



## 2008 Combat Vehicles Conference

*“Urgent Need Today For Tomorrow’s Capabilities”*

Dearborn, MI

20-22 October 2008

### Agenda

**Tuesday, 21 October 2008**

### WELCOME TO DETROIT REMARKS

Mr. John “Jack” Dugan, Deputy Commander, TACOM LCMC

### KEYNOTE ADDRESS

LTG Michael A. Vane, USA, Director, Army Capabilities Integration Center United States Army Training and Doctrine Command

### PANEL DISCUSSION: *“Future Combat Systems (FCS)”*

#### Panelists:

- Manned Ground Vehicle Overview, COL Bryan McVeigh, Project Manager, Future Combat Systems (BCT)
- Manned Ground Vehicles Non-Line of Sight Cannon Overview, LTC Robert (Bob) Hannah, Project Manager, Future Combat Systems (BCT)
- Mounted Combat Systems Unmanned Ground Vehicles Overview, LTC Winfield Keller, Project Manager, Future Force Unmanned Aircraft Systems

### GENERAL SESSION - *“Urgent Need Today For Tomorrow’s Capabilities”*

BG Michael M. Brogan, USMC Commander, Marine Corps Systems Command

### PANEL DISCUSSION: *“PEO & PM Land Systems Command”*

Moderator: Dr. Robert Lusardi Deputy Program Manager Light Armored Vehicles, U.S. Army TACOM

#### Panelists:

- Test & Evaluation, Expeditionary Fighting Vehicle (EFV) Program, Lt Col Daryl Crane, USMC Deputy Director, Test & Evaluation, PM Advanced Assault Amphibian

### PANEL DISCUSSION: *“PEO & PM Ground Combat Systems”*

Moderator: Mr. Michael Viggato, Deputy PEO, Ground Combat Systems

#### Panelists:

- Heavy Brigade Combat Team, COL Paul R. Lepine, PM HBCT
- PM Mine Resistant Ambush Protection (MRAP) Stryker Brigade Combat Team, Col. Robert Schumitz, PM SBCT
- Lightweight 155 MM Howitzer, Mr. Michael Viggato, Deputy PEO, Ground Combat Systems
- Modular Brigade Enhancements Ground Combat Support (GCS), Readiness & Sustainment (R&S), Mr. Kenneth Kish

**Wednesday, 22 October 2008**

### R&D/FUTURE PROGRAMS

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

**WAR PANEL: “Operation Iraqi Freedom”**

- Bradley Battalion Commander, Captain Brian Gilbert
- MRAP EOD Company Commander, Captain James Kelley
- Former Stryker Company Commander, Captain Damian M. Gill
- Marine with light Combat Experience, Major Innes Quiroz

# 2008 COMBAT VEHICLES CONFERENCE

**“URGENT NEED TODAY  
FOR TOMORROW’S CAPABILITIES”**

## HIGHLIGHTS TO INCLUDE:

- ▶ Future Combat Systems (FCS)
- ▶ PEO & PM Land Systems, USMC
- ▶ PEO & PM Ground Combat Systems
- ▶ R&D/Future Programs
- ▶ War Panel  
“Operation Iraqi Freedom”



OCTOBER 20-22, 2008  
[WWW.NDIA.ORG/MEETINGS/9620](http://WWW.NDIA.ORG/MEETINGS/9620)

HYATT REGENCY DEARBORN

▶ DEARBORN, MICHIGAN

EVENT #9620

MONDAY, OCTOBER 20, 2008

3:00 PM - 6:30 PM

**Registration Open**

5:00 PM - 6:30 PM

**Welcome Reception**

*drinks and light hors d'oeuvres provided*

TUESDAY, OCTOBER 21, 2008

7:15 AM - 7:00 PM

**Registration Open**

7:15 AM - 8:15 AM

**Continental Breakfast**

*provided*

8:15 AM - 11:30 AM

**General Session I**

*Session Chair:*

*LTG John S. Caldwell, USA (Ret)*

*Parametric Technologies*

*The Spectrum Group*

*Chairman, Combat Vehicles Division, NDIA*

9:30 AM - 9:50 AM

**Morning Break**

*provided*

11:30 AM - 12:30 PM

**Lunch**

*provided*

MONDAY, OCTOBER 20, 2008

3:00 PM - 6:30 PM

**REGISTRATION OPEN**

5:00 PM - 6:30 PM

**WELCOME RECEPTION**

TUESDAY, OCTOBER 21, 2008

7:15 PM - 7:00 PM

**REGISTRATION OPEN**

7:15 AM - 8:15 AM

**CONTINENTAL BREAKFAST**

8:15 AM - 11:30 AM

**GENERAL SESSION - SESSION I**

**“Urgent Need Today For Tomorrow’s Capabilities”**

*Session Chair: LTG John S. Caldwell, USA (Ret)*

*Parametric Technologies Corporation*

*The Spectrum Group*

*Chairman, Combat Vehicles Division, NDIA*

8:15 AM

**ADMINISTRATIVE REMARKS**

► **LTG John S. Caldwell, USA (Ret)**

*Parametric Technologies Corporation*

*The Spectrum Group*

*Chairman, Combat Vehicles Division, NDIA*

8:25 AM

**WELCOME TO DETROIT REMARKS**

► **Mr. John “Jack” Dugan**

*Deputy Commander, TACOM LCMC*

8:45 AM

**KEYNOTE ADDRESS**

► **LTG Michael A. Vane, USA**

*Director, Army Capabilities Integration Center, United States Army Training and Doctrine Command*

9:30 AM - 9:50 AM

**MORNING BREAK**

9:50 AM

**ACQUISITION KEYNOTE ADDRESS**

► **BG Anthony J. Tata, USA**

*Deputy Director, JIEDDO*

10:30 AM

**PANEL DISCUSSION**

*“Future Combat Systems (FCS)”*

**Moderator:** **BG R. David Ogg, Jr., USA**

*Deputy Program Manager, Future Combat Systems (BCT), Platforms*

**Panelists:**

► **Manned Ground Vehicle Overview**

**COL Bryan McVeigh, USA**

*Project Manager, Future Combat Systems (BCT), Manned Ground Vehicles*

► **Non-Line of Sight Cannon Overview**

**LTC Robert (Bob) Hannah, USA**

*Project Manager, Future Combat Systems (BCT), Mounted Combat Systems*

► **Unmanned Ground Vehicles Overview**

**LTC Winfield Keller, USA**

*Project Manager, Future Force Unmanned Aircraft Systems*

11:30 AM - 12:30 PM

**LUNCH**

## TUESDAY, OCTOBER 21, 2008

12:30 PM - 5:30 PM

### GENERAL SESSION - SESSION II

“Urgent Need Today For Tomorrow’s Capabilities”

*Session Chair: Mr. Roy Perkins  
BAE Systems*

- BG Michael M. Brogan, USMC  
*Commander, Marine Corps Systems Command*

1:00 PM

### PANEL DISCUSSION

“PEO & PM Land Systems Command”

**Moderator:** Dr. Robert Lusardi  
*Deputy Program Manager Light Armored Vehicles, U.S. Army TACOM*

#### Panelists:

- **Test & Evaluation, Expeditionary Fighting Vehicle (EFV) Program**  
LtCol Daryl Crane, USMC  
*Deputy Director, Test & Evaluation, PM Advanced Assault Amphibian*
- **Assault Amphibious Vehicles**  
Mr. Bryan Prosser  
*Program Manager, Assault Amphibious Vehicles*
- **Tank Systems**  
Mr. Philip Patch  
*Program Manager, Tank Systems*

2:30 PM - 3:00 PM

### AFTERNOON BREAK

3:00 PM

### PANEL DISCUSSION

“PEO & PM Ground Combat Systems”

**Moderator:** Mr. Michael Viggato  
*Deputy PEO, Ground Combat Systems*

#### Panelists:

- **Heavy Brigade Combat Team**  
COL Paul Lepine, USA,  
*PM HBCT*
- **Stryker Brigade Combat Team**  
COL Robert Schumitz, USA  
*PM SBCT*
- **Lightweight 155 MM Howitzer**  
Mr. Michael Viggato  
*Deputy PEO, Ground Combat Systems*
- **PM Robotics**  
Mr. Jeffrey Jaczkowski  
*RS JPO*
- **Ground Combat Support (GCS), Readiness & Sustainment (R&S)**  
Mr. Kenneth Kish  
*GCS R&S*

4:30 PM - 6:00 PM

### ANNUAL CONFERENCE RECEPTION

## TUESDAY, OCTOBER 21, 2008

*Continued*

12:30 PM - 5:30 PM

### General Session II

*Session Chair:  
Mr. Roy Perkins  
BAE Systems*

2:30 PM - 3:00 PM

### Afternoon Break

*provided*

4:00 PM

### Adjourn for the Day

4:30 PM - 6:00 PM

### Annual Conference Reception

*drinks and light hors d'oeuvres provided*

## COMBAT VEHICLES DIVISION INFORMATION

### Chairman

LTG John S. Caldwell, USA (Ret)  
Parametric Technologies Corporation  
The Spectrum Group

### Steering Committee

Col Reed T. Bolick, USMC (Ret)  
Cypress International

Mr. James R. Williams  
General Dynamics

Mr. Roy Perkins  
BAE Systems

Mr. Chuck Prikopa  
BAE Systems

Mr. John Whitehead  
Omega Training

### Government Liason Representative

Ms. Kimberly Maples  
TACOM

## 2008 COMBAT VEHICLES CONFERENCE CONFERENCE AGENDA

WEDNESDAY, OCTOBER 22, 2008

7:00 AM - 12:15 AM

**Registration Open**

7:00 AM - 8:00 AM

**Continental Breakfast**

*provided*

8:00 AM

**Administrative Remarks**

9:00 AM - 12:15 PM

**General Session III**

*Session Chair:*

*Mr. Chuck Prikopa*

*BAE Systems*

10:30 AM - 11:00 AM

**Morning Break**

*provided*

12:15 PM

**Conference Adjourns**

## COMBAT VEHICLES DIVISION

The primary objective of the Combat Vehicles Division of NDIA's is to enhance the security of the United State by promoting communications and interaction between defense industry, government, and military in the area of combat vehicles activities.

WEDNESDAY, OCTOBER 22, 2008

7:00 AM - 12:15 AM

7:00 AM - 8:00 AM

8:00 AM - 12:15 AM

8:00 AM

8:10 AM

9:00 AM

10:30 AM - 11:00 AM

11:00 AM

12:00 PM

12:15 PM

**REGISTRATION OPEN**

**CONTINENTAL BREAKFAST**

**GENERAL SESSION - SESSION III:**

**"Introducing Future Capabilities into Today's Fighting Forces"**

*Session Chair: Mr. Chuck Prikopa*

*BAE Systems*

**ADMINISTRATIVE REMARKS**

► Mr. Chuck Prikopa

*BAE Systems*

**R&D/FUTURE PROGRAMS**

► Dr. Grace Bochenek

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

**WAR PANEL**

*"Operation Iraqi Freedom"*

**Moderator :** MG Julian Burns, USA (Ret)

*Vice President Business Development, BAE Systems*

**Panelists:**

► LTC David Lesperance, USA

*Battalion Commander, 1st 8th Cavalry, 1st Cavalry Division*

► CSM Robert French, USA

*Battalion Command Sergeant Major, 1st 8th Cavalry, 1st Cavalry Division*

► Major Innes Quiroz, USMC

*Light Armored Vehicle Commander, Marine Corps Systems Command*

► CPT James Kelly, USA

*Assistant TRADOC Capability Manager-Infantry Brigade Combat Team*

**MORNING BREAK**

**GREYBEARD PERSPECTIVE**

► GEN Paul Kern, USA (Ret)

*President, AM General*

**CLOSING REMARKS**

► LTG John S. Caldwell, USA (Ret)

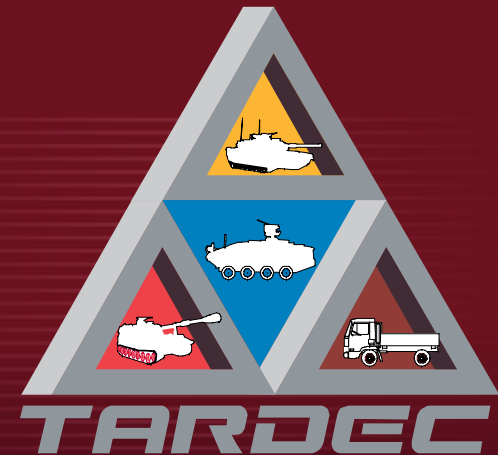
*Parametric Technologies Corporation*

*The Spectrum Group*

*Chairman, Combat Vehicles Division, NDIA*

**CONFERENCE ADJOURNS**





***TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.***

## Emerging Technologies For the Future Fight

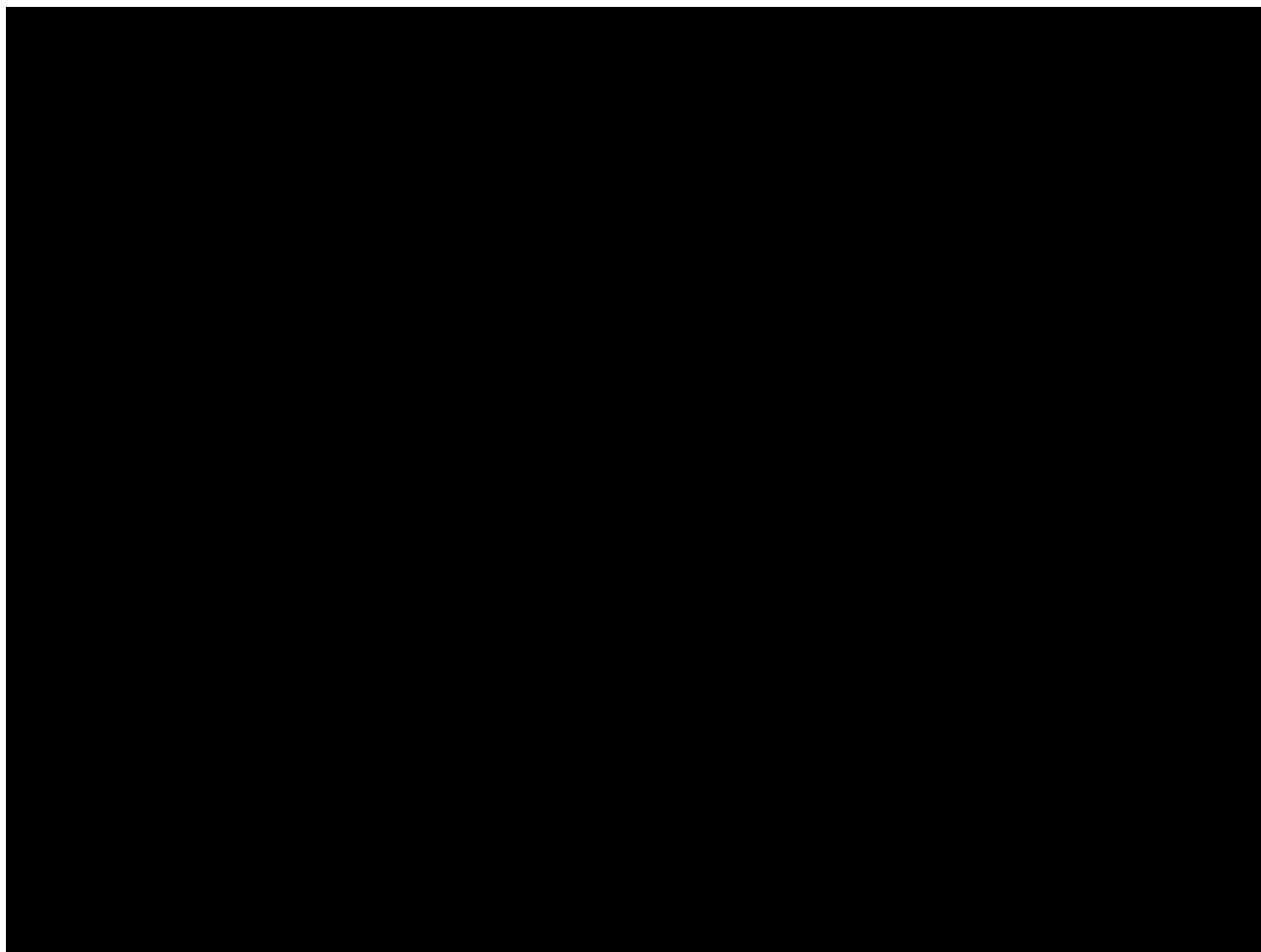
Grace M. Bochenek, Ph.D.

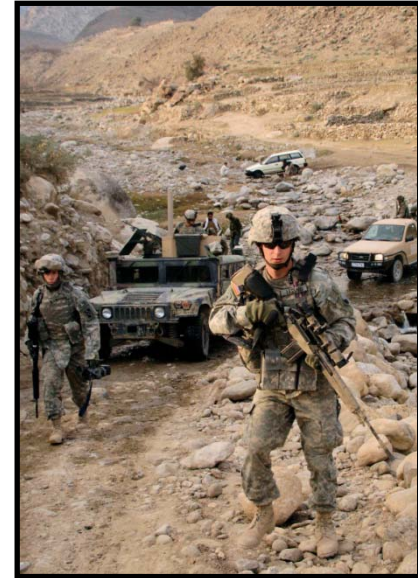
Director, U.S. Army Tank Automotive Research, Development and Engineering Center



- The Current Fight
- Building for the Future Fight *NOW*
  - **Power & Energy**
  - **Robotics**
- Partnering with the Nation's Best
- Building the Future Workforce









- **Increase force protection**
  - Fewer fuel convoys means fewer people and systems in harm's way
- **Increase sustainability**
  - Operate for longer / go farther without resupply
  - Reduce O&S costs
  - Crude oil closed at \$96.37/Bbl on 11-7-07; DoD standard (refined) price is additional \$25/Bbl
  - Free up manpower and equipment
- **Reduce Dependency on foreign oil**
  - Reduce revenue flow to unfriendly / unstable nations



**“For too long our nation has been dependent on foreign oil...and the way forward is through technology.”**

*President George W. Bush, State of the Union Address, 23 January 2007*

**“We’ve also got to address the challenges of energy security and global climate change. We need to harness the power of technology**

*President George W. Bush, Speech at the Asia-Pacific Economic Cooperation Business Summit, 7 August 2007*



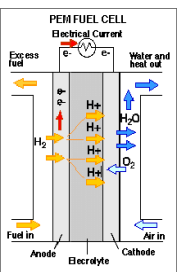
**“Reducing the military's dependence on fuel for power generation could reduce the number of road-bound convoys.”**

*U.S. Marine Corps Maj. Gen. Richard Zilmer, Defense News, August 2006*



## Supply Security

## Demand Reduction



### Supply

- Conventional fossil fuels
- Synthetic fuels (e.g. coal, natural gas derived fuels)
- Other alternative fuels (e.g. renewable jet and diesel, biomass, alcohols, hydrogen, etc.)
- Renewables (e.g. solar, geothermal, wind, wave/ocean)
- Novel supply (e.g. fuel cells)
- Nuclear
- Exotics (e.g. isomers)
- Local electrical grid

### Demand

- Conservation Initiatives
- Fixed base
- Tactical base
- Platforms
- Efficiency
- Life-Cycle Cost



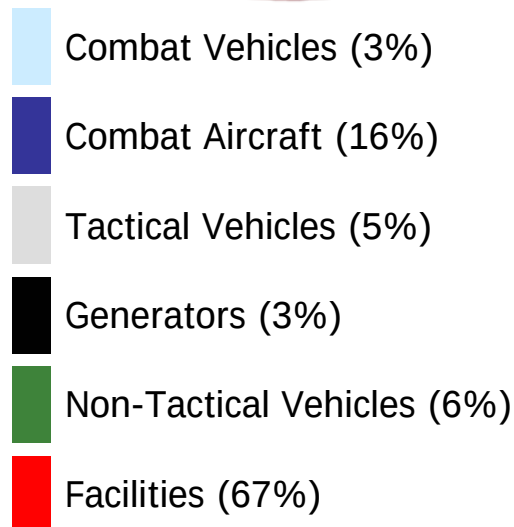
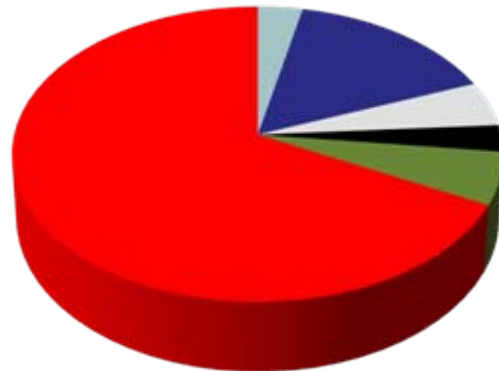
- Direct oil / fossil fuel costs
- Policy, processes and risk assessment
- Refining capacity
- Energy availability
- Doctrine

### Assured Distribution

Convergence for Energy Security

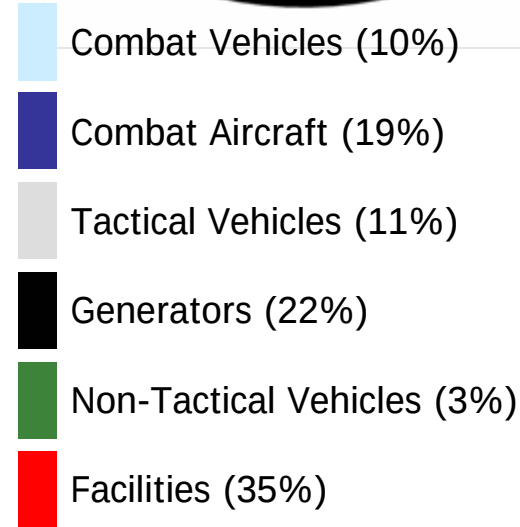
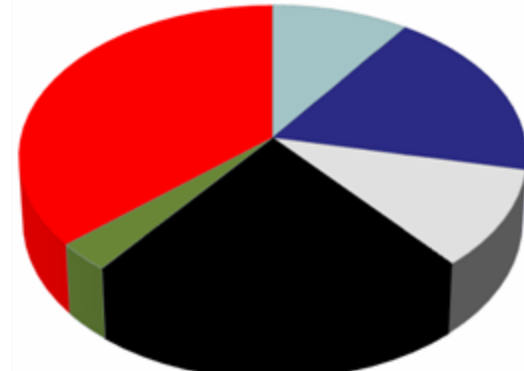
## Peacetime Consumption (DSB Report)

112.4 Trillion Btu



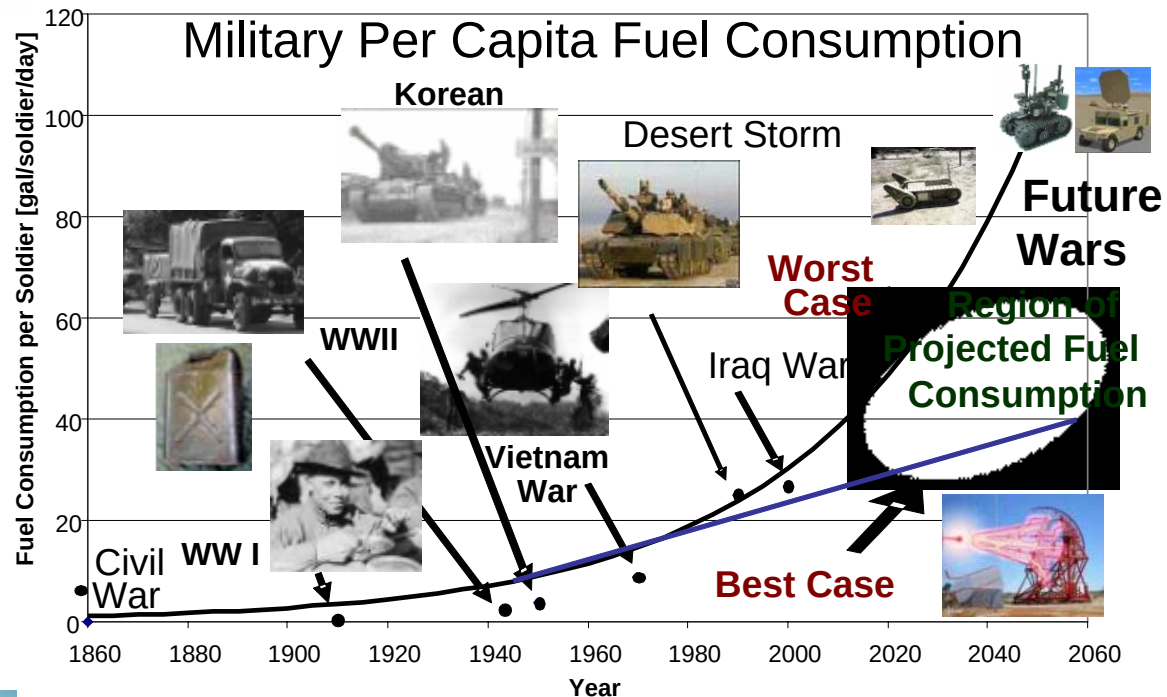
## Wartime Consumption (DSB Report)

