Chapter 5

MILITARY ELEMENT VALUE THEORY

Essential to the analysis of tactical warfare is some rational, logical means of assigning values to targets. Target value is an input variable indicating the tactical desirability of attack on any target; the value of any target, coupled with its vulnerability to weapons within an input mix determines the priority of delivery of these weapons against the diverse assets and military operations of the enemy.

A simple method of valuing Interdiction targets is hypothesized in Chapter 6.0 and applied in a study of Interdiction Fire (Chapter 8.2) . Although Interdiction Fire targets are shown to be very much time and situationally dependent, target values for the study of Support Fire are substantially more so. Further, as weapon lethality has increased, tactical warfare has increasingly emphasized maneuver and suppressive fire (i.e., time and situational factors). This necessitates a careful integration of the closely related combat and support functions in some form of target value that reflects the effects of maneuver and disruption of enemy courses of action as well as the time honored effect of physical damage or destruction.

The theory for establishing target values for military elements was adressed initially in Chapter 3.0 and is extended herein.

1.0 PURPOSE

This Chapter outlines a reasoned approach to the calculation of values for military elements, these values being usable for Target Selection, for Force Balancing, and possibly for other purposes. The method, as explained below and illustrated by very simple low-level tactical situations, is a major step toward practical analysis of military system effectiveness.

2.0 CAVEATS

Prior to presenting the simplified explanation, it may be well to list the areas of difficulty and the probable resolutions thereof.

1. Precise calculation of values by either Blue or Red command elements requires a detailed knowledge of the situation such as is impossible even for information on friendly forces, much more so for information on enemy forces. However, the value calculation by the methods outlined herein may be thought of as the *true* value inherent in the situation. Each commander must make an estimate of that value. The nearness of the estimate to the true value will be determined by : 1) the accuracy of information regarding the enemy -- determined by the performance of intelligence elements, (2) the accuracy of information regarding friendly forces -- determined by the command function designated as Status Report, and (3) the accuracy of Estimation -- a Command process.

2. Tactical planning is presented as a construction of a logical *tree* of possible future events in a two-sided game, with many provisions for reaction to contingency. Even a world chess master cannot consider *all* possibilities for more than five or six moves ahead, and a squad-level tactical situation is considerably more complex than a chess game. Planning will actually proceed more on a basis of *potential* than of specifically forecast events. This will be eventually reflected in the methodology by the use of potential (See Chapter 3.0) to derive the apparent value of elements.

3. The illustration below is in terms of military elements. Obviously even at the platoon level the number of elements involved will be greater than the number of pieces in a chess game. This difficulty must be overcome by expressing *unit*, rather than elemental potentials. Since a unit will typically have some potential in each of the nine functions (including Command as represented in Figure 3-8), which are expressed in various units of measurement, the values must be combined in terms of contribution to combat[1] potential.

4. The elements to be valued are those which perform the nine disparate functions shown in Figure 3-8. The common dimension of value is postulated to be man-days of enemy effort negated; the common dimension of cost is man-days of friendly effort expended. These are not what might be called "natural" units for the functions; a natural unit for Transportation, e.g., would be ton-miles per day. Translation from these natural units to common units of

[1] Combat is a composite of the nine specified military functions. Combat potential can be measured only in a specific scenario and for a specific pair of opposing courses of action. Combat potential is then equivalent to objective function expectation (See Chapter 3). From a Blue point of view, the situational value of each Blue element is its contribution to Blue combat potential in the selected course of action (normally a maximin). From the same viewpoint, the situational value of each Red element is its detraction from Blue combat potential (again in the maximin combination of courses of action).

combat potential will be by some coefficients of equivalence, which are expected to be very situation-dependent.[2]

5. In passing from the very simple "one-on-one" type of interaction illustrated to a more complex and realistic situation, the algorithms required will become quite involved. This will require that approximation methods which will be developed and verified later.

3.0 ELEMENTAL VALUES

The general development of elemental values is pictured as a process of adding on to *residual values* furnished by the next higher command a *situational value* derived from analysis of the element's contribution to combat potential for a chosen course of action.

Specifically, suppose a Blue platoon leader has received orders which require him to select a combat plan for the period of time t_1 to t_U. The company commander furnishes a "residual value" for each Blue element assigned to the platoon leader $\left(V_{B_i} \big]_{t_U} \right)$ - this is the value or worth to future plans of the company commander and higher echelons of having element B_i functioning at time t_U.

The platoon leader formulates and evaluates courses of action for the period t_1 to t_U. specified by the company commander. In this process he uses the $V_{B_i} \big]_{t_U}$ as an input to his objective function. Having completed his planning he must frame orders to guide the action of squad leaders during the period t_1 to t_2 ($t_2 < t_U$). He adds to $V_{B_i} \big]_{t_U}$ the situational value of B_i in his plan for the period t_2 to t_U, and passes this on to the squad leader as $V_{B_i} \big]_{t_2}$.

