Research Report 1994

Assessing Sustainment Operations in a Decisive Action Training Environment

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14. ABSTRACT *(Maximum 200 words)*:

At the request of the Joint Readiness Training Center Warrior Leadership Council, we explored whether a guide on sustainment could improve sustainment operations. The research design allowed for comparison of a control and experimental group. The experimental group received a manipulation or a Sustainment Warfighting Function Guide with the intent of improving performance on planning, mission execution and follow-up operations. Significant differences between control and experimental groups occurred primarily during mission planning and follow-up; differences were small and in favor of the control group. The experimental group was more likely to coordinate with other units, submit expenditure reports, and request resupply. However, they were also more likely to be interrupted by sustainment requirements and have friction between higher echelons and supporting units. Overall, units performed all the Sustainment tasks at a "minimum standard" or "standard" level only. Minimum performance on the Sustainment Operations Checklist may have resulted from not having a standard operating procedure for sustainment nor planning for sustainment operations. It is recommended that sustainment operations be continually emphasized and integrated during home station training.

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ASSESSING SUSTAINMENT OPERATIONS IN A DECISIVE ACTION TRAINING ENVIRONMENT

EXECUTIVE SUMMARY

Research Requirement:

This report describes research conducted by Joint Readiness Training Center (JRTC) Warrior Leadership Council (WLC) to collect data on the capabilities of sustainment operations at the battalion, company, and platoon levels across multiple rotations at the JRTC. The Sustainment Operations Checklist was developed by the WLC as a means for Observer/Coach/Trainers (OCT) to collect data on how well units were conducting the sustainment warfighting function. The Sustainment Warfighting Function Guide was developed and distributed to the experimental rotations. The effectiveness of the Sustainment Warfighting Function Guide was determined by examining differences between the control and experimental rotations on the Sustainment Operations Checklist.

Procedure:

The checklists used by OCTs allowed for assessment of units on four areas: Unit Information, Planning, Mission Execution, and Follow-up Operations. Performance was compared between the control or baseline group and the experimental group; the experimental group received the Sustainment Warfighting Function Guide, while the control group did not. The purpose of the guide was to increase sustainment operations performance in accordance with Army Doctrine Publication 4-0 (formerly Field Manual 4-0) *Sustainment*, Field Manual 3-21.20 (Chapter 10) *The Infantry Battalion*, Field Manual 6-0 *Commander and Staff Organization and Operations*, and Soldier Handbook 21-76, *The Ranger Handbook*. Data were collected from 456 checklists from seven rotations. Fifty-six percent of the rotations were in the control group, and 44% of the rotations were in the experimental group.

Findings:

Significant differences found between control and experimental groups were small and mostly in favor of the control group. It is possible that the Sustainment Warfighting Function Guide was more detrimental than helpful to leaders in the experimental group. The guide could have been cumbersome or impeding; providing the leaders with more information about sustainment requirements may have distracted from overall performance. This could explain why, despite being provided a list of sustainment strategies, the experimental group consistently performed worse on the majority of checklist items.

Collectively, all units excelled at having, maintaining, and accounting for the required personnel and equipment, and performing self-aid, buddy-aid, medical evacuation (MEDEVAC), and casualty evacuation (CASEVAC). However, units struggled with having, being familiar with, and following a Standard Operating Procedure (SOP) for sustainment, test firing weapons, and with subordinate leaders' back-briefing sustainment tasks. Overall, units performed all the

Sustainment tasks at a “minimum standard” or “standard” level only. Minimum performance on the Sustainment Operations Checklist may have resulted largely from the lack of having an SOP for sustainment and planning for sustainment operations. In further analyses, units that had an SOP for Sustainment, tended to perform better on most sustainment-related tasks.

Utilization and Dissemination of Findings:

Findings were provided to the members of the WLC in September, 2014. To be carried out efficiently, the sustainment warfighting function must be fully integrated with the other elements of combat power during home station training. Research recommendations based on successful educational practices and empirical evidence from psychological science are provided that should lead to development of more effective training aids. By utilizing evidence from psychological research, future measures and tools should produce more desired effects.

ASSESSING SUSTAINMENT OPERATIONS IN A DECISIVE ACTION TRAINING ENVIRONMENT

CONTENTS

APPENDICES

Assessing Sustainment Operations in a Decisive Action Training Environment

Generating and maintaining combat power throughout an operation is essential to success. Warfighting functions help commanders exercise command and control over an area of operations to provide and maintain the combat power necessary to succeed. A warfighting function is a "group of tasks and systems (people, organizations, information, and processes) united by a common purpose that commanders use to accomplish missions and training objectives" (Department of the Army, 2012, August). Sustainment is one of the six warfighting functions necessary for achieving combat power and, as a result, decisive action.[1] Sustainment can be trained and assessed in a decisive action training environment, such as the one currently established by the Joint Readiness Training Center (JRTC).

The sustainment warfighting function is essential to accomplishing the mission. Unlike other decisive operations that focus on the enemy and enemy targets, sustainment operations focus on maintaining combat power of friendly forces. Sustainment includes personnel and logistics support, rear area security, movement control, terrain management, and infrastructure development throughout the area of operations (Department of the Army, 2012, May). The ability to sustain operations and complete missions is provided via sustainment that includes logistics, personnel services, and health service support (Department of the Army, 2012, May). Sustainment allows units a continuance of operations and can influence how quickly and how far units can maneuver in their operational environment.

Achieving and maintaining sustainment occurs through constant and deliberate coordination, collaboration, and synchronization between all teams, from the strategic bases to tactical level operations. Communication between logistics and personnel and services and health-service support, and between these units and maneuver units, allows Army forces to achieve operational reach, freedom of action, and prolonged endurance. The head of these operations is mission command, responsible for conducting decisive action and ensuring tactical success. Integration of the appropriate national and global resources ensures Army forces are physically available, properly equipped, and at the right place and time to support the commander in the conduct of operations and accomplish the mission (Department of the Army, 2012, July).

Sustainment builds and maintains combat power, supports strategic and operational reach, and enables an endurance of operations. Units are trained to understand how sustainment operations are integrated and synchronized into the overall operations process – plan, prepare, execute, and assess (Department of the Army, 2012, July). However, sustainment is a warfighting function that needs further examination and integration by units as it has been noted that the poor execution of sustainment operations may negatively influence the ability of units to conduct all other operations (Center for Army Lessons Learned, 2013, May; 2013, June). Members of JRTC's Warrior Leadership Council (WLC)[2] determined that examining

[1] Decisive Action is a fundamental concept of unified land operations that "emphasizes the continuous, simultaneous combinations of offensive, defensive, and stability or defense support of civil authorities' tasks" (Army Doctrine Research Publication 3-0, pg. 2-2).
[2] Led by the Deputy Commander and Command Sergeant Major of the Operations Group, the Council consists of representatives from each Operations Group division, as well as the 1st Battalion (Airborne) 509th Infantry, and the U.S. Army Research Institute for the Behavioral and

sustainment operations during JRTC exercises would inform and improve overall performance for future rotations, especially for Infantry units. At the request of the JRTC WLC, we explored whether or not the Sustainment Warfighting Function Guide, could improve sustainment operations. The potential effectiveness of the Sustainment Warfighting Function Guide was examined by assessing differences in sustainment operations between rotations that did not receive the guide (control group) and rotations that did receive the guide (experimental group).

To enhance Sustainment Operations, in accordance with ADP 4-0 (formerly FM 4-0) *Sustainment*, FM 3-21.20 (Chapter 10), *The Infantry Battalion*, Soldier Handbook (SH) 21-76, *Ranger Handbook*, and Army Tactics, Techniques, and Procedures (ATTP) 5-01[3] *Commander and Staff Officer Guide*, data were collected on the effectiveness of sustainment operations by units at the battalion, company, and platoon levels for seven consecutive rotations. Units were observed during all phases of the rotations, with specific focus placed on planning, mission execution, and follow-up operations. Performance for all rotations was assessed using the Sustainment Operations Checklist (Appendix A). The pocket-sized quick reference guide, the Sustainment Warfighting Function Guide, (Appendix B) to assist the commander, staff member, or leader in planning and execution of sustainment operations was presented to the final four rotations (experimental group). The potential impact of this guide was assessed by comparing the responses on the Sustainment Operations Checklist from the initial rotations (control group) to the responses from the experimental group. This design allows for an examination of whether or not the training aid could enhance sustainment operations.

Materials and Methods

Sample

Data were collected from seven rotational Brigade Combat Teams (BCT). Over the course of seven rotations, OCTs filled out 465 Sustainment Operations Checklists at the respective echelon they were observing and mentoring. The control group consisted of the initial four rotations; 260 checklists were filled out for those units. The remaining three rotations were in the experimental group; 205 checklists were filled out for those units. The majority of data collected on rotation types in the control group were either platoons (56%) or companies (16%), were Infantry (45%) or Cavalry (15%), were observed during Force-on-Force (61%) or Situational Training Exercises (15%), while conducting a Deliberate mission type (86%). The majority of data collected on rotation types in the experimental group were either platoons (52%) or companies (26%), were Infantry (47%) or Cavalry (8%), were observed during Force-on-Force (89%) or Live Fire (4%), while conducting a Deliberate mission type (84%). Over the course of all seven rotations, the majority of data were collected on platoons (55%) and companies (20%), while the remaining data were collected on battalions, detachments, sections, squads, and troops. The majority of unit type observed was Infantry (46%) or Cavalry (12%) and the remaining units consisted of various other types (42%, see Section I, General Information). Force-on-Force (FOF) rotations consisted of 53% of the rotation phases observed, 13% were Situation Training Exercises (STX), and the remaining were marked Live Fire (6%),

Social Sciences (ARI). The primary purpose of the Council is to leverage the expertise of JRTC Observer/Coach/Trainers (OCT) in order to identify and prioritize the most serious small unit leadership and training deficiencies in sustainment found across rotations (ARI, 2005).

[3] This ATTP has been superseded by FM 6-0, *Commander and Staff Organization and Operations.*

all (0.9%), or not indicated, (28%). The majority of missions were Deliberate (67%) or hasty (11%), while some missions were both (1.3%) and 21% of mission type were not marked.

