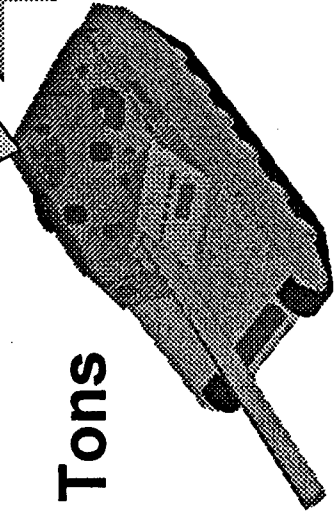
## The Survivability Challenge

*Through the use of these new technologies and integration techniques we can provide survivability to the lighter forces of the 21st century!*

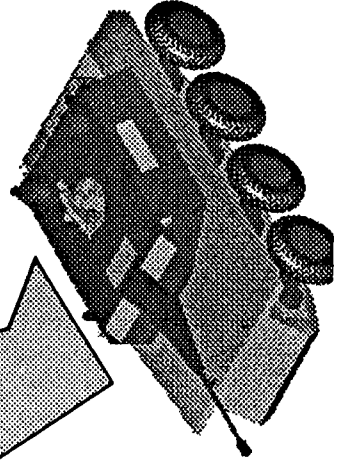
70 Tons



40 Tons



20 Tons



~D

OPSEC REVIEW CERTIFICATION  
(AR 530-1, Operations Security)

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: James L. Thompson GM-15 Associate Director

Name James L. Thompson Grade GM-15 Title Associate Director  
Signature [Signature] Date 7 January 00

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Author/Originator(s): TARDEC (AMSTA-TR-R/263)

Publication/Presentation/Release Date: 14 January 2000

Purpose of Release: Briefing Presentation by Mr. Chapin at GDLS meeting with foreign guests

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

Reviewer's Determination (check one)

- 1. Unclassified Unlimited.
- 2. Unclassified Limited, Dissemination Restrictions IAW \_\_\_\_\_
- 3. Classified. Cannot be released, and requires classification and control at the level of \_\_\_\_\_

Security Office (AMSTA-CM-XS):

Concur/Nonconcur [Signature]  
Signature

11 JAN 00  
Date

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11 JAN 2000  
Date