Technology to the Warfighter Quicker

Tactical Wheeled Vehicles

Over 50,000 Trucks in AOR

SAE Ground Vehicle Reliability Committee

Chair – Dr. David Gorsich
Co-chair – Prof. KK Choi

DOD Maintenance Symposium and Exhibition

Oct 23, 2006
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Setting the Stage

- 12,000 HMMWVs in Army Depots for repair
- 100,000+ HMMWVs in the field
- How do we analytically study weight impacts
Starting point - Reliability Track Record

1985-1995

Demonstrated Reliability vs. Requirements for Operational Tests

Only 41% Met Requirement

1996-2000

Demonstrated Reliability vs. Requirements for Operational Tests

Only 20% Met Requirement

Most Of Our Systems Fail To Achieve Reliability Requirements In OT
And The Trend Appears To Be Downwards
Automotive Reliability Historical Perspective

<table>
<thead>
<tr>
<th>Year</th>
<th>Auto Industry</th>
<th>Averages ~ defects per 100 vehicles</th>
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<tbody>
<tr>
<td>1981</td>
<td>Auto Industry</td>
<td>Averages ~ 500 defects per 100 vehicles</td>
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<tr>
<td>1997</td>
<td>Auto Industry</td>
<td>Averages ~ 100 defects per 100 vehicles</td>
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- Competition has helped drive defect reduction, quality & reliability improvements
- Automotive warranties today have gotten longer too – some are now up to 10 yrs & 100K miles

The competitive marketplace has resulted in automobiles being increasingly reliable
Logistics Transformation Task Force

To be successful, new logistics concepts will require significant RMS enhancements to the designs of our systems.

Early stages of the program are when the greatest benefit from RMS decision process improvements can be realized.

Although constrained acquisition budgets will continue to make the Army’s Transformation challenging, the affordability of RMS improvements must be viewed in the context of entire life cycle costs.
Management of Reliability

- Incentives
- Physics of Failure
- Training
- Maintenance
- Accelerated Tests
- Diagnostics/Prognostics
- Smart Data Collection
- Pit-stop Engineering
- Technology Maturity
- Process Error Proofing
- Supplier Management

- User Requirements
- Fault Trees to include SOS
- Manufacturing Quality/Variability
- Reliability Based Design Optimization
- Systems Engineering Process
- Vehicle Aging
- Recapitalization
- Etc

Reliability is complex and multi-faceted
The mission of the reliability committee is to develop ground vehicle standards and guidelines in the area of system reliability and durability. The committee provides an environment for government, industry and academia to have technical discussions and work out challenges in the field of reliability.
Simulation-based Ground Vehicle Design

- Dynamics and Control of Vehicles and Mobile Robots
- System Mobility Evaluation
- Vehicle System Integration, Optimization & Robustness
- Control & Design Integration
- Optimal System Design & RBDO
- System Complexity Reduction
- High Performance Structures and Materials
- Human Centered Design

- Reliability & Maintainability Evaluation
- Developing New Physics of Failure Capability
- Testing Augmentation
- Advanced Propulsion Systems
- $40M program Multi-year effort

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TARDEC Efforts to Improve Failure Prediction

"Reliability Tech Director Initiative"

Improved Component Design via Optimization (HPC enabled)

Manufacturing Defect Failure Contribution
≤ 6 orders of magnitude greater probability of fatigue failure at a defect

Multi-Physics Computer-Aided Analysis

Road Load History

FEA/Fatigue Analysis

Other Systems being Impacted

Technology Developments being Leveraged from Auto Industry

Component Data Collection

Data for improved models

V&V

V&V

V&V

V&V

Field Data Collection

TARDEC GVSL Data Collection & Lab Accreditation

"Reliability Tech Director Initiative"

P.G. Dynamic Simulation

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