---

2 As an example, consider the contribution to Blue's combat potential of Class V (ammunition) supply potential as an ability to deliver certain quantities of ammunition to fire units during the period of time t_1 to t_2. From this potential a certain Blue supply plan is developed to support the Blue combat plan,- this involves deliveries of ammunition in certain quantities to certain fire elements at certain times. The deliveries increase the risk imposed on Red functioning by the Blue fire elements. This risk, according to the Red combat course of action, results in an increase of either Blue's expectation of time on objectives or expectation of Red attrition,. These increases raise Blue's combat potential. A coefficient of equivalence between supply potential and combat potential will be dependent on situational factors such as (1) $t_2 - t_1$, (2) Blue's fire element stockage, (3) Red combat strength, (4) etc.

Similarly the squad leader develops and passes on to the fire team leader a $V_{B_i}\big]_{t_L}$, which is $V_{B_i}\big]_{t_2}$ plus the situational value of B_i for the period t_L to t_2. The fire team leader can develop a situational value for the period t_1 to t_L, as illustrated by the use of the example shown in Figure 5-1 (a).

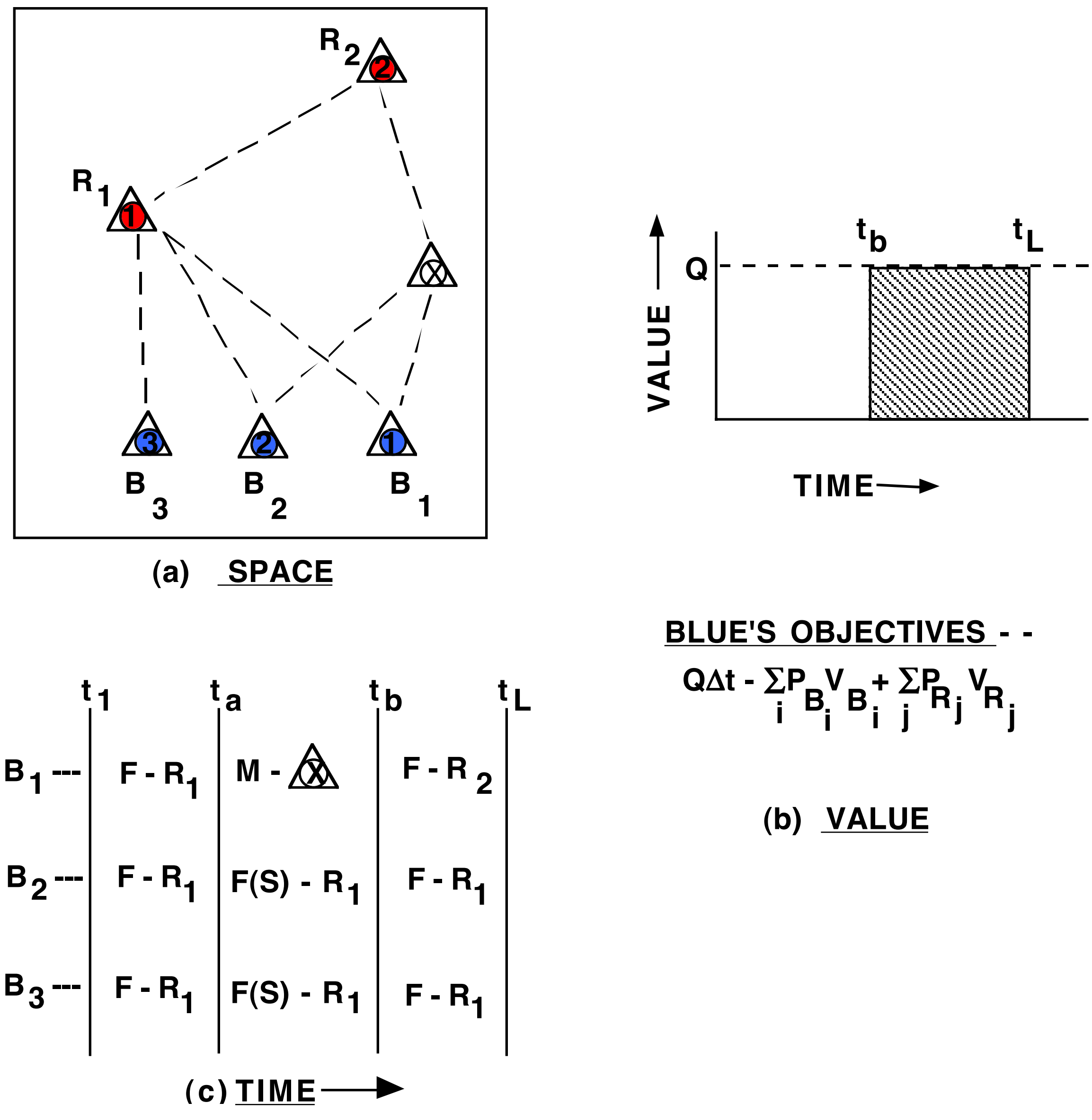

Figure 5-1 - A Fire-team Leader Plans One Course of Action to Achieve an Objective within Space and Time Limitations.

