TACTICAL EFFECTIVENESS TESTING OF ANTITANK MISSILES

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ABSTRACT

In December 1970, the Program Budget Division 464 established the Army's Study on Tactical Effectiveness Testing of Antitank Missiles (TETAM). This study includes the generation of valid data using field experimentation and the use of these data in combat simulations. The combination of these two efforts will allow for the assessment of the effectiveness of three U.S. antitank missiles; TOW, SHILLELAGH, and DRAGON and two foreign missiles; the British SWINGFIRE and the French-German MILAN. This paper discusses the nature of the field experimentation being conducted and presents some results which have emerged.

I. Introduction

The Tactical Effectiveness Testing of Antitank Missiles (TETAM) is part of a larger antitank missile (ATM) system test program, Program Budget Decision (PBD) 464. Although the acronym TETAM covers more than the field experimentation part of the ATM Study, that acronym will be used for both the experimentation and the study in this paper. As part of this continuing effectiveness testing of ATM, the purposes of TETAM are to:

Contribute to the assessment of combat effectiveness of the SHILLELAGH, TOW, DRAGON, SWINGFIRE and MILAN under simulated combat conditions.

Provide data for use as input to pertinent subroutines of certain US Army high resolution predictive combat models, primarily DYNTACS, CARMONETTE, and IUA.

Verify, to the extent possible with data produced by the TETAM Experiment pertinent subroutines of these US Army high resolution predictive combat models.

The experiment is being conducted over a two-year period as shown below.

Phase	Time Frame
IE	March - June 1972
IA, B, C, L	September - December 1972
II	April - June 1973
III	October - December 1973

Phase I of the experiment obtained intervisibility data between attacking armored elements and defensively employed antitank weapons, and data on the performance of ATM systems in acquiring attacking armored elements as targets. Phase II obtained performance data on attacking armored elements in acquiring defensively employed ATM systems as targets. The results from Phases I and II will be used with predictive models, and to assist in the selection of force-mixes for Phase III, which is a two-sided, non-live fire, near real-time loss assessment, ATM system-versus-tank experiment.

Each phase and sub-phase will be discussed separately.

II. Phase I, TETAM

A. Phase IE:

The specific objective of Phase IE was to obtain line-of-sight, i.e., intervisibility, data between a number of simulated, defensively employed SHILLELAGH, TOW, and DRAGON missile systems and a simulated, advancing tank force in an assumed mid-intensity European conflict setting.

Since ATM systems are line-of-sight limited, previous studies were examined to determine how terrain limits the use of these systems.

This examination showed that previous studies lacked a sufficient base of reliable data upon which conclusions could be drawn. Phase IE, by exhaustively gathering verified data from 12 FRG sites, has supplied this base of data.

The experiment was conducted in the FRG during March-June 1972. Twelve sites were utilized for field execution. Five of the sites were located within a 40 km radius of FULDA, GERMANY. A sixth site was located in the Seventh Army Training Area at HOHENFELS, GERMANY. The remaining six sites were located in the BERGEN-HOHNE-SOLTAU training areas, south of HAMBURG, in the NORTH GERMAN PLAIN area.

On each of these 12 sites, ten realistic tank trails were laid out. These trails represented the path an attacking tank may take if it were part of a force attempting to take the hill on which the ATM positions were located. The 30 to 36 ATM positions on each site were selected to represent positions from which one of the three missile systems under study may fire at the attacking force.

At 25 meter intervals on each tank trail, determination was made of which of the 30 - 36 ATM positions had intervisibility with the trail. This intervisibility was determined for each of three heights above the ATM position (4', 6' and 10') and two heights above the trail (4' and 7'). If intervisibility did not exist, what was in the way was recorded. Since each trail was from 3000 to 5000 meters long, a little arithmetic shows that data were collected on well over one-half million pairs of points.

The results of Phase IE are the topic of another paper in this symposium.

B. Phase IA, B, C, L:

In preparation for phases IA, B, and C, intervisibility data were collected on two sites at Hunter Liggett Military Reservation in California. The procedure for this data collection was similar to that in Phase IE. A significant difference was that on one of the sites at HLMR two sets of trails were laid out, one representing a rapid approach route and the other representing a deliberate approach in which maximum use was made of cover and concealment.

Phase IA was designed to examine the effectiveness of evasive maneuvers on the part of the attacking tanks.

This Phase was executed following completion of the intervisibility work, so it was known which viewing point on each path was intervisible with each ATM panel. Stakes marking each 25-meter viewing point on the rapid approach paths were left in place to allow tanks to follow the paths and as a key to initiate evasive maneuvers.

