

ARMY RESEARCH LABORATORY



**Personnel and Training Evaluation for the
M270A1 Fire Control System**

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ARL-MR-546

SEPTEMBER 2002

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Army Research Laboratory

Aberdeen Proving Ground, MD 21005-5425

ARL-MR-546

September 2002

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ACKNOWLEDGMENTS

Special thanks to SFC James Yahraes, SSG Paulino Lopez, and others from the U.S. Army Field Artillery School for sharing their expertise with the M270A1 weapon system and for their willingness to assist in this evaluation.

Special thanks to T.J. Johnstone, Training and Doctrine Command System Manager-Rocket and Missile Systems, for his trust and commitment to providing the necessary support and resources for this evaluation to take place.

Finally, special thanks to Tim Kogler of the U.S. Army Evaluation Center and Laurel Allender of the U.S. Army Research Laboratory (ARL) for their guidance in developing the structure of the evaluation and to Celine Richer of ARL for her help with IMPRINT.

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PERSONNEL AND TRAINING EVALUATION FOR THE M270A1 FIRE CONTROL SYSTEM

1. Introduction

The Human Research and Engineering Directorate of the U.S. Army Research Laboratory (ARL) performed a personnel and training evaluation of the M270A1 multiple launch rocket system (MLRS) fire control system (FCS) for the Training and Doctrine Command System Manager-Rocket and Missile Systems (TSM-RAMS) at Fort Sill, Oklahoma. The M270A1 FCS is an improved version of the current M270 FCS. It improves the capability and versatility of the FCS by using a “Windows¹-like” operating system. During the time of this evaluation, the M270A1 was in the engineering and manufacturing development phase of acquisition.

Improving the capability and versatility of the operating system does not necessarily improve the usability of the operating system. The complexity of the system can affect personnel and training requirements of the military occupational specialty (MOS) 13M for successful operation of the FCS. Therefore, the evaluation was performed to determine if personnel and training requirements should be changed to provide effective training for the new FCS.

2. Objective

The objective of this study was to answer three concerns that are addressed in the following questions:

1. Does the new FCS require a higher aptitude for the 13M?
 2. How often will the trained 13M need retraining?
 3. Does the current soldier entering the 13M crew member course need training in Windows before entering the course?
-

3. Background

The M270A1 FCS provides overall control of the M270A1 launcher. This includes executing fire missions for missile and rocket munitions, performing reloading operations, providing secure

¹Windows is a trademark of Microsoft Corporation.

digital communications with upper echelons, and providing vehicle location information to the FCS and the crew. The FCS is equipped with a global positioning system (GPS), built-in test, and built-in test equipment and is capable of isolating malfunctions in the circuit card assemblies.

During the time of this evaluation, there was a concern within the TSM-RAMS office and with the instructors at the U.S. Army Field Artillery School (USAFAS) that many students who presently enter the 13M crew member course may not have the capabilities and skills to successfully complete the training for operating the new FCS. While the operating system for the M270A1 FCS provides more capabilities for the gunner, it also requires that he or she must learn and remember more procedures. Therefore, specific concerns must be addressed in order to select qualified soldiers and properly train them. In addition, retention of the training is also a concern. Many MOS 13Ms will not apply this training for months, possibly even years after they complete their initial training, based on their assignments after training. Their proficiency in these skills may lessen over time.

In conjunction with the M270A1 FCS, a 13M crew member is also required to operate a portable computer, commonly referred to as the Soldier's Portable On-System Repair Tool (SPORT). SPORT's main functions are to host the Interactive Electronic Technical Manual (IETM) and interface with the FCS to download data files. The operating system used by SPORT is currently Windows 95. This additional piece of equipment adds concerns in the area of training. Current 13M crew member courses provide instruction to soldiers about how to use printed technical manuals. Instructing a soldier to use an IETM will require familiarity with Windows 95.

The personnel and training evaluation included an examination of three issues. The first issue was to determine whether the Armed Services Vocational Aptitude Battery (ASVAB) aptitude area cut-off score² for Operator and Food (OF) handler for entrance into the 13M crew member course needed to be raised to accommodate for a more complex FCS. The aptitude area, OF, is comprised of a set of ASVAB subtests used to measure the soldier's ability to operate the MLRS. The second issue was to determine how long a trained 13M crew member can retain proficiency before there is a need for retraining. The third issue was to determine if there is a need to include Windows training for incoming 13M crew member students for effectiveness on both the FCS and the SPORT.

² Cut-off score is the lowest possible score for acceptance into the course for a particular MOS. For the MOS 13M, an individual must score 105 or better in specific areas of the ASVAB to be accepted into the 13M crew member course.

4. Approach

The approach of the personnel and training evaluation was threefold. First, use the Improved Performance Research Integration Tool (IMPRINT) (Dynamics Research Corporation, 1999) to determine if the current ASVAB composite cut-off score for entering the 13M crew member course was restrictive enough to allow only those who were capable of operating the new FCS. Second, use the U.S. Army Research Institute's (ARI) Military Task Retention Prediction Model (ARI, 1985) to predict when a soldier's retention for performing specific tasks had dropped below a desired level of proficiency. Third, perform a study to determine the percentage of current 13M crew member students who are familiar with Windows.

5. Evaluation Procedure

An evaluation team was established between representatives from ARL, TSM-RAMS, and USAFAS. Five of the representatives from TSM-RAMS and USAFAS, identified as MLRS trainers and users, served as subject matter experts (SMEs) on the new FCS. The members of this team identified selected missions, functions, and tasks for the fire control operations and the SPORT IETM operations. A task was defined as a simple action that has a measurement of time and probability of success. For example, pressing a button or typing a series of words or numbers would be a task. Tasks grouped together to meet a certain objective are called a function. The mission was defined by the series of functions that are necessary to complete the mission. In addition, the SMEs worked closely with ARL to help establish the necessary input parameters for the models and provide needed expertise for the Windows familiarity study.

The workload imposed on a 13M crew member when he or she is operating the new FCS will be manifested through visual, auditory, cognitive, and psychomotor requirements. To thoroughly define the workload placed on a 13M crew member, the operation of the new FCS was examined task by task within specified functions of a fire mission. In the interest of saving time, every task for every function of the FCS could not be examined. Therefore, the operating tasks involved in a fire mission during usual conditions, as defined by the IETM (1999), were selected to provide a sample of what a 13M crew member would experience when using the FCS. This included tasks that were part of the following functions: initialize the FCS, program the FCS, load the GPS keys, and perform a fire mission. In addition, the operation of building a database was also included as a function in the evaluation. This provided a thorough representation of the different operating tasks that are used during operation of the FCS. Selected functions that use ETM on SPORT were also evaluated. Three functions were selected that best represent the tasks that would be common to the 13M crew member when IETM is used. These include an information

search for preventive maintenance checks and services (PMCS), troubleshooting, and manual launcher module (LM) operations.

The FCS and IETM functions and tasks were used in the IMPRINT and military task retention analyses to address the concerns about aptitude requirements and retention. In addition, some of the functions include tasks that require a basic understanding of Windows operations, such as opening, minimizing, maximizing, and saving files in Windows WordPad. The Windows familiarity study addressed the concern about whether Windows training is needed. The procedures and results for each of the models and the study are provided in detail in the following sections.

6. IMPRINT Model

Soldiers currently entering the 13M crew member course are required to have an ASVAB OF score of 105 or better (Department of the Army, 1999). When the training begins for the new FCS and SPORT, its complexity will increase. This complexity may require students to have higher aptitudes and thus require a higher cut-off score for entrance into the 13M crew member course. Manpower availability, however, may restrict the cut-off scores from being raised. It is also worth noting that future manpower limitations may cause the cutoff to be lower than 105. Therefore, the performance of individuals who have cut-off scores lower than 105 should be taken into account. Based on recommendations from the SMEs, cut-off scores ranging from 90 to 115 were addressed.

An additional training concern is that newly trained 13M crew members may not immediately be assigned to an M270A1 vehicle. Some may not operate the M270A1 FCS for a year or more. For these individuals, the time since their last training may also affect their operating performance on the M270A1 FCS because of reduced proficiency of the learned tasks.

6.1 Procedure

Task models were prepared for each function developed with IMPRINT to determine if changing the aptitude area cut-off score is necessary to meet the workload requirements of the 13M crew member for operating the new FCS and SPORT. The baseline model included personnel characteristic parameters that were similar to a current 13M crew member having an ASVAB OF cut-off score of 105. These parameters also included the mean time and probability of success required to correctly complete each of the tasks of the selected FCS and SPORT IETM functions as determined by the evaluation team. The mean task time was defined as the average time that it would take individuals with similar aptitude and training to successfully complete the task in the first attempt. Similarly, the probability of success was defined as the percentage of individuals with similar aptitude and training who could successfully complete the task in the first attempt.

The baseline mean times and probabilities of success were established by the SMEs at the Field Artillery School at Fort Sill who have first-hand experience using the M270A1 FCS. IMPRINT was then used to predict how these task times and probabilities of success would be impacted as cut-off scores and training frequency were varied.

To examine the effects of the ASVAB OF cut-off score on performance, the personnel characteristics, training frequency, and stressor option of IMPRINT was used. This option allows the user to observe changes in time and probability of success when personnel characteristics (cut-off scores), training frequency, and stressors (such as temperature or sleep deprivation) are varied. Specifically, only the personnel characteristics (see Figure 1) and training frequency (see Figure 2) were manipulated for this evaluation.

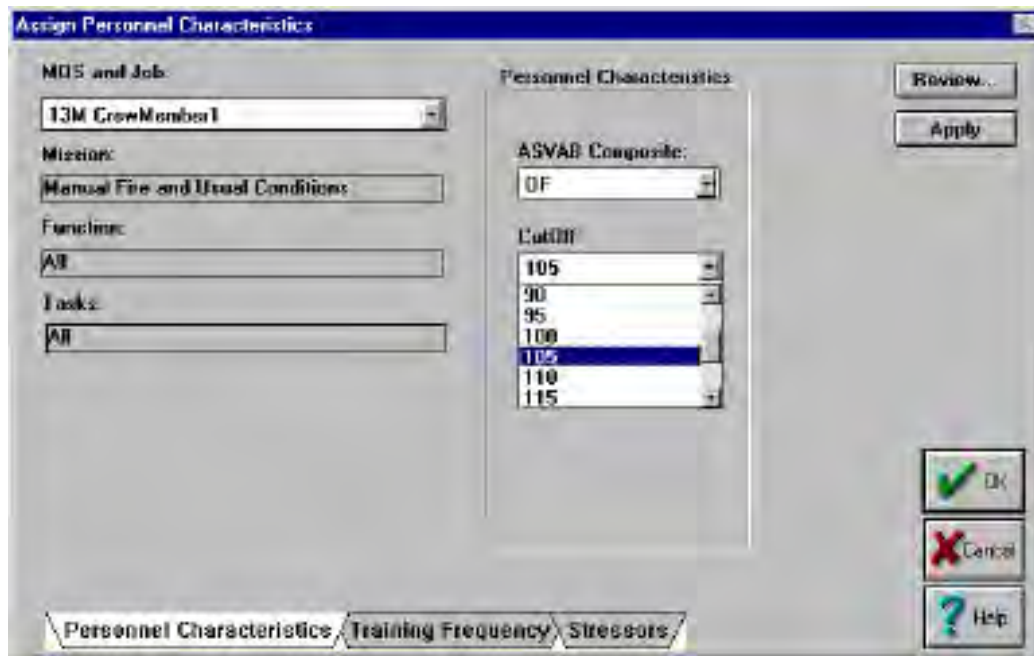


Figure 1. IMPRINT option to vary the personnel characteristics.

In Figure 1, the author manipulated the personnel characteristics by changing the cut-off score. For this model, performance comparisons were made between the baseline cut-off score of 105 and the following cut-off scores: 110 and 115 for the higher aptitudes and 100, 95, and 90 for the lower aptitudes. The cut-off scores of 110 and 115 were used to determine if higher aptitudes noticeably improved a 13M's performance with the M270A1. Conversely, the cut-off scores of 100, 95, and 90 were used to determine if lower aptitudes noticeably degraded a 13M's performance. These comparisons were made for the occurrence of two types of training frequencies that were options available in IMPRINT (see Figure 2). The first training frequency was training that occurred once a month. This selection best describes the 13M crew member who is assigned to an M270A1 unit soon after training. The other IMPRINT option chosen for

training frequency was training that occurred “less than twice a year”. This represents the 13M crew member who is not assigned to an M270A1 unit for a year or more since first receiving training.

