**Title:** TARDEC Update for TTCP

**Authors:** Mark Mazzara

**Performing Organization:**
US Army RDECOM-TARDEC 6501 E 11 Mile Rd Warren, MI 48397-5000

**Sponsoring/Monitoring Agency:** TACOM/TARDEC

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:

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17. LIMITATION OF ABSTRACT
SAR

18. NUMBER OF PAGES
37
The purpose of this brief is to update The Technology Co-operation Program team on several fronts.
# TARDEC Organization

## Chief Scientist
- Gorsich, Dr. David 4-7413

## Senior Research Scientist
- Gerhart, Dr. Grant 4-8634

## Executive Assistant
- Teceno, Mary Lou 4-8626

## TARDEC Director
- Bochenek, Dr. Grace 4-6144
  - Executive Officer
- Ryans, Almena 4-6125
  - Executive Assistant
- Rosario, Ruth 4-6144

## MILDEP
- LTC Andres Contreras 4-5059
  - Executive Assistant
- Schehr, Steve – AD 4-5780
  - Quick Reaction Cell**

## Operations Cell**
- Smith, Vicki – TL
  - VACANT

## Strategic Transformation Cell**
- Gonda, Terry 925-2601

## Lean Six Sigma Cell**
- VACANT Direct/Matrix Support to PMs

## Strategic Communications**
- VACANT

## Exec Dir of Development
- Mathes, Mr. Thom 4-5802
- Force Projection Technology
- Balling, Fred 4-4100
- Design & Rapid Prototyping Ctr
- Soltesz, Jim 4-6191
- Director of NAC
- Skalny, Paul 4-6387
- Director of Center Support
- DeVuono, Frank*** 4-8589
- Dir of Pgm Analy and Eval
- Misuraca, Tony*** 4-7173
  - Business Manager
- Misuraca, Tony 4-7173
- Plans & Programs Manager
- Sanders, Derhun* 4-7126

## Exec Director of Research
- Rogers, Dr. Paul 4-6378

## Ground Veh Power & Mobility
- Coutteau, Chuck* 4-8237
  - Survivability
- Ciarelli, Ken* 4-5086
  - Advanced Concepts
- Iler, Carey 4-6073

## Concepts, Analysis, Sys Sim & Integ (CASSI) Dir
- Knott, Steve 4-6601
- Analytics AD

## Intelligent Ground Systems
- Thomas, Dave 4-6160
- Gorsich, Dr. David 4-7413
- Sys Demonstrators AD

## Joint Center for Robotics
- Overholt, Dr. Jim 4-8618
- Loewen, George* 4-6150
- HW & Man-in-loop Sim AD

## Tech PM for Unmanned Ground Vehicles
- Ostrowski, Chris 3-2620
  - Brudnak, Dr. Mark* 4-7355
- HPC & Data Mgmt AD
- Ciarelli, Ken* 4-5086

## Exec Dir of Engineering
- Athnasios, Magid 4-7448

## Combat Vehicles
- Bohdanowicz, Ed 4-5246
- Brendle, Dr. Bruce 4-5798
- VE/DMSMS & OSCR
- SE & Integ Support to MRAP

## Tactical Vehicles & RAM
- Gaereminck, Randal 4-8602
- Richman, Todd – TL 4-6164
- Systems Engineering Group

## Product Lifecycle Data Mgmt Engineering Business Office
- Sturgeon, Ronald 4-6345
- Andres, Ed – TL 4-6651
- Engineering Business Office
- VACANT
- Direct/Matrix Support to PMs

## Power & Materials
- Tomkiw, Marta 4-7455
- Slominski, Mark 4-4260
- Next Gen Software

* 120-Day Detail Positions
** Shown on another chart
*** Acting

12 APR 2009
CASSI within TARDEC’s RBG

**Ground Vehicle Power & Mobility**
- Hybrid Electric
- Pulse Power
- Engines
- Fuel Cells
- Suspension
- Tracks

**Vehicle Electronics & Architecture**
- Power Architecture/Management
- Electronics Integration
- Data Architecture
- Condition Based Maintenance (CBM)
- Diagnostics/Prognostics

**Intelligent Ground Systems**
- Robotic Systems Technology
- Human-Robot Interaction
- Crew Interface and Automation
- Robotic Follower ATD

**Ground System Survivability**
- Active Defense
- Signature Management
- Laser Vision Protection
- Ballistic Protection
- Crew Survivability

**Force Projection Technology**
- Water Generation & Purification
- Petroleum, Oils & Lubricants
- Mechanical Countermine
- Combat Engineering/Bridging
- Gap Crossing
- Future Truck System