Sustainment Guide

The Sustainment Warfighting Function Guide (Appendix A) was developed by members of JRTC's WLC as a training aid to enhance sustainment operations performance. The pocket-sized guide was designed as a quick reference for the proper planning, execution, and follow-up of sustainment operations. At 5.5 by 4.25 inches, the guide could fit in the pocket of leaders for easy access during exercises. This guide was issued to squad/platoon/company leaders[4] in the final three rotations during their initial JRTC rotation briefings. This guide served as the only independent variable.

The topics covered by the guide were the same topics addressed on the Sustainment Operations Checklist, Planning, Execution, and Refit and Recovery (Follow-Up) Operations. These topics were based on performance of initial rotations, observations of OCTs, and feedback from Council members. Each topic contained several subtopics to assist in conducting sustainment operations. The Planning section addressed, among other topics, the incorporation of sustainment in the unit mission plans, rehearsals of sustainment plans, and having a Primary Alternate Contingency Emergency (PACE) plan for contacting internal and external support. The Execution section highlighted the importance of having an established Logistics Rally Point (LRP), determining casualty precedence, and the importance of bump plans and tactical cross-loading. The Refit and Recovery section encouraged leaders, especially at the company and battalion echelons, to account for mission essential equipment and sensitive items as well as submit the necessary reports to the correct individuals/offices.

Sustainment Operations Checklist

Unit sustainment performance was measured using the Sustainment Operations Checklist. The Sustainment Operations Checklist was developed and approved by the WLC. Measures of interest included unit information, planning, (mission) execution, and follow-up operations. An additional section was included for general information about the rotational unit. Specific questions were developed from each of the broad topics and organized into five sections (Appendix B). Observer/Coach/Trainers (OCT)[5] were issued Sustainment Operations Checklists prior to each rotation through their JRTC Operations Group division. Division members of the WLC were responsible for insuring the OCT data collection forms in their respective division provided satisfactory data on the measures of interest. The WLC collected the checklists at their meetings after each rotation.

The Sustainment Operations Checklist asked OCTs to respond to both dichotomous (Yes/No) and continuous (scale) questions. Previous checklists of this nature have used only dichotomous questions, which provide data as to whether the unit performed the task or not. Based on a recommendation presented in Vowels, Dasse, Ginty, and Emmons (2014), we incorporated items using a response scale with a range from 0 = *Unsatisfactory/Not at all* to 4 = *Exceeds standard/performed all tasks and prepared for contingencies*. The intent was to provide a means for assessing degree of task performance rather than simply asking whether a task was

[4] No personally identifying information was collected about leaders; these could have included Non-Commissioned Officers (NCO) and officers.
[5] No personally identifying information was collected about the OCTs; they can be NCOs or Officers.

performed or not (See Appendix B, Vowels et al., 2014). Thus, with the continuous/scaled questions we asked OCTs to report "how well" the unit performed certain sustainment operations tasks. Including the continuous/scaled questions also allowed for the use of different types of statistical tests in the analysis. More importantly, examining data across multiple response categories rather than just two, potentially provides a more specific understanding of unit performance. Informal feedback from OCTs indicated that they did not experience any additional conflicts in the completion of the checklists.

In Section I, OCTs were asked to provide general observations, such as the size of the unit, the type of mission, and the rotation phase. Section II of the checklist was concerned with unit information, for instance, item 1 asked if the unit had a current SOP for sustainment operations. Subsequent questions addressed whether the Leaders/Soldiers were familiar with their unit's SOP, if the unit SOP identified the duties and responsibilities of key leaders and if the leaders knew how to perform these duties, the effectiveness of the unit's checklists, and whether the unit had the equipment necessary for the mission.

Section III of the checklist was concerned with planning sustainment operations, specifically with questions about sustainment operations were included in mission plans and if the unit rehearsed vehicle recovery and medical evacuation (MEDEVAC) and casualty evacuation (CASEVAC). This part of the checklist also addressed how well the units were coordinated, if Pre-Combat Checks (PCC), Pre-Combat Inspections (PCI) and Preventive Maintenance Checks and Services (PMCS) were performed, if a Communication Exercise (COMMEX) was conducted and whether the unit had a Primary, Alternate, Contingency, and Emergency (PACE) plan for communication.

Section IV of the checklist addressed mission execution. For example, item 1 asked if the unit had the necessary resources to accomplish the mission. Further questions asked how well dedicated sustainment support was available to the unit, if external support was available for the unit, and if the unit had a Medic or Combat Lifesaver (CLS) personnel and how well the unit established a Helicopter Landing Zone (HLZ) or Cordon for MEDEVAC, CASEVAC, Resupply or Recovery.

Section V of the checklist contained questions about follow-up operations, specifically whether the unit accounted for all mission essential equipment and sensitive items, and how well the unit crossed level loads after operations and submitted expenditure reports and requested resupply, and if sustainment requirements interrupted or caused the unit to deviate from the mission. The OCTs were also asked to identify sustainment tasks that the unit should sustain and improve.

Procedure

Through the JRTC Operations Group divisions, the OCTs were issued the checklists prior to each rotation and were collected upon completion of each rotation. The guide was given to each unit in the experimental group before each rotation. However, there was no verification of who received the guide, how many leaders used the guide during their rotation, or how frequently and to what extent. Further, OCTs were not blind to the purpose of the control versus the experimental groups or the purpose of the manipulation or Sustainment (Warfighting

Function) Guide. The research developed by the WLC was approved by the Deputy Commander and Command Sergeant Major of the JRTC Operations Group (Appendix C).

Results

Two checklists were excluded from the analyses because they were missing more than 20% of the data. Excluding these checklists did not influence later analyses because the checklists accounted for less than 1% of the data. Furthermore, "Not applicable" responses were coded so as to not influence the means and significance of our statistical tests. Our analyses are discussed in the following sections.

The primary purpose of this research was to examine sustainment operations at JRTC as observed by OCTs. In particular, we examined what, if any, effect the Sustainment Guide had on sustainment operations. Additionally, we examined how sustainment operations were effected depending on whether or not unit's had an SOP for sustainment operations.

In addition to the overall and SOP analyses, we also conducted subgroup analyses. The majority of our observed rotations were comprised of platoon-sized Infantry units during the FOF phase and conducting deliberate missions. We focused specifically on these units in a subgroup analyses; the results are provided in Appendix D.

The overall analysis and subgroup analyses follow the same structure. First, we examine results for each section of the checklist. Chi-square tests for independence were used to analyze the dichotomous items (Yes or No questions) on the checklist. Independent t-tests were used to analyze scale items (0-4). Throughout the results and discussion, scale items are referred to as "continuous" items because the items ask "how well" the unit performed on a task instead of simply whether the unit performed the task (Yes/No). Results are then followed by tables of all non-parametric test results and all parametric test results. The results of the statistical tests for all sections are shown in Tables 1 (dichotomous) and 2 (continuous).

In order to control for possible Type I errors, we adjusted the experimentwise alpha levels to be more conservative. We used an alpha level of .01 to determine statistical significance for all analyses. Though such an adjustment would decrease the power of the analyses (i.e., finding an effect when there is indeed one present), given the number of comparisons within the same data set, it guards against the chance of mistaking an insignificant result for a significant one.

Furthermore, to encourage a better understanding of our findings, we reported the magnitude of differences as well as additional analyses. The effect sizes provided for the dichotomous data are *Phi* coefficients (Kotrlik & Williams, 2003). For the continuous data, we report Cohen's *d* (Cohen, 1988). A range for interpretation of the effect sizes is included below Tables 1 and 2. For further discussion and reference on effect sizes, other sources are available (Fritz, Morris, & Richler, 2012; Rea &Parker, 1992; Sun, Pan, & Wang, 2010)[6].

[6] See also Cooper and Hedges (Chapters 16 and 17, 1994) for further discussion of parametric and non-parametric effect sizes and conversion of effect sizes.

Overall Analysis: Control versus Experimental

Section II: Unit Information. Chi-square tests for independence indicated no significant differences between groups (control versus experimental) on items 1, Did the unit have an SOP for Sustainment, 4, Did the unit have a form of operations, or 8A, Did unit have required equipment or appropriate shortage annexes (all $p > .01$). In regards to the continuous data, there were no significant differences between the control and experimental groups on items 3: How familiar were units with their SOPs, 5: How well did unit SOP identify the responsibilities of the unit leaders, 6: How effective were the checklists, 7: How well did leaders understand how to perform Sustainment tasks (all $p > .01$). There was a significant difference between control ($M = 2.61$, $SD = 0.94$) and experimental groups ($M = 2.34$, $SD = 1.17$) on item 8B, How well was required equipment maintained, t (361.97)[7]= 2.59 2.60, $p < .010$.

Section III: Planning. There were significant differences between the control and experimental groups on item 7, Did the unit test fire weapons, χ^2 (1, $N = 403$) = 16.87, $p < .000$, item 9A, Did the unit conduct a COMMEX, χ^2 (1, $N = 417$) = 12.14, $p < .000$, and item 9B, Did the unit have a PACE plan, χ^2 (1, $N = 383$) = 15.16, $p < .000$. All of these effects are considered small according to Cohen's 1988 criteria (see Table 1 for effect sizes and criteria).

A significant number of units, regardless of group, did not test fire weapons prior to commencing their mission (item 7), and the control group was more likely to test fire weapons than the experimental group. The control group was also more likely to conduct a COMMEX and have a PACE plan than the experimental group.

In regards to the continuous data, there was a significant difference between control ($M = 2.00$, $SD = 0.97$) and experimental groups ($M = 1.73$, $SD = 1.01$) on item 3, During the warning order/operations order (WARNO/OPORD), how well was Sustainment explained as part of the plan, t (369.79) [8] = 2.77, p = .006, and between control ($M = 1.96$, $SD = 1.13$) and experimental groups ($M = 1.54$, $SD = 1.19$) on item 4, How well did rehearsals cover Sustainment operations, t (391.78)[9] = 3.69, $p < .000$. The magnitude of the differences in these means was small. (See Table 2 for effect sizes and criteria)

Section IV: Mission Execution. There were significant differences between control and experimental groups on item 2, Did the unit have a Medic or CLS, χ^2 (1, $N = 446$) = 8.32, $p < .000$, item 3, How well did the unit execute hasty recovery, deliberate recovery, or battle damage assessment and repair (BDAR), t (323) = 3.67, $p < .000$. The control group ($M = 2.37$, $SD = 1.06$) and the experimental group ($M = 2.01$, $SD = 1.09$) also differed significantly on item 8, How well did the unit establish and secure an HLZ or Cordon for MEDEVAC, CASEVAC, Resupply, or Recovery, t (326) = 2.98, $p = .003$. The magnitude of the differences in the means was small (Cohen's $d = .33$). The control group was significantly more likely to have executed hasty recovery, deliberate recovery, or BDAR and establish and secure an HLZ or Cordon than the experimental group.