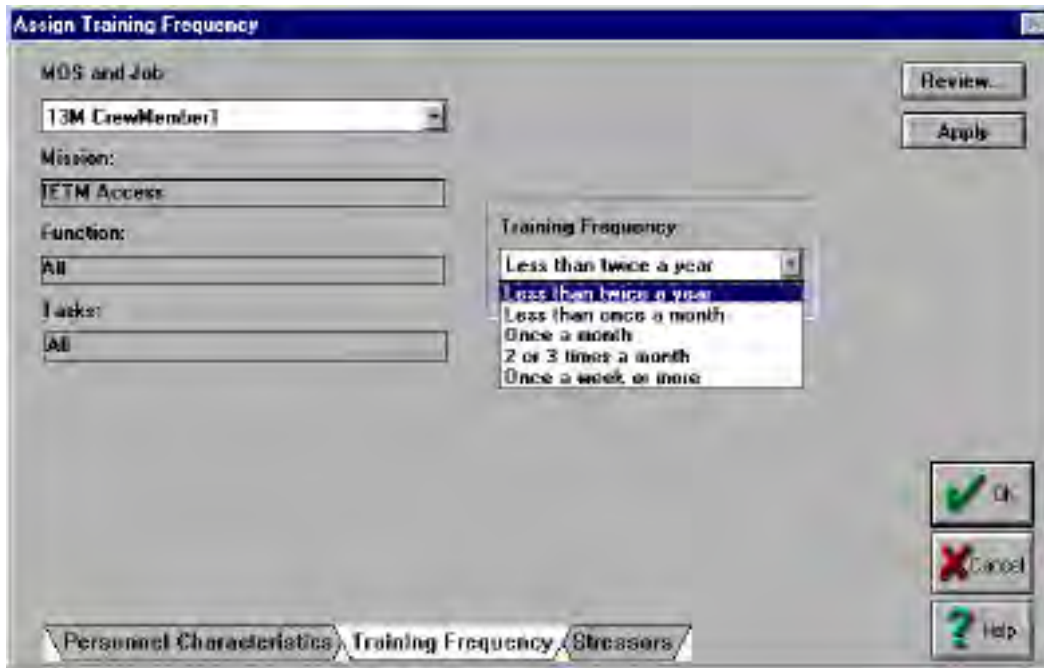


Figure 2. IMPRINT option to vary the training frequency.

With the personnel characteristics and training frequency options in IMPRINT, 12 variations of aptitude and training frequencies for the 13M crew member were included in the comparison. Each variation included a different combination for cut-off score and training frequency. Table 1 shows the variations for each of 12 runs. For each run, IMPRINT calculated the impact of each variation on the baseline task performance (time and probability of success). The differences in time and probability of success for operation of the new FCS for various cut-off scores and training frequencies when compared to the baseline were then evaluated.

6.2 Results

Most of the identified tasks performed on the FCS are very similar. Tasks typically required the 13M crew member to press a function button that corresponds to the options displayed on the panel display or type numbers using the keyboard. Pressing a function button or typing 8 to 10 digits does not require much time. Likewise, the tasks involved in operating the SPORT IETM were also similar to each other. Most involved moving the cursor to an icon or a “hot spot”. Therefore, in the model, the mean time to complete a task was small for each task. For the baseline ASVAB OF cut-off score of 105, the SMEs identified the mean time of each task as being between 1 and 10 seconds. Likewise, the SMEs defined the probability of success for an individual with an ASVAB OF cut-off score of 105 to complete each task. The probability of

success identified for each task ranged from 50% to 90%. The mean times and probability of success for each task are shown in Appendix A.

Table 1. Run variations for comparing the effects that the ASVAB OF cut-off score and training frequency have on task performance

Run	ASVAB Aptitude Cut-off Score	Training Frequency
1	90	Once a month
2	95	Once a month
3	100	Once a month
4	105	Once a month
5	110	Once a month
6	115	Once a month
7	90	Less than twice a year
8	95	Less than twice a year
9	100	Less than twice a year
10	105	Less than twice a year
11	110	Less than twice a year
12	115	Less than twice a year

Using the baseline parameters, IMPRINT generated new values for mean task time and probability of success for the variations of cut-off scores and training frequencies listed in Table 1. Table 2 summarizes the generated values for all the tasks included in the FCS and SPORT IETM operations. The differences (or deltas) in mean time and probability of success for a variation, when compared to the baseline values, were also determined. The deltas for every task for every variation are not reported, but the deltas for mean time and probability of success for every variation are summarized in Table 2. Table 2 also displays how much the mean time and probability of success changed for all tasks in the form of a range. For example, when training occurred once a month and the cut-off score was adjusted to 95, the mean time for all the tasks increased individually by anywhere from 0 to .05 second. Likewise, the probability of success for all the tasks decreased individually by anywhere from 4% to 8%. This is represented in Table 2 as -4% and -8%. Negative values represent a decrease.

Table 2 reveals that the mean time to perform any of the tasks included in the model for the FCS and SPORT IETM operations changed less than 5% by the variation of ASVAB OF cut-off scores, training frequency, or both. The probability of success for some tasks was affected for certain run variations, especially those tasks that initially had a low probability of success. However, since the tasks' mean times were relatively small, it is not clear whether the tasks with lower probabilities of success had an effect on the entire mission time. To evaluate the effect of combining tasks, mean times and probability of success were determined at the function level for different cut-off scores and training frequencies.

IMPRINT was then used to determine the total time for the specified functions at the different run variations. IMPRINT took into account the mean times for all the tasks within each function. IMPRINT also considered the probability of success for each task and determined the number of

times that a task needs to be attempted until it is successfully completed. Each time a task is attempted, the time to complete that task becomes a multiple of its mean time and the number of attempts. The following figures show how the variations in ASVAB OF cut-off scores and training frequency affect the times of each function because of repeated tasks.

Table 2. Estimated task performance change for the 13M crew members for various cut-off scores and training frequency for all tasks included in the FCS and SPORT IETM operations

Training – Once a month		
Cut-off Score	Mean Time Delta	Probability of Success Delta
90	0.00 to 0.07 seconds	-4 to -11% ^a
95	0.00 to 0.05 seconds	-4 to -8% ^a
100	0.01 to 0.03 seconds	-2 to -4% ^a
105*	0 seconds	0%
110	-0.01 to -0.03 seconds ^a	2 to 5%
115	-0.02 to -0.05 seconds ^a	4 to 10%
Training – Less than twice a year		
Cut-off Score	Mean Time Delta	Probability of Success Delta
90	0.00 to 0.12 seconds	-8 to -21% ^a
95	0.00 to 0.11 seconds	-6 to -18% ^a
100	0.01 to 0.09 seconds	-4 to -15% ^a
105	0.00 to 0.07 seconds	-2 to -10% ^a
110	-0.04 to 0.07 seconds ^a	0 to -10% ^a
115	-0.06 to 0.03 seconds ^a	2 to -5% ^a

*Baseline for comparison

^aNegative sign represents decrease

In Figures 3 and 4, the function time for programming the FCS was affected when the ASVAB OF cut-off score was varied for both training frequencies. For a training frequency of once a month, the completion time for this function changes by 1 to 1.5 minutes for every 5-point change in ASVAB OF cut-off score. When the training frequency is less than twice a year, the completion time for this function changes by 1.5 to 2 minutes for every 5-point change in ASVAB OF cut-off score.

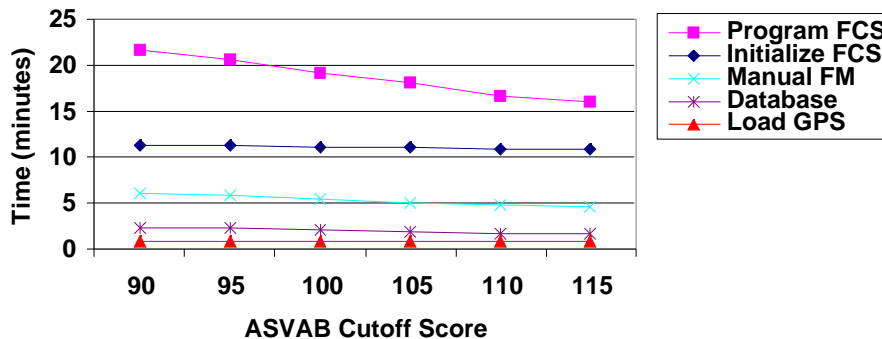


Figure 3 . FCS function times versus ASVAB OF cut-off score (once a month training frequency).

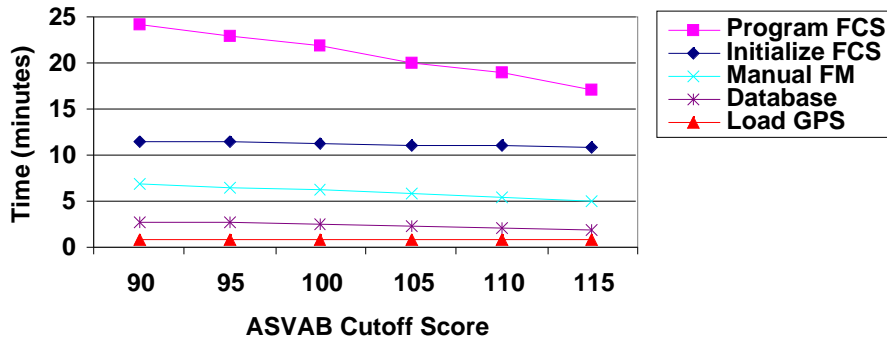


Figure 4. FCS function times versus ASVAB OF cut-off score (less than twice a year training frequency).

Figures 5 and 6 show completion times for the selected functions for IETM operations. As can be seen, the completion times did not change as a function of ASVAB OF cut-off score for either training frequency.

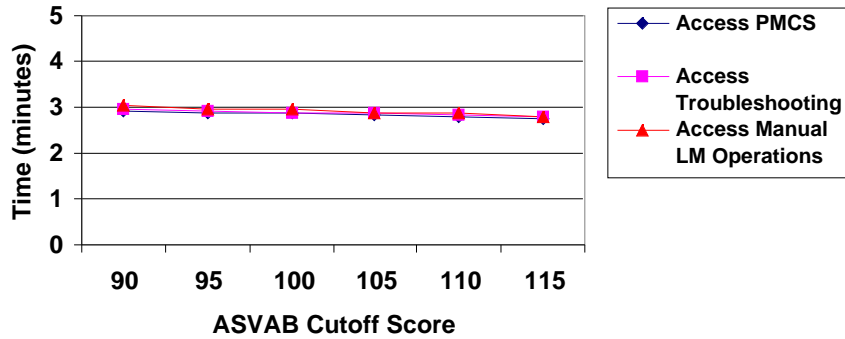


Figure 5. IETM function times versus ASVAB OF cut-off score (once a month training frequency).

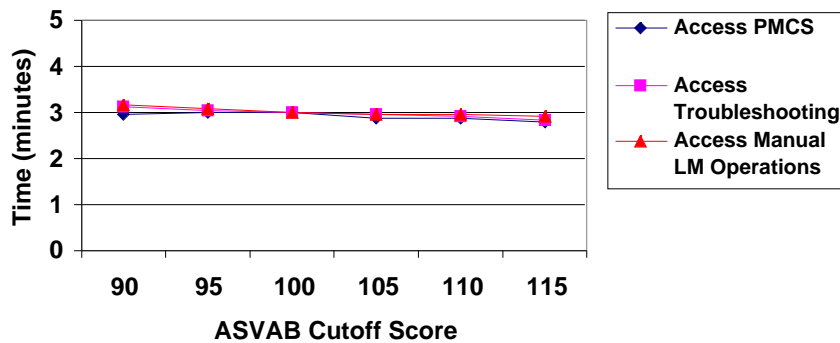


Figure 6. IETM function times versus ASVAB OF cut-off score (less than twice a year training frequency).

7. Military Task Retention Prediction Model

7.1 Procedure

Soldiers may forget tasks that are not practiced on a regular basis. Therefore, periodic sustainment training may be needed after the initial training for the soldiers to remain proficient in the tasks that are difficult to remember. With numerous tasks involved in the use of the FCS and the SPORT IETM, it is necessary to understand the training frequency needed to maintain a desired level of proficiency. It is also important to know the specific tasks that require retraining and which do not in order to reduce the retraining time.

Under contract to ARI, the American Institutes for Research developed a method for predicting how rapidly individual tasks that were once learned are forgotten when there are intervals of no practice (ARI, 1985). The results from this model are used to determine which tasks require retraining and the frequency of retraining. The model uses a prediction method for task retention that is based on whether a task contains characteristics known to influence retention (memory aides, sequences, etc). The model contains ten multiple choice questions that include each retention characteristic (see Appendix B). Each question has answers that can be chosen, which are weighted with a particular numerical value. When the series of questions for each task has been answered, the numerical values of each answer are summed. The total value is the retention score for that particular task. The score is then evaluated by the performance prediction tables shown in Appendix C.

The numbers within the body of the performance prediction tables represent the expected percentage of previously trained soldiers who are able to perform a task correctly after a given interval with no practice. The first table provides the predictions for monthly intervals (until 12 months). The second table provides the predictions for weekly intervals (until 26 weeks).

