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Review of the
M1 Unit-Conduct of Fire Trainer (U-COFT)
Validation and Verification Test Report

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Submitted by
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proficiency on the U-COFT.

The reviewers concluded that:

- (1) Deficiency identification was conducted in a logical, systematic manner; and resulted in useful hardware and software improvements,
2. Thirty hours of U-COFT sustainment training produced substantial average gains in the proficiency of a test group comprising five TC-gunner pairs,
3. Forty hours of U-COFT transition training with another five TC-gunner pairs produced average exit-level scores equal to or greater than those obtained by the sustainment pairs. Proficiency gains for the transition group, while probably substantial, could not be estimated accurately, because entry-level proficiency scores were not obtained,
- (4) Proficiency gains in target-acquisition time on the U-COFT were underestimated by at least one-third in the V/V report,
- (5) Substantial gains were found in percents of targets acquired, engaged, hit, and killed by the sustainment and transition groups. The gains resulted from improvements in acquisition time, engagement time, and first round hits, which in turn allowed time to scan, acquire, and engage available second and third targets, and
- (6) Nine hours of U-COFT training and testing produced statistically significant improvements between pretest and posttest scores of eight Canadian Armor Trophy (CAT) TC-gunner pairs on several measures of gunnery proficiency. Statistically significant differences were not found, however, in percent main gun hits or in target coverage with the coaxial machinegun. The CAT teams were so proficient at hitting targets before U-COFT training began that there was little room for improvement.
7. Review of VU-graphs, which were used to summarize proficiency before and after training in a briefing to LTG W. F. Ulmer, revealed that the reported performance levels and gains were inconsistent with V/V test data. The briefing data were based, not on pretest and posttest scores, but on V/V test administrators' impressions of soldiers' progress in training.
8. The V/V findings regarding proficiency retention were not reliable enough to be used in making decisions about retention or retraining intervals.
9. Consideration should be given to expanding the content of TC training to include more prefiring activities; target acquisition, for example, and making initial main gun lays for gunners' engagements.
10. The TC and the TC-gunner tests used in V/V did not provide adequate sampling of training content. NBC gunnery, for example, and several aspects of degraded-mode gunnery were practiced but not tested. Domain-referenced methods should be used for constructing U-COFT and other tank gunnery tests.

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EXECUTIVE SUMMARY

REQUIREMENT

The requirement addressed by this report was initiated by a letter (11 March 1985) from the Honorable James R. Ambrose to the USAMC Commanding General, and others, in which the Under Secretary requested that "analysts who are not partisans in the U-COFT program" review the report, "Training Matrix Validation and Verification Test Report for the M1 Unit-Conduct of Fire Trainers (U-COFT)." Colonel James M. Ball, PM TRADE, asked the Field Unit Chief, US Army Research Institute (ARI) at Fort Knox, to perform the review. This report is the response to that request.

APPROACH

The validation and verification ("V/V") had two principal thrusts:

1. Identifying and correcting deficiencies in U-COFT hardware and software.
2. Ascertaining the extent to which practice with the U-COFT improved proficiency on the U-COFT.

The V/V report was examined by the authors of this review. Our review was supplemented by information from other sources, including briefings and additional analyses of data provided by the U-COFT contractor, General Electric Company.

CONCLUSIONS

The reviewers concluded that:

1. Deficiency identification was conducted in a logical, systematic manner; and resulted in useful hardware and software improvements.
2. Thirty hours of U-COFT sustainment training produced substantial average gains in the proficiency of a test group comprising five TC-gunner pairs.
3. Forty hours of U-COFT transition training with another five TC-gunner pairs produced average exit-level scores equal to or greater than those obtained by the sustainment pairs. Proficiency gains for the transition group, while probably substantial, could not be estimated accurately, because entry-level proficiency scores were not obtained.
4. Additional analyses of test data suggested that proficiency gains in target-acquisition time on the U-COFT were underestimated by at least one-third in the V/V report.
5. Additional analyses of test data also showed substantial gains in percents of targets acquired, engaged, hit, and killed. The gains resulted from improvements in acquisition time, engagement time, and first round hits, which in turn allowed time to scan, acquire, and engage available second and third targets.