206.6 Trillion Btu



## The Challenges

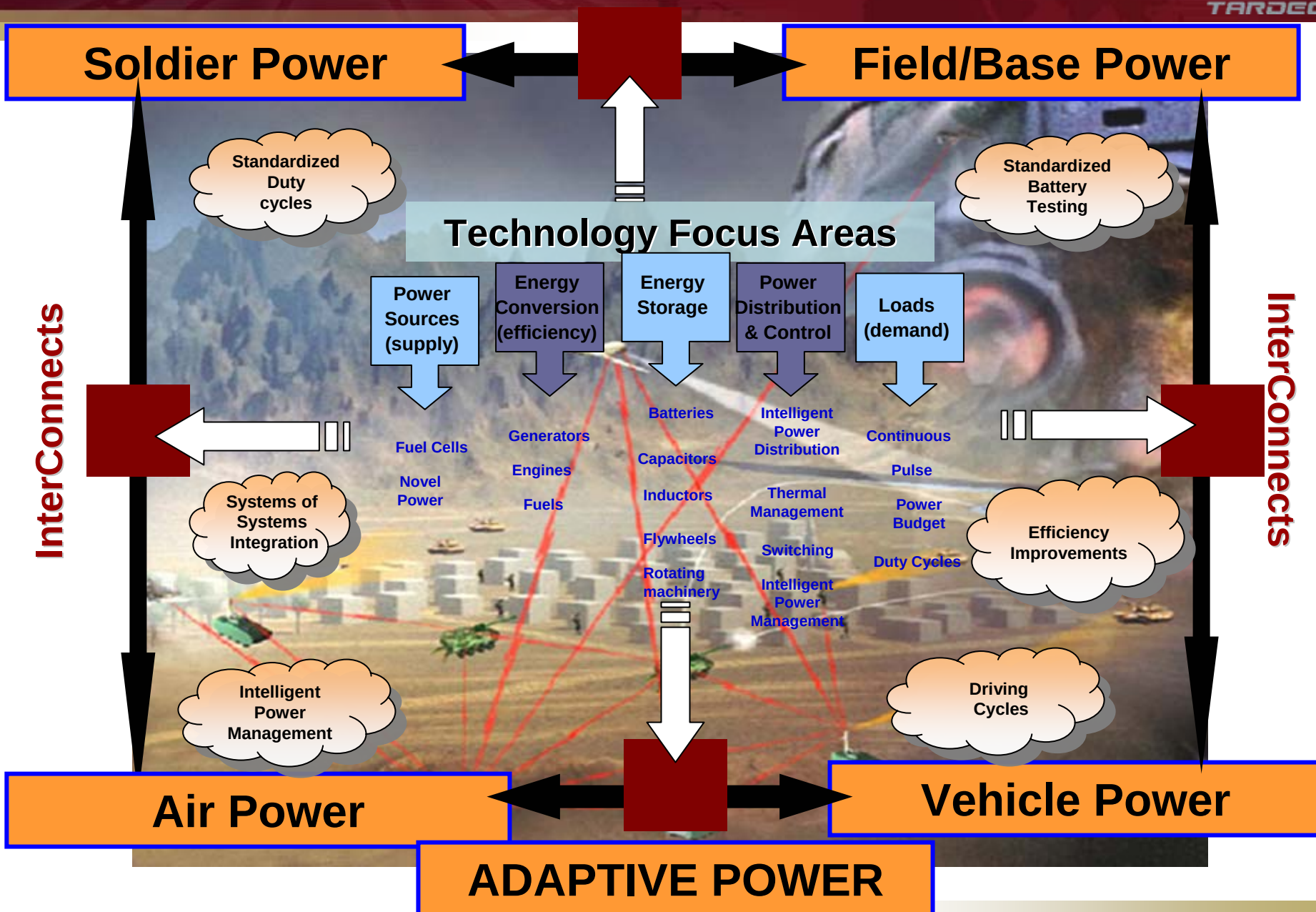
- Battlefield consumption of energy increasing
- Energy security problematic
- Operational issues
- Increased emphasis on system power metrics



**Discarded Batteries  
(90% Still Usable)**



**The HMMWV has progressed from a 85  
amp alternator to a 400 amp alternator**



## Generation

## Distribution

## Transfer

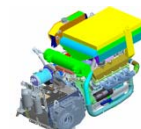
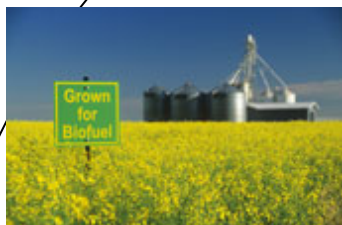
## Vehicle

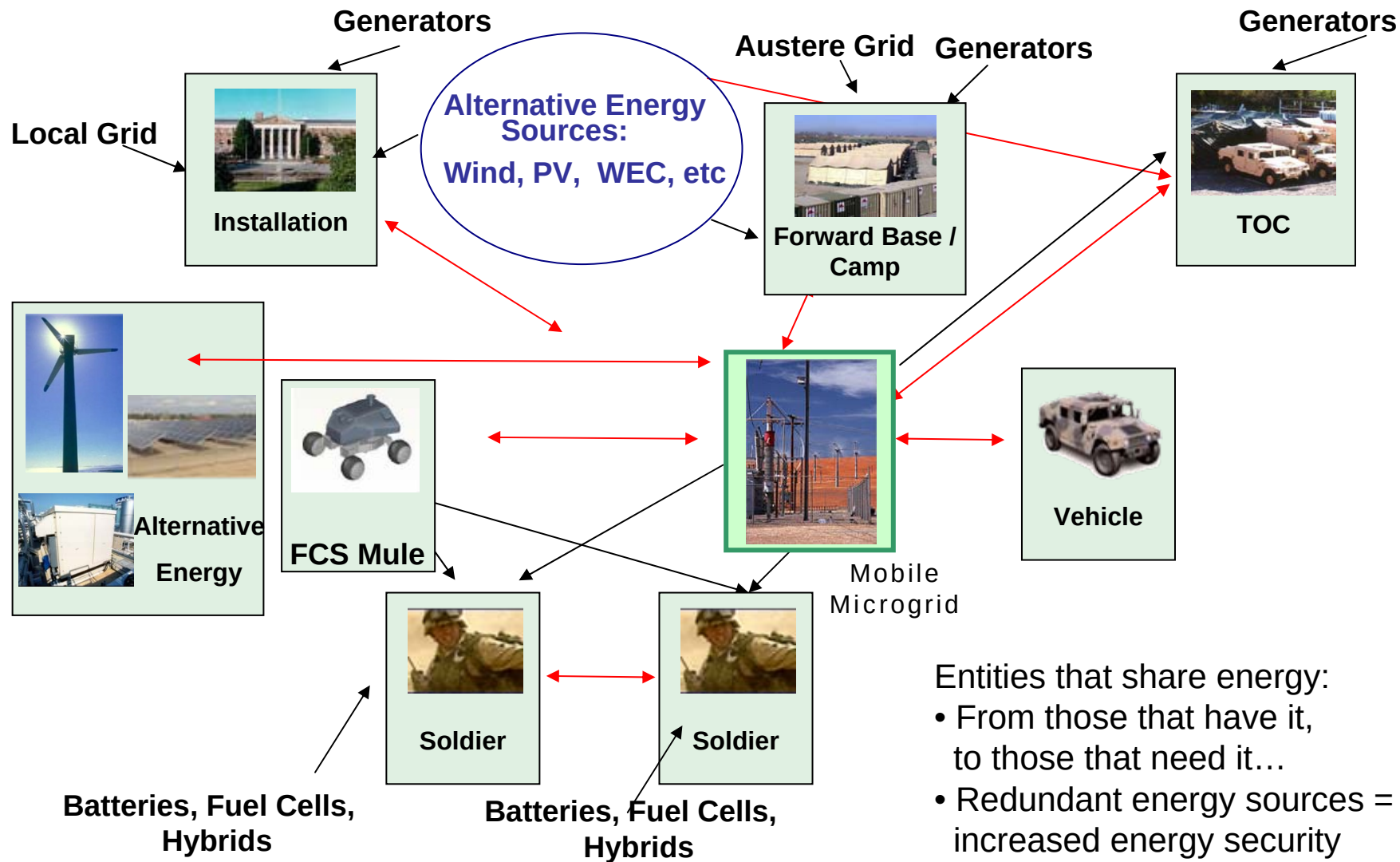
### Power & Thermal Management

### Energy Storage

### Non-primary Power

### Prime Power





Improving energy capability through holistic power sharing - you're in the fight...!

## COMPONENTS

### Component Elements



DC/DC Converters



Batteries

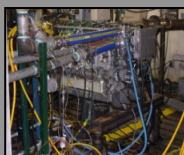


Motors

### Subsystem Elements



Engines



Engine Generator

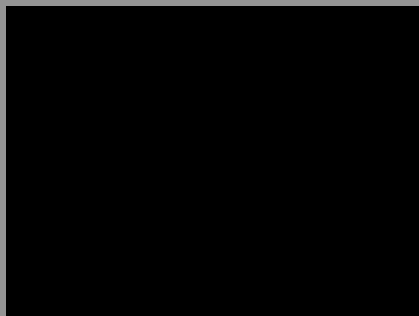
### High Temperature Electronics



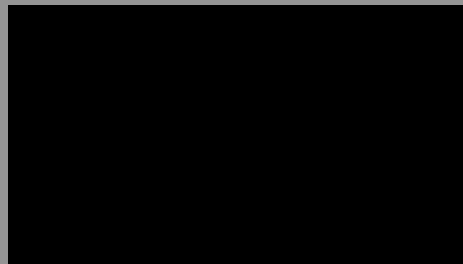
High Temperature Power Electronics

## SYSTEM INTEGRATION

Engine  
Generator  
Test Lab  
(EGTL)  
Warren, MI



Power &  
Energy SIL  
Santa Clara,  
CA



## FCS NLOS-C

### Design Benefits

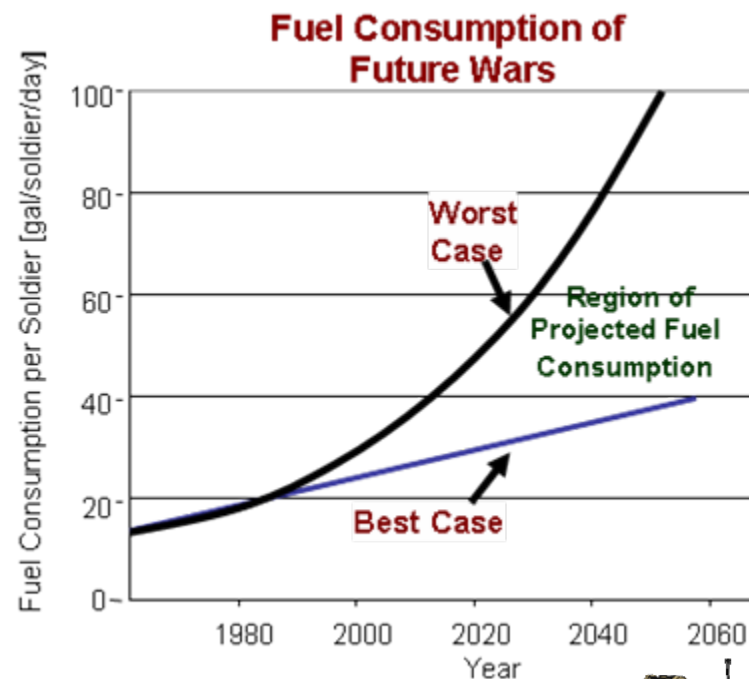
- No Mechanical Link
- No Drive Shaft
- Design Flexibility
- Improved Maintainability
- Lower Silhouette



Benefits of Hybrid  
Propulsion to the Soldier

Realizing the Vision for a Hybrid-Electric Combat Vehicle

- **Silent Watch/Mobility**
- **Improved energy efficiency**
- **Fuel economy and emissions reduction**
  - Reduced logistics burdens
  - Regenerative braking / energy recovery
- **Enhance functionality, flexibility, power quality, and management of on-board power**
  - Net-centric warfare and C4ISR
  - Extra power to handle peak electronic loads
  - Pulse power and directed energy weapons
- **Improved export-power capabilities**



## Current Systems

### Current Technology

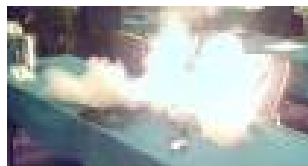


Advanced Lead-Acid

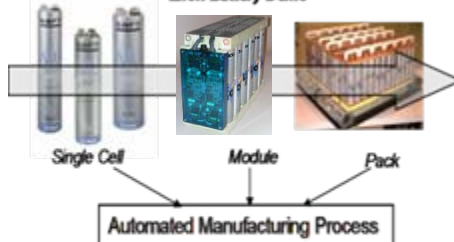


Capacitors for EMA

### Testing



Li-Ion Battery Demo

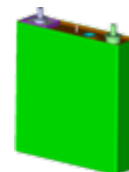


### Efforts Supporting Current Force

- Battery Monitoring Technology development & testing
- Advanced Lead acid battery testing & qualification
- Advanced Lead Acid Battery Technology Enhancement
- *Battery Ballistic Impact Test & Evaluation*
- Battery Pack Integration, Testing & Evaluation

## Future Systems

### Improvements



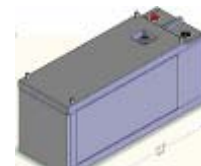
Li-Ion Prismatic Cell



L-i-Ion Battery Module (50V)



NiZn Cell



Li-Ion / Ultracap Hybrid Energy Storage



LFP cathode

### Efforts Supporting Future Force

- *High Power High Energy Li-Ion Battery Manufacturing*
- Large format Li-Ion prismatic cells with integrated liquid cooling development
- Lithium-Iron Phosphate Battery Safety Improvements
- Ultra High Power Li-Ion Cells for *Pulse Power*
- *Thermal Runaway Studies*
- Battery Pack Integration, Testing & Evaluation
- Nickel Zinc Battery Development

**Advanced Batteries are the foundation for hybrid vehicles and technologies**

## Alternative Fuels Program



### *Fuel Evaluations*

- Chemical composition
- Physical properties
- Fuel system impacts



### *System Evaluations*

- Fuel-system interactions
- System performance and durability
- Fuel specification inputs
- Suitability of fuel for use in Army equipment



### *Engine Evaluations*

- Fuel ignitability
- Fuel combustion
- Performance / durability

## Domestic Manufacturing Capability



## Dual use Applications



## Alternative Fuel Vehicles & Infrastructure



### *SANGB Hydrogen Filling Station*



## Advanced Mobile Microgrid



## Advanced automotive batteries - Enabler of alternative energy



Cells



Modules



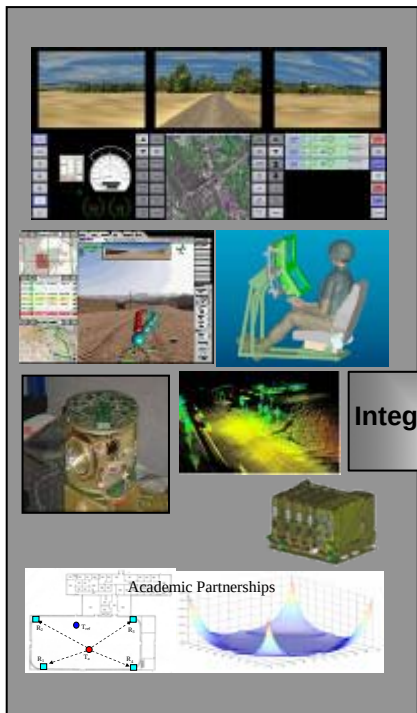
Packs



***“The future of the auto is bright and increasingly electronic. Autonomous driving means that someday you could do your email, eat breakfast, do your makeup and watch a video while commuting to work”.***

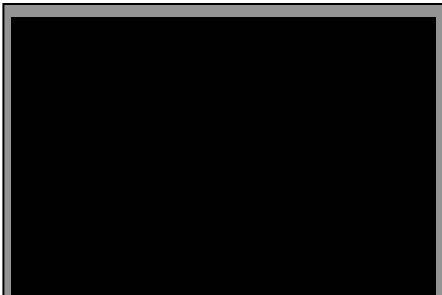
Rick Wagoner, CEO GM, Consumer Electronics Show 2008 Keynote address stating that GM plans to test driverless cars by 2015 and have them in production by 2018.

## Technology Components



Integration

## Demonstrators



Gladiator



Robotic Decontamination



RF Stryker



TAGS-CX

SME  
Defined  
Scenarios

## Military Relevant Test & Experimentation



Robotics Collaboration  
and RVCA ATO  
Experimentation



Convoy Active Safety  
Technologies (CAST)

Integration Technology Development  
Lessons Learned to Enable Early  
Technology Insertion

## Transition and Requirements Development



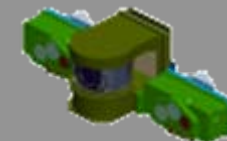
Future Force SMI



FCS JTRS



FCS MULE



FCS ANS



Current Force Convoy  
Operations

Tying in Commercial Automotive Safety Research



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

**Jointly Funded by OSD JGRE and JCR**

## Program Goals:

- Provide low cost (\$10-20K) convoy automation (Leader/Follower) capability for current force Army vehicles
- Support Warfighter requirement for convoy automation and active safety
- Provide Robotics capability in CS/CSS community
- Leverage RF, RDECOM and other FCS Technologies

## Enhanced Soldier Protection

- Increased Situational Awareness
- Reduced Collisions
- Reduced Crew Driving Tasks
- Reduced Fatigue
- Increased Driver Cognition



**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

- S&T Support to the RS-JPO
- Develops and Fosters external Relationships
- Matures technology for Insertion into ATO programs
- Robotics Outreach
- RS JPO Collaboration Cell Lead
- Support to IGS Capability Cells
- Robotics Academic Programs (Including Curriculum Development)



| Government Partnerships | Industry Partnerships | Academia Partnerships | Community Outreach                                                                  |
|-------------------------|-----------------------|-----------------------|-------------------------------------------------------------------------------------|
|                         |                       |                       | <p>TARDEC Robotics Quarterlies</p> <p>Robotics, Engineering and Technology Days</p> |

## Robotics, Engineering and Technology (RET) Days

- Students gain insights into technology careers, math & science.
- Robotics is a multi-disciplinary field (electrical, mechanical & computer engineering).
- Supports Michigan's objective to be a technology based economy

## Michigan Robotics FIRST Support

- **3 Michigan Regional Competitions in 2008**
  - Provided VIP Speakers
  - Provided Technical Judges
- **TARDEC engineers serve as mentors to several metro-Detroit area high schools**
- **Future Activities:**
  - 2009 Michigan Regional Sponsorship
  - Assisting in building arenas for regional competitions
- **2009 – International Competition**

## Intelligent Ground Vehicle Competition (IGVC)

- **University Engineering education challenging students to design autonomous vehicles**
- **16 Competitions since 1993**
  - Thousand of Students
  - 332 Teams
  - 67 University
  - 4 Countries (Canada, India, Japan, and Mexico)

2nd Annual  
Robotics, Engineering and  
Technology (RET) Days

December 4 - 6, 2007



## Summer Hires:

- 20 Colleges, 53 Students
- 15 High Schools, 15 Students
- 2008 10% of Summer Hires converted to Co-op Program

## Projects:

- Survivability Material Processes & Ceramics Analysis
- Manipulator Arm Training for Walking Robot Prototypes
- Diesel Engine Simulations & Analysis

**47 Projects 68 Students**

## Co-Ops & Interns

- 2001-2006 more than 85% of TARDEC workforce recruited from co-op program
- 51 Co-Op Positions as of Sep 08
- 17 AMC Interns
- 95% Retention rate
- 18 Local University Memorandums of Understanding
- In 2007 126 TARDEC associates participating in higher education
  - 78% focused on emerging technology & global leadership curriculums



TARDEC's 2008 Summer Hire Expo

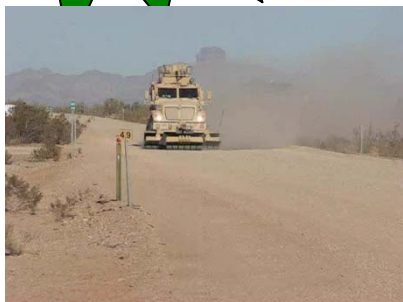


The Honorable Governor Jennifer Granholm &  
The Honorable Senator Carl Levin  
Touring the 2008 Summer Hire Exposition

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

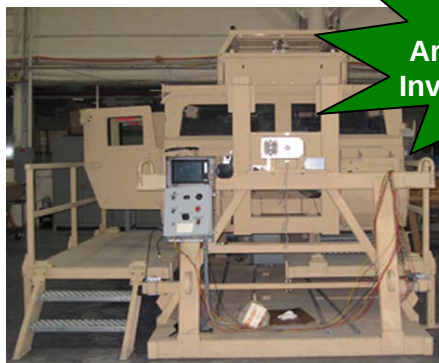
## Life-Saving Solutions

**2007  
Army's Greatest  
Inventions Winner**



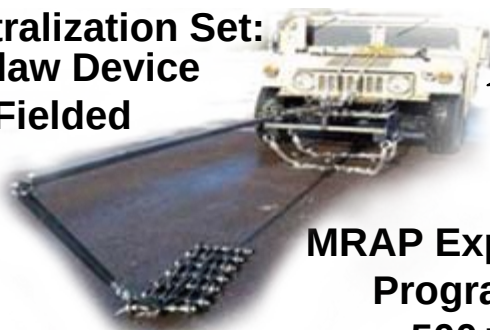
**SPARK Mine Roller 360+ Fielded**

**2007  
Army's Greatest  
Inventions Winner**



**HMMWV Egress Assistance  
Trainer (HEAT)**

**Wire Neutralization Set:  
Wolf Claw Device  
10 Fielded**



**MRAP Expedient Armor  
Program (MEAP)  
500+ Fielded**

**2008  
ASA (ALT)  
Collaboration  
Award Winner**

**2008  
Army Acquisition  
Excellence Award  
Winner**



## Additional Life-Saving Solutions

- Vehicle Expedient Armor
- M939 Crew Protection Kit (CPK)
- All Terrain Armored Cab
- Interim High Mobility Engineering Excavator (IHMEE) Advanced Crew Protection Kit
- Tactical Vehicle Add-on-Armor (AoA)
- Construction Vehicles AoA
- Fuel Tank Fire Protection
- HMMWV Automatic Fire Extinguishing System (AFES)
- M1114 HMMWV Motorized Turrets
- Omni-Directional Inspection System (ODIS)
- Weapon Systems Mapping Software (WSMS)
- Wolf Collar and Tail Wire Neutralization Set

**Getting the Right Technologies to the Warfighter Quicker**



## DoD's Ground Vehicle Center of Excellence



## Tactical Fuel Logistics & Protection

|                                                                           |              |
|---------------------------------------------------------------------------|--------------|
| Kuwait/OIF/OEF Fuel to FOB (Million gallons/yr).....                      | 431          |
| Fuel trucks needed.....                                                   | 140,075      |
| Convoys needed.....                                                       | 9,332        |
| Soldiers per convoy trip<br>(Fuel trucks, protection, other support)..... | 120          |
| Soldier Convoys.....                                                      | 644,360      |
| <b>Fewer Soldier Convoys.....</b>                                         | <b>6,444</b> |
| <b>(Resulting from 1% Fuel Savings)</b>                                   |              |

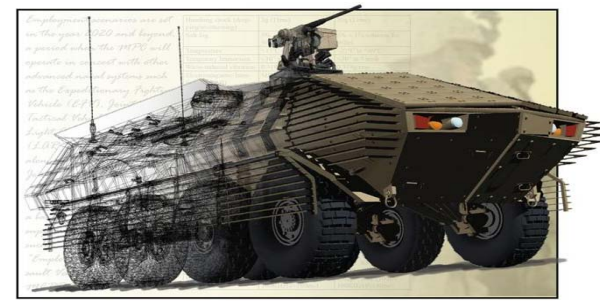
# MARINE CORPS SYSTEMS COMMAND

**EQUIPPING THE WARFIGHTER TO WIN**

## Combat Vehicles Conference Marine Corps Systems Command 21 October 2008



Brigadier General Michael M. Brogan



### Responsibility

#### MCSC

- LAV

- AAV

- Tank

- HMMWV/ECV

- MRAP

Replaced By

Replaced By

Replaced By

Replaced By

#### PEO LS

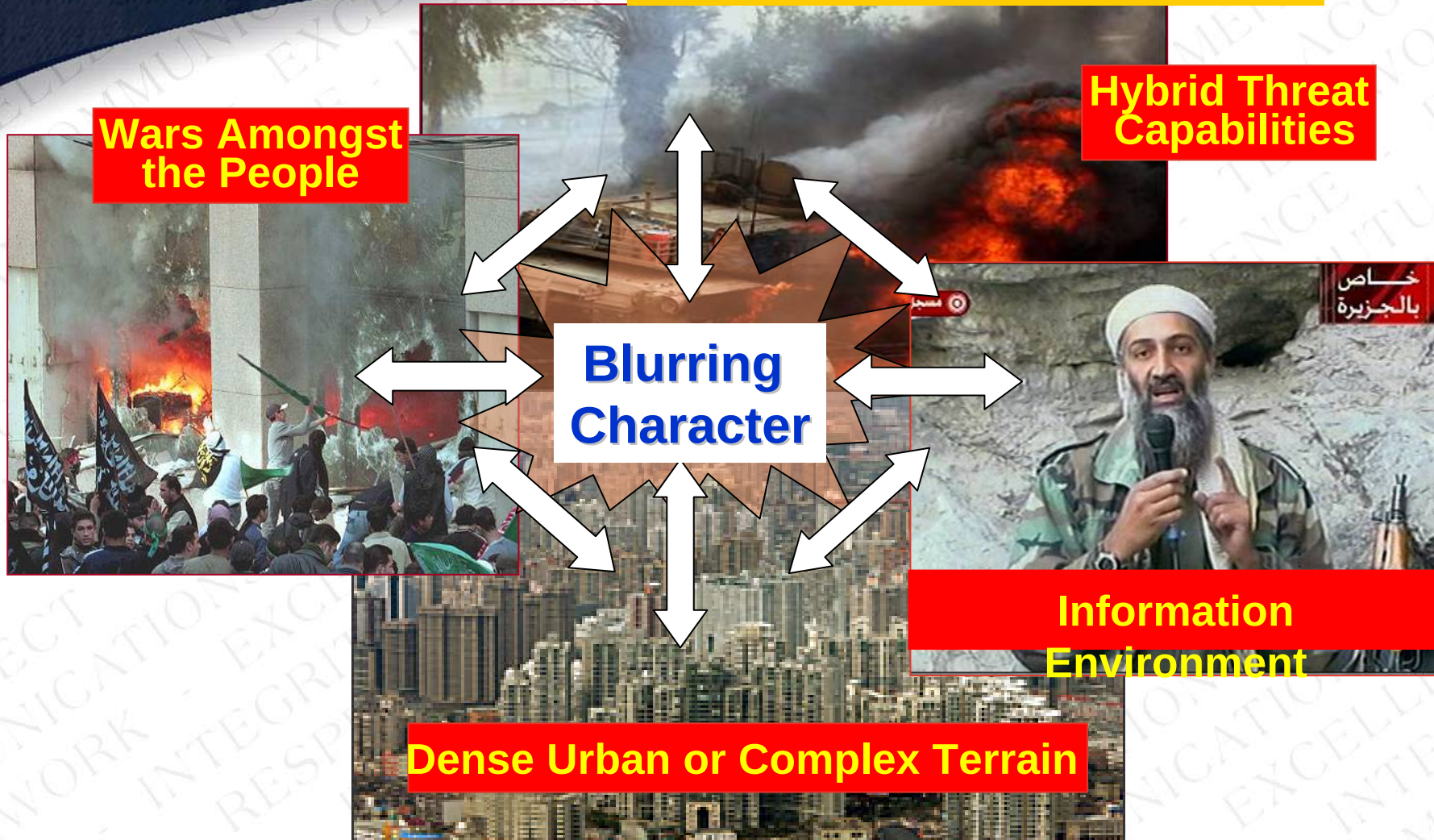
- --- ---

- EFV, MPC

- --- ---

- ?JLTV?