[7] This test violated the equal variances assumption; the unequal variance *t* and *df* are reported.
[8] This test violated the equal variances assumption; the unequal variance *t* and *df* are reported.
[9] This test violated the equal variances assumption; the unequal variance *t* and *df* are reported.

Section V: Follow-Up Operations. There were significant differences between control and experimental groups on item 2, Did the unit account for all mission essential equipment and sensitive items after recovery plan, χ^2 (1, N = 436) = 20.21, p < .000, item 8A, Did sustainment requirements interrupt or affect mission accomplishment, χ^2 (1, N = 389) = 19.02, p < .000, and item 9, Did friction points exist between the unit and higher echelons/supporting elements, χ^2 (1, N = 396) = 27.79, p < .000. All of these effects are considered small according to Cohen's (1988) criteria. The control group was significantly more likely to account for all mission essential equipment and sensitive items, less likely to have sustainment requirements interrupt or affect mission accomplishment, and less likely to have friction points with higher echelons/supporting elements. In regards to the continuous data, there were significant differences between control (M = 2.44, SD = 0.98) and experimental (M = 2.09, SD = 1.00) groups on item 1, How well did the unit execute a refit and recovery plan, t (404) = 3.47, p = .001. The control group (M = 2.61, SD = 0.93) was more likely to cross level loads after operations/expenditures (item 3) than the experimental group (M = 2.32, SD = 1.08), t (394) = 2.89, p = .004.

Table 1
Non-parametric Tests: Control versus Experimental

Checklist Item	Sample Size	*Pearson's χ^2*	*p*	*Phi Coefficient*
II 1 SOP	455	0.13	.716	-.02
II 4 Form for Ops	443	4.17	.124	.09
II 8A Equipment	382	0.17	.678	.02
III 2 OPORD Sustainment	369	0.01	.921	.01
III 7 Test Fire	403	16.87	.000*	.21
III 8 Unit Coordination	419	5.53	.019	-.12
III 9A COMMEX	417	12.14	.000*	.17
III 9B PACE	383	15.16	.000*	.20
IV 1 Necessary Resources	454	0.75	.386	.04
IV 2 Medic or CLS	446	8.32	.004*	.14
IV 9 IAW MEDROE***	132	0.11	.738	-.03
V 2 Essential Equipment	436	20.21	.000*	.22
V 4 Expenditure/Logistics Statistical Report	357	6.54	.011*	-.14
V 5 PMCS IAW-10 TM**	390	2.59	.107	.08
V 6 Mild Traumatic Brain Injury Screenings	118	0.75	.388	.08
V 8A Interruptions	389	19.02	.000*	-.22
V 9 Friction	396	27.79	.000*	-.27

Note. Cohen's (1988) criteria of .10 for small effect, .30 for medium effect, and .50 for large effect. Comparisons for Items II 4, Forms for Operations and IV 7, Dedicated Support were greater than the 2x2 format reported above as they contained more than two response categories; neither comparison was statistically significant.
*Indicates a statistically significant difference at the alpha level of .01.
**Preventative Maintenance Checks and Services In Accordance With -10 Technical Manual
***In Accordance With Medical Rules of Engagement

Table 2
Parametric Tests: Control versus Experimental

Checklist Item	Group	*N*	*Mean*	*SD*	*t*	*p*	*Cohen's d*
II 3 Familiarity with SOP	Control	182	1.76	1.06	1.49	.136	.16
	Experimental	160	1.59	1.12			
II 5 SOP Responsibilities	Control	158	2.28	1.13	2.22	.027	.26
	Experimental	146	1.98	1.27			
II 6 Unit Checklists	Control	176	1.93	1.20	1.52	.130	.17
	Experimental	161	1.73	1.28			
II 7 Leader Understanding	Control	226	2.23	0.93	1.33	.183	.13
	Experimental	189	2.10	1.05			
II 8B Equipment Maintenance	Control	231	2.61	0.94	2.60	.010*	.26
	Experimental	192	2.34	1.17			
III 1 Mission Plans	Control	233	2.18	0.95	1.98	.048	.19
	Experimental	197	1.99	1.05			
III 3 WARNO/OPORD	Control	228	2.00	0.97	2.77	.006*	.29
	Experimental	177	1.73	1.01			
III 4 Rehearsals	Control	234	1.96	1.13	3.69	.000*	.37
	Experimental	188	1.54	1.19			
III 5 Back-brief	Control	229	1.79	1.10	2.43	.015	.24
	Experimental	188	1.52	1.16			
III 6 PCCs/PCIs/PMCS	Control	244	2.09	1.10	2.04	.042	.19
	Experimental	198	1.87	1.18			
III 10 Account for Personnel	Control	247	2.72	1.07	1.95	.053	.19
	Experimental	198	2.52	1.14			
IV 3 Recovery	Control	188	2.55	1.04	3.67	.000*	.41
	Experimental	137	2.11	1.12			
IV 4 Self-aid, MEDEVAC, CASEVAC	Control	217	2.68	0.96	2.31	.022	.24
	Experimental	173	2.43	1.13			
IV 5 Unit SOP Followed	Control	172	2.02	1.05	1.97	.049	.11
	Experimental	154	1.77	1.18			
IV 8 Establish/Secure an HLZ	Control	186	2.37	1.06	2.98	.003*	.33
	Experimental	142	2.01	1.10			
V 1 Refit/Recovery	Control	213	2.44	0.99	3.47	.001*	.35
	Experimental	193	2.09	1.01			
V 3 Cross Level Loads	Control	210	2.61	0.93	2.89	.004*	.29
	Experimental	186	2.32	1.08			

Note. For *Cohen's d* .2 = small effect, .5 = medium effect, and .8 = large effect (Cohen, 1988).
*Indicates a statistically significant difference at the alpha level of .01.

Control versus Experimental Discussion

Initially, it appears the Sustainment Warfighting Function Guide, had little influence on sustainment operations of the experimental group. The significant effects found were small, and mostly in favor of the control group. The guide highlighted the importance of incorporating sustainment into the overall plan, rehearsing sustainment operations, and having a PACE plan. None of these items showed an experimental group advantage, suggesting Soldiers and leaders did not benefit from having the guide during the planning phase of the mission.

Scores from the Mission Execution phase showed the same pattern. In fact, all significant findings from Mission Execution were in favor of the control group, despite the guide specifically mentioning the importance of having a Medic or CLS personnel for the mission and establishing and securing an HLZ or Cordon for MEDEVAC, CASEVAC, resupply or recovery. During Follow-Up operations, the guide reminded leaders to execute a refit and recovery plan, coordinate with higher echelons and supporting units, and cross level loads after operations/expenditures, but the experimental group performed worse on these items compared to control group.

The OCTs observing the experimental group reported sustainment requirements were significantly more likely to interrupt or affect mission accomplishment (as measured by the dichotomous item 8A)[10]. It was possible that the Sustainment Warfighting Function Guide was more detrimental than helpful to leaders in the experimental group. The guide could have been cumbersome or impeding, and providing the leaders with more information about sustainment requirements may have distracted from overall performance or prevented leaders from conducting other tasks. This could explain why, despite being provided a list of sustainment guidelines, the experimental group consistently performed worse on the majority of checklist items. Additionally, as discussed in the procedure, there is no verification of who received the guide or how many leaders used the guide during their rotation.

The control group scored a higher number of "Yes/Go" responses on 10 of the 17 items, six of which were significant differences mentioned earlier in the results. Four of the remaining seven questions were large proportional differences ("Yes" compared to "No" responses) in favor of the experimental group, but these differences need to be interpreted with caution. The "yes" responses in favor of the experimental group indicated these rotations were more likely to report sustainment was an interruption and that there was friction between higher ups and supporting units. The additional proportional differences were minimal.

Collectively, all rotations excelled at having, maintaining, and accounting for the required personnel and equipment, and performing self-aid, buddy-aid, MEDEVAC, and CASEVAC. However, most units struggled with having, being familiar with, and following an SOP, test firing weapons, including sustainment in rehearsals, and subordinate leaders back-briefing sustainment tasks.

It is problematic for us to conclude that the control group performed significantly better than the experimental group on sustainment operations. Further assessment of the means by examining the best performing scale checklist items shows that the highest performing item on

[10] Item 8B asks for OCTs to explain their response to item 8A; there were few responses to 8B.

the checklist for the control group (Section III, item 10, how well did the unit account for personnel) was 2.72, but each individual continuous item score could range from 0 to 4. Neither the control nor experimental groups as a whole scored a mean of 3 or higher on these checklist items, indicating that both groups performed all tasks between a "minimum standard" or "standard" level, rather than "exceeds standard, prepared for contingencies."

Unit SOP Analysis

In order to provide further insight concerning the present data, we conducted additional analyses using both dichotomous and continuous items from the checklist. By doing so, we could ask questions such as, "Does the presence of a unit SOP influence responses to the dichotomous and continuous (scale) items on the Sustainment Operations Checklist?" The following tables provide an illustration of the data for all dichotomous items (Table 3) and continuous items (Table 4).

Chi-square tests of independence were conducted to examine the influence of unit SOP on dichotomous checklist responses. The independent variable was the presence of or lack of a unit SOP for sustainment operations. Few of the dichotomous comparisons were statistically significant. And, only one item showed consistent poor performance across groups, as indicated by a "No" on the checklist, test firing weapons.

However, on every continuous item, as shown in Table 4, units who were reported as having an SOP for Sustainment operations had a higher mean than units whom did not have an SOP. There were statistically significant differences in 15 of 17 comparisons at the adjusted alpha level.

General Discussion

Sustainment is one of the six essential warfighting functions that allow Army forces to exercise decisive action (Department of Army, July, 2012, pg. 2-2). Effective sustainment requires constant coordination and communication between all support teams (and with the maneuver units) to ensure that necessary resources are integrated and available. Sustainment operations can determine how far units can move in the operational environment and for how long units can carry out their respective missions. In this research, ability of rotational units to conduct Sustainment operations at JRTC was examined. Rotations were categorized based on the issuance of the Sustainment Warfighting Function Guide, a training aid designed to assist units in the experimental group with specific aspects of sustainment at the different mission stages: planning, mission execution, and follow-up operations.