A Blue fire team leader has received orders to capture the objective designated as Δ_X. The mission-type[3] orders furnish four basic pieces of information, which are discussed in turn below. How these pieces of information are developed will be discussed in sections 4 and 5.

3.1 Resource Allocation

The first piece of information is an allocation of resources. The fire team leader is given control over three Blue riflemen (B_1, B_2, and B_3) of which he is probably one. Allocations of resources are not completely issued in actual orders; in the absence of stated change the resources are presumed to remain as last allocated. However, the allocation of resources can be considered a virtual component of all orders.

3.2 Objective Value

A time value is assigned to the occupation of the objective[4]. For simplicity in this case, a constant value of Q is assigned from t_b to t_L; more complex functions $Q(t)$ are equally possible. Q is in a dimension of *men* - probably in this case a fraction of a man. For every minute between t_b and t_L that a functioning rifleman occupies a terrain feature, Δ, Q man-minutes are gained as indicated by figure 5-1(b). This concept of military orders is, of course, entirely artificial for the purpose of the model. It is held to be reasonable, however, in actual practice objectives are taken at the risk or sacrifice of life, and the value of the objectives fluctuates in time as strategies unfold.

3.3 Residual Values

A residual value (V_{B_i}) is assigned to each Blue element for the period after t_L. The value is stated in man-minutes (to keep the units consistent). This establishes the amount of risk which can be taken with each element in the attempt to realize value by occupation of the objective. Again, this is an artificial modeling of a real consideration - resources must be conserved for the continuation of the conflict.

---

[3] Mission-type orders are framed to allow for implementing decisions by the recipient. Combat orders specify the information discussed in text, plus the area of operations. These are normally accompanied by specialized orders in various functional fields. As an example, the supply plan as translated into orders may specify residual levels of certain types of supply which must be available at t_2 - the expiration of the plan of the recipient of the orders.

[4] The occupation of the objective must be by a combat element or unit - one having a potential for fire, maneuver, intelligence, or all three. Orders may specify the type and level of potential required; this aspect is ignored in the simple example discussed since Blue is credited with only one type of combat element.

A residual value (V_{R_j}) is assigned to each Red element for the period after t_L. This reflects the dual nature of most military missions - to control terrain and to destroy enemy assets. Either Q or V_{R_j} can be equated to zero if it is desired to show only one facet of the normal mission.

3.4 Objective Function

With the above information, an objective function for the Blue fire team leader can be constructed; which is ---

$$Q\Delta t - \sum_i p_{B_i} V_{B_i} \Big]_{t_2} + \sum_j p_{R_j} V_{R_j} \Big]_{t_2}$$

where Δt is to be understood as the period between t_b and t_L during which the objective is occupied by a functioning Blue rifleman. p_{B_i} and p_{R_j} are to be understood as the probabilities of kill before t_L of the corresponding Blue and Red elements.

3.5 Courses of Action

A very large number of courses of action are open to both Blue and Red during the time before t_L. Each of these courses of action should be thought of as a detailed program[5] for the functioning of the Blue (Red) elements until the time t_L. An example is given in Figure 5-1(c).

Suppose R_2 (Figure 5-1(a)) is a weapon which outranges those of the Blue elements, and can cover the objective but cannot reach them in their present positions. Suppose R_1 is a rifleman who can also cover the objective and the present positions of the Blue elements. *One* possible Blue course of action is for all three elements to fire at R_1 until t_a, the latest time at which B_1 can leave his position and arrive on the objective by t_b. During B_1's move, B_2 and B_3 continue firing at R_1 for *suppressive effect*. R_2 can fire at B_1 as he moves and after he arrives at the objective. Given all details of element capability, current state, and environment, it is possible to compute the exact expected value of the Blue objective function if this course of action is adopted.

[5] As noted earlier, the combat course of action selected and promulgated as the Blue plan will be accompanied by specialized plans in each functional field. The potentials and possible courses of action in each functional field. The potentials and possible courses of action in each support function do influence the selection of the combat course of action. Sometimes they are merely analyzed on a go-no-go basis for required potential to support the chosen course of action; in other cases detailed alternative plans for the support function are a major consideration in choice of a combat course of action. An example of the latter situation would be an amphibious operation in which transportation alternatives are fundamental considerations in the combat plan.

The course of action has assumed that the Red elements will remain in place and fire, while, of course, they may do other things, such as occupy the objective to forestall Blue. Red has many courses of action available, and Blue has many besides the one just described.

Referring back to Figure 3-9, the planning process of Blue is modeled as the creation of a game matrix in which the estimated values of his objective function for each pair of opposing courses of action are placed as matrix elements. Red, of course, will also construct a matrix - probably different in objective function and in the details of courses of action presented. There is also an "Umpire" matrix which lists the Blue courses of action as envisioned by Blue, the Red courses of action as envisioned by Red, and the true values of each pair of opposing courses of action for each "player" according to his own objective function. The "true" value of any Red element as a target for Blue is derived from its degradation of the Blue objective function in the opposing courses of action actually adopted. Blue, following a maximin strategy, will assign to each Red element the value attained in that course of action most adverse to Blue's chosen plan.