**Concepts, Analysis, System Simulation & Integration**
- Requirements Capture, Concept Development, Program Formulation
- Dynamic/Structural Performance, Mathematical Modeling, Data Analysis
- Physical Validation, Systems-Level Validation
- High Power Computing, Product & Program Data Management
- Integrated System-Level Demonstrators

RBG = Research Business Group
Concepts / Analysis / System Simulation / Integration (CASSI) Mission & Objectives

Mission:
- Provide Rapid Assessment and Integration Services to both Technology and System/Platform Development Programs
  - Throughout the Lifecycle (Requirements – Technology Insertion – Demo – Production – Sustainment – Product Improvement Projects)
  - Consider War fighter, System, and System-of-Systems Contexts

Objectives:
- Provide (Systems/System of Systems) Perspective to Combat Developer, PM and Tech Developer on Requirements, Tradeoffs & Integration
- Provide SWAP, Performance, Operational, Cost, & Sustainment Impacts
- Provide and Share Configuration Managed Data on Technologies, Systems, M&S and related programs/processes
- Explore Multiple Options and Trades Rapidly

Methods:
- Develop Vehicle Concepts & Perform Concept Analysis and Trade Studies
- Perform System Assessments using Physics-based, Statistical-based, HW/Man-in-the-Loop, and Distributed Simulation Tools
- Develop Integrated System Level Demonstrators
**Insight into Army Ground Vehicle Business**

**TACOM LCMC (2007)**
- 19,651 million
- 2.4%
- 474 million

**US AUTOMOTIVE INDUSTRY**
- GM: 215,023 million (3.3%)
- Ford: 189,669 million (4.3%)
- DaimlerChrysler: 156,365 million (3.9%)
- Total: 7,155 million

**Other US INDUSTRY**
- 3M: 22,026 million (6.2%)
- Microsoft: 40,544 million (21%)
- Total: 1,371 million

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*Based on 2007 TACOM APBI

**Based on 2004 Annual Reports

(2007 Dollars based on 2004 figures at a rate of inflation of 3.25%)**
Ground Vehicle Update

Predecessor Vehicle: Armor Protected MXT
Produced under contract to the US Army’s TARDEC: National Automotive Center

- Work has started on a fleet of over 200 new 'go anywhere' vehicles which will greatly improve the protection of British troops in Afghanistan.
- Navistar Defense is building and supporting the new Husky vehicle which has been designed for a range of missions including transporting food, water and ammunition, and acting as a command vehicle at headquarters.
- Equipped with a machine gun, the new protected support vehicle is designed to provide commanders with a highly mobile and flexible load-carrying vehicle for the troops on operations.
- The vehicle is based on the Navistar MXT-MV platform, which was developed in partnership with the US Army’s TARDEC-NAC.

The Husky will provide a robust and highly mobile protected support vehicle for operations.
The Future Combat Systems (FCS) is the cornerstone of Army Modernization. FCS is the Army’s promise to provide Soldiers the best equipment and technology available as soon as practical. FCS is not just a technology development program—it is the development of new Brigade Combat Teams—these new brigades, with more infantry, better equipment, unmatched situational awareness and communications allowing complete domination in asymmetric ground warfare while allowing the Army to build a force that can sustain itself in remote areas. It can also be adaptable to civil support, such as disaster relief. FCS will provide the Army and the joint force with unprecedented capability to see the enemy, engage the enemy, and defeat the enemy on today’s and tomorrow’s battlefield.
Joint Light Tactical Vehicles
Overview

LTC Wolfgang Petermann
Product Manager
JLTV, US Army
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(586) 239-2302

LtCol Ruben Garza
Program Manager
JLTV, US Marine Corps
ruben.garza@usmc.mil
(703) 432-5385
MISSION:
Jointly develop, produce, field and sustain safe, reliable, suitable and effective family of Joint Light Tactical Vehicles

VISION:
JLTV – Providing our Joint Warfighter with the very best in light tactical vehicle payload, protection and performance
JLTV Capability Discussion

Capability gaps within existing fleet are the result of an imbalance in protection, payload, and performance within a transportable vehicle

- **Current fleet mix:**
  - **Protection:** fixed protection in light vehicles
    - Require inherent and supplemental armor, scalable to mission
  - **Payload:** supplemental armor reduces useable payload
    - Require a design that supports armor, warriors, mission equip, C4, cargo
  - **Performance:** supplemental armor degrades all elements
    - Require a design that supports mobility, reliability & maintainability at gross vehicle weight & transport at essential combat configuration
  - **Transportability:** current platforms lack armor design flexibility to allow full range of transportability
    - Require a design which enables Rotary and Fixed Wing Air, Sea, Overland transport

