

TACWAR # 138A
14 Feb. '75

CONCEPT FOR ANALYSIS OF WARFARE

HCBrown

CHART

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3. The "SYSTEM -- -- Is Defined To Suit The Analysis
4. Combat Involves -- -- Nine Military Functions
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FINIS

The background of the title page is a light-colored marbled paper with a complex, organic pattern. A large, light gray rectangular box is centered on the page, containing the title and authors' names. The title 'The Anatomy of Combat' is written in a large, black, serif font. Below it, the authors' names 'Raymond J. Volluz' and 'Raymond M. Volluz' are written in a smaller, black, serif font, separated by the words 'by' and 'and'.

The Anatomy of Combat

by
Raymond J. Volluz
and
Raymond M. Volluz

TEXT NOTES: keyed to Chart Nos.

Concept for Analysis of Warfare

TACWAR 138A

14 February 1975

0

We believe we may be able to contribute some concepts for the structuring and execution of this study. I propose to discuss these concepts under the four major heading shown here

Content - -

- Definition of “System”
- Analysis of System Worth
- Descriptive Model of Combat
- Information-Handling Functions

- - of the Briefing 1

CHART 1 - The "System" may be defined in various ways for various studies - I shall show you three alternative definitions we have used for force-mix studies.

We employ a different and quite comprehensive approach to the evaluation of overall system worth.

This approach is dependent on a Descriptive Model of Combat, which I will outline.

The most difficult area for analysis is that of the information-handling functions. In this area we have approaches which have enabled us to model the effect of flexible tactics on the outcome of a conflict.

This portion of our briefing is necessarily quite theoretical and general, because of the limited time available. To demonstrate that this approach can indeed be applied to practical problems, Mr. Volluz will follow my portion with a specific example of application.

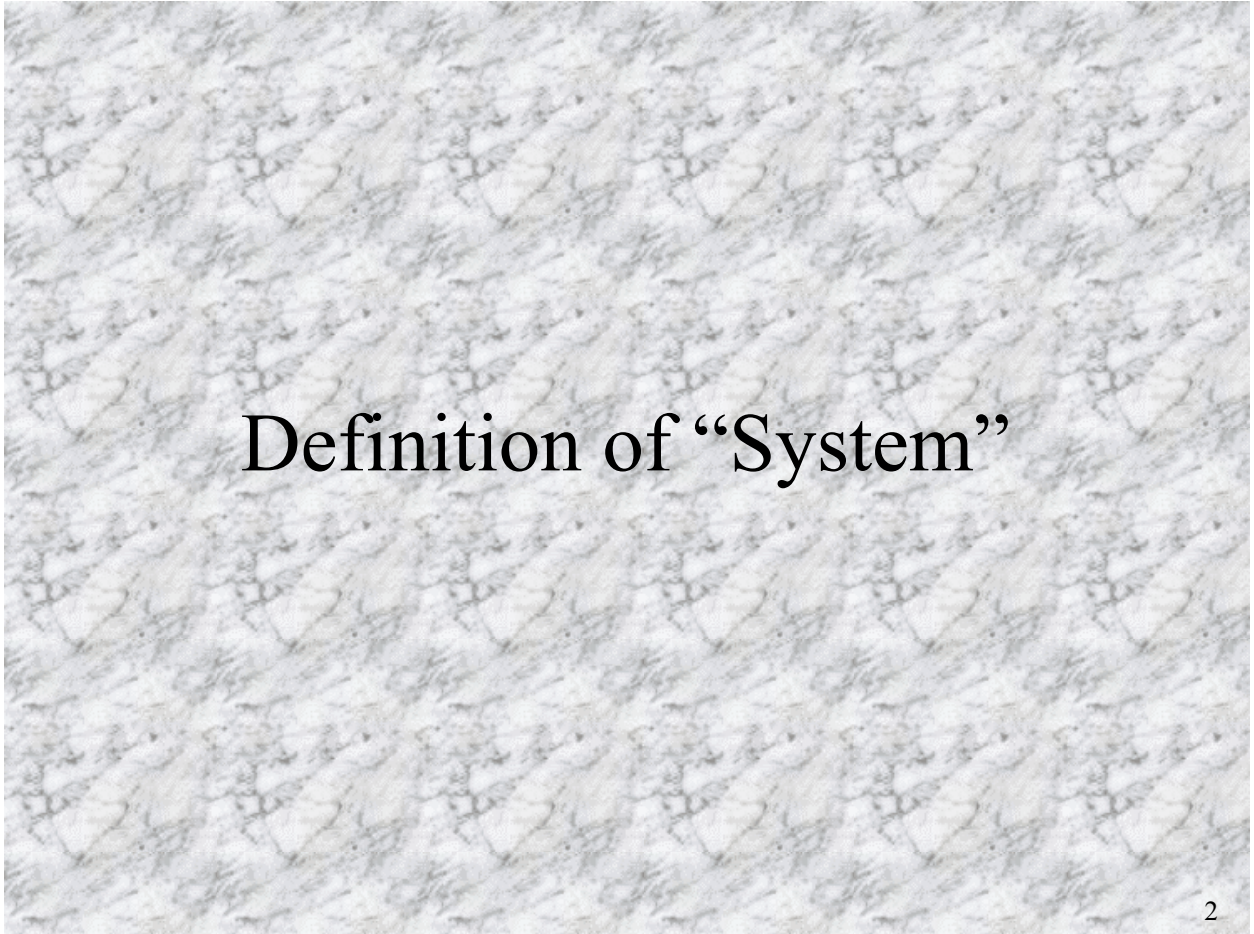
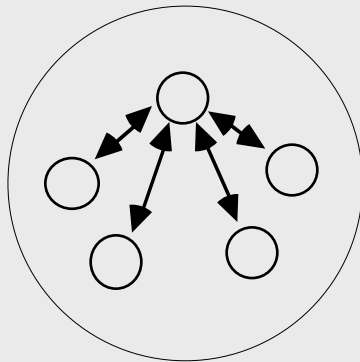


CHART 2. -- (No comment)

The System - -



○ A MILITARY ELEMENT
OR
A COLLECTION OF ELEMENTS
PERFORMING SOME (MILITARY)
FUNCTION

- - is defined to suit the Analysis

3

CHART 3 - By "element" we mean some entity which performs one or more military functions, and which cannot be subdivided without denial of that functional capability. Examples are - a Rifleman, a Tank with its crew, a Supply Point, a Truck with driver.

The analysis of element configuration to determine performance characteristics is Level VI analysis (levels of analysis will be explained later). We prefer to leave that type of analysis to the design engineers and concentrate on the interaction of elements within a larger system, and the interactions among systems. Of course, the validity of any quantitative results is dependent on the credibility of the inputs as to elemental performance.