# Complex Operational Environments



**Hybrid threats exploit the complex terrain of the urban littoral to maximize their disruptive capacity**

## *Blurring The Lines*

### Combat Vehicles

- LAV
- AAV
- Tank

### Tactical Wheel Vehicles

- HMMWV
- MTVR
- LVS

MRAP





### HMMWV Timeline

Planned fielding  
of JLTV



1984

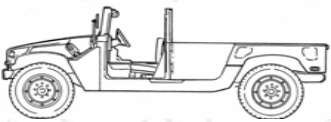
1998

2003

2006

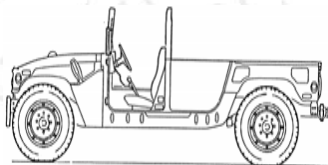
2012

First HMMWV  
Fielded to fleet



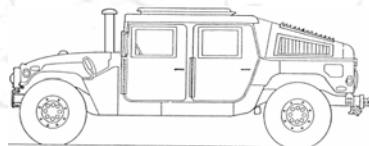
M998 /  
M1038

HMMWVA2  
fielded



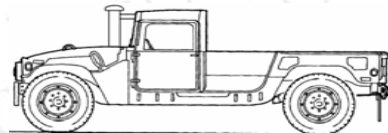
M1097A2

M1114  
fielded



M1114

M1151/M1152  
produced



M1152  
2-dr w/ A/C  
MRC / Shelter or Troop Carrier



M1151  
4-dr w/ A/C  
Armament Carrier

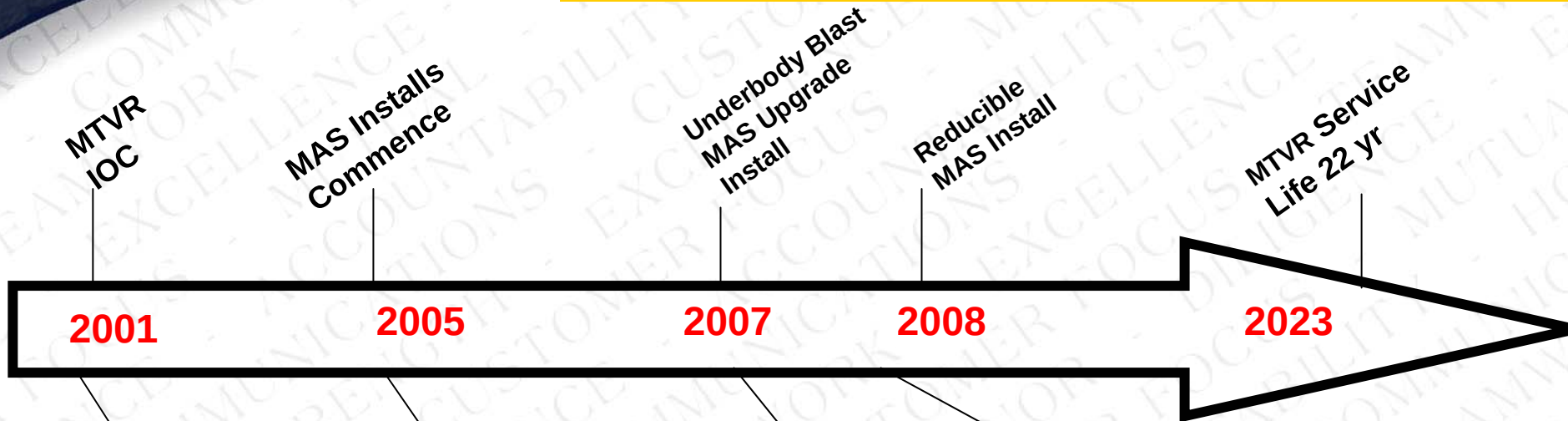


## *HMMWV Today*





# MTVR Armor System Timeline



### MTVR Today



### LVS Timeline

1984

↑  
LVS Fielding



1993

↑  
LVS A2  
Fielding



2006

↑  
LVS MAK I



2009

↑  
LVS MAK II



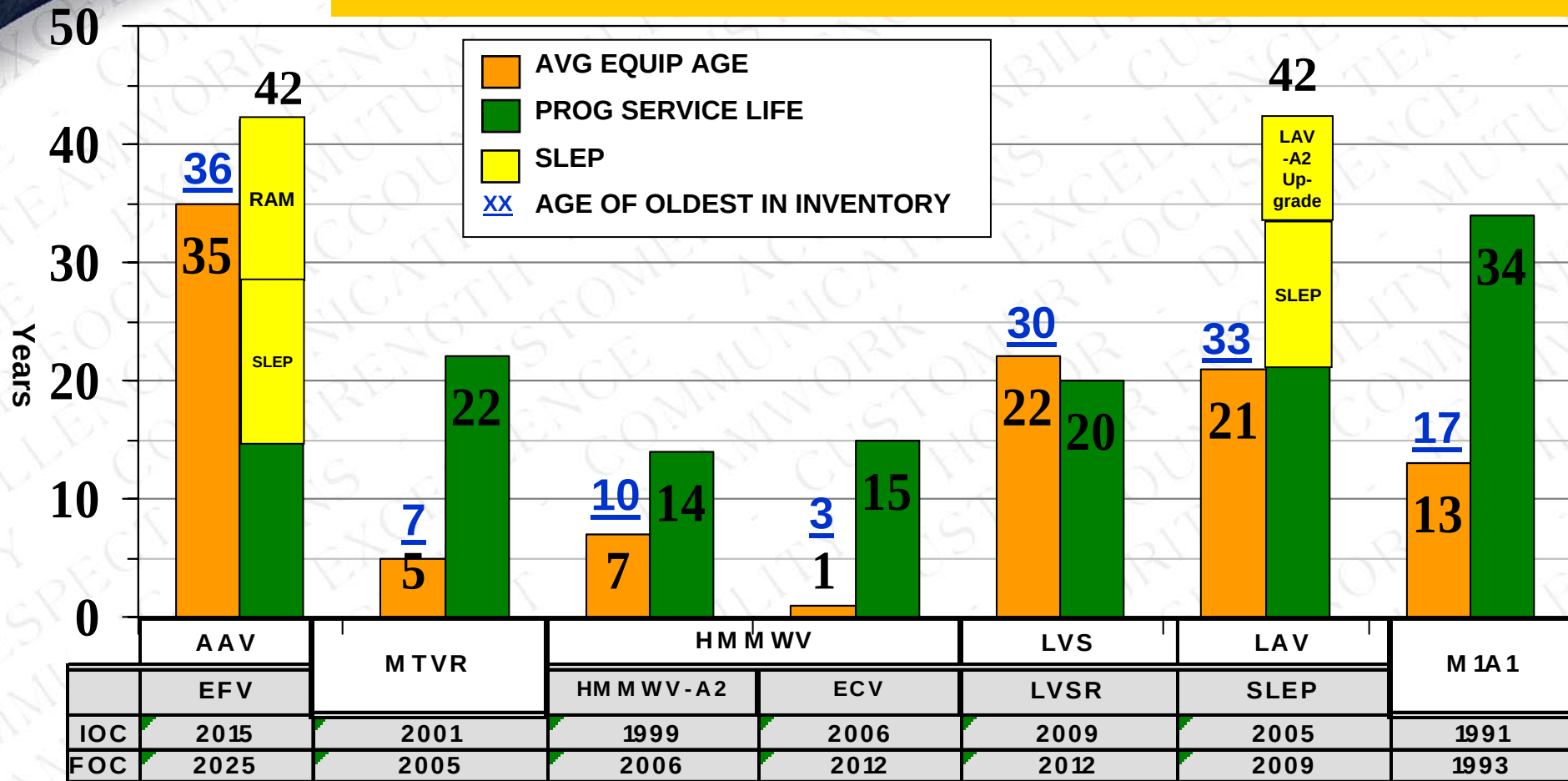
2012

↙  
LVSR Fielding



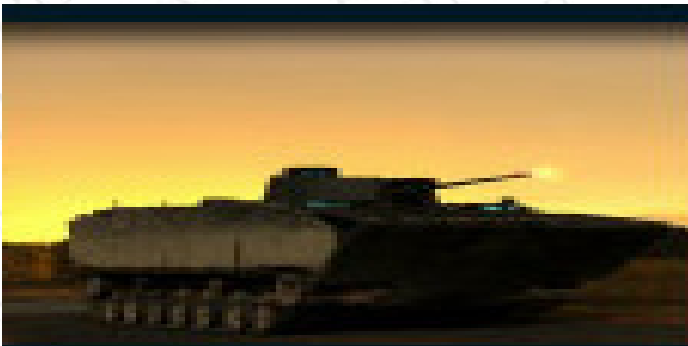


### SELECTED GROUND EQUIPMENT AGING



## Marine Corps Challenges

- Funding
- Timing
- Expeditionary



### Industry Challenge

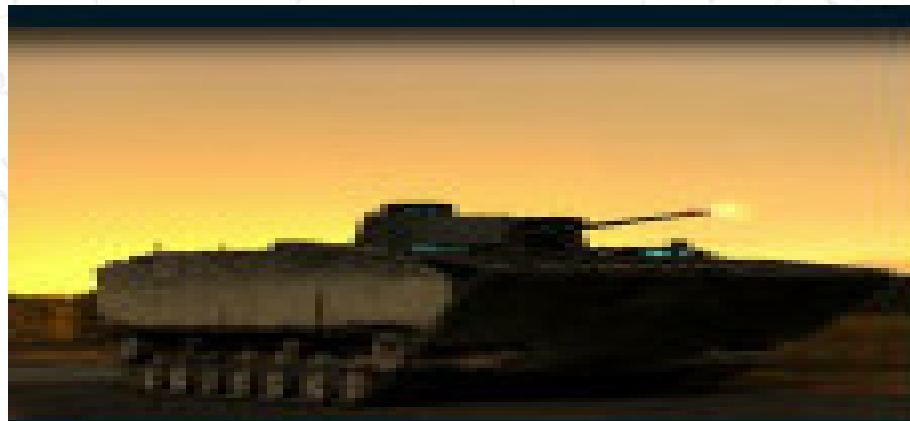
- Requirements
- Funding
- RAM







### Questions



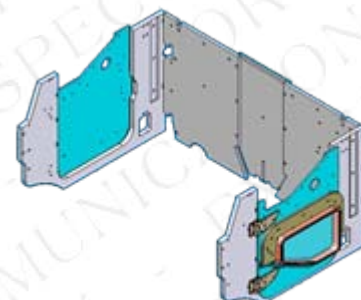
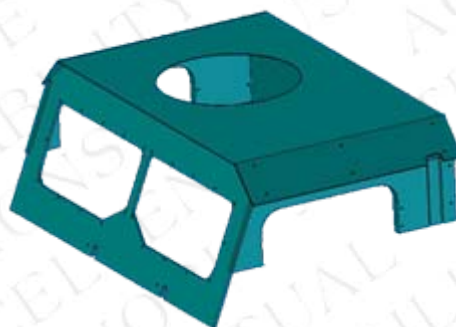
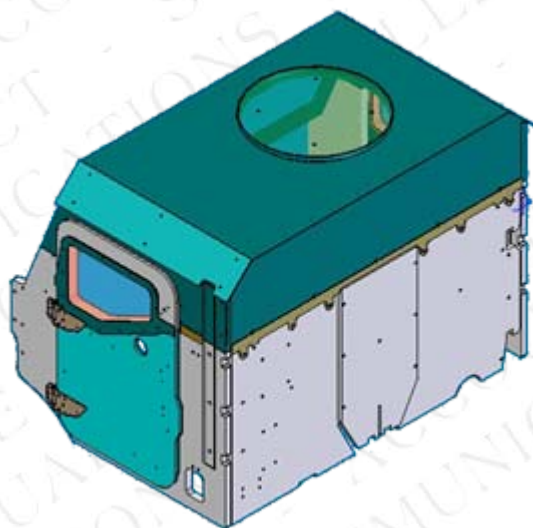
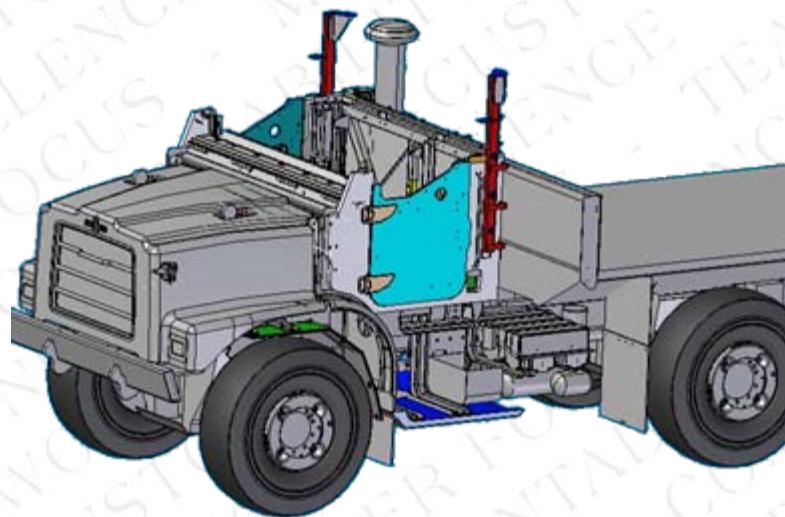
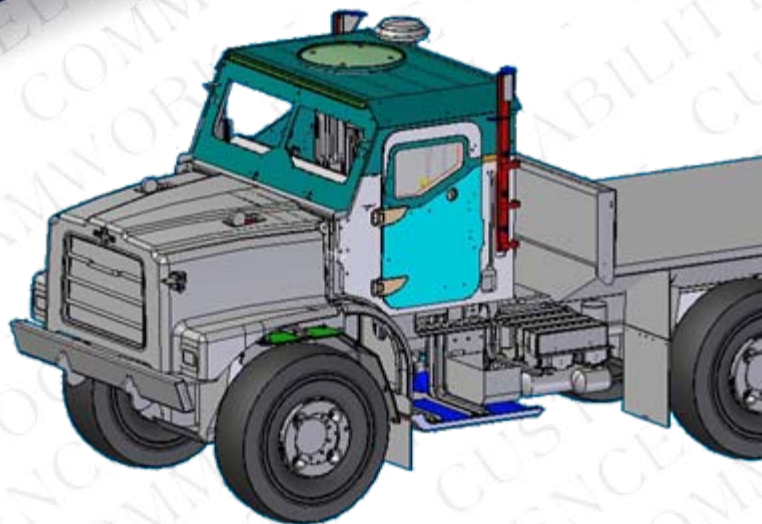


# Back-ups

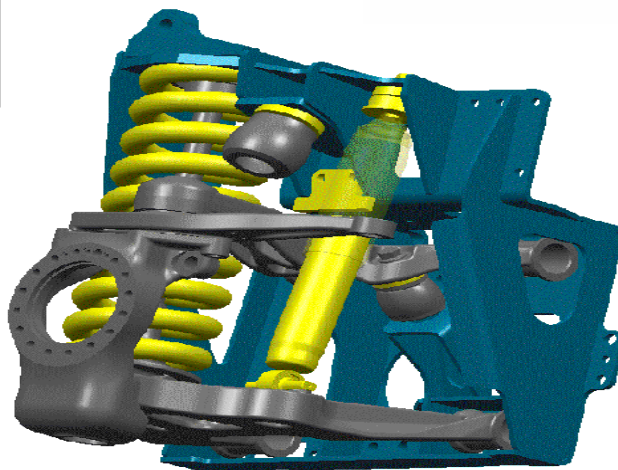
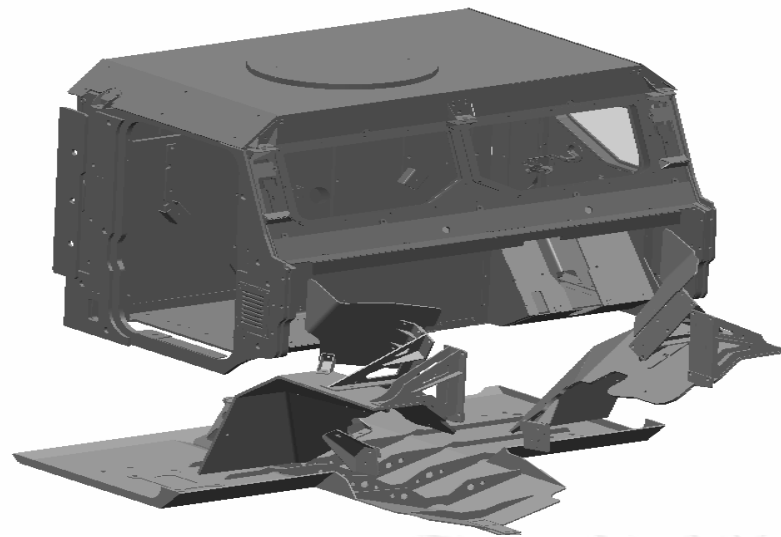
### MRAP All Terrain Light Combat Vehicle

- Mobility and Protection





UNCLASSIFIED





# EXPEDITIONARY FIGHTING VEHICLE (EFV)



***National Defense Industrial Association (NDIA)  
Combat Vehicle Division Conference  
21 Oct 08***



# EFV MISSION



**Provide High Speed  
Transport of Embarked  
Marine Infantry From Ships  
Located Beyond the Horizon  
to Inland Objectives**



**Provide Armor Protected  
Land Mobility and Direct  
Fire Support During  
Combat Operations**



# EFV

## Revolutionizing Expeditionary Maneuver Warfare



### *Future: EFV*

### *Present: AAV*

- WWII Doctrine
- No Standoff Distance for ATF
- Slow Speed Amphibious Assault
- 1960's Technology
- Limited Survivability



- EFV directly supports the Marine Corps' Capstone Concept: Expeditionary Maneuver Warfare
- The EFV will provide the tactical mobility asset required to spearhead the EMW concept and permit the Marine Corps to fully exploit littoral areas as maneuver space
- The EFV will allow immediate, high speed maneuver of Marine infantry units as they emerge from ships located beyond the horizon (25 nm and beyond)
- The EFV's unique combination of offensive firepower, armor, NBC protection, and high speed mobility on land and sea represent major breakthroughs in the ability of Naval and Marine expeditionary forces to avoid an enemy's strength and exploit its weakness



**Leap Ahead to 21st Century  
Technology**



# EFV

## Mission Essential Functions



**Move (Land)**



**Move (Water)**



**Shoot**



**Communicate**



**Carry**



**Protect**



# EFV - KEY PERFORMANCE PARAMETERS



| <u>CRITERIA</u>                                                                                            | <u>THRESHOLD</u>       | <u>OBJECTIVE</u>        |
|------------------------------------------------------------------------------------------------------------|------------------------|-------------------------|
| • <b>High Water Speed</b> - 2' significant wave height, for not less than one continuous hour              | 20 knots               | 25 knots                |
| • <b>Land Speed</b> - Forward speed on hard surface road                                                   | 69 kph                 | 72 kph                  |
| • <b>Firepower</b> - Maximum effective range<br>Interoperability/standard ammunition with other service(s) | 1500m                  | 2000m                   |
| • <b>Armor Protection</b> - Any azimuth                                                                    | 14.5mm/300m            | 30mm/1000m              |
| • <b>Reliability</b> - Mean Time Between Operational Mission Failure                                       | 43.5 hrs               | 56 hrs                  |
| • <b>Carrying Capacity</b>                                                                                 | 17 Marines             | 18 Marines              |
| • <b>Net Ready</b><br>* Information Exchange Requirements (IERS)                                           | 100% of Critical *IERS | 100% of Top Level *IERS |



Currently Demonstrated



Plan to Demonstrate



# PROGRAM UPDATE

## SIGNIFICANT EVENTS

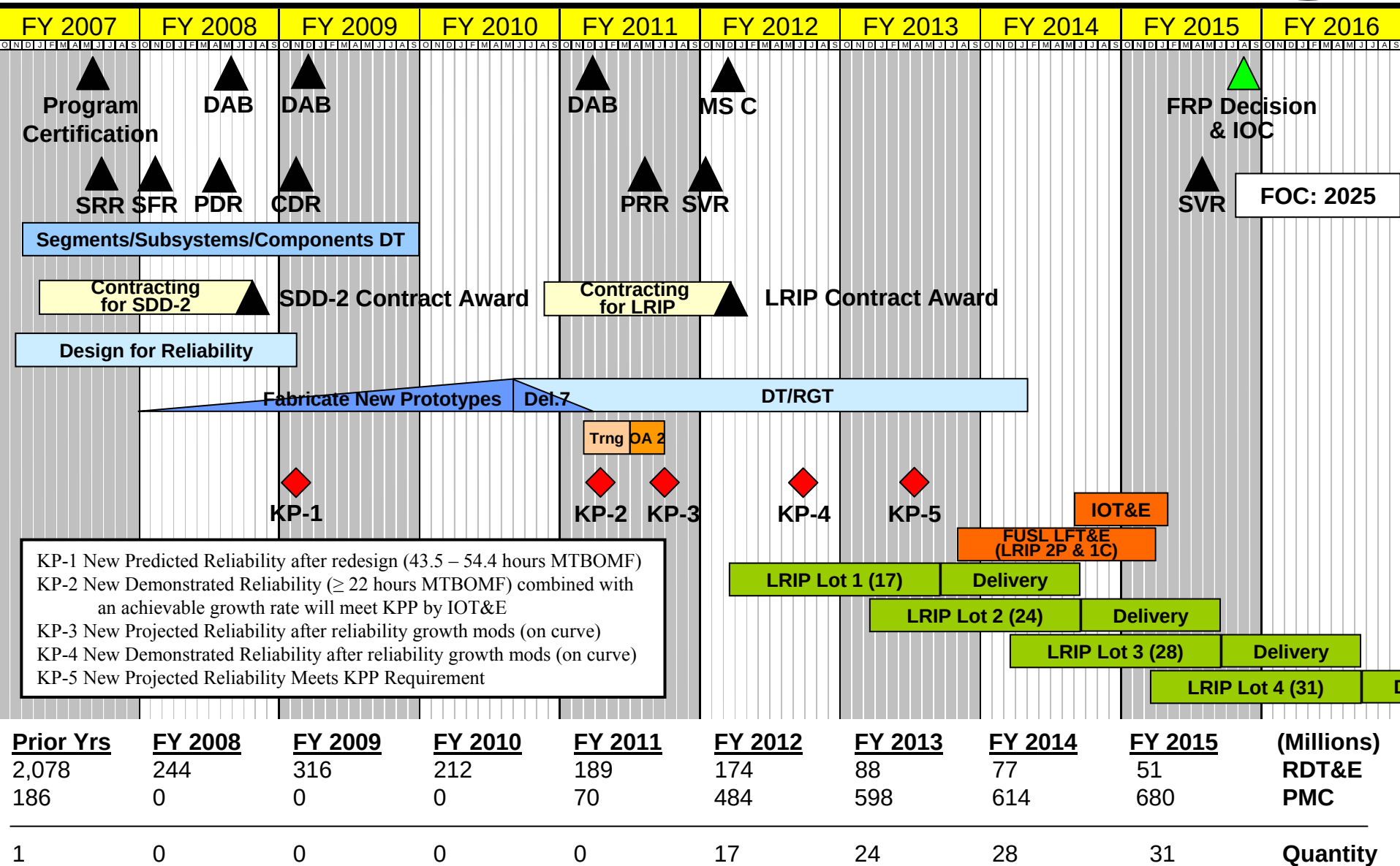


- System Requirements Review (SRR) completed 28 Jun 07
- System Functional Review (SFR) completed 11 Dec 07
- DFR Contract Mod Definitized 17 Jan 08
  - 51 Mission Essential Components included
  - Fault Tree Model continues to predict a design of 60.7 hrs Mean Time Between Operational Mission Failure (MTBOMF)
- System Software Review (SSR) conducted 28 Feb 08
- Capstone Preliminary Design Review (PDR) conducted 2 May 08
- Systems Development & Demonstration - 2 (SDD-2) Defense Acquisition Board Review conducted 30 May 08
- SDD-2 Contract awarded 31 Jul 08
- Component Design Review (CDR) Nov 08
- Integrated Baseline Review (IBR) Jan 08



# PROGRAM UPDATE

## 13 AUGUST 2007 EFV PROGRAM STRUCTURE





# Program Efforts Leading To MS C



- **Redesign for reliability**
  - Instituting robust systems engineering processes
  - Extensive segments/subsystems/components developmental testing
- **Build new prototypes**
  - Prototypes will be fabricated as parts “earn their way in” through the design release/verification process
- **Conduct extensive testing on new vehicles**
  - Developmental Testing and Reliability Growth Testing
  - Confirmation program is on reliability growth curve
  - Operational Assessment to support Milestone C



# SDD-2 PROGRAM GOALS



- **Reduce Vehicle Weight**
- **Reduce Vehicle Cost**
- **Improve Vehicle Performance**
- **Improve Vehicle Reliability, Availability, Maintainability, Durability (RAM-D)**
- **Introduce New Warfighting Capabilities**



# PROGRAM OBJECTIVES



- **Emphasize near term technology, but anticipate for future upgrades through production and fielding.**
- **Reduce Vehicle Weight**
  - Lighter Weight Track
  - Lighter Weight Armor
  - Material Substitution
- **Reduce Vehicle Cost / Life Cycle Cost**
  - Identify Substitute Line Replaceable Units
  - Improve Manufacturing Processes
  - Improve Logistic Support Programs



# PROGRAM OBJECTIVES



- **Improve Vehicle Performance**
  - Improve Power Transmission
  - Increase Armor Protection
- **Improve Vehicle RAM-D**
  - Corrosion Prevention
  - Robustness
- **Introduce New Warfighting Capabilities**
  - Wireless Technology
  - Advanced Displays
- **Introduce Design Enhancements**
  - Dissimilar Metal Avoidance
  - Modeling & Simulation of Battle Damage



