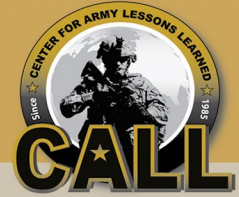




# BULLETIN



NO. 18-21

MAY 2018

# **U.S. ARMY ORDNANCE CRUCIBLE**



## **Combat Repair Team Observations**

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# United States Army Ordnance Crucible Combat Repair Team Observations

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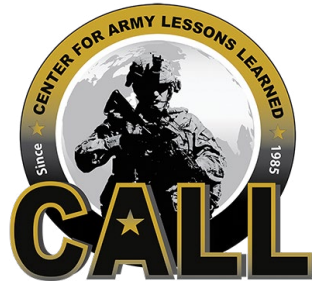
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## Foreword

The purpose of this bulletin is to provide the Army's operating force with recommendations based on a deliberate collection of tactical and technical observations gained during the 2017 Combat Repair Team of the Year competition as part of the U.S. Army Ordnance Crucible.

The 2017 U.S. Army Ordnance Crucible consisted of three major competitions: Ammunition Transfer and Holding Point, Combat Repair Team, and Explosive Ordnance Disposal. The competitions were designed to test Soldiers' teamwork and critical thinking skills as they applied technical solutions to real-world problems. The U.S. Army Ordnance Crucible allowed divisions to validate institutional training and their respective units' skills.

Participants in each competition were subjected to a decisive action training environment (DATE) that tested knowledge and mastery of tasks within their respective occupational skill sets. Additionally, the competition integrated elements of physical and mental rigor.

With the October 2017 publication of Field Manual (FM) 3-0, "Operations," it is evident that the Army must adapt and prepare for *"large-scale combat operations in highly-contested, lethal environments where enemies employ potent long range fires and other capabilities that rival or surpass our own."* Furthermore, FM 3-0 discusses the necessity for building agile and adaptive leaders who can prevail in large-scale combat operations. Winning in this environment *"requires tough, realistic, and repetitive training."*

This bulletin consists of dozens of recommendations for our Army's operating force as it prepares for large-scale combat operations. The following three training recommendations, arguably, are fundamental to maintenance operations at any level:

- Integrate additional maintenance operations into each combat training center rotation. By employing repair teams into the competitive training environment, we will stimulate the necessary response to develop adaptive and agile munitions operators and leaders.
- Train maintenance Soldiers routinely. Whether at the section level or echelons above brigade maintenance company, preventing maintenance skills from atrophy requires routine sustainment training at home station.

- Integrate technical and tactical proficiency into realistic training events. FM 7-0, *“Train to Win in a Complex World,”* discusses the Army’s principles of training. The key to success when preparing maintenance Soldiers, sections, and units for large-scale combat operations is to resource and validate competency in basic tasks of “occupy and defend assigned area.” This training should be held concurrently while setting conditions for the establishment and execution of repair operations.

This publication highlights the major observations from the Combat Repair Team competition, held 21-25 AUG 2017, at Fort Pickett, VA. The recommendations will facilitate improvements in our institutional, operational, and self-development domains. Furthermore, it advances the Ordnance Corps mission to train, educate, and develop adaptive ordnance professionals and to be the premier proponent that develops Ordnance ordnance professionals, doctrine, and capabilities for the total force in support of Army readiness.

A handwritten signature in black ink, reading "David Wilson". The signature is fluid and cursive, with the first name "David" and last name "Wilson" clearly distinguishable.

David Wilson  
Brigadier General, U.S. Army  
40th Chief of Ordnance

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<b>Center for Army Lessons Learned</b>	
<b>Director</b>	<b>COL Michael F. Pappal</b>
<b>CALL Analyst</b>	<b>CPT Ryan St. Jean</b>

This bulletin identifies numerous issues that are related to home station training and frequently identifies some possible solutions. The Ordnance community should further explore the implications and recommendations described in this publication.



Michael F. Pappal  
COL, AR  
Director, Center for Army Lessons Learned

The Secretary of the Army has determined that the publication of this periodical is necessary in the transaction of the public business as required by law of the Department.

Unless otherwise stated, whenever the masculine or feminine gender is used, both are intended.

**Note:** Any publications (other than CALL publications) referenced in this product, such as ARs, ADRPs, ADPs, ATPs, FMs, TMs, etc., must be obtained through your pinpoint distribution system.



## Chapter 1

### Introduction and Event Description

**LTC Eric L. Booker, 16th Ordnance Battalion**  
**CSM Patricio Cardonavega, 16th Ordnance Battalion**

The U.S. Army Combat Repair Team (CRT) portion of the Ordnance Crucible took place 21-25 AUG 2017. This challenging competition enhanced teamwork and readiness, using current and relevant training that reflects the latest doctrine and technical manuals. The competition incorporated the most challenging current maintenance trends, which allowed the Ordnance Regiment and participating organizations the opportunity to gauge the operational forces' effectiveness. Participants in the competition were subjected to a decisive action training environment (DATE) that tested their mastery of tasks related to maintenance management, forward maintenance operations, and security of maintenance operations.

Each organization that elected to participate had to hand-select their team, ensuring that the various participants possessed certain skill sets, such as the "H8" skill identifier, which was essential for the recovery portion of the competition. Additionally, an equipment density list was provided well in advance so organizations would be aware of the various pieces of equipment that would be used throughout the competition.

The events within the competition were designed by instructors, senior maintenance technicians and other leaders within the Ordnance School and Regiment. Subsequently, instructors served as the evaluators for each event. Prior to the competition, time trials were conducted for each event to certify the validity of the lanes.

The competition took place at Fort Pickett, VA, where multiple training areas were used to incorporate an austere environment. All events were time and standards based, amplified by technical precision requirements and the demands of time limitations.

#### CRT Ordnance Crucible 2017 Competitor Composition

- The completion was designed to consist of seven-man teams.
- 15 teams (105 participants) competed.
- The ranks represented included (6) second lieutenants (2LTs), (9) first lieutenants (1LTs), (1) chief warrant officer 3 (CW3), (8) chief warrant officer 2s (CW2s), (5) warrant officer 1s (WO1s), (8) sergeants first class (SFCs), (17) staff sergeants (SSGs), (23) sergeants (SGTs), (25) specialists (SPCs), and (3) privates first class (PFCs).
- There was a diverse group of military occupational specialities (MOSs) represented in the competition, including:
  - **Officers:** 91As (12), 88As (3)
  - **Warrant officers:** 915As (10), 914As (2), 913As (2), 948D (1)
  - **Enlisted:** 91B (25), 91C (2), 91D (8), 91E (1), 91F (5), 91H (1), 91J (1), 91S (2), 94F (3)

**Table 1-1. CRT Ordnance Crucible Events and Assessment Methodology**

CRT Ordnance Crucible 2017 Events	Assessment Methodology
<ul style="list-style-type: none"> <li>• Army physical fitness test</li> <li>• Defend the repair team site (included weapons range)</li> <li>• Repair team operations (focused on expeditionary and fix forward)</li> <li>• Recovery and battle damage assessment and repair (BDAR) operations</li> <li>• 12-mile road march (maintenance tasks were incorporated through various intervals)</li> <li>• Maintenance written knowledge exam</li> </ul>	<ul style="list-style-type: none"> <li>• Grading rubrics</li> <li>• Individual surveys</li> <li>• Team after action reviews (AARs)</li> <li>• Hot washes with event officer in charge (OIC)/noncommissioned officer in charge (NCOIC) and other subject matter experts</li> <li>• Comments derived from visiting battalion commanders and other distinguished visitors</li> <li>• Overall competition AAR</li> </ul>

Critical to the success of the competition was the assessments process. This consisted of multiple, integrated components. First, the mission command organization executed a daily commander’s update brief, which integrated a daily AAR from event commanders and evaluators. This captured the larger observation and focus while also creating shared understanding for the following events. The subject matter experts’ observations and insights created the core of this document. Second, concluding each event’s execution was a basic hot wash. This captured the immediate positive and negative observations from the participating teams and their evaluators. Third, each event’s scorecard was collected and analyzed, contributing to initial and follow-up trend assessments. This was expanded into skill level, MOS, and type of unit. Finally, at the conclusion of the entire competition, event commanders and their subject matter experts assembled each participating team and conducted a written survey. This survey provided both qualitative and quantitative data, which was further used for this document.

An invaluable enabler for the event and development of this product was the integration of 55th Signal Company (combat camera). Embedded into each of the competitive events, its visual imagery allowed a deeper analysis to tell a clear story of what happened during the competition.

The competition revealed that organizations sent out strong competitors, who proved to be very impressive. Throughout this document, key lessons, observations, and recommendations will be addressed. Four common themes include:

- **Shortfall in aspects of recovery operations expertise:** Trends indicated that the operational force requires an H8 recertification process to refresh this perishable skill. This was revealed during the recovery operations event of the competition in the overturned vehicle scenario and the mired vehicle scenario, which proved to be the most challenging to the competitors. Eight of the 15 teams struggled with the recovery mathematical calculations, and 12 were penalized for various safety violations, which included infractions that precluded multiple competing teams from completing portions of the competition.
- **Knowledge shortfall with maintenance support devices:** Maintenance support devices (MSDs)-focused training has not permeated through the Army, and “guess work” from past experiences often trumped the doctrinal procedures. During the competition, seven of the 15 teams did not identify and correct all faults on the M1151 within the allocated time. Only four teams properly performed troubleshooting on the 5kw generator. Additionally, rather than using the provided schematics for troubleshooting, 10 teams attempted to disassemble the generator to find faults.
- **Deficiency in tactical proficiency:** Additional emphasis is needed on site defense operations while executing the maintenance mission. None of the teams completed the DA Form 5517 (range cards) to standard at all four firing positions and subsequent sector sketches. Furthermore, 11 teams demonstrated challenges while engaging targets during the defense phase, averaging less than 20 of 30 targets accurately engaged. Moreover, during the repair team site event portion of the competition, five teams did not emplace the M240B as a protective or defensive fire capability for their defensive posture.
- **Lack of familiarity with maintenance equipment used in expeditionary tactical operations:** Units need to improve and expand training on maintenance systems and equipment used in expeditionary tactical operations, especially the contact truck and lightweight maintenance enclosure (LWME). Five teams executed movement in the contact trucks with the tailgate down, risking loss of tools. Additionally, evaluators stated that competitors were requesting tools that were included in the contact truck. In regards to the LWME, four teams received half or less points for safety considerations during its assembly. Discussions through AARs with teams revealed that multiple teams do not practice or use the LWME at their home station.



## Chapter 2

### Recovery Operations

CPT Regina Rauer, A Co, 16th Ordnance Battalion  
1SG Keith Gantt, A Co, 16th Ordnance Battalion

#### Competitive Event Overview

**Task:** The recovery operations event consisted of four different scenario areas, which included:

- Recover a mired wheeled vehicle
- Recover an overturned wheeled vehicle
- Conduct battle damage assessment and repair (BDAR)
- Conduct hasty vehicle evaluation lanes

**Condition:** In a contemporary operational environment, the unit received a request to provide a recovery support element to recover and repair inoperative equipment, conduct hasty vehicle recovery, and recover an overturned wheeled vehicle and a mired wheeled vehicle. Recovery equipment and tools, BDAR kits, technical manuals, and applicable references were available.

**Standard:** Recovery teams were tasked to conduct recovery missions without causing damage to the equipment or injury to personnel in accordance with Army Techniques Publications (ATPs) 4-31 and 4-33, and Army standard and applicable publications. Each team was given one hour to complete the BDAR event and two hours each for the overturned vehicle and mire pit recovery, and one hour for the hasty vehicle recovery.



**Figure 2-1. A competitor maintains security while an overturned vehicle recovery operation occurs in the background.**



**Figure 2-2. An evaluator inspects the proper rigging procedures for recovering an overturned vehicle.**

### **Issue 1: H8 Recertification**

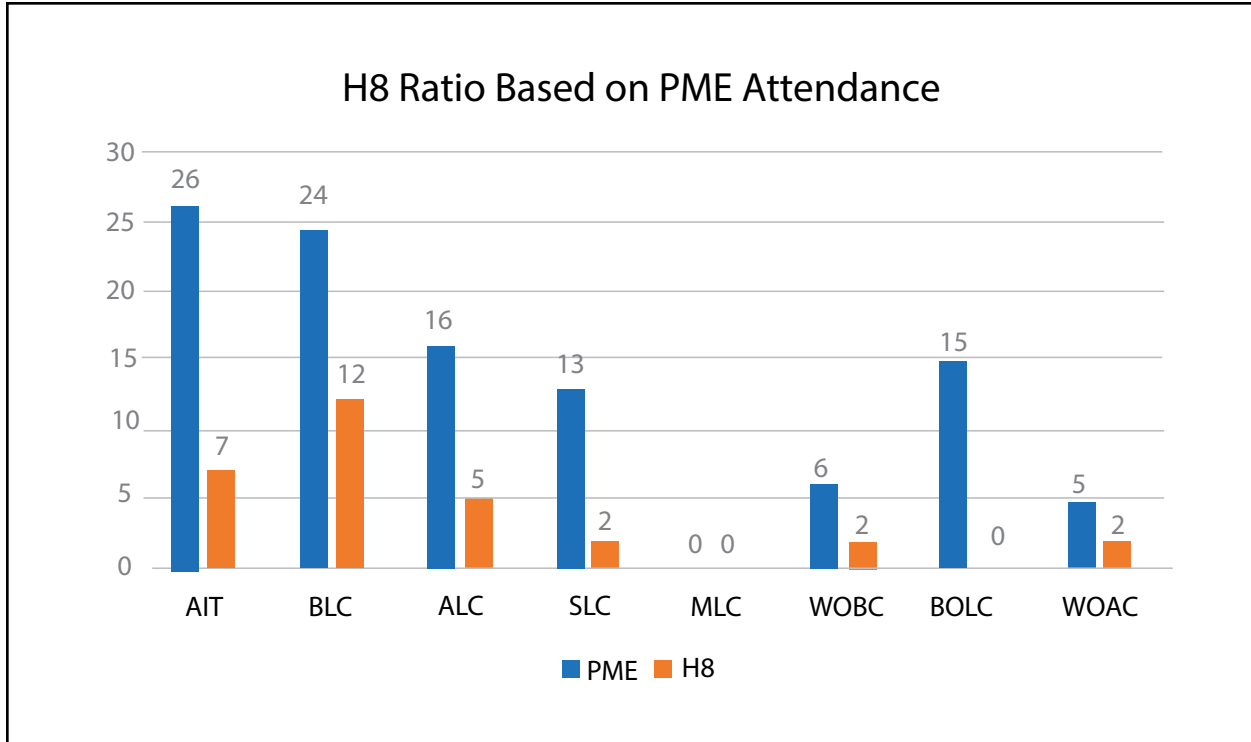
H8 Soldiers who received their training and certification several years ago were not up to date with the doctrinal recovery procedures.

#### **Discussion: Trends and Observations**

Out of the 105 competitors, 30 possessed the H8 identifier. During the recovery operations lane, the evaluators noticed the competitors were unaware of the updates made since they attended the course. Surveys and the after action review (AAR) revealed that 11 out of the 30 H8 competitors completed their H8 qualifications more than five years ago.

There were common challenges the competing teams encountered. Nine teams struggled with properly rigging the overturned vehicle, while six did not use proper hand and arm signals throughout the recovery operations event.

Safety violations proved to be a significant downfall for numerous teams. Seven teams did not follow prescribed safety precautions and warning statements; therefore, two did not finish the recovery event due to three major safety violations, while one did not complete the recovery event within the required time.



**Figure 2-3. A depiction of the professional military education level that 30 H8 competitors completed.**

**Conclusion:** Inference derived is that H8 is a perishable skill and there is no current H8 recertification to allow Soldiers to refresh themselves on the doctrinal/technical updates/changes.

### Recommendations

**Operational recommendations:** Units should establish a recertification process to be executed at home station. The Ordnance School established online training to address this issue; however, units should include recovery mission/table certifications into unit training events to recertify personnel through practicum and to obtain Objective-T (OBJ-T).

Units should conduct low density recovery training and H8 refresher training at their home stations under supervision of allied trade and recovery technicians. Units should also use the various training scenarios that were incorporated into the competition as a model for home station training.

For collective tasks at rotation exercises, units should maximize the training by requesting the evaluating team to incorporate a catastrophic incident to a tactical movement scenario. In this endeavor, units should ensure that there are no administrative moves, but units should conduct hands-on recovery.

**Self-development:** Units should provide access and encourage online training programs. Furthermore, units should integrate H8 recovery basics into structured self-development (SSD). Additionally, personnel should continuously review ATP 4-31 (Recovery and BDAR). Based on struggles during the competition, there should be extra emphasis on Sections 2-1 (Rigging) and 2-26 (Rigging Techniques).

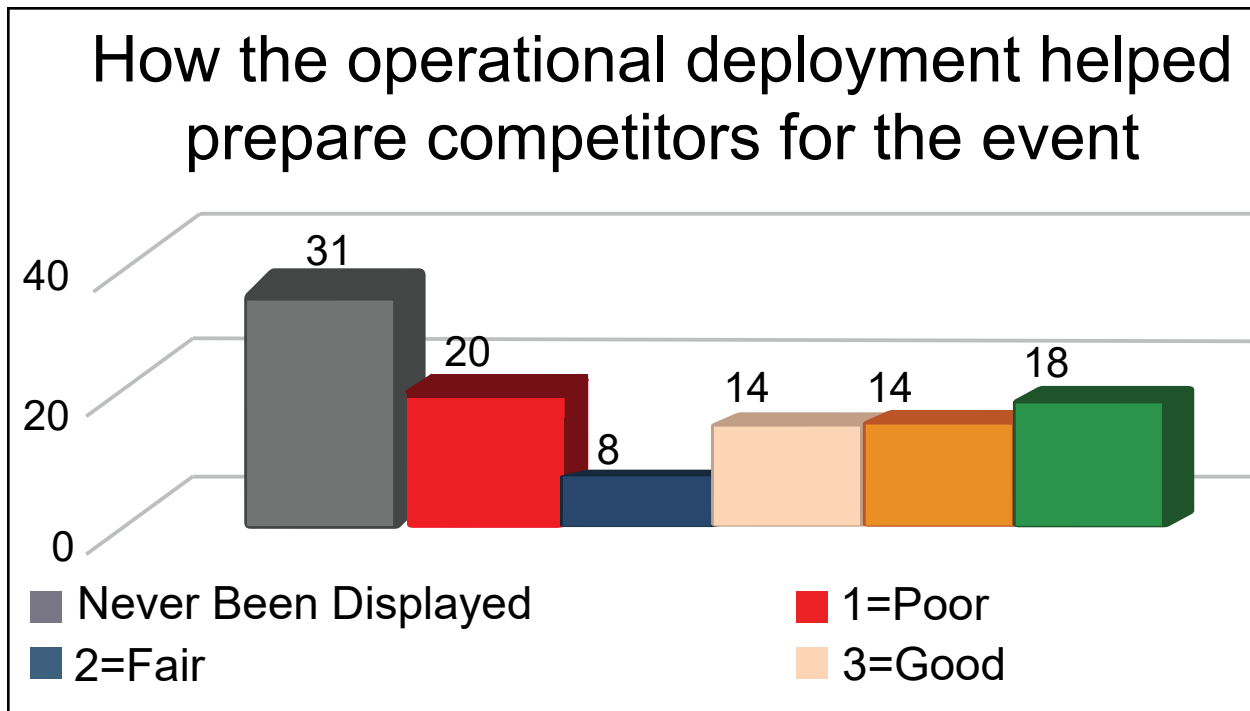


Figure 2-4. Surveys indicated that competitors were split on whether or not deployments and CTC rotations prepared them for the event.

## Issue 2: Recovery Doctrinal Basics

91B/H8 Soldiers struggle with following doctrinal techniques when at home station.

### Discussion: Trends and Observations

The majority of the H8 competitors struggled while calculating recovery data. Competitors stated in subsequent AARs and surveys that they do not or rarely use this skill at their home stations during recovery missions. Eight teams struggled with the recovery mathematical calculation. Out of the eight teams, five struggled with the equations and had incorrect calculations of the mechanical advantage (MA) all the way through the calculation of fall line force (FLF).

Safety violations proved to be a challenge throughout the recovery operations event. Twelve teams received deductions for safety violations, while two were not allowed to complete the recovery event due to three major safety violations.

**Conclusion:** Inference derived from discussion of issue is that Soldiers get accustomed to unit tactics, techniques, and procedures (TTPs) and rarely use worksheet calculations at their home stations; hence they forget the doctrinal basics of recovery operations.

### Recommendations

**Operational recommendations:** For collective tasks, H8 tasks should be incorporated into an exercise evaluation (EXEVAL) tasks at unit collective training decisive action training environment (DATE) and combat training centers (CTCs) to stimulate proficiency.





Figure 2-5. Recovery of a Mire Factor 2 MTV.

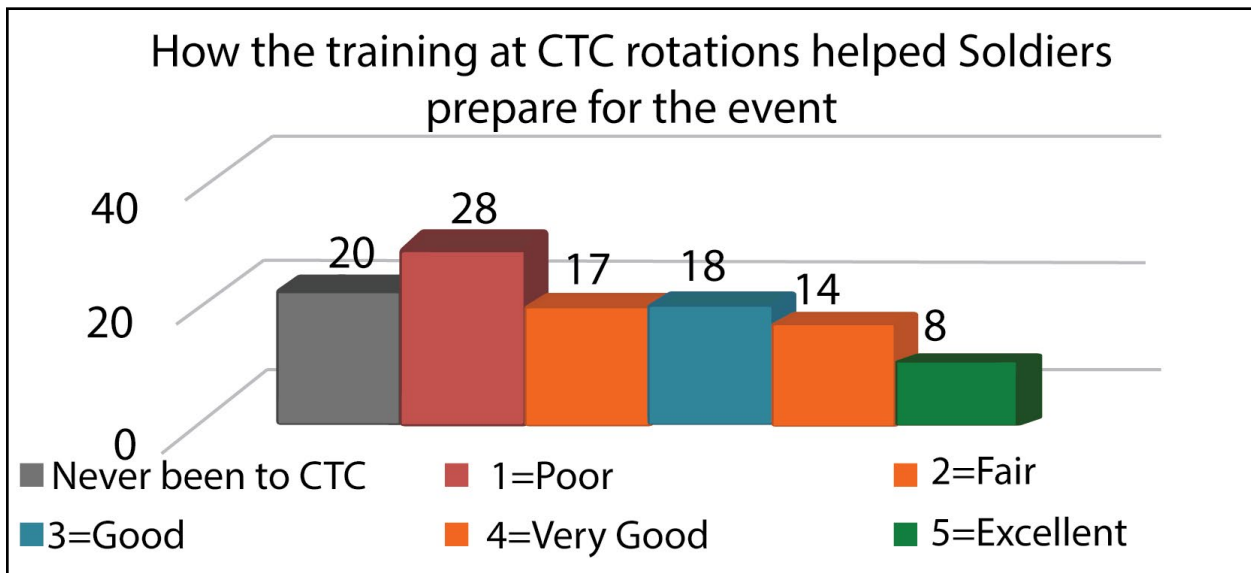
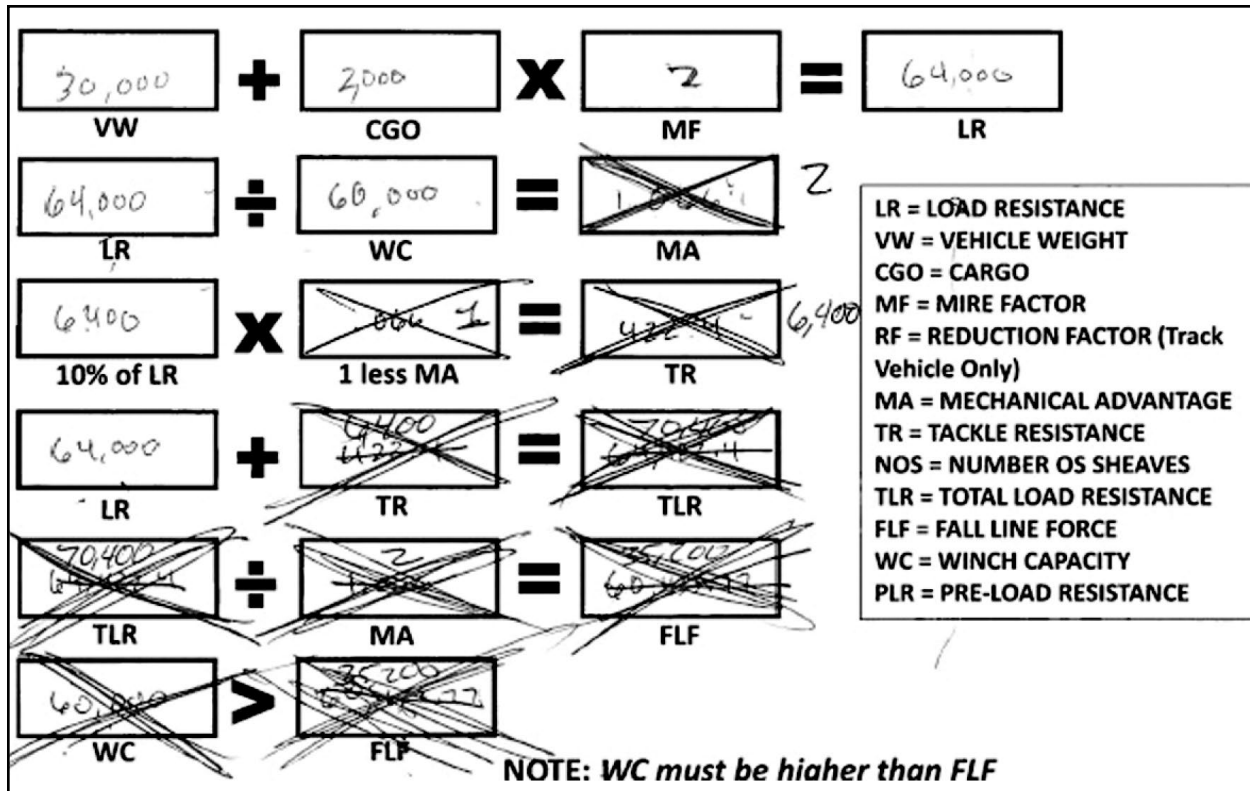


Figure 2-6. Survey shows that only eight out of 85 Soldiers rated their training in CTC rotations as “excellent” in preparation for the recovery event. Twenty-eight Soldiers stated that training in CTC rotations was “poor” and did not have recovery training done during their rotations.



**Figure 2-7.** The above worksheet was used during the competition and it depicts incorrect calculations with incorrect mechanical advantage (i.e. must be rounded up to the next whole number). Therefore, it was an incorrect mathematical equation.

**Self-development:** H8-trained Soldiers should continuously review the calculation process, and they should contact the Ordnance School when necessary for further explanation.

H8 Soldiers should become familiar with the recently developed vehicle recovery worksheet application/software, which can be used on various vehicles with various recovery missions.

H8 Soldiers should become familiar with the new direct recovery operations (DRO) application/cellphone application. The DRO application is accessible to all Soldiers through Google Play or the Apple Store. It is a centralized location for accessing instant mathematical equations to recover military vehicles immediately. This innovative application calculates the types of resistance for the recovery operation. The application contains accessible information for more than 200 vehicle types. The application is versatile and it can calculate the various facets, which includes the required recovery material for the arsenal of Army vehicles. Additionally, Soldiers should study the reference resources within the application, which includes the most current ATPs, Army regulations (ARs), and the digital graphic training aid (GTA) riggers card.

## Issue 2: Recovery (Hasty) Operations Challenges

Hasty recovery using tow bar, chains and straps is not a common recovery mission at unit stations.

## Discussion: Trends and Observations

Competitors struggled with the CRT's hasty recovery event using the tow bar, chains, and straps. The greatest challenge for the competitors proved to be the tow bar. Three teams failed to loop the recovery strap on the disabled vehicle's two front shackles and into the recovery vehicle's tow pintle. Four teams struggled in connecting the tow bar and properly inserting/securing the locking pin. Nine teams did not follow prescribed safety precautions/obeyed all safety, caution and warning statements.

Many competitors commented during the AAR and within the survey that the hasty recovery task was not included in the unit stations' training. Dedicated recovery assets, such as wreckers, were often used during recovery missions; therefore, proper training on the use and hook up of the tow bar, chains, and tow straps do not often occur.

Twenty Soldiers assessed that enhanced home station training could better prepare them for the recovery operations.

**Conclusion:** Unit stations' TTPs are often focused on just recovering the equipment from the danger zone; hence, improper training on the use and hook up of the tow bar, chains, and tow straps occurred.

## Recommendations

**Operational recommendations:** Units should include self-recovery and like-vehicle recovery into their drivers training program or unit training DATE events. For home station training, units should conduct repetitive hand and arm signals in compliance with ATP 4-31 (Recovery and BDAR) Appendix B. This could be incorporated into common reoccurring events such as motor stables, and it should be continued and evaluated in field training exercises in scenario-based events. During these field training exercises (FTXs), units should ensure all aspects of self and like recovery are tested; therefore, units must ensure adequate equipment remains on hand, such as tow bars, straps, and chains.

**Self-development:** Leaders and Soldiers should be knowledgeable on ATP 4-31 (Recovery and BDAR). Soldiers should focus on Chapter 3, Section 3-24 (Self-Recovery and Like-Vehicle Recovery).



**Figure 2-8. Competitors performing hasty recovery. This basic task is easily forgotten when units do not train frequently on this type of operation.**



## Chapter 3

### Repair Team Site

**CPT Russell Vickers, E Co, 16th Ordnance Battalion  
1SG Rene Aleman, E Co, 16th Ordnance Battalion**

#### Competitive Event Overview

**Task:** The event consisted of multiple facets. Teams had to establish a repair team site within a designated area, and conduct numerous tasks in this regard. Simultaneously, the teams had to provide maintenance support forward (i.e. maintenance reaction course [MRC]) through priorities of work and movement to supported units.

**Condition:** Teams arrived in an austere environment and were provided maintenance tents, a contact truck with a maintenance support device (MSD), a general maintenance tool kit (GMTK) and technical manual (TM).

**Standard:** Complete as many of the unit maintenance collection point (UMCP) and maintenance tasks as possible within eight hours while maintaining security, safety, established procedures and executing maintenance injects hourly (ATP 4-33, AR 750-1, applicable TMs).

#### Issue 1: Expeditionary Familiarity

Teams demonstrated a lack of familiarity with the use of expeditionary maintenance support equipment and establishing site in decisive action training environment (DATE).

**Table 3-1. Repair Team Site and Maintenance Reaction Course**

Repair Team Site	Maintenance Reaction Course
<ul style="list-style-type: none"> <li>• Establish communications</li> <li>• Establish security</li> <li>• Global Combat Support System – Army (GCSS-A) and maintenance reports</li> <li>• Provide status updates</li> <li>• M240 troubleshooting</li> <li>• Construct a lightweight maintenance enclosure (LWME)</li> </ul>	<ul style="list-style-type: none"> <li>• 1151 air conditioner (AC) inoperable (INOP)</li> <li>• AN/PVS 14 night vision goggles (NVG)</li> <li>• 10K generator K15 relay</li> <li>• Light medium tactical vehicle (LMTV) fuel relay</li> <li>• 5K generator K12 relay</li> <li>• 1097 starter INOP</li> <li>• 249 function check/pin INOP</li> </ul>



**Figure 3-1. Competitors erect an LWME – a basic field expedient capability to conduct maintenance operations in an austere environment.**

### **Discussion: Trends and Observations**

Five teams did not emplace the M240B as a protective or defensive fire capability for their defensive posture.

Competitors demonstrated a lack of experience with the maintenance expeditionary equipment, as five teams executed movement in the contact trucks with the tailgate down, risking loss of tools. Additionally, evaluators stated that competitors were requesting tools that were included in the contact truck.

In regards to the LWME, four teams received half or less points for safety considerations during its assembly. Discussions through after action reviews (AARs) with teams revealed that multiple teams do not practice or use the LWME at their home station.

During the AAR, 26 percent of competitors described their training at Fort Lee, VA, as too conceptual and missing connection of conducting maintenance during tactical operations.

**Conclusion:** The survey and group AAR revealed that units are not regularly using expeditionary equipment at home stations training, and not incorporating expeditionary movements in combat training center (CTC) rotations.

### **Recommendations**

**Individual and collective task:** Units must train on expeditionary maintenance such as the contact truck and LWME at unit collective training.

**Collective task:** Units should focus on decisive action training and avoid “FOB (forward operating base) mentality” to deployments. Additionally, units should comply with guidance from ATP 4-33 (Maintenance Operations; Section 3-67 through 71), which describes “field site selection and layout for maintenance operations. Units must maximize home station training by affording leaders and junior Soldiers the opportunity to use expeditionary equipment during common reoccurring events, such as motor stables. Subsequently, the leaders and Soldiers should



**Figure 3-2. Units showed multiple shortcomings with use of the pictured contact truck.**

be evaluated on their efficiency with the equipment during field training exercises (FTXs). Units should also use the various training scenarios that were incorporated into the competition as a model for home station training.

Units should consistently train with expeditionary equipment as the standard, whether in garrison or FTXs, such as the contact trucks, LWME, forward repair systems (FRSs), and the standard automotive tool sets (SATS).

### **Self-development:**

- Soldiers at all levels must review CATS and identify the tasks that apply to success of their assigned mission.
- Use virtual training modules for the contact truck and SATS maintenance platforms.

### **Issue 2: Troubleshooting Proficiency**

There was a lack of troubleshooting proficiency and ability to identify faults and order parts to fix the faults.

### **Discussion: Trends and Observations**

- Eleven teams displayed issues conducting troubleshooting procedures using schematics on the generator systems.
- Thirteen teams had issues identifying the correct part required to correct the M240B fault using the TM.
- Seven teams did not identify and correct all faults on the M1151 within time.
- Only four teams properly performed troubleshooting on the 5kw generator. More than 75 percent of the teams, rather than using the schematics for troubleshooting, attempted to disassemble the generator to find faults.
- AAR and individual team discussions revealed that multiple teams had no experience or knowledge of basic weapons maintenance from their home station.



**Figure 3-3. Competitors use the maintenance support device (MSD) to troubleshoot equipment. The MSD will walk Soldiers through the troubleshooting procedures for faults.**



**Figure 3-4. The above MSD is an instrumental tool in the diagnostics of a vehicle in garrison and on the battlefield.**

**Conclusion:** Competitors were challenged, identifying faults through proper troubleshooting (i.e. doctrine or regulation), and relied on personal experiences.

### **Recommendations**

**Individual task:** During FTXs, units should incorporate scenario-based training that involves troubleshooting procedures. In a DATE, maintainers should be familiar with the ability to resolve issues involving 10 level care of generators and weapons. Units should also use the various training scenarios that were incorporated into the competition as a model for home station training.

**Collective task:** Units should include maintenance operations/table certifications into unit training events to reach Objective-T (OBJ-T). Use expeditionary equipment as standard, whether in garrison or FTXs, such as the contact trucks, LWME, forward repair systems (FRSs), and the standard automotive tool sets (SATS).

**Self-development:** Soldiers should work with TMs on unfamiliar equipment to rely on the publication more than experience or previous knowledge.

### **Issue 3: MSD Familiarity**

Teams struggled to expediently perform maintenance trouble shooting while using the MSD.

### **Discussion: Trends and Observations**

- More than 75 percent of teams scored points for using the TMs found within the MSDs; however, of those teams, more than half did not correct the deficiencies in the time allotted.



<b>HMMWV (M1151) Fault (91B)</b>			
<b>TEAM NAME/#:</b> [REDACTED]			
<b>TASK:</b> Perform PMCS on an HMMWV M1151 vehicle (Task 441-14S-1002)			
<b>CONDITION:</b> A PMCS is required on an M1151 HMMWV vehicle due to an unknown fault. The following are available: 1. The vehicle with fault 2. Applicable TM for vehicle 3. GMTK. 4. MSD. 5. DA Form 2404 and/or DA Form 5988-E.			
<b>STANDARD:</b> Sequentially performs PMCS on vehicle per appropriate TM. Corrects all correctable deficiencies and records all uncorrected deficiencies on DA Form 2404 and/or DA Form 5988-E per DA Pam 738-750.			
<b>Environment:</b> Environmental planning is not just the law but the right thing to do. It is a continual process and starts with deliberate planning. Always be alert to ways to protect our environment during training and missions, IN doing so you will contribute to the sustainment of our training resources while protecting people and the environments from harmful effects. Refer to FM 3-34.5 Environmental considerations.			
<b>Safety:</b> In a training environment, leaders must perform a risk assessment in accordance with ATP 5-19, Risk Management. Leader will complete a DRAW in accordance with appropriate guidance, environmental considerations, level of training and known hazards for the operation and, at a minimum, account for mission, enemy, troops, terrain and weather, time and civilian considerations (METT-TC).			
<b>PERFORMANCE MEASURES</b>	<b>POINTS</b>	<b>POINTS EARNED</b>	<b>REMARKS/ NOTES</b>
1. Proper use of TM	4	4	
2. Identify the fault	4	0	<i>Stopped trouble shooting and</i>
3. Identify the part needed to correct the deficiency	4	0	<i>started looking up wire</i>
4. Correct the Fault	4	0	<i>harness</i>
5. Complete the DA 2404 with all spaces filled in correctly	4	0	
<b>TOTAL</b>	<b>20</b>	<b>4</b>	

**Figure 3-5. A scorecard used during the competition on a non-mission capable M1151.**

- Evaluators stated that competitors complained of having to go step-by-step according to the TM, and they repeatedly made choices that were not the most efficient to troubleshoot the system when not using the MSD.
- Through the AAR, teams stated that many had a shortage, older, or inoperable MDSs at home station.
- Several leaders were unfamiliar with use of the MSD, and they disregarded suggestions from recently trained junior leaders.

**Conclusion:** Through AAR discussion, competitors have become accustomed to performing maintenance without the use of electronic technical manuals (ETMs), and junior leaders need to be empowered to demonstrate their knowledge.

**Recommendations**

**Leader and individual task:** Concepts and understanding of skills-based training should be reinforced at sergeant’s time training to ensure universal understanding of institutional/doctrinal trouble shooting procedures. MSD usage should be reinforced at all times. The usage should be incorporated into common reoccurring events, such as motor stables, and it should be tested and evaluated during FTXs.

**Self-development:** 91B trainees use MSDs at Fort Lee in the wheel maintenance training department from their first day of training until the last, including their FTX toward the end of the course. In this endeavor, it is used in an expeditionary manner in a semi-austere environment. Soldiers should continue to use the MSDs at all times at their units to maintain proficiency.



## Chapter 4

### Defend a Repair Team Site

CPT Marcus Nelson, D Co, 16th Ordnance Battalion  
1SG Benjamin Paul, D Co, 16th Ordnance Battalion

#### Competitive Event Overview

**Task:** The defend the repair site was developed in multiple facets. Teams were tasked to:

- Establish a repair team site
- Conduct maintenance on three pieces of equipment (i.e. M1078A1P2, 10K generator, and M1097 high mobility multipurpose wheeled vehicle (HMMWV))
- Secure and defend a repair site in a large scale operation scenario
- “Jump” repair team sites

**Condition:** In a controlled austere environment with a M4/M16 pop-up range, teams were given equipment to complete ordnance operations, and material to complete range cards and sector sketches. They were also given 30 rounds of 5.56 ball ammunition.



**Figure 4-1.** A competitor engages a target during the defend a repair team site event. Accuracy and fire suppression are important aspects of a defensive posture.

**Standard:** Within the allotted time of 1.5 hours, the entire team had to establish the repair team site, perform maintenance tasks, as well as successfully defend their respective sites prior to displacing the repair team site. Individual range scores were added to task scores to create an overall team score.

**Issue 1: Tactical Proficiency in a Decisive Action Training Environment During Defense of Repair Site**

Leaders demonstrated a lack of proficiency communicating, engaging targets, and completing specified tasks in decisive action training environment (DATE) during the secure and defense phases of defend a repair team site (DRTS) lane.

**Discussion: Trends and Observations**

None of the teams completed DA Form 5517 (range cards) to standard at all four firing positions and subsequent sector sketches. Eleven teams demonstrated challenges engaging targets during the defense phase with an average of less than 20 out of the 30 targets accurately engaged.

Seven teams exhibited a lack of consistent communication and adherence to specified reporting procedures (i.e. request start point (SP) time, size, activity, location, uniform, time, equipment SALUTE) and liquids, ammunition, casualties, and equipment (LACE) report, radio checks etc.).

**Conclusion:** Teams from organizations that emphasize tactical proficiency were poor in technical skill and vice versa. This suggests that units are separating the technical and tactical training when they should be executing technical tasks in a DATE.

**Recommendations**

**Collective task:** Units should use the defend repair team site event as a model to meet Objective T (OBJ-T) for live-fire proficiency.

Units at home station should consider maintenance support operations as it relates to FM 3-0 Chapter 2, within Section IV (Training for Large Scale Combat Operations). Section 2-272 discusses how live, virtual and constructive training should be applied to home station training. Section 2-274 further states that rotational training should focus on decisive action, force-on-force exercises and live fire against a regional peer threat. Units should also use the various training scenarios and concepts that were incorporated into the competition as a model for home station training.

POSITION IDENTIFICATION		DATE		
WEAPON	WEAPON	EACH CIRCLE EQUALS METERS		
NO.	DIRECTION-DEFLECTION	ELEVATION	RANGE AMMO DESCRIPTION	
1	11.1 / 1000	25		
2	14.1	25		
3	14.1	50		
4	14.1	100		
5	14.1	250		
REMARKS:				

**Figure 4-2. An unsuccessful range card (DD Form 5517) generated by a competitor.**



**Figure 4-3. A competitor vigilantly maintains security of his assigned sector couple tactical prowess with technical capabilities during the competition.**

There needs to be further development in unit training reference sheets to ensure units understand key leader competencies that must be included in training design to test maintenance triage in the DATE.

**Self-development:** Self-study and familiarization of Level 1 Soldier tasks are encouraged.

Leaders need to become familiar with FM 3-0 to gain an understanding of supporting large scale combat operations. In this endeavor, maintainers must pay particular attention to Chapter 1 to study the current and future challenges that the Army faces, and leaders must also study Chapter 2 (Training for Large Scale Combat Operations).

## **Issue 2: Technical Proficiency in Decisive Action Training Environment during Defense of Repair Site**

There was a lack of technical proficiency in managing priorities of work, triaging the priorities of maintenance, and using schematics for respective systems in DATE.

### **Discussion: Trends and Observations**

Thirteen teams prioritized maintenance on a generator before the prime mover that could be used to move the item out of a danger area. This demonstrated poor triage of maintenance within the DATE.

Three teams received maximum points for both the high mobility multipurpose wheeled vehicle (HMMWV) and generator troubleshooting summaries respectively.

During the event, full-blown posters of schematic diagrams were available with the maintenance support device (MSD); however, teams lacked personnel with the proper knowledge of how to troubleshoot relays using schematics.

**Conclusion:** Competitors rely upon their individual experiences without following proper troubleshooting procedures. Some competitors demonstrated a lack of tactical expeditionary thinking in regards to triage, as they prioritized the generator before the light medium tactical vehicle (LMTV).

### **Recommendations**

**Individual task:** Units should reinforce training at operational units during sergeant's time training (i.e. field exercises).

**Collective task:** Organizations should include maintenance operations/table certifications into unit training events to reach OBJ-T.

**Self-development:** Soldiers should use video series and the Ordnance School's maintenance readiness playbook, which demonstrates and assists with troubleshooting procedures.

## Chapter 5

### Ordnance Knowledge Exam

CPT Tyler Weightman, B Co, 16th Ordnance Battalion  
1SG Charles Vanzandt, B Co, 16th Ordnance Battalion

#### Competitive Event Overview

**Task:** Competitors had to complete a 134-question knowledge exam designed to test their understanding of maintenance procedures and shop operations.

**Condition:** In a classroom setting, combat repair teams had to engage and complete an ordnance knowledge exam. Each competitor attempted to complete a written exam within two hours. Competitors were provided a Technical Manual (TM)-10 for a high mobility multipurpose wheeled vehicle (HMMWV) and a TM-20 for a light medium tactical vehicle (LMTV).

**Standard:** Successfully answer as many questions as possible individually within two hours to achieve the maximum amount of points. In the Army's complex environment, where mission command is needed, the event revealed technical knowledge gaps within various ranks.

#### Discussion: Trends and Observations

Top-scoring competitors were queried during the after action review (AAR) sessions and correlations were made in regards to their backgrounds and success. The top scorer was a warrant officer one (WO1) with a score of 81 percent. He had prior military service as a 91B, achieving the rank of sergeant first class. He possessed experience as a maintenance control sergeant, platoon sergeant, and squad leader mechanic.

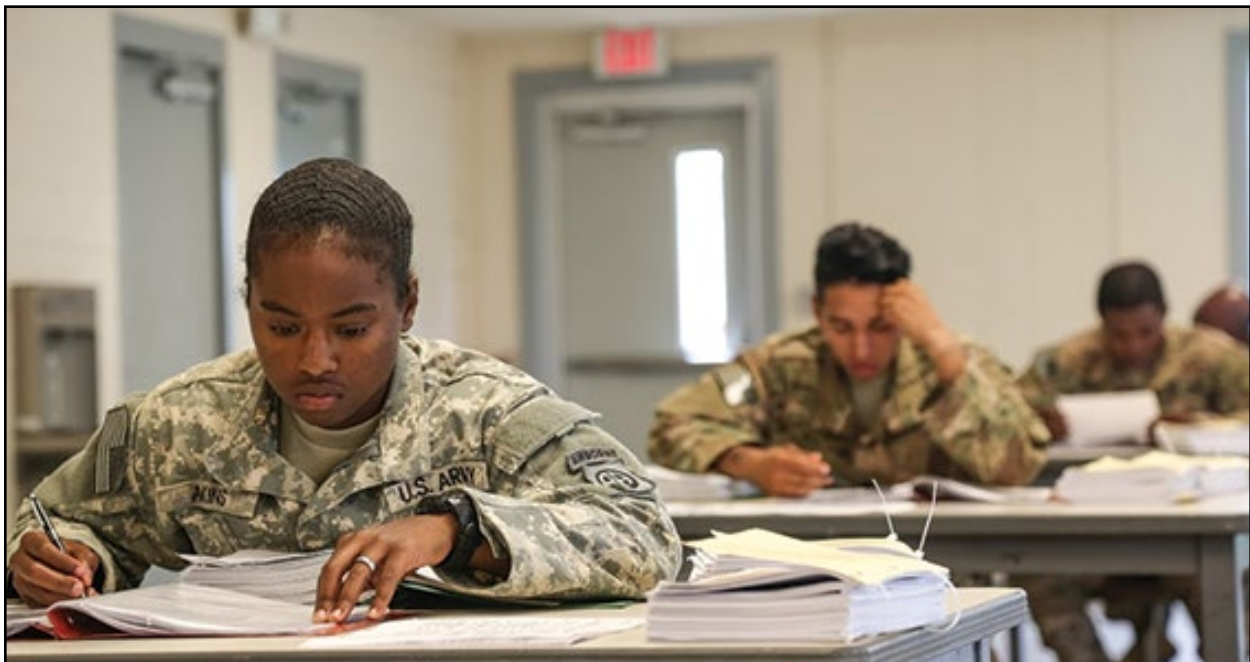
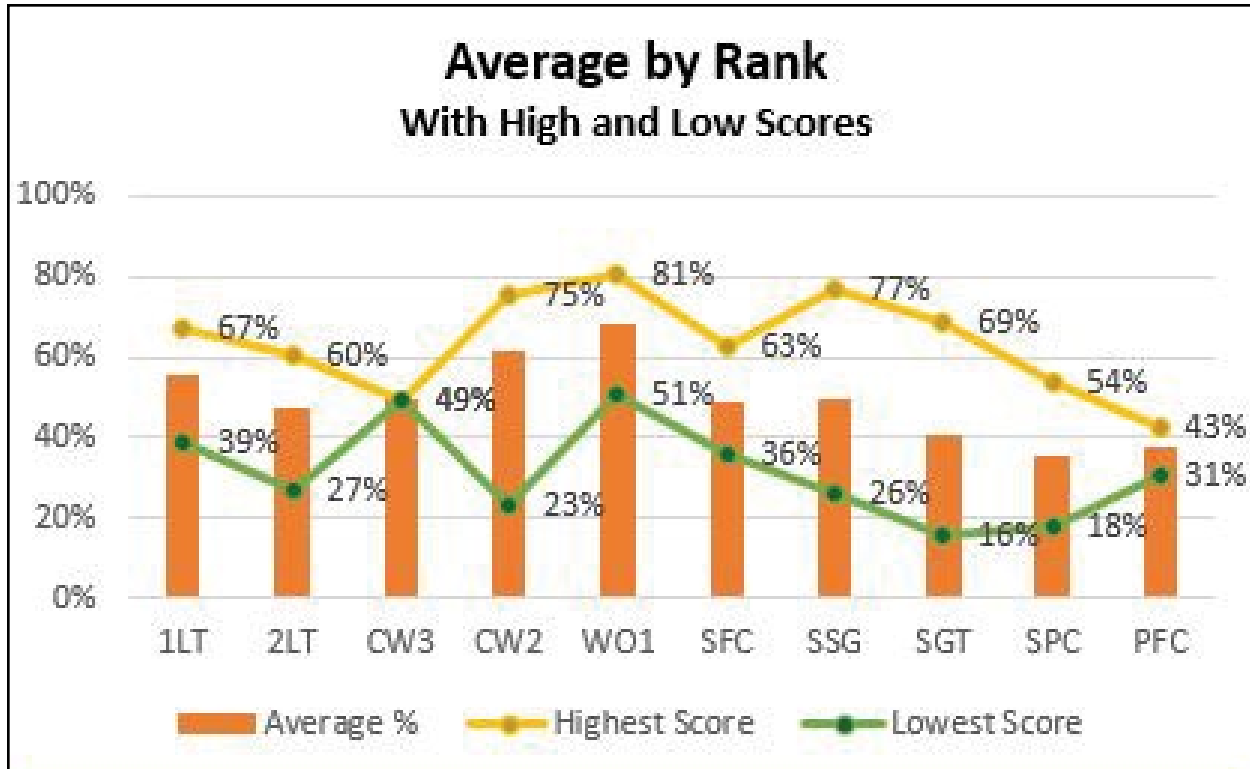


Figure 5-1. The knowledge exam tested technical comprehension in a classroom setting.



**Figure 5-2. The bar graph above depicts how competitors performed by rank and the vertical bars depict the average score by rank.**

The second highest score belonged to a staff sergeant, who achieved a score of 77 percent. The noncommissioned officer (NCO) said he had a strong mentor, a senior warrant officer that he worked with in the brigade support operations officer (SPO) maintenance section, and that he attended the Maintenance Management Course.

The third highest scorer was a warrant officer 1 (WO1), who achieved a score of 76 percent. He achieved the rank of staff sergeant as a 91B. He also stated that he was automotive service excellence (ASE)-master certified before joining the Army.

The fourth highest scorer was a chief warrant officer two (CW2), who scored 75 percent. He said he possessed a diverse background, working in Stryker, infantry, and special operations forces (SOF) units. Additionally, he said he dedicated a significant amount of personal time for self-development.

**Conclusion:** The issue that was derived from the event is that leaders need to ensure effective mentorship occurs tactically and technically through various leader professional developments (LPDs) and other sessions, as well as strong encouragement in self development.



### Notable Trends

- Officers missed key managerial metric questions related to modification work orders. There needs to be more emphasis in Basic Officer Leader Course (BOLC).
- Senior NCOs showed a lack of knowledge with GCSS-Army generated reports. More training is needed in units and at the Senior Leader Course (SLC)/Advanced Leader Course (ALC).
- Specialists (SPCs) with more than four years of service scored lowest overall, and they were outscored by privates first class by more than 20 percent; SPC with only two years of service scored equal to staff sergeant (SSG).
- Many warrant officers (WOs) scored significantly higher than many team members. These subject matter experts must focus on sharing knowledge and training their teams.

### Recommendations

**Operational Recommendations:** For home station training, units should conduct continuous LPDs and low density training, addressing the most relevant challenges within the maintenance arena. Unit command teams should remain tuned into various venues where major challenges are addressed, such as the quarterly ordnance connect that can be accessed through the ordnance website at [www.goordnance.army.mil](http://www.goordnance.army.mil).

Senior warrant officers should identify functional talent within the NCO corps and mentor those displaying warrant officer potential.

Units should fully incorporate GCSS-Army into daily activities and maximize its potential during field training exercises (FTXs), as well as virtual training exercises.

**Self-development:** Leaders should obtain the most current maintenance regulations, and become familiar with the guidance. Company grade officers are encouraged to obtain and study the “Soldier’s Manual and Trainer’s Guide; Officer Foundation Standards, Maintenance and Munitions Management (91A), and the Company Grade Officer’s Manual,” released 17 JUL 2017. The leaders should strive to be proficient in the tasks listed within this manual.

There should be structured development of NCOs by warrant officers via the Army Career Tracker (ACT) system.

Operators, maintainers and supervisors must be knowledgeable on all aspects of two-level maintenance. Furthermore, this knowledge must be shared with junior Soldiers. The 40th chief of ordnance released a “hip pocket guide” in the Army Sustainment Magazine in the January–February 2018 edition. The guide can be accessed at [http://www.alu.army.mil/alog/2018/JANFEB18/PDF/JANFEB2018\\_insert.pdf](http://www.alu.army.mil/alog/2018/JANFEB18/PDF/JANFEB2018_insert.pdf).



## Chapter 6

### Summary

#### Combat Repair Team Portion of the Ordnance Crucible and its Correlation to Objective-T

No model currently exists to guide maintenance units to achieve Objective-T (OBJ-T) readiness. The competition can be a tool to help design and test the total force (i.e. OBJ-T readiness process).

All 15 teams stated they had not done training like this at home station.

The competition is comparable to the training required to meet OBJ-T readiness goals for maintenance teams/crews.

Units must rely on supporting sustainment brigades and combat sustainment support battalions (CSSBs) for subject matter expert support and external evaluations to meet OBJ-T.

Survey analysis – nearly half of the competitors felt that maintenance operations were not sufficiently stressed during training. Two battalion commanders who observed various portions of the competition stated that this event helped define how they can address OBJ-T requirements.

OBJ-T requires live fire proficiency. Often units execute “conduct and defend a tactical convoy.” For the CRT, the defend the repair team site (DRTS) was a live fire defense as a collective live fire proficiency task.

Evaluators focus on the CRT centered on recovery as a common requirement among the Army’s maintainers as well as repair site and forward repair tasks.

The eight-step training model process was key to integrating resources external to the unit to execute the competition.



**Figure 6-1. Recovering a mired vehicle.**



**Figure 6-2. Using an MSD to troubleshoot a weapon.**



**Figure 6-3. Using concealment during security operations.**



**Figure 6-4. Competitors work together to erect the LWME.**

**Four major reoccurring challenges during the competition include:**

**Recovery operations:** H8 Soldiers who received their training and certification several years ago are not up to date with the doctrinal recovery procedures. Units should establish practicum to recertify personnel at home station (i.e. Phase I online and a Phase II practicum: recovery mission table certifications).

**MSD familiarity:** Teams struggled to expediently perform maintenance trouble shooting through use of the maintenance support device (MSD). Units must emphasize and train repairers on the expedient use of MSDs at every level/conduct a data call to determine MSD readiness across the force.

**Tactical proficiency:** Some teams failed managing priorities of work and correctly triaging the priorities of maintenance. Additionally, some teams demonstrated a lack of proficiency communicating, engaging targets, and completing specified tasks during the secure and defense phases of DRTS lane. Further refinement and improvement of in-field training is necessary for all professional military education (PME) that emphasizes executing technical tasks in a DATE.

**Expeditionary equipment familiarity:** Several teams demonstrated a lack of familiarity with the use of expeditionary maintenance support equipment and establishing site in a DATE. Units should train on expeditionary maintenance systems (i.e. contact truck and LWME) at unit collective training and DATE events.

## Chapter 7

### Changes in the Institutional Domain that Supports the Operating Force

LTC Eric L. Booker, 16th Ordnance Battalion  
CSM Patricio Cardonavega, 16th Ordnance Battalion

The Ordnance Crucible Combat Repair Team of the Year competition revealed shortfalls in multiple development domains. The Ordnance School has identified institutional changes, which will improve the knowledge and capability of Soldiers and leaders as they return to the force.

#### Recovery Operations

Safe recovery operations is a skill that must be retrained and rehearsed. The Ordnance School is working to establish a recertification process to be executed at home station. The Ordnance School will design an online training platform to address this issue, as well as a training packet focused on the key Soldier and leader tasks that units should add to their training plan. The concept is based on table certifications for recovery crews. Discussions are ongoing to expand current recovery basic blocks of instructions into professional military education (PME) [i.e. Senior Leader Course (SLC), Basic Officer Leader Course (BOLC), and Warrant Officer Basic Course (WOBC)].

Currently, additional directed training in other areas has required recovery training to lose dedicated time in the Advanced Leader Course (ALC) program of instruction (POI), reducing training from 40 hours to 10 hours in Fiscal Year 2019. Studies are in progress to allow time dedicated to H8/recovery training during NCO PME. Also, the Ordnance School will study the viability of training maintenance MOSs untraditionally, given the opportunity to attend H8 Additional Skill Identifier (ASI) Recovery School.

Teams exhibited insufficient training on completing the required mathematical calculations to execute safe recovery operations. A vehicle recovery worksheet application/software was developed based on this issue for different vehicles with various recovery missions.

A mobile/cellphone application was developed to demonstrate and assist with mathematical calculations during recovery operations. The Ordnance School will work to develop an online hasty recovery section within the Ordnance Regiments' maintenance readiness playbook to be shared with the operational force.

The Ordnance School will execute a full review of individual tasks for recovery assessment at the operational level for update in the Combined Arms Training Strategy. The Ordnance School will also develop the collective task list to certify all units in hasty recovery operations.

## **Ordnance Knowledge**

The power of mentorship is a force multiplier for our Army. The Ordnance School is implementing programs to encourage instructors and developing NCOs during PME to use the Army Career Tracker (ACT) during PME and expand its use across the force. This will enable better sharing of tactics, techniques, and procedures (TTPs) and help disperse creative training ideas to get after training maintenance tasks at home station training.

Ordnance Connect Quarterly sessions will keep leaders abreast of current issues and trends, and it will focus on various areas that junior leaders should hone in to further enhance their knowledge.

## **Repair Team Site Defense**

The ability to shoot, move, and communicate are paramount skills for all Soldiers and cannot be separated from a maintainer's mission to fix. Shortfalls were noted from the teams during the crucible competition.

The Ordnance School is in an ongoing process of designing training to reflect the requirements of the DATE mission. Current efforts have refined BOLC field training and further implementation is ready for advanced individual training (AIT) and noncommissioned officer education system (NCOES) decisive action training environment (DATE)-focused training.

The Ordnance School is working to provide standard training packets designed to help units plan situations training exercised (STX) and events to meet Objective-T (OBJ-T) requirements for maintenance units. The goal is to publish these training support packages by Fiscal Year 2019.

## **Repair Team Site Operations**

Teams repeatedly showed shortfalls in executing maintenance tasks using standard modified table of organization and equipment (MTOE) field maintenance equipment. With that in mind, the Ordnance School is developing plans to incorporate tasks designed to use the contact truck, forward repair system (FRS), and general maintenance tool kit (GMTK) during the execution of maintenance during tactical exercises at PME, and designing better ways to integrate these requirements during unit DATE training.

The training plan includes a phased 91 series recertification requirement by rank. Tentatively, the design includes a Phase I online portion and a Phase II practicum (i.e. maintenance specific table certifications).

The goals are to emphasize and train repairers on the expedient use of MSDs at every level – AIT, ALC, SLC, etc., and conduct a data call to determine MSD readiness across the force.

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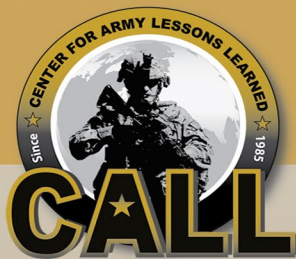
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