

Gunnery Predictive Analysis: An Empirical Study Using Mixed-Methods Research

**NO.25-1072
August 2025**



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Introduction

Lethal tank and Bradley crews will be critical in the next conflict. This research dives deep into what separates successful tank and Bradley crews at Gunnery Table 6 to identify the critical factors driving performance. By using both data-driven analysis with direct insights from the crews themselves, this report delivers actionable insights for improving training and operational effectiveness.

Research Objectives

- Identify key performance indicators (KPIs) that impact the success of tank and Bradley crews at Gunnery Table 6.
- Analyze the relationship between these KPIs and the performance outcomes.
- Develop predictive models for crew performance.
- Understand the perspectives and experiences of top- and bottom-performing crews through qualitative interviews.

Methodology

Research Design

A mixed-methods research design was employed, utilizing descriptive statistical methods for quantitative data and thematic analysis for qualitative data. The author collected data from multiple sources, including training records, crew demographics, performance metrics, and interviews.

Participants

The study involved all 3-8 CAV tank and Bradley crews scheduled to complete Gunnery Table 6. The quantitative research included a sample size of 28 tank crews (112 service members) and 17 Bradley crews (51 service members). For the qualitative component of the research, the author interviewed the top and bottom-performing crews (6-8 service members).

Data Collection

S-2 intelligence analysts and S-3 master gunners collected data on the following variables:

- Self-professed proficiency: Experience, vehicle status, knowledge (study), maintenance, ability to engage (shoot), and resilience. Soldiers can find definitions for each proficiency in the glossary at the end of this article.
- Performance Metrics: Scores from Gunnery Table 6.
- Environmental Conditions: Weather, time of day, terrain.
- Qualitative Data: Interviews with top and bottom-performing crews focusing on their experiences, challenges, and strategies.

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Data Analysis

3-8 CAV S-2 analysts used Power BI for data visualization and analysis when basic Microsoft Excel functions did not facilitate visual representation of the data.

Evaluators/Researchers/Author took the following steps for quantitative data:

- Data Cleaning: S-2 intelligence analysts ensured data accuracy and completeness.
- Descriptive Statistics: S-3 Operations Sergeant Major provided summarizations of the basic features of the data.
- Correlation Analysis: S-2 intelligence analysts, S-3 master gunners, and the S-3 Operations Sergeant Major identified relationships between variables. This included weighting certain factors predicted to have a higher significance on performance outcomes.
- Visualization: S-2 intelligence analysts created interactive dashboards, graphs, and charts to present findings. Figures 1-3 depict crew self-professed proficiency and their impact on crew qualification.

Figure 1 indicates crew qualification is primarily reliant on the vehicle commander. If the vehicle commander is removed from this crew, the crew's gunnery proficiency would likely dramatically decrease unless supplemented with a vehicle commander of the same skill level.