Combat Involves - -

F FIRE

M MANEUVER

I INTELLIGENCE

D COMMAND

X SIGNAL

S SUPPLY

T TRANSPORTATION

R MAINTENANCE

E CONSTRUCTION

- - Nine Military Functions

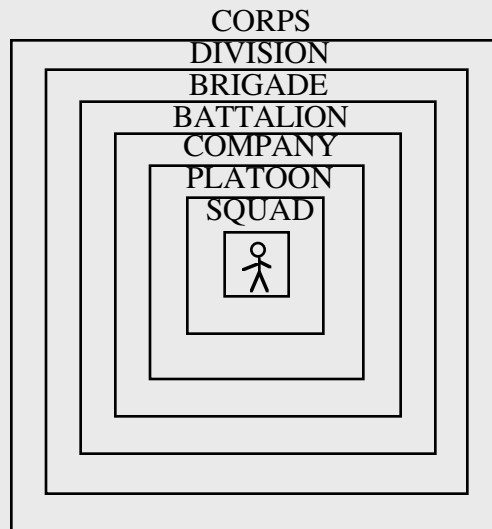
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CHART 4. - When we refer to the "military functions," performed by elements or systems, we mean these. Other functions - for instance administrative services, psychological warfare - will have some bearing on combat outcome; however, we have selected these as the most important for modeling.

Fire and Maneuver are the fundamental expressions of land combat power. Command, Intelligence, and Signal are all information-handling functions. The four listed on the bottom are the fundamental logistic support functions. We take some liberties with accustomed