To determine the percentage of soldiers able to correctly perform a task for a chosen period of time, one must first select the number in the left column of the table closest in value to the retention score of each task. Then, reading across the top, one must select the desired time interval. The table entry that corresponds with the task score and the time interval is the percentage of soldiers who could be expected to perform the task correctly at that time interval. This is also considered the level of proficiency. In addition, the table can provide the time interval for retraining learned material. When the desired level of proficiency and the task numerical value are known, the time interval for retraining can be determined.

As stated before, all the operational tasks were evaluated for retention via the methods of the Military Task Retention Prediction Model. The model's instructions suggest that the 10 questions should be answered by at least two SMEs. For this evaluation, five instructors who are specifically assigned to the M270A1 scored the tasks. The scoring was done by consensus

through a “round table” discussion. If there were any differences in answers (scores) within the group for a certain question, the group discussed that question for the related task until an agreement was reached. The scores for each task are provided in Appendix D.

7.2 Results

In Appendix D, the task score sheets are arranged by the specific functions for the FCS and IETM operations. The score sheets show the task score for each retention question as well as the total score. Not all questions needed to be answered for all tasks, as seen by the blanks on the score sheets. Some questions were included solely to provide more detail for the answer that was provided in the previous question. Other times, these questions were skipped. When that occurred, the model directed the raters to skip to the next relevant question.

During the evaluation of the tasks, the author felt that since some of the functions included more than 70 tasks, it was necessary to also evaluate the function as whole with the scoring process of the model. The scores for the functions are also included in Appendix D.

Table 3 represents a modified version of the performance prediction tables from Appendix C. The second column in the table includes the percentage of all tasks that had a retention score that corresponded closest to the retention score in the first column. In Table 3, 55% of the tasks had a score close to 180 or higher. A score of 180 or higher predicts that 100% of those trained to perform those tasks will remember how to perform them for more than 1 year. Another 37% of the tasks scored between 175 and 155. This group of tasks will require retraining some time between 3 months and 1 year to maintain a level of proficiency of 70% (how many soldiers in 100 still remember how to perform the task). Approximately 8% fall below 155. This remaining group of tasks will require retraining some time between 1 month and 3 months to maintain a level of proficiency of 70%. The level of proficiency of 70% was chosen arbitrarily to show one scenario of when retraining is needed.

The numbers in the columns under “Since Last Performance” in Table 3 represent the level of proficiency. As mentioned before, when a task with a certain retention score drops below a desired level of proficiency, it is time to retrain that task. The desired level of proficiency is not a set number. It varies with the mission and the availability for retraining and is left to the user’s discretion. No specific target figure was selected for comparison in this report.

The retention score for each of the FCS and the IETM functions is also scored and shown in Table 4. Because some functions include numerous tasks and in some cases, require tasks to be done sequentially, the functions as a whole were evaluated. The results show that the retention scores for the functions are noticeably smaller than the retention scores for the individual tasks. When the function retention scores are compared to the prediction tables, it is seen that there is a significant loss of retention after the first month.

Table 3. Modified performance prediction table with score percentages

Score	% of Tasks	Since Last Performance				
		1 month	3 months	6 months	9 months	1 year
180+	55.0	100	100	100	100	100
175	5.8	97	92	85	79	73
170	11.6	94	85	72	62	53
165	1.9	92	78	61	48	37
160	14.3	89	71	51	36	26
155	3.1	86	64	42	27	17
150	0.0	83	58	34	20	11
145	0.0	80	52	27	14	7
140	3.5	77	46	21	10	4
135	0.4	74	40	16	6	2
130	0.0	70	35	12	4	1
125	0.8	67	30	9	2	0
120	0.4	63	25	6	1	0
115	0.0	59	20	4	0	0
110	0.8	54	16	2	0	0
105	0.0	50	12	1	0	0
100	0.4	44	8	0	0	0
95	0.8	38	4	0	0	0
90	0.0	31	3	0	0	0
85	0.4	22	1	0	0	0
80	0.0	3	0	0	0	0
75	0.0	0	0	0	0	0
70 or less	0.8	0	0	0	0	0

Table 4. Military task retention prediction score for each function

Function	Retention Score
Initialize the FCS	48
Program the FCS	74
Load the GPS keys	68
Build a Database	84
Perform a Fire Mission	58
IETM – PMCS Access	99
IETM – Access Troubleshooting	99
IETM – Access Manual LM Operations	99

8. Windows Familiarity Study

8.1 Procedure

A study was performed with 40 participants from the 13M crew member course at Fort Sill to determine how familiar incoming students were with Windows³. The format for this study was

³The investigator has adhered to the policies for protection of human subjects as prescribed in AR 70-25

based on related research conducted by the U.S. Army Global Combat Support System (GCSS) at Fort Hood, Texas⁴. GCSS performed the study as a pre-test, training, and post-test design. More specifically, GCSS scored the pre-test and post-test as either pass or fail. Failure was considered less than 10 of 10 (100%).

The procedure for the Fort Sill study began by each participant being placed in front of a PC that used Windows 95 as the operating system. The participants were then asked to complete a 10-step test of basic Windows procedures (see Appendix E). The author and SMEs developed this test, based on the GCSS Windows test. Each participant was given a maximum time of 3 minutes per task. When a participant had completed the task or the 3 minutes had expired, the test administrator determined if he or she had done the task correctly. If a participant did not successfully complete a task in the allotted time, the test administrator recorded it as unsuccessful and prepared the PC for the next task. The participant was prevented from watching the test administrator prepare the PC in order to avoid confounding the study by any learning that took place during the test administrator's key strokes or menu selection.

The test administrator gathered participants on a voluntary basis from students who were currently attending the 13M crew member course. The participants were informed of the purpose for the study and were instructed about the test procedure. They were also asked for their consent to allow the release of their ASVAB OF scores to the principal investigator of the study. The scores were used to determine if there was a correlation between ASVAB OF scores and their score on the Windows familiarity study. Upon each participant's consent, the study was performed. When all ten tasks (questions) were attempted and scored, the participants rejoined their class, and their scores were tallied and recorded.

8.2 Results

The results from the 10-question Windows familiarity test are displayed in Figure 7. The scores of the 40 participants from the 13M crew member course ranged from 0 to 10 correct. Ten participants of the 40 performed all 10 tasks correctly. Twenty-nine of 40 were able to correctly complete 7 or more of the 10 tasks. Two participants said that they were not familiar with Windows at any level and could not correctly perform any of the tasks. The scores were also segregated task by task. The results are seen in Table 5.

⁴ Private conversation with individuals from the GCSS, Fort Hood.

The GCSS study results showed that 27% scored 10 of 10. That corresponds with the results in Figure 7 in which 25% scored 10 of 10. Figure 7 also shows that most participants are familiar with Windows. The question then is whether training is necessary for those who did not perform well or even marginally well. The GCSS results provide one answer to that question. When 1.5 to 2 days of Windows training were provided to those GCSS participants who scored less than 10 of 10 on the pre-test, an additional 64% scored 10 of 10 on the post-test (similar to the pre-test) upon completion of the Windows training. A total of 91% were proficient in Windows when 1 to 2 days of training were offered.

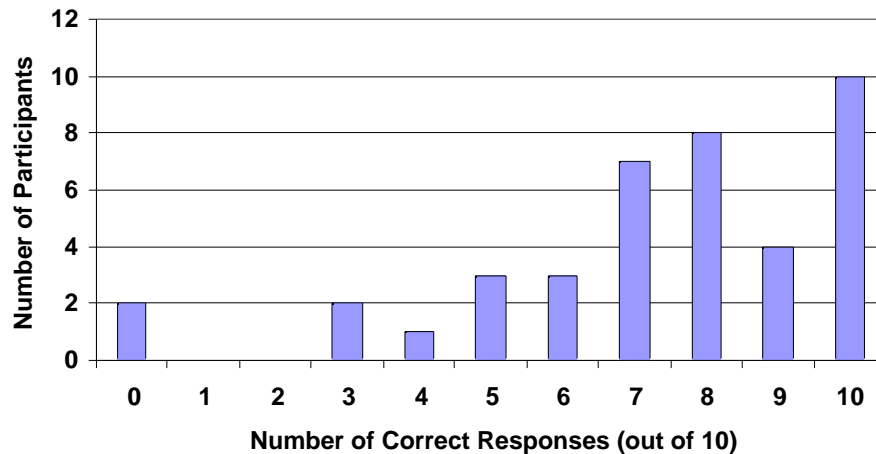


Figure 7. Ranking of correct tasks by participants in the windows familiarity study.

Table 5. Windows familiarity results for each task

Task	Number of participants successfully completing the task
1. Navigate Menus - Open, Minimize	17 (43%)
2. Maximize & Close Programs	23 (58%)
3. Open File in WordPad	34 (85%)
4. Create a Document in WordPad	35 (88%)
5. Save a File	37 (93%)
6. Copy Text from a File	23 (58%)
7. Paste Text to Another File	28 (70%)
8. Cut & Paste Text	34 (85%)
9. Access Topic in Help	35 (88%)
10. Open Mouse in Control Panel	26 (65%)

9. Conclusions

9.1 IMPRINT Model

The model for the 13M crew member's performance for the various runs in IMPRINT varied as one might expect when cut-off scores and training frequency were varied. When ASVAB OF cut-off scores were raised above the baseline (105), the mean time decreased and the probability of success increased for completion of the tasks. Conversely, when ASVAB OF cut-off scores were lowered below 105, the mean time increased and the probability of success decreased for successful completion of the tasks. Moreover, the mean time and probability of success depended on training frequency. This is seen primarily for the function, programming the FCS. When training occurs less than twice a year, the mean time will be greater and probability of success to perform this function will be lower when compared to the mean time and probability of success to perform this function when training occurs once a month.

At the task level, the results from raising or lowering the cut-off scores, compared to the baseline, did not show much of an increase or decrease in the 13M crew member's overall performance per task. When the training frequency was less than twice a year, which is realistic for the 13M crew member, the performance of each task decreased when performance of each task was compared when training is conducted once a month. The decrease, however, was small.

When the results were evaluated at the function level, only the function time for programming the FCS was affected when the ASVAB OF cut-off scores was varied. The completion time changed as much as 10% when the cut-off score was varied by 5-point increments. The remaining functions for the FCS and SPORT IETM operations remained fairly constant when the ASVAB OF cut-off scores were varied. The change in function times, however, did increase as much as 10% for each function when the training frequency was changed from once a month to less than twice a year. The function time for programming the FCS was the only function that was affected when the ASVAB OF cut-off scores and the training frequency were both varied.

9.2 Military Task Retention Prediction Model

Fifty-five percent of all tasks for the FCS and SPORT IETM operations will maintain a level of proficiency of 100 for at least a year. The remaining 45% of tasks will fall below a level of proficiency of 70 within 6 months after training. When the prediction of retention for an entire function is observed, some functions have retention scores that fall below 70 one month after training.

Most of the tasks, individually, were simple and easy to remember. When they needed to be remembered together as a function, the level of proficiency decreased rapidly over time. A 13M

crew member will have difficulty remembering how to perform the functions if the FCS and IETM SPORT are not operated on a monthly basis.

9.3 Windows Familiarity Study

For the Windows familiarity study, the results show that most of the 13M crew member students have a basic familiarity with Windows. About 75% of the participants successfully completed 7 or more of the 10 tasks. By GCSS's standards for failure, only 25% of the participants could successfully complete 10 of 10. Based on the results from the GCSS study, a person's familiarity with Windows can be considerably enhanced with 1.5 to 2 days of Windows training.

10. Recommendations

- The IMPRINT results indicate that raising or lowering the ASVAB OF cut-off score would not greatly affect soldier performance with the FCS and the IETM.
- Because of a major concern about retention for operating the FCS and the SPORT IETM, it is recommended that instructional prompts be displayed on the screen to aid the 13M crew member in the proper operational sequence.
- It is also recommended that a checklist that can be accessed to provide details about whether required tasks have been performed to complete the operations of the FCS be embedded.
- Two days of Windows training would prepare most 13M crew member students for training on the M270A1 FCS.

