# Ensuring Reliability for Middle Tier Acquisition Programs

**Melanie Goldman**
**Operations Research Analyst**
**CCDC Data and Analysis Center**



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# OVERVIEW

- **Background**
  - Middle Tier Acquisition Programs
  - Alternative approach to ensure reliability
- **Case Studies**
  - Tactical Vehicles
  - Combat Vehicle
  - Electronics System
- **Conclusions**

# BACKGROUND

- **Section 804 of 2016 National Defense Authorization defines path for Middle Tier Acquisition (MTA)**
  - Rapid acquisition approach
  - Deliver capability in shortened timeframe (2-5 years)
  - Utilize two pathways:
    - (1) Rapid Prototyping
    - (2) Rapid Fielding
- **Shortened timelines for MTA programs present numerous difficulties for traditional reliability growth testing**
  - Potentially increasing risk of delivering an unreliable system to end user

# ENSURING RELIABILITY

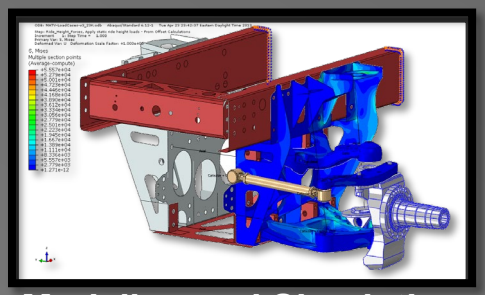
- **Alternative approach can be used to mitigate risks:**
  - (1) Identify potential failure modes and mechanisms in subsystems/components of concern
  - (2) characterize the highest priority failure modes using most efficient means available
- **Tools and models exist today that can further accelerate fielding for more systems**
- **The following case studies show great opportunity to apply these proven and cost-effective methods to MTA programs resulting in:**
  - Reduced Schedules
  - Lower Cost
  - Managed Risk

# CASE STUDIES

# TACTICAL VEHICLE

- **Need to understand potential impacts on vehicle durability when increasing rear axle weight**
- **Applied combination of resources:**
  - Limited instrumented field testing to determine loading cases for each component
  - Modeling and simulation (M&S) to identify highest risk components
  - Simulated 15,300 miles on Vehicle Durability Simulator (VDS) in 1.5 months (opposed to around 9 months with traditional testing)
- **Testing an analysis showed suspension upgrade was not necessary – overall saving time and money**

Instrumented Field Testing



Modeling and Simulation

Durability Simulation

# AMBULANCE

- **Vehicle underwent significant engineering changes to constitute the Ambulance**
- **Changes needed to be evaluated for impact on vehicle reliability**

- **Ground Vehicle System Center (GVSC) used their test facilities to focus on subsystems:**
  - Suspension, Medic seat/gunner platform, etc.
- **GVSC completed testing in ~3 weeks vs 6 months, saving months of time and $250K in test costs**

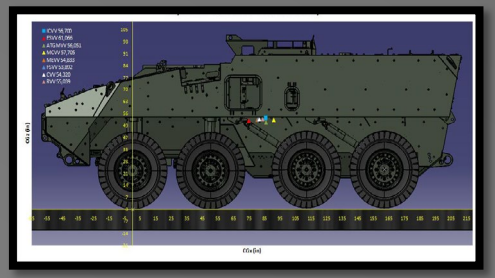
# TACTICAL VEHICLE

- **Test more efficiently & effectively**
  - 85% of failures observed in early testing could have been found using simulators or chamber testing
  - Failure modes could have been surfaced sooner, including modes not typically seen during reliability testing (e.g., wear out)