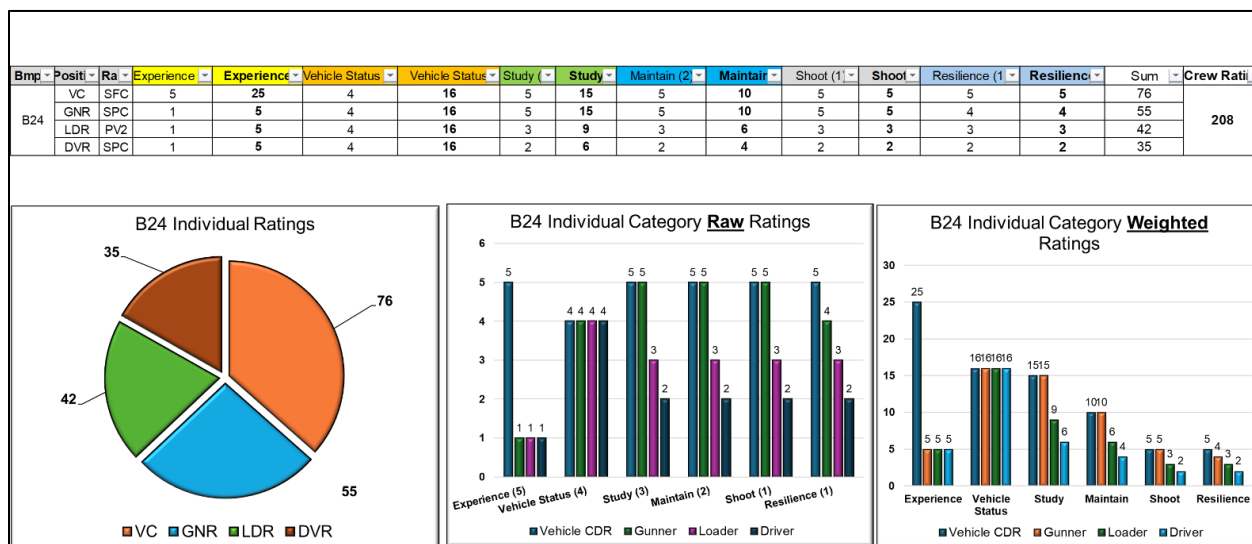


Figure 1. B24 Crew Self-Professed Performance Rating. (CPT Michael Christy, JMRC OC/T)

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Figure 2 indicates a similar finding, but the crew is reliant on the gunner. If the gunner would be removed from this crew, the crew's gunnery proficiency would likely dramatically decrease unless supplemented with a gunner of the same skill level.

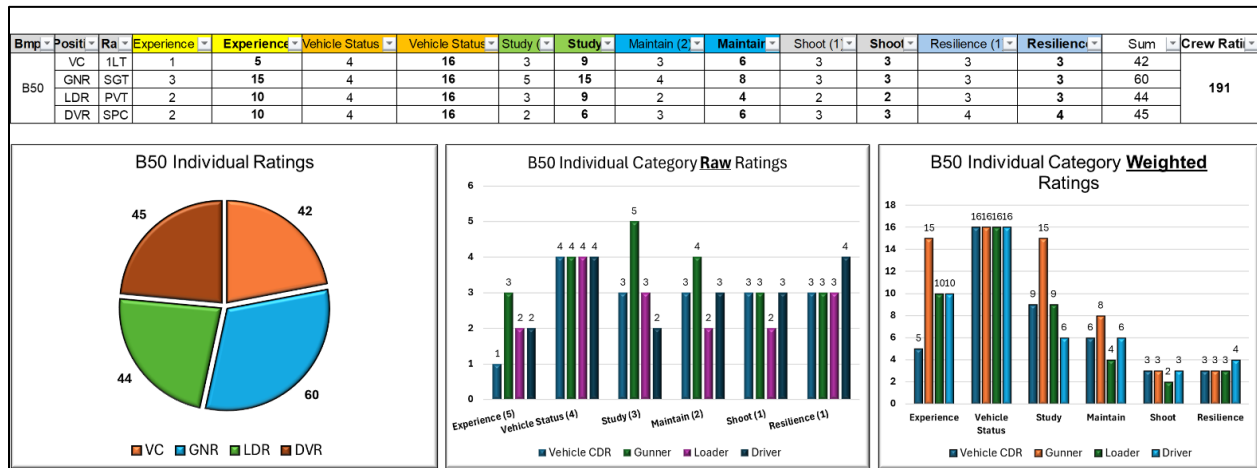


Figure 2. B50 Crew Self-Professed Performance Rating. (CPT Michael Christy, JMRC OC/T)

Conversely, figure 3 indicates that all the crew member's scores are relatively balanced. This possibly indicates the crew is a more cohesive team unit and therefore would operate better as a group.