Beginning at the opposite end of the site, a tank advanced toward the ATM positions, following exactly a tank trail laid for the rapid approach route. As a tank approached a viewing point known to be intervisible with a particular ATM panel, a controller directed the team at that panel to detonate an artillery simulator in front of the panel. He also notified the tank commander that he was about to be "fired" upon from his left, right or center. When the tank crew detected the simulator, they took watever evasive action the tank commander felt would most quickly break LOS with the ATM position which had "fired" on him. The tank commander was allowed to maneuver up to 20 seconds.

The results of the experiment showed that the median distance of travel required to break line-of-sight on that piece of terrain was about 70 meters.

Phase IB consisted of two similar experiments concerning detection of approaching vehicles. In the first part of Phase IB three types of vehicles were configured to appear like threat tanks, anti-tank guided missile launch vehicles, and APCs. A random mix of six of these vehicles advanced toward the ATM positions, following exactly the rapid approach paths. It was therefore known where intervisibility segments began and ended on each path. Each vehicle was instrumented to provide continuous position data.

Players, located at ATM positions, scanned the area where the armored vehicles were advancing, using either the unaided eye or binoculars. When a player detected an advancing vehicle, he announced "DETECT" to the data collector, who immediately recorded the detection. This information along with previously known intervisibility patterns allows the calculation of time to detect given an opportunity. Analysis of these data is included in another paper in this symposium.

In the second part of Phase IB, the detection as described above was followed by identification of the target and simulated fire upon it. The trigger pull activated a bore-sighted camera which photographically recorded the event. This, in addition to giving time to fire data, provided assurance that a target had indeed been detected. Results showed median times of two seconds to identify and 8 to 11 seconds to engage (depending upon weapons system).

The objective of Phase IC was to obtain data on the times required for and the problems encountered in passing a target from a person detecting it, through normal channels in a platoon, to an ATM weapon crew for possible engagement. This process was termed "handoff."

Rather than recreate the entire chain of command, nine handoff pairs were formed consisting of a platoon leader handing off to a squad leader, a rifleman handing off to a squad leader, or a squad leader handing off to an ATM gunner. The two team members were located separately and communicated by telephone.

Six vehicles, configured as threat tanks, antitank guided missile launch vehicles, and APCs, advanced toward the ATM positions in three zones. One member of each team scanned the site until he detected an advancing vehicle. He then handed off the vehicle by identifying it and describing its location. The other member of the team then attempted to detect the same vehicle.

Results of this experiment showed that 51 to 68% of the handoffs were successful (depending on range) and mean time required when the handoff was successful was between 18 and 31 seconds.

In Phase IL, intervisibility data were gathered at two sites in Ft Lewis, Washington. The procedure was the same as for Phase IE.

III. Phase II - TETAM

The second major phase of TETAM was primarily concerned with detecting and bringing under fire the defensive ATM positions by the attacking force. The three parts of Phase II dealt with different detection cues, such as flash, missile flight, and movement.

A. Phase IIA:

The objective of Phase IIA was to obtain data on the ability of attacking armor crews to detect, identify, localize, and pinpoint ATMs with either random sighting or missile launch signature as possible detection cues. The missile launch was simulated with approved signature simulators. The SHILLELAGH and DRAGON simulators provided dust, smoke, flash, and noise. The TOW simulator fired a slug as well.

M60 tanks and M551 vehicles were used as threat armor vehicles. Each vehicle operated in one of three modes: advancing unbuttoned, stationary unbuttoned, or stationary buttoned.

The defensive array consisted of tactically deployed SHILLELAGH, M113-mounted TOW, and DRAGON ATM systems. In addition, six positions in the defensive area were designated as artillery simulation positions.

For convenience of execution, trials were conducted in a series of movement intervals (MI). As each MI began, the threat crews were allowed to scan the defensive area, and the advancing vehicles moved toward it. At predetermined time intervals, the Experimentation Control Center directed each ATM to fire a missile launch signature simulator; 12 simulators were fired during each MI. Interspersed with the ATM firings, personnel at the artillery positions detonated 1/4 pound blocks of TNT, simulating incoming artillery and presenting distracting detection cues to the threat array. The threat crews were required to detect, identify, localize, and pinpoint as many ATMs as possible. In the case of the advancing unbuttoned M551s, detection and localization were accomplished while the vehicle was still moving; they then came to a short halt to pinpoint and engage. Times that these events occurred were recorded by the data collector on each vehicle; "firing" the main gun at an acquired ATM activated the movie camera, taking a film strip of the ATM/IR beacon "fired" upon. This film provided the pinpoint accuracy data and the identification of the particular ATM pinpointed.

Following completion of each MI threat crews were moved out of view of the defensive area and the ATMs changed positions preparatory for the next MI.

Results of Phase IIA show that the TOW is the easiest to detect followed by the SHILLELAGH and the the DRAGON. The percent of launches which resulted in detection were from 32 to 47 for TOW (depending on which armor element was attempting to detect), from 22 to 35 for SHILLELAGH and from 18 to 29 for DRAGON.

