Tactical Vehicle Cons & Reps Cost Estimating Relationship (CER) Tool

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Objective/Purpose

- Developing a single consumables and reparables parts cost estimating relationship (CER) for the Army's Tactical Vehicle fleet is a significant challenge. This study sought an Excel-based tool that would allow analysts to select data relevant to their specific vehicles, efficiently and comprehensively compare multiple relationships, and choose the CER most relevant to their programs. This paper will discuss challenges and detail the process for quantifying the relationship between tactical vehicle reliability and parts cost.

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Previous Studies

- Two predecessor tasks to the current study
- Completed for the Office of the Deputy Assistant Secretary of the Army for Cost and Economics (ODASA-CE)
- Same objectives as current study: to develop a methodology to support consumables and reparables (Cons and Reps) parts cost estimating for tactical vehicles
- Two operating hypotheses led the studies to seek Cons and Reps cost ratio plots against reliability:
  1) Cons and Reps per mile varies inversely with reliability (i.e., Cons and Reps cost decreases as vehicle reliability increases)
  2) Cons and Reps per mile varies directly with vehicle price (i.e., Cons and Reps cost increases with vehicle average unit price (AUP))

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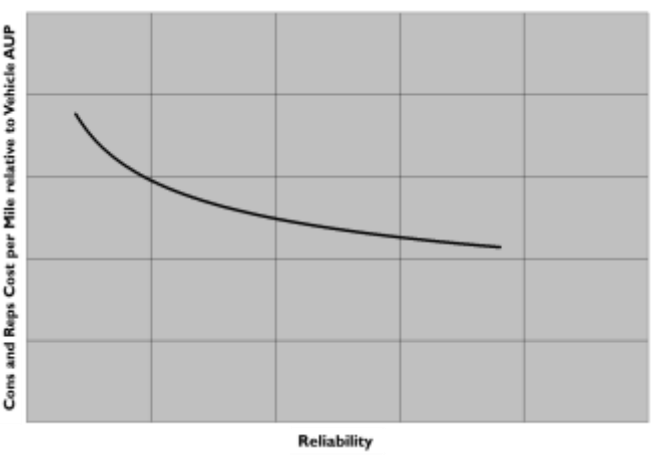
Theoretical Cost Ratio



Theoretical Cost Ratio of (Cons and Reps per Mile) / (Vehicle AUP) vs. Reliability

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Previous Studies

- 2008 Vehicle Study
  - Vehicle AUP data from varied sources
  - Reliability metrics not consistent
    - Mean miles between operational mission failure (MMBOMF), mean miles between system abort (MMBSA), mean miles between hardware mission failure (MMBHMF)
    - Captured during different stages in the lifecycle of the vehicle (e.g., Developmental Test (DT), Operation Test (OT), Limited User Test (LUT))
  - Cons and Reps costs and activity (miles) based on OSMIS data
- 2012 Tactical Vehicle Study
  - Vehicle AUP data all from the Wheeled and Tracked Vehicle (WTV) Automated Cost Database (ACDB)
  - Reliability metrics all from Army Materiel Systems Analysis Activity (AMSAA) Sample Data Collection (SDC)
  - Cons and Reps costs and miles all from AMSAA SDC

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Current Study – Hypotheses Revisited

- Same Two Operating Hypotheses:
  1) Cons and Reps costs (per mile) vary inversely with reliability
     - Cons and Reps costs decrease as reliability increases
  2) Cons and Reps costs (per mile) vary directly with vehicle cost
     - Cons and Reps costs increase as vehicle AUP increases
  - Using hypotheses 1 and 2 above, aimed to create similar Cons and Reps cost ratio plot against reliability
    - (Cons and Reps per Mile) / (Vehicle AUP) vs. Reliability
    - And explore other alternatives
      - Two variable case, Cons and Reps per mile = f(Reliability, AUP)
      - Three variable case, Cons and Reps = f(Reliability, AUP, Miles)
      - Cons modeled separately; Reps modeled separately