3.6 Calculation

Suppose the courses of action actually adopted are as previously described, what is the value of R_2? To find this out it is necessary to analyze each part of the course of action on which R_2 has an influence. In the simple example given here, R_2's influence is limited to a probability of kill (p) against B_1 while en route to the objective and while occupying same. For this calculation the contributions of B_2, B_3 and R_1 to the Blue objective function can be ignored [6]; thus, the value of the Blue objective function if R_2 is functioning is:

$$(1-p)Q(t_L-t_b)-pV_{B_i}$$

If R_2 is not functioning during the interval t_a to t_L, then the value is

$$Q(t_L-t_b)$$

---

[6] This is an approximation. Let p_1 be the probability of kill of B_1 by R_1, and p_2 the probability of kill of B_1 by R_2. The exact formula with R_2 functioning is:

$$(1-p_1)(1-p_2)\,Q\,(t_L-t_b)-\left(1-(1-p_1)(1-p_2)V_{B_1}\right)$$

Without R_2, it is:

$$(1-p_1)\,Q\,(t_L-t_b)-p_1V_{B_1}$$

The first formulation is ($-p_2+p_1\ p_2$) times the second; the $p_1\ p_2$ term is ignored.

ignoring any action by R_1 since we are calculating value for R_2.

Then the value of suppressing R_2's fire in this situation is the simply the difference between these two values above, or

$$pQ(t_L - t_b) + pV_{B_i}$$

If R_2 is *killed*[7], its residual value V_{R_2} is added

$$pQ(t_L - t_b) + pV_{B_i} + pV_{R_2}$$

In a similar fashion, the value of support to R_2 can be calculated. Suppose, for instance, R_2 has limited ammunition which reduces the p to p'. Another Red element which can furnish enough ammunition to restore the p has a value of:

$$(p - p')\,Q\,(t_L - t_1) + (p - p')V_{B_i}$$

There is an upper limit to the value of R_2, as estimated by Blue, p can be no higher than that value which makes the apparent (to Blue) value of the chosen course of action less than the apparent value of the next most profitable course of action. In such case, of course, Blue would have chosen that next most profitable course. Of course, if Blue has faulty intelligence about R_2 (including complete ignorance of its presence), he may choose the wrong course of action and the true value of R_2 is not limited in this manner.

The value of R_2 (or any other element) is very much a function of time. The value changes every time that either commander alters his course of action in a manner that affects the performance of R_2. In addition, the value as computed with respect to this particular fire team course of action may or may not be the same as the value assigned at the next higher echelon. The latter value may be more, but it cannot be less. That next higher echelon will be the subject of section 4.0.

---

[7] *Killed* implies a degradation or cancellation of functional capability at time t_L (see section 4.0).

4.0 NEXT HIGHER ECHELON VALUES

The fire team leader of section 3.0 received his orders from the immediately superior command element in the chain of command. To illustrate, it is assumed that this is a squad leader who has divided his unit into two fire teams and a support team including his grenade launchers and automatic rifles as indicated in Figure 5-2 His plan is as follows:

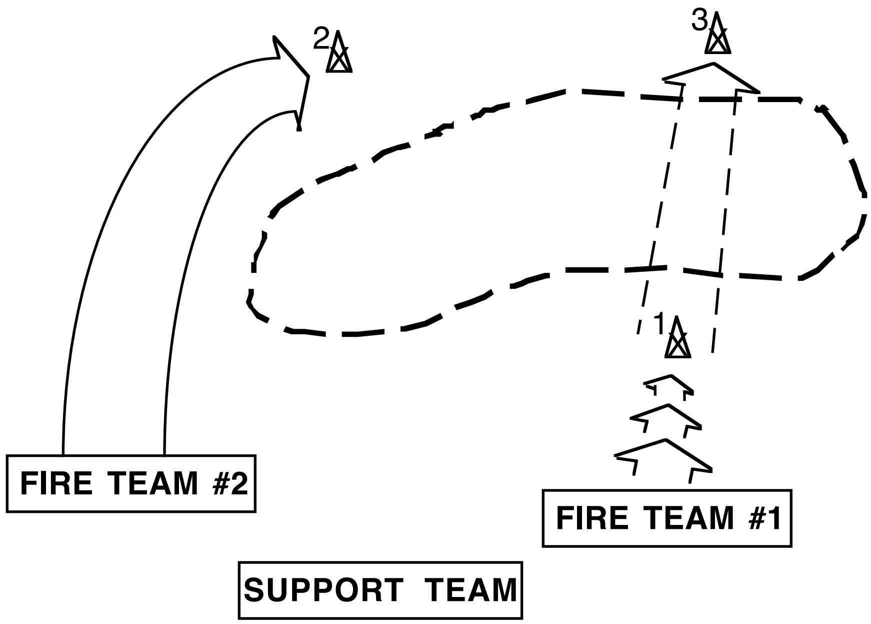

Figure 5-2 - Objective Values are Determined at Next Higher Echelon - Q , V_{B_i} , V_{R_j}

Fire Team 1 will seize Objective 1 by t_b in order to place suppressive fire on the Red position. Fire Team 2 will then circle the Red position to seize Objective 2 by t_L. Red will then be subject to fire from both front and rear; he may retreat, or failing that, is calculated to suffer enough casualties so that Fire Team 1 can proceed to the squad objective (Objective 3), arriving by t_2. The Support Team is available to deliver support fire for the benefit of both Fire Team 1 and Fire Team 2.

