

TACWAR # 73
29 August '72

REQUIREMENTS FOR ARMY TACTICAL MISSILES ANALYTIC APPROACH

HCBrown, RJVolluz

1. The question posed is in essence two questions in one -- What are the requirements "for" and "on" tactical missile systems to support the Army beyond 1976? (We are assuming 1976 + since any conceivable earlier system is probably already relatively frozen.)

The requirements "for" question has been phrased as follows:

Question A. "What will candidate new or improved missile systems of definable fire capability ($K_{F,B}$) contribute to Blue (U.S. and possibly allies) combat potential ($\pi_{C,B}$) in 1976+?"

An answer to this question would serve to confirm or refute the judgmental priority given to the DSM¹, the LOFAADS², and a "Defense Suppression" type of missile. The question requires study of an appropriate weapon mix for U.S. ground forces, and must include some consideration of fire support by air and naval forces.

Analysis of this question requires input information on intended force structure and doctrine which may prove unavailable; necessitating the use of alternative assumptions.

2. In phrasing the question as above, we have limited our task to the analysis of worth of competing systems, assuming that someone else can define a set of feasible systems. For a weapon system, the definition should be of the following fire characteristics:

- 1) Accuracy, ($\Pr(v_D)$) -- as a function of Range
- 2) Lethality, ($L(v_D)$) -- against each Red elemental target {....., R_j ,}
- 3) Rate of Fire, (v_F)
- 4) Delay Time, (Δt_{I-D}) -- between fire order (Aim Point Designation) and detonation

¹ Division Support Missile

² Low Altitude Forward Anti-Air Defense System

These fire characteristics will suffice for the "Capability" comparisons required by top-level Question A; other characteristics of the weapon system, bearing on Vulnerability and Compatibility, will come under a second top-level question relate to Requirements "on" which is phrased as follows:

Question B. " For those missile systems of greatest priority identified under Question A, what combination of performance variables contributes most to Combat Potential ($\pi_{C,B}$)?"

which will be mentioned again in Paragraph 11 below.

3. The Blue combat potential for a given time period t_1 to t_2 is given by the following formula:

$$\pi_{C,B}|_{t_2-t_1} = \sum_g Q_{V_g}^B \Delta t_{V_g} - \sum_i P_{B_i}|_{t_2-t_1} \bullet V_{B_i}^B|_{t_2} + \sum_j P_{R_j}|_{t_2-t_1} \bullet V_{R_j}^B|_{t_2}$$

This potential is established, in part, by the Red force and its adopted course of action during the period t_1 to t_2 . The force is represented by the set $\{ \dots, R_j, \dots \}$ of Red elements, to be described both physically and in terms of functional performance characteristics. The Red courses of action can be evaluated by the directive information governing its strategy - $\{ \dots, Q_{V_g}^R, \dots \}$, $\{ \dots, V_{B_i}^R, \dots \}$, $\{ \dots, V_{R_j}^R, \dots \}$.

This information is that portion of a scenario to which we refer as the "enemy environment". Various scenarios should be used reflecting alternatives as to the enemy (Red) and his mission.

4. The terrain and weather affect the various potentials of both forces and thus influence the Δt_g , P_{B_i} , and P_{R_j} contained in the expression for π_C given above. Therefore the scenarios should include a description of the natural environment.

5. Political considerations basically dictate the $\{ \dots, Q_{S,V_g}, \dots \}$ strategic value of terrain points. In addition, they may limit the weapons used, or directly rule out certain courses of action. Thus scenarios require some description of political objectives and limitations.

6. These considerations bring about the statement of the first subordinate question which is phrased:

Question A₁: "What scenarios are to be used as a basis for evaluation?"

We have, of course, the three basic scenarios (Central Europe, Mid-East, and Southeast Asia) previously used, and failing any better input they can be used again. It is considered rather unlikely that results from these three varied scenarios will agree on development priorities for missile types.

7. Combat potential (π_C) is composed of potentials in each of the nine military functions we have defined for analysis - Command (π_D), Fire (π_F), Maneuver (π_M), Intelligence (π_I), Supply (π_S), Maintenance (π_R), Construction (π_E), Transportation (π_T), and Signal (π_X). These functions are interdependent; for instance the contribution to π_C of π_F is always influenced by at least π_D , π_I , π_X , and π_T . Evaluation of the contribution of a given weapon system requires information as to the Blue force structure and the capabilities of supporting systems. This leads to statement of the second subordinate question:

Question A₂: "What Blue force structure(s) are to be considered in evaluation of the missile system?"

8. The Blue force structure and its method of employment are interdependent. At the extreme, consider the difference between a fortified area defense organization and an armored unit designed for rapid exploitation. Other forces, not so specialized, may engage in a variety of operation; for analysis these can be described by $\{ \dots, Q_{V_g}^R, \dots \}$, $\{ \dots, V_{B_i}^R, \dots \}$, $\{ \dots, V_{R_j}^R, \dots \}$.

This leads to:

Question A₃: "What Blue force mission is to be considered in evaluation of the missile systems?"

9. The fire potential (π_F) contributes to the combat potential (π_C) in three basic ways:
- 1) Defensive fire, such as is furnished by anti-aircraft or anti-tank weapons, reduces the loss of Blue elements (P_{B_i}).
 - 2) Area fire limits the Red plan of maneuver and thus enhances the Blue expectation of $Q\Delta t$. Area fire includes the use of mines.
 - 3) Point fire contributes to the attrition of Red elements, (P_{R_j}). Point fire is delivered against either: a) Fixed Targets, or b) Moving Targets.