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Current Study – Data Definition

- Wheeled and Tracked Vehicle (WTV) Automated Cost Database (ACDB)
  - Army's primary source of contract acquisition price
  - Data housed in WTV ACDB used to calculate vehicle variant AUP
- Army Materiel Systems Analysis Activity (AMSAA) Sample Data Collection (SDC)
  - Army source of consistent CONUS and field exercise data
  - Served as the study's source of reliability data
- Army Operating and Support Management Information System (OSMIS)
  - Army's primary source of O&S phase costs
  - Served as the source of Cons and Reps parts cost, miles driven (activity), and inventory (density)

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Current Study – Data Collection

- Compiled list of tactical vehicles with contract and Cost Data Summary Report (CDSR) production data in WTV ACDB
- Obtained peacetime reliability metrics from AMSAA
  - Mean miles between non-mission-capable visits (MMB NMC Visits)
- Compiled list of vehicles for which data was available both within the WTV ACDB and AMSAA SDC
- Where possible, extracted Class IX Summary (cons and reps costs, miles, and inventory) data for aforementioned list of vehicles from OSMIS:
  - Due to differing surcharge applications, data was pulled for both of the following:
    - Base Year (BY) 2012
    - Then Year (TY) and escalated to BY12 via Army OMA indices
  - Peacetime costs (Without CONOPS)
  - Provided years individually and averaged, the latter done in an effort to level-out fluctuations in the data

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Current Study – Data Collection

- Compiled a list of vehicles for which all three data sources were available, resulting in a list of 93 vehicles
- Completed "Pareto-Plus" analysis to reduce sample size to a manageable number of systems based on the following criteria:
  - Included vehicles that comprised top 95% of total inventory, and
  - Included vehicles that comprised top 95% of total miles driven
- Extracted contracts and CDSRs from the WTV ACDB for the resulting list of 52 vehicles
- Utilized Total Price and Quantity as well as OPA inflation indices to obtain vehicle AUP in BY2012
- Per customer direction, MRAP M-ATV (M1240) and ASV (M1117) added to data set in later iteration
- Developed Visual Analysis Tool (VAT) to develop CERs for these **54 vehicles** across 12 series (the list of vehicles is shown on the next slide)

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Current Study – Data Collection

Vehicle Series	Vehicle Variant		Vehicle Series	Vehicle Variant		Vehicle Series	Vehicle Variant		Vehicle Series	Vehicle Variant
HMMWV	M998		FMTV	M1078A1-6343		M939 Series	M923A2		HEMTT	M978-7672
HMMWV	M1025		FMTV	M1083A1-3890		M939 Series	M923		HEMTT	M984A1
HMMWV	M1097A2		FMTV	M1088A1-3893		M939 Series	M931A2		HEMTT	M977-6426
HMMWV	M1114		FMTV	M1078A1P2-8577		M939 Series	M931		HEMTT	M985-7673
HMMWV	M997-2274		FMTV	M1083A1P2-8610		M939 Series	M925		HEMTT	M1120A2
HMMWV	M1113		FMTV	M1088A1P2-7759		M939 Series	M925A2		HEMTT	M1120A2R1
HMMWV	M1038		FMTV	M1078A1-3888		M939 Series	M929A2		HEMTT	M978A2-8215
HMMWV	M1037		FMTV	M1083A1-3884		M939 Series	M929		HEMTT	M977-0260
HMMWV	M1026		FMTV	M1089A1-3892		M915 Series	M915A3-4847		HEMTT	M984A2
HMMWV	M966		FMTV	M1078A1P2		M915 Series	M915A1		PLS	M1075
HMMWV	M1025A2		M-35 Series	M35A2-1617		M915 Series	M915A2		PLS	M1074
HMMWV	M1152		M-35 Series	M35A2C-0873		M915 Series	M915		M809 Series	M818-8984
HET	M1070		M916 Series	M916		M915 Series	M920		M809 Series	M813A1-8913
MRAP	M1240		ASV	M1117						