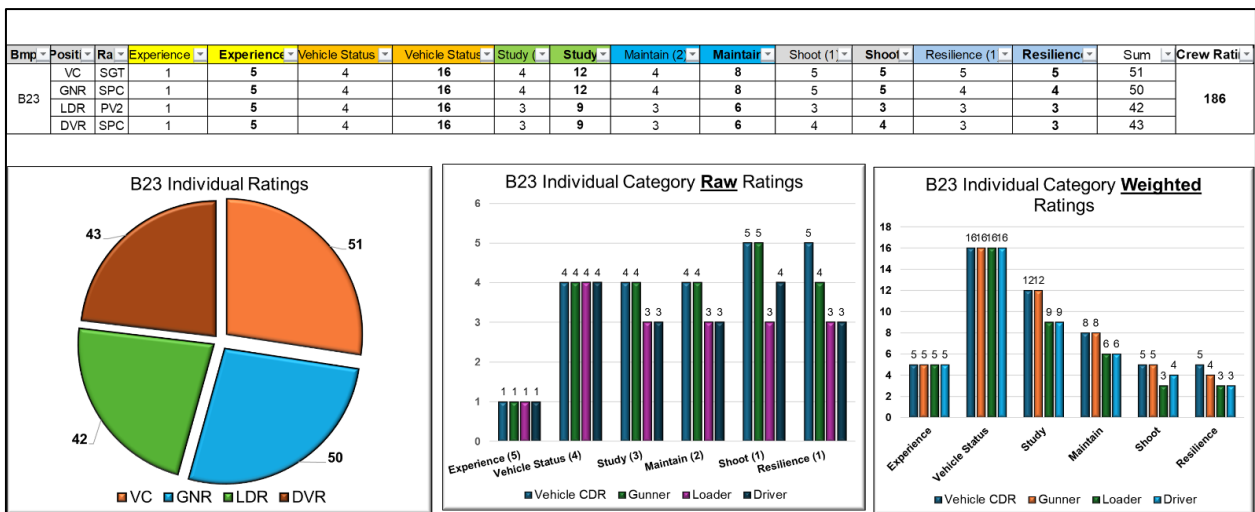


Figure 3. B23 Crew Self-Professed Performance Rating. (CPT Michael Christy, JMRC OC/T)

For qualitative data:

- Thematic Analysis: Coding and identifying key themes from the interviews.
- Integration: Combining quantitative and qualitative findings to provide a comprehensive understanding of performance factors.

Significance of the Study

This research will contribute to the understanding of factors influencing tank and Bradley crew performance. Army leaders can use insights gained from both quantitative data and qualitative interviews to enhance training effectiveness, ultimately improving operational readiness and mission success.

Timeline

- 22 July – 16 August 2024: Literature review and research design finalization.
- 19 – 30 August 2024: Data collection.
- 3 – 13 September 2024: Data analysis using Power BI and Microsoft Excel.
- 30 September – 4 October 2024: Report writing, dissemination of findings, and recommendations for future training strategies.

Budget

- Software: Power BI licenses
- Personnel: S-2 intelligence analysts, S-3 tank and Bradley master gunners, S-3 Operations Sergeant Major.

Post-Study Evaluation and Findings

Several critical insights emerged after we completed our study examining the performance of tank and Bradley crews at Gunnery Table VI. While the initial baseline accounted for key variables such as crew resiliency and vehicle maintenance proficiency, the current data indicates leaders should afford these variables a higher weighted ranking when considering self-professed proficiency ratings. Specifically, Soldiers who rated themselves higher in resiliency and maintenance skills consistently demonstrated stronger overall performance during the gunnery exercises.

Considering these findings, we recommend that FY 25 gunnery and combat training programs emphasize stress shoots and incorporate additional misfire and stoppage drills. The inclusion of such scenarios would better prepare crews for the unpredictable nature of combat and reinforce resilience under high-stress conditions. Other Army units including the 3rd Infantry Division and 1st Armored Division emphasize the need for stress induced scenarios and have experimented with these engagements. Moreover, operations and intelligence have concurred that the original key performance indicators (KPIs) of resilience and maintenance remain valid; however, these variables require refined definitions. These refinements will allow us to better predict friction points encountered during gunnery operations, improving both training and assessment accuracy.