6. Nine hours of U-COFT training and testing produced statistically significant improvements between pretest and posttest scores of eight Canadian Armor Trophy (CAT) TC-gunner pairs on acquisition time, first round fire time, first target hit time, second target fire time, second target hit time, and number of coaxial machinegun rounds fired. Statistically significant differences were not found in percent main gun hits or in target coverage with the coaxial machinegun. The CAT teams were so proficient at hitting targets before U-COFT training began that there was little room for improvement.
7. Review of VU-graphs, which were used to summarize proficiency before and after training in a briefing to LTG W. F. Ulmer, revealed that the reported performance levels and gains were inconsistent with V/V test data. The briefing data were based, not on pretest and posttest scores, but on V/V test administrators' impressions of soldiers' progress in training.
8. Proficiency loss was, according to the V/V report, "definite" after 10 weeks, and nonexistent after three. These findings are not reliable enough to be used for making decisions about retention or retraining intervals: The number of compared TC-gunner pairs was small (two each in the 10- and 3-week groups), and the transition group received more training than did the sustainment group.
9. Tank Commander training exercises dealt mainly with firing. Consideration should be given to expanding the content of TC training to include more prefiring activities; target acquisition, for example, and making initial main gun lays for gunners' engagements.
10. The TC and the TC-gunner tests used in V/V did not provide adequate sampling of training content. NBC gunnery, for example, and several aspects of degraded-mode gunnery were practiced but not tested. Domain-referenced methods, described in several ARI reports, should be used for constructing U-COFT and other tank gunnery tests.

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**REVIEW OF THE M1 UNIT-CONDUCT OF FIRE TRAINER (U-COFT)
VALIDATION AND VERIFICATION TEST REPORT**

The Honorable James R. Ambrose, in a letter (11 March 1985) to the USAMC Commanding General and others, requested that "analysts who are not partisans in the U-COFT program" review the report, "Training Matrix Validation and Verification Test Report for the M1 Unit-Conduct of Fire Trainers (U-COFT)" (General Electric Company, 9 March 1984). The USAMC Commanding General recommended to the USA TRADOC Commanding General that the US Army Research Institute "be tasked as the 'non-partisan' analyst" mentioned in the Under Secretary's letter. Colonel James M. Ball, PM TRADE, requested (letter dated 16 May in Appendix A) that ARI Fort Knox examine the G.E. report and respond to the Under Secretary's request. This report summarizes the results of the requested examination.

INFORMATION SOURCES

The review of the G.E. validation and verification (V/V) report was supplemented by information from other sources, including:

1. Briefing slides from G.E. briefing, "M1 U-COFT Instructional Subsystem Test Results," to LTG Walter F. Ulmer, 16 January 1984.
2. G.E. briefing to authors of this report on 14 May 1985.
3. Additional analyses of data summarized in the G.E. report.
4. U-COFT data (not included in the V/V report) from eight Canadian Armor Trophy (CAT) crews.

The V/V report had two principal thrusts:

1. Identifying and correcting deficiencies in U-COFT hardware and software.
2. Ascertaining the extent to which practice with the U-COFT improved proficiency on the U-COFT.

DEFICIENCY CORRECTIONS

The changes made as a result of G.E.'s validation and verification are documented in the V/V report, and were described in the 14 May briefing by G.E. A sample of the changes is:

1. Rules for progressing through U-COFT exercises were revised to provide practice on a greater number and variety of exercises, and to minimize the occurrence of situations in which a student "bounces back and forth" between an unsuccessfully completed exercise and a successfully completed one; that is, situations in which a student fails a test exercise, is directed back to a previously passed exercise, passes it again, fails the test exercise, and so forth.

2. Software was revised to improve hardening of terrain features and other "non-targets"; this was done to prevent hitting targets by shooting through other objects, and to prevent students' being "killed" by targets shooting through terrain features.
3. Software was revised to provide clearer kill indicators; tank targets, for example, now tilt forward when killed. (Notice that enhanced kill indicators may produce "crutch effects"; that is, performance breakdowns in combat and other situations in which the feedback used in training is absent. Lessons learned from the National Training Center, for example, suggest that difficulty in distinguishing between dead and live targets results in overkilling some and ignoring others. To the extent that this discrimination is simplified in training, performance in more realistic situations is likely to suffer.)
4. Computer image generation was revised to eliminate unrealistic target scenes; flying tanks, for example.
5. Haze density was reduced for improved visibility of previously undetectable targets.
6. Scoring was revised to reduce the proportion of students getting "A" for performing exercises, and to increase the proportion getting "B."