Vehicle Series and Variants for Tactical Vehicle Cons and Reps CER Tool

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Current Study - Analysis

- Desired CER and results differ depending on the subset of tactical wheeled vehicles of interest
- Differing results due to inherent variations in Cons and Reps data as well as large variations in data depending on the vehicle of interest (weight, mission, etc.)
- Created Excel-based VAT
  - Robust tool that enables the user to select desired data subset, regression form, and variables
  - Outputs graphs, statistics, CER (in both fit and unit space), residual analysis, and data for effective analysis
  - Analyst able to analyze multiple relationships in a short period of time, enabling more efficient and comprehensive analyses

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Current Study - Results

- Recommend summing MACOMs (i.e., selecting Total from the MACOM dropdown within the Tool)
  - Individual MACOMs produce varying results for which no significant relationships were identified to warrant use
- Recommend utilizing average across the years
  - Statistics suffer when utilizing all years individually
  - Large annual variance when utilizing all years vice average
  - May have 8 years of data for one vehicle and 2 years for another; skews results
- Recommend two variable power model, f(Reliability, AUP), when assessing the dataset as a whole
  - Power model makes most sense when considering asymptotic trends
  - R^2 improves when compared to the one variable relationship
  - Results in cost per mile estimate, the Army's preferred output

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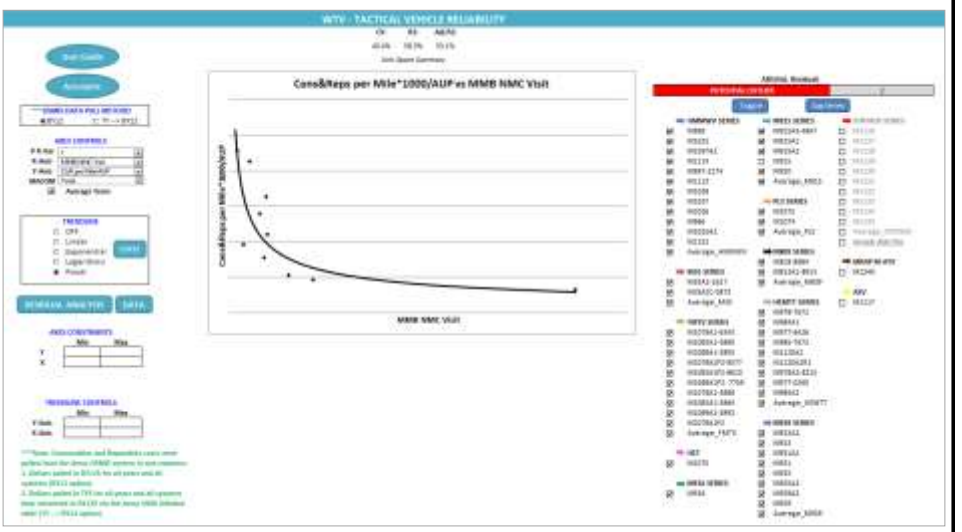
Current Study - Results



Tactical Vehicle Cons and Reps Cost Estimating Tool

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Current Study - Conclusions

- Specific CER utilized depends on analysis
- Do not recommend a single CER for all cases
- Recommend summing MACOMs (selecting Total from the MACOM dropdown)
- Recommend utilizing average across years
- Tactical Vehicle Cons & Reps CER Tool enables users to assess the level of fit for various relationships efficiently and comprehensively
  - More in-depth analyses in order to determine the relationship that makes most sense for current estimation needs
  - Analysts have control over and insight into the relationships being built when using this tool
  - All necessary information is provided to the analyst so that he/she may make the best CER selection

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Tactical Vehicle Cons and Reps CER Tool Demo

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Learn More and Contact Us

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