The analysis also revealed leaders should modify the weighted rankings of the baseline variables. Specifically, resilience and maintenance should carry more weight in relation to other KPIs, given their substantial impact on crew performance. In this regard, data from Warhorse gunnery crews show consistent difficulty in managing simultaneous engagements involving multiple weapon systems. This struggle was particularly evident in scenarios requiring crews to operate under degraded environmental conditions, such as a simulated chemical attack.

One of the primary challenges the author identified is that crew scores in this training cycle were notably lower than last year's scores. They attribute the decrease in performance to significant mid-to-senior-level NCO turnover. This turnover led to Warhorse rapidly promoting many junior Soldiers to fill critical positions, which may have affected overall crew cohesion and skill execution.

Moreover, we identified potential fidelity issues in the initial data collection process. Specifically, there may have been inaccuracies in the self-professed proficiency variables reported by Soldiers. For future studies, we recommend that staff members directly collect these survey results to ensure greater objectivity and data reliability.

DOTMLPF-P Recommendations

Recommendations for future training and empirical research will follow a **DOTMLPF-P** framework.

Similar research, specifically Readiness-Level Progression: Certifying Expertise in Lethality as a Subset of the Armor Standardization and Training Strategy 2030 by LTC Dan Cannon and LTC John Nimmons, has gained and reinforced many of these insights.¹

The study recognizes that improving gunnery performance requires a comprehensive approach across all areas of the **DOTMLPF-P** framework. Below are recommendations based on the results of the completed study, integrated with insights from LTC Dan Cannon and LTC John Nimmons' strategy.²

Doctrine

Crew Certification: There is a need to refine the doctrine around crew certification by standardizing when and how proficiency tests occur.

¹ Cannon, Dan, and John Nimmons. "Readiness-Level Progression: Certifying Expertise in Lethality as a Subset of the Armor Standardization and Training Strategy 2030." *Armor Magazine*, 2024.

² Ibid.

The Maneuver Center of Excellence (MCoE) should revise the Integrated Weapons Training Strategy (IWTS) to include annual platform-proficiency exams for individual and crew certification. We assess that an implementation of these exams will reinforce the crew's sense of urgency when improving their knowledge of maneuvering and fighting on an armored platform. This directly correlates to the key performance indicator of "self-study."

Master Gunner Role: We recommend expanding the roles of master gunners at both the company and battalion levels to ensure consistent application of these certifications, as recommended in Cannon and Nimmons' work.³ The 3-8 CAV operations and intelligence sections recognize the importance of master gunners at the company level and recommend an expansion of the knowledge base amongst junior-level leaders, specifically platoon and squad leaders. This population has become the new "norm" for the continuity of crew development through multiple training cycles.

Reporting and Audits:

Training and Doctrine Command (TRADOC) should develop additional training programs to address reporting requirements, unit training plan audits, and data input into digital systems of record, such as the Digital Training Management Systems (DTMS). These new training strategies should attempt to strengthen the key performance indicators found to produce positive results amongst all armor crew members.

Organization

Master Gunner Expansion: As previously identified, enhancing the role of the battalion and company master gunners is critical. This includes ensuring all master gunners are the senior advisors to the battalion and company commanders on crew proficiency and making them responsible for certifying new personnel before they assume critical roles. Most armor units utilize the knowledge base of the master gunners very well, but incorporating the knowledge base into the squad levels will likely yield promising results.

Operations and Intelligence Integration: Data collected by S-2 and S-3 analysts and master gunners should continue to inform operational adjustments based on unit proficiency. The operational framework should allow battalion commanders to receive assessments before approving crew certifications. This study emphasizes that operations and intelligence are not two separate entities, but one capability synchronized by the S-2 OIC, Battle Captain, and the Operations Sergeant Major.

Operations NCOs and officers provide subject-matter expertise for armor gunnery, while the S-2 OIC provides the basic analytical tradecraft and techniques that allow for rapid

³ Ibid.

data collection, integration, visualization, analysis, and dissemination. Many working groups chaired by both operations and intelligence make these recommendations, not in a vacuum.

Training

Stress Shoots and Misfire / Stoppage Drills: Based on the analysis, FY25 training should emphasize stress shoots and misfire/stoppage drills. Units should incorporate training scenarios that simulate real-world conditions under stress, as well as engagement with multiple weapon systems. Crew performance during these drills should emphasize the SM's concentration on the key performance indicators, specifically resilience and encouragement of continued progress.

Environmental Challenges: Many crews struggled to perform under degraded environmental conditions, particularly during chemical attacks. Future training iterations should incorporate more scenarios simulating degraded environments. The rapidly changing OE demands that all Soldiers be familiar with CBRN related capabilities of our adversaries, as well as the protective equipment that enables our units to persevere through these conditions.

AGTS / BATS Certification: Units should adopt the Readiness-Level Progression article's recommendation of implementing a certification test-administered using the Advanced Gunnery Training System (AGTS) or Bradley Advanced Training System (BATS). This certification test ensures crews demonstrate functional knowledge on their platform before assuming duties. We assess that implementation of this strategy will yield better results in the early gunnery tables, which will likely improve crew confidence, and increase scores in table VI.

Materiel

Digital Systems Expansion: A universal digital system is essential to track certifications and proficiency levels. We recommend that the *Digital Training Management System (DTMS)* expand its capabilities to include crew certification data, gunnery scores, and training records for individual Soldiers. We also recommend that DTMS access, training, and utilization be stressed at the squad level, and amongst all training room and staff personnel. All staff sections (especially the S-2 and S-3) should be familiar with how to use the Army's program of record to reference training strategies, calendars, and results.

Simulators: Increasing access to AGTS / BATS for all personnel is crucial for testing and validating crew proficiency. This aligns with previous research recommendations for call for digital test-taking, which will require classrooms, computers, and software. Fort Cavazos-based units should incorporate training schedules created in DTMS and align

them with the Mission Training Complex (MTC) annual calendar. This will facilitate synchronization with Army civilian resources and battalion-level staff planners.

Leadership Development

Tailored Leader Development: As Soldiers progress through the system, leaders must have access to data that identifies areas where expertise is lacking. This data will allow leaders to tailor developmental programs based on individual and crew deficiencies. The emphasis on leader development will ensure that officers and NCOs are adequately prepared for their roles. We recommend that battalion-level staff relook knowledge management techniques for utilizing Microsoft Teams, Excel, Share Point, One Drive, and Power BI. All company and battalion-level leaders should have basic knowledge of data management.

Focus on Lethality: The study underscores the importance of adjusting leadership development models to reinforce lethality outcomes, consistent with Cannon and Nimmons' recommendation.⁴ This involves continuous evaluation and tailored training for leaders based on data analysis. We recommend that junior leaders, specifically at the squad level, be the recipients of a leader professional development program focused on warfighting. 3RD Brigade Engineer Battalion's *Libby Leadership Academy* is a great example of a junior soldier targeted professional development initiative. Although this program will involve a change in culture, it will likely result in organizational dividends for years to come.

Personnel

NCO Turnover: One key finding from this study is that lower performance scores in the current cycle were likely due to critical turnover in mid- to senior-level NCOs, compounded by the promotion of junior Soldiers to fill essential NCO positions. Addressing this personnel gap is crucial for maintaining continuity and proficiency.

Master Gunner Positions: To sustain the strategy, units must prioritize identifying and filling master gunner vacancies at both the company and battalion levels, ensuring there are no gaps in the certification and assessment process. We cannot overstate the importance of the master gunner in this initiative; they will inspire junior Soldiers and instill a tactical stewarding of the profession.

Facilities and Policy

Training Facilities: Expand classrooms and simulation spaces for AGTS/BATS training to accommodate the increased emphasis on digital certifications and written tests for proficiency. Units widely utilize the Fort Cavazos MTC for all training, but if they truly

⁴ Ibid.

align forecasted training plans with the MTC calendar, they will likely need to expand the facilities' resources internally. The author also identified challenges in handling simultaneous engagements and degraded conditions.

Policy Adjustments: The implementation of standardized crew certification processes will require updates to existing Army policies, ensuring that certification requirements are consistent across the force.

Conclusion

This study aimed to develop a predictive analysis of factors influencing 3-8 CAV Tank and Bradley crews' performance during Gunnery Table 6 in 2024, using a mixed-methods approach combining quantitative data and qualitative interviews. Key objectives included identifying performance indicators (KPIs), analyzing their relationships to crew outcomes, and offering actionable recommendations. The findings highlighted that resilience and maintenance significantly impacted performance, with high turnover rates among mid-level NCOs leading to disruptions in crew readiness. The author also identified challenges in handling simultaneous engagements under degraded conditions.

Recommendations across the DOTMLPF-P spectrum include revising doctrine to enhance certification processes, expanding the role of battalion master gunners, incorporating more realistic stress shoots, and improving digital systems to track crew proficiency. Addressing personnel gaps and enhancing leader development are also essential to improve operational readiness. By refining these training and organizational practices, all Army units can significantly enhance future crew performance and combat effectiveness.

Glossary

Experience

Defined as the total count of live-fire exercises conducted by a crew member in their specific role. It is crucial because higher experience often correlates with improved skill, accuracy, and familiarity with the weapon systems and tactics, leading to better overall performance and effectiveness in combat situations.

Shoot

The ability to accurately engage and destroy enemy targets using the vehicle's weapon systems.

- **Weapon Systems**: Utilization of the tank's main gun, coaxial machine guns, and secondary weapons to engage targets.
- **Target Acquisition**: Detecting and identifying targets using various sensors and sighting systems.
- **Fire Control**: Properly aiming and firing the weapon systems to ensure effective target engagement.
- **Engagement Drills**: Following established procedures and tactics for engaging targets efficiently and effectively.

Maintain

- **Weapons Maintenance**: The upkeep of weapon systems to ensure they are clean, functional, and reliable. This includes regular inspections, cleaning, lubrication, and repairs.
- **Knowledge of the Muzzle Boresight Device**: understanding how to use the tool to align a weapon's sighting system with its barrel. This includes knowledge on setting up the device, aligning the sight correctly, and calibrating the weapon accurately for effective targeting.
- **Main Gun GST Disassembly to Assembly**: The process and time required to disassemble and reassemble the main gun for maintenance. This includes removing and reattaching components and verifying functionality.
- **Stoppage Drills**: The ability to correct any mechanical interruption in the cycle of operation that prevents the weapon from firing. You do not necessarily need to repair it, but you must act immediately to resume firing.
- **Misfire Drills**: A misfire occurs when the firing pin strikes the primer of the round, but the round fails to fire. This could be due to a defective round or other mechanical issue. Misfires require careful handling, as the round may delay in firing (hang fire).

Vehicle Status

Monitoring the condition and operational readiness of the vehicle.

- **Services**: Regular maintenance tasks performed to keep the vehicle in good working condition, such as oil changes, filter replacements, and system checks.
- **Preventative Maintenance Checks and Services (PMCS)**: Scheduled inspections and upkeep procedures designed to identify and address potential issues before they lead to breakdowns, ensuring the vehicle remains reliable and operational.

Study

- Self-Study: Individual learning and review of technical manuals, tactics, and procedures to enhance personal knowledge and skills.
- Individual and Crew Training: Structured training programs designed to develop both individual proficiency and team coordination, including drills, simulations, and tactical exercises to improve overall operational effectiveness.

Resilience

- A crew's ability to fight through adversity (whether that is maintenance issues, weather, illness, or unexpected friction). This is a critical factor to consider because any number of additional problems can have a detrimental effect on a crew's mood and morale. How well or poorly a crew reacts to stress likely has a direct correlation to how well they shoot.

Reference

Cannon, Dan, and John Nimmons. "Readiness-Level Progression: Certifying Expertise in Lethality as a Subset of the Armor Standardization and Training Strategy 2030." *Armor Magazine*, 2024.