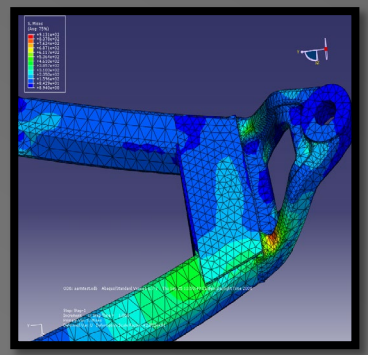
- **Mitigating failures prior to formal development test had potential to significantly improve reliability**
  - 85% reduction in number of operational mission failures yields reliability more than 2x requirement
  - Potential to eliminate further testing
- **Testing could have been completed in ~10 days vs 3 months**

# COMBAT VEHICLE

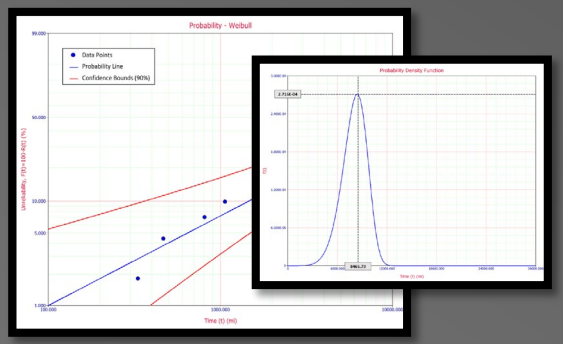
- **New weapon station added to existing platform**
- **Testing focused on weapon station integration and potential durability issues from increased weight**
  - Attempted to compress 3 years usage into ~3 months
- **Analysis of current field data show expected life >50,000 miles for multiple load-effected components**
  - Not realistic to observe in test
- **M&S could have provided more meaningful insights on weight impacts**



Dynamics Model



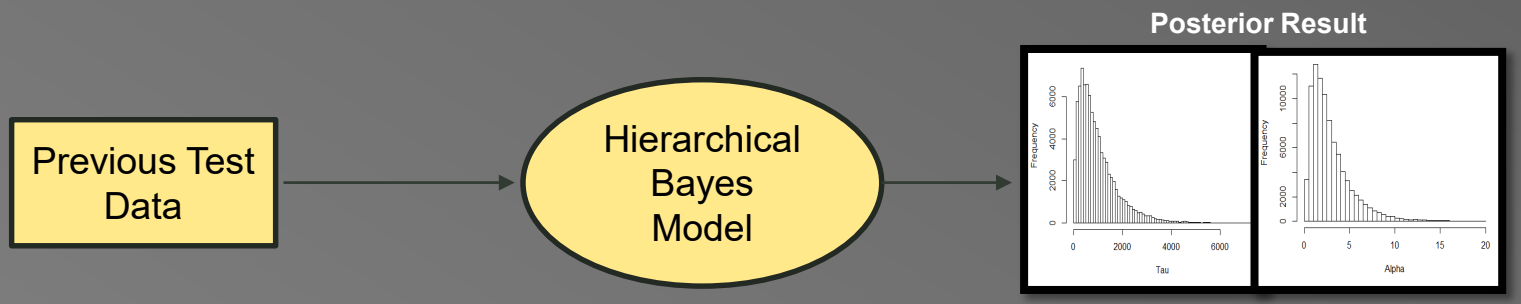
Finite Element Analysis




Component Life Prediction

# ELECTRONICS SYSTEM COMPONENTS

- Upgrades were made on subset of components within two communications systems
- Failure mode analysis identified potential improvements for one of the subsystems
- Focused Chamber testing conducted to characterize failure mode and identify the risk
- Used hierarchical Bayesian model with previous test data to plan assurance test
- Resulting test lengths 60% less than traditional methods



# CONCLUSIONS

- **Current capabilities can yield significant savings in cost and schedule**
- **Utilizing computer modeling, lab, and simulator testing can all be used (to a much greater extent) to reduce risk and drive down testing requirements**
  - Capabilities are in place today – and underutilized
- **Hierarchical Bayesian models are useful for designing efficient assurance tests when necessary**
- **Same approach can be applied to other programs – not just MTA**

***Can accelerate fielding while ensuring necessary system reliability is achieved to maintain readiness and control life-cycle costs***