# Small Business Innovation Research Program Initiatives



- **Reduction of Ground Vehicle Observables**
  - Reduce the vulnerability of ground vehicles to detection and weapon-targeting systems
- **Blast and Impact Resistance of Polyurea Coatings on Metallic and Non-Metallic Materials**
  - Research, develop and characterize polyurea materials ability to increase blast and fragment protection
- **Directional High Flow Ballistic Exhaust Grille**
  - Research, design and build a high flow rate ballistic exhaust grille that allows directional output control



# Small Business Innovation Research Program Initiatives



- **Low Cost, Low Weight, Self-Sealing Fuel Tank Technology Development**
  - Conduct research in self-sealing fuel tank technology and the development of an integrated material solution that is low cost, rugged, lightweight, and non-flammable; solution will enable vehicle operation in hostile environments and minimize loss of fuel due to a direct / indirect hit
- **Air Flow Noise Reduction Techniques**
  - Develop techniques to reduce engine cooling system noise levels to mitigate the potentially adverse health affects on crew members



# Small Business Innovation Research Program Initiatives

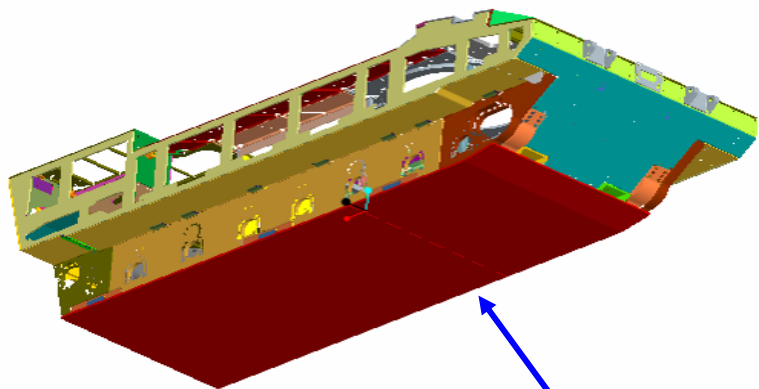


- SBIR Point of Contact is
  - Craig Harvey Program Manager, Advanced Technology
  - (703) 780-2458

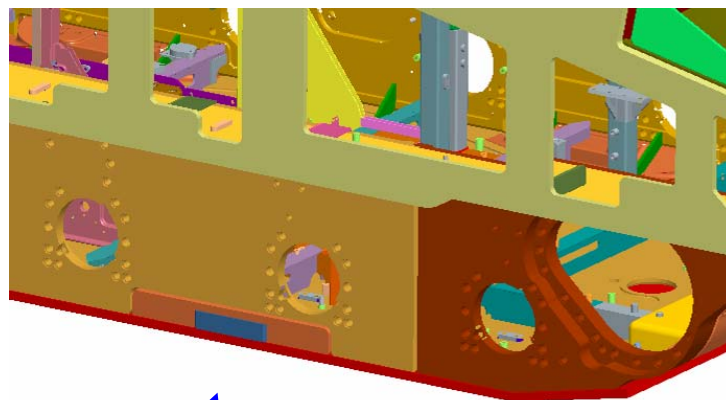


# OTHER INITIATIVES

- Appliqué Armor Kit
  - Provides Mine Blast Protection for Extended Land Operations
  - Belly/appliqué integration has minimal impact on reliability, production, Land Operation Modes
  - Reduced Water Mode Capabilities



Appliqué kit



Appliqué kit attaches to existing features on the vehicle



# PROGRAMMABLE AIRBURST MUNITIONS (PABM)



B004  
MK310



ATK HEAB

| FY08                          | FY09                                 | FY10                                             | FY11                        | FY12     | FY13 |
|-------------------------------|--------------------------------------|--------------------------------------------------|-----------------------------|----------|------|
| • PABM qual effort (1200 rds) |                                      | • RDT&E PABM buy (4000 rds) /\$3.6 mil purchased |                             | Unfunded |      |
|                               | • PABM system integration (2520 rds) |                                                  |                             |          |      |
|                               |                                      |                                                  | • SDDII vehicle integration |          |      |

- PM AAA is the lead in a joint (US Army, Navy & USMC) effort to qualify PABM round
- Testing and lethality modeling prove 30mm AB Munitions have 4-6 greater lethal effects against Infantry and light to medium material targets
- Approximately eight 30mm AB rounds as lethal as a 155mm round
- The significant increase in lethality provided by the 30mm PF/AB round will provide ~\$10M cost savings over the Life Cycle
- PABM efforts currently on hold due to lack of funding

Note: Our CPD requirement is – 1 EFV will take out a MRPlatoon (T), take out a MRCompany (O). MPLD/HEI meets the threshold requirement, PABM gets us closer to the objective requirement



[www.efv.usmc.mil](http://www.efv.usmc.mil)



# 2008 TACOM LCMC Combat Vehicles Conference



***“Urgent Need Today for Tomorrow’s Capabilities”***

**TACOM LCMC**



**Mr. Jack Dugan  
TACOM LCMC Deputy  
to the Commander**



**21 October 2007**

# Skill & Experience





# Why We Do What We Do



**Sustain**  
**Prepare**  
**Reset**  
**Transform**





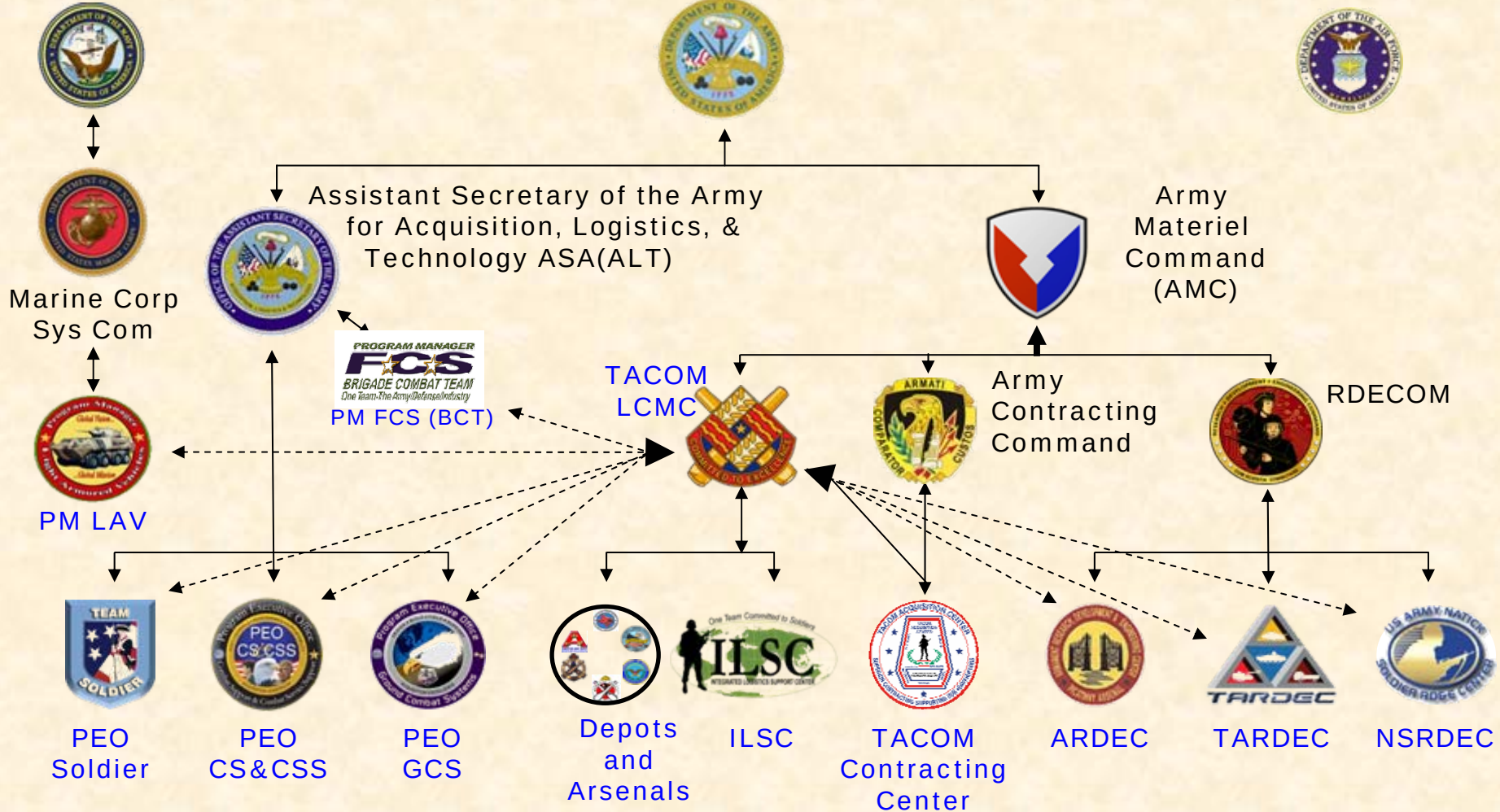
# TACOM LCMC



Department of Navy

Department of Army

Department of Air Force





# TACOM LCMC...What We Do



**MISSION:** Develop, acquire, field, and sustain Soldier and ground systems for the Warfighter through the integration of effective and timely Acquisition, Logistics, and cutting-edge Technology

## Core Competencies:

- Acquisition / Program Management
- Logistics, Industrial Operations, and Contracting
- Research, Development, and Life Cycle Engineering

## The Magnitude:

- Over 70% of the Military's Equipment / Systems
- Over 150 Allied Countries Own Our Equipment
- Nearly 3,000 Fielded End Items
- Approximately 37,000 Components
- Nearly 500,000 PLISNs

## The TACOM LCMC Product Lines:

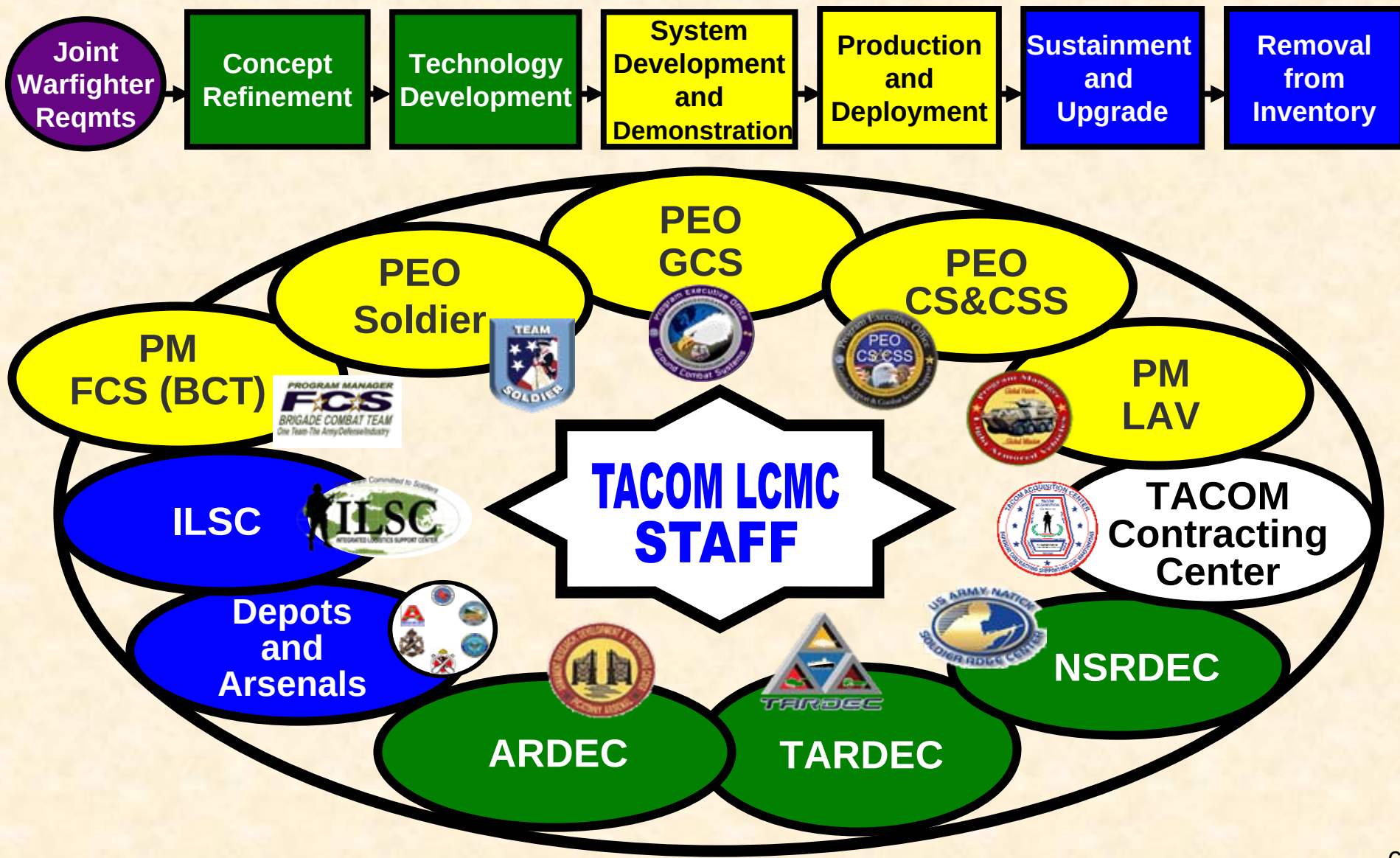
- |                                          |                             |
|------------------------------------------|-----------------------------|
| ▪ Combat Vehicles                        | ▪ Sets, Kits & Outfits      |
| ▪ Trailers                               | ▪ Shop Equipment            |
| ▪ Materiel Handling Equipment            | ▪ Large Caliber Guns        |
| ▪ Fuel & Water Dist Equipment            | ▪ Watercraft                |
| ▪ Chemical Defense Equipment             | ▪ Mortars                   |
| ▪ Howitzers                              | ▪ Aircraft Armaments        |
| ▪ Commercial Vehicles                    | ▪ Rail                      |
| ▪ Tactical Vehicles                      | ▪ Fuel & Lubricant Products |
| ▪ Construction Equipment                 | ▪ Rifles / Machine Guns     |
| ▪ Tactical Bridges                       | ▪ Soldier Equipment         |
| ▪ Armored Security Vehicle               | ▪ Rapid Fielding Initiative |
| ▪ Route Clearing Vehicle                 | ▪ Robotics                  |
| ▪ Mine Resistant Ambush Protected (MRAP) |                             |



We support a diverse set of product lines through their life cycles, from combat and tactical vehicles, armaments, watercraft, fuel and water distribution equipment, to soldier, biological, and chemical equipment.



# TACOM LCMC Organizations and Our Life Cycle





# Where We Are

## TACOM LCMC Associates

### Depots and Arsenal

**Personnel ≈ 21,000**  
9 Primary locations  
79 Smaller Locations

**HQ TACOM LCMC**  
4027 Civ & 89 Mil  
**TARDEC (1173 Civ & 9 Mil)** R&D for  
Ground Vehicle Power & Mobility

**Watervliet Arsenal 587 Civ**  
Sole facility making large caliber cannons

**Natick-138 Civ**  
**NSRDEC-614 Civ**  
R&D for soldiers

**Picatinny- 233 Civ**  
**ARDEC- 3188 Civ & 24 Mil**  
R&D for armament and munitions systems

**JSMC - Lima**  
(GOCO)  
M1 Tank

**Rock Island 1213 Civ**  
**Arsenal - 1540 Civ**  
largest government-owned weapons manufacturing arsenal

**Sierra Army Depot 747 Civ**  
Munitions disposal, long term storage, reset of Reverse Osmosis Water Purification Units (ROWPUS)

**Anniston Army Depot (4320)**  
Repairing all heavy tracked vehicles

**Red River Army Depot (3375)**  
Repairs Bradley, Multiple Launch Rocket System, and Combat Tactical Wheeled Vehicles

- TACOM LCMC Locations
- ◆ Depots/ Arsenals
- ★ R&D Facilities

Data as of Aug 08  
TACOM LCMC G1 Office

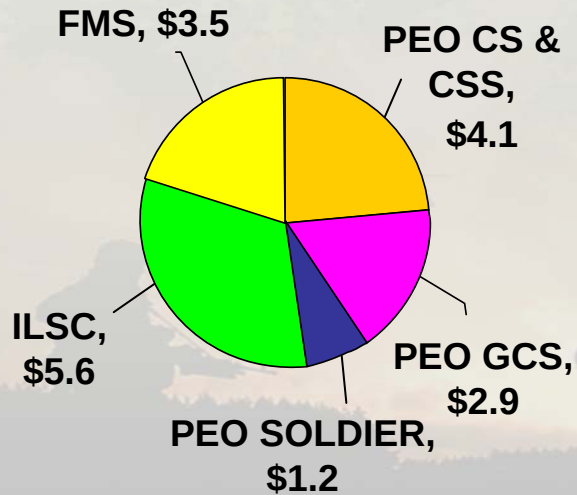
Numbers denote physically located at the site.



# TACOM LCMC

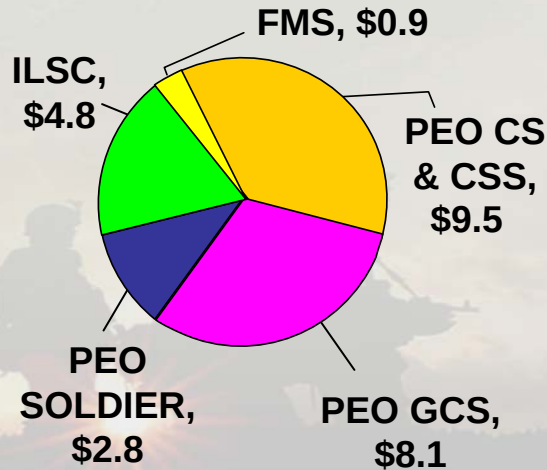
## FY08 Total Command Obligations

### Base Program



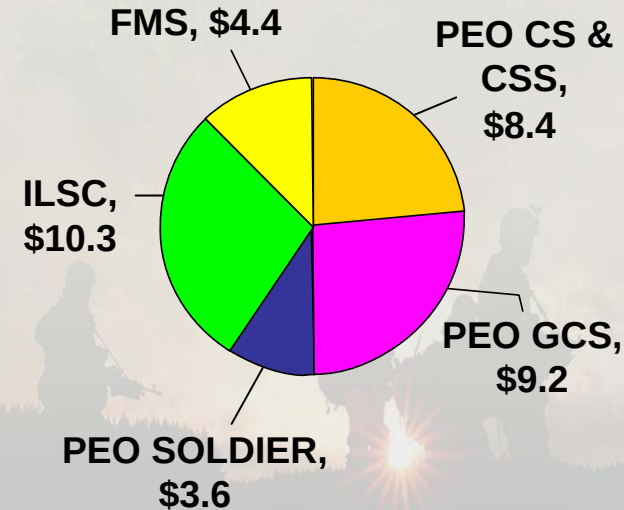
**\$17.3B**

### Supplemental Program



**\$26.1B**

### Obligations



**\$36.0B**

**TOTAL FY08 CONTRACTS: \$30.5B**

*Includes \$'s from customers outside TACOM LCMC*

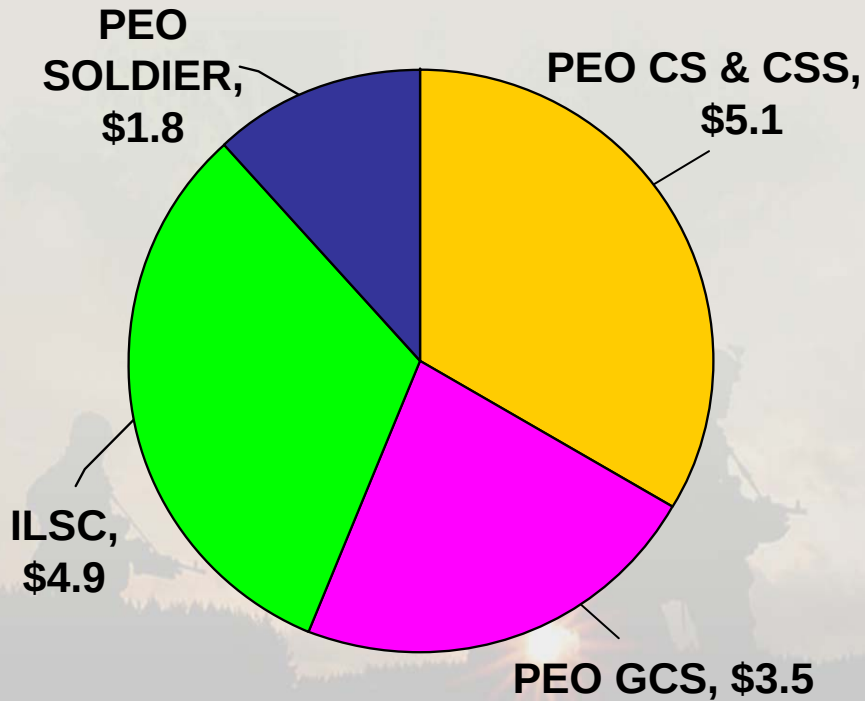


# TACOM LCMC FY09 What We Think



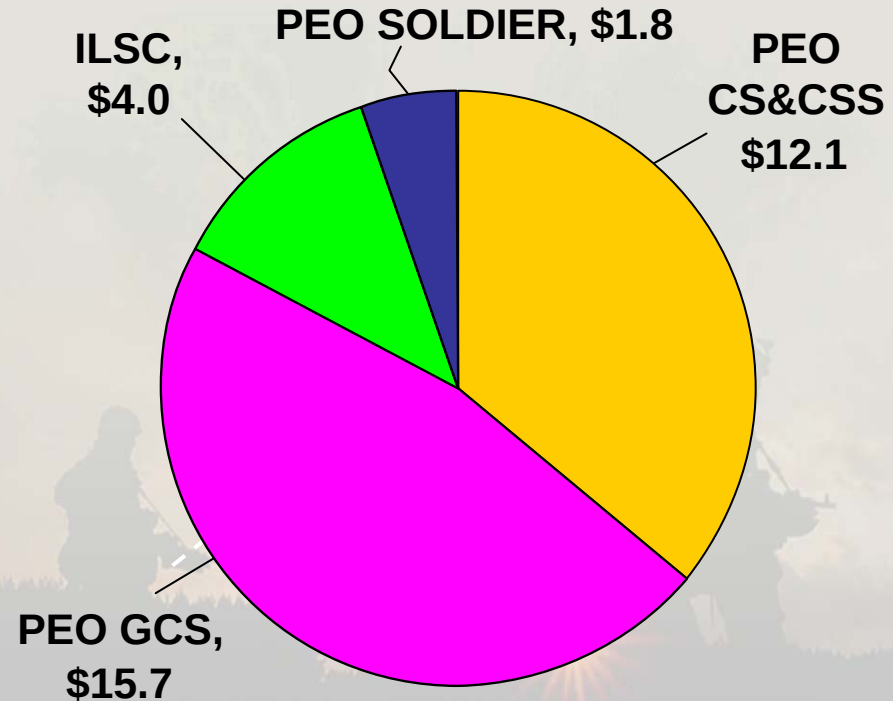
**(\$B)** ***FY09 Total Command Budget \$48.9B (estimated)*** **(\$B)**

## Base Program



**\$15.3B**

## Estimated Supplemental

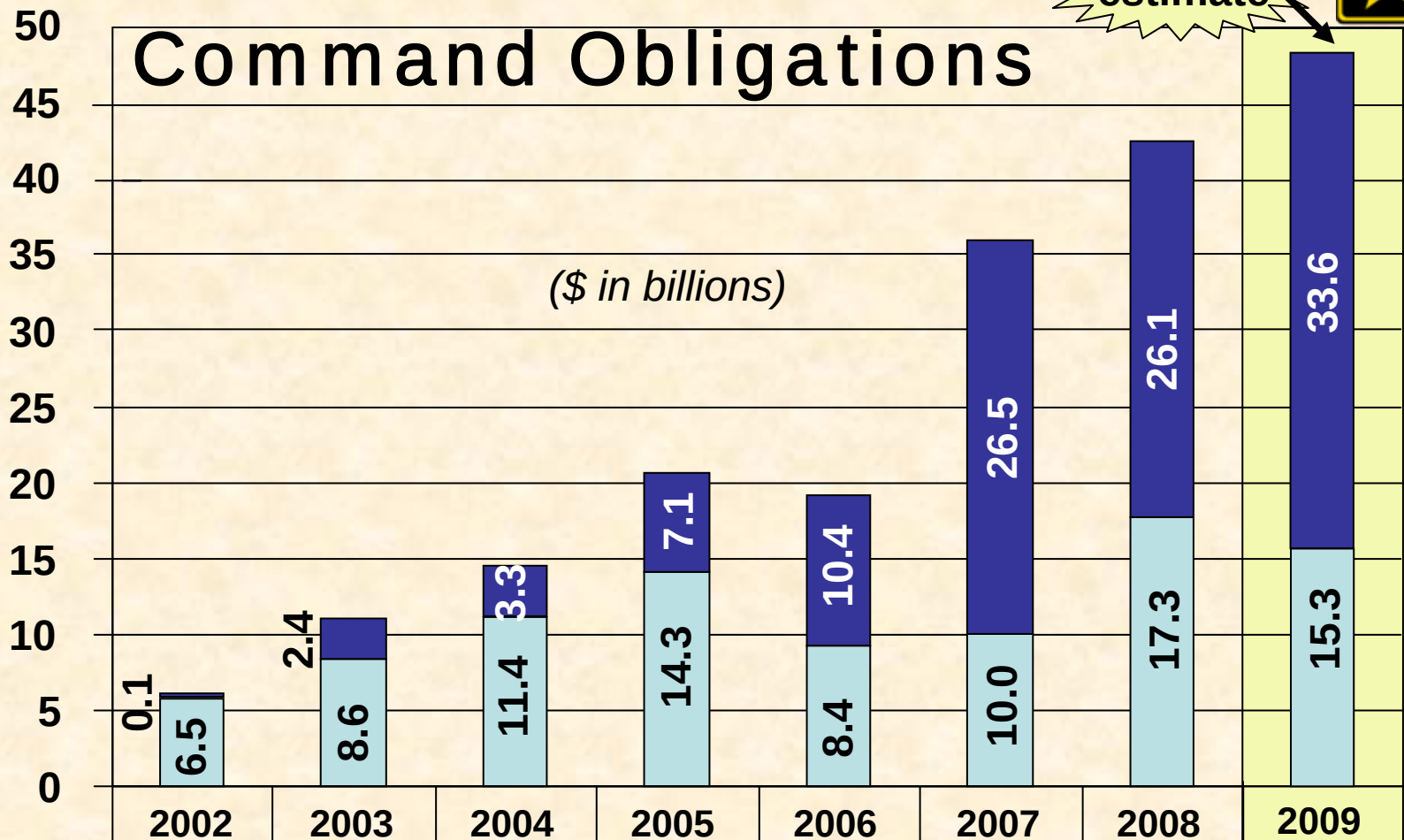
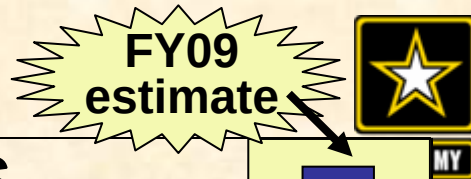