Table 3
Frequencies for Dichotomous Items: SOP versus No SOP

		Response		
Checklist Item	Grouping Variable	Yes	No	Total
II 4 Form for Ops	SOP	133	77	210
	No SOP	18	51	69
II 8A Equipment	SOP	117	70	187
	No SOP	97	95	192
III 2 OPORD Sustainment	SOP	142	40	182
	No SOP	128	54	182
III 7 Test Fire	SOP	59	142	201
	No SOP	51	148	199
III 8 Unit Coordination	SOP	124	82	206
	No SOP	127	83	210
III 9A COMMEX	SOP	131	69	200
	No SOP	116	95	211
III 9B PACE	SOP	102	73	175
	No SOP	107	96	203
IV 1 Necessary Resources	SOP	167	53	220
	No SOP	162	65	227
IV 2 Medic or CLS	SOP	207	11	218
	No SOP	208	14	222
IV 7 Dedicated Support	SOP	147	42	189
	No SOP	129	50	179
IV 9 IAW MEDROE	SOP	50	19	69
	No SOP	44	17	61
V 2 Essential Equipment	SOP	175	32	207
	No SOP	186	36	222
V 4 Expenditure/LOGSTAT	SOP	119	45	164
	No SOP	118	71	189
V 5 PMCS IAW-10 TM	SOP	106	83	189
	No SOP	88	107	195
V 6 mTBI Screenings	SOP	18	44	62
	No SOP	26	28	54
V 8A Interruptions	SOP	63	123	186
	No SOP	77	122	199
V 9 Friction	SOP	120	70	190
	No SOP	145	57	202

Table 4
Frequencies for Continuous Items: SOP versus No SOP

Checklist Item	Grouping Variable	Scale Position					Total	*M*	*SD*
		0	1	2	3	4			
II 3 Familiarity with SOP*	SOP	16	45	81	68	8	218	2.03	.98
	No SOP	42	39	30	7	2	120	1.07	.99
II 5 SOP Responsibilities*	SOP	12	15	66	92	26	211	2.50	.99
	No SOP	29	30	11	15	5	90	1.30	1.24
II 6 Unit Checklists*	SOP	23	28	61	67	20	199	2.17	1.15
	No SOP	43	38	22	26	4	133	1.32	1.20
II 7 Leader Understanding*	SOP	6	24	85	78	24	217	2.41	.93
	No SOP	18	46	70	58	3	195	1.91	.98
II 8B Equipment Maintenance*	SOP	7	17	65	83	41	213	2.63	.99
	No SOP	12	38	49	80	27	206	2.35	1.10
III 1 Mission Plans*	SOP	10	26	86	71	22	215	2.32	.97
	No SOP	20	53	81	53	4	211	1.85	.97
III 3 WARNO/OPORD*	SOP	10	36	82	57	11	196	2.12	.95
	No SOP	27	64	72	37	4	204	1.64	.99
III 4 Rehearsals*	SOP	31	43	55	63	18	210	1.97	1.20
	No SOP	40	62	58	40	7	207	1.57	1.11
III 5 Back-brief*	SOP	27	41	67	53	16	204	1.95	1.14
	No SOP	49	68	58	30	3	208	1.38	1.04
III 6 PCCs/PCIs/PMCS*	SOP	14	44	72	54	30	214	2.20	1.12
	No SOP	27	70	61	49	15	222	1.80	1.12
III 10 Account for Personnel*	SOP	8	19	43	80	65	215	2.81	1.08
	No SOP	7	40	69	58	49	223	2.46	1.11
IV 3 Recovery	SOP	10	17	51	63	28	169	2.49	1.07
	No SOP	13	25	43	53	16	150	2.23	1.12
IV 4 Self-Aid, MEDEVAC, CASEVAC	SOP	9	23	40	82	37	191	2.60	1.08
	No SOP	4	31	46	80	32	193	2.54	1.02
IV 5 Unit SOP Followed*	SOP	16	41	70	70	15	212	2.13	1.05
	No SOP	25	34	28	20	3	110	1.47	1.12
IV 8 Establish/Secure an HLZ*	SOP	11	22	45	60	22	160	2.38	1.10
	No SOP	15	30	63	43	12	163	2.04	1.06
V 1 Refit/Recovery*	SOP	8	21	61	85	23	198	2.47	.97
	No SOP	12	50	63	68	11	204	2.08	1.01
V 3 Cross Level Loads*	SOP	6	20	52	75	38	191	2.62	1.02
	No SOP	8	30	74	65	23	200	2.33	1.00

Note. The checklist scale ranged from 0 = *Unsatisfactory/Not at all*, 1 = *Sub-standard/Performed some tasks*, 2 = *Minimum standard/Performed most tasks*, 3 = *Standard/Performed all tasks*, 4 = *Exceeds Standard/Performed all tasks and prepared for contingencies*, and N/A = *Not Applicable.*
*Indicates a statistically significant difference at the adjusted alpha level of .01.

Control and experimental groups performed significantly different on a minimal number of items on the Sustainment Operations Checklist. These item differences were present throughout all analyses, regardless of unit size, unit type, or type of mission, and were mostly small to medium effects. Rotations in the experimental group were more likely to coordinate with other units for sustainment support. This consistent finding could be attributed to the utilization of the guide, which repeatedly emphasizes the importance of knowing the position and status of other units. Additionally, the experimental group was consistently more likely to submit expenditure reports/LOGSTAT and request resupply effectively; the guide specifically highlights the need to complete these tasks. However, OCTs reported observing that sustainment requirements interrupted or affected the mission of the experimental group more so than the control group. Finally, the experimental group showed more friction points with their supporting units/higher echelons, which could partly be attributed to more reported coordination with other units. If fully utilized, the guide could have influenced units in the experimental group to be more attentive to sustainment operations. As a result, more coordination would have been necessary, increasing the likelihood of friction points up the echelons and, potentially, disrupting their primary mission. In sum, incorporating the Sustainment Warfighting Function Guide into JRTC training rotations may have increased units' performance on some items, but also may have hindered their performance on others.

A better understanding of overall performance on Sustainment tasks may be gleaned from the best and worst performance data. A common theme among all rotations was best performance on items pertaining to having and maintaining necessary equipment and medical care, as well as accounting for necessary personnel. Rotations performed the worst on items that examined the test firing of weapons and subordinate leaders back-briefing sustainment operations.

It is important to clarify that "best" performance on these items does not necessarily mean good performance. Some items on the checklist had continuous response choices ranging from zero (unsatisfactory/did not perform the tasks) to four (exceeds standards, prepared for contingencies). Though some units were sporadically scored as "4"s on some of the checklist items, the best performance item on the checklist (how well did the unit account for personnel) had a mean value of 2.72. All rotations performed all the Sustainment tasks at a "minimum standard" or "standard" level only.

"Standard" performance on the Sustainment Operations Checklist may simply be the result of a lack of planning for sustainment operations. Only roughly half of the rotations reported having an SOP, being familiar with an SOP, and following a SOP. If the majority of rotations were not planning/preparing for sustainment operations, then it could not have been expected to be an active priority. Further, if units had an SOP for Sustainment, they tended to perform better on a majority of individual checklist items and overall. Not necessarily surprising, if units had an existing SOP for sustainment operations that was likely already integrated into home station training, we would expect units to perform better on this warfighting function. To see unit performance on Sustainment Operations "exceed standards," it is suggested that the importance of sustainment operations is continually emphasized and fully incorporated during training of other warfighting functions at home station.

A major change to the measure format used previously (see Vowels, et al., 2014) was the inclusion of checklist items that required OCTs to respond "how well" an observed unit was

performing a task using a scale ranging from 0 to 4 as opposed to only whether a unit was performing a task, Yes or No. As we continue to employ, and refine, such scales, we begin to learn more about what separates units that fail to perform compared to those units that do perform. We also learn about differences between units that are performing minimally enough to "pass" and those who are exceeding the standard. Better understanding of such gradations in performance (whether examine parametrically or non-parametrically) is not possible if only a dichotomous response scale is used. For instance, we can begin to explore questions such as are the degrees in performance the same (or different) for units that typically score "0" versus "1" the same as those units that typically score "3" versus those scoring "4"?

Recommendations

As noted in the discussion, most performance of sustainment operations was only at the standard or minimal level, particularly for Infantry units. Despite the sustainment warfighting guide containing useful information for many aspects of sustainment operations, it could not improve performance in the rotations that received the guide. Sustainment operations involve a great deal of coordination and communication starting at the squad level. The brief guide was largely developed for company level leaders (with emphasis on interactions between company and battalion echelons). The bulk of the data were collected at the platoon level; another reason the guide may have also had minimal impact. Further, the short guide developed in the present study was not likely to provide sufficient information on how to correct practices and procedures, especially in the span of time during a combat training center rotation.

Approximately half the units reported not having an SOP for Sustainment operations. Thus, training and preparing for sustainment operations would likely require greater integration at home station with a more detailed and lengthy block of instruction, including time for repetitive practice. However, current and future training environments may be limited by resources and time. As a result, concise guides like the one developed in this project may be the most feasible to produce. And if the focus of measurement will be on platoon level, training should, of course, be tailored to that echelon. In an effort to provide recommendations for developing such tools, several techniques have been identified that could improve their development, not only for sustainment operations, but for other types as well.

Previous manipulations have served as reminders for squad/platoon leaders to perform necessary tasks for mission accomplishment (Evans & Blizzard, 2011; Evans, & Coerper, 2009; Evans & Snyder, 2010; Vowels, Dasse, Ginty, & Emmons, 2014). In those situations, there was also little opportunity for a tool to have a large impact. Therefore, future guides or aids should be designed to not only provide Soldiers and leaders with the information and materials necessary to complete required tasks, but also to encourage deeper processing and long-term retention of sustainment training techniques and requirements. Recommendations are based on research and findings from the fields of education and psychology. Obviously, some of the more effective learning techniques require effort and time that squad/platoon leaders might not have when leading their squad/platoon members through a rotation. Therefore, future guides may be both efficient and effective by incorporating abbreviated learning techniques. Such methods can assist in maximizing learning by promoting the integration of new information with existing knowledge. Though many of these techniques are already used in same Army training, tying them directly to Sustainment operations could prove beneficial.