The JLTV vehicles YOU will build will address this imbalance & meet DoD goals for costs & long-term sustainability
Government Funded LTV Development

Sources: JLTV CDD, CONOPS, & OMS/MP

JLTV Tech Demo: CAD models of JLTV FoV

2005

2007
JLTV to provide scalable C4I and adaptable levels of protected mobility to Fire Teams and Combat Support teams.

Adaptable:
• Varying levels of protection in response to mission threat
• Expeditionary vehicle family
• Over full range of operations / conditions

Protected Mobility:
• Exceeds current TWV payload & tactical mobility
• Increase protection (especially EFP & IED) through scalable armor
• Returns payload currently traded for armor

Network-Ready / Interoperable
• Space, weight, power claims for C4I systems

Resilient:
• Designed to enter harms way & return forces safely
• Adapts light fleet to the IED / Counter Insurgency paradigm
• Retains Major Combat Operations capability

Increased commonality:
• JLTV to be designed for commonality beyond major components, to include repair parts, tools, training, system design, maintenance procedures and sources of supply

Increases maneuver capacity:
• Provides protected mobility on the modern battlefield

Sources: JLTV CDD, CONOPS, & OMS/MP
PAYLOAD CATEGORY A
Payload: 3,500
Performance: Exceed HMMWV
Transport: 1x EAT* CH 47/53
2x IAT** C130

Sub-Configurations
- General Purpose Mobility (4 Seat) - Army/USMC

TARDEC Concept Example

PAYLOAD CATEGORY B
Payload: 4000/ 4500 lbs
Performance: Exceed HMMWV
Transport: 1x EAT* CH 47/53
1x IAT** C130

Sub-Configurations
- Infantry Carrier, Fire Team (6 Seat) - Army/USMC
- Reconnaissance (6 Seat) - Army
- C2OTM (4 Seat) - Army/USMC
- Heavy Guns Carrier (MP, Patrol, Escort) (4 Seat+ Gunner) - Army/USMC
- ITAS (TOW) Carrier (4 Seat) - Army/USMC
- Utility (2 Seat) – USMC
- Ambulance (3 Seat+2 Litters) - Army/USMC

ONR & TARDEC Concept Examples

PAYLOAD CATEGORY C
Payload: 5,100 lbs
Performance: Exceed HMMWV
Transport: 1x EAT* CH 47/53
1x IAT** C130

Sub-Configurations
- Shelter Carrier / Utility /Prime Mover (2 Seat) - Army/USMC
- Ambulance (3 seat + 4 Litter) - Army/USMC

ONR & TARDEC Concept Examples

Program focus during Technology Development Phase is on these key configurations build key vehicles, 1 A, 2 B, 1 C

Trailers for each payload category to have equivalent payload and mobility to support prime movers.
• Continue to monitor funding situation and schedule impact
• KP Reviews are designed to inform the CDD and PD requirements by looking at requirements achievability across all 3 KTRs
  • Organized thru Requirements IPT and led by Combat Developer
JLTV TD Exit Criteria

- Approval of the appropriate capabilities development document (CDD or CPD), supported by analysis from TD work

- Demonstration of an ability to achieve TRL 6 (minimum) in an integrated system with a focus on:
  - Protection
  - Transportability
  - Reliability
  - Producibility

- An assessment of commonality across the JLTV FoV

- An assessment of the technical risks relevant to entering initial production will to lay a foundation for the Manufacturing Assessment done during EMD.
Survivable Vehicles for the Warfighters

Light & Medium Armored Vehicles
2-6 Feb 09

COL Kevin Peterson
Principal Deputy Program Manager
Joint MRAP Vehicle Program
MRAP Variant Overview

Manufacturer

Navistar Defense

MaxxPro

BAE

CAIMAN CAT I (BAE-TVS)

MaxxPro MEAP Ready

CAIMAN PLUS

MaxxPro Plus

MaxxPro Dash

Force Protection

FP COUGAR CAT I (FPII CAT I)

FP COUGAR CAT II (FPII CAT II)

General Dynamics

GDLs RG31 (MK5) • CAT I

GDLs RG31 (MK5) EM • CAT I

BAE CAT II RG 33L

BAE CAT II LRIP 10
- Nine separate Foreign Military Sales Cases open with Four different Coalition Partners
- Eight different Variants procured to date
- Two models custom designed to meet Country unique requirements
- 10 Additional Coalition Force / Country inquiries with 2 potential procurements efforts pending
- MATV will be added to procurable MRAP line this FY.
• Approved Army ONS for 134 vehicles to recover MRAP

• Addendum to MRAP I Performance Specification being developed to address recovery capabilities.