**\$33.6B**

***TOTAL Estimated FY09 Contract Awards: \$27.9B***



# Total TACOM LCMC Command Obligations

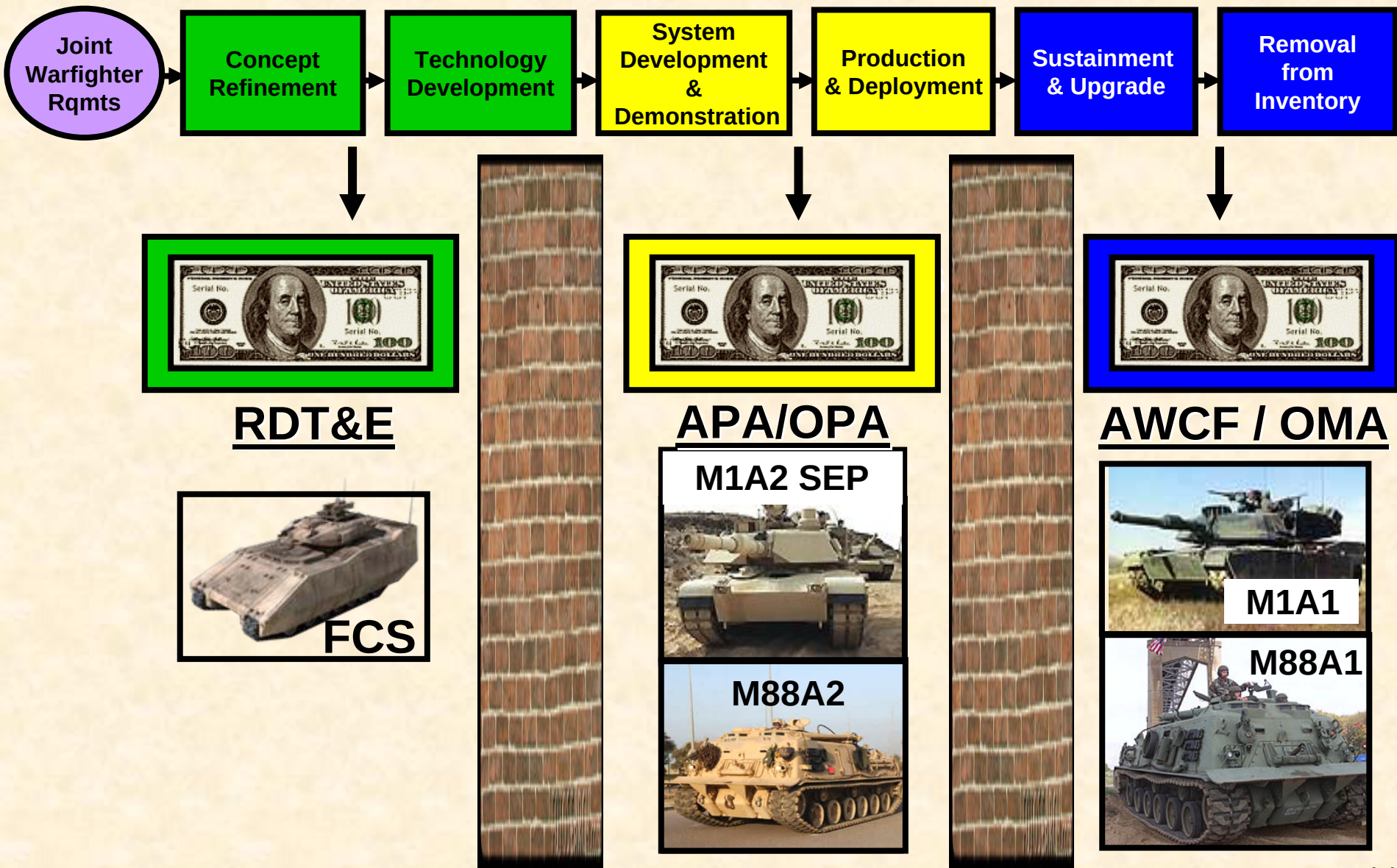


|                    | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|--------------------|------|------|------|------|------|------|------|------|
| SUPP               | .1   | 2.4  | 3.3  | 7.1  | 10.4 | 26.5 | 26.1 | 33.6 |
| Base               | 6.5  | 8.6  | 11.4 | 14.3 | 8.4  | 10.0 | 17.3 | 15.3 |
| Total              | 6.6  | 11.0 | 14.7 | 21.4 | 18.8 | 36.5 | 43.4 | 48.9 |
| Base as % of Total | 98%  | 78%  | 78%  | 67%  | 45%  | 27%  | 40%  | 31%  |

Base SUPPLEMENTAL

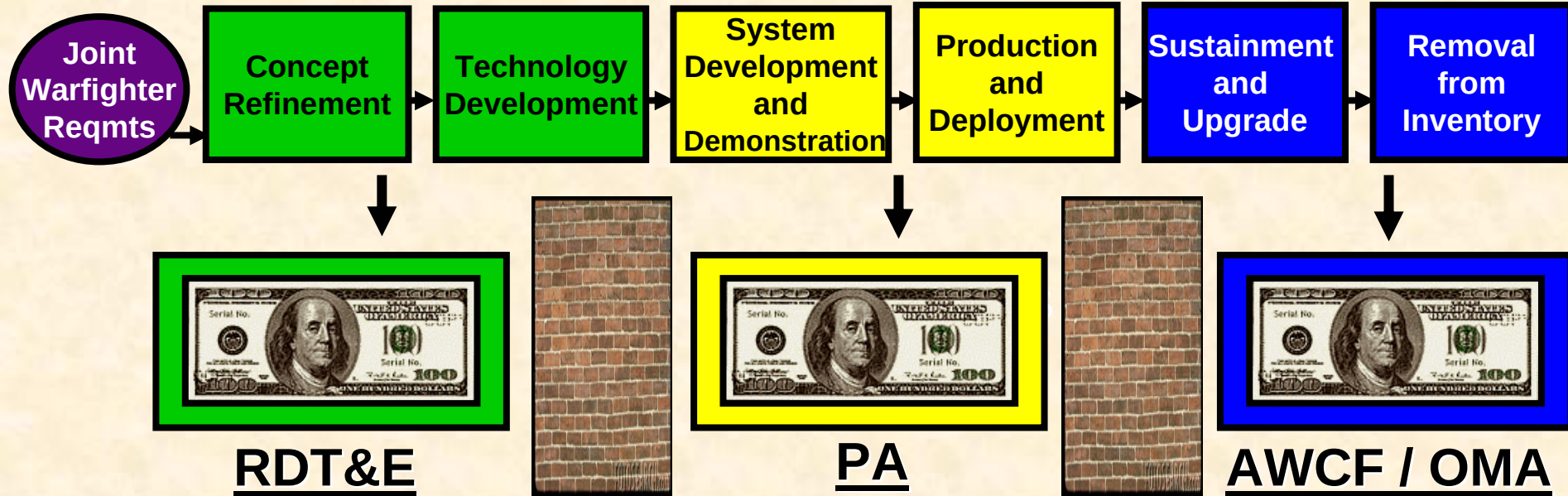


# Funding Within the Life Cycle





# LCMC TRANSFORMATION CHALLENGE



- **CONCEPTUAL BARRIERS**
- **FINANCIAL BARRIERS**
- **POLICY BARRIERS**
- **LEGISLATIVE BARRIERS**
- **CULTURAL BARRIERS**
- **ORGANIZATIONAL BARRIERS**



# Partnering in End Items

**Abrams AIM/SEP  
Tank**

**GDLS ↔ ANAD**

**Bradley Fighting  
Vehicle**

**BAE ↔ RRAD**

**Stryker Battle  
Damage Repair**

**GDLS ↔ ANAD**

**HEMTT Reset**

**Oshkosh ↔ RRAD**

**FMTV Reset**

**BAE ↔ RRAD**

**HMMWV Recap**

**AM General ↔ RRAD**

**MRAP**

**BAE ↔ LEAD**

**ASV**

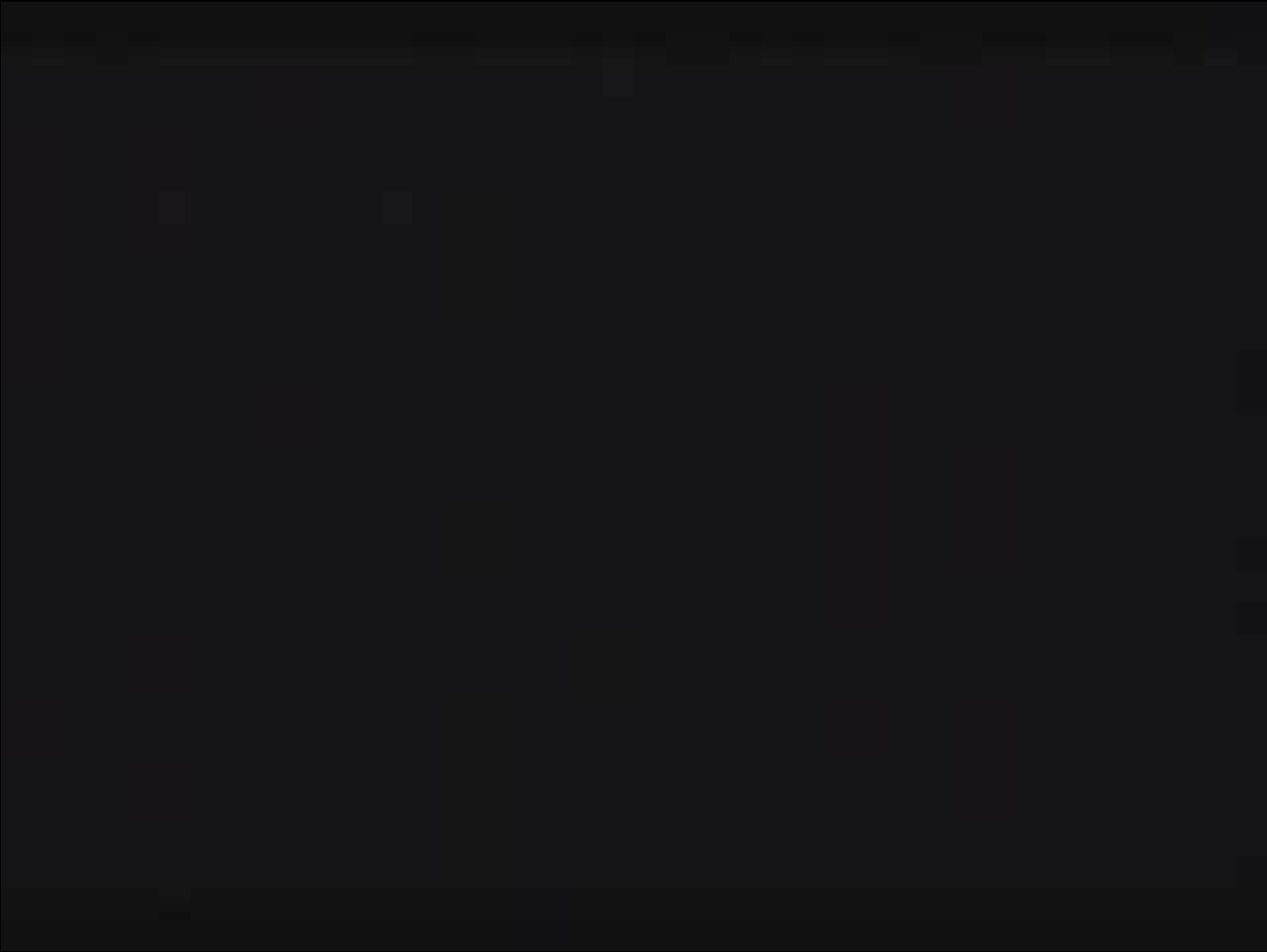
**Textron ↔ RRAD**

**FCS Cannon**

**GDOTS ↔ WVA**



# Urgent Need to Keep the Army Strong





# America's Army



- We exist to support warfighters, and we will do what it takes to meet their needs
- We're a high tech, global organization. We are prepared for changes in threat, technology, and mission
- We're constantly working to increase the safety of our Soldiers
- Our programs are at the core of Army Modernization; failure to modernize is measured in lives





# Captain Brian Gilbert – NDIA Combat Vehicle Conference

Background –

✓ 3 Separate Deployments in support of OIF.

⇒ OIF I: 3<sup>rd</sup> ACR Troop XO (Bradleys)

⇒ OIF III: 1-15 IN, 3 HBCT, 3ID: AS3 (M1114)

⇒ OIF V: D/1-15, 3 HBCT, 3ID: Tank Company Team Commander (M1, M2, MRAP, M1151)

✓ OIF V:

⇒ 3 HBCT, 3ID Task Organization: 1xCAB, 1xRISTA Squadron, 1xArtillery BN, 1xGG BN, 1xBSB, 1xBSTB

⇒ Company Team Consisted of 1xTank Platoon, 1xInfantry Platoon, 1xScout Platoon, 1xMortar Platoon.

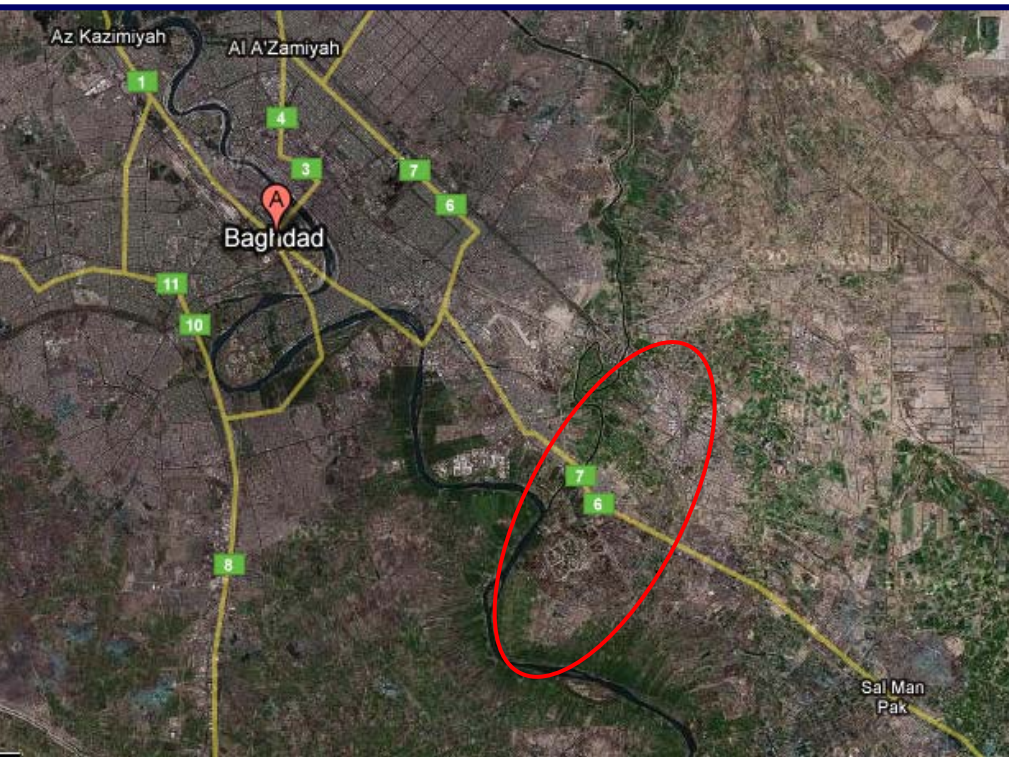
⇒ Company operated out of a combat outpost located in the city of Jisr Diyala. Approximately 3km southeast of Baghdad. Population approx. 200,000.

⇒ Company AO consisted of both urban and rural terrain. Rural terrain was extremely diverse ranging from Unrestricted – Severely Restricted. Specifically along the Tigris River.





# Company Area of Operations: March 07 – May 08



## Brigade Mission

3 HBCT conducts Full Spectrum (FSO) ICW Iraqi Security Forces (ISF) and Sons of Iraq (Sol), to interdict accelerants IOT deny extremist elements freedom of movement from the Mada'in Qada into Baghdad and prevent sectarian violence.

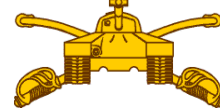
## Company Missions

1. Secure LOCs/Deny Accelerants into Baghdad
2. Secure Population
3. Develop Sons of Iraq Groups
4. Capture/Kill Criminals/Terrorists



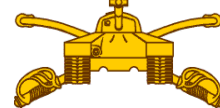


# Effects of The Brigade Operation



- ✓ **EKIA: 160**
- ✓ **EWIA: 13**
- ✓ **# DETAINED: 602**
- ✓ **HVI'S KILLED OR DETAINED: 47**
- ✓ **IED'S FOUND/DETONATED: 197/137 FOUND RATE 59%..IED event every 1.3 days**
- ✓ **CACHES SEIZED:205**
- ✓ **BOATS DESTROYED: 172**
- ✓ **BATS/HIDES: 12,053**
- ✓ **BLDGS CLEARED: 3,892**
- ✓ **VEHICLES SEARCHED: 18,215**
- ✓ **TDF MISSIONS: 2615, fired over 7000 rds**
- ✓ **A company named operation...1 every 1.7 days...10,825 CBT Patrols...17,528 ISF patrols**
- ✓ **15,000 jobs restored**
- ✓ **Increased water irrigation: 540%**
- ✓ **500,000 dollars in small business grants**
- ✓ **45 million in Cerp...468 projects**
- ✓ **1 radio station built..81 Iraqi media events**
- ✓ **750 Combat Logistics Patrols**
- ✓ **Over 60 sources developed...over 2,000 SIR, DIIR, and or Spot-reps**
- ✓ **Over 5,200 SUAV flights....1040 missions**





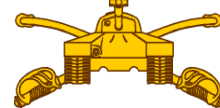
# Captain Brian Gilbert – NDIA Combat Vehicle Conference

Background Cont.

✓ OIF V:

- ⇒ MRAPs were primarily used when conducting operations on improved roads where deep buried IEDs were the main threat.
- ⇒ The MRAP provided us the protection that the M1151 lacked while still giving us the mobility needed to operate in tight spaces and on roads that could not bear the weight of an M1 or M2.
- ⇒ We conducted weekly route clearance on an improved road that bordered the Tigris River. This road historically had Deep Buried IEDs that were command detonated. Each side of the road was lined by palm groves and dense foliage. The MRAP obviously provided good protection but also the height for the Gunner to see into those palm groves to provide accurate and timely direct fire.
- ⇒ Drawback to the MRAP was also the height due to low hanging wires throughout the AO. This caused us to make modification to the truck in order to push the wires out of the way of the gun turret.





# Captain Brian Gilbert – NDIA Combat Vehicle Conference

Background Cont.

✓ OIF V:

- ⇒ With the infantry platoon the MRAP maintained the capability of the M2 as far as troop carrying ability. Although the Soldiers had some difficulty dismounting because of the height of the ramp we were still able to deploy dismounted Soldiers fairly quickly from this platform.
- ⇒ Because of the troop carrying capability we often used the MRAP during Raid operations in Urban environment when the threat of enemy contact was minimal and speed and surprise was essential. The MRAP is much more quiet than a Bradley and can easily act as a blocking vehicle on the inner cordon. Again the only concern was the low hanging wires because of the height of the vehicle.
- ⇒ The final drawback to the MRAP was the suspension. Because of the tight suspension we rarely used the MRAP on unimproved roads. The vehicle seemed prone to roll overs in rugged terrain and at higher speeds the smallest pothole caused the vehicle to bounce.





# Captain Damian M. Gill – NDIA Combat Vehicle Conference

Background –

- ✓ Executive Officer: D-TRP/2-1 CAV/4<sup>th</sup> SBCT/2<sup>nd</sup> ID
- ✓ Platoon Leader: Stryker NBC RV Operation Iraqi Freedom 2007-2008
- ✓ Stryker NBC RV Fielding and IOT&E



Deployment OPERATION IRAQI FREEDOM:

- ⇒ PLT Consisted of three Stryker NBC RVs
- ⇒ A part of the RSTA Squadron, 2-1 Cavalry Regiment
- ⇒ Operated out of FOB Warhorse, Diyala Province Iraq
- ⇒ 4<sup>th</sup> SBCT was the land owning unit for the Diyala Province, north east of Baghdad
- ⇒ Responsible for cities of Baqubah, Muqadia, and Khalis
- ⇒ Province of roughly 1.5 million persons
- ⇒ Executed 14 months of combat operations that brought AQI to their knees





# Captain Damian M. Gill – NDIA Combat Vehicle Conference

## 4<sup>th</sup> SBCT COMBAT OPERATIONS

- ✓ Conducted 14 months of continuous combat operations
- ✓ Stryker Vehicles used as the primary weapon system for the BDE
- ✓ Our SQDN used them as a mix of Infantry and Cavalry—arrive quickly, silently, dismount, attack and then destroy lethally
- ✓ Notable involvements were the following:
  - ✓ Involvement with Operation Arrowhead Ripper (clearing of Baqubah)
  - ✓ Blackhawk Reaper (clearing of the canal area Hib Hib)
  - ✓ Blackhawk Harvest (opening of HWY-5, previously closed for 2 years)
  - ✓ Operation Justice League (clearing of northern Khan Bani Sa'ad)





# Captain Damian M. Gill – NDIA Combat Vehicle Conference

## OVERALL PERFORMANCE

- ✓ Fulfilled the mission set
- ✓ Strykers fit down the streets of Baqubah
- ✓ Soldiers got on and off quickly—Got to the Objective!
- ✓ Benefits:
  - ✓ WPN Systems—RWS is in color and is precise
  - ✓ Quiet compared to tracked vehicles
  - ✓ Armored, most of our Soldiers came back home
  - ✓ Compatibility—all the platforms can interchange
  - ✓ Stryker allows for quick access maintenance—maintainers quickly pull pack, operate, and reinstall
  - ✓ Combined arms operations with all Stryker variants
  - ✓ Driver Enhancement Kit (DEK)--lifesaver





# Captain Damian M. Gill – NDIA Combat Vehicle Conference

## ✓Future Considerations:

- ✓Space—continue to optimize any small things, ex. Radio mounts, location of Duke
- ✓Hatches—the RV and NBC RV should have an additional commander's hatch
- ✓Modified mounts for M240s
- ✓Stryker Specific Recovery Capabilities
- ✓Properly designed turret shields for air guards



# Mechanized, Motorized, and Maritime Operations in OIF III AAR and Lessons Learned

By

James (Brad) Kelley

CPT, IN

TRADOC Capability Manager, IBCT

[Brad.kelley@us.army.mil](mailto:Brad.kelley@us.army.mil)

310.498.0006 C

706.545.4317 W

# Background

- Platoon Leader, 2/11 ACR
- 12 months in Babil Province, 35 km South of Baghdad
- M2A2, M1114, and M998 variants
- Missions
  - Cordon and Search
  - “Presence” patrols and Demonstration of Force (DOF)
  - Route Clearance
  - Intelligence, Surveillance, and Recon (ISR)
  - Humanitarian Aid
  - Lethal and non-lethal targeting

# USMC Combat Vehicles



**NDIA Combat Vehicle Conference**  
**21 October 2008**

**Dr. Robert Lusardi**  
**Deputy Program Manager**  
**Light Armored Vehicles**

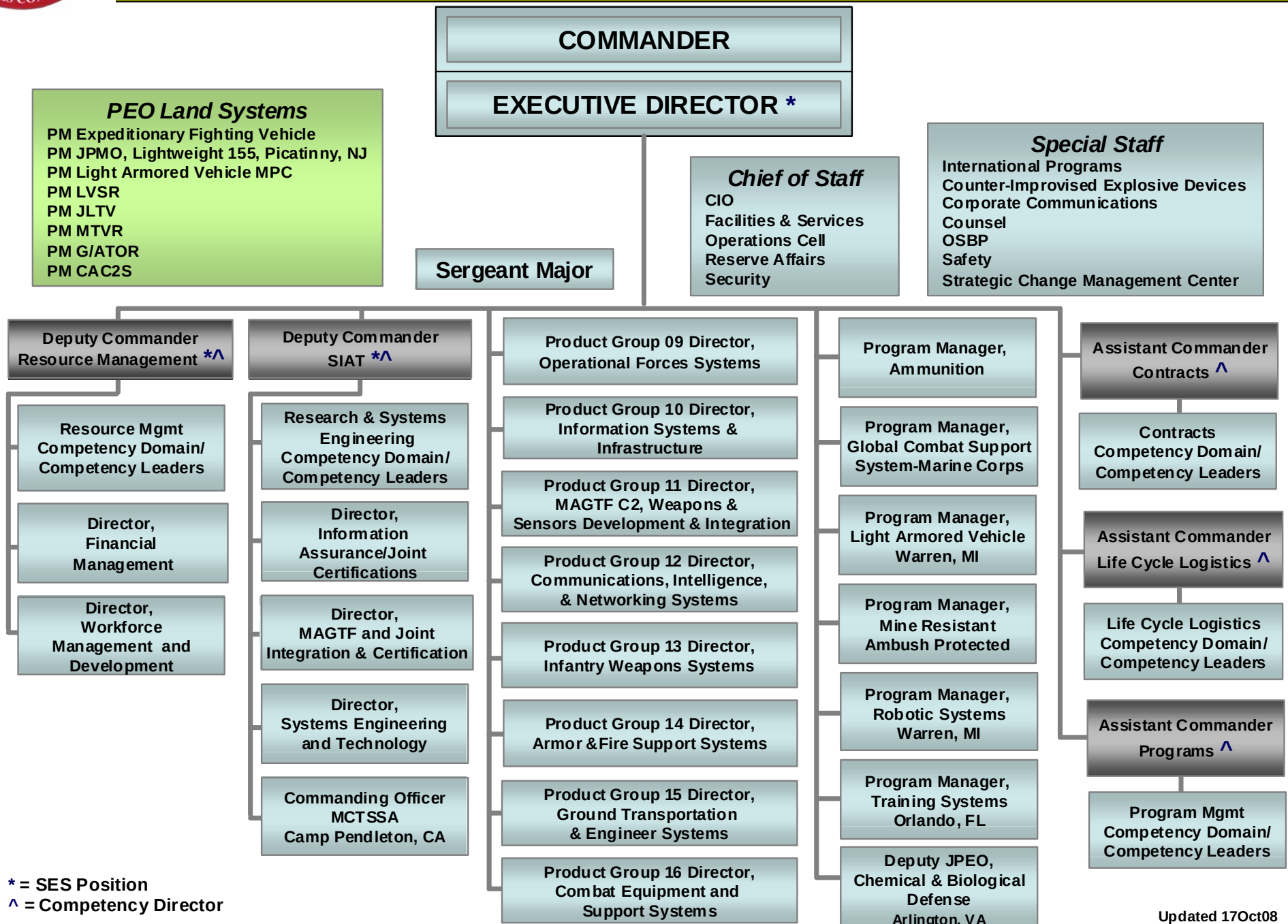
# Agenda

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- **USMC Combat Vehicle Organizations**
- **Light Armored Vehicles**
- **Assault Amphibious Vehicles**
- **Tank Systems**
- **Expeditionary Fighting Vehicle**
- **Marine Personnel Carrier**
- **Q&A**