4.1 <u>Resource Allocation</u>

If the squad leader has a perfect and detailed knowledge of the whole situation, his division of resources into two fire teams and a support team is a mathematical problem of optimization. Such knowledge is at least uncommon, and his decisions normally must be made under considerable uncertainty as to what the future may hold. Fire Team 1 has the more important mission, since it will seize the squad objective, Objective 3. Fire Team 2, on the other hand, has a more difficult *intermediate* objective, Objective 2, and since it has further to go is probably more vulnerable to unknown risks. Under these circumstances, he might balance Fire Teams 1 and 2 at three men each, attaching one of the support weapons - probably an automatic rifle - to Fire Team 2, because it must operate out of range of the initial Support Team position. Under such an arrangement, the Squad Leader would initially remain with the Support Team, forming a strong reserve for unpredicted contingencies. The relation of expected objective function value realized by this allocation of resources to the maximum realizable in the situation and against the chosen Red course of action is determined by three factors; (1) the quality and quantity of intelligence available to the squad leader, (2) the skill of the squad leader in planning and estimation, and (3) the comparative generalship of the opposing commanders.

4.2 Objective Value

Regardless of the fact that better squad courses of action may exist, the value (Q_1) of Objective 1 given to the leader of Fire Team 1 is determined by the chosen course of action of the squad leader. Fire Team 2 will be proceeding to Objective 2 during the interval t_b to t_L, and a rifleman posted at Objective 1 will reduce the expectation of loss of Blue elements in Fire Team 2. The amount of that reduction, measured in man-days (as is V_{B_i}), is part of the assigned value of Objective 1. The other parts are a heightened expectation of realizing the value of Objective 3 as assigned by the Platoon Leader, and a heightened expectation of realizing the residual value beyond t_L of one or more Red elements.

4.3 Residual Values

With reference to Blue elements, a residual value beyond t_2 is assigned by the Platoon Leader, using methods identical to those of the squad leader. The latter, however, has a use for these elements between t_L and t_2 - they are scheduled to proceed to Objective 3. The lessened expectation of value gained in objective 3 *due* to loss of an element prior to t_L is the amount of residual value added by the squad leader.

The residual value of these elements has an upper limit - the cost in man-days of providing a replacement, plus the denial of performance of the element during the period before a replacement arrives (situational value). At some one of the levels of command above the squad leader, the commander can count on replacements for lost elements prior to the critical time at which his plans, as distinguished from those of the subordinate units, are to take effect. Thus the residual value he assigns to the element is merely the cost of replacement. Of course, the add-on of situational value at those subordinate echelons can be very high for an element which is critical to the success of the current plan of action.

The residual value of Red elements, as assigned by the Blue command echelons, is calculated very similarly to the above. The Blue squad leader receives a residual value from the platoon leader and adds thereto his expectation of gain in objective function value if a specified Red element is missing during the period t_L to t_2. The value is limited by replacement capabilities in a manner entirely analogous to that described above.

5.0 PYRAMIDAL ECHELON VALUES

Neglecting for the moment the impossibility of such detailed calculations (for approximations, see section 6.0 of this chapter) at all levels, the picture is one of situational values and residual values being established down through the chain of command.

5.1 Situational Values

As previously noted, there is a point in the chain of command at which the pyramiding of situational values can stop. Consider a commander, at some level unspecified, who has an objective for his critical time, say t_{U4} (the U_4 designating an upper echelon), and has assigned objectives carrying his subordinates to some time t_{U3} short of t_{U_4}. In his plans he has a definite use beyond t_{U3} and between that time and t_{U_4} for each of the elements assigned to his subordinates (including reserve), and therefore, must assign a residual value beyond t_{U3}. However, he also can count on a certain replacement capability; if an element is lost at some time t, it can be replaced at some later time $(t + \Delta t_{\boldsymbol{R}})$ at a cost $\boldsymbol{R}$ in man-days. Thus, if the element is lost prior to $\left(t_{U3} - \Delta t_{\boldsymbol{R}}\right)$, the total loss to him is only $\boldsymbol{R}$. The time $\left(t_{U3} - \Delta t_{\boldsymbol{R}}\right)$ is prior to the critical time of the next subordinate echelon, but not prior to the critical time of some echelon still further down the chain of command. That last echelon, in computing residual values, need count only values occurring within a span $\Delta t_{\boldsymbol{R}}$ from the critical time to be named, and add $\boldsymbol{R}$.