The identification of deficiencies was, in our view, conducted in a logical, systematic manner; and resulted in many useful corrections.

PROFICIENCY IMPROVEMENTS

Our review of proficiency improvements with the M1 U-COFT was accomplished using information from:

1. Sustainment training described in the V/V report.
2. Transition training described in the V/V report.
3. Reanalysis of selected sustainment and transition training data.
4. Canadian Armor Trophy (CAT) Team training.
5. Briefing data.

Sustainment Training

Five TC-gunner pairs, one of which was M1-qualified, received an orientation, eye examination, and U-COFT warm-up, totaling about one hour. They were then pretested on one TC and four TC-gunner exercises, each comprising 10 targets. (See Appendix B.) This was followed by approximately 30 hours of U-COFT training over a period of three weeks, during which each TC-gunner

pair completed an average of 143 U-COFT exercises. Each TC-gunner pair took a posttest on completion of training, which was identical to the pretest taken before training.

Comparisons of the sustainment group's pretest and posttest scores are presented later, in "Additional Analyses" (Tables 1, 2, 3, and 4). Those data showed substantial improvements in:

1. Acquisition time.
2. Percents of:
 - (a) Classification errors.
 - (b) Multiple target engagements completed.
 - (c) Targets engaged.
 - (d) First round hits.
 - (e) Targets hit.
 - (f) Targets killed.
 - (g) Area coverage with coaxial machinegun.

Transition Training

Five TC-gunner pairs, three of which were qualified on tanks other than the M1, and two of which were not qualified on any tanks, received an orientation, eye examination, and U-COFT warm-up, totaling about three hours. They were not pretested. The orientation period was followed by approximately 40 hours of U-COFT training over a period of three weeks, during which each TC-gunner pair completed an average of 174 exercises. The TC-gunner pairs were then tested using the same test as was used for the sustainment pretest and posttest.

The transition group's posttest scores are presented later, in "Additional Analyses" (Tables 2, 3, and 4). The transition group's posttest scores were as good as or better than the sustainment group's on:

1. Acquisition time.
2. Percents of:
 - (a) Multiple target engagements completed.
 - (b) Targets engaged.
 - (c) First round hits.

(d) Targets hit.

(e) Targets killed.

(f) Area coverage with coaxial machinegun.

The transition group did less well than the sustainment group on posttests of identification and classification errors. The absence of pretest scores for the transition group or of a no-training control group made it impossible to determine the amount of proficiency gain ascribable to transition training.

Estimates of the transition crews' gains relative to the sustainment crews' could be made along the following lines: Assume that the sustainment crews were, at the outset of U-COFT training, more proficient in M1 gunnery than were the transition crews. Assume further that performance on the U-COFT test reliably predicts gunnery performance on the M1 tank. Given these assumptions, the transition crews, had they taken the U-COFT pretest, would have scored lower than the sustainment group scored on the same test. Since the transition crews' exit-level scores were equal to or greater than those of the sustainment crews', the gain registered by the transition crews would have been at least as great as the gain registered by the sustainment crews. This line of thinking is, in our view, unwarranted for several reasons:

1. The number of crews (five) constituting each group probably was too small to permit reliable inferences about differences between the groups' performance.
2. Only one of the five sustainment crews was M1 qualified.
3. The transition crews' entry-level proficiency with M1 gunnery was unknown.
4. The extent to which scores on U-COFT gunnery tests are related to scores on M1 gunnery tests is unknown: The assumption that soldiers who are more proficient in M1 gunnery will score higher on a device-mediated test than will soldiers who are less proficient is equivocal. One suspects in fact that, to the extent that a device differs (within limits) from its parent equipment, a device-mediated test will yield greater underestimates of masters' skill levels than of non-masters'.

Additional Analyses

Additional analyses of the V/V data were performed in an effort to separate performance features that were interdependent in the V/V data; that is, to determine exactly how and why performance gains occurred. The additional analyses addressed:

1. Target acquisition times.
2. Identification and classification errors.

3. Percents of target engagements completed.

4. Target engagement results.

Target acquisition times. If no target was acquired in V/V, no time was recorded. Since failing to acquire is more likely before training than after, the effect of this scoring technique is to underestimate acquisition times on the pretest. This in turn would yield underestimates of acquisition-time gains. Our reanalysis therefore assigned 40 seconds as a minimum estimate of the missing times when no target was acquired or fired on, and estimated the effects of including those values in the acquisition-time averages. (Forty seconds is the maximum target exposure time for crew exercises in the Army's Field Manual for M1 tank gunnery.) The results of reanalyzing acquisition times are shown in Table 1.