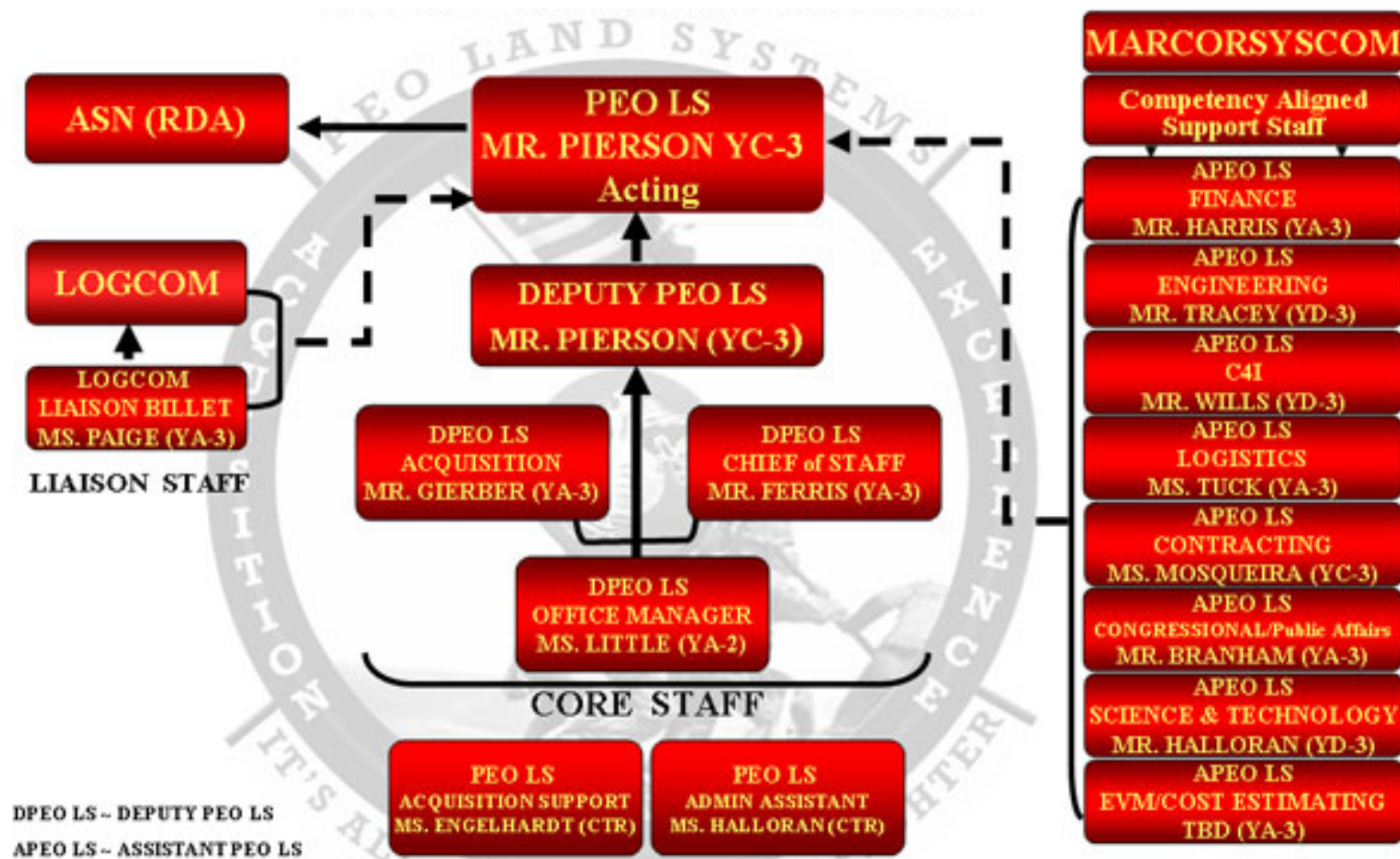


# Marine Corps Systems Command





# USMC PEO Land Systems



DPEO LS ~ DEPUTY PEO LS  
APEO LS ~ ASSISTANT PEO LS

PEO LS PORTFOLIO IS \$9.7B ACROSS THE FUTURE YEARS DEFENSE PLAN (FYDP).

LW155

LVSR

MTVR

EFV

MPC

JLTV

CAC2S

G/ATOR

*“Making the Transition to the Future”*



# Marine Corps Light Armored Vehicles

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## NDIA Combat Vehicles Conference

21 Oct 2008



**Dr. Robert Lusardi**  
**Deputy Program Manager**  
**Light Armored Vehicles**

*"Making the Transition to the Future"*



# PM LAV

- **PM LAV Mission** - Research, development, acquisition and life cycle support for USMC Light Armored Vehicle family of vehicles.
- **Our Location** – MARCORSYSCOM program office supported by TACOM in Warren, Michigan



- **LAV – in the Light Armored Reconnaissance Battalion.**

- Conduct reconnaissance, security, and economy-of-force operations, limited offensive or delaying operations that exploit the unit's mobility and firepower.
- Eight-wheeled armored combat vehicle with a 25-year history to remain in service until to 2025 and possibly beyond.



- **MPC – will reside in the Amphibious Assault Battalion.**

- Provide armor-protected mobility for infantry battalion maneuver task forces. 2 MPCs will lift a reinforced rifle squad.
- The MPC program balances vehicle performance, protection, and payload attributes.

*“Making the Transition to the Future”*



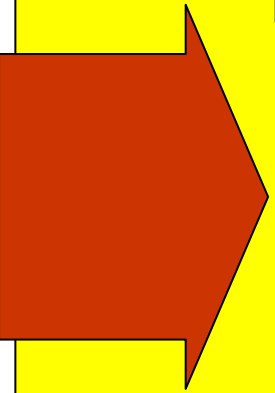
# LAV Modernization Plans

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## Funded Programs

- LAV SLEP/ Improved Thermal Sight System (ITSS)- Fielding.
- LAV-C2 Upgrade- Moving towards Milestone-C.
- LAV-25 Lethality Upgrade- Working.
- OIF Upgrades, A2 Upgrade, LAV Re-Procurement- Fielding.

## Future LAV Programs (FY08-FY09)

- 
- LAV Rapid Acquisitions & Modifications (RAM)
  - LAV Survivability Upgrades - Part II
  - LAV Fleet Sustainment Upgrades - EPLS



# Past RAM Projects



ALL PROJECTS COME OUT THROUGH:  
**Federal Business Opportunities**  
**[www.FedBizOpps.gov](http://www.FedBizOpps.gov)**



*"Making the Transition to the Future"*



# LAV Survivability Upgrade – Part II

- Incorporate Floor Spall Liner
- Protection or Relocation of Fuel Tank
- Incorporate Mine Blast Resistant Seating where possible
  - LAV-25
    - VC and Gunner
    - Scouts
  - Mission Role Vehicles
    - VC and staff locations
  - Driver cannot be suspended but will need a reinforced seat and leg protection





# LAV - Closing Remarks

---

- USMC LAV projected to remain *in service until 2025*
- LAV family of vehicles must remain
  - ***Effective*** in the face of increasing threat capabilities
- ***Supportable*** in the face of increasing age (CBM+ & Obsolescence are growing issues)
- The challenge: *How much survivability, lethality and mobility can be packed into an air-transportable, swim-capable LAV?*

- **Near Future:**
  - **LAV RAM projects**
  - **LAV Survivability Upgrades**
  - **LAV Sustainment Upgrades**



# Marine Personnel Carrier (MPC)

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*"Making the Transition to the Future"*



# MPC: System Description

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- MPC is part of a portfolio of capabilities that provide closure to real world operational gaps and shortfalls in the ability of the MAGTF to conduct ground based maneuver tasks. The MPC, as the medium capability category platform, provides a bridge in capability between the EFV and JLTV and a balance between the performance, protection and payload attributes.
- The MPC is an expeditionary armored personnel carrier - ideal for irregular warfare - yet effective across the full range of military operations. Providing armor-protected mobility for infantry battalion maneuver task forces.
- The MPC family of vehicles includes the base armored personnel carrier and two supporting mission role variants: a command & control variant and a recovery & maintenance variant.
- Each vehicle type will be subjected to automotive performance, electromagnetic effects, reliability, live fire and operational tests.
- Although there is no existing Joint application, there are ongoing discussions between the Marine Corps and the Army to identify potential points of joint convergence.



# Marine Personnel Carrier (MPC)

## Pre-MS A: The Near Future...

- Currently working with ONR to mature technologies that need to be integrated on the MPC
  - **Advance Lightweight Armor** Materials/ Technologies
  - **Advanced Seat Technology** for blast resistance, shock mitigation and roll-over protection
  - **Active Protection System**
  - On-Board Vehicle Power for **exportable power**
  - **Fuel Efficiency** & Battlefield Power
  - **Advanced Suspension**
  - **TBD**



*“Making the Transition to the Future”*

# Questions?

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*“Making the Transition to the Future”*

# PM FCS (BCT) Platform Overview - Combat Vehicles Conference

21 OCT 2008

## **Future Combat Systems (BCT) Overview**

### **Manned Ground Vehicle Overview**

**COL Bryan McVeigh, Project Manager**

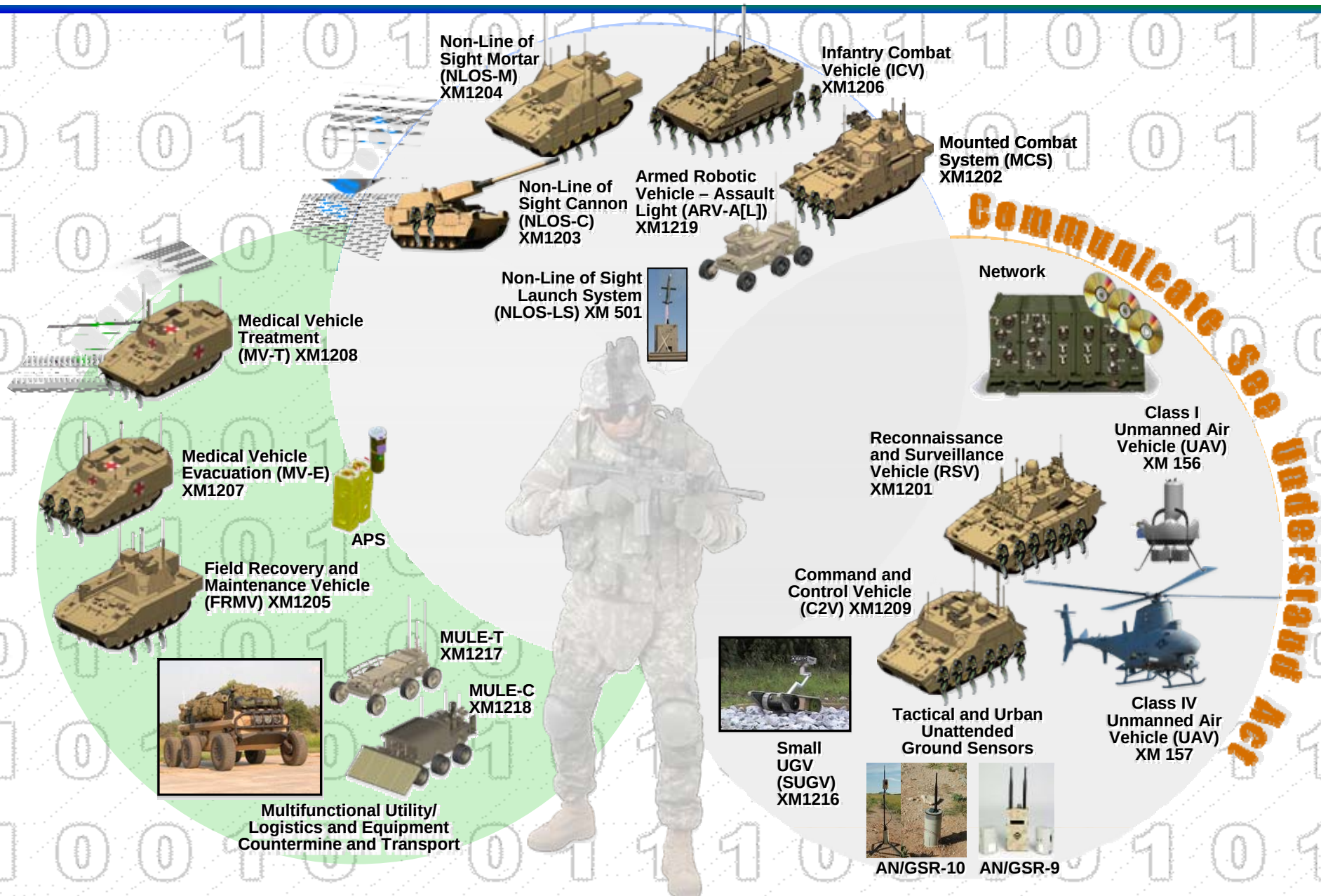
### **Mounted Combat System Tank, Combat, Full Tracked: Medium**

**LTC Robert Hannah, Product Manager**

### **Unmanned Air Vehicles Overview**

**LTC Winfield Keller, Product Manager**

# Future Combat Systems



# Recent Program Accomplishments

- Delivered 1<sup>st</sup> Non-Line of Sight Cannon Prototype (NLOS-C P1) vehicle for testing, successful first round firing
- Completed Spin Out 1 Tactical Field Test (TFT), Field Demonstration, Test and Evaluation (FDT&E), and Preliminary Limited User Test (P-LUT)
- Delivered first set of “accelerated” Small Unmanned Ground Vehicle (SUGV) and Class 1 Block 0 units
- System of Systems Common Operating Environment (SoSCOE) 2.0 Deliveries/Testing
- Completed Autonomous Navigation System (ANS) and Multi-function Utility/Logistics and Equipment (MULE) Vehicle Preliminary Design Reviews
- Completed Joint Expeditionary Force Experiment (JEFX-08)
- Non-Line of Sight Launch System (NLOS-LS) Control Test Vehicle (CTV) 2 Successful Flight
- Airborne Standoff Minefield Detection System (ASTAMIDS) Captive Flight Test
- First end-to-end Active Protection System (APS) Test



**Executing to Support Army Modernization Strategy**

# Manned Ground Vehicle Overview

COL Bryan McVeigh  
Project Manager, FCS (BCT), Manned Ground Vehicles

21 OCT 2008

# Manned Ground Vehicle (MGV) Family

**C2V**  
**XM1209**



**RSV**  
**XM1201**



**MCS**  
**XM1202**



**NLOS-C**  
**XM1203**



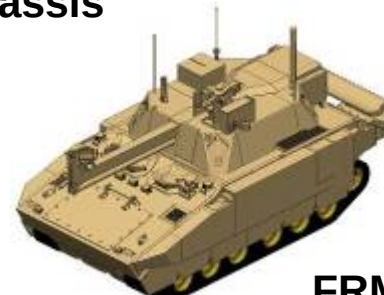
**MV(E/T)**  
**XM1207/1208**



**Common**  
**Chassis**



**ICV**  
**XM1206**



**FRMV**  
**XM1205**



**NLOS-M**  
**XM1204**

# Manned Ground Vehicles Since the Last Conference

1<sup>st</sup> QTR 08

2<sup>nd</sup> QTR 08

3<sup>rd</sup> QTR 08

4<sup>th</sup> QTR 08

Oct 07 – Dec 07

RSV Mock-Up Evaluation



MGV Track Testing at YPG - Nov 2007

First Direct and Indirect Vision System Evaluation – Dec 2007



Jan 08 – Mar 08

Non-Line of Sight Mortar Firing Platform Completes Breech Cycle Testing – Jan 2008

XM1201, Reconnaissance and Surveillance Vehicle (RSV) Test Rig – March 2008



Apr 08 – Jun 08

MGV-P3 Power Pack Testing - April 2008

Non-Line of Sight Mortar Firing Platform Completes Phase II Testing – May 2008



Non-Line of Sight Cannon Integration – May 2008

NLOS-C Delivery – Jun 08



July 08 – Oct 08

Active Protection System Design Verification Test



Medical Vehicle Mock-up Pit Stop Evaluations

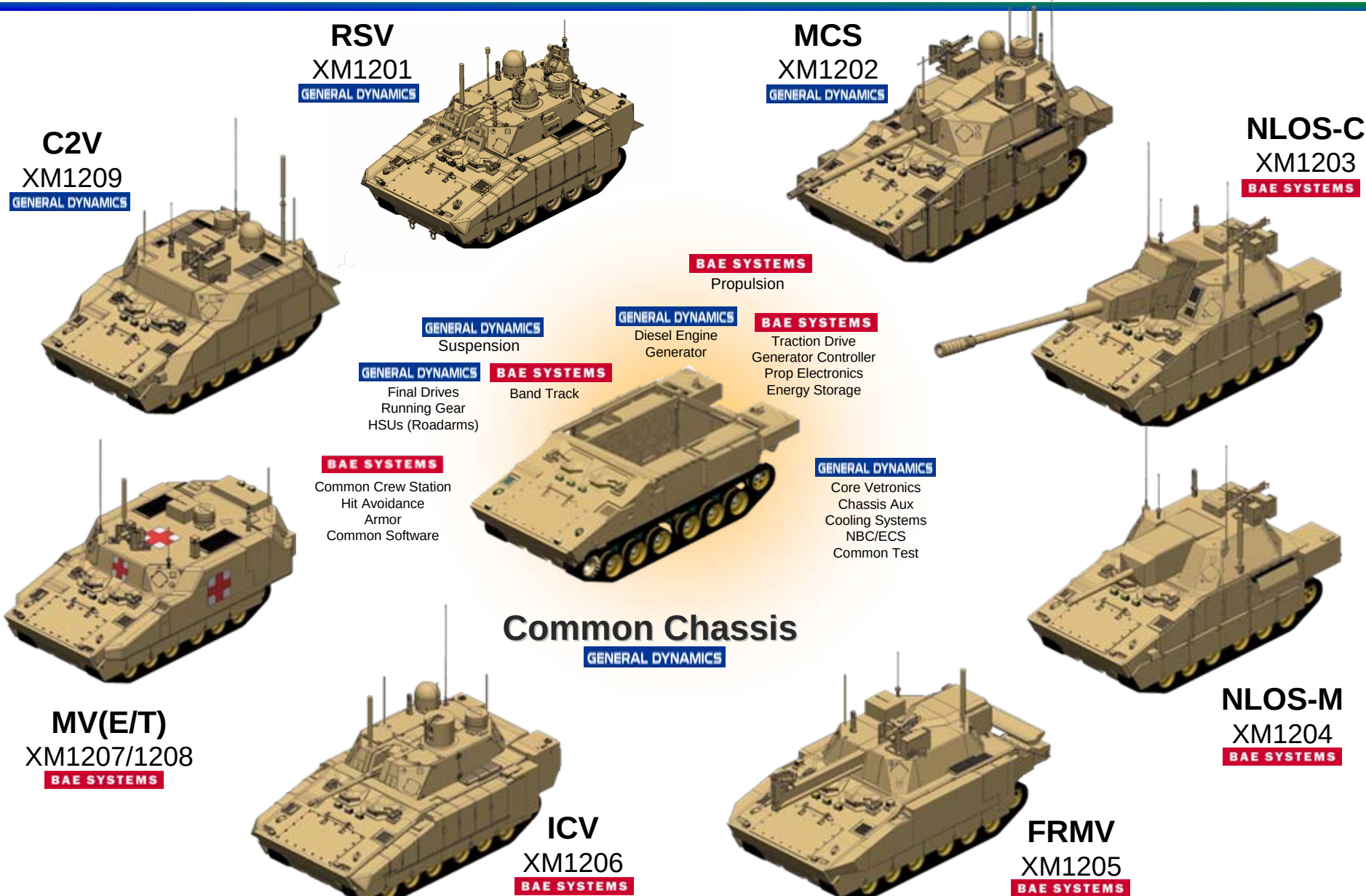
NLOS-C Prototype 3 Driving

NLOS-C Prototype 1 Firing



# Manned Ground Vehicle (MGV) Fleet

Joint development between both of the FCS One Team Partners



# XM1202 Mounted Combat System Tank, Combat, Full Tracked: Medium

LTC Bob Hannah, PdM MCS  
21 October 2008

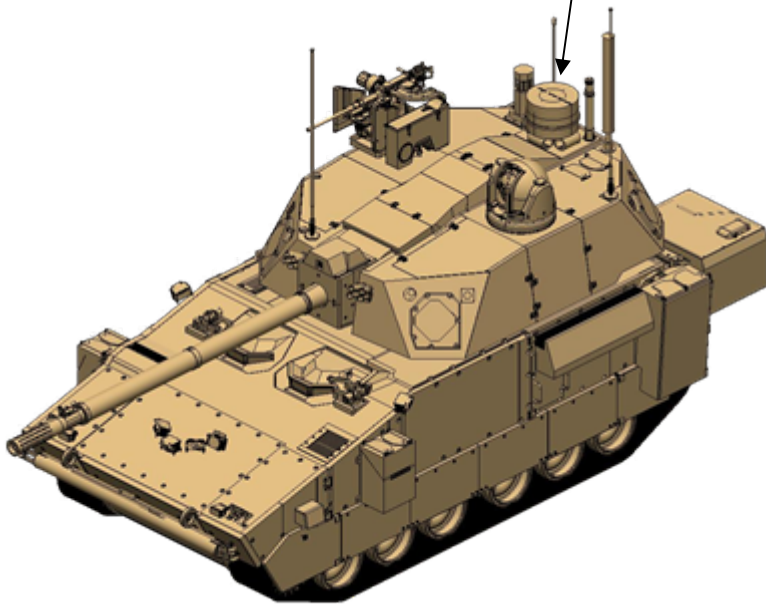
# XM1202 Mounted Combat System (MCS)

## Key Capabilities

- Provides highly lethal, mobile Line-Of-Sight (LOS) and Beyond-Line-Of-Sight (BLOS) capabilities
- Increased rate of fire through auto-loader and the automated ammunition handling system reduces crew fatigue
- Lightweight XM360 120mm cannon with 27 ready rounds
- Fires all current 120mm rounds and Mid-Range Munition (MRM)
- Light/ heavy caliber secondary armament with integrated fire control

## Status

- Ammo Handling System/ Primary Weapon Assembly/ Turret Structure/ armament sub-systems were integrated into Firing Platform at the Armament Subsystem Development Laboratory in Shelby, MI
- Began testing the Firing Platform at TARDEC in Aug 08; testing the Firing Platform on live-fire range at Aberdeen Proving Ground beginning 1<sup>st</sup> Qtr FY09.
- Gun tube Proof testing / Cannon Interim Safety Firing Test #1 completed at Aberdeen Proving Ground. 500-round Safety Firing Test #2 began in 4<sup>th</sup> Qtr FY08. More than 1650 rounds fired in XM360 development to date.



