RDECOM

TARDEC

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

2007 COMBAT VEHICLES CONFERENCE

24 October 2007

Dr. Grace M. Bochenek

Director, U.S. Army Tank Automotive Research, Development and Engineering Center

Agenda

- Theatre Challenges Today
- Our Challenge –
  - Balancing Performance, Protection, Payload
- The Evolving Threat – An Enemy that Adapts & Learns
  - Survivability
  - Condition Based Maintenance
  - Power & Energy
- Preparing for the Next Conflict

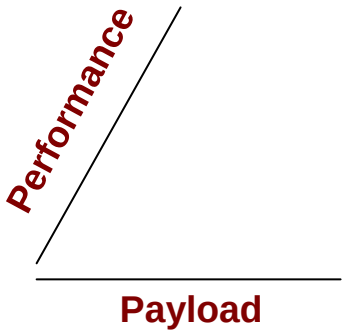
Theatre Challenges Today

- Extreme environmental temperatures lead to excessive engine temperature & fuel consumption
- Excessive weight from Add-on-Armor
- Excessive amounts of sand interfere with system operations
- Excessive speeds over rough terrain
- Lack of scheduled maintenance or incomplete maintenance
- Vehicles absorbing large amounts of ballistic damage
- Excessive vehicle idling based on mission profiles / needs
- Increased vehicle power requirements due to survivability initiatives
- Mission creep on vehicles (e.g., RHINO, Mine roller kits, MRAP MEAP, CROWS, FRAG 5, Reactive Armor Tiles)
- Extended supply distribution system

Back-up - Miles Per Year

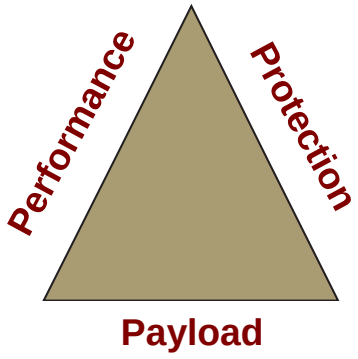
Our Challenge – Balance Performance, Protection, Payload