• Acquisition Strategy similar to MRAP Armored Utility Vehicle may be pursued.

• Survivability requirements similar to that of MRAP I

• Draft Characteristics:
  – Flat Tow & Lift Tow MRAPs
  – 30 Ton Crane Capacity
  – 40 Ton Main Recovery Winch Capacity
Technology Insertion into Future MRAP Production/Retrofit

- Technology Insertion
  - Rear-View Camera
  - Long Range Advanced Scout Surveillance Sensor (LRAS3)
  - CROWS II
  - Boomerang
  - VanGuard
  - TOW Integrated Target Acquisition Sensor (ITAS)
  - Additional Exterior Lighting
  - Mounted Battle Command on the Move (MBCOTM)
  - DVE Forward Assisted Detection System (FADS)
Technology Insertion into Future MRAP Production/Retrofit

- Onboard Electric Power Enhancement
  - Leveraging Stryker and FCS Common Modular Power System development
  - Pursuing APU and Dual Alternators as Risk Mitigation
- Common C4 Architecture
  - Supports future growth and possible FCS technologies
- Survivability Enhancements
  - Improved Gunner Restraint System
  - Overhead Wire Mitigation System
  - Automated Fire Extinguishing System
    - Crew Compartment, Engine Compartment, Tires
  - Improved Seats/Seat Belts
• Responses received September 2008.
• Requirements Based On JUONS.
  – MRAP Protection Levels.
  – Agility, Maneuverability, Mobility of HMMWV
• Industry Input Will Be Evaluated To Determine Achievability of Defined Need
• Assuming Evaluation Determines One or More Approaches Submitted are Viable to Achieve Stated Requirements Funding Will be Requested.
MRAP Survivability

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
• BACK-UP SLIDES
Who’s Who in JLTV Development

Program Governance
• OSD / ARMY / NAVY
• Program Certification & Milestone Decisions

Material Development
• PEO CS & CSS / PM JCSS / PM JLTV
• Program Management
• Milestone Documentation Development

Requirements Development
• CASCOM / MCCDC
• CDD Development & Staffing for Approval

Industry
• BAE Systems – Ground Systems
• Lockheed Martin Owego
• General Tactical Vehicles

Science & Technology
• TARDEC / ONR
• Technology Development
• Trade Studies to Support Requirements Development

International Participants
• Countries: Australia, Israel & Canada
  • PA: Australia
  • Pending PA / Technical Discussions: Israel
  • Data Exchange Agreements: Canada & UK
JLTV to be designed for commonality beyond major components, to include repair parts, tools, training, system design, maintenance procedures and sources of supply.
Tactical Response

• Change in enemy tactics generated an urgent Warfighter need for:
  – Mine Resistant Ambush Protected Vehicle
  – Large quantities
  – Required ASAP

• MRAP Program is the response to this urgent need
  – Unprecedented effort
  – Unprecedented speed
  – Unprecedented Gov / Industry Teamwork
<table>
<thead>
<tr>
<th>Event</th>
<th>FY 2007 Days</th>
<th>FY 2008 Days</th>
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<tbody>
<tr>
<td>RFP &amp; Sole Source Award</td>
<td>15 Days</td>
<td></td>
</tr>
<tr>
<td>Award of 9 competitive Contracts</td>
<td>93 Days</td>
<td></td>
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<tr>
<td>JUONS 26 Oct</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st Competitive LRIP Award</td>
<td>107 Days</td>
<td></td>
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<tr>
<td>1st Competitive fielding</td>
<td>180 Days</td>
<td></td>
</tr>
<tr>
<td>Requirement validated by JROC (10 may)</td>
<td></td>
<td>196 Days</td>
</tr>
<tr>
<td>1st Sole Source fielding</td>
<td></td>
<td>8815 Vehicles Ordered 358 Days</td>
</tr>
<tr>
<td>1st Army Unit Equipped</td>
<td></td>
<td>593 fielded in Theatre (1 Nov) 371 Days</td>
</tr>
<tr>
<td>196 Days</td>
<td></td>
<td></td>
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<tr>
<td>1st Competitive Fielding</td>
<td>299 Days</td>
<td></td>
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<tr>
<td>165 days after Contract Award</td>
<td></td>
<td>372 Days from JUONS</td>
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<tr>
<td>192 days after contract award</td>
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<tr>
<td>8815 Vehicles Ordered</td>
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</tbody>
</table>
Operational Demand Signal