XM360 Test at APG, MD

Firing Platform Integration



# XM 1202 Mounted Combat System

1<sup>st</sup> QTR 08

2<sup>nd</sup> QTR 08

3<sup>rd</sup> QTR 08

4<sup>th</sup> QTR 08

Oct 07 – Dec 07



Ammo Handling System, Primary Weapon Assy, Turret Structure deliveries completed in December 2007

Jan 08 – Mar 08

Ammo Handling System, Primary Weapon Assy, Turret Structure were integrated into the Firing Platform at the Armament Subsystem Development Lab in Shelby, MI from Jan-Jun 2008



Apr 08 – Jun 08

Gun tube Proof Testing/ Cannon Interim Safety Test # 1 completed at Aberdeen Proving Ground in June 2008



Demonstrated Firing Platform functionality for the Army Chief of Staff on 18 June 08

July 08 – Oct 08

MCS Firing Platform Testing on the Turret Motion Base Simulator at TARDEC: Jul – Nov 08



# Class I & IV

# Unmanned Air Vehicles

1<sup>st</sup> QTR 08

Oct 07 – Dec 07

**Airframe static load testing**



**E3 Testing**



2<sup>nd</sup> QTR 08

Jan 08 – Mar 08

**Experiment 2.1**



**Rotor Hub Fatigue Test with the US Navy**



**Class IV Phase I Assembly of A4 & A5**



3<sup>rd</sup> QTR 08

Apr 08 – Jun 08

**ASTAMIDS Initial Flight Test (IFT) and Contractor Flight Test (CFT)**



**Class I 5hp Heavy Fuel Engine risk reduction test**



4<sup>th</sup> QTR 08

July 08 – Oct 08

**Class IV Transportability Test**



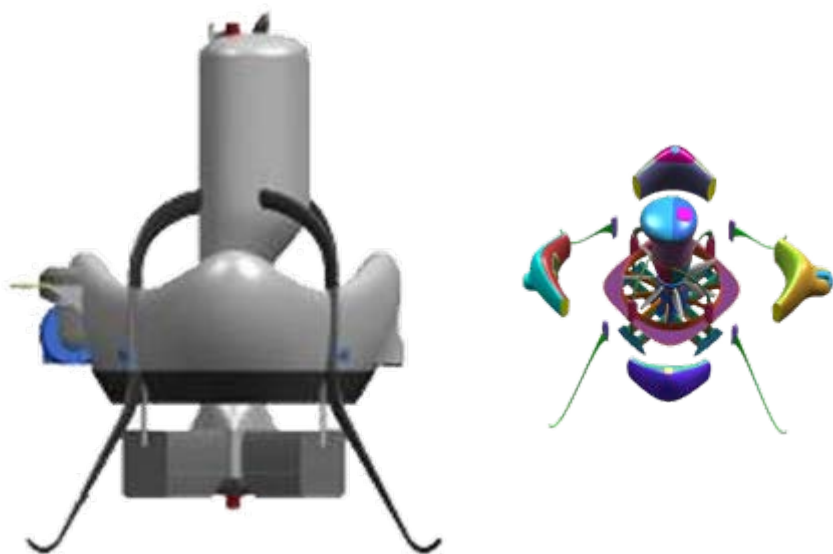
**25th ID deployment of gMAV**



**P-LUT**



# Class I Description and Events



## Missions

- RSTA
- Laser Designation

## Description

- Manpackable/Air Droppable
- Hover & Stare Capability
- EO/IR/LD/LRF Sensor
- Heavy Fuel Engine
- Deployable within Five Minutes



# Class IV UAV Overview



Airborne Surveillance,  
Target Acquisition and  
Minefield Detection  
System (ASTAMIDS)

SAR/GMTI

## Missions

- RSTA
- Laser Designation
- Wide Area Surveillance
- Wideband Communications Relay
- Standoff CBRN
- Met Data for NLOS
- Manned/Unmanned teaming

## Description

- Brigade Combat Team organic Reconnaissance, Surveillance, and Target Acquisition (RSTA) capability
- Transportable by Ground, Rail, Sling, C-130
- Autonomously take off and land at unprepared and unimproved landing zones
- Autonomous flight and navigation



# Current Efforts



## OIF Support

- 36 gMAV air vehicles fielded
- 40+ Trained operators
- Transitioned to PM UAS
- Supporting additional training, fielding, development and procurement

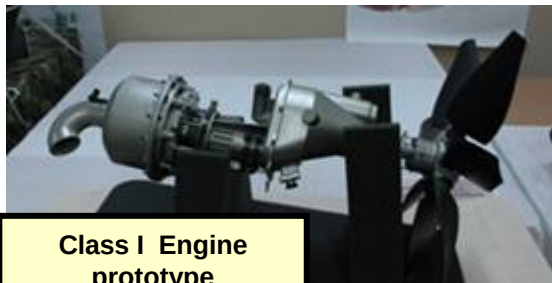
## AETF Activities

- 20+ Trained operators
- P-LUT
  - Gimbaled sensor
  - JTRS/SRW integration
  - Lessons Learned
  - TTP
- LUT
  - Engine Control Unit
  - Electric Starter
  - Centralized Controller excursion



# Unmanned Aerial Vehicles (UAV)

## Class I



Class I Engine  
prototype

Class I Block 0  
with soldier



Class I Block 0  
in Flight



Class I Block 0 with  
Gimbaled sensor



Experiment 1.1



Army A7 undergoing  
shipping inspection  
process at SAC

A2 Engine Run at Moss  
Point, MS 7 Aug 07



Army / Navy  
Fire Scouts at  
Moss Point, MS



N1 being flown at  
AUVSI Demo at  
Webster Field, MD



## Class IV



Army A5 on Display @ Marine  
Corp Day, Quantico, VA



Army A2 being loaded on C130 at  
Trent Lott International Airport, MS

# Questions

# Backup

# Future Combat Systems Since the Last Conference

1<sup>st</sup> QTR 08

2<sup>nd</sup> QTR 08

3<sup>rd</sup> QTR 08

4<sup>th</sup> QTR 08

Oct 07 – Dec 07

Unattended  
Ground Sensors &  
MULE



Jan 08 – Mar 08

B-Kit in M1151A1



Apr 08 – Jun 08

C2V Demonstrator



Captive Flight Test #12  
– May 2008



NLOS – LS Test



July 08 – Oct 08

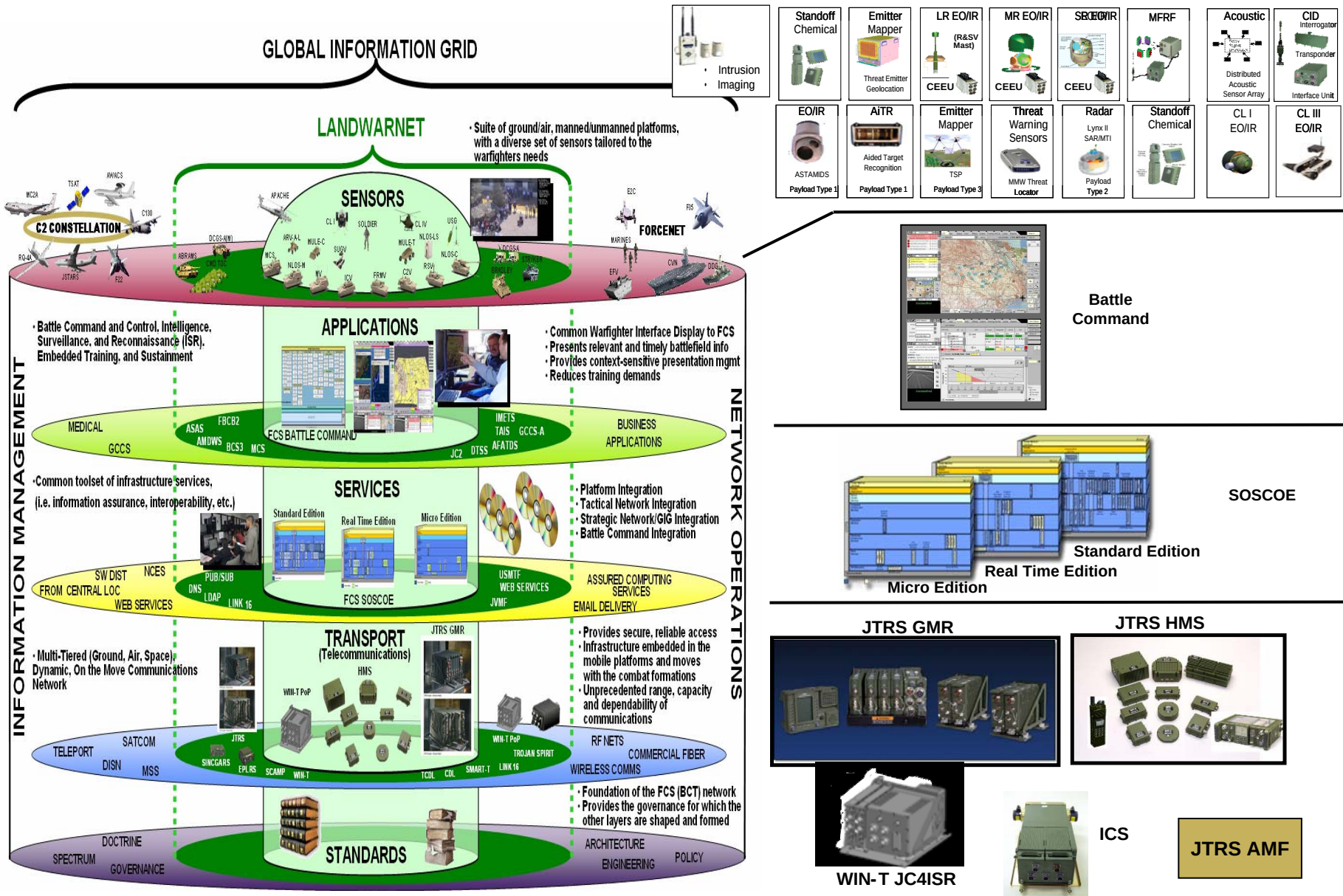
SUGV Video Imagery  
Sent to B-Kitted  
HMMWV During Spin  
Out P-LUT



Spin Out P-LUT at AETF



# Future Brigade Centric Team Network



# MGV System Overview

## Force Protection/Survivability

- Upgradeable Armor
- Active Protection System
- Hit Avoidance Suite
- Mine Kit
- Crew Seating – Ceiling Mounted

## Lethality

- Automated Rate of Fire & Precision
- Autoloader = Less Soldiers (MCS, NLOS-C/M)
- Infantrymen: HBCT 324 vs FCS BCT 702
- MCS has 2km LOS & 12 km BLOS Capability

## Supportability

- Reduced Sustainment Burden
  - Fuel: 33% reduction
  - Spares: 62% reduction
  - 30 Min. Time To Repair
- 80% of maintenance tasks performed by crew

## Commonality

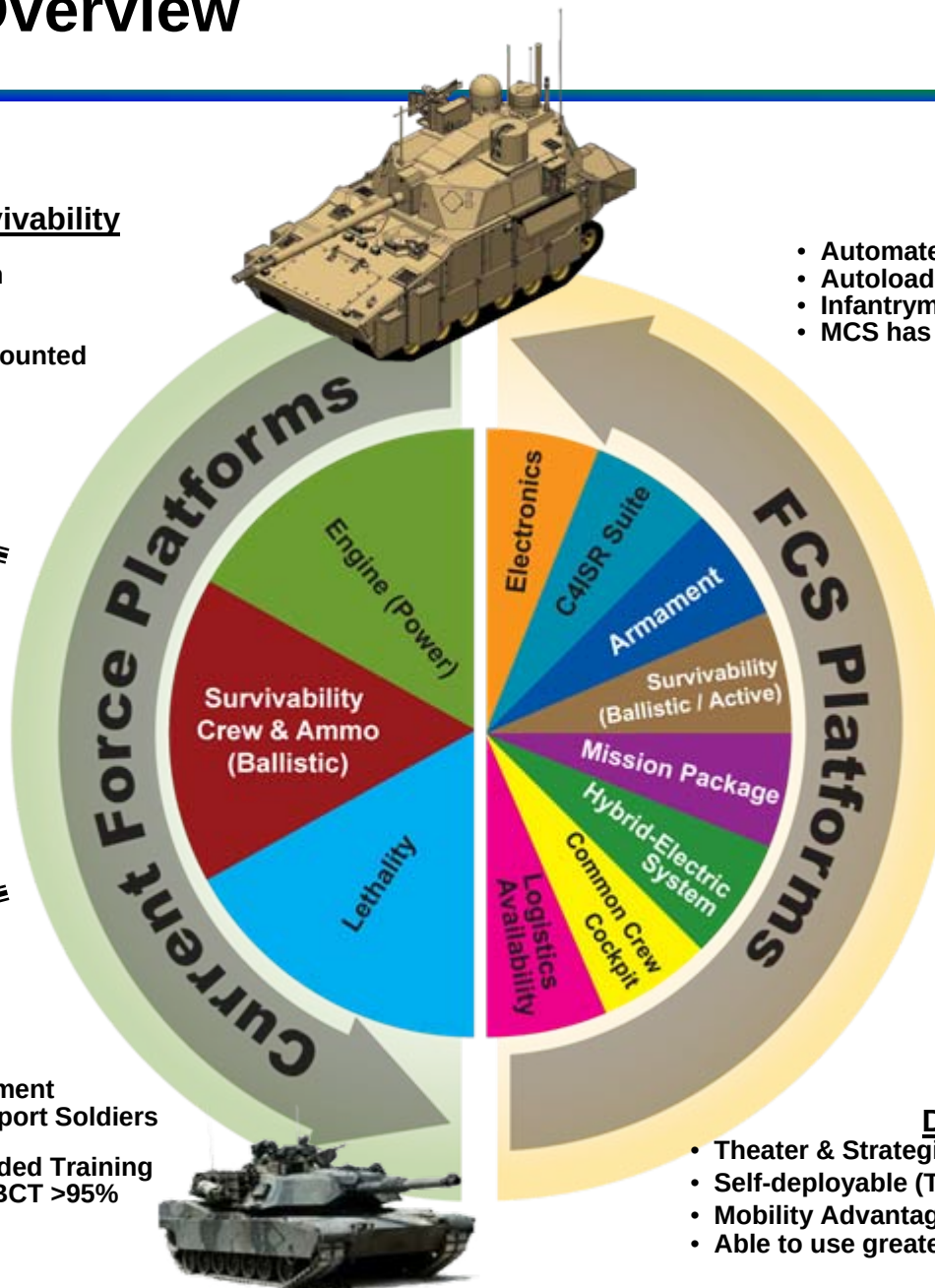
- Common MGV Chassis
- 75% of MGV parts are common to all platforms
- 10 common tools per platform
- 20 total common tools
- Common SW throughout BCT

## Affordability

- Reduced Manpower and Sustainment
- Cost less to Maintain: HBCT Support Soldiers 1186 vs FCS BCT 411
- Costs less to train due to Embedded Training
- Vehicle Ao: HBCT >90% vs FCS BCT >95%
- Power and Energy to Grow

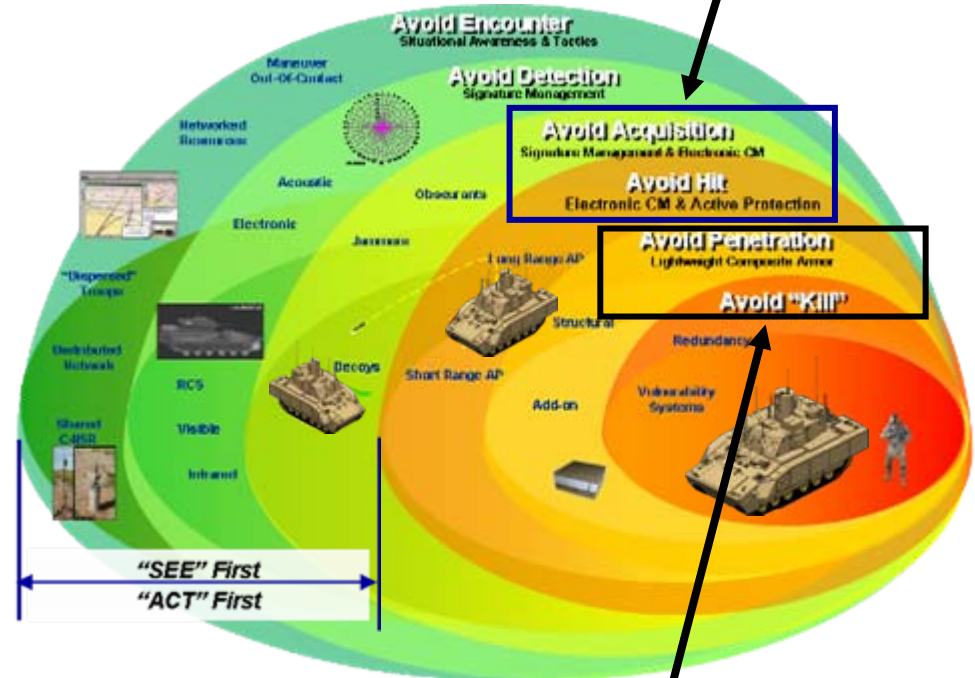
## Deployability

- Theater & Strategic Deployable: C-5 / C-17
- Self-deployable (Tactical Road March w/o HETTS)
- Mobility Advantage: Bridges/Unimproved Roads
- Able to use greatest variety of Rail Services



# FCS Survivability – A Holistic Approach

- “Onion Skin” methodology which leverages layers to protect the Soldier and equipment
- Leverage Power of System of Systems
  - Avoiding kill
    - Including reducing impulse to Mounted Soldiers
  - Avoiding penetration
    - Including standoff and ballistic protection
  - Avoiding acquisition and hit with countermeasures
    - Including decoys
  - Avoiding encounter with situational awareness and tactics
    - Including detection using Multifunctional Utility/Logistics and Equipment Vehicle - Countermine (MULE-CM)



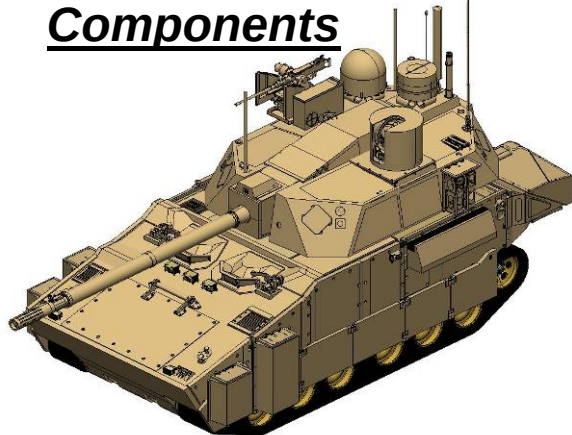
**Platform Hit Avoidance System is one component of Full Spectrum Survivability**

**Ballistic Protection and other platform attributes further support Soldier Survivability**

# MGV On-board Survivability Suite

## Hit Avoidance System Components

Active



Multi-Function Counter Measure (MFCM)

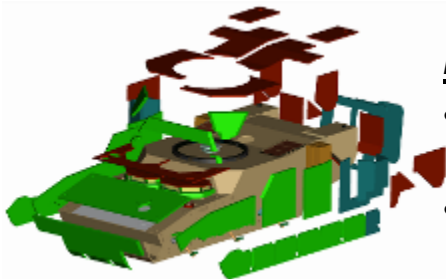
Passive Threat Warning Sensor (4X)

MFRF Radar Antenna (4X)

Laser Threat Warning Sensor (4X)

Active Protection System (APS)  
Long Range Counter Measure  
Short Range Counter Measure

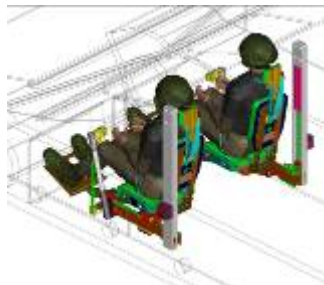
Passive



### Base "B" Armor

- Armor upgradability designed into each MGV via A+B approach
- Bx/Ux path forward provides periodic armor updates every ~3 years
- Modular AT Mine kit

Soldier



### Vehicle Structure and Crew Seats

- Designed to mitigate impulses to Soldier

### Short Range Countermeasure will Defeat



### Long Range / MFCM Countermeasures will Defeat



### Armor & Mine Kit will protect Against



# MGV Common Chassis



## Status

- Maturing common chassis design in advance of MGV PDR
- Various components in test now including hybrid electric propulsion, composite armor, active protection system, and bandtrack & hydro-pneumatic suspension
- P1 NLOS-C chassis assembly complete
- P3-P6 NLOS-C chassis integration & assembly ongoing

# MGV ICV & RSV

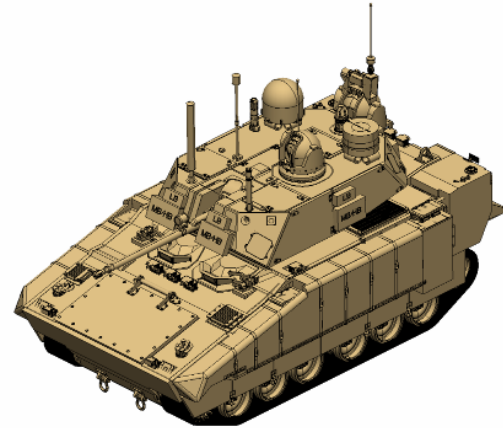
## Infantry Combat Vehicle (ICV)



### Status

- Conducted ICV mock-up ingress/egress demonstrations
- Awarded system subcontracts for:
  - M240 remote operating kit
  - 30mm ammunition handling system
  - Mk44 30mm gun
- Conducted critical design reviews for the gun turret drive system, multi-media slipring, off-slipring processing system and ammunition

## Reconnaissance & Surveillance Vehicle (RSV)



### Status

- Continuing to mature RSV design to PDR
- Maturing SIGINT integration approach
- Executing RSV Rooftop Deconfliction Test
  - Turreted Rooftop Test Rig construction completed
  - Physical placement and electro-magnetic interference assessment in process
  - Test began July 2008

# MGV C2V & MCS

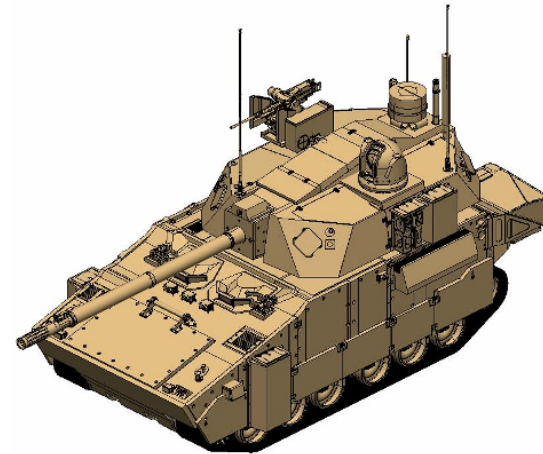
## Command & Control Vehicle (C2V)



### Status

- Continuing to mature C2V design to PDR
- Maturing SIGINT integration approach
- Preparing for Rooftop Deconfliction Test phase 2
  - Architecture update, E3 and Test model update
  - Test to begin March 2009

## Mounted Combat System (MCS)

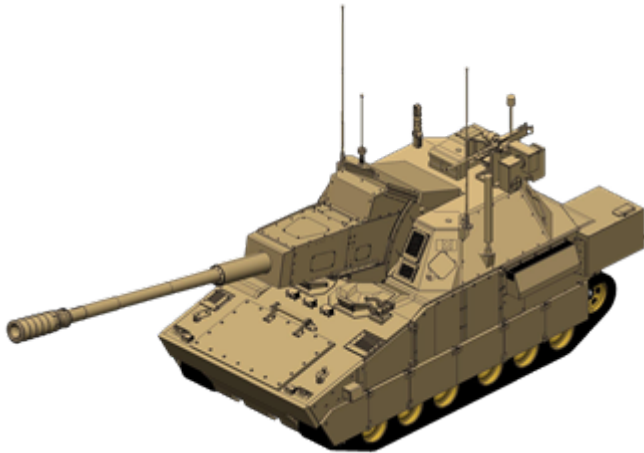


### Status

- Ammo Handling System/ Primary Weapon Assembly/ Turret Structure/ armament sub-systems were integrated into Firing Platform at the Armament Subsystem Development Laboratory in Shelby, MI
- Began testing the Firing Platform at TARDEC in Aug 08; testing the Firing Platform on live-fire range at Aberdeen Proving Ground beginning Nov 08.
- Gun tube Proof testing / Cannon Interim Safety Firing Test #1 completed at Aberdeen Proving Ground. 500-round Safety Firing Test #2 began in Jul 08. More than 1400 rounds fired in XM360 development to date.

# MGV NLOS-C & NLOS-M

## Non-Line Of Sight – Cannon (NLOS-C)



### Status

- Firing platform at YPG fired over 2800 rounds
- Prototype #1 – Rolled out at Army Birthday
- Prototype #1 start Firing testing Sep 08
- Prototype #3 start Mobility testing Oct 08
- Prototype #4-6 Mission Module and Chassis assembly and integration ongoing

## Non-Line Of Sight – Mortar (NLOS-M)



### Status

- NLOS-M Firing Platform has fired 1178 rounds
- Ultra-light weight tube delivered and tested during Phase II at Camp Ripley
- Upgraded and Tested In-bore Air Retention System and Automated Mortar Cleaning System at Camp Ripley Apr-May 08
- Mortar Ammunition Handling System in process of being assembled

# MGV MV-E/T & FRMV

## Medical Vehicle – Evacuation (MV-E) Medical Vehicle – Treatment (MV-T)



### Status

- Executed MV-E PitStop Engineering Evaluation validating the design of the litter lift handling system, placement of medical equipment and medic workstation
- Incorporated PitStop evaluation findings to improve LLHS design, placement of medical equipment and medic workstation design
- Conducted data entry assessment using the Rapid Automated Medical Processing System
- Executed MV-T Mock Up Demonstration and Evaluation
- Conducted assessment on MV-T medical equipment set stowage, MV-T treatment table and MV-T shelters

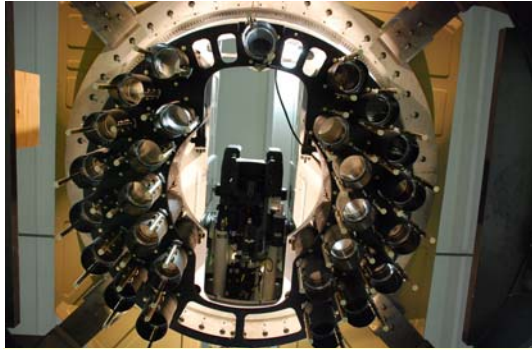
## Field Recovery & Maintenance Vehicle (FRMV)



### Status

- Increased design-to capacities for the recovery equipment and maintenance lift to support all FCS manned and unmanned ground vehicles
- Completed recovery winch and crane boom actuator Preliminary Design Reviews
- Maintained Light Weight Tactical Crane and Towing Component Maturation Plans per baseline plans

# XM1202 MCS Recent Accomplishments



Ammunition Handling System

- Ammo Handling System/ Primary Weapon Assembly/ Turret Structure/ armament sub-systems were integrated into Firing Platform at the Armament Subsystem Development Laboratory (ASDL) in Shelby, MI from 2nd – 3<sup>rd</sup> Qtr FY08.
- Demonstrated Firing Platform functionality to the Army Chief of Staff on 18 Jun.
- Gun tube Proof testing / Cannon Interim Safety Firing Test #1 completed at Aberdeen Proving Ground in 3 Qtr FY08.
- Firing Platform began testing on the Turret Motion Base Simulator in 4<sup>th</sup> Qtr FY08.
- More than 1650 rounds fired in XM360 development to date.