One technique is the use of imagery. The presentation of training material with or in pictures is an effective learning and memory procedure. Research has shown that the encoding of material in different modalities (words and images) not only promotes a stronger memory of the information, but also provides the learner with more cues, and more (and varied) cues can facilitate faster retrieval. For instance, multimedia learning (imagery and words presented together) is effective in the integration of new information with prior knowledge (Mayer, 1996; Moreno & Valdez, 2007; Vogel-Walcutt, Fiorella, & Malone, 2013). Another technique for rapid learning is the use of good and bad examples. Providing leaders with a clear example of what may go wrong if they do not follow proper training protocol, might motivate them to remember their training (Anderson et al., 2010). Further, demonstrating how to correct the "wrongs" and ways to achieve the desired outcome could also improve performance. Similar to providing examples, is the idea of counterfactual thinking at the follow-up stage of a mission (Roese & Olson, 2003). An example could be asking, "What could have gone better or worse if different courses of action were taken?" Though the checklist already asks OCTs to identify an area that units should sustain and improve, also encouraging the squad/platoon/company (leaders and Soldiers) to think about other outcomes would allow them to compare and contrast their experiences within the unit if something had been done differently.

The application of other learning techniques endorses more leader and unit participation. For example, re-reading and summarizing a task or plan promotes the processing of main ideas (Dunlosky et al., 2013). Using analogies (Gentner & Grudin, 1985) to reason about the relationship between the role of sustainment operations and other parts of a mission can create a correspondence between the two and may motivate leaders to more deeply assess their sustainment roles in the unit. Creating a mnemonic that applies to a training checklist or sustainment operation can also help with remembering concepts because chunking conserves space in memory and promotes better encoding (Miller, 1956; Anderson et al., 2010). Previous training rotations have shown an overall problem with using the necessary graphic control measures for mission accomplishment (Vowels, Dasse, Ginty, & Emmons, 2014). However, encouraging leaders and units to make the best use of available templates may facilitate better understanding of the plan because it can enhance organization of task-relevant knowledge (see Zipperer et al., 2003).

Finally, a manipulation that asks questions of the squad/platoon/company leaders, either by testing the unit during training or having them explain or reflect on their sustainment operations out loud can promote information processing. Likewise, asking leaders (and members) to summarize their plans, promotes deeper processing of the material and better encoding (Craik& Tulving, 1975). The generation of one's own explanations, answers, or summaries allows for the learner to extract the gist of the material, and increase retention likelihood through the integration of new information into existing knowledge (Jacoby, 1978). Therefore, when needing the material again, the learner can use multiple access points to retrieve that particular knowledge. Further, by engaging in numerous methods of processing, learners can form multiple and stronger associations between important elements of the information. Thus, when creating a plan, executing a plan, or following up on how effective the plan was carried out, leaders could retrieve sustainment operations information faster using multiple memory traces (Craik & Lockhart, 1972).

We predict that basic learning and retention strategies such as multimedia learning and imagery, self-generation of responses, explanation, summaries, vivid examples and mnemonics, will facilitate better understanding and improve performance of sustainment operations. The acronym VEST (Visualize, Elaborate, Summarize, and Test) provides a means for the learner to quickly gain as much relevant information as possible in order to better recall and utilize the information later. Each represents a process that could lead to better information acquisition, recall, and use. By utilizing VEST, the learner can take advantage of several evidence-based processes that enable better learning.

The Abbreviated Learning Techniques table (Appendix E) illustrates several learning procedures, including those used in VEST. The techniques are separated into three subsets which represent different levels of processing from shallow to deep (Craik & Lockhart, 1972). Shallow processing is the lowest level at which we can process information, and involves encoding only the physical qualities of a stimulus. Intermediate and deep processing engage more semantic and elaborative encoding strategies. Sustainment operations training is more likely to be better remembered and easily retrieved if processed deeply, but additional processing of any training materials is likely to be of some benefit.

Visualizing involves creating mental imagery of training material (as relevant to the training environment). For example, visualizing the steps of a sustainment task (perhaps, supplemented with images) either as a team or a leader, at the beginning of training could make later rehearsals and execution of the plan more efficient. Elaboration involves not only further developing relevant ideas, but linking associated points together for more thorough processing and to better retain the information. In the initial planning phase of sustainment operations training, leaders need to explain the role of sustainment as part of the plan. By elaborating on the definition of sustainment, as well as each individual role in maintaining sustainment operations, leaders are more likely to be able to effectively complete their tasks. Summarizing involves, of course, summating relevant material, but more importantly gaining a higher level meaning from the summed information. Summarization might come into play during pre-mission rehearsal by asking subordinates to back-brief the sustainment plan and also during debriefing, when leaders and units assess the tasks they should sustain or improve. To quickly summarize the results of the mission allows Soldiers to relate the results of the current training mission to results of previous training missions, as well as note what needs to be changed. Finally, Testing can and should take many forms to best augment retention. It might benefit a team to take a moment during execution to reflect on the SOP developed during planning and assess how well the unit SOP is being followed and what deviations are necessary. Of course, the learner should not limit him/herself to only the techniques provided above and in Appendix E. For instance, Reif (2008; see also Vogel-Walcutt, Carper, Bowers, & Nicholson, 2010) reviews how an understanding of basic and advanced cognitive processes can improve educational practices and, as a result, enhance learning.

There are at least two advantages to VEST that can facilitate the acquisition of information, especially in Army training environments. For instance, VEST inherits aspects of current training techniques found in such processes as after action reviews (AAR). The VEST, as well as AARs, can be applied at individual and collective levels. The AARs are particularly good at allowing for elaboration and summation of both appropriate and inappropriate actions taken during a training exercise. However, training environments and schedules can lack both

the initial process, visualization and the final process, testing. Visualize, Elaborate, Summarize, and Test affords pre-elaborative to post-summative techniques to bolster information acquisition and retention before, during and after training.

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Appendix A

Sustainment Warfighting Function Guide

1. Logistics(CONT):
Expenditure Reports/LOGSTAT/Combat Power: Units should inventory on hand supplies, ammunition, and key equipment and report shortages, battle loss, and battle damage to BN S4 and Maintenance Control Section.

Mission Sustaining Operations (MSO): A deliberate period of replenishment and refit in which a unit is pulled off the line, receives its full basic load (or more), as well as replacements for personnel and equipment, and thorough maintenance checks/ repairs in anticipation of a near future operation. During MSO, the unit will most likely draw resupply from a supply point.

2. Health Service Support:

Screening for TBI: Soldiers exposed to concussive/blast event (50 meter radius) should be screened for symptoms of TBI at their Role I facility.

Replenishment of CL VIII (IFAK, CLS Bags, Aid Bags, etc); Medical Supplies shortages reported to BN Aid Station (Role I) for resupply from BDE Medical Supply Office. CL VIII supplies must be inventoried and cross loaded for future operations by all units.

3. Human Resource Support:

Replacements: Companies are responsible for submitting necessary Personnel Replacement Requests thru the BN S-1; the S-1 is responsible for consolidating replacement requests and submitting to BDE.

Enemy Prisoners of War: The Combat Trains Command Post/Field Trains Command Post plans and coordinates detainee operations, collection points, and evacuation procedures

4. Refit Checklist (Things to Consider):

- √ What type of replenishment will we receive?
- √ Have we submitted updated LOGSTATs to the S-4?
- √ Have we cross-leveled ammunition and critical supplies?
- √ What is the mortuary affairs plan?
- √ Have Soldiers been exposed to a blast event and need screening for mTBI?
- √ What does the CO owe BN?
- √ What is the plan for detainee/EPW transfer?
- √ When/where do replacements arrive from?
- √ Was a debriefing conducted for the operation?

COMMANDER/LEADER NOTES

PAGE 4

SUSTAINMENT WARFIGHTING FUNCTION GUIDE FOR COMPANY COMMANDERS AND LEADERS

References:
ATTP 5-0.1 The Command and Staff Officers Guide
FM 3-21.20 The Infantry Battalion
ADP 4-0 Sustainment

I. Planning Considerations

1. Eight Principles of Sustainment (ADP 4-0): Integration, Anticipation, Responsiveness, Simplicity, Economy, Survivability, Continuity, Improvisation

2. OPORD/FRAGO Sustainment Paragraph IV (ATTP 5-0.1): Paragraph IV should include pertinent Sustainment information all participants of an operation should understand. Annex F (Sustainment) should include detailed information pertinent to those responsible for executing the Sustainment-centric tasks (usually at BN level and above).

IV. (U) Sustainment. Overall scheme of sustainment; where sustainment assets will be located, how support will be provided to supported units.
- a. (U) Logistics. Supply, Maintenance, Transportation requirements, schedules,
- b. (U) Personnel. Key tasks for managing manpower—where are your people at?
- c. (U) Army Health System Support. What we do when people get hurt.

3. Logistics Planning Factors (FM 3-21.20):
10 Classes of Supply: **I**-Food/Water; **II**-Individual Equipment; **III**-Petroleum, Oil, and Lubricants; **IV**-Construction/Engineering Materials; **V**-Ordnance; **VI**-Sundry Items; **VII**-Major End Items; **VIII**-Medical Supplies; **IX**-Tools/Repair Parts; **X**-Civil Support Materials

How do we get our food, ammo, and fuel? How many people and vehicles are we supporting? What is our LOGSTAT format and how/when do we submit to higher?

What are the locations of maintenance support, vehicle recovery plan, PMCS priorities?

PACE plan; how do we contact internal and external support elements?

4. Health Service Support Planning Factors (FM 3-21.20):

What is the MEDEVAC/CASEVAC plan?

Where are the CCPs and Ambulance Exchange Points?

Who knows the plan and how do we validate understanding?

Has the BN MEDO reviewed the company HSS plan?

What do we do if Air MEDEVAC is unavailable?

What is the location of the various roles of care? (Role I: BN Aid Station; Role II: C-MED; Role III: Combat Support Hospital)

5. Human Resource Planning Factors (FM 3-21.20):

What are our manifest plan and accountability requirements?

Where will all Company personnel be located? How do we account for them there?

What are the casualty reporting requirements and what is the timeline for submission to BN S-1?