Table 1

Sustainment Group's Original and Adjusted Mean Acquisition Times (Seconds)
for Stationary and Moving Tank Targets Engaged during Day and Night

Target Condition	Pretest		Posttest		Gain	
	Orig	Adj	Orig	Adj*	Orig	Adj
Stationary Tank						
Day	14.3	18.0	8.8	8.8	5.5	9.2
Night	12.1	14.1	7.5	7.5	4.6	6.6
Moving Tank						
Day	6.3	7.9	4.1	4.1	2.2	3.8
Night	8.8	10.4	4.5	4.5	4.3	5.9
Average	10.4	12.6	6.2	6.2	4.2	6.4

*No change; all targets groups were acquired and fired on.

Here it can be seen that, while the adjustments proved small, the average gain in acquisition time was underestimated by at least one-third (4.2 vs 6.4 seconds).

Identification and classification errors. Identification errors occurred when the TC called a terrain feature a target, for example, or a BMP a tank. Classification errors occurred when multiple targets were engaged in an order other than most to least lethal. While identification and classification errors were recorded separately in the V/V, their numbers depended upon the numbers of targets acquired: The number of errors could be minimized by not

detecting any targets. Our analysis therefore examined the number of target groups acquired relative to the number available, and computed errors as percents of acquired target groups. The results are shown in Table 2, where

Table 2

Numbers of Target Groups Acquired and Available,
with Errors as Percents of Acquired Groups

	Sustainment Pretest	Posttest	Transition Posttest
Number of acquired groups/ number of available groups (per crew)	17/18	18/18	18/18
Identification Errors	8.2	5.6	10.0
Classification Errors	32.9	17.8	27.8

it can be seen that the crews in the sustainment group failed on average to detect only one target group in the pretest; and acquired, as did the transition group, all target groups in the posttest. The percent of identification errors decreased slightly for the sustainment group (because room for improvement was slight), and percent classification errors was nearly halved. The reason for the transition group's relatively high error percents is not clear. The error data, coupled with the high target hit scores however, suggest that the transition group was shooting first and asking questions later.

Percents of target engagements completed. One way to estimate proficiency on the U-COFT is to examine differences in the numbers of targets engaged before and after training. Data for such an examination were available from the V/V, but had to be converted to percents for comparability. The results of doing so are shown in Table 3, where it can be seen that the sustainment group improved considerably in its ability to engage two- and three-target arrays, and was engaging about 80 percent of the number of available targets at the end of training. The transition group was, at the end of training, engaging 88.5 percent of the number of available targets in two-target arrays, and 95 percent of the number available in three-target arrays.

Target engagement results. Table 4 summarizes target engagement results as percents of targets available. The sustainment group showed substantial gains in engaging, hitting, and killing targets, with exit scores on kill indicators averaging about 80 percent. The comparable figure for the transition group was about 85 percent.

Summary of Additional Analyses. The results of our additional analyses showed that practice with the U-COFT resulted in substantial gains in the

percents of targets engaged, hit, and killed. The gains resulted from improvements in acquisition time, engagement time, and first round hits, which in turn allowed time to scan, acquire, and engage available second and third targets.

Table 3

Target Engagements Completed, as Percents of Target Groups Available, for Two- and Three-Target Groups

	Sustainment Pretest	Posttest	Transition Posttest
Two-Target Groups (n=18)			
No Targets Acquired	7.1	0.0	0.0
No Targets Engaged	10.0	0.0	0.0
One Target Engaged	51.4	18.6	11.5
Two Targets Engaged	31.4	81.4	88.5
Three-Target Groups (n=4)			
No Targets Acquired	0.0	0.0	0.0
No Targets Engaged	0.0	0.0	0.0
One Target Engaged	50.0	5.0	5.0
Two Targets Engaged	45.0	15.0	0.0
Three Targets Engaged	5.0	80.0	95.0