1 Original TWV Design



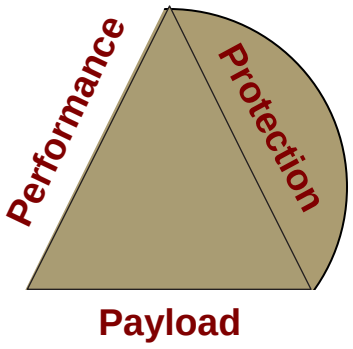
Pre 2000

2 DESIRED TWV Future



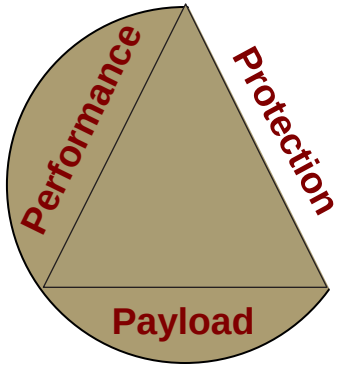
Post 2000

3 Buying Protection



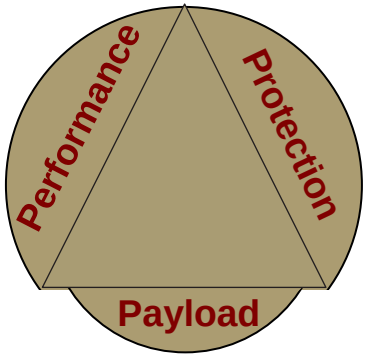
Current HMMWV

4 Buying Performance/Payload



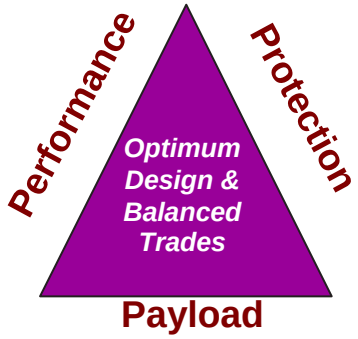
Trades

5 Buying All with Current Tech

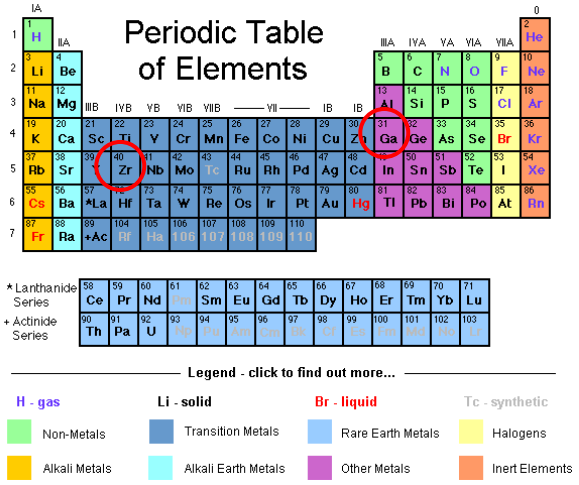


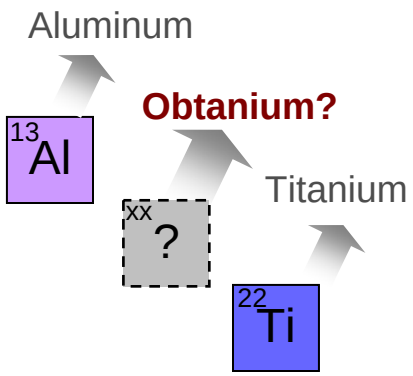
Heavier Vehicle

6 Maintaining the Iron Triangle



JLTV





S&T needs to define/achieve "Obtanium" for light-weight armor that is affordable or an integrated approach

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Our Challenge

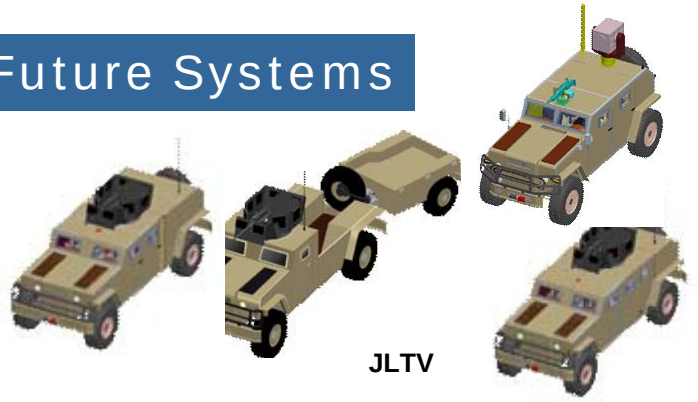
Current Systems

M1114

RG31

MRAP

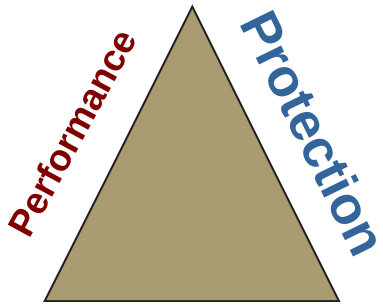
Future Systems



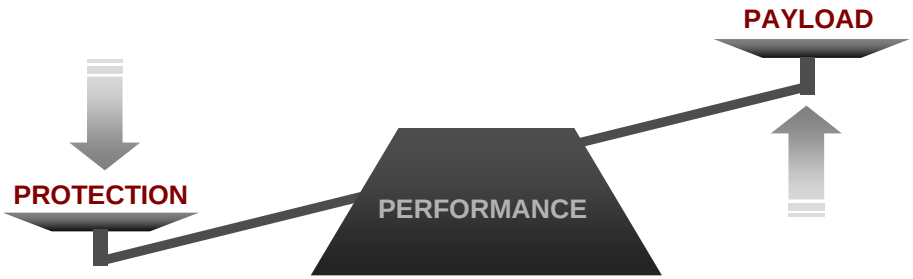
JLTV

FCS MGV

Desired TWV Future



Post 2000



UNBALANCED

What is the next-generation vehicle that allows the same protection but also payload & performance?