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Appendix A: Task Mean Time and Probability of Success

Table A-1. Task mean and probability of success

Task ID	Task Name	Function Name	Time Mean	Prob Success
1	101 Ensure that ARM is set to SAFE and FIRE switch is DOWN	Initialize the FCS	00:00:02.00	90
2	102 Set SYSTEM POWER ON-Obs SYS PWR ON & FCP PWR indicator	Initialize the FCS	00:00:02.00	90
3	103 Adjust ALM VOL, DSPL BRT, & PNL BRT	Initialize the FCS	00:00:15.00	90
4	104 Wait for boot up	Initialize the FCS	00:02:00.00	90
5	105 Press STORE PF-key to select US language	Initialize the FCS	00:00:02.00	90
6	106 Wait for appropriate software to be downloaded	Initialize the FCS	00:04:00.00	90
7	107 Press SELECT for time source chg. or STORE to accept displayed	Initialize the FCS	00:00:02.00	90
8	108 Use arrow PF-keys to select ALPHA or ZULU, press ENTER	Initialize the FCS	00:00:03.00	90
9	109 Key in current hour, minute, and second - press ENTER after each	Initialize the FCS	00:00:10.00	90
10	110 Key in current day, month, and year - press ENTER after each	Initialize the FCS	00:00:10.00	90
11	111 Press RETURN PF-key to exit editing routine	Initialize the FCS	00:00:02.00	90
12	112 Press NEXT/PREVIOUS to toggle to another choice.	Initialize the FCS	00:00:02.00	90
13	113 Press SELECT PF-key to edit choice	Initialize the FCS	00:00:02.00	90
14	114 Scroll choices with arrow PF-keys, press ENTER	Initialize the FCS	00:00:03.00	90
15	115 Key in present EASTING from startup data form, press ENTER	Initialize the FCS	00:00:08.00	90
16	116 Key in present NORTHING from startup data form, press ENTER	Initialize the FCS	00:00:08.00	90
17	117 Key in present ALTITUDE (feet above sea level), press ENTER	Initialize the FCS	00:00:08.00	90
18	118 Key in present GRID ZONE, press ENTER PF-key	Initialize the FCS	00:00:04.00	90
19	119 Press RETURN PF-key to exit COORDINATE DISPLAY routine	Initialize the FCS	00:00:02.00	90
21	121 Press SELECT PF-key to edit INITIALIZE COMMS	Initialize the FCS	00:00:02.00	90
22	122 Use Arrows to scroll, YES to INITIALIZE COMMS or NO to skip	Initialize the FCS	00:00:02.00	90
23	123 For YES, press ENTER PF-key to complete system update	Initialize the FCS	00:00:02.00	90
24	124 Use PREV/NEXT to highlight desired FCS Net Channel SELECT	Initialize the FCS	00:00:04.00	90
25	125 Use UP/DOWN to highlight desired mode, press ENTER	Initialize the FCS	00:00:04.00	90
26	126 Press EDIT to edit Comms Data or press ENTER to accept Comms	Initialize the FCS	00:00:02.00	90
27	127 Use UP/DOWN to select desired On The Air Option (ON/OFF)	Initialize the FCS	00:00:04.00	90
28	128 Use UP/DOWN to select desired Crypto Status, press ENTER	Initialize the FCS	00:00:04.00	90
29	129 Press C/E, select desired PLT/TP BIT, press ENTER	Initialize the FCS	00:00:10.00	90
30	130 Press C/E, Key in desired PLT/TP Address, press ENTER	Initialize the FCS	00:00:06.00	90
31	131 Press C/E, Key in desired Own BIT value, press ENTER	Initialize the FCS	00:00:06.00	90
32	132 Press C/E, Key in desired Own Address value, press ENTER	Initialize the FCS	00:00:06.00	90

33	133 Press C/E, Key in desired BTRY Address value, press ENTER	Initialize the FCS	00:00:06.00	90
34	134 Use UP/DOWN for desired Access Delay Time data, ENTER	Initialize the FCS	00:00:04.00	90
35	135 Use UP/DOWN to select desired Baud Rate, press ENTER	Initialize the FCS	00:00:04.00	90
36	136 Use UP/DOWN to select desired Block Mode, press ENTER	Initialize the FCS	00:00:04.00	90
37	137 Use UP/DOWN to select desired Preamble, press ENTER	Initialize the FCS	00:00:04.00	90
38	138 Use UP/DOWN for desired Radio Net Busy Override, ENTER	Initialize the FCS	00:00:04.00	90
39	139 Use UP/DOWN for desired Accept Next Msg, press ENTER	Initialize the FCS	00:00:04.00	90
40	140 Use UP/DOWN for desired Use to BTRY Serial Num., ENTER	Initialize the FCS	00:00:04.00	90
41	141 Press C/E in desired BTRY Serial Number value, press ENTER	Initialize the FCS	00:00:06.00	90
42	142 Use UP/DOWN for desired Use to PLT/TP Serial Number, ENTER	Initialize the FCS	00:00:04.00	90
43	143 Press C/E for desired PLT/TP Serial Number value, press ENTER	Initialize the FCS	00:00:06.00	90
45	145 Press Return	Initialize the FCS	00:00:02.00	90
46	146 Press Enter	Initialize the FCS	00:00:02.00	90
48	148 Press SELECT to select Lot Numbers	Initialize the FCS	00:00:02.00	90
49	149 Use UP/DOWN to select weapon lot number, press ENTER	Initialize the FCS	00:00:04.00	90
50	150 Press ENTER PF-key	Initialize the FCS	00:00:02.00	90
51	151 Press SELECT to edit data or press ENTER to accept values	Initialize the FCS	00:00:02.00	90
52	152 Use UP/DOWN to select either YES or NO for HIGH QE, ENTER	Initialize the FCS	00:00:04.00	90
53	153 Press NEXT to edit LP/C2 DATA or press ENTER to accept	Initialize the FCS	00:00:02.00	90
54	154 Press SELECT to edit data or press ENTER to accept values	Initialize the FCS	00:00:02.00	90
55	155 Use UP/DOWN to select either YES or NO, press ENTER	Initialize the FCS	00:00:04.00	90
56	156 Press NEXT PF-key	Initialize the FCS	00:00:02.00	90
57	157 Press SELECT to edit USE LP/C 2 ON MALFUNCTION data	Initialize the FCS	00:00:02.00	90
58	158 Use UP/DOWN to STOP or CONTINUE for HANGFIRE, ENTER	Initialize the FCS	00:00:04.00	90
59	159 Press NEXT PF-key	Initialize the FCS	00:00:02.00	90
60	160 Press SELECT PF-key	Initialize the FCS	00:00:04.00	90
61	161 Use UP/DOWN to STOP or CONTINUE for MISFIRE, ENTER	Initialize the FCS	00:00:04.00	90
62	162 Press NEXT PF-key	Initialize the FCS	00:00:02.00	90
63	163 Press SELECT PF-key for DUD FUZE	Initialize the FCS	00:00:02.00	90
64	164 Use UP/DOWN to select SKIP or FIRE for DUD FUZE, ENTER	Initialize the FCS	00:00:04.00	90
65	165 Press ENTER PF-key	Initialize the FCS	00:00:02.00	90
66	166 Press HOME on keyboard	Initialize the FCS	00:00:02.00	90
67	167 Observe that INIT, RELOAD and weapon information is displayed	Initialize the FCS	00:00:02.00	90
68	168 Observe that WEAPON FUZE TEST IN PROGRESS is displayed	Initialize the FCS	00:00:02.00	90
69	169 Observe that WEAPON FUZE TEST COMPLETE is displayed	Initialize the FCS	00:00:02.00	90

70	170 Press STORE PF-key	Initialize the FCS	00:00:02.00	90
71	171 Press ENTER	Initialize the FCS	00:00:02.00	90
72	172 Press OPERATIONAL PF-key	Initialize the FCS	00:00:02.00	90
73	173 Using keyboard, enter 2 digit BIT, Press ENTER	Initialize the FCS	00:00:06.00	90
74	174 Press PREV/NEXT to select DEFAULT DESTINATION	Initialize the FCS	00:00:04.00	90
75	175 Press SELECT PF-K	Initialize the FCS	00:00:02.00	90
76	176 Use UP/DOWN to select DEFAULT DESTINATION & CHANNEL	Initialize the FCS	00:00:04.00	90
77	177 Press ENTER PF-K	Initialize the FCS	00:00:02.00	90
78	178 Press ENTER PF-K1	Initialize the FCS	00:00:02.00	90
79	179 Press OVERRIDE or CONTINUE LST	Initialize the FCS	00:00:02.00	90
1	201 Apply power to SPORT by pressing on/off button (top right corner)	Program the FCS	00:00:02.00	50
2	202 Press the FNC key until it is back lit	Program the FCS	00:00:02.00	50
3	203 Press the DEL/F8 key, when 'press DEL to enter SETUP' appears	Program the FCS	00:00:02.00	50
4	204 Highlight 'Power Management Setup' using up and down arrows	Program the FCS	00:00:04.00	50
5	205 Press the ENTER key	Program the FCS	00:00:02.00	50
6	206 Press the FNC key to remove back lighting	Program the FCS	00:00:02.00	50
7	207 By 'Power Management', if 'User Define' not displayed, use * key	Program the FCS	00:00:03.00	50
8	208 Using Up/Down arrows, move highlight bar to 'HDD Power Down'	Program the FCS	00:00:04.00	50
9	209 Press the * key to change the field until 'Disable' is displayed	Program the FCS	00:00:02.00	50
10	210 Continue same process for 'Doze Mode'	Program the FCS	00:00:06.00	50
11	211 Press the ESC key on the SPORT	Program the FCS	00:00:02.00	50
12	212 Press rt. arrow key to move highlight bar to 'SAVE & EXIT SETUP'	Program the FCS	00:00:02.00	50
13	213 Press ENTER	Program the FCS	00:00:02.00	50
14	214 Press the FNC button until it is back lit	Program the FCS	00:00:02.00	50
15	215 Press the #3 key	Program the FCS	00:00:02.00	50
16	216 Press ENTER	Program the FCS	00:00:02.00	50
17	217 System will automatically reboot	Program the FCS	00:02:15.00	50
18	218 When SPORT reboots, left click on the 'START' key	Program the FCS	00:00:03.00	50
19	219 Move the mouse arrow to 'Settings'	Program the FCS	00:00:03.00	50
20	220 From Control Panel, 2x click the left mouse button on the 'N'	Program the FCS	00:00:03.00	50
21	221 Top window, 2x click the left mouse button on 'Megahertz CC10BT'	Program the FCS	00:00:03.00	50
22	222 Left click on the Advanced tab	Program the FCS	00:00:03.00	50
23	223 Value window, if 'THIN COAX (10BASE2)' displayed, left click	Program the FCS	00:00:03.00	50
24	224 If 'THIN COAX (10BASE2)' not displayed, left click down	Program the FCS	00:00:03.00	50
25	225 Scroll down by clicking down arrow until 'TCP/IP Megahertz'	Program the FCS	00:00:07.00	50
26	226 2x click the left button on 'TCP/IP Megahertz CC10BT/2 Ethernet'	Program the FCS	00:00:03.00	50
27	227 Change the values by left clicking on IP Address	Program the FCS	00:00:07.00	50
28	228 Type 13820972	Program the FCS	00:00:08.00	50
29	229 Press the right arrow key	Program the FCS	00:00:02.00	50
30	230 Press the FNC button until it is back lit	Program the FCS	00:00:02.00	50

31	231 Press the DEL key three times	Program the FCS	00:00:04.00	50
32	232 Press the FNC button to remove the backlighting	Program the FCS	00:00:02.00	50
33	233 Type 108	Program the FCS	00:00:03.00	50
34	234 If the 'Subnet Mask' field not correct, 2x click on it, enter number	Program the FCS	00:00:15.00	50
35	235 Left click OK when done editing	Program the FCS	00:00:03.00	50
36	236 Left click OK again	Program the FCS	00:00:03.00	50
37	237 Press ENTER or left click on Yes to restart	Program the FCS	00:00:03.00	50
38	238 After reboot, close the Control Panel	Program the FCS	00:00:03.00	50
39	239 With SPORT powered up, insert the PLU CSCI CD in the SPORT	Program the FCS	00:00:10.00	50
40	240 Left click on the 'START' key	Program the FCS	00:00:03.00	50
41	241 Move the mouse arrow to 'Programs'	Program the FCS	00:00:02.00	50
42	242 Move mouse arrow to 'Windows Explorer' and left click the mouse	Program the FCS	00:00:03.00	50
43	243 Open the CD ROM by clicking once on the CD drive	Program the FCS	00:00:03.00	50
44	244 Locate CD ROM drive ICON on the left side of the screen	Program the FCS	00:00:02.00	50
45	245 Left click on CD ROM drive.	Program the FCS	00:00:02.00	50
46	246 Right click the mouse on the file called PLU	Program the FCS	00:00:03.00	50
47	247 Move the mouse arrow to COPY and left click	Program the FCS	00:00:03.00	50
48	248 Move mouse to the Pcu 5100 (C:) drive and right click	Program the FCS	00:00:03.00	50
49	249 A menu will appear, left click on PASTE	Program the FCS	00:00:03.00	50
50	250 Select 'YES TO ALL', if PLU program was previously loaded	Program the FCS	00:00:03.00	50
51	251 After it reboots, left click the X to close the Control Panel	Program the FCS	00:00:03.00	50
52	252 Power off on SPORT	Program the FCS	00:00:10.00	50
53	253 Insert PCMCIA CCA into SPORT	Program the FCS	00:00:00.00	70
54	254 a. Open access door on the back of SPORT	Program the FCS	00:00:10.00	70
55	255 b. Press in on the silver tab to allow the door to open further	Program the FCS	00:00:02.00	70
56	256 c. Insert the CCA into the slot closest to the access door	Program the FCS	00:00:10.00	70
57	257 d. When inserted, the CCA ejection will pop up for removal	Program the FCS	00:00:02.00	70
58	258 Insert the 'Pigtail' cable into the CCA	Program the FCS	00:00:10.00	70
59	259 Connect the 'T' adapter to the 'Pigtail'	Program the FCS	00:00:05.00	70
60	260 Connect the 'Terminator' to one side of the 'T' adapter	Program the FCS	00:00:05.00	70
61	261 Connect the W10 Cable to the other side of the 'T' adapter	Program the FCS	00:00:05.00	70
63	263 FCS and SPORT power off	Program the FCS	00:00:04.00	70
64	264 Connect SPORT to the FCS (W10 and W11), and Boot SPORT	Program the FCS	00:02:45.00	70
65	265 Insert PLU Tactical CD and left click on the 'Plu.exe' ICON	Program the FCS	00:00:10.00	70
66	266 Power applied to the FCS with MSD Installed	Program the FCS	00:00:02.00	70
67	267 Select 'CONNECT' after FCP PROC light flashes	Program the FCS	00:00:03.00	70
68	268 After 'Connection successful' is displayed , left click 'START PLU'	Program the FCS	00:00:03.00	70
69	269 When 'Transfer complete' displayed, disconn. PLU and Cycle FCS	Program the FCS	00:00:30.00	70
70	270 Verify System Functioning Normally (Boot FCS)	Program the FCS	00:02:17.00	70
71	271 Continue same process for 'Standby Mode'	Program the FCS	00:00:06.00	50
72	272 Continue same process for 'Suspend Mode'	Program the FCS	00:00:06.00	50
1	301 Press MENU BAR key on FCP	Load the GPS keys	00:00:02.00	90
2	302 Press NEXT PF-key to highlight DATABASE field	Load the GPS keys	00:00:02.00	90