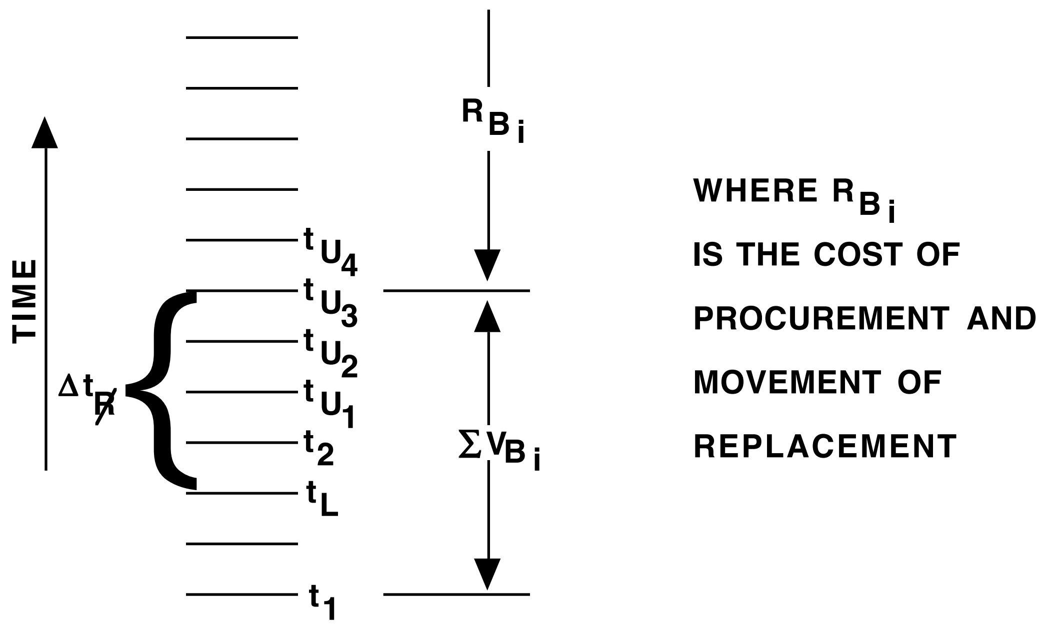

Figure 5-3 - Residual Values Have a Limit.

Referring to Figure 5-3, supposing that the time required for unit replacement is $\Delta t_{\boldsymbol{R}} = \left(t_{U_3} - t_2\right)$, the commander doing the planning at the level distinguished by critical time t_2, must assign to the next lower level a residual value beyond t_L for each element. This residual value he computes by summing the situational values computed for each of the intervals between t_L and t_{U_3} and adding $\boldsymbol{R}$. It will be noted that any element not scheduled for beneficial employment during the period t_L to t_{U_3} has a residual value of only $\boldsymbol{R}$.

The residual values assigned to Red elements by the Blue commander are subject to the same type of calculation.

5.2 Replacement Values

$\boldsymbol{R}$ is the replacement cost of any specific element, to be measured in man-days of effort. To go on with the specific example illustrated by figure 5-3, the plans of the commander of level U_4 are not affected by the loss of the element prior to t_L if he has the means to provide a replacement at the proper place by t_{U_3}. This requires some transportation and processing effort, which is measurable; it also requires an element not previously under his command, and presumably gotten from level U_5. Level U_5 cannot simply absorb the loss, since it will affect his plans for the period t_{U_4} to t_{U_5}.

In fact, all elements in the theater are considered as incorporated in plans at some level, their loss will affect situational value at some level, and replacement must come from outside the theater. If these replacements are available, then the cost *to the theater* is simply the man-day effort expended in processing and transportation to the point of first use.

However, the cost to the Joint Chiefs of Staff (JCS), the agency which develops and implements world-wide strategy, is greater than the cost to the theater. The JCS has plans for other theaters as well, and the furnishing of an element from one of those theaters will reduce the objective value function within that theater. Thus, if replacement cost $\boldsymbol{R}$ is to be used as a substitute for a loss of objective function value above level U_3 (in the specific illustration), it must be the total cost to the nation of creating a suitable military element and placing it at the planned point of use.

The cost in man-day effort of producing any item of military hardware is as calculable as its cost in dollars. In the case of human elements (soldiers), the cost to the nation is the diversion to the purposes of national security of effort that could be devoted to other collective projects. The soldier costs, in effect, one man-day for each day in service. His death or disability, even from a completely non-humanitarian viewpoint, costs the nation the future effort, in man-days, of his active life span.

The effort that has gone into the procurement of military hardware is largely *sunk* -- very little of the equipment is particularly useful for non-military pursuits. The value of equipment is determined only by its future contribution to military strategy. The men, on the other hand, have a residual value to the nation beyond the end of the war.