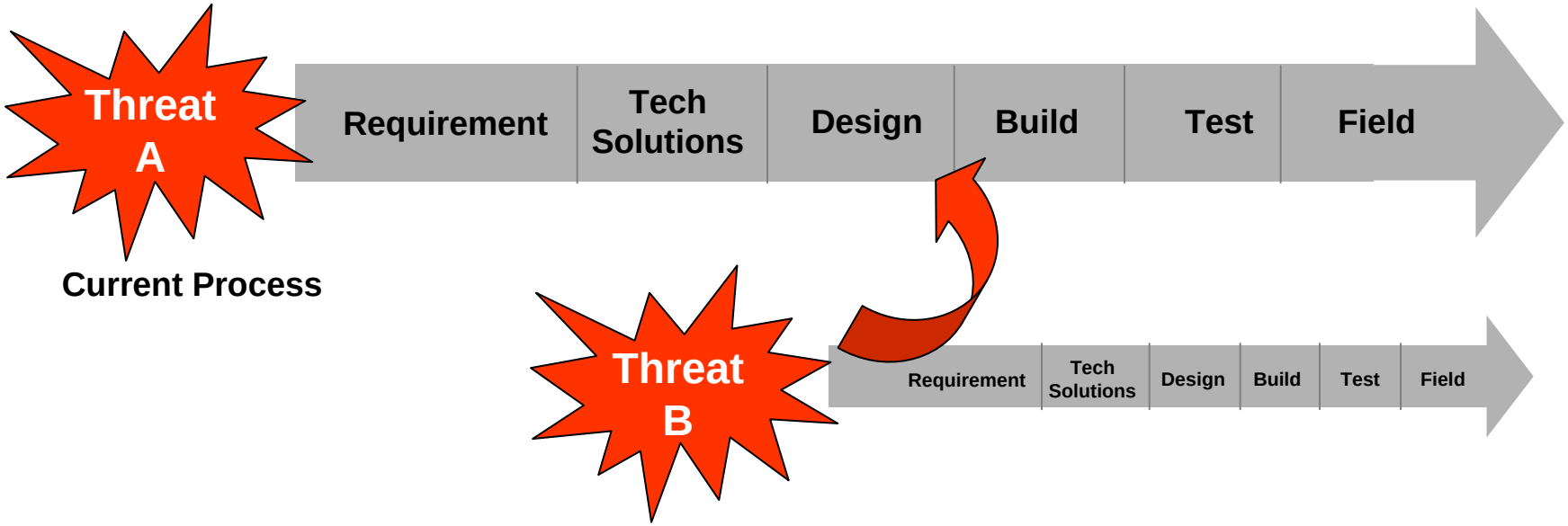
The Evolving Threat – An Enemy that Adapts & Learns

- Asymmetrical Tactics
- Urban/Guerilla Warfare
  - Hide in plain sight
  - Use of hostages
- Insurgent Weaponry
  - Improvised explosive devices
  - Rocket-propelled grenades
  - Blasting caps
  - Small arms
  - Anti-tank weapons
  - Biological and chemical weapons
  - Chlorine
  - Precision weapons
  - Automatic and self-loading rifles
  - Explosively formed projectile

"…Insurgents are always 'seeking to achieve higher levels of effectiveness' and these new tactics are part of the normal 'evolution of sophistication.'"

-- Associated Press

How Do We Keep Ahead



- Threat Rapidly Adapting to Our Technologies
- Use a “Systems Approach” Design
- Investigate New Materials or Develop New TTPs
- Quickly Adapt to Changes in Threat & Leverage Advances and Technology Changes

A Game of Cat and Mouse

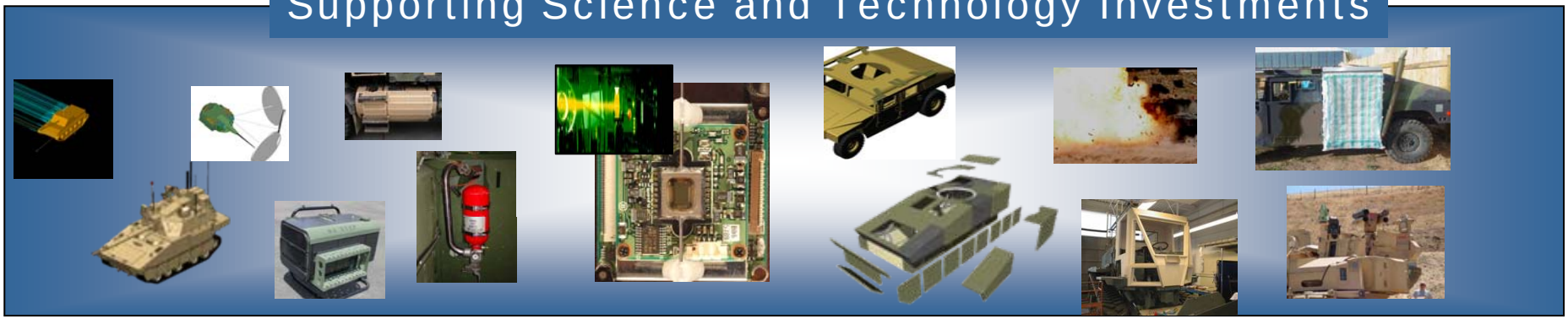
Survivability

Current Systems

Future Systems

- Full spectrum active protection systems countering both close and long range threats
- Lightweight, multifunctional armor for manned *<u>and</u>* unmanned ground platforms (Combat and Tactical)
- Improved and enhanced damage mitigation technologies (*fire suppression, design for survivability, laser*)
- Modular 360 degree day/night vision systems for situational awareness – application of MEMS imagers
- MEMS and Nanosystems for vehicle based sensing of chemicals, explosives and biological agents
- Hand-held transducers for armor health determination
- Functional MRI for diagnosis and of treatment guidance of blast induced traumatic brain injury coupled to vehicle mounted accelerometers