3	303 Press NEXT PF-key to highlight SYSTEM field	Load the GPS keys	00:00:01.00	90
4	304 Press SELECT PF-key	Load the GPS keys	00:00:02.00	90
5	305 Use NEXT PF-key to highlight SET SYSTEM PARAMETERS	Load the GPS keys	00:00:01.00	90
6	306 Use NEXT PF-key to highlight SHUTDOWN	Load the GPS keys	00:00:01.00	90
7	307 Use NEXT PF-key to highlight PURGE	Load the GPS keys	00:00:01.00	90
8	308 Use NEXT PF-key to highlight LOG	Load the GPS keys	00:00:01.00	90
9	309 Use NEXT PF-key to highlight CRYPTO KEY STATUS	Load the GPS keys	00:00:01.00	90
10	310 Use NEXT PF-key to highlight LOAD GPS KEY	Load the GPS keys	00:00:01.00	90
11	311 Press SELECT PF-key	Load the GPS keys	00:00:02.00	90
12	312 Connect DTD to FCP	Load the GPS keys	00:00:10.00	90
13	313 Press INITIATE PF-key to initiate GPS loading	Load the GPS keys	00:00:02.00	90
14	314 Press INITIATE PF-key to initiate GPS loading	Load the GPS keys	00:00:01.00	90
15	315 When loading is complete, disconnect DTD to purge the key path	Load the GPS keys	00:00:05.00	90
16	316 Press CONTINUE PF-key on FCP	Load the GPS keys	00:00:02.00	90
17	317 Press RETURN PF-key to exit	Load the GPS keys	00:00:02.00	90
18	318 Use NEXT PF-key to highlight WEAPON	Load the GPS keys	00:00:02.00	90
19	319 Use NEXT PF-key to highlight FILE	Load the GPS keys	00:00:01.00	90
20	320 Use NEXT PF-key to highlight EXIT	Load the GPS keys	00:00:01.00	90
21	321 Press SELECT	Load the GPS keys	00:00:02.00	90
1	401 Press HOME key to display database selection PF-keys	Manual Fire Mission	00:00:02.00	90
2	402 Press the FIRE MSN DB to display the fire mission database	Manual Fire Mission	00:00:02.00	90
3	403 Press MORE PF-key	Manual Fire Mission	00:00:02.00	90
4	404 Press CREATE PF-key	Manual Fire Mission	00:00:02.00	90
5	405 Press EDIT PF-key	Manual Fire Mission	00:00:02.00	90
6	406 Press C/E, Enter Target #, Press ENTER	Manual Fire Mission	00:00:10.00	90
7	407 UP/DOWN to select MOC, press ENTER PF-key	Manual Fire Mission	00:00:04.00	90
8	408 Press C/E, Enter Easting, Press ENTER PF-key	Manual Fire Mission	00:00:10.00	90
9	409 Press C/E, Enter Northing, Press ENTER PF-key	Manual Fire Mission	00:00:10.00	90
10	410 Press C/E, Enter Altitude, Press ENTER PF-key	Manual Fire Mission	00:00:10.00	90
11	411 Press C/E, Enter Grid Zone, Press ENTER PF-key	Manual Fire Mission	00:00:06.00	90
12	412 UP/DOWN to select WEAPON TYPE, press ENTER PF-key	Manual Fire Mission	00:00:04.00	90
13	413 Press C/E, Enter # of rounds, Press ENTER PF-key	Manual Fire Mission	00:00:06.00	90
14	414 Press C/E, Enter # of Aim Points, Press ENTER PF-key	Manual Fire Mission	00:00:06.00	90
15	415 Press C/E, Enter Time Between Rounds	Manual Fire Mission	00:00:06.00	90
16	416 Press RETURN PF-key	Manual Fire Mission	00:00:02.00	90
17	417 Press MORE PF-key	Manual Fire Mission	00:00:02.00	60
18	418 Press LNCHR MOVE TO PF-key	Manual Fire Mission	00:00:02.00	60
19	419 Press FIRING POINT PF-key	Manual Fire Mission	00:00:02.00	60
20	420 Press EDIT F(X)'s PF-key	Manual Fire Mission	00:00:02.00	60
21	421 Press CREATE PF-key	Manual Fire Mission	00:00:02.00	60
22	422 Press EDIT F(X)'s PF-key	Manual Fire Mission	00:00:02.00	60
23	423 Press EDIT. PF-key	Manual Fire Mission	00:00:02.00	60
24	424 Press C/E, Enter Point ID, Press ENTER PF-key	Manual Fire Mission	00:00:08.00	60
25	425 Press C/E., Enter Easting, Press ENTER PF-key	Manual Fire Mission	00:00:08.00	60
26	426 Press C/E., Enter Northing, Press ENTER PF-key	Manual Fire Mission	00:00:08.00	60

27	427 Press C/E., Enter Altitude, Press ENTER PF-key	Manual Fire Mission	00:00:08.00	60
28	428 Press C/E., Enter Grid Zone, Press ENTER PF-key	Manual Fire Mission	00:00:06.00	60
29	429 Press ENTER PF-key to skip PKG HDG brackets	Manual Fire Mission	00:00:02.00	60
30	430 Press ENTER PF-key to skip PKG HDG brackets	Manual Fire Mission	00:00:01.00	60
31	431 Press C/E, Enter Left Mask, Press ENTER	Manual Fire Mission	00:00:10.00	60
32	432 Press C/E, Enter Right Mask, Press ENTER	Manual Fire Mission	00:00:10.00	60
33	433 Press C/E, Enter Elevation Mask, Press ENTER	Manual Fire Mission	00:00:10.00	60
34	434 Press C/E, Enter Rng Mask, Press ENTER	Manual Fire Mission	00:00:10.00	60
35	435 Press RETURN PF-key to close	Manual Fire Mission	00:00:02.00	60
36	436 Press RETURN PF-key to back out	Manual Fire Mission	00:00:02.00	60
37	437 Press EXECUTE PF-key to display the fire mission database	Manual Fire Mission	00:00:02.00	60
38	438 Press RETURN PF-key	Manual Fire Mission	00:00:02.00	90
39	439 For Parking, verify Heading, Position, & Slope	Manual Fire Mission	00:00:08.00	90
40	440 When parked, press the LCHR LAY PF-key	Manual Fire Mission	00:00:02.00	90
41	441 Observe AIM POINT CMD and 01 OF 01 ACTL are displayed	Manual Fire Mission	00:00:02.00	90
42	442 Observe hooks UNLOCKED indicator	Manual Fire Mission	00:00:02.00	90
43	443 Observe launcher raises in elevation	Manual Fire Mission	00:00:02.00	90
44	444 Observe launcher begins to move in azimuth	Manual Fire Mission	00:00:02.00	90
45	445 Verify firing data	Manual Fire Mission	00:00:02.00	90
46	446 Observe ARM WEAPONS prompt. Select ARM on the FCP	Manual Fire Mission	00:00:02.00	90
47	447 Observed LAUNCHER ARMED advisory is displayed	Manual Fire Mission	00:00:02.00	90
48	448 Observe the FIRE WEAPON prompt. Select FIRE on the FCP	Manual Fire Mission	00:00:02.00	90
49	449 Observe FIRING CIRCUITS ENABLED advisory is displayed	Manual Fire Mission	00:00:02.00	90
50	450 Mission complete. Place ARM/SAFE switch in SAFE position	Manual Fire Mission	00:00:02.00	90
51	451 Press STOW	Manual Fire Mission	00:00:02.00	90
52	452 Observe launcher is approximately 311 mils ele. and 0 mils az.	Manual Fire Mission	00:00:02.00	90
53	453 Obs. LM STOW COMPLETE advisory, Lchr down, hooks LOCKED	Manual Fire Mission	00:00:02.00	90
54	454 Press MORE PF-key.	Manual Fire Mission	00:00:02.00	90
55	455 Press EXECUTE PF-key.	Manual Fire Mission	00:00:02.00	90
56	456 Press RETURN PF-key.	Manual Fire Mission	00:00:02.00	90
57	457 Press HOME on Keyboard.	Manual Fire Mission	00:00:02.00	90
1	501 Press LOCATION DB	Build a Database	00:00:02.00	60
2	502 Press FIRING PT	Build a Database	00:00:02.00	60
3	503 Press CREATE	Build a Database	00:00:02.00	60
4	504 Press EDIT	Build a Database	00:00:02.00	60
5	505 Press C/E	Build a Database	00:00:02.00	60
6	506 Enter PT ID on keyboard	Build a Database	00:00:06.00	60
7	507 Press ENTER	Build a Database	00:00:02.00	60
8	508 Dummy	Build a Database	00:00:00.00	0
9	509 Press ENTER for EASTING	Build a Database	00:00:02.00	60
10	510 Press ENTER for NORTHING	Build a Database	00:00:02.00	60
11	511 Press ENTER for ALTITUDE	Build a Database	00:00:02.00	60
12	512 Press ENTER for GRID ZONE	Build a Database	00:00:02.00	60

13	513 Press ENTER for PKG HDG brackets	Build a Database	00:00:02.00	60
14	514 Press ENTER for PKG HDG field	Build a Database	00:00:02.00	60
15	515 Press C/E, Type Left Mask, Press ENTER	Build a Database	00:00:10.00	60
16	516 Press C/E, Type Right Mask, Press ENTER	Build a Database	00:00:10.00	60
17	517 Press C/E, Type Elevation, Press ENTER	Build a Database	00:00:10.00	60
18	518 Press C/E, Type Range, Press ENTER	Build a Database	00:00:10.00	60
19	519 Press RETURN	Build a Database	00:00:02.00	60
20	520 Press RETURN1	Build a Database	00:00:02.00	60
21	521 Press RETURN2	Build a Database	00:00:02.00	60
22	522 Press RETURN3	Build a Database	00:00:02.00	60
23	523 Press C/E, Type EASTING, Press ENTER	Build a Database	00:00:10.00	60
24	524 Press C/E, Type NORTHING, Press ENTER	Build a Database	00:00:10.00	60
25	525 Press C/E, Type ALTITUDE, Press ENTER	Build a Database	00:00:10.00	60
26	526 Press C/E, Type GRID ZONE, Press ENTER	Build a Database	00:00:08.00	60
27	527 Press RETURN4	Build a Database	00:00:02.00	60
28	528 Press RETURN5	Build a Database	00:00:02.00	60

Appendix B: Questions for Military Task Retention Prediction Model

Question 1. Are job memory aids used by the soldier in performing (and in the performance evaluation of) this task?

Answer Choice

Yes (1)

No (0) GOTO QUESTION 3

Question 2. How would you rate the quality of the job or memory aid?

Answer Choice

Excellent (56) Using the job/memory aid, a typical soldier can do the entire task correctly with no additional information. GOTO QUESTION 6

Very Good (25) With the job/memory aid, a typical soldier would need only a little additional information to complete the task.