terminology; e.g., we regard Medical Services as Maintenance of personnel, and the Replacement Service as Supply of personnel.

The letters listed are used throughout our Symbology to denote these functions.

Each Combat Unit - -



- - Is a System

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CHART 5. - The combat element is a member of a small unit, a squad, which is part of a platoon, which belongs to a company, and so on. Each of these increasingly complex systems exists for just one fundamental purpose - to maximize the performance of the combat elements. However, as long as we keep that basic truth in mind, our force design should maximize the performance of the whole force - not of any specialized system or element.

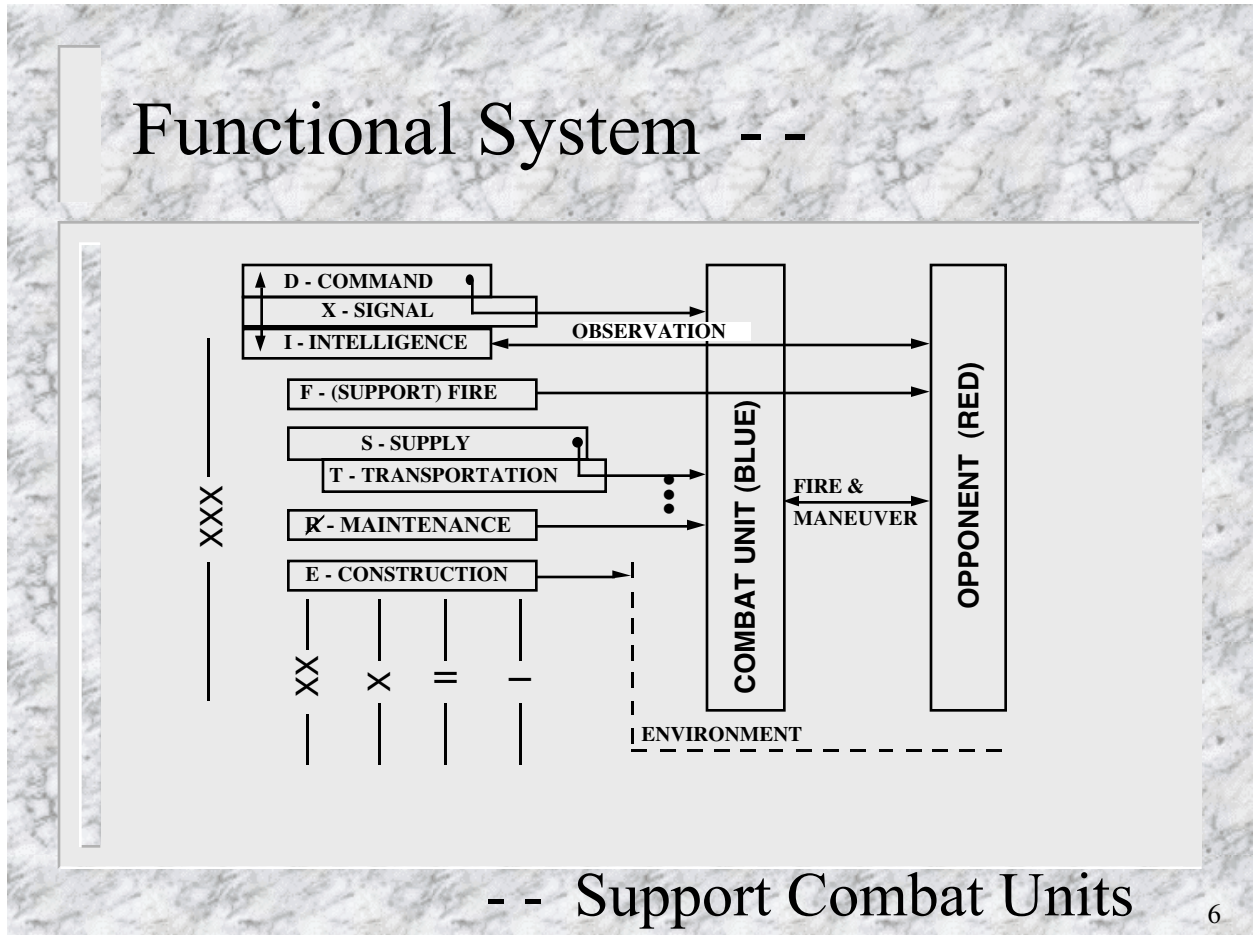
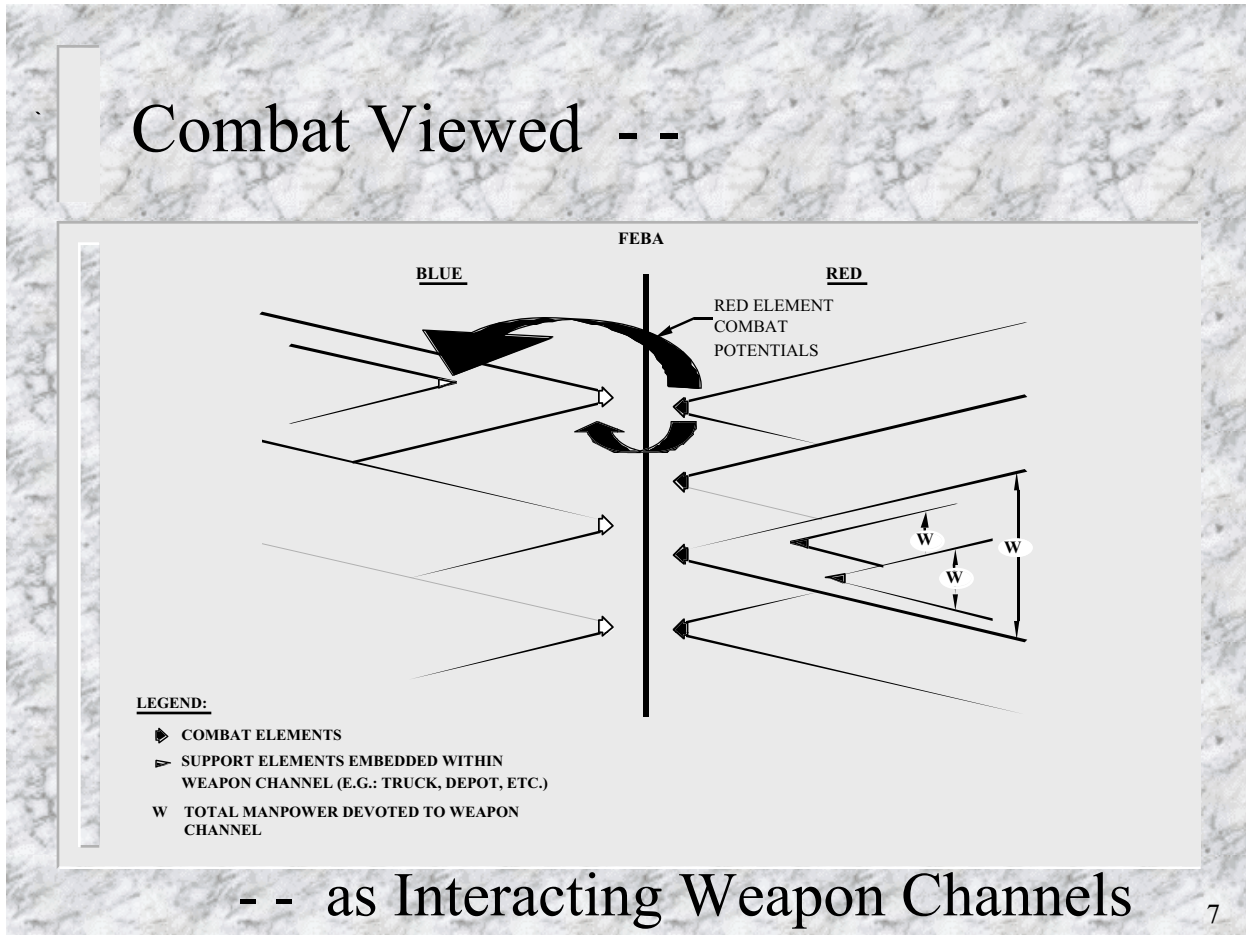


