Joint Light Tactical Vehicle (JLTV) Automotive Requirements Development

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Overview

• US Army Aberdeen Test Center (ATC) recently finished Technology Demonstration (TD) testing of the JLTV, supporting testing at ATC, Yuma Test Center (YTC), and Accredited Test Services (ATS)

• With the support/encouragement of Program Manager (PM)-JLTV, ATC influenced and enhanced the acquisition process
  – Note: Existence of the TD test phase gave ATC a unique opportunity to interface more with the PM office and re-think the role of testers and our methods
    • Testing is conducted to reduce risk!

• Today’s presentation will highlight our contributions
TD Vehicle Demonstrators

JLTV Technology Demonstrators
JLTV TD Phase Overview

- JLTV Family of Vehicles Technology Demonstration (aka “Tech Demo”) testing occurred May 2010 – May 2011

- Test Objectives:
  - Shakedown Purchase Description requirements
  - Demonstrate prototype vehicles and new technologies
    - Electronic stability control, active suspensions, on-board power generation, integrated Command, Control, Communications, Computers, and Intelligence (C4I)
  - Identify and develop new test methodologies to deal with new technologies and related safety risks
    - Fording of high voltage systems can present additional risks
ATC’s Roles During TD

• Army Aberdeen Test Center (ATC)
  – Automotive performance (17 vehicles)
  – Reliability, Availability, Maintainability (RAM) of Australian vehicles (2 vehicles)
  – Power management
  – Integrated C4I
  – Transportability
  – Human Factors
  – Toxic Fumes
  – Test Course Characterization (Profilometer and instrumented Land Rover)
  – Weapons compatibility

• Yuma Test Center (YTC)
  – Instrumentation support for RAM (9 vehicles)
  – Test course characterization (Profilometer and instrumented Land Rover)
  – Measurement of vehicle loads on RAM courses
ATC’s Roles During TD

• Accredited Test Services
  – Located in Monegeetta, Victoria, Australia
  – Instrumentation support for RAM (5 vehicles)
  – Test course characterization (Profilometer and instrumented Land Rover)

• Engineering Research and Development Center (ERDC)
  – Located in Vicksburg, MS
  – Vehicle support
  – Technical interface with PM-JLTV
Automotive Performance Tests

- Vehicle Characteristics
- Standard Obstacles
- Grades and Slopes
- Steering and Handling
  - Including Electronic Stability (ESC) testing
- Ride Quality
- Speed and Acceleration
- Braking

- Full-load Cooling
- Soft-Soil Mobility (support ERDC)
- Central Tire Inflation System (CTIS)
- Fording
- Fuel Consumption
- Weapon Compatibility
- Armor Compatibility
TD Planning

• Sorted all requirements into “testable” categories
  – Requirements initially grouped by vehicle subsystems
  – Re-grouped the requirements by pre-existing functional test teams at ATC
  – Some requirements spanned more than one test team and were identified early

• Drafted Detailed Test Plan (DTP)
  – ATC functional groups worked with PM staff to review requirements and draft the detailed test plan
    • Hundreds of requirements reviewed
  – Subtest priority list was developed based on:
    • Need to inform PM of results from high risk requirements early
    • Safety information required to support the Limited User Evaluation (LUE)
    • Cost and time considerations
## ATC Functional Groups

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<th>Performance Engineering</th>
<th>Controls &amp; Test Automation (CTIS)</th>
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<td>Towing &amp; Recovery</td>
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<td>Gradeability &amp; Side Slopes</td>
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- **HFE**
- **Weapons Compatibility**
- **Environmental**
- **Road Shock & Vibration**
- **Chemical Sampling Branch**
- **Transportability**
- **Generator Test Site**
- **Electromagnetic Interference (EMI)**
- **C4ISR**
- **RAM/ILS**
TD Planning

- Identified instrumentation, methodology, personnel, and facilities needed to execute new/unusual test requirements:
  - C4ISR bay station assembled to support data transfer
  - Military Operations on Urban Terrain (MOUT) course built to reflect Operational Mode Summary/Mission Profile (OMS/MP)
  - Initial Electronic Stability Control (ESC) test processes determined
  - Robotic operator for fording with high voltage systems required
- Coordinated test planning and provided resources across multiple test centers
  - Created synergy across all test centers by utilizing the same test methodologies, instrumentation, data collection process
MOUT Course Obstacles

Rubble Pile

Construction of Staircase
TD Planning

• Lessons Learned
  – Identified non-testable requirements:
    – “The ground pad on each rear stabilizer leg shall have sufficient ground contact area to support the JLTV-T at GVW under wet and muddy conditions.”
    – No clear pass/fail criteria, multiple ways to interpret success
  – Identified conflicting or competing requirements

ATC communicated potential issues like these with PM-JLTV so they could be addressed by the respective Subject Matter Experts (SMEs)
TD – Test Execution

• Traditional Role - Test Execution

• Enhanced Roles:
  – Attended PM Knowledge Point (KP) reviews
    • Provided insight from testing
    • Proposed requirement improvements
  – Attended PM System Engineering meetings
    • Provided additional technical assistance to system engineers drafting and modifying PD requirements
    • Proposed new PD requirements to improve reliability and reduce safety risks
  – ATC personnel served as SMEs to assist PM-JLTV and contractors with failure mode analysis
Post-TD and Pre-EMD

• Traditional Roles
  – Write reports
  – Identify and discuss lessons learned
  – Update Test Operating Procedures (TOPs) to reflect current technologies and lessons learned
  – Develop new TOPs as needed
  – Participate in Test and Evaluation Master Plan (TEMP) reviews

• Enhanced Roles
  – ATC worked with PM staff to draft new requirements to reduce risk in addressing user needs
  – Conducted additional excursion tests to better “inform the requirements”
  – Supported contractor and TARDEC modeling and simulation efforts by making extensive force environment and terrain data available
    • Intent is to help vendors build better military trucks
  – Currently working on means to accelerate durability testing
Summary

• ATC is focused on helping PM/Army reduce risk on JLTV program
  – Testing is all about reducing risk
• Influenced PD Requirements
• Developed draft test protocol for ESC testing
  – Never done before on military vehicles of this class
• Created sets of force and terrain data to help vendors improve designs and to assist TARDEC with analysis
  – Includes YTC and ATC off-road terrains
Questions?

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