Supporting Science and Technology Investments



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Condition Based Maintenance

Today's Health Management

Future Desired Endstate

- Prognostics – Predictive Maintenance
- Condition Based Maintenance – Fact Based, Trend Analysis
- Vehicle Health Management System – Embedded Diagnostics, Self Reporting, Self Monitoring
- Platform Information – Electronic Technical Manuals, Built in Test / Fault Isolation Test, Vehicle Diagnostic Management System
- Digital Platforms – Digital Architecture / Data Collectors

Power & Energy

Current Systems

400A Alternator
(M1114 Kit)

280A Alternator
(RG-31 Kit)

10kW Rotary JP-8
Auxiliary Power Unit

3.5kW Auxiliary Power
Unit to support
Asymmetric Threat
Defeat JUONS

Future Systems

Diesel Engine Research

MTU 4L 890 Engine

Battery
Improvement

Pulse Power Supply
for High Energy Lasers

Efforts Supporting Current Force

- AGT-1500 Engine Durability
- LMTV Full Load Cooling Challenges
- TWV engines and emissions challenges
- Demand on Systems
- On Board Power Kits for M1114 and RG-31
- APU Upgrades for M-939 and RG-31
- Non-primary Power for PEO GCS Combat Vehicles testing and development
- Non-primary power load profiles

Efforts Supporting Future Force

- High operating temperature power electronics (SiC)
- Compact integrated hybrid power systems for future combat and wheeled vehicles
- Battery Improvements

TRENDS IN OUR BUSINESS

- Moving from serial, phased milestones to addressing full lifecycle, parallel events
- Moving from the age of creating information to the age of leveraging information, data, and expertise ----GLOBALIZATION
- Moving from physical to virtual & collaborative product commerce
- Moving from drawing & document creation to information reuse and management
- Moving from self-solving to collaborative problem solving

Preparing for the Next Conflict

- Better Partnerships to achieve rapid technology evaluation
- What toolsets/expertise can or should we adapt for our use?
- Requires system engineering & analysis to understand the trade space
- Traditional and Non-Traditional Partners
- Rely on Teamwork
- Risk Taking versus Risk Adverse
- Leverage, leverage, leverage

So how do we get there?

YOU, ME and US

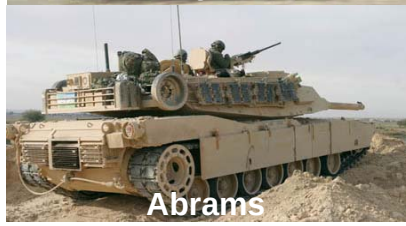
Trends on the Systems – Miles Per Year

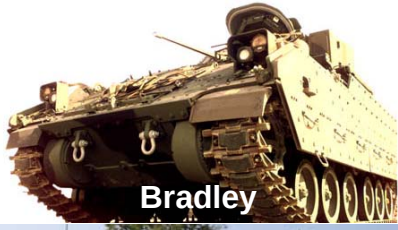
COMBAT SYSTEM			
SYSTEM	PEACETIME ANNUAL OPTEMPO	WARTIME Only ANNUAL OPTEMPO	ANNUAL OIF (Operation Iraqi Freedom) OPTEMPO
M1126 STRYKER ICV	N/A	3406	13308
M1A2 ABRAMS	736	992	3684
M3A3 BRADLEY	786	2486	9924
M113A3 APC	287	411	864
TACTICAL VEHICLES			
M1114 - Up Armored HMMWV	5464	11438	30600
M998 HMMWV	2165	4034	10284
M915A3 Line Haul	6621	10000	21876
M1070 HET	1069	6568	17208
M1075 PLS	1572	5724	3000

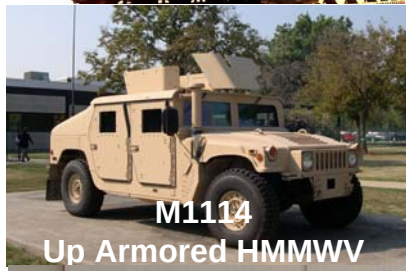
Source of Data - Army OSMIS and AMSAA SDC Reports on Part Replacement in OIF.

Peacetime Data reflects 2002 timeframe and Wartime Data reflects 2005 timeframe. SDC Data is based on data being collected in theater from 2004 to August 2006 timeframe.


Stryker


Abrams


Bradley


M1114 Up Armored HMMWV


M915