CHART 6. - To understand the functioning of units higher than squad or perhaps platoon, it is helpful to look at the "systems" in this alternate way. Note that we are defining a combat unit as the primary system interacting with the enemy by fire and maneuver. It is supported by functional systems as defined in the preceding chart not limited by the next higher unit's capability.

For chart simplicity only the most fundamental interrelations are pictured. The opposing combat units influence each other by fire and maneuver; the information-handling systems provide directive and intelligence information; the support systems provide supplies and services. Note that the construction system works directly on the environment (terrain), which in turn influences the combat units.

There are of course many other relations, which we recognize but have not shown on this chart. For instance command issues directive information to all other systems as well as the combat units.



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CHART 7. - We sometimes, especially for our approximate valuing methods, represent each combat element or unit as using a certain share of manpower and other theater resources. This we refer to as a "weapon channel"; it is a concept similar to that of "division slice". Dedicated support elements backing up the weapon may have support channels of their own, which is a part of the investment in the weapon channel.

These arrows indicate that a weapon channel can be degraded either by attacking the weapon directly or by attacking some element of its support.

At this point we have established three alternative definitions of what we mean by "system". We can now address the analysis of system worth to the U.S.Army.

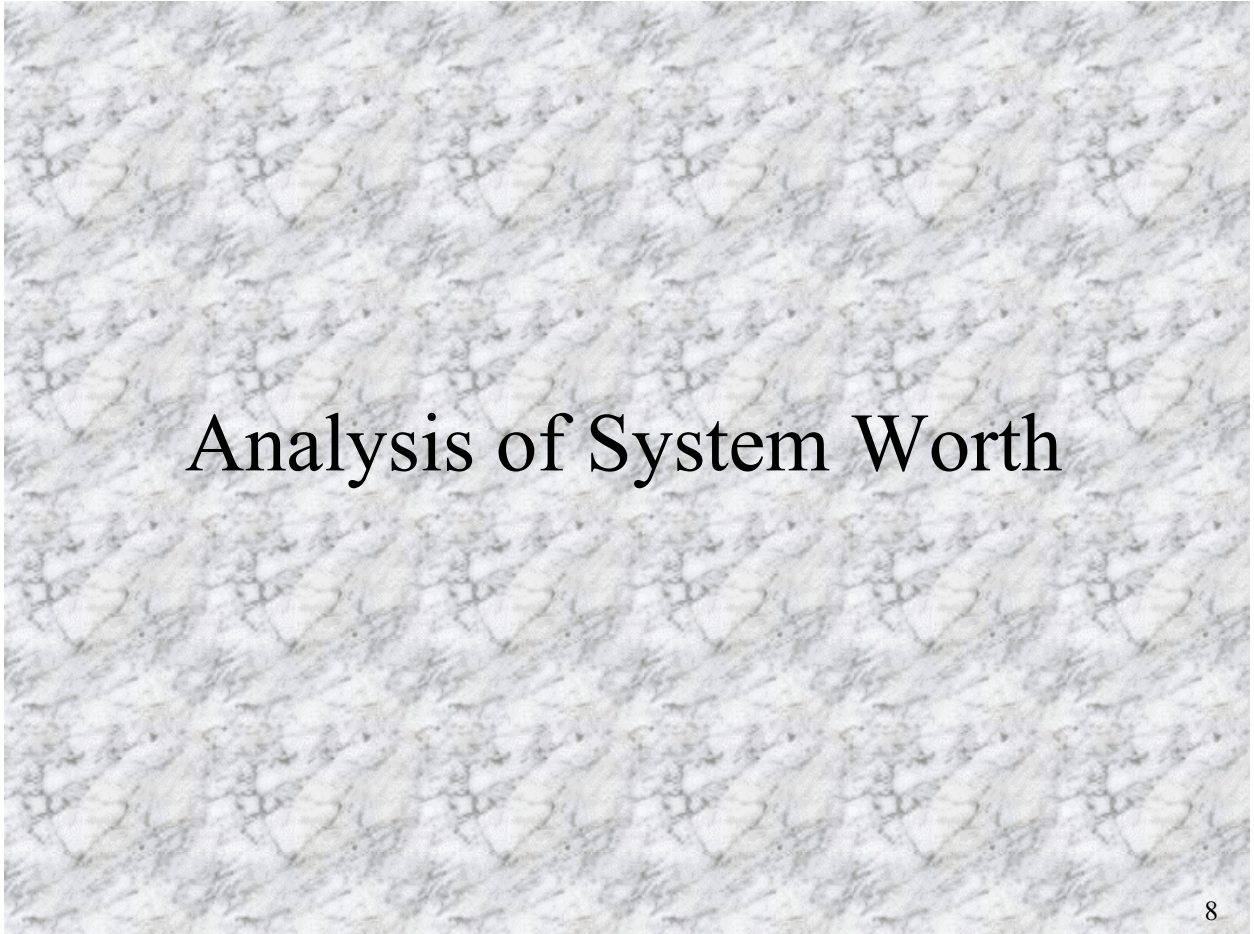
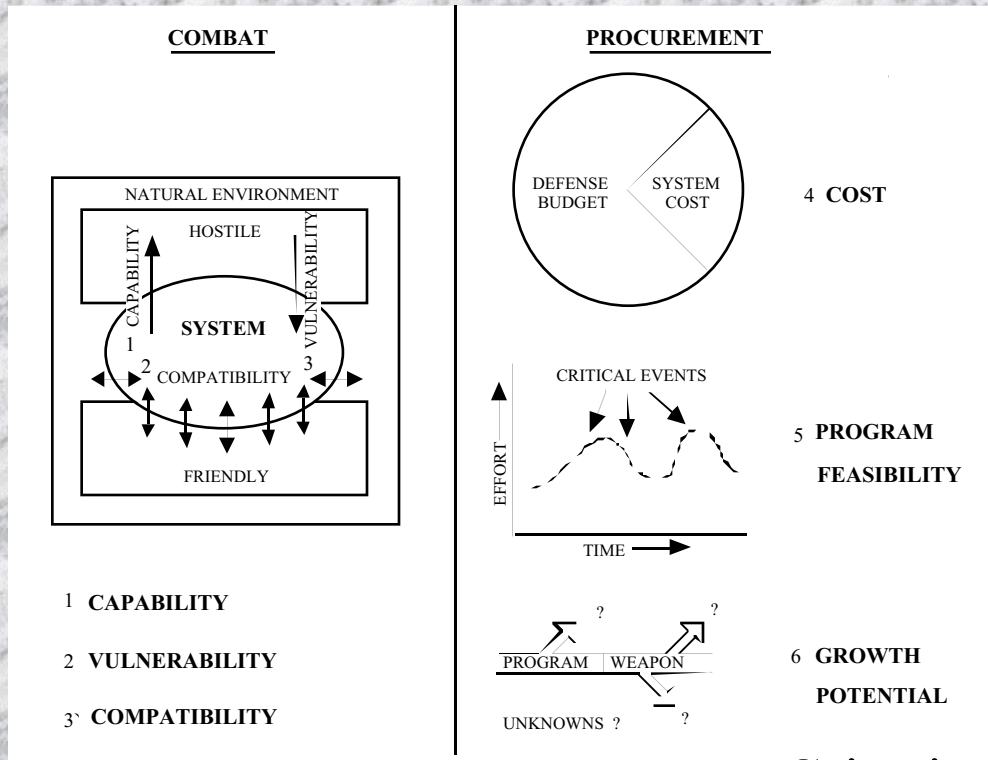


CHART 8. - (No comment)

System Decision - -



- - Criteria

CHART 9. - The "system", however defined, must operate in a three-part environment as shown here. Combat elements or units have a capability against the enemy, a vulnerability to the enemy, and compatibility with the friendly and natural environments. Non-combat elements or units have capability to support combat units, vulnerability to the enemy, and compatibility with the friendly and natural environments.

To do useful analysis we must describe the system and its performance and also the total environment with which it must interact. This description of the three-part environment, with dimensions of both space and time, is what we call a scenario. Systems must be analyzed in those environments in which they are expected to operate; thus proper analysis must include construction and use of suitable scenarios.

The three criteria on the left are those which determine combat worth and are of interest to the field commander - they will influence force mix decisions and tactical decisions taken at the point of use. The procurement agency must define and procure the system years before its use, and must consider, in

addition to combat worth, the three criteria shown on the right. One of the really fundamental problems of analysis is to discover useful methods to combine the different criteria influencing combat decisions and procurement decisions. Of course, "cost effectiveness" is widely used. However, we consider it an over-simplification which often leads to suboptimization. We therefore prefer the method shown on our next chart.