Table 4

Target Engagement Results for TC-Gunner Pairs and TC Only, as Percents of Numbers of Targets Available

Results	Number Targets Available	Sustainment Pretest	Posttest	Transition Posttest
TC-Gunner Test				
Engaged Target	40	55.5	91.0	96.5
First Round Hit = Nbr Eng'ts		65.0	82.3	83.1
Hit Target	40	43.0	79.5	87.5
Killed Target	37 Main Gun	42.7	79.4	88.6
Area Coverage	3 Coaxial	17.5	37.5	35.8
TC Test				
Acquired Target	10	98.0	100.0	100.0
Engaged Target	10	94.0	100.0	100.0
Targets Hit	10	84.0	100.0	100.0
Targets Killed	9 Main Gun	82.2	100.0	100.0
Area Coverage	1 Coaxial	52.5	52.5	57.5

Canadian Armor Trophy (CAT) Team Data

Analyses were performed of U-COFT data obtained from eight CAT TC-gunner pairs. These data were not part of the V/V report, but were generously provided by G.E. in support of our review.

The training and testing sequence for the CAT teams was:

1. One hour orientation and warm-up.
2. One hour U-COFT pretest.
3. Seven hours U-COFT training.
4. One hour U-COFT posttest (identical to pretest).

Statistically significant differences (improvements) between pretest and posttest scores were found on:

1. Acquisition time.
2. First round fire time.
3. First target hit time.
4. Second target fire time.
5. Second target hit time.
6. Number of coax rounds fired.

Statistically significant differences were found neither in percent hits with the main gun, nor in target coverage with the coaxial machinegun. The CAT teams were proficient at hitting targets before U-COFT training began, and were only slightly more so after it ended: their high pretest scores allowed little room for improvement.

Briefing Data

The results of U-COFT V/V were summarized in a briefing by G.E. to LTG W. F. Ulmer on 16 January 1984. Copies of VU-graphs from that briefing were provided by PM TRADE to the Under Secretary of the Army in February 1985, and to the authors of this review in May 1985. Copies of the VU-graphs which summarized the results of sustainment pretests and posttests, and of transition posttests are presented in Appendixes C and D. Here it can be seen that soldiers' performance on nine dimensions was reported:

1. Target acquisition.
2. Reticle aim.
3. Tracking/control manipulation.

4. Stationary single targets.
5. Stationary multiple targets.
6. Moving single targets.
7. Moving multiple targets.
8. Degraded-mode gunnery.
9. Crew coordination.

Our review of the test exercises and performance data uncovered no measures of degraded-mode conditions, and no measures of crew coordination. Crew performance with stationary and single moving targets also was not tested, although ability might conceivably be inferred from performance against multiple stationary and moving targets. We called G.E. for clarification, and were told that the information in the VU-graphs was based, not on pretest and posttest scores, but on V/V test administrators' impressions of progress in training. The data in the VU-graphs were therefore discarded from consideration. Future reports of performance levels and gains should distinguish between objectively measured test data and other kinds of information.

ADDITIONAL CONSIDERATIONS

Our review of the V/V report led to two additional considerations:

1. Proficiency retention.
2. Training and test contents.

Proficiency Retention

Proficiency retention was examined in the V/V report by retesting two TC-gunner pairs 10 weeks after they completed sustainment training, and by retesting another two TC-gunner pairs 3 weeks after they completed transition training. The sustainment crews showed a "definite proficiency loss" (p. 39) after 10 weeks, and the transition crews showed none after three weeks. The findings are not reliable enough to support making decisions about retention or retraining intervals: The number of compared crews (two per group) was small, and the transition group practiced for about a third more time, and performed more than 20 percent more exercises (310 more targets) than did the sustainment group. The question of whether the transition group's superior retention was due to the amount of time between training and testing, or to amount of training remains open.