6. PCCs, PCIs, & Rehearsals:
Who is responsible for executing PCCs/PCIs and when are they performed?

6. PCCs, PCIs, & Rehearsals(CONT):
Is sustainment included in CO/PLT Rehearsals (i.e. MEDEVAC, CCP, and Vehicle Recovery)? Who should attend BN and BDE Sustainment Rehearsals? What type of rehearsal is required for all missions?

II. Execution

1. Logistics (IAW FM 3-21.20):
Company Trains-Consists of Company Supply Section, managed by 1SG or XO; may or may not be collocated with the Logistics Rally Point where replenishment operations are conducted.
Logistics Rally Point: A secure location at or near the company trains where the company can receive resupply from the FSC or BSB. Usually managed by the 1SG or XO, the receiving unit is responsible for identification and security of the LRP.

2. Health Service Support (IAW FM 3-21.20):
Actions at Point of Injury: Unit leadership insures that all injured Soldiers receive immediate first aid and coordinates with the company senior medic for ground evacuation and routes. Accurate information about casualties must be reported to the proper channels.

Actions at CCP: Medics will determine casualty precedence; higher precedence will be evacuated first. When loading a MEDEVAC aircraft, casualties with the highest precedence are loaded LAST (so they will be unloaded first at the medical treatment facility).
- Routine: Injuries non-life threatening if treated by a medic.
- Priority: Injuries life threatening, but can be stabilized by a medic of Role I facility.
- Urgent: life threatening injuries that require immediate medical care at Role I or above.

Evacuation Plan: Ensure CCP operations and Evacuation Plan are rehearsed prior to execution. Evacuation points must be secure; Air MEDEVAC assets will not land in an unsecure HLZ.

3. Human Resource Support (IAW FM3-21.20):
Bump Plans-Key for Airborne and Air Assault Operations; ensures that the key leaders arrive on the DZ/LZ. At the company level, the 1SG is responsible for the bump plan.

Tactical Cross-load-For both Airborne/Air Assault and mounted operations, key personnel, enablers, and special teams should be distributed between platforms to ensure survivability of unit capabilities.

Accountability reports: Ensure commander has situational awareness regarding the location and disposition of his forces.

Casualties and Replacements: Submit mandatory casualty reports and Personnel Replacement Requests IAW established timelines (set by BN or BDE); integrate replacements into the unit.

III. Refit and Recovery Operations

1. Logistics:
Replenishment Operations: Replenishment of Company Trains is based on LOGSTAT reports submitted from the CO 1SG/XO/Supply SGT to the BN S-4. The FSC is responsible for the delivery of resupply.

Appendix B

Sustainment Operations Checklist

SUSTAINMENT OPERATIONS CHECKLIST

Disclosure: Data collected with this form will be used for routine research purposes only. Information will not be used in whole or part in making any determination about an individual or unit. Information gathered will be used for statistical control purposes only and will not be disclosed to any unit undergoing rotations at the Joint Readiness Training Center.

SECTION I: GENERAL INFORMATION

DATES OBSERVED: FROM _____ **TO** _____ **ROTATION NUMBER:**_____
SIZE UNIT OBSERVED: CO BTRY TRP PLT SECT SQD DET
TYPE UNIT OBSERVED: IN AR SF CAV FA EN OD ADA AVN SC MI MP MS RSTA CHEM QM TC CA PSYOP Multiple Types Other **ROTATION PHASE:** STX FOF LF
TYPE OF MISSION: DELIBERATE HASTY **(Please Circle Size, Types and Phase)**
SCALE: 0= Unsatisfactory/Not at all 1 = Sub-standard/Performed some tasks 2 = Minimum standard/Performed most tasks 3 = Standard/Performed all tasks 4 =Exceeds Standard/ Performed all tasks and prepared for contingencies N/A = Not applicable

SECTION II: UNIT INFORMATION

1. Did the unit have an SOP for Sustainment (Logistics, Personnel, Medical)?
   Circle all applicable Yes No
2. What references did the unit use to establish the SOP?
   Please identify references_____
3. How well were Leaders/Soldiers familiar with their SOP? 0 1 2 3 4 N/A
4. Did the unit SOP include an example of forms for operations? Yes No No SOP
5. How well did unit SOP identify responsibilities of unit Leaders? 0 1 2 3 4 N/A
6. How effective were the unit's checklists? 0 1 2 3 4 N/A
7. How well did leaders understand how to perform Sustainment tasks? 0 1 2 3 4 N/A

8A. Did unit have required equipment (BII, COEI, etc) or appropriate shortage annexes? Yes No N/A
8B. How well was required equipment maintained? 0 1 2 3 4 N/A
Comments:_____

SECTION III: PLANNING PHASE

1. How well was Sustainment included in the unit mission plans at all echelons observed? 0 1 2 3 4 N/A
2. Did the higher Command Level OPORD contain Sustainment (Paragraph 4)? Yes No N/A
3. During the WARNO/OPORD, how well was Sustainment explained as part of the plan? 0 1 2 3 4 N/A
4. How well did rehearsals cover Sustainment operations (i.e. vehicle recovery, MEDEVAC/CASEVAC plans)? 0 1 2 3 4 N/A
5. How well did subordinate leaders Back-Brief Sustainment tasks/functions? 0 1 2 3 4 N/A
6. How well did unit perform PCCs/PCIs and Before Ops PMCS? 0 1 2 3 4 N/A
7. Did unit test fire weapons? Yes No N/A
8. Did units coordinate with other units for Sustainment support? Yes No N/A

9A. Did the unit conduct a COMMEX? Yes No N/A
9B. Did the unit have a PACE plan? Yes No N/A **If yes, describe:**
P_____A_____C_____E_____

10. How well did unit account for personnel (including attachments)? 0 1 2 3 4 N/A

Comments:_____

SECTION IV: EXECUTION PHASE

1. Did unit have necessary resources to accomplish the mission? Yes No
   If no, explain _____
2. Did unit have a Medic or CLS personnel for the mission?
   Circle one Yes No Both N/A
3. How well did unit execute hasty recovery, deliberate recovery or BDAR?
   Circle all applicable 0 1 2 3 4 N/A
4. How well did unit perform Self-Aid, Buddy-Aid, MEDEVAC or CASEVAC?
   Circle all applicable 0 1 2 3 4 N/A
5. How well was the unit SOP followed? 0 1 2 3 4 N/A
6. Was external Sustainment support required (dedicated recovery, refuel, resupply, maintenance, medical)? **Circle all applicable and explain:** _____
7. Was dedicated Sustainment support available to the unit? Yes No Unknown
8. How well did the unit establish and secure an HLZ or Cordon for MEDEVAC, CASEVAC, Resupply, or Recovery? **Circle those applicable** 0 1 2 3 4 N/A
9. If non-US casualties were identified, where they treated IAW MEDROE?
   Yes No N/A

Comments: _____

SECTION V: FOLLOW UP OPERATIONS

1. How well did the unit execute a refit and recovery plan? 0 1 2 3 4 N/A
2. Did the unit account for all mission essential equipment and sensitive items after RP? Yes No N/A
3. How well did the unit cross level loads after operations/expenditures?
   0 1 2 3 4 N/A
4. Did the unit submit expenditure report/LOGSTAT and request resupply?
   Yes No N/A
5. Did the unit conduct after operations PMCS IAW -10 TM? Yes No N/A
6. If personnel were exposed to a concussive event, were mTBI screenings conducted? Yes No Unknown N/A

7A. How long after RP before the unit was mission ready or executed another mission?

7B. Did this meet unit standards/mission requirements? **Explain:** _____

8A. Did Sustainment requirements interrupt or affect mission accomplishment? Yes No N/A

8B. **Explain:** _____

9A. Did friction points exist between the unit and higher echelons/supporting elements? Yes No N/A

9B. **Explain:** _____

10. Identify sustainment tasks that the unit should sustain: _____

11. Identify sustainment tasks that the unit should improve: _____

Classes of Supply: I (Food/Water); II (Individual Equipment); III (Petroleum, Oil, and Lubricants); IV (Construction/Engineering Materials); V (Ammunition/Ordnance); VI (Personal Demand Items); VII (Major End Items); VIII (Medical); IX (Tool Kits and Repair Parts); X (Civil-Military Resources) **Functions of Sustainment:** Logistics: Maintenance, Transportation, Supply, Field Services, Distribution, Operational Contract Support, General Engineering Personnel Services: Human Resources Support, Finance, Legal Support, Religious Support Health Service Support: Medical Support, Hospitalization, Dental, Behavioral Health, Laboratory Services, Treatment of CBRN Casualties

O/C/T Initials_____ **O/C/T Call sign**_____ **Division/Task Force**_____

Number of rotations O/C/T has observed_____

Appendix C

Memorandum of Record

DEPARTMENT OF THE ARMY
JOINT READINESS TRAINING CENTER OPERATIONS GROUP
7260 ALABAMA AVENUE
FORT POLK, LOUISIANA 71459-5314

REPLY TO ATTENTION OF:

ATZL-JRO-Z

MEMORANDUM OF RECORD

SUBJECT: Research Plan for Sustainment Operations at the Joint Readiness Training Center Operations Group, Warrior Leadership Council, and U.S. Army Research Institute (ARI)

1. Goal. To increase effective Army-wide Sustainment Operations, in accordance with ADP 4-0 Sustainment, FM 3-21.20, Chapter 11, FM 4-0 Sustainment, Ranger Handbook, ATTP 5-01 Sustainment.

2. Concept of Research. The intent is to collect data on the capabilities and effectiveness of sustainment operations by units at the battalion, company, and platoon levels for nine consecutive rotations. The first rotation will be a pilot rotation to verify usability and suitability of the data collection instrument. We will collect and analyze baseline data for the next four rotations. Based on cumulative analysis of data after each rotation, revisions to data collection methods will be made if needed. The Warrior Leadership Council (WLC) will then propose a guide to be introduced to unit commanders and leaders prior to the next four rotations. An example of a guide may be the pocket-sized quick reference guide to assist the commander, staff member, or leader in planning and execution of sustainment operations. To gauge the overall effectiveness of the guide, we will statistically compare the effectiveness of sustainment operations between the last four and the first four rotations.

3. Scope. Echelons of interest are battalions, squadrons, batteries, companies, troops, and platoons with the battery, company, and troop being the center of interest. Units will be observed during all phases of the rotations. The research will focus on unit information, planning, and execution.