Marginally Good (2) Even with the job/memory aid, a typical soldier would need important information to complete the task.

Poor (1) Even with the job/memory aid, a typical soldier would need a great deal of additional information in order to complete the task.

Question 3. Into how many steps has the task been divided?

Answer Choice

One Step (25) GOTO QUESTION 6

Two to five steps (14)

Six to ten steps (12)

More than ten steps (0)

Question 4. Are the steps in the task required to be performed in a definite sequence?

Answer Choice

None are (10)

All are (5)

Some are and some are not (0)

Question 5. Does the task provide built-in feedback so that you can tell if you are doing each step correctly?

Answer Choice

Has built-in feedback for all steps (22)

Has built-in feedback for most steps (50% and above) (19)

Has built-in feedback for only a few steps (up to 50%) (11)

Has no built-in feedback (0)

Question 6. Does the task or part of the task have a time limit for its completion?

Answer Choice

There is no time limit (40)

There is a time limit, but it is fairly easy to meet under test conditions (35)

There is a time limit and it is difficult to meet under test conditions (0)

Question 7. How difficult are the mental processing requirements of this task?

Answer Choice

Almost no mental processing requirements (37)

Simple mental processing requirements (28)

Complex mental processing requirements (3)

Very complex mental processing requirements (0)

Question 8. How many facts, terms, names, rules, or ideas must a soldier memorize in order to do this task?

Answer Choice

None (or the job/memory aid provides all necessary information) (20)

A few (1 – 3) (18)

Some (4 – 8) (13)

Very many (more than 8) (0)

Question 9. How hard are the facts, terms, rules, or ideas must be remembered?

Answer Choice

Not applicable – there are none to remember or the job or memory aid provides all the needed information (34)

Not hard at all – the information is simple (31)

Somewhat hard – some of the information is complex (12)

Very hard – the facts, rules, terms, etc are technical or specific to the task and must be remembered in exact detail (0)

Question 10. What are the motor control demands of this task?

Answer Choice

None (2)

Small but noticeable degree of motor control required (0)

Considerable degree of motor control needed (16)

Very large degree of motor control needed (3)

Table C-1. Percent of soldiers able to complete task as a function of score and time since last training

Total Score	Months Since Last Performance at Proficiency											
	1	2	3	4	5	6	7	8	9	10	11	12
180+	100	100	100	100	100	100	100	100	100	100	100	100
175	97	95	92	90	87	85	83	81	79	77	75	73
170	94	90	85	81	76	72	69	65	62	59	56	53
165	92	85	78	72	66	61	56	52	48	44	40	37
160	89	80	71	64	57	51	45	40	36	32	29	26
155	86	75	64	56	48	42	36	31	27	23	20	17
150	83	70	58	49	40	34	28	24	20	16	14	11
145	80	65	52	42	34	27	22	17	14	11	9	7
140	77	60	46	36	27	21	16	12	10	7	6	4
135	74	55	40	30	22	16	12	9	6	5	3	2
130	70	50	35	25	17	12	8	6	4	3	2	1
125	67	45	30	20	13	9	6	4	2	1	1	0
120	63	40	25	16	10	6	4	2	1	0	0	0
115	59	35	20	12	7	4	2	1	0	0	0	0
110	54	29	16	8	4	2	1	0	0	0	0	0
105	50	25	12	6	3	1	0	0	0	0	0	0
100	44	20	8	4	1	0	0	0	0	0	0	0
95	38	15	3	1	0	0	0	0	0	0	0	0
90	31	10	2	0	0	0	0	0	0	0	0	0
85	22	5	1	0	0	0	0	0	0	0	0	0
80 or less	3	0	0	0	0	0	0	0	0	0	0	0

Table C-2. Percent of soldiers able to complete task as a function of score and time since last training

Weeks Since Last Performance at Proficiency																										
Total Score	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
180+	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
175	99	98	98	97	96	96	95	95	94	93	93	92	92	91	90	90	89	89	88	87	87	86	86	85	85	84
170	98	97	96	94	93	92	91	90	88	87	86	85	84	83	82	81	79	78	77	76	75	74	73	72	71	71
165	97	96	94	92	90	88	86	85	83	81	79	78	76	75	73	72	70	69	67	66	65	63	62	61	60	58
160	97	94	91	89	86	84	82	80	77	75	73	71	69	67	65	64	62	60	58	57	55	54	52	51	49	48
155	96	93	89	86	83	80	77	75	72	69	67	64	62	60	58	56	54	52	50	48	46	45	43	42	40	39
150	95	91	87	83	80	76	73	70	66	64	61	58	56	53	51	49	46	44	42	40	39	37	35	34	32	31
145	94	89	85	80	76	72	68	65	61	58	55	52	49	47	44	42	40	37	35	34	32	30	28	27	26	24
140	93	88	82	77	72	68	63	60	56	52	49	46	43	40	38	36	33	31	29	27	26	24	23	21	20	19
135	92	86	79	74	68	63	59	55	51	47	43	40	37	35	32	30	28	26	24	22	20	19	17	16	15	14
130	91	84	77	70	64	59	54	50	45	42	38	35	32	29	27	25	22	21	19	17	16	14	13	12	11	10
125	90	81	74	67	60	54	49	45	40	36	33	30	27	24	22	20	18	16	15	13	12	11	10	9	8	7
120	89	79	70	63	56	50	44	40	35	31	28	25	22	20	17	16	14	12	11	10	9	8	7	6	5	5
115	87	76	67	59	51	45	39	35	30	26	23	20	18	15	13	12	10	9	8	7	6	5	4	4	3	3
110	86	74	63	54	47	40	34	29	25	22	19	16	14	12	10	8	7	6	5	4	4	3	3	2	2	1
105	84	70	59	50	42	35	29	25	21	17	14	12	10	8	7	6	5	4	3	3	2	2	1	1	1	1
100	81	66	54	44	36	29	24	20	16	13	10	8	7	5	4	4	3	2	2	1	1	1	0	0	0	0
95	78	62	49	38	30	24	19	15	11	9	7	5	4	3	2	2	1	1	1	0	0	0	0	0	0	0
90	74	56	42	31	23	17	13	10	7	5	4	3	2	1	1	1	0	0	0	0	0	0	0	0	0	0
85	68	47	32	22	15	10	7	3	3	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	42	17	7	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70 or less	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Table D-1. Task retention scores for initializing the FCS

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Score
FCS Function #1 - Initialize the FCS	1	1	0	0	11	35	0	0	0	0	48
Ensure that ARM is set to SAFE and FIRE switch is DOWN	1	56				35	37	18	31	0	178
Set SYSTEM POWER switch to ON - Observe SYSTEM PWR ON & FCP PWR indicator lights are on	1	56				35	37	18	31	0	178
Wait for boot up	1	56				35	37	18	31	0	178
Adjust ALM VOL, DSPL BRT, and PNL BRT by holding key and adjusting by using arrows	1	56				35	37	20	34	0	183
Press STORE PF-key to select US language	1	56				35	37	20	34	0	183
Wait for appropriate software to be downloaded	1	56				35	37	18	31	0	178
Press SELECT PF-key for time source change or STORE to accept all displayed values	1	56				35	37	20	34	0	183
<i>Pressed SELECT PF-key (for Time Source)</i>											
Use arrow PF-keys to select ALPHA or ZULU, press ENTER	1	56				35	37	20	34	0	183
Key in current hour, minute, and second - press ENTER after each entry	1	56				35	37	20	34	0	183
Key in current day, month, and year - press ENTER after each entry	1	56				35	37	20	34	0	183
Press RETURN PF-key to exit editing routine	1	56				35	37	20	34	0	183
Press NEXT or PREVIOUS PF-key to toggle to another choice to edit or	1	56				35	37	20	34	0	183
Press SELECT PF-key to edit choice	1	56				35	37	20	34	0	183
<i>Pressed SELECT PF-key (for Coordinate Display)</i>											
Scroll choices with arrow PF-keys, press ENTER	1	56				35	37	20	34	0	183
<i>Selected LAT/LON</i>											
Key in current LATITUDE in degrees, minutes, & seconds, press ENTER PF-key after each entry	1	56				35	37	20	34	0	183
Key in current LONGITUDE in degrees, minutes, & seconds, press ENTER PF-key after each entry	1	56				35	37	20	34	0	183

Key in present ALTITUDE (feet above sea level), press ENTER PF-key	1	56				35	37	20	34	0	183
Press RETURN PF-key to exit LAT/LON routine	1	56				35	37	20	34	0	183
<i>Selected UTM</i>											
Key in present EASTING from startup data form, press ENTER PF-key	1	56				35	37	20	34	0	183
Key in present NORTHING from startup data form, press ENTER PF-key	1	56				35	37	20	34	0	183
Key in present ALTITUDE (feet above sea level), press ENTER PF-key	1	56				35	37	20	34	0	183
Key in present GRID ZONE, press ENTER PF-key	1	56				35	37	20	34	0	183
Press RETURN PF-key to exit COORDINATE DISPLAY routine	1	56				35	37	20	34	0	183
<i>Initialize COMMS</i>											
Press SELECT PF-key to edit INITIALIZE COMMS	1	56				35	37	20	34	0	183
Use Arrows to scroll, YES PF-key to INITIALIZE COMMS or NO to skip	1	56				35	37	20	34	0	183
For YES, press ENTER PF-key to complete system update	1	56				35	37	20	34	0	183
Press STORE PF-key	1	56				35	37	20	34	0	183
Use PREVIOUS/NEXT PF-keys to highlight desired FCS Net Channel and press SELECT PF-key	0		14	5	0	35	3	18	12	0	87
Use UP/DOWN PF-keys to highlight desired mode, press ENTER PF-key	0		14	10	0	35	28	18	31	0	136
Press EDIT PF-key to edit Comms Data or press ENTER PF-key to accept Comms Data	1	56				35	37	20	34	0	183
For EDIT, Use UP/DOWN PF-keys to select desired On The Air Option (ON/OFF), press ENTER	1	56				35	37	20	34	0	183
Use UP/DOWN PF-keys to select desired Crypto Status, press ENTER	1	56				35	37	20	34	0	183
Press C/E PF-key, select desired PLT/TP BIT, press ENTER	1	56				35	37	20	34	0	183
Press C/E PF-key, Key in desired PLT/TP Address, press ENTER	1	56				35	37	20	34	0	183
Press C/E PF-key, Key in desired Own BIT value, press ENTER	1	56				35	37	20	34	0	183
Press C/E PF-key, Key in desired Own Address value, press ENTER	1	56				35	37	20	34	0	183
Press C/E PF-key, Key in desired BTRY Address value, press ENTER	1	56				35	37	20	34	0	183
Use UP/DOWN PF-keys to select desired Access Delay Time data, press ENTER	1	56				35	37	20	34	0	183
Use UP/DOWN PF-keys to select desired Baud Rate, press ENTER	1	56				35	37	20	34	0	183
Use UP/DOWN PF-keys to select desired Block Mode, press ENTER	1	56				35	37	20	34	0	183

Use UP/DOWN PF-keys to select desired Preamble, press ENTER	1	56				35	37	20	34	0	183
Use UP/DOWN PF-keys to select desired Radio Net Busy Override, press ENTER	1	56				35	37	20	34	0	183
Use UP/DOWN PF-keys to select desired Accept Next Msg, press ENTER	1	56				35	37	20	34	0	183
Use UP/DOWN PF-keys to select desired Use to BTRY Serial Number, press ENTER	1	56				35	37	20	34	0	183
Press C/E, Key in desired BTRY Serial Number value, press ENTER	1	56				35	37	20	34	0	183
Use UP/DOWN PF-keys to select desired Use to PLT/TP Serial Number, press ENTER	1	56				35	37	20	34	0	183
Press C/E, Key in desired PLT/TP Serial Number value, press ENTER	1	56				35	37	20	34	0	183
Press PREV/NEXT to select DEFAULT DESTINATION	1	56				35	37	20	34	0	183
Press SELECT PF-Key	1	56				35	37	20	34	0	183
Use UP/DOWN arrows to select DEFAULT DESTINATION & CHANNEL	1	56				35	37	20	34	0	183
Press ENTER	1	56				35	37	20	34	0	183
Press ENTER	1	56				35	37	20	34	0	183
Press ENTER	1	56				35	37	20	34	0	183
Press RETURN	1	56				35	37	20	34	0	183
Press ENTER	1	56				35	37	20	34	0	183
Press SELECT PF-key to select Lot Numbers	1	56				35	37	20	34	0	183
Use UP/DOWN PF-keys to select weapon lot number, press ENTER PF-key	1	56				35	37	20	34	0	183
Press ENTER PF-key	1	56				35	28	18	31	0	169
Press SELECT PF-key to edit data or press ENTER PF-key to accept values	1	56				35	37	20	34	0	183
Use UP/DOWN to select either YES or NO for HIGH QE, press ENTER PF-key to accept	1	56				35	37	20	34	0	183
Press ENTER	1	56				35	37	20	34	0	183
Press SELECT PF-key to edit data or press ENTER to accept values	1	56				35	37	20	34	0	183
Use UP/DOWN to select either YES or NO for HIGH QE, press ENTER PF-key to a	1	56				35	37	20	34	0	183
Press NEXT PF-key to edit LP/C2 DATA or press ENTER PF-key to accept values	1	56				35	37	20	34	0	183
Press SELECT PF-key to edit data or press ENTER PF-key to accept values	1	56				35	37	20	34	0	183
Use UP/DOWN to select either YES or NO, press ENTER PF-key to accept	1	56				35	37	20	34	0	183
Press NEXT PF-key	1	56				35	37	20	34	0	183
Press SELECT PF-key to edit USE LP/C 2 ON MALFUNCTION data	1	56				35	37	20	34	0	183
Use UP/DOWN PF-keys to select STOP or CONTINUE for HANGFIRE, press ENTER PF-key	1	56				35	37	20	34	0	183