Firing Platform Integration



XM360 Test at APG, MD



GEN Casey at the ASDL in Shelby



Firing Platform on TMBS at TARDEC

# Class I FY 09 and 10 Way Ahead

## FY 09

- Conduct Class I PDR - 1st Qtr FY09
- Procure Engines and Airframes for Early Developmental Assets
- Conduct EO/IR/LD/LRF Payload CDR – 3rd Qtr FY09
- Conduct Class I 1st Risk Reduction Flight – 4th Qtr FY09



Class I Engine  
prototype

## FY 10

- Conduct Class I CDR – 2nd Qtr FY10
- Procure Remaining Engines and Airframes for Early Development Assets
- Risk reduction flight on Early Developments Assets – 4th Qtr FY10



EDA Risk  
Reduction flight

# Class IV FY 09 and FY 10 Way Ahead

## FY 09

- Conduct Class IV UAVS Preliminary Design Review (PDR) 1st Qtr FY 09
- Complete Phase 1 of air vehicle assembly at Moss Point, MS for Air Vehicles A6-A8
- Support ASTAMIDS EO/IR/LD/CM payload CDR 3rd Qtr FY 09
- Conduct Cooperative Rotor Hub Fatigue Testing to begin 1st QTR FY 09
- Support ASTAMIDS Contractor Flight Testing at YPG 1st QTR FY 09



Moss Point, MS  
Assembly Facility

## FY 10

- Conduct Class IV UAVS Critical Design Review (CDR) 1st Qtr FY 10
- Begin Phase 2 of air vehicle assembly (includes installation of FCS unique equipment) at Moss Point, MS for air vehicles A1-A4
- Conduct integration and test at Northrop Grumman/FCS Class IV UAV System Integration Lab (SIL):
  - JTRS HMS SFF-J and WIN-T radios
  - ASTAMIDS and SAR/GMTI payloads
  - Type IV ICS brass board



# Marine Corps Light Armored Vehicles



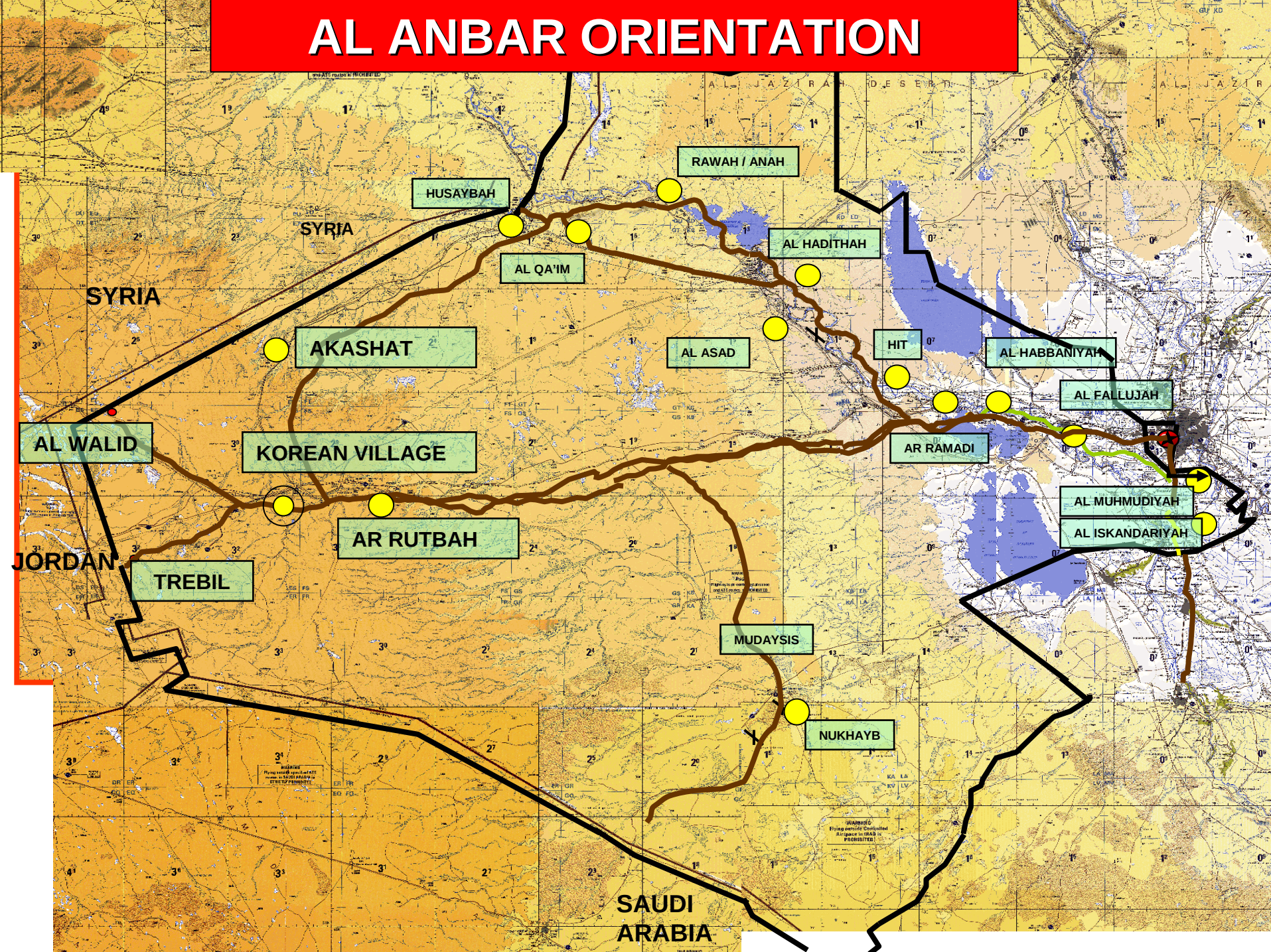
Major Innes Quiroz, Operations Officer  
Program Managers Office, Light Armored Vehicle

# ***Introduction***

- Maj Innes Quiroz
  - Marine Corps 1982 - Current
  - Multiple Marine Expeditionary Unit LAV deployments, “Life at Sea”
  - OIF I, *“The March Up”, Infantry Company Commander, Co K, 3d Bn, 7<sup>th</sup> Marines, 1<sup>st</sup> MarDiv*
  - OIF II, *“Al Fajr”, Operations Officer, 3d LAR Bn, 1<sup>st</sup> MarDiv*
  - *Currently Operations Officer for PMO LAV*
    - *Acquisitions billet representing LAV users worldwide*



# AL ANBAR ORIENTATION



# ***LAV Points for Industry***

- LAVs Deployed Globally (Expeditionary, OIF & OEF)
  - Need to retain tactical, operational and strategic mobility
- Task Organized - Rarely LAV pure
  - Must remain interoperable
- Weight is always an issue
- Electrical Power Constraints
- Space Claim
- Need Scalable Protection to meet the threat and environment



**NDIA Combat Vehicle Conference**

# **Army Capabilities Integration Center**

**LTG Michael A. Vane**

**Deputy Commanding General, Futures and  
Director, Army Capabilities Integration Center  
US Army Training and Doctrine Command**

**21 Oct 2008**

***TRADOC: Victory Starts Here !***



# ***Army Capabilities Integration Center***

## **Mission**

**The Army Capabilities Integration Center leads the development and integration of force capabilities across the DOTMLPF for the Army within a Joint and Multinational environment to support Joint Force Commanders.**

## **Vision**

**World class professionals developing innovative, integrated, resource-informed, and outcome-based solutions for the current to future force.**



# ARCIC Priorities

Build the force: by 2024, field the modular force as envisioned by the Army Capstone Concept.

## Connect

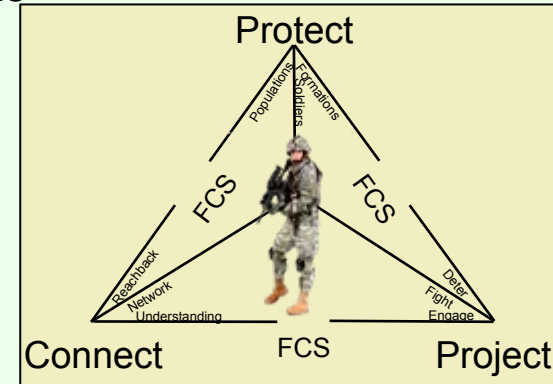
- Develop affordable and achievable LandWarNet and LWN Systems
- Enable Unified Battle Command
- Develop Network Vulnerability Strategy
- Develop bridge to Ground Soldier System

## Protect

- Optimize current and future force readiness; minimize op'n'l risk
- Develop organizationally based force protection capabilities

## Project

- Deliver expeditionary full spectrum capabilities to the force.
- Joint Future Theater Lift and Tactical Lift
- Accelerated current capabilities while modernizing the future force



Think and learn for the Army: conceptual framework beyond 2024.

- QDR Roles and Missions Support to ARSTAF
- Collect & analyze operational data to better represent Irregular Warfare
- Develop Human Dimension, Generating Force, Capstone Concepts
- Execute CSA/CG TRADOC Future Warfare Study
- Campaign of Learning
  - Leading from the edge
  - Baseline and integrate analyses: Mod Force, FCS, and SBCT.
  - Conduct other key analyses reflecting force effectiveness;
    - Tactical Vehicle Strategy
    - RSTA and ISR support to BCT
  - Capability Needs Analysis; timely to meet warfighter needs

Adapt community of practice culture to deliver organizationally-based solutions.

- People
  - Training, Education, and Certification
  - NSPS and Evaluation links to Objectives
- ARCIC Campaign Plan
- Implement COEs w/ FCS COE



## ***Among other things.....***

- **Help the Army think**
- **Account for the future strategic environment**
- **Advocate Joint Interdependencies**
- **Warfighter's “*agent*” for capabilities development**
- **Voice for Army S&T and FCS Stratcoms**
- **Interface with academia, industry, labs....**
- **Key integration role: future force and *current* fight**



# **Big-Five Warfighter Outcomes to Guide S&T Investment**

## **Battle Command Network**

- **Beyond-line-of-sight**
- **Integrate Command and Control**
- **Optimized for mobile operations**
- **Increase access and available to all echelons and the individual Soldier**



## **Counter IED and Mine**

- **Detect, identify and neutralize CBRNE obstacles**
- **Safe standoff distance**
- **Determine threat, select best method to neutralization, and ascertain potential effects**
- **Maintains maneuver force momentum while protecting Soldiers and platforms**



## **Power & Energy**

- **Enhanced agility to operate worldwide, reducing weight and volume**
  - **Sufficient pulsed power enabling advanced lethality options**
  - **Increased continuous power and fuel economy**
- **Emerging electrical components and systems require dismounted Soldiers to possess a radical increase of available power, at half the tactical weight.**



**Power ("P") = rate at which work is performed or energy transmitted.**

**Energy ("E") = capacity to do work.**

**Work = force times distance (dot product) moved in the direction of the force.**



# ***Big-Five Warfighter Outcomes to Guide S&T Investment***

## **Human Dimension**

- ***Enhance & restore cognitive and physical performance***
- ***Function efficiently as integral component of a network and society***
- ***Interface with multiple unmanned systems***
- ***Mitigate the increase in physiological and psychological stress***
- ***Improving mental, moral and physical capacity and performance***



## **Training**

- ***Live, virtual, constructive and mixed venues***
- ***Enable the Future Force to impart more skills, faster, at lower and with greater retention than currently achievable***
- ***Use non-traditional home station training techniques and technology, train prior to employment***
- ***Enhance and account for individual proficiencies and learning rates (outcome based)***
- ***Leader development must be completely adaptable and scalable to cover the full spectrum of operational challenges facing the Soldier***

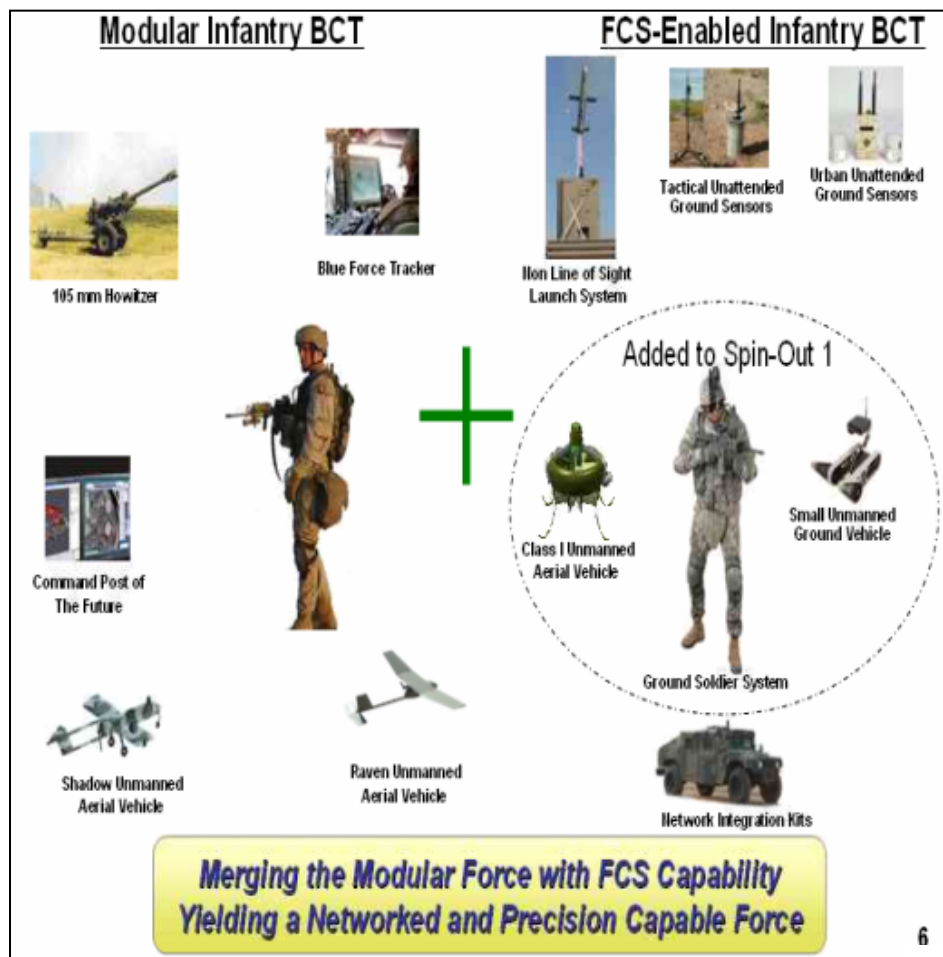




# Refocusing Spin-Outs to IBCTs

## Focus Before

- Most vulnerable force (Infantry Brigade Combat Team) not getting Spin-Outs until FY14.
- Spin-Outs were focused on the most capable force – Heavy Brigade Combat Teams.
- Not achieving integration of the Soldier in the network fast enough.
- Not getting Spin-Outs to current force fast enough.
- **Size, weight, and power challenges with current heavy platforms (Abrams, Bradley, Stryker, M113, & Paladin).**
- Multiple Battle Command Systems.



## Way-Ahead

- Spin-Outs focused on most vulnerable force (Infantry Brigade Combat Teams) first-FY11.
- Willing to accept risk, Heavy Brigade Combat Teams are good enough for now.
- Soldier in the network with Ground Soldier Ensemble – FY12
- Accelerating and adding needed capabilities to the current force.
- Integrated Battle Command System.

6



# ***The Vehicle Challenge***

***Develop a vehicle strategy that will support the Army in an Era of Persistent Conflict .....***

- ***By meeting force requirements for deployability, mobility, lethality, and survivability***
- ***By providing more Soldiers to engage adversaries***
- ***By increasing power requirements for:***
  - ***Battle Command***
  - ***Weapon systems***
  - ***Stability and Support Operations***
- ***Supported by reducing sustainment requirements for:***
  - ***Manpower, fuel, and ammunition***
  - ***Equipment (vehicles, trailers, generators, tools...)***
  - ***Life-cycle costs***

***What is the magnitude of the problem?***



# Combat Vehicles (Total MTOEs, TDA, APS)



≈ 2349  
all variants



≈ 3834  
all variants



≈ 2516  
all  
Variants

## ➤ ***Performing superbly in combat today but...***

- Reaching limits of space, weight, and power
- Driving unaffordable sustainment requirements
  - Support vehicles (*ammo, fuel*)
  - Repair vehicles, wreckers
  - Trailers
  - Generators
  - Support personnel (*maintenance, supply, refueling, ammo...*)



≈ 1594  
all variants



≈ 974  
all variants



≈ 5877  
all variants



# Tactical Wheeled Vehicles

## A snapshot of the Light, Medium and Heavy Tactical Wheeled Vehicle (TWV) Fleet



**LIGHT**  
**156,868**  
**64%**



**MEDIUM**  
**65,562**  
**26%**



**HEAVY**  
**24,976**  
**10%**



**ASV**



**STRYKER**



**MRAP**

• Numbers do not include ASV, STRYKER, MRAP

## BLUF

- The Army has documented need for 295,997 TWVs
- There are 247,406 TWVs fielded
- ~ 15% - 20% of TWV fleet is armored
  - Total includes armored vehicles procured under the Operational Needs Statement (ONS) OEF/OIF
- 86 variants (Light, Medium, Heavy)
- 25,047 Medium vehicles are over 30 years old:
  - 38% of the Medium fleet
  - Nearly 23,000 vehicles with manual transmissions ~ requires additional training



# Generators and Trailers

## Army Tactical Electric Power Requirements

**Army has 102,000+ Generator Sets**



### Command & Control

8,728 Gen Sets (8%)



### Maneuver Support & Sustainment

68,439 Gen Sets (67%)



### Fire Support

2,769 Gen Sets (3%)



### Air Defense

1,735 Gen Sets (2%)



### Maneuver

16,255 Gen Sets (16%)



### Mobility/Counter-Mobility/Survivability

4,567 Gen Sets (4%)

## Trailers

Light = 12,517

Med = 9,906

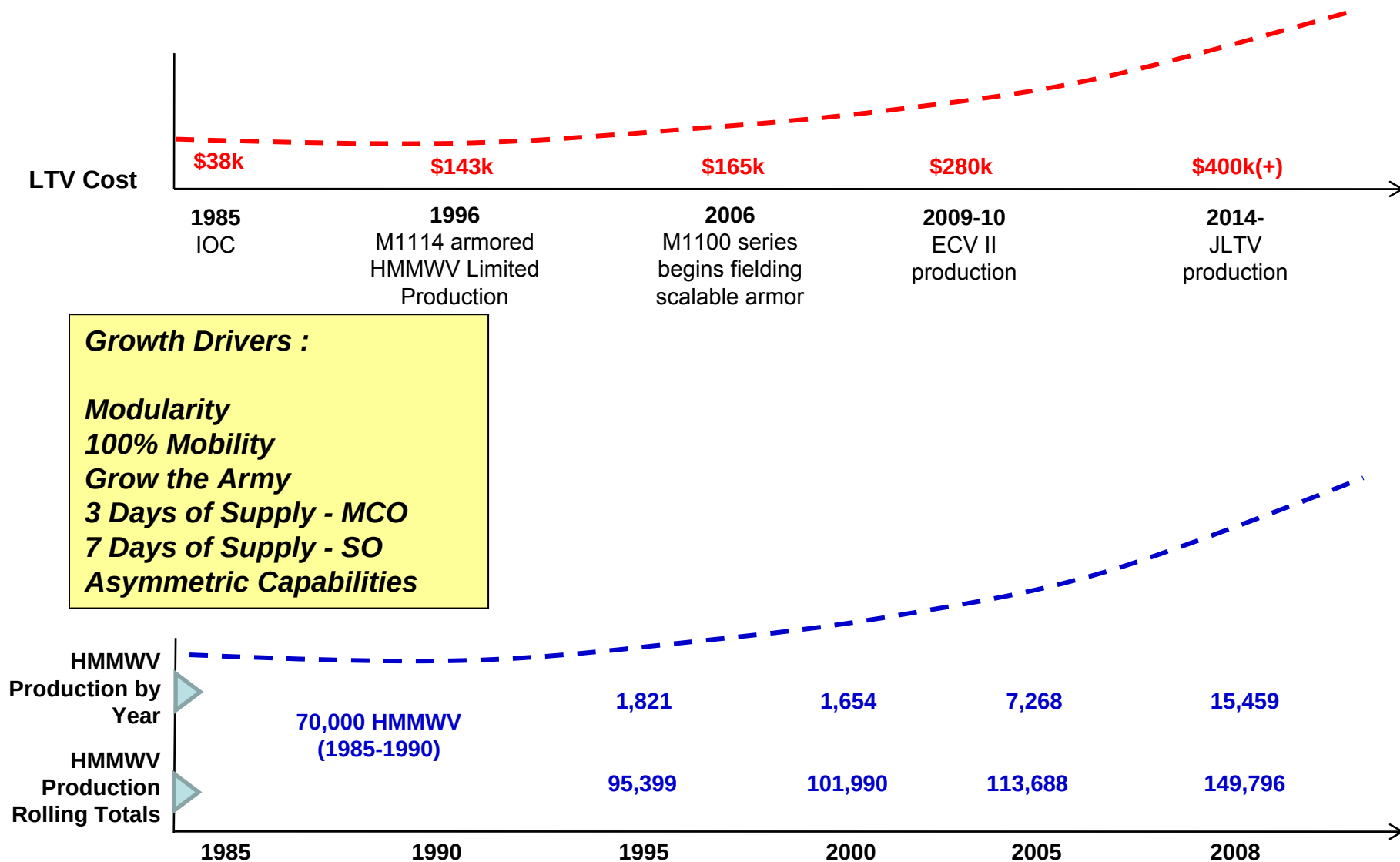
Heavy = 34,226

Total

56,649



# Increased Quality and Quantity Drive Increased Overall Cost





# ***Where we need help from Industry***

- ***Holistic protection concepts and strategies. Move beyond just more armor.***
- ***Power and Energy Strategy***
  - ***Improve fuel efficiency***
  - ***Reduce transportation & distribution requirements (vehicles, trailers)***
  - ***Increase power capacity***
  - ***Eliminate Generators***
- ***Improve Reliability, Availability, Maintainability***
  - ***Embedded diagnostics***
  - ***Parts and tool reduction***
  - ***Improve life-cycle costs***
  - ***Reduce number of support personnel requirements***
- ***Improve Lethality and packaging of ammo***
- ***Reduce Weight, improve mobility and deployability***



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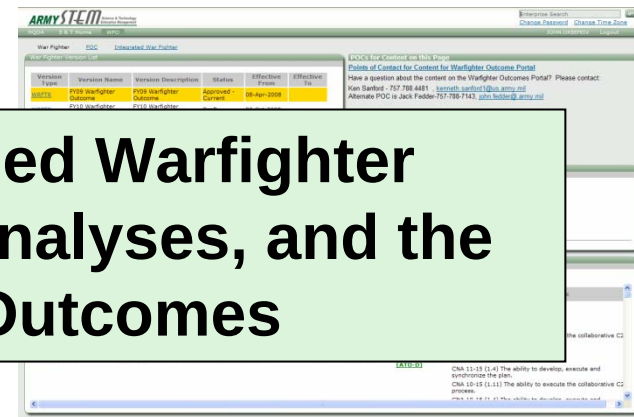
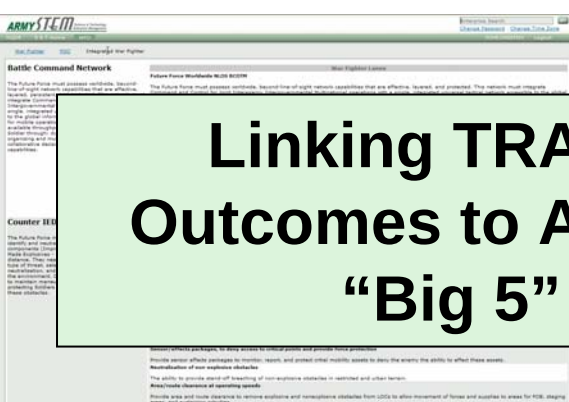
**21 Oct 2008**

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# Warfighter Outcomes Portal

- **Purpose:** Link and Track Capability Need Priorities to S&T Investments
- Assists TRADOC CDIDs/DCDs to
  - Define and monitor Warfighter Outcomes (WFOs)
  - Crosswalk WFOs to Authoritative Sources
  - Link and track potential solutions from ATOs, SBIRs, etc.
- Assists Army S&T Community to link investments to WFOs
- Links:
  - Army S&T Enterprise Management System
  - Army Small Business Innovative Research System
  - PEO C3T T2MATRIX Database



**Linking TRADOC CDID/DCD Managed Warfighter Outcomes to Army S&T, JCAs, Gap Analyses, and the “Big 5” Integrated Warfighter Outcomes**



# Warfighter Outcomes to Guide S&T Investment

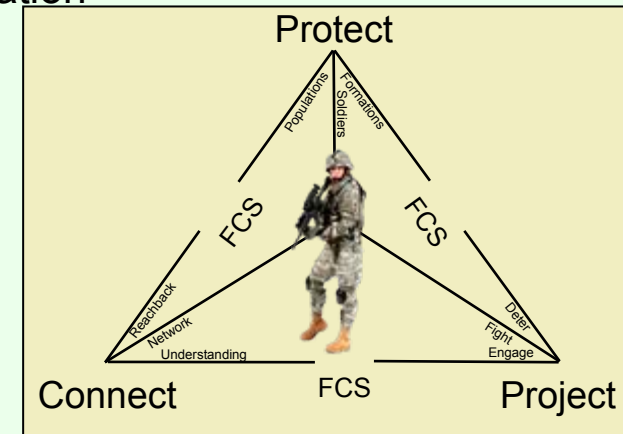
- Stand alone statements that articulate capabilities needed for the Army Warfighter by FY 2024 and include:
  - Clearly articulated description of capability.
  - Rationale explaining reason for the capability.
  - Metrics to describe achievement of the capability.
- “Big Five” Warfighter Outcomes
  - Army Leadership “top down” investment areas that have the potential for a profound impact on future capabilities.
  - Requirement for cross-domain coordination warrants Senior Leadership awareness and monitoring of progress toward achieving capability.
  - Sufficiently shape the S&T Investment so that the capability can be realized within the next 10-15 years.



# ARCIC Outcomes

Build the force: by 2024, field the modular force as envisioned by the Army Capstone Concept.

- AROC Approval of Rifleman Radio
- LandWarNet CONOPS approved 11 Feb 08
- USMC & Army common way-ahead for Position Location Information
- Unified Battle Command
- Tactical Wheeled Vehicle Strategy
- Requirement Determination Phase of TAA 10-15
- Redesign of Division, Corps, and ASCC (DP 123)
- Combat ID ICD validated by JROC in Aug
- TF ODIN
- FFID IOC 1 Oct 07
- Spin-out 1 Force Development Test and Evaluation (May 08)
- Accelerated fielding and training of SUGV and Class I UAS
- Implemented SO1 change from HBCT to IBCT



## Think and learn for the Army

- Protection Strategy
- Organizational Based Assessment
- Combat and Tactical Vehicle Strategy (PDM II)
- Brigade Combat Team Holistic Review
- Army / Air Force UAS CONOP
- CCJO and JOE development
- ARCIC Technology and Industry Information Exchanges
- Human Dimension Concept
- Emerging Global Trends
- Success of Army Expeditionary Warrior Experiments

## Adapt community of practice culture

- CNA in support of POM 11-15
- Re-focused Warfighting Outcomes to support S&T investment
- TR 71-20
- Teamed with HQDA to write and staff AR 71-9
- Developed ARCIC Campaign Plan
- NSPS