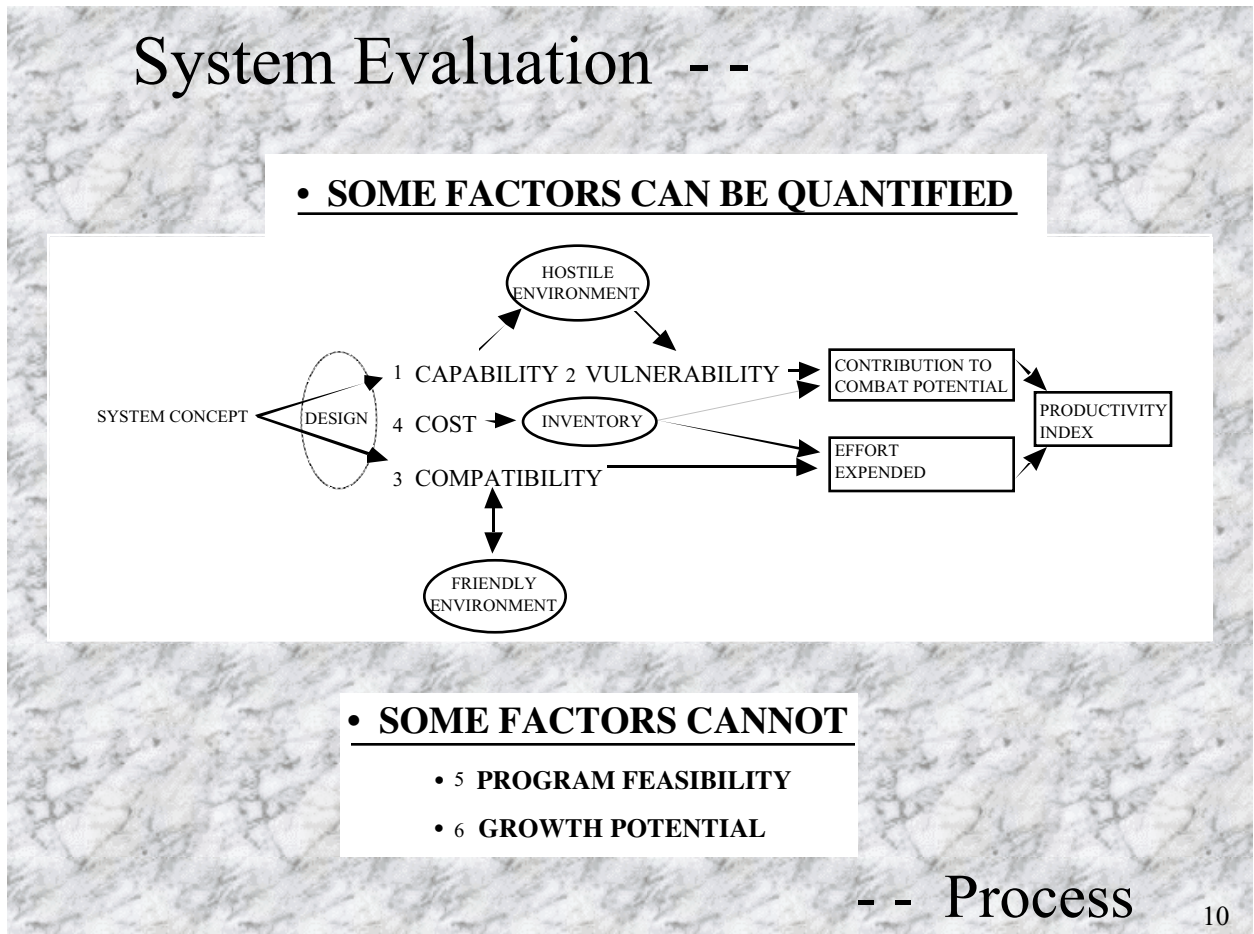


CHART 10. - This chart sets forth our overall quantitative approach to analyzing the combat worth of a proposed system. We recommend it as an alternative to "cost effectiveness".

Any new system can presumably be described in terms of configuration, cost, and operating characteristics. The configuration and operating characteristics determine capability, vulnerability and compatibility (load placed on friendly environment). Cost, combined with budget considerations, establishes the inventory which can be procured.

When these factors are quantitatively analyzed within a scenario, we can determine the contribution to combat potential (a concept we shall explain later) and the effort expended in operation and support of the system. When contribution is divided by effort, we get a productivity index, which we feel is a valid measure of combat worth.

In addition to combat worth, the developer must consider these factors - Program Feasibility and Growth Potential -- which are not usefully quantifiable.

Model Recognizes Budgetary, Procurement, - -

<u>Level</u>	<u>Type</u>	<u>Activity</u>	<u>Responsible</u>
I	Budgetary	Structure Force	National Government/ US Defense Department
II	Strategic	Balance Resources Versus Threats	Joint Chiefs of Staff
III	Strategic	Plan Use of Resources to Achieve Objectives	Unified Commander (Theater)
IV	Tactical	Implement Theater Strategy	Unit Commander
V	Tactical	Utilize Capability	Military Element
VI	Procurement	Produce Capability	Procurement Agency

DOLLARS MEANINGFUL AT LEVELS I AND VI ONLY

- - Strategic, & Tactical Considerations

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CHART 11. - We have noted that the concerns of the procurement agency and the combat user may differ. In fact, we believe that appraisal of any system differs according to each of many points of view. It is the analyst's job to attempt to incorporate all these valid criteria into a single unified appraisal.

This chart is one simplified presentation (and the one we consistently use) of the various echelons having valid interest in a system acquisition. To unify these various points of view it is necessary to determine a unit of Input/Output which is meaningful at all levels. Dollars do not qualify; with some

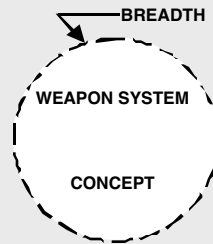
difficulty they can be used to measure input, but they break down completely as a measure of combat output.

We propose instead (and consistently use) a measure of "man-days". Our principal reasons are as follows:

- 1) Man-days permit us to specifically introduce the vital factor of time, and the function of maneuver.
- 2) Man-days permit us to interrelate and compare widely-varying function, such as close ground combat, tactical air strikes, and rear-area maintenance.
- 3) Man-days do not lead us into some of the "cost effectiveness" paradoxes. For instance the Air Force asks "Is it worth-while to use a multi-million dollar aircraft to attack a \$20,000 truck?" We say it is indeed, under certain circumstances, but this can be shown only with a man-day measure.

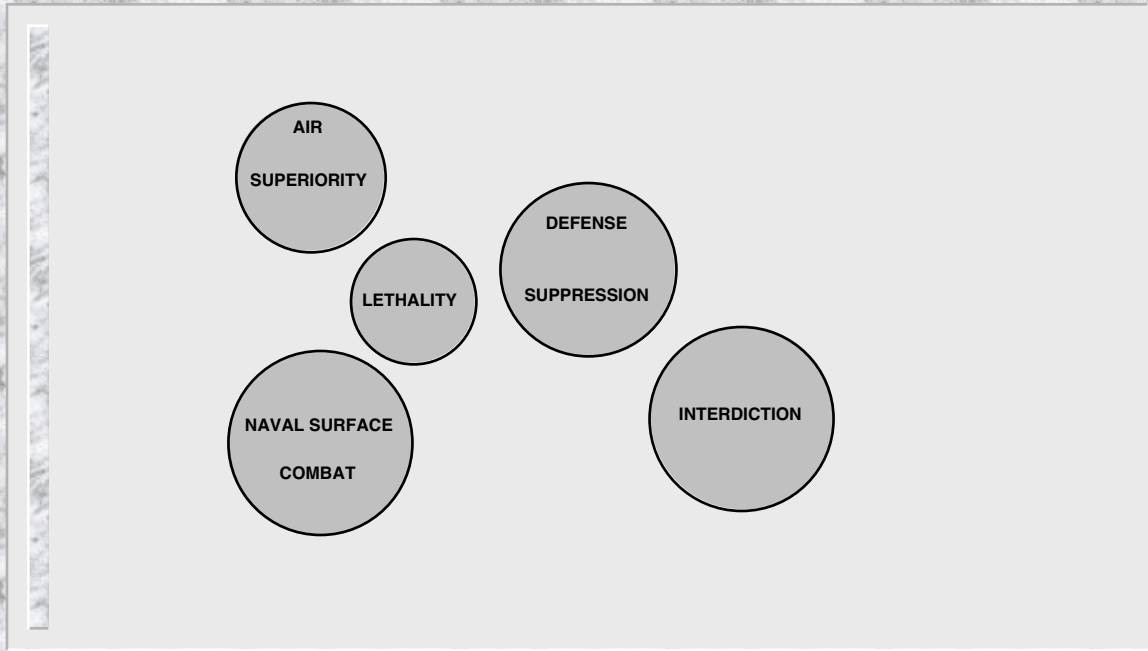
When the task is one of force mix, and involves selection among widely-varying functional systems, it is mandatory that one have a "road-map" of all the system interrelations which influence the outcome of combat. In this way one can integrate the outputs of the various detailed studies which must be performed. Such a road-map we call a descriptive model of combat. We have developed, to considerable detail, such a road-map and I shall turn to its description after the next chart.