Training and Test Contents

Review of the information sources listed earlier yielded several suggestions for changes in U-COFT training and testing. Consideration should, for example, be given to:

1. Expanding the content of TC training exercises to include more pre-firing activities; target acquisition, for example, and making initial main gun lays for gunners' engagements. Present TC training exercises deal mainly with firing.
2. Increasing the difficulty of TC tests. High pretest scores in the V/V suggested that the test was too easy. High pretest scores produce ceiling effects, which preclude showing differences between or within groups on posttests.
3. Changing the TC test for broader coverage of the TC training exercises. Engagements with stabilization and laser rangefinder malfunctions, for example, were addressed in training but not tested; as were 50 caliber engagements, battlesight engagements, and long-range moving targets. The point here is that U-COFT (and other) gunnery tests constitute samples of the population or domain of possible target engagements. Tests of proficiency in that domain should not just be made up on the basis of intuitive notions about the adequacy of sampling or covering the domain. Procedures exist for developing domain-referenced tests, and should be followed in constructing tests to estimate tank-gunnery proficiency. The use of domain-referenced testing procedures would result in more reliable and therefore potentially more valid proficiency estimates than those obtained in the U-COFT V/V. A list of documents which describe procedures for constructing domain-referenced tank gunnery tests is presented in Appendix E.

CONCLUSIONS

Among the conclusions which can be drawn from this review are that:

1. Deficiency identification was conducted in a logical, systematic manner; and resulted in useful hardware and software improvements.
2. Thirty hours of U-COFT sustainment training produced substantial average gains in the proficiency of a test group comprising five TC-gunner pairs.
3. Forty hours of U-COFT transition training with another five TC-gunner pairs produced average exit-level scores equal to or greater than those obtained by the sustainment pairs. Proficiency gains for the transition group, while probably substantial, could not be estimated accurately, because entry-level proficiency scores were not obtained.
4. Additional analyses of test data suggested that proficiency gains in target-acquisition time on the U-COFT were underestimated by at least one-third in the V/V report.

5. Additional analyses of test data also showed substantial gains in percents of targets acquired, engaged, hit, and killed. The gains resulted from improvements in acquisition time, engagement time, and first round hits, which in turn allowed time to scan, acquire, and engage available second and third targets.
6. Nine hours of U-COFT training and testing produced statistically significant improvements between pretest and posttest scores of eight Canadian Armor Trophy (CAT) TC-gunner pairs on acquisition time, first round fire time, first target hit time, second target fire time, second target hit time, and number of coaxial machinegun rounds fired. Statistically significant differences were found neither in percent main gun hits nor in target coverage with the coaxial machinegun. The CAT teams were so proficient at hitting targets before U-COFT training began that there was little room for improvement.
7. Review of VU-graphs, which were used to summarize proficiency before and after training in a briefing to LTG W. F. Ulmer, revealed that the reported performance levels and gains were inconsistent with V/V test data. The briefing data were based, not on pretest and post-test scores, but on V/V test administrators' impressions of soldiers' progress in training.
8. Proficiency loss was, according to the V/V report, "definite" after 10 weeks, and nonexistent after three. These findings are not reliable enough to be used for making decisions about retention or re-training intervals: The number of compared TC-gunner pairs was small (two each in the 10- and 3-week groups), and the transition group received more training than did the sustainment group.
9. Tank Commander training exercises dealt mainly with firing. Consideration should be given to expanding the content of TC training to include more prefiring activities; target acquisition, for example, and making initial main gun lays for gunners' engagements.
10. The TC and the TC-gunner tests did not provide adequate sampling of training content. NBC gunnery, for example, and several aspects of degraded-mode gunnery were practiced but not tested. Domain-referenced methods, described in several ARI reports, should be used for constructing U-COFT and other tank gunnery tests.

APPENDIX A

LETTER FROM COL J. M. BALL
TO ARMY RESEARCH INSTITUTE



DEPARTMENT OF THE ARMY
OFFICE OF THE PROJECT MANAGER FOR TRAINING DEVICES
NAVAL TRAINING CENTER
ORLANDO, FLORIDA 32813

REPLY TO
ATTENTION OF.

16 MAY 1985

AMCPM-ARD

SUBJECT: Response to Under Secretary of the Army

ARI Field Unit-Fort Knox
Steele Hall
Fort Knox, KY 40121-5620

1. During a 28 January 1985 visit to PM TRADE, the Under Secretary requested a copy of the COFT training matrix validation test results. The information was furnished the Under Secretary through HQ AMC. The Under Secretary responded on 11 March 1985 with several comments, one of which follows: "It seems to me that it should be examined carefully and in detail by analysts who are not partisan in the U-COFT program area for the lessons to be derived." Consequently, your office was contacted and arrangements made for a full-up briefing to your people on the validation/verification effort and report.