185, May 06 MNF-W Commander

1,185, Dec 06 JROC Validated

4,066, Nov 06 Army-USMC board

6,738, Feb 07 MROC validated

7,774, May 07 JROC validated

15,374, Sep 07 JROC validated

Increased Army totals from 2,500 to 10,000 vehicles and included 100 test vehicles

14,204-19,655 (Army Interim 12,010) vehicles Mar 08 JROC validated
MRAP Vendor Locations

**BAE**
- CAT I SOCOM
  - Demmer, Lansing, MI
  - Benoni, South Africa
- CAT II HAGA
  - Spartan, Charlotte, MI
  - Benoni, South Africa
- Capsule fabrication, welding and final assembly
  - York, PA
  - Benoni, South Africa

**FPii**
- CAT III BUFFALO
  - Ultra Machines, Kings Mtn, NC
  - MCLB, Albany, GA
  - FPii, Charleston, SC
  - Armor Holdings, Sealy, TX
- Chassis
  - Spartan, Charlotte, MI
- Welding and final assembly
  - BAE, York, PA

**IMG**
- CAT I MAXXPRO
  - IMG, West Point, MS
  - IMG, Gap, TX
  - IMG, West Point, MS
  - Armor
  - Plasan Sasa, Israel

**GDLs-C**
- CAT I RG31E
  - Demmer, Lansing, MI
  - Benoni, South Africa
- Chassis
  - Spartan, Charlotte, MI
  - Benoni, South Africa
- Capsule fabrication, welding and final assembly
  - York, PA
  - Benoni, South Africa

**BAE-TVS**
- (Formerly Armor Holdings)
  - CAT I CAIMAN
    - Capsule fabrication
      - Armor Holdings GVSD, Fairfield, OH
      - Armor Holdings Sealy AD, Phoenix, AZ
      - Armor Holdings TVSD, Sealy, TX
    - Chassis
      - Armor Holdings TVSD, Sealy, TX

**Benoni, South Africa**
- Capsule fabrication
  - Demmer, Lansing, MI
  - Benoni, South Africa
  - Spartan, Charlotte, MI
  - Benoni, South Africa
  - Yor, PA

**Plasan Sasa, Israel**
- Capsule fabrication
  - Ultra Machines, Kings Mtn, NC
  - MCLB, Albany, GA
  - FPII, Charleston, SC
  - Armor Holdings, Sealy, TX
- Chassis
  - Spartan, Charlotte, MI
- Welding and final assembly
  - BAE, York, PA
The MRAP Team - Production

- 62 Major Tier 2 vendors for 15 critical sub-assemblies, for example:
  - Armor (8)
  - Diesel Engines (3)
  - Suspension components (9)
- Defense Contract Management Agency (DCMA)
- Testing and Evaluation Commands
<table>
<thead>
<tr>
<th>Service</th>
<th>JROC Service Requirements</th>
<th>Procured Against Requirements</th>
<th>Remaining Vehicles to Order</th>
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<tr>
<td>USMC</td>
<td>2,225</td>
<td>2,209</td>
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<tr>
<td>Army</td>
<td>12,000</td>
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<td>SOCOM</td>
<td>378</td>
<td>378</td>
<td>0</td>
</tr>
<tr>
<td>Ballistic Testing</td>
<td>133</td>
<td>133</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15,838</strong></td>
<td><strong>15,822</strong></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>

- Above based on JROCM 151-08 dtd 28 July 2008
- JROCM 226-08 dtd 20 November 2008 increases Total to 16,238. These add’l 400 vehicles will be allocated among the Services and SOCOM to support the efficient fielding and coordination of the Theater Commander’s priorities.
• SPAWAR System Center
  – Now integrating an average of 50 vehicles per day.

Lean Six Sigma Consortium of Government and Industry
The MRAP Team - Fielding

- Services and Components
  - USMC
  - USA
  - USAF
  - USN
  - SOCOM

- Service Logistic Commands

- Warfighters

Original Plan

7,774 Vehicles on Order
- Centralized Fielding
- Centralized Support Requirements
- 90 Day Parts Block

Current Reality

16,238 Vehicles on Order
- Decentralized Simultaneous Fieldings
- Decentralized Support Requirements
- Hybrid/Organic Support Concept

Warfighter Feedback and Lessons Learned
**Trade-Offs**

- Speed to field
- Multiple variants
- Urgent Fielding
- COTS
- Variations along the way

**vs**

- Complete Testing
- One variant
- Fully supported
- Designed for Services
- Configuration controlled