Press NEXT PF-key	1	56				35	37	20	34	0	183
Press SELECT PF-key	1	56				35	37	20	34	0	183
Use UP/DOWN PF-keys to select STOP or CONTINUE for MISFIRE, press ENTER PF-key	1	56				35	37	20	34	0	183
Press NEXT PF-key	1	56				35	37	20	34	0	183
Press SELECT PF-key for DUD FUZE	1	56				35	37	20	34	0	183
Use UP/DOWN PF-keys to select SKIP or FIRE for DUD FUZE, press ENTER PF-key	1	56				35	37	20	34	0	183
Press ENTER PF-key	1	56				35	37	20	34	0	183
Press HOME on keyboard	1	56				35	37	20	34	0	183
Press OPERATIONAL PF-key	1	56				35	37	20	34	0	183
<i>For NO</i>											
Observe that INIT, RELOAD PF-keys and weapon information is displayed	1	56				35	37	18	31	0	178
Observe that WEAPON FUZE TEST IN PROGRESS prompt is displayed	1	56				35	37	18	31	0	178
Observe that WEAPON FUZE TEST COMPLETE prompt is displayed,	1	56				35	37	18	31	0	178
Press OVERRIDE or CONTINUE LST	1	56				35	37	18	31	0	178

Table D-2. Task retention scores for programming the FCS

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Score
FCS Function #2 - Programming the FCS	1	2	0	5	11	40	3	0	12	0	74
<i>PM Timers Deactivation</i>											
Apply power to SPORT by pressing on/off button (top right corner)	1	56				40	37	20	34	0	188
Press the FNC key until it is back lit	1	56				40	28	20	34	0	179
Press the DEL/F8 key, when "press DEL to enter SETUP" appears at bottom of screen	1	56				40	28	20	34	0	179
Highlight "Power Management Setup" using up and down arrows in the upper left portion	1	56				40	28	20	34	0	179
Press the ENTER key	1	56				40	28	20	34	0	179
Press the FNC key to remove back lighting	1	56				40	28	20	34	0	179
Next to "Power Management", if "User Define" is not displayed, use * key to change to it	1	56				40	28	20	34	0	179
Using Up/Down arrows, move highlight bar to "HDD Power Down"	1	56				40	28	20	34	0	179
Press the * key to change the field until "Disable" is displayed	1	56				40	28	20	34	0	179
Continue same process for "Doze Mode", "Standby Mode", & "Suspend Mode". Set each to "Disable"	1	56				40	28	20	34	0	179
Press the ESC key on the SPORT	1	56				40	28	20	34	0	179
Press the right arrow key to move the highlight bar to "SAVE & EXIT SETUP"	1	56				40	28	20	34	0	179
Press ENTER	1	56				40	28	20	34	0	179
Press the FNC button until it is back lit	1	56				40	28	20	34	0	179
Press the #3 key	1	56				40	28	20	34	0	179
Press ENTER	1	56				40	28	20	34	0	179
System will automatically reboot	1	56				40	28	20	34	0	179
<i>SPORT Network Setup</i>											
When SPORT reboots, left click on the "START" key	1	56				40	28	20	34	0	179
Move the mouse arrow to "Settings"	1	56				40	28	20	34	0	179
From the Control Panel screen, double click the left mouse button on the "Network" icon	1	56				40	28	20	34	0	179
In the top window, double click the left mouse button on "Megahertz CC10BT/2 Ethernet Driver"	1	56				40	28	20	34	0	179
Left click on the Advanced tab	1	56				40	28	20	34	0	179
In the value window, if "THIN COAX (10BASE2)" is displayed, left click on OK	1	56				40	28	20	34	0	179
If "THIN COAX (10BASE2)" is not displayed, left click on down arrow, left click on "THIN COAX (10BASE2)" left click OK	1	56				40	28	20	34	0	179
Scroll down to top window by clicking on on down arrow until "TCP/IP Megahertz CC10BT/2 Ethernet Driver" is displayed	1	56				40	28	20	34	0	179

Double click the left mouse button on "TCP/IP Megahertz CC10BT/2 Ethernet Driver" and verify the following settings: IP address: 138.209.72.108, Subnet Mask: 255.255.255.0	1	56				40	28	20	34	0	179
Change the values, if they appear different, by positioning the mouse in the left most portion of the "IP address" field and double click the left mouse button	1	56				40	28	20	34	0	179
Type 13820972	1	56				40	28	20	34	0	179
Press the right arrow key	1	56				40	28	20	34	0	179
Press the FNC button until it is back lit	1	56				40	28	20	34	0	179
Press the DEL key three times	1	56				40	28	20	34	0	179
Press the FNC button to remove the backlighting	1	56				40	28	20	34	0	179
Type 108	1	56				40	28	20	34	0	179
If the "Subnet Mask" field is not correct, position the mouse in the left most portion of the "Subnet Mask" field and double click the left mouse button and enter 2552552550	1	56				40	28	20	34	0	179
Left click OK when done editing	1	56				40	28	20	34	0	179
Left click OK again	1	56				40	28	20	34	0	179
Press ENTER or left click the mouse on Yes when asked if you want to restart the computer	1	56				40	28	20	34	0	179
After it reboots, left click the X in the upper right corner to close the Control Panel screen	1	56				40	28	20	34	0	179
<i>Installing the PLU Program</i>											
With SPORT powered up, insert the PLU CSCI CD in the SPORT	1	56				40	28	20	34	0	179
Left click on the "START" key	1	56				40	28	18	31	0	174
Move the mouse arrow to "Programs"	1	56				40	28	20	34	0	179
Move the mouse arrow to "Windows Explorer" and left click the mouse	1	56				40	28	20	34	0	179
Open the CD ROM by clicking once on the CD drive	1	56				40	28	20	34	0	179
Locate the CD ROM drive ICON on the left side of the screen (most likely D:\). The CD ROM drive is indicated by a CD ICON associated with the letter designator	1	56				40	28	20	34	0	179
Left click on the CD ROM drive. The right side of the screen will show the contents of the CD ROM	1	56				40	28	20	34	0	179
Right click the mouse on the file called PLU	1	56				40	28	20	34	0	179
A menu with several options will appear, move the mouse arrow to COPY and left click the mouse	1	56				40	28	20	34	0	179
Move the mouse to the Pcu 5100 (C:) drive and right click the mouse	1	56				40	28	20	34	0	179
A menu will appear, left click on PASTE	1	56				40	28	20	34	0	179
Select "YES TO ALL", if system prompt displays that the PLU program has previously been loaded	1	56				40	28	20	34	0	179
After it reboots, left click the X in the upper right corner to close the Control Panel screen	1	56				40	28	20	34	0	179
<i>PLU Setup for Operation</i>											
Power off on SPORT	1	56				40	28	20	34	0	179

Insert PCMCIA CCA into SPORT											
a. Open access door on the back of SPORT	1	2	14	5	19	40	28	18	31	0	158
b. Press in on the silver tab to allow the door to open further	1	2	14	5	19	40	28	18	31	0	158
c. Insert the CCA into the slot closest to the access door	1	2	14	5	19	40	28	18	31	0	158
d. When inserted, the CCA ejection will pop up, this button is pressed to remove the CCA	1	2	14	5	19	40	28	18	31	0	158
Insert the "Pigtail" cable into the CCA	1	2	26			40	3	18	31	0	121
Connect the "T" adapter to the "Pigtail"	1	56				40	28	18	31	0	174
Connect the "Terminator" to one side of the "T" adapter	1	56				40	28	18	31	0	174
Connect the W10 Cable to the other side of the "T" adapter	1	56				40	28	18	31	0	174
<i>Master Mode Outline</i>											
FCS and SPORT power off	1	56				40	37	20	34	0	188
SPORT connected to the FCS (W10 and W11), and Boot SPORT	1	56				40	37	18	31	0	183
Insert PLU Tactical CD and left click on the "Plu.exe" ICON	1	56				40	28	18	31	0	174
Power applied to the FCS with MSD Installed	1	56				40	37	20	34	0	188
Select "CONNECT" after FCP PROC light flashes	1	56				40	28	20	34	0	179
After "Connection successful" is displayed on the SPORT, left click the "START PLU" button on the SPORT to begin download	1	56				40	28	20	34	0	179
When "Transfer complete" is displayed on the SPORT, disconnect PLU and Cycle FCS Power	1	56				40	28	20	34	0	179
Verify System Functioning Normally (Boot FCS)	1	56				40	28	20	34	0	179

Table D-3. Task retention scores for loading the GPS keys

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Score
FCS Function #3 - Load GPS Keys	1	1	0	5	11	35	3	0	12	0	68
Press MENU BAR key on FCP	1	25	25			35	28	18	31	0	163
Press NEXT PF-key to highlight DATABASE field	1	25	25			35	28	18	31	0	163
Press NEXT PF-key to highlight SYSTEM field	1	25	25			35	28	18	31	0	163
Press SELECT PF-key	1	25	25			35	28	18	31	0	163
Use NEXT PF-key to highlight SET SYSTEM PARAMETERS	1	25	25			35	28	18	31	0	163
Use NEXT PF-key to highlight SHUTDOWN	1	25	25			35	28	18	31	0	163
Use NEXT PF-key to highlight PURGE	1	25	25			35	28	18	31	0	163
Use NEXT PF-key to highlight LOG	1	25	25			35	28	18	31	0	163
Use NEXT PF-key to highlight CRYPTO KEY STATUS	1	25	25			35	28	18	31	0	163
Use NEXT PF-key to highlight LOAD GPS KEY	1	25	25			35	28	18	31	0	163
Press SELECT PF-key	1	25	25			35	28	18	31	0	163
Connect DTD to FCP	1	25	25			35	28	18	31	0	163
<i>Using DTD, transfer GPS Key 1</i>	0		0	5	0	35	0	0	0	0	40
Press INITIATE PF-key to initiate GPS loading	1	25	25			35	28	18	31	0	163
<i>Using DTD, transfer GPS Key 2</i>	0		0	5	0	35	0	0	0	0	40
Press INITIATE PF-key to initiate GPS loading	1	25	25			35	28	18	31	0	163
When loading is complete, disconnect DTD to purge the key path	1	25	25			35	28	18	31	0	163
<i>Shutdown DTD</i>											
Press CONTINUE PF-key on FCP	1	25	25			35	28	18	31	0	163
Press RETURN PF-key to exit	1	25	25			35	28	18	31	0	163
Use NEXT PF-key to highlight WEAPON	1	25	25			35	28	18	31	0	163
Use NEXT PF-key to highlight FILE	1	25	25			35	28	18	31	0	163
Use NEXT PF-key to highlight EXIT	1	25	25			35	28	18	31	0	163
Press SELECT	1	25	25			35	28	18	31	0	163

Table D-4. Task retention scores for a manual fire mission

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Score
FCS Function #4 - Manual Fire Mission	1	2	0	5	0	35	3	0	12	0	58
Press HOME key to display database selection PF-keys	1	25	25			35	28	18	31	0	163
Press the FIRE MSN DB PF-key to display the fire mission database	1	56				35	28	18	31	0	169
Press MORE PF-key	1	25	25			35	28	18	31	0	163
Press CREATE PF-key	1	56				35	28	20	34	0	174
Press EDIT PF-key	1	25	25			35	28	18	31	0	163
Press C/E, Enter Target #, Press ENTER	1	56				35	28	18	31	0	169
UP/DOWN to select MOC, press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter Easting, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter Northing, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter Altitude, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter Grid Zone, Press ENTER PF-key	1	56				35	28	18	31	0	169
UP/DOWN to select WEAPON TYPE, press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter # of rounds, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter # of Aim Points, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter Time Between Rounds, Press ENTER	1	56				35	28	18	31	0	169
Press RETURN PF-key	1	2	25			35	28	18	31	0	140
Press MORE PF-key	1	2	25			35	28	18	31	0	140
Press LNCHR MOVE TO PF-key	1	25	25			35	28	18	31	0	163
Press Firing Point PF-key	1	25	25			35	28	18	31	0	163
Press EDIT F(X)'s PF-key	1	1	25			35	3	18	12	0	95
Press CREATE PF-key	1	56				35	28	20	34	0	174
Press EDIT F(X)'s PF-key	1	1	25			35	3	18	12	0	95
Press C/E PF-key	1	25	25			35	28	18	31	0	163
Enter Point ID, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter Easting, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter Northing, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter Altitude, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter Grid Zone, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press ENTER PF-key to skip PKG HDG brackets	0		25			35	3	18	31	0	112
Press ENTER PF-key to skip PKG HDG brackets	0		25			35	3	18	31	0	112
Press C/E, Enter Left Mask, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter Right Mask, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter Elevation Mask, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press C/E, Enter Rng Mask, Press ENTER PF-key	1	56				35	28	18	31	0	169
Press RETURN PF-key to close	1	56				35	28	18	31	0	169

Press RETURN PF-key to back out	1	56				35	28	18	31	0	169
<i>OR</i>											
Press EXECUTE PF-key to display the fire mission database	1	56				35	28	18	31	0	169
Press RETURN PF-key	1	56				35	28	18	31	0	169
Press MORE PF-key.	1	56				35	28	18	31	0	169
Press EXECUTE PF-key.	1	56				35	28	18	31	0	169
Press RETURN PF-key.	1	56				35	28	18	31	0	169
For Parking, verify Heading, Position, & Slope	0		14	0	22	35	3	18	31	2	125
Press HOME on Keyboard.	1	56				35	28	18	31	0	169
When parked, press the LCHR LAY PF-key	1	56				35	37	20	34	0	183
<i>Continue</i>											
Observe AIM POINT CMD and 01 OF 01 ACTL are displayed	1	56				35	37	18	31	2	180
Observe hooks UNLOCKED indicator & observe launcher begin to elevate	1	56				35	37	18	31	2	180
Observe launcher raises in elevation	1	56				35	37	18	31	2	180
Observe launcher begins to move in azimuth	1	56				35	37	18	31	2	180
Verify that CMD & ACTL match	1	56				35	37	18	31	2	180
Observe ARM WEAPONS prompt. Select ARM on the FCP	1	56				35	37	20	34	2	185
Observed LAUNCHER ARMED advisory is displayed	1	56				35	37	18	31	2	180
Observe the FIRE WEAPON prompt. Select FIRE on the FCP	1	56				35	37	20	34	2	185
Observe FIRING CIRCUITS ENABLED advisory is displayed	1	56				35	37	18	31	2	180
Mission complete. Place ARM/SAFE switch in SAFE position	1	56				35	37	20	34	2	185
Press STOW	1	56				35	37	20	34	2	185
Observe LM STOW COMPLETE advisory prompt, launcher down, hooks LOCKED	1	56				35	28	18	31	2	171
<i>Digital Fire Mission</i>	1	25	0	5	19	35	3	0	12	0	100
CALL FOR FIRE message received, press COMM ACK on FCP	1	56				35	37	20	34	0	183
Press WILCO PF-key to proceed with CFF or press CANTCO PF-key otherwise	1	56				35	37	20	34	0	183
For parking, verify heading, position, & slope	0		14	0	22	35	3	18	31	2	125
When parked, press the LCHR LAY PF-key	1	56				35	37	20	34	0	183
Observe AIM POINT CMD and 01 OF 01 ACTL are displayed	1	56				35	37	20	34	2	185

Table D-5. Task retention scores for building a database

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Score
FCS Function #5 - Building a database	1	2	0	5	11	35	3	13	12	2	84
<i>At the firing location</i>											
Press LOCATION DATABASE	1	25	25	0	0	35	28	20	31	0	165
Press FIRING PT	1	25	25	0	0	35	28	20	31	0	165
Press CREATE	1	25	25	0	0	35	28	20	31	0	165
Press EDIT	1	25	25	0	0	35	28	20	31	0	165
Press C/E	1	25	25	0	0	35	28	20	31	0	165
Enter PT ID on keyboard	1	2	25	0	0	35	28	20	31	0	142
Press ENTER for Easting	1	2	25	0	0	35	28	20	31	0	142
Press ENTER for Northing	1	2	25	0	0	35	28	20	31	0	142
Press ENTER for Altitude	1	2	25	0	0	35	28	20	31	0	142
Press ENTER for Grid Zone	1	2	25	0	0	35	28	20	31	0	142
Press ENTER for PKG HDG brackets	1	2	25	0	0	35	28	20	31	0	142
Press ENTER for PKG HDG field	1	2	25	0	0	35	28	20	31	0	142
Press C/E, key in Left Mask, Press ENTER	1	2	14	5	22	35	28	18	31	0	156
Press C/E, key in Right Mask, Press ENTER	1	2	14	5	22	35	28	18	31	0	156
Press C/E, key in Elevation, Press ENTER	1	2	14	5	22	35	28	18	31	0	156
Press C/E, key in Range, Press ENTER	1	2	14	5	22	35	28	18	31	0	156
Press Return	1	25	25	0	0	35	28	18	31	0	163
Press Return	1	25	25	0	0	35	28	18	31	0	163
Press Return	1	25	25	0	0	35	28	18	31	0	163
Press Return	1	25	25	0	0	35	28	18	31	0	163
<i>Not at the firing location</i>											
Press C/E, key in Easting, Press ENTER	1	2	14	5	22	35	28	18	31	0	156
Press C/E, key in Northing, Press ENTER	1	2	14	5	22	35	28	18	31	0	156
Press C/E, key in Altitude, Press ENTER	1	2	14	5	22	35	28	18	31	0	156
Press C/E, key in Grid Zone, Press ENTER	1	2	14	5	22	35	28	18	31	0	156
Press Return	1	25	25	0	0	35	28	18	31	0	163
Press Return	1	25	25	0	0	35	28	18	31	0	163

Table D-6. Task retention scores for specified IETM functions

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Score
IETM Function #1 - PMCS Access	1	25	0	0	0	40	3	18	12	0	99
Press PWR ON/OFF	1	56				40	37	20	34	0	188
Observe Boot-up	1	56				40	37	20	34	0	188
Move to "MLRS IETM" ICON, left click two times	1	25	14	5	22	40	28	18	31	0	184
Press Enter to acknowledge note	1	25	14	5	22	40	28	18	31	0	184
Move mouse to "Alphabetical Index" button, left click one time	1	25	14	5	22	40	28	18	31	0	184
Move mouse to "P", left click	1	25	14	5	22	40	28	18	31	0	184
Move mouse to "PMCS Operator Maintenance", left click	1	25	14	5	22	40	28	18	31	0	184
Move mouse to access "PMCS Table", left click	1	25	14	5	22	40	28	18	31	0	184
Press Enter to acknowledge note	1	56				40	37	20	34	0	188
IETM Function #2 - Access Troubleshooting	1	25	0	0	0	40	3	18	12	0	99
Press PWR ON/OFF	1	56				40	37	20	34	0	188
Observe Boot-up	1	56				40	37	20	34	0	188
Move to "MLRS IETM" ICON, left click two times	1	25	14	5	22	40	28	18	31	0	184
Press Enter to acknowledge note	1	25	14	5	22	40	28	18	31	0	184
Move mouse to "Troubleshooting" button, left click two times	1	25	14	5	22	40	28	18	31	0	184
Move mouse to "Message Index", left click	1	25	14	5	22	40	28	18	31	0	184
Move mouse to "Continue", left click	1	25	14	5	22	40	28	18	31	0	184
Move mouse to "G", left click	1	25	14	5	22	40	28	18	31	0	184
Move mouse to "GPS Input Fault" hotspot, left click	1	25	14	5	22	40	28	18	31	0	184
Press Enter to acknowledge note	1	56				40	37	20	34	0	188
Move mouse to "Continue", left click	1	25	14	5	22	40	28	18	31	0	184
Press Enter to acknowledge note	1	56				40	37	20	34	0	188
IETM Function #3 - Access Manual LM Operations	1	25	0	0	0	40	3	18	12	0	99
Press PWR ON/OFF	1	56				40	37	20	34	0	188
Observe Boot-up	1	56				40	37	20	34	0	188
Move to "MLRS IETM" ICON, left click two times	1	25	14	5	22	40	28	18	31	0	184
Press Enter to acknowledge note	1	25	14	5	22	40	28	18	31	0	184
Move mouse to "Alphabetical Index" button, left click two times	1	25	14	5	22	40	28	18	31	0	184
Move mouse to "M", left click	1	25	14	5	22	40	28	18	31	0	184
Move mouse to "Manual Cps LM", left click	1	25	14	5	22	40	28	18	31	0	184
Press Enter to acknowledge note	1	56				40	37	20	34	0	188
Press Enter to acknowledge caution	1	56				40	37	20	34	0	188
Press Enter to acknowledge caution	1	56				40	37	20	34	0	188
Move mouse to "Unlock Travel Lock", left click	1	25	14	5	22	40	28	18	31	0	184
Press Enter to acknowledge note	1	56				40	37	20	34	0	188
Move mouse to "Continue", left click	1	25	14	5	22	40	28	18	31	0	184

Appendix E: Windows Familiarity Test

1. Navigate through menus to open **Accessories>Calculator**, then minimize; open **WordPad**, then minimize; open **Paint**, then minimize; open **Windows Explorer**, then minimize; open **My Computer**, then minimize; open **Recycle Bin**.
2. Restore **Calculator, Paint, Windows Explorer, and My Computer, Recycle Bin**. Close these windows.
3. Restore and Maximize **WordPad** and open file **Survey.txt**.
4. Then, in **WordPad** create a new document. Type “**I am taking a survey on Windows desktop familiarity. I am familiar with Windows. I do not require further training.**”
5. Save the file that you just created by naming it “Your last name”.txt
(Ex. Jones.txt)
6. Return to **Survey.txt** using the Window pull-down menu and select and copy the sentence, “**You have done it correctly**”
7. Return to “Your last name”.txt using the Window menu and paste it below the text, “**I am taking a survey on Windows desktop familiarity. I am familiar with Windows. I do not require further training.**” Save “Your last name”.txt.
8. Then select and cut the sentence, “**You have done it correctly**” and paste it before the text, “**I am taking a survey on Windows desktop familiarity. I am familiar with Windows. I do not require further training.**”
9. From the Help Menu, access topic – Printing : Change printers and printing options
10. Open Control Panel – open Mouse

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE September 2002	3. REPORT TYPE AND DATES COVERED Final	
4. TITLE AND SUBTITLE Personnel and Training Evaluation for the M270A1 Fire Control System			5. FUNDING NUMBERS AMS Code 622716 PR: AH70	
6. AUTHOR(S) Savick, D.S. (ARL)				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Research Laboratory Human Research & Engineering Directorate Aberdeen Proving Ground, MD 21005-5425			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSORING/MONITORING AGENCY REPORT NUMBER ARL-MR-546	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) The Human Research and Engineering Directorate of the U.S. Army Research Laboratory performed a personnel and training evaluation of the M270A1 multiple launch rocket system fire control system (FCS) for the Training and Doctrine Command System Manager-Rocket and Missile Systems at Fort Sill, Oklahoma. The M270A1 FCS is an improved version of the current M270 FCS. It improves the capability and versatility of the FCS by using a "Windows-like" operating system. The M270A1 is currently in the engineering and manufacturing development phase of acquisition. Improving the capability and versatility of the operating system does not necessarily improve the usability of the operating system. The system's complexity can affect personnel and training requirements of the military occupational specialty 13M to successfully operate the FCS. Therefore, the evaluation was performed to determine if personnel and training requirements should be changed to provide effective training for the new FCS. More specifically, this report answers three concerns that are addressed in the following questions: <ol style="list-style-type: none"> 1. Does the new FCS require a higher aptitude for the 13M? 2. How often will the trained 13M need retraining? 3. Does the current soldier entering the 13M crew member course need training in Windows before entering the course? <p>The results of this study are as follow.</p> <ol style="list-style-type: none"> 1. Raising or lowering the cut-off scores does not have a large effect on the 13M crew member's overall performance; therefore, the new FCS does not require a higher aptitude. 2. Fifty-five percent of all tasks analyzed in this study can be remembered by the 13M crew member for at least 1 year after initial training in these tasks. The remaining 45% of tasks will require personnel to be re-trained 1 to 6 months after the initial training. 3. Results from a Windows familiarity study given to 40 soldiers entering the 13M crew member course show that 75% of them had a basic understanding of Windows necessary for entering the course. A two-day Windows training period would provide all new entrants with sufficient familiarity with Windows to enter the 13M crew member course. 				
14. SUBJECT TERMS aptitude IMPRINT training fire control system M270A1 Windows proficiency			15. NUMBER OF PAGES 50	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT	

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