2. Request you examine the report in detail and respond per Under Secretary's request.


JAMES W. BALL
Colonel, ORDC
Project Manager

APPENDIX B

TEST EXERCISES USED IN U-COFT VALIDATION AND VERIFICATION

CREW EXERCISES

U-COFT File Number	Description
34611	Stationary Tank - Long Range Multiple Stationary and Moving Targets (Gunner - Precision - GPS - Normal - Commander - Caliber .50 - Day)
34621	Stationary Tank - Long Range Multiple Stationary and Moving Targets (Gunner - Precision - GPS - Normal - Night)
34631	Moving Tank - Long Range Multiple Stationary and Moving Targets (Gunner - Precision - GPS - Normal - Day)
34641	Moving Tank - Long Range Multiple Stationary and Moving Targets (Gunner - Precision - GPS - Normal - Night)

TANK COMMANDER EXERCISE

U-COFT File Number	Description
21211	Stationary Tank - Short Range Single Stationary Targets (Commander - Precision - GPSE - Normal - Day - Malf: GPCH)

APPENDIX C

SUMMARIES OF SUSTAINMENT GROUP'S PRETEST AND POSTTEST SCORES
(FROM G.E. BRIEFING TO LTG W. F. ULMER, 16 JANUARY 1984)



COFT PRODUCTION PROGRAM

SUSTAINMENT CREW PRE-TEST PROFICIENCY LEVEL

SIMULATION AND CONTROL
SYSTEMS DEPARTMENT

GOOD FAIR POOR

TARGET ACQUISITION			X
RETICLE AIM		X	
TRACKING/CONTROL MANIPULATION			X
STATIONARY SINGLE TARGETS			
STATIONARY MULTIPLE TARGETS	X		X
MOVING SINGLE TARGETS			X
MOVING MULTIPLE TARGETS			X
DEGRADED MODE			X
CREW COORDINATION			X

PRE-TEST BEFORE PLACE
RESULTS TOOK PLACE
U. COFT TUG



COFT PRODUCTION PROGRAM

SUSTAINMENT CREW POST-TEST PROFICIENCY LEVEL

SIMULATION AND CONTROL
SYSTEMS DEPARTMENT

GOOD FAIR POOR

TARGET ACQUISITION			
RETICLE AIM	X	X	
TRACKING/CONTROL MANIPULATION		X	
STATIONARY SINGLE TARGETS	X		
STATIONARY MULTIPLE TARGETS		X	
MOVING SINGLE TARGETS	X		
MOVING MULTIPLE TARGETS		X	
DEGRADED MODE		X	
CREW COORDINATION	X		

APPENDIX D

SUMMARY OF TRANSITION GROUP'S POSTTEST SCORES
(FROM G.E. BRIEFING TO LTG W. F. ULMER, 16 JANUARY 1984)



COFT PRODUCTION PROGRAM

TRANSITION CREW POST-TEST PROFICIENCY LEVEL

SIMULATION AND CONTROL
SYSTEMS DEPARTMENT

GOOD FAIR POOR

TARGET ACQUISITION	X		
RETICLE AIM	X		
TRACKING/CONTROL MANIPULATION		X	
STATIONARY SINGLE TARGETS	X		
STATIONARY MULTIPLE TARGETS	X		
MOVING SINGLE TARGETS	X		
MOVING MULTIPLE TARGETS	X		
DEGRADED MODE	X		
CREW COORDINATION	X		

APPENDIX E

REPORTS OF PROCEDURES FOR
CONSTRUCTING TANK GUNNERY TESTS

Kraemer, R.E., Boldovici, J.A., and Boycan, G.G. Job Objectives Compared to Proposed Training for M60A1 (AOS) Tank Gunnery. Arlington, VA: US Army Research Institute, 1975.

Boldovici, J.A., Wheaton, G.R., and Boycan, G.G. Selecting Items for a Tank Gunnery Test. Louisville, KY: Human Resources Research Organization, 1976.

Wheaton, G.R., Fingerman, P.W., and Boycan, G.G. Development of a Model Tank Gunnery Test. Alexandria, VA: US Army Research Institute, 1977.

Boldovici, J.A., Boycan, G.G., Fingerman, P.W., and Wheaton, G.R. Tank Gunnery Data Handbook. Washington, DC: American Institutes for Research, 1979.

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