Analysis of a System Carved From - -



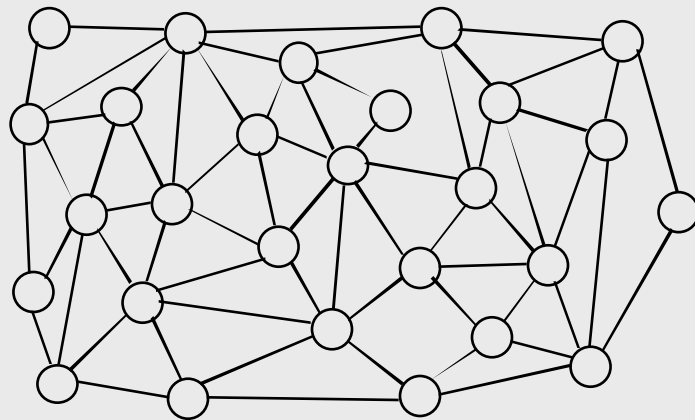
- - Descriptive Model of Combat

Analysis of a System Carved From - -



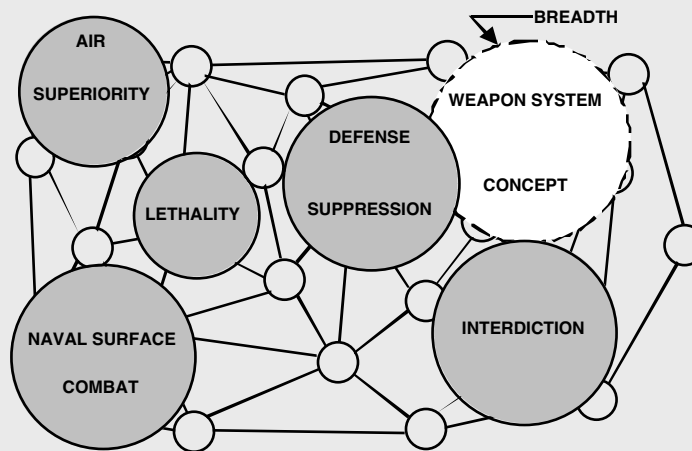
- - Descriptive Model of Combat

Analysis of a System Carved From - -



- - Descriptive Model of Combat

Analysis of a System Carved From - -

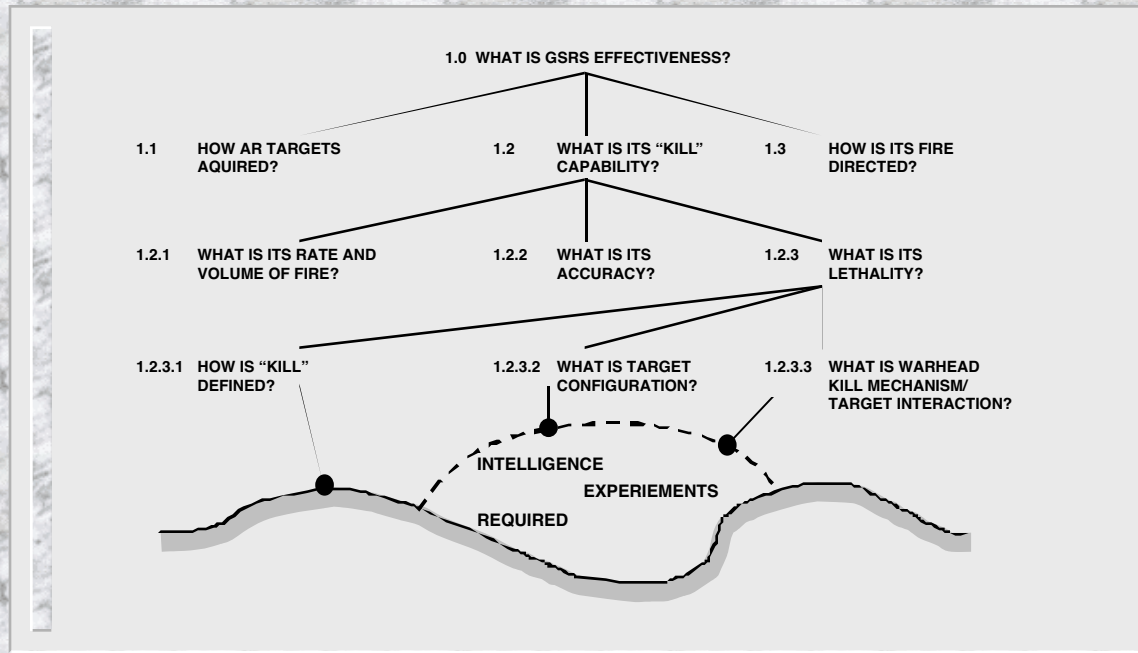


- - Descriptive Model of Combat

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CHART 12. - This chart is intended to represent the complex interrelations of the numerous differing systems essential to modern warfare. To do meaningful analysis within limits of study effort available, it is necessary to establish the "breadth" of the analysis to be performed - the type systems and interactions to be examined in detail. Relations with systems beyond the breadth of the analysis must be covered by assumption or estimation; these may be more knowledgeable if the adjacent areas has been covered by previous study (gray shading).

Any Question Tree Roots In - -



- - Credible Experience Data

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CHART 13. - Even with a restricted breadth of analysis, one has problems as to the level of detail to be used in the examination of phenomena. As an example, the effectiveness of a weapon depends on target acquisition, fire direction, and "kill" capability. Kill capability depends on rate and volume of fire, accuracy, and lethality. Lethality depends on the definition of kill, on the target configuration, on the warhead configuration and functioning, and on the kill mechanism interaction with target components.

We maintain that studies of a system should be pursued to a "depth" (by which we mean level of detail) at which one can use actual experience data as input. This is not always possible - but where the effort fails the study has defined an area for experimentation.