B. Phase IIB:

Phase IIB generated the most interest of all phases of TETAM. This was mainly because in this phase we fired actual (inert) missiles at stationary targets and also at a manned moving heavily armored tank. Although the success of the missile system operators in hitting the target received much attention, that was not the primary objective of this phase.

The primary objective was the same as Phase IIA, with missile flight added as a possible detection cue. Secondary objectives were to obtain hit data on evasive and stationary targets, and on the ability of the TOW and MILAN to track an evasive tank.

The threat array consisted of the stationary, buttoned M60 tanks used in Phase IIA. Stationary targets were wooden panels with the silhouette of a T62 tank in half-hull defilade on them. The evasive target tank (ETT) was a modified, manned, M48A3 tank.

In Phase IIB, one DRAGON and two each SHILLELAGH, TOW, and MILAN systems made up the defensive array. In later trials SWINGFIRE systems replaced the MILANs, the DRAGON was not used, and SHILLELAGH and TOW fired signature simulators.

During a trial, each system which was firing missiles fired one at the ETT and three at stationary targets.

Results indicate that the flight of the missile seldom provided a cue to those trying to detect the ATM positions. The percent of firing in which the missile was reported as a cue were none for DRAGON, 5 for TOW, 7 for MILAN, 9 for SHILLELAGH and 13 for SWINGFIRE. Hit data are classified.

C. Phase IIC:

The objective of Phase IIC was to obtain data on the physical exposure of ATM systems when engaging an attacking armor element. The ATM systems tested were the TOW, SHILLELAGH, DRAGON, MILAN, and 106mm Recoilless Rifle.

Each ATM system started in a defilade, or "hide," position. On command of a data collector collocated with the ATM, the crew moved the weapon forward to a firing position. Once in the firing position, they laid on a target panel downrange and simulated firing and tracking a round. At the end of the time of flight, the data collector announced "Impact," which was the signal for the crew to move the weapon back to the hide position.

Data similar to that collected in Phase IIA were recorded. The purpose was to determine if the movement had a significant effect.

The results showed movement was a significant cue. The percentage of all detections for which movement was reported as a cue was 9 for the DRAGON, 53 for the TOW and 61 for the SHILLELAGH.

A small side experiment in Phase II was conducted to see how well the TOW and MILAN could track an agile target, the XR-311 "Dunebuggy." Tracking film is available but has not been analyzed.

IV. Phase III:

Part IIIA is exploratory experimentation to verify operational procedures and to confirm the design of subsequent parts. One of the primary design objectives of exploratory experimentation is to verify that the specified force mixes will provide a balanced force structure. It may become necessary to adjust the structure of the defensive or threat forces based on the results of exploratory experimentation.

The keystone in the design for Phase III is based on the execution of Part IIIB. All other parts of Phase III will be conducted under all or a selected portion of the conditions under which Part IIIB will be conducted.

TETAM has six objectives. Phase III will address Objectives 5 and 6 only. These objectives are:

5A - To obtain performance data on antitank missile systems in defensive positions when engaging an attacking armored element in simulated combat.

5B - To obtain performance data on attacking armored elements when engaging defensively employed antitank missile systems in simulated non-live fire combat.

6B - To obtain data to assess the effect of countermeasures on antitank missile systems performance.

6C - To obtain data to assess what counter-countermeasures should be taken to overcome aggressor countermeasures.

This phase is being conducted between September and December 1973.

Following the basic trials of Phase IIIB additional trials will be run in which the primary objectives are:

IIIC - Evaluation of SWINGFIRE Gunner-launcher separated concept.

IIIE - To allow the DRAGON to attack from the flank.

IIIF - To evaluate an Indirect Fire Casualty Assessment System.

IIIG - To evaluate the systems in night combat.

IIIH - To evaluate the contribution of scatterable mines.

(Don't worry about IIID as it was cancelled.)

V. Summary

The conduct of field experimentation to obtain data on all possible combinations of conditions in support of effectiveness evaluations is beyond reasonable resources and time consideration. A logical means to obtain such quantities of information is through a program whereby field experimentation data can be obtained for input to, and use in validating computer simulation models. If the latter is successful, the models can then be used to generate additional credible data for those conditions not obtained during experimentation. This integrated field experiment-model program approach has been used in designing all phases of the experiment.

To further the exchange of information and improve the understanding of the antitank missile capabilities of the NATO forces, an Ad Hoc Evaluation Group for Antitank Missile Testing has been formed with representatives from the United States, Great Britain, France, and the Federal Republic of Germany. TETAM is the first antitank missile experiment to be conducted since the formation of the Ad Hoc Group. The MILAN and the SWINGFIRE concept are evaluated in both Phases II and III.

Complete reports of Phases I and II are available through Headquarters, US Army Training and Doctrine Command. Reports of Phase III will be available by 1 March 1974.