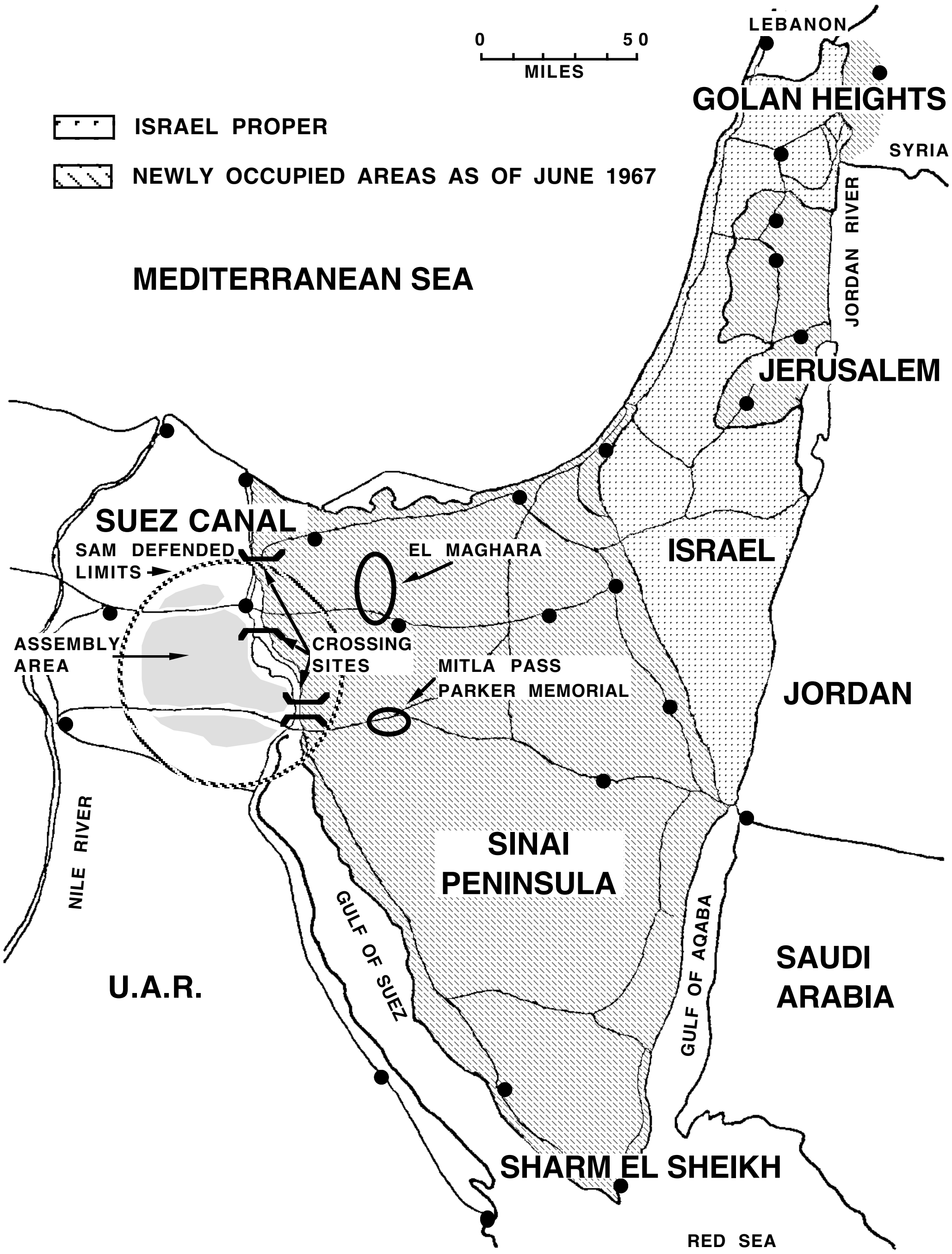

Figure 5-4 - Six Day War Theater Objectives.

6.0 THEATER LEVEL VALUES

The manner in which the value of Objective 1, the fire team objective mentioned above, is derived from the value of Objective 3, the squad objective, has been explained. Assuming enough predictive and calculational capability, the value of Objective 3 can be explained in terms of some platoon objective and thus up the military chain of command within the theater. However, at theater level the objectives are no longer valued in purely military terms. Several examples from the Arab-Israeli Six-Day War will illustrate this point with the aid of the map in Figure 5-4.

6.1 Military Objectives

The Golan Heights is an example of a theater objective of purely military value. Possession of the heights enables better and more economical security for the neighboring territories of Israel. Unless required for other sectors, the military effort saved could be turned to other national projects.

6.2 Economic Objectives

Sharm el Sheikh is a different sort of objective (economic). Expenditure of military effort here would add to the burden of future defense. However, by safeguarding Israeli access to the Gulf of Aquaba, it would prevent very substantial economic loss (in fact, some sort of rear "life-line" was probably absolutely indispensable to the nation).

6.3 Political Objectives

A suitable defense for Sharm el Sheikh required occupation of some portion of the Sinai peninsula. However, it is questionable that occupation all the way to the Suez Canal was of benefit for future security in strictly military terms. The Canal was probably a political objective - designed to discourage the Arabs from further military efforts and eventually lead to some negotiated peace. The Canal has formed a blue chip for bargaining purposes.

6.4 Psychological Objectives

The west bank of the Jordan River may have furnished some defensive advantage; however, Jerusalem was another political objective. The Canal was intended to hurt the enemy; Jerusalem, with the Wailing Wall, would give psychological benefit to the Israeli people (and probably better support for the government).

6.5 Quantification

These are examples of the sort of political and economic objectives which lead to military operations. Conceptually some of them might be quantifiable (e.g., security for the Gulf of Aqaba), but the intangible benefits of Jerusalem can hardly be put in terms of man-days. What is significant is that the nation signifies, by going to war, that it is willing to pay some military price for their possession.

Again assuming perfect predictional and calculational capability, it is possible for the theater commander to state the military price of seizure and defense of the following theater objectives.

DEFENSE ------------------------------------ GOLAN HEIGHTS

ECONOMIC ---------------------------------- SHARM - EL – SHEIKH

POLITICAL ----------------------------------- SUEZ CANAL

PSYCHOLOGICAL-------------------------- JERUSALEM

THEN Q IS THE AGREED UPON COST TO SEIZE AND HOLD THE OBJECTIVE

$$Q = W \Delta t + \sum_i P_{B_i} \cdot R_{B_i}$$

The price would be in two parts as indicated above - an expected expenditure of man-days to seize the military objective, and a commitment of men and equipment to defend that objective for some indefinite time until a political settlement is achieved. Note that if a more defensible position is attained, the future commitment may turn out less than the present commitment. If this price is acceptable to the political authorities, the objectives become "worth" the calculated expenditure for their seizure. It is not meant to imply that these costs are ever actually calculated and agreed; perhaps if they were, military operations would be less frequent.

The value of any theater objective, then, is the agreed price which must be paid for it, and the theater commander is entitled to expend that price in the campaign which culminates in the seizure of that objective. The price comes in three parts: (1) destruction of equipment, (2) death or disabling of men, and (3) the utilization of manpower for the period of the campaign. Equipment is valued at its replacement cost in man-days - provided it is required after the end of the campaign. Otherwise, it is valued only for its planned use prior to the end of the campaign. Lost manpower costs the nation a number of man-days equal to the average remaining useful life of the casualty. This is true whether or not the man is required for future defense, since men are eminently convertible to non-military pursuits.

The man-days expended on the campaign - exclusive of those charged for personnel and equipment casualties - are a loss or *cost* to the nation to the extent that they exceed those which would have been spent for security in the theater in the absence of active military operations.

7.0 LEVELS OF PERFORMANCE

In the simple illustration of section 3.0 of this chapter, element R_2 was valued according to expected performance between t_2 and t_L against element B_1 of Fire Team 1. That plus the residual value calculated as explained above *is* the value of R_2 so far as the leader of Fire Team 1 is concerned. However, if R_2 can engage elements of Fire Team 2 on the way to Objective 2, he has a value, probably different, as far as the leader of Fire Team 2 is concerned. The squad leader, assessing the total situation, may credit R_2 with dividing his fire optimally between Fire Team 1 and Fire Team 2. With that approach, the squad leader will assign a higher value of R_2 than that visualized by either Fire Team leader, even before t_L.

Each function has various measures as pointed out in Figure 1-9 (see Chapter 1.0). Now the *real* value of R_2 will lie in its *Performance* as dictated by the chosen Red course of action. As explained in Chapter 3.0, that Performance can never exceed the Potential, and usually falls short by a factor attributable to the timing and nature of decisions of the Red command echelons. However, unless Blue, by an exercise of generalship, can foretell mistakes to be made by the Red opponent, Blue at some level must value each Red element proportionally to its Potential.

Potential, as explained and illustrated in Chapter 3.0, is very situation dependent. Further, Potential is constantly altered by such events as movement to a different location, expenditure of ammunition, replenishment of ammunition, etc. It is probably possible to estimate Potential fairly accurately for a low-level engagement of brief duration. As the problem gets more complex, the Potential must be calculated from a generalized Capability modified by factors pertaining to the environment, the opposing forces, and their missions.

This was the approach taken in Valuing Targets for Interdiction Fire which follows in Chapter 6.0 except that a raw *Capability* unmodified by situational factors was used. The *well designed force* assumption makes this possible by crediting the enemy with infinite predictive and estimating capacity. Since his force is perfectly designed, the ratio of Potential over Capability, η, is a constant for all elements for the duration of the campaign and his input effort is perfectly allocated proportional to the Potential.

Actually, from the viewpoint of the commander having t_2 as an objective time:

Support Fire value of a Red element is its situational value before t_L.

Interdiction Fire value of a Red element is its situational value between t_L and t_2.

Strategic Fire value of a Red element is its *residual* value after t_2 as limited by replacement capabilities which merely relate the classic categories of Fire with the analytical description using time and levels of performance in measuring value.

Click here to open the Contents

Click here to open Chapter 6