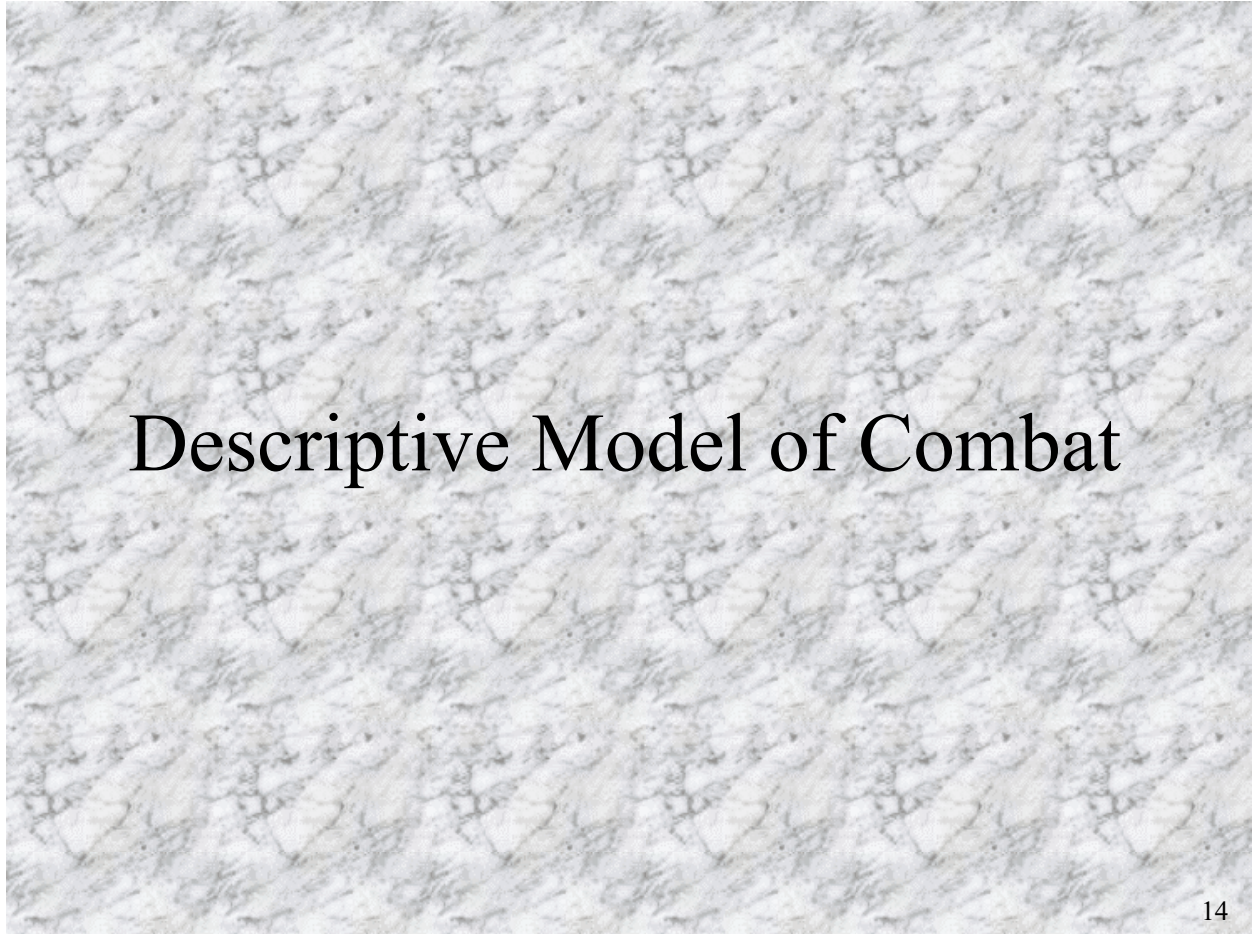


CHART 14. - I now turn to a discussion of the Descriptive Model of Combat. This centers around land combat, but also treats the contribution of Navy and Air Force.

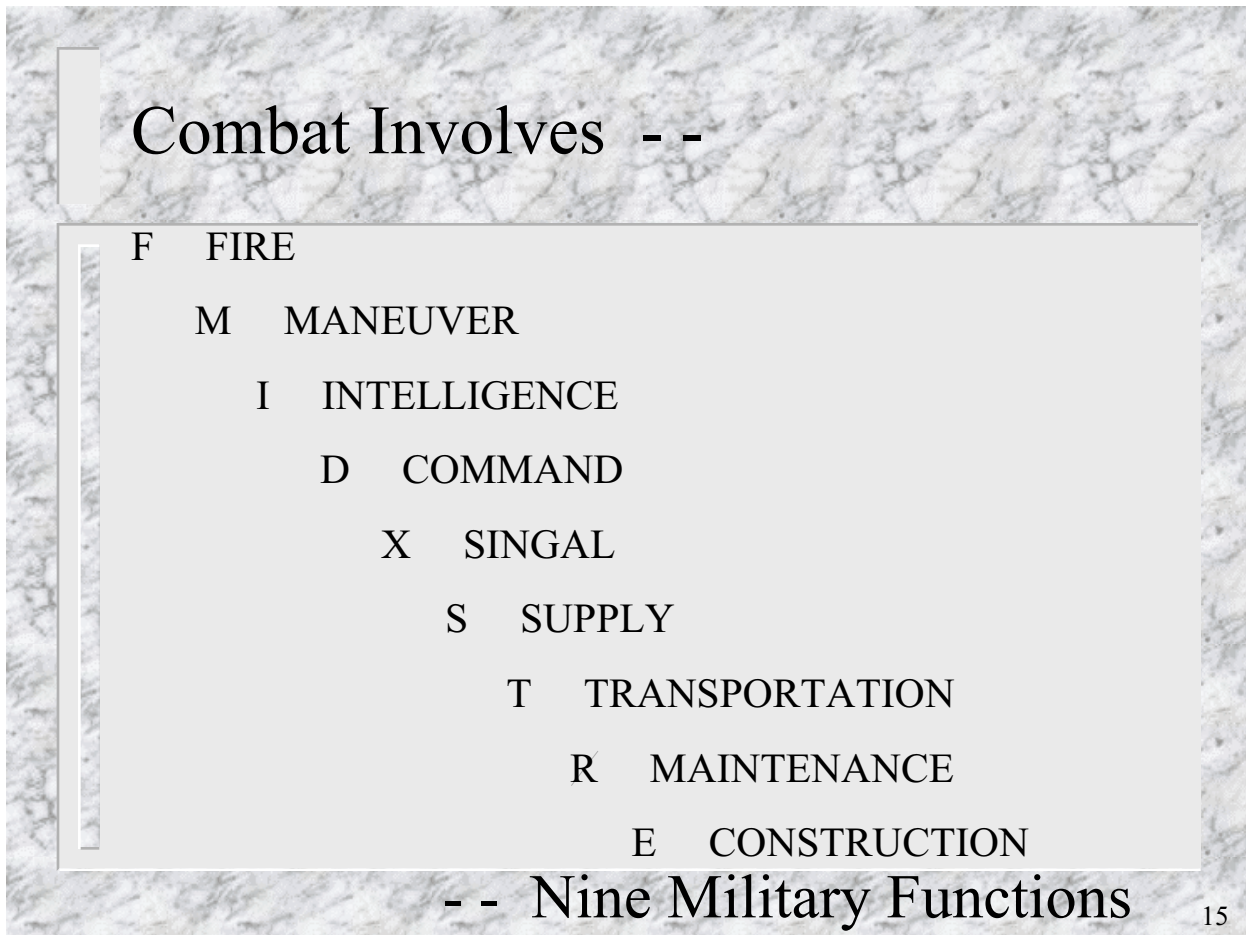


CHART 15. - This descriptive model establishes the rationale for analysis of the contribution of systems performing each of these military functions to the combat potential of a military force. I shall not have the time to present each of the interrelations. Rather I shall describe the basic concepts underlying our analytic system, with some additional detail in the area of the information -handling functions.

A word as to the status of this descriptive model. As to breadth, we can describe the interactions of any systems performing the nine military functions. As to depth, in some areas we have computational models which can indeed use credible experience data, if such is available, in other areas we have not even started the necessary detailing work.

What I am presenting today is merely an overview; I have some backup charts for more detailed discussions if you desire. In addition, in any area in which you have an interest, we may have additional backup material we can send you.

Combat Potential Ratio - -

$$\frac{\pi_{C,B}}{\pi_{C,R}} \Bigg]_{t_1}^{t_2} = ?$$

Ratio Too Small, Blue Gives Up

Ratio Too Big, Red Gives Up

- - Decides Conflict

16

CHART 16. - Our descriptive model is based on the concept of combat potential - which is the ability to accomplish one's own objectives and defeat those of the enemy. What this says is: If either of two opposing commanders evaluates the ratio of combat potential for some time into the future as unsatisfactory for accomplishment of his objectives he "gives up". At a low level "give up" means surrender, retreat or request reinforcements or change of objectives. Any of these alternatives has an impact on the combat potential of the next higher echelon. At theater or national level "give up" probably means to sue for peace, abandoning some or all of the political objectives which led to the combat.

Now, neither commander has any way of knowing the point at which the opponent will give up. Therefore, the objective of any combat commander must be to attain a ratio of combat potential as favorable as possible within assigned resources and in the existing situation. The objective of the force or system designer must be to make the greatest possible contribution to combat potential in possible future conflicts, within budgetary and other constraints.

Combat Potential Is - -

$$\pi_{C,B} \Big]_{t_1}^{t_2} =$$

-- Ability to Control Terrain --

$$\sum_{\ell} Q_{\ell} \Delta t_{\ell} \Big]_{t_1}^{t_2}$$

-- And Inflict Damage --

$$\sum_j P_{Rj} \Big]_{t_1}^{t_2} V_{Rj} \Big]_{t_2}$$

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CHART 17. - This is our basic formula for computation of combat potential; it includes the functions of maneuver and fire. Some explanation of our notation is certainly in order.

π signifies potential, π_C is combat potential, $\pi_{C,B}$ is combat potential of Blue (our side). All evaluations are made for specific future time period beginning at t_1 , and ending at t_2 . In the normal planning process, of course, a headquarters might be evaluating the situation and preparing plans for more than one such time interval.

Q_{ℓ} is the tactical value of a specified terrain feature (the ℓ^{th}) - this is usually a function of time. Δt_{ℓ} is the duration of occupation by Blue of that ℓ^{th} feature during the period t_1 to t_2 . V_{Rj} is the benefit to Blue of having a specified Red element (the j^{th}) out of action at t_2 ; p_{Rj} is the probability of sufficient damage during the period t_1 to t_2 to put that j^{th} Red element out of action.

Now, if we study the performance characteristics of the elements involved, it is possible to compute both p_{Rj} 's and Δt_{ℓ} 's for two opposed courses of action. The Q 's and V 's are different, they are

"directive" information to the Blue commander, and represent the importance or value to the overall Blue strategy of occupation of features and destruction of opposing assets.

We have given considerable study to these directive variables and their representation of normal decision processes. In order to save time and not lose the main thread of my presentation I am omitting this value discussion here - it can be presented later if desired.

Combat Interaction - -

Lanchester Equations:

$$\frac{dR}{dt} = -K_1 B \quad \frac{dB}{dt} = -K_2 R$$

Alternate Formulation:

$$\Delta_C \pi_{C,R} \Big|_t^{t_2} = -\tau_B \pi_{C,B} \Big|_{t_1}^t (t_1 - t)$$

$$\Delta_C \pi_{C,B} \Big|_t^{t_2} = -\tau_R \pi_{C,R} \Big|_{t_1}^t (t_1 - t)$$

- - Changes Combat Potential

18

CHART 18. - Combat potential is changed during the conflict by the performance of both sides. Lanchester first expressed this fact by his equations of 1916 and after. It has of course been recognized that these equations are too simple - they represent attrition only, an isolated conflict, and non-realistic assumptions on distribution of fire. However, they are a starting point. We suggest an alternate formulation as shown.

What we mean by this is: At any time (t) in the conflict between two combat units, Red's combat potential for the future has been changed by Blue's performance of fire and maneuver to that point (and

vice versa, of course). Blue's performance has been established by his combat potential, the duration of the time period, and the rate τ at which Blue combat potential has been applied or realized. τ , which we call "pace", is strictly a function of Blue information handling and decision making.

The subscript C on the Δ_C implies that this is the change in potential produced by the interaction of the combat units in isolation.. Of course -

We all know that battles are seldom fought in isolation. For useful analysis we must also be able to express the effect on the combat interaction of various external influences. For this purpose, in our methodology we postulate various other increments to combat potential, as shown on this next chart.

External Influences - -

- Δ_C (\pm) Combat Interaction (Internal)
- $\Delta_{F,R}$ (-) Red Support Fire
- Δ_B (\pm) Blue Reinforcement (Removal)
- $\Delta_{R,B}$ (+) Blue Repair (Maintenance)
- $\Delta_{S,B}$ (\pm) Blue Resupply (Expenditure)
- $\Delta_{E,B}$ (+) Blue Construction
- $\Delta_{E,R}$ (-) Red Construction

- - Affect Blue Combat Potential 19

CHART 19. - These are the changes to combat potential we attempt to model and eventually to calculate. The first; internal and previously-listed, results from the fire and maneuver of the opposing combat units selected for analysis. It can be plus or minus - the situation can improve or worsen - and an event that is plus for Blue is minus for Red, provided their objectives are directly opposing.

Support Fire is delivered by higher combat echelons for the purpose of directly influencing the conflict in question. It is always minus, unless Red gunners are very sloppy and destroy their own troops.

By Reinforcement we mean the introduction of new elements or units; not simply replacement of those which may have been destroyed. The latter is considered "Resupply".

Repair restores elements which have been damaged and are therefore non-functional. This is usually battle-field repair, unless evacuation and return are extremely fast.

Resupply can compensate for expenditure, and may even increase potential during the course of the conflict.

Blue Construction is intended to help Blue; Red construction (principally obