New Army and DoD Reliability Scorecard

Marguerite Shepler
U. S. Army Materiel Systems Analysis Activity

October 28, 2010

40 Years of AMSAA Excellence in Analysis

Overview

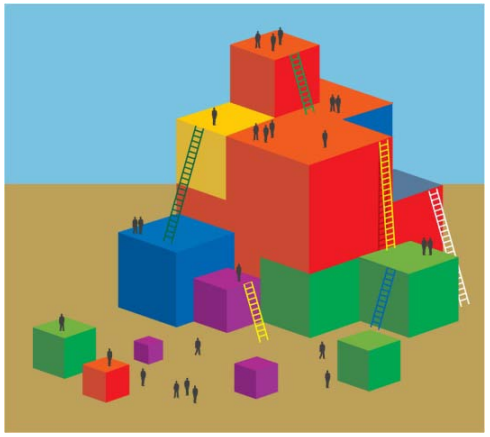
- Background information
- References
- Scorecard categories
- Scorecard elements
- Element Example 1
- Element Example 2
- Calculate reliability risk level and score
- Reliability scorecard assessment results
- Benefits
- Summary and conclusion
- Next steps and future work

Background Information

- December 2007, the Army Acquisition Executive released an Army Reliability Policy
- U.S. Army Materiel Systems Analysis Activity (AMSAA) and U.S Army Evaluation Center (AEC) developed the Reliability Program Scorecard
- Reliability Program Scorecard is of the key products from the OSD Reliability Improvement Working Group

Reliability Program Scorecard

- New Army Reliability Policy requires an early engineering evaluation.
- Standard way to evaluate programs, given we have multiple systems, engineers, and analysts involved.
- Scorecard initially examines a combat developer's Reliability Program Plan, Reliability Case
- Scorecard applies to reliability engineering activities in the Engineering and Manufacturing Development (EMD) Phase
- Structured approach will allow for future refinement and improvement.



Reliability Program Scorecard

- Documentation (i.e. Reliability Program Plan, Reliability Case, TEMP), site visits, and technical interchange meetings are key components in further assessing a program's risk level
- Engineering activities should follow reliability best practices
- Assessment is conducted prior to the threshold Developmental Testing Event
- Results are provided to the Reliability, Availability, Maintainability (RAM) Subgroup of the Test and Evaluation Working-level Integrated Product Team

Scorecard References and Review

IEEE Standards Board, “IEEE Draft Standard for Organizational Reliability Capability,” IEEE Std P1624™ / Draft 2, 2008.
Tiku, S., and Pecht, M., “Reliability Capability Evaluation for Electronics Manufacturers,” Dissertation to the Faculty of the Graduate School of the University of Maryland, College Park, 2005.
Alion Science and Technology Corporation, "Alion System Reliability Center Reliability Maturity Assessment Procedure.”
Raytheon Reliability Scorecard (items referenced and reviewed)
GEIA Standard 4 April 2008.
RIAC System Reliability Toolkit
Incorporated changes suggested by: AEC, RIAC, TRADOC, ASA(ALT), Raytheon and Others

Scorecard Categories

8 Categories

- ❑Reliability requirements and planning
- ❑Training and development
- ❑Reliability analysis
- ❑Reliability testing
- ❑Supply chain management
- ❑Failure tracking and reporting
- ❑Verification and validation
- ❑Reliability Improvements

		High Risk Criteria	Medium Risk Criteria	Low Risk Criteria	H	M	L	NE
Category	**Element Description**	High Risk narrative	Medium Risk narrative	Low Risk narrative				

Scorecard Elements

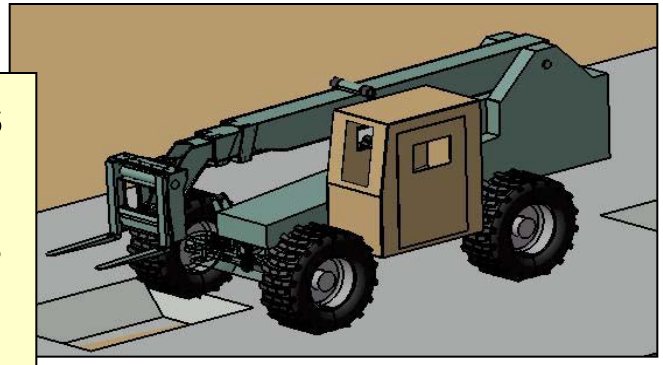
- Within each category there are several elements with associated rating criteria, 40 elements total
- Elements based off of Reliability Best Practices, IEEE document and GEIA standard
- Each element contains narrative description to help evaluator determine appropriate risk score

Green = 1 **Yellow** = 2 **Red** = 3

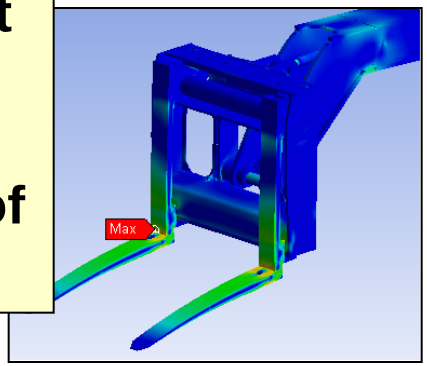
Modeling to Address Failure Mechanisms Element

- Comprehensive Thermal and Vibration analyses and/or Finite Element Analyses (FEA) are conducted to address potential failure mechanisms and failure sites
  - Design is modeled for thermal and vibration characteristics. Special items and operating conditions will be modeled. FEA will be performed on structure. **Low**
  - Design may be modeled. Limited FEA may be carried out. Some thermal/vibration objectives will not be met. **Medium**
  - No thermal or vibration analyses or FEA are planned. **High**

Dynamics model replicates durability course

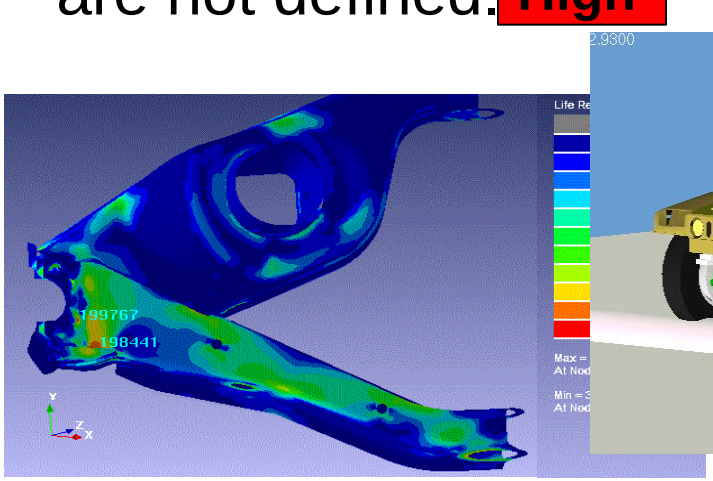


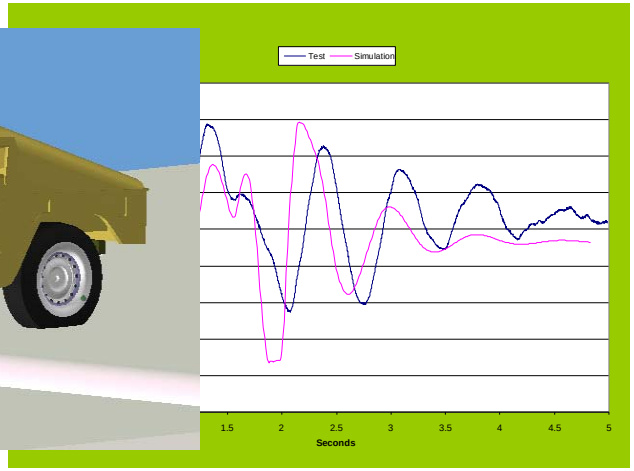
Finite Element Model (FEM) identifies critical areas of high stress



Loads, Stresses, Life Cycle Environment Element

- Critical loads and stresses are characterized; life cycle environment and operation duty cycle stresses are characterized
  - Failure modes and distributions are clearly identified and confirmed through analysis, test, or accelerated test. **Low**
  - Estimate life-cycle user environmental loads from "like-systems" in similar operational environments. **Medium**
  - Life-cycle user environmental loads and duty cycle stresses are not defined. **High**





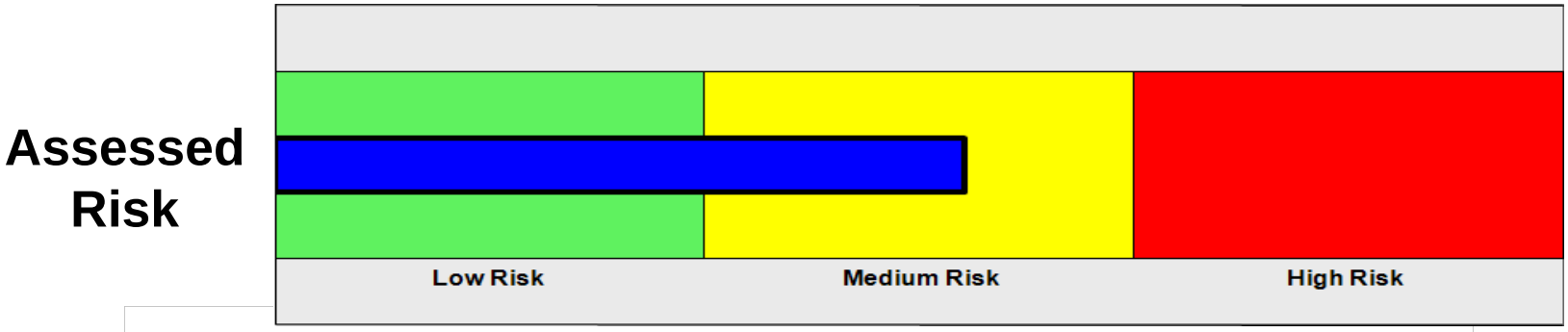
Calculating Reliability Risk Level and Score

- Each of the 40 elements are assigned risk score as red, yellow, green, or gray (risk = high, medium, or low respectively; gray = not evaluated)
- Element Risk Level equates to a score of 3, 2, or 1
- Elements are weighted for importance 3, 2, or 1 (fixed)
- Risk score for element is Risk Level * Weight
- Not Evaluated elements are removed from calculations
- Overall Risk Score is normalized to a 100-point scale

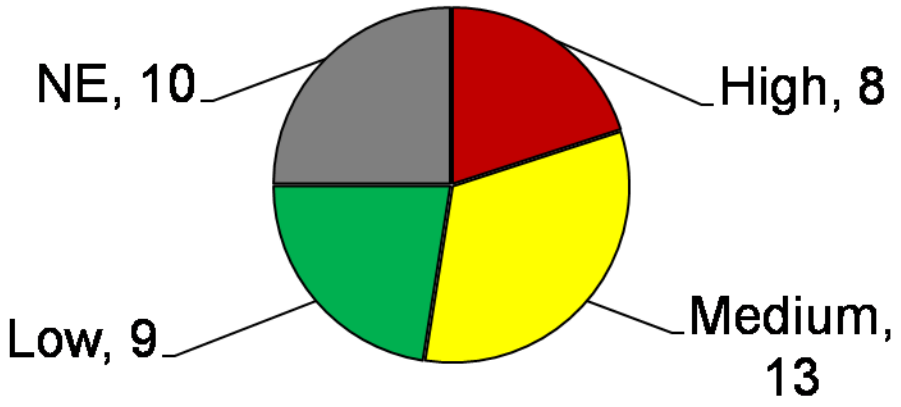
Reliability Scorecard Risk Assessment Results

Normalized Risk Score (1 to 100 scale where 100 is the highest) = 55

Overall Risk Assessment

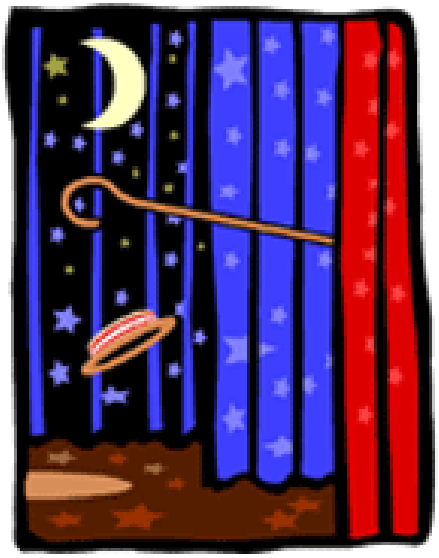


Total Number of Ratings by Risk Level



Benefits

- Identify poor performers earlier
  - Those that do not utilize best reliability practices will likely fall short



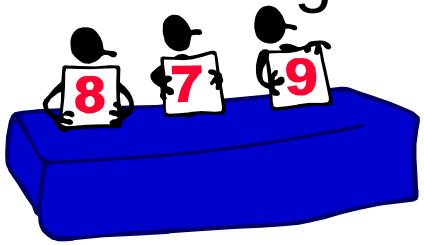
- Provide consistency to the engineering and reliability program reviews

- Provide a mechanism to capture useful metrics

Summary and Conclusions

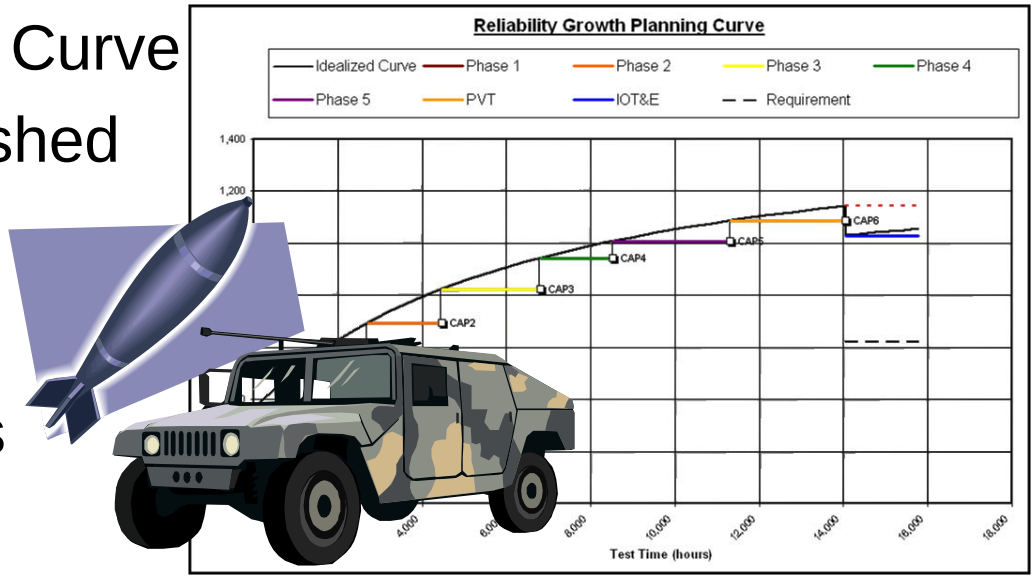
- Examines a combat developer's use of
  - Reliability best practices
  - Planned and completed reliability tasks

- The Scorecard is important
  - Tracking achievements of reliability requirements
  - Rating the overall adequacy of the Program's Reliability Program throughout the life cycle



Next Steps and Future Work

- Plan further development of Scorecards
  - Army - Assess contractual requirements implemented by the December 2007 ASA(ALT) memorandum
    - ✓Reliability Growth Curve
    - ✓Threshold established
  - Commodity Specific:
    - ✓Missile
    - ✓Wheeled Vehicles



- Revamp scorecard as metrics show need for improvement

Contact Information

Marguerite Shepler
USAMSAA
392 Hopkins Road
Bldg. 237 (RDAM-LR)
Aberdeen Proving Ground, MD 21005

410-278-5124
marguerite.shepler@us.army.mil