These classes of fire do overlap to a considerable extent -- for instance, area fire will destroy some Red elements, and point fire has some effect in suppression of movement. However, a first step in the consideration of weapon mix should be determination of the general balance among the three classes of fire. Hence:

Question A₄: "What balance among fire classes 1), 2), 3a), and 3b) best implements the stated Blue doctrine?"

To answer this question would be the first task in analysis of "Requirements for".

10. The balance among classes 2) and 3b) is very dependent on target acquisition potential (π_I). Mobile targets can be attacked by point fire weapons if the interval between target acquisition and weapon detonation (Δt_{I-D}) is sufficiently short. Otherwise, area fire against selected locations may cause some damage and inhibit movement. Even this technique becomes relatively ineffective at longer ranges, where the movement of the target during Δt_{I-D} has a large possibility of taking it out of the area of effect. Thus the balance among weapon classes, and the ranges advisable for the constituents of a weapon mix, are much influenced by π_I . Hence:

Question A₅: "What is the intelligence potential (π_I) of the Blue Force?"

11. Each of the above five subordinate question will lead to a specific type of investigation -- a branch of the "Question Tree". It is important that this type of investigation be conducted on a

long-term, relatively low-effort basis; this can lead to understanding of the fundamental Army problems of the future.

At the same time, we should develop a "Requirements On" question tree for the systems assumed to have highest priority -- viz., DSM, q, and some type of "Defense Suppression" missile, presumed to be helicopter-delivered. A question tree for this type investigation is typified by the Interdiction Question Tree shown in Figure 1 (following page), but with the top question modified:

These tasks will produce evidence on the first of the three fundamental questions:

- 1) "What missile systems are needed by the U.S. Army of the future?"
- 2) "What missile systems will the U.S.A. (or others) buy in the future?"
- 3) "What missile systems can be profitable for an industrial contractor?"

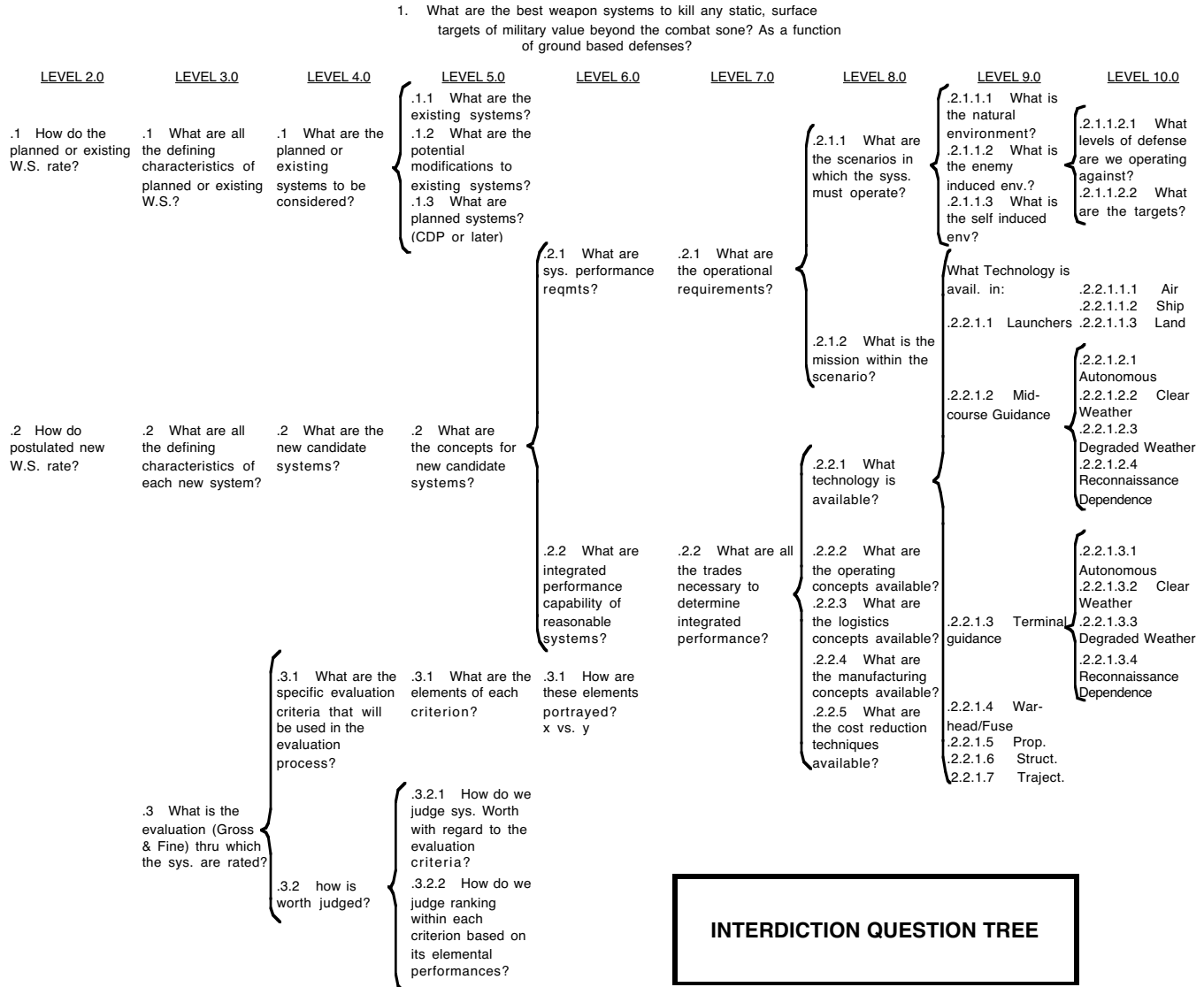


Figure 1 - Interdiction Question Tree