4. Data Collection. Observer/Coach/Trainers (OCT) at each echelon will collect data using a checklist developed and approved by the WLC. Measures of interest include the following:

ATZL-JRO-Z
SUBJECT: Research Plan for Sustainment Operations at the Joint Readiness Training Center Operations Group, Warrior Leadership Council, and U.S. Army Research Institute (ARI)

a. Unit Information.

- Did the unit have a current SOP for sustainment operations?
- Were leaders/Soldiers familiar with their unit's SOP?
- Did the unit SOP include an example of forms for operations?
- Did unit SOP identify duties and responsibilities of key unit leaders?
- Did the unit have a checklist for operations?
- Did individual leaders/Soldiers understand how to perform sustainment operations?
- Did the unit have equipment loaded and readily available (durable and expendable items) for the mission?

b. Planning.

- Was sustainment operations included in the unit mission plans at all echelons observed?
- Did the higher command level OPORD contain sustainment operations?
- Did the unit WARNO/OPORD include sustainment operations and were the operations explained?
- Did unit rehearsals include sustainment operations?
- Did the unit rehearse resupply, refueling, vehicle recovery, casualty treatment and evacuation?
- Did unit leaders perform PCCs, PCIs and PMCSs?
- Did units coordinate with other units operating in the AO for sustainment operations?
- Did the unit conduct a COMMEX?
- Did the unit have a PACE plan?
- Did the unit have a manifest for all personnel?
- Did the Soldiers understand their units' sustainment plan?

c. Execution.

- Did the unit have necessary resources to accomplish the mission?
- Was the situation identified and conditions set for sustainment operations?
- Was dedicated/deliberate support available to the unit?
- Did the unit establish a secure site for sustainment operations to included casualty evacuation?
- Did the unit conduct hasty recovery or BDAR operations?
- Was external sustainment support available for the unit?
- Were timely spot reports communicated?
- Was sustainment operations executed in accordance with the established time line?
- Was the unit SOP followed?
- Did sustainment operations interrupt or cause the unit to deviate from the mission?

d. Follow-up operations.

- Were units debriefed?
- Did the unit account for all mission essential equipment and sensitive items?
- Did the unit cross level loads after operations?
- Did the unit submit expenditure reports and request resupply?
- Did the unit execute after operations plans refit, recovery and PMCSs?
- If personnel were exposed to a blast, were mTBI screenings accomplished?
- Did sustainment operations interrupt or cause the unit to deviate from mission accomplishment?
- Did friction points exist between the unit and higher echelons?
- Identify sustainment tasks that the unit should sustain.
- Identify sustainment tasks that the unit should improve.

5. Responsibilities.

a. Operations Group (OPS GRP) Deputy Commander and Command Sergeant Major shall provide command oversight to the sustainment operations investigation.

b. The Army Research Institute (ARI) technical representative shall provide technical and scientific support to the WLC, analyze data after each rotation, and provide a written report of the research findings for review by the council and OPS GRP Commander following the conclusion of the research.

c. The ARI Liaison Officer shall provide administrative support and warrior experience to the WLC, develop and revise the research plan, develop a data collection form to be used by OCTs, and provide local coordination for plan approval and execution.

d. OCTs within each division shall be responsible for collecting data on measures of interest.

e. Division members of the WLC shall be responsible for insuring OCT data collection forms in their respective Division provide satisfactory data on measures of interest as outlined in paragraph 4.

f. Through its regularly scheduled meetings after each rotation, the WLC shall ensure consistency and continuity of data collection efforts across Divisions.

6. Points of contact. Captain, John C. Thomas, Warrior Leadership Council Chairman, 337-531-8299, john.c.thomas.193.mil@mail.mil, Sergeant First Class, Floyd G. Getchell, Warrior Leadership Council Vice Chairman, 337-531-9495, floyd.g.getchell.mil@mail.mil, and, Bill Gates, U.S. Army Research Institute, Liaison Officer, 337-531-1248, julius.w.gates.civ@mail.mil.

Appendix D

Infantry Analysis

In a previous research effort, a certain echelon, the (Infantry) squad, was examined (Vowels, Dasse, Ginty, & Emmons, 2014). In the current study, the research moved beyond the previous scope by examining units, including Infantry, as they conducted a specific warfighting function, sustainment operations. The primary aim of this project was to explore differences in sustainment operations between control and experimental groups due to the distribution and use of the Sustainment Warfighting Function Guide. Our analyses showed the Sustainment Warfighting Guide was largely ineffective in assisting leaders with sustainment operations during these training rotations. As most of the units being observed in this projects were Infantry, we had the opportunity to specifically examine Infantry units between control and experimental groups.

Unit type: Infantry

The majority of units that attend training at JRTC are Infantry units in some form. As expected, the majority of our sample was Infantry (46%), therefore differences between control (n = 116) and experimental (n = 97) Infantry units were assessed. This provides a window into the training capabilities of this type of unit as it performs warfighting functions at a combat training center. Though Infantry units are often construed as exhibiting the destructive capabilities of combat power, in order to maintain enduring combat, they must have the capacity and wherewithal to engage in successful sustainment operations. Tables 5 and 6 provide non-parametric and parametric test results, respectively.

Section II: Unit Information. There were no significant differences in performance between control and experimental groups on items in this section (all $p > .01$). **Section III: Planning.** There were significant differences between the control and experimental groups on item 9A, Did the unit conduct a COMMEX, χ^2 (1, N = 200) = 12.88, p = .000, *phi* = .25, and item 9B, Did the unit have a PACE plan, χ^2 (1, N = 183) = 14.22, p = .000, *phi* = .28. The Infantry units in the control group were more likely to conduct a COMMEX and have a PACE plan. **Section IV: Mission Execution.** There were no significant differences in performance between control and experimental groups on items in this section (all $p > .01$). **Section V: Follow-Up Operations.** There were significant differences between control and experimental groups on item 4, Did the unit submit expenditure reports/LOGSTAT and request resupply, χ^2 (1, N = 169) = 14.24, p = .000, *phi* = -.29. The Infantry units in the experimental group were more likely to submit expenditure reports/LOGSTAT and request resupply

Subgroup Analysis: Infantry Units Only

Table 5
Non-parametric Tests: Control versus Experimental, Infantry Only

Checklist Item	Sample Size	*Pearson's* χ^2	*p*	*Phi Coefficient*
II 1 SOP	211	0.44	.505	-0.05
II 4 Form for Ops	207	3.21	.201	0.13
II 8A Equipment	174	0.54	.463	-0.06
III 2 OPORD Sustainment	178	0.09	.769	-0.02
III 7 Test Fire	197	2.51	.113	0.11
III 8 Unit Coordination	192	6.09	.014*	-0.18
III 9A COMMEX	200	12.88	.000*	0.25
III 9B PACE	183	14.22	.000*	0.28
IV 1 Necessary Resources	208	0.02	.901	-0.01
IV 2 Medic or CLS	208	1.59	.207	0.09
IV 9 IAW MEDROE	63	0.08	.781	-0.04
V 2 Essential Equipment	203	5.58	.018	0.17
V 4 Expenditure/LOGSTAT	169	14.24	.000*	-0.29
V 5 PMCS IAW-10 TM	174	0.00	.994	-0.00
V 6 mTBI Screenings	59	0.14	.712	0.05
V 8A Interruptions	178	8.04	.005*	-0.21
V 9 Friction	179	5.76	.016	-0.18

Note. Cohen's (1988) criteria of .10 for small effect, .30 for medium effect, and .50 for large effect
*Indicates a statistically significant difference at the adjusted alpha level of .01.

Table 6
Parametric Tests: Control versus Experimental, Infantry Only

Checklist Item	Group	*N*	*Mean*	*SD*	*t*	*p*	*Cohen's d*
II 3 Familiarity with SOP	Control	88	1.75	1.04	0.27	.788	0.04
	Experimental	82	1.71	1.02			
II 5 SOP Responsibilities	Control	71	2.28	1.03	0.14	.891	0.02
	Experimental	70	2.26	1.09			
II 6 Unit checklists	Control	85	1.99	1.14	0.62	.537	0.09
	Experimental	83	1.88	1.14			
II 7 Leader Understanding	Control	102	2.11	0.91	0.09	.927	0.01
	Experimental	94	2.10	0.93			
II 8B Equipment Maintenance	Control	102	2.55	0.84	2.27	.024	0.33
	Experimental	95	2.23	1.09			
III 1 Mission Plans	Control	107	2.08	0.88	0.77	.444	0.11
	Experimental	95	1.99	0.86			
III 3 WARNO/OPORD	Control	106	2.02	0.87	1.73	.086	0.25
	Experimental	85	1.79	0.95			
III 4 Rehearsals	Control	107	1.86	1.08	2.54	.012*	0.36
	Experimental	93	1.46	1.14			
III 5 Back-brief	Control	104	1.73	1.12	2.31	.022	0.33
	Experimental	92	1.37	1.06			
III 6 Perform PCCs/PCIs/PMCS	Control	112	2.00	1.08	0.83	.410	0.11
	Experimental	96	1.88	1.09			
III 10 Account for Personnel	Control	113	2.63	1.05	1.44	.153	0.19
	Experimental	96	2.42	1.08			
IV 3 Recovery	Control	83	2.25	1.08	1.56	.122	0.26
	Experimental	66	1.98	1.00			
IV 4 Self-aid, MEDEVAC, CASEVAC	Control	108	2.67	0.97	1.55	.122	0.22
	Experimental	93	2.44	1.08			
IV 5 Unit SOP Followed	Control	80	1.98	0.97	0.07	.943	0.01
	Experimental	82	1.96	1.07			
IV 8 Establish/Secure an HLZ	Control	94	2.27	1.04	1.16	.249	0.18
	Experimental	79	2.09	0.95			
V 1 Refit/Recovery	Control	100	2.32	0.97	2.11	.037	0.30
	Experimental	94	2.04	0.85			
V 3 Cross Level Loads	Control	103	2.52	0.93	1.35	.178	0.19
	Experimental	93	2.34	0.94			

Note. For *Cohen's d* .2=small effect, .5=medium effect, and .8=large effect (Cohen, 1988)
*Indicates a statistically significant difference at the adjusted alpha level of .01.

Infantry Discussion

The items on which the Infantry only comparisons show significant differences are some of the same items as indicated in the overall analyses. One primary difference between the overall analyses and that using only Infantry units is the lack of a significant difference between experimental and control groups on item 8A, Did Sustainment requirements interrupt or affect mission accomplishment. Compared to other types of units, Infantry is the branch of the Army that is trained specifically in close range, face-to-face ground combat. Thus, primary purposes of the Infantry include engaging in offensive and defensive operations particularly via the movement and maneuver warfighting function. However, in order to maintain a tactical edge, these units must also successfully engage in the sustainment warfighting function. As indicated by the results, regardless of group assignment (control or experimental), most units performed to minimum standard or below concerning sustainment operations. If sustainment operations are not a priority, then they can't interrupt or affect mission completion. For instance, the majority of mean performance scores on the sustainment checklist for Infantry were less than 2.30 (indicating minimally standard performance) and less than the average mean performance score when all unit types and rotations were included (2.50). Thus, a requirement for all units, especially Infantry, should be more focus on improving sustainment operations via training at home station and during combat training center rotations.

Infantry Platoons, FOF phase, and Deliberate Missions

Differences between control and experimental groups using only Infantry have already been discussed. The Infantry control group were more likely to conduct a COMMEX, have a PACE plan, and communicate better with higher echelons/supporting elements, while the Infantry experimental group was better at coordinating with other units, submitting reports, and requesting resupply. Army Doctrine places considerable emphasis on sustainment operations for the lower echelons of Infantry, specifically the platoon and squad (Field Manual 3-21.8; see also FM 3-21.10 for discussion of Sustainment at the Company level). Chapters 6 of FM 3-21.8 describes responsibilities for platoon and squad leaders and provides clarification on planning and resupply efforts within sustainment operations. The majority of unit type observed in the current project were Infantry and most were at the platoon size echelon.

As identified earlier, the Infantry platoon is a critical echelon for not only conducting combat operations, but for the continuation of the combat mission, namely through effective sustainment operations. The FOF phase of JRTC rotations is an opportunity for units to exhibit combat effectiveness. Thus, we have the present opportunity to examine such effectiveness against the backdrop of sustainment. Finally, the Infantry mission should include the sustainment warfighting function, especially in deliberate missions. Deliberate missions provide more time (than hasty missions) to effectively plan for continued operations; this type of mission is also examined using only Infantry units. To provide further insight into Infantry unit performance the following Infantry subgroups are explored in order, the Platoon echelon, during FOF rotations and while conducting Deliberate missions.

Size of Unit: Platoon

Differences between Infantry control (n = 101) and Infantry experimental groups (n = 74) at the platoon size were assessed by section. **Section II: Unit Information.** There were no significant differences in performance between control and experimental Infantry groups of platoon size on any of the items in this section (all $p > .01$). **Section III: Planning.** There were significant differences between the Infantry units in the control versus the experimental groups on item 9A, Did the unit conduct a COMMEX, χ^2 (1, N = 165) = 11.68, p = .001, *phi* = .27 and item 9B, Did the unit have a PACE plan, χ^2 (1, N = 150) = 9.54, p = .002, *phi* = .25. The control group was more likely to conduct a COMMEX and have a PACE plan than the experimental group. **Section IV: Mission Execution.** There were no significant differences in performance between control and experimental Infantry groups of platoon size on any of the items in this section (all $p > .01$). **Section V: Follow-Up Operations.** The Infantry experimental group performed significantly better on item 4, Did the unit submit expenditure report/LOGSTAT and request resupply, χ^2 (1, N = 134) = 11.84, p = .001, *phi* = -.30.

Type of Phase: FOF

Differences between the Infantry control (n = 48) and Infantry experimental (n = 53) groups during the FOF phase were assessed by section. **Section II: Unit Information.** There were significant differences between the Infantry control (M = 2.78, SD = 0.69) and Infantry experimental groups (M = 2.29, SD =1.14) on item 8B, How well was required equipment maintained, t (85.97) = 2.52, p = .014. Infantry units in the experimental group maintained their equipment better. **Section III: Planning.** The Infantry control group performed significantly better on item 9A, Did the unit conduct a COMMEX, χ^2 (1, N = 92) = 6.43, p = .011, *phi* = .26. **Section IV: Mission Execution.** There were no significant differences in performance between control and experimental Infantry groups during the FOF phase on any of the items in this section (all $p > .01$). **Section V: Follow-Up Operations.** There were no significant differences in performance between control and experimental Infantry groups during the FOF phase on any of the items in this section (all $p > .01$).

Type of Mission: Deliberate

Differences between Infantry control (n = 85) and Infantry experimental groups (n = 67) conducting deliberate missions were assessed by section. **Section II: Unit Information.** There were no significant differences in performance between control and experimental Infantry groups conducting deliberate missions on any of the items in this section (all $p > .01$). **Section III: Planning.** There were no significant differences in performance between control and experimental Infantry groups conducting deliberate missions on any of the items in this section (all $p > .01$). **Section IV: Mission Execution.** There were no significant differences in performance between control and experimental Infantry groups conducting deliberate missions on any of the items in this section (all $p > .01$). **Section V: Follow-Up Operations.** The Infantry experimental group performed significantly better on item 4, Did the unit submit expenditure report/LOGSTAT and request resupply, χ^2 (1, N = 120) = 14.94, p = .000, *phi* = -.35. The Infantry experimental group was also significantly more likely to be interrupted or affected by Sustainment requirements (item 8A), χ^2 (1, N = 133) = 10.02, p = .002, *phi* = -.27, and Have friction points exist between the unit and higher echelons/supporting elements, χ^2 (1, N = 130) = 6.09, p = .014, *phi* = -.22.

Infantry Subgroup Discussion

Across all Infantry subgroups, the experimental group, regardless of size of mission, type of phase, and type of mission, were better at submitting expenditure reports/LOGSTAT and requesting resupply. Submitting LOGSTATs is specifically mentioned on the Sustainment Warfighting Function Guide. Infantry units of platoon size in the control group and during the FOF phase were more likely to conduct a COMMEX. Conducting a COMMEX is not present on the Sustainment Warfighting guide.

Infantry units in the experimental group conducting deliberate missions and during the FOF phase were more likely to coordinate with other units for sustainment support. Coordination was specifically mentioned on the guide. However, this group was also more likely to be interrupted by sustainment requirements and have friction points between higher echelons/supporting elements. Thus, results were sporadic across these subgroup analyses, leaving little room for further conclusive remarks.

Appendix E

Abbreviated Learning Techniques

Technique	Academic Reference (students/teachers)	Military Reference* (Soldiers)	Medium	Methods for employing
Shallow				
Signaling	Stull & Mayer (2007)	Vogel-Walcutt, Fiorella & Malone (2013)	Paper/pencil	Emphasize the most important material with arrows or visual cues.
Pre-training	Kester et al., (2001)	Vogel-Walcutt, Fiorella, & Malone, (2013)	Computer	Provide necessary background information prior to training so learners can build a foundation for new information.
Multimedia and spatial/temporal contiguity	Bodemer, Ploetzner, Feuerlein & Spada (2004) Moreno & Valdez (2007)	Vogel-Walcutt, Fiorella, & Malone, (2013)	Paper/pencil Computer	Present training material using pictures and words together.
Demonstration-based training	Renkl, Atkinson, Maier, & Staley (2002)	Anderson et al., (2010); Salas et al., (2009)	Computer program	Incorporate correct and incorrect demonstrations using good and bad examples.
Structure and function	Kieras & Bovair (1986)	Anderson et al., (2010)	Verbal Models	Provide instructions that emphasize the structure and function of the task, rather than the list.
Re-reading	Rothkopf (1968); Dunlosky et al.,(2013)		Paper/pencil	Re-reading the paragraph or text to identify the main ideas.
Intermediate				
Cueing/cued recall	Pyc & Rawson (2010)		Paper/pencil	Establish a cue or cue a memory from storage, easy access via prompt.
Mnemonic creation	Levin (1992)	Anderson et al., (2010)	Paper/pencil	Chunking words, lists of tasks, or a long process into an acronym can help with remembering lists or concepts easily.
Keyword mnemonic creation	Atkinson & Raugh (1975); Dunlosky et al., (2013)		Computer	Using keywords or mental imagery to associate verbal materials with images for better retention.
Visualize and draw graphics	Talley (1973); Wu, Krajcik, & Soloway et al., (2001)	Anderson et al., (2010); Zipperer et al., (2003)	Computer	Visualization of the text or training material and drawing of necessary graphics and plans.
Deep				
Goal setting	Eccles & Wigfield (2002)	Vogel-Walcutt, Fiorella, & Malone (2013)	Paper/pencil	Setting specific and reachable goals motivates focus on relevant material.
Chunking	Mautone & Mayer (2007)	Vogel-Walcutt, Fiorella, & Malone (2013)	Paper/pencil	Splitting information into manageable chunks for better short term memory storage.

Questions Self testing	King (1992); Dunlosky et al., (2013)		Paper/pencil	Test trainees on the material (with open ended questions, sentence completion tasks, or verbal walkthroughs of a task) can enhance retention.
Self explanation	Atkinson, Renkl, & Merrill (2003); Berry (1983); King (1994); Dunlosky et al., (2013)	Vogel-Walcutt, Fiorella, & Malone (2013)	Verbal	Explicitly explain all steps to working out a problem, see the structure, explain how new information is integrated with old, or steps taken during problem solving.
Metacognitive prompting and processing	Berthold, Nuckles, & Renkl (2007)	Fiore, Hoffman, & Salas (2008); Vogel-Walcutt, Fiorella, & Malone (2013)	Paper/pencil	Provides trainees with prompting that encourages reflection on understanding of the material to help them select appropriate learning strategies.
Elaboration	Craik et al., (1972); Pressley, Johnson, & Symons (1987); Dunlosky et al., (2013)		Paper/pencil	Elaborate on and rehearse each point and how they related back to the squad for deeper processing and better retention (includes self-reference effect).
Summarization and note taking	Bretzing & Kulhavy (1979); King (1992)		Paper/pencil	Writing summaries or notes of plans or training material and attended to and extracting higher level meaning and gist of material.
Generation of material	Jacoby (1978); Dunlosky et al., (2013)		Verbal	Generating materials (answers, questions, plans, or graphics) to promote deeper processing.

*Also refer to Army Doctrine Publication 7-0 and Army Doctrine Reference Publication 7-0, both entitled, *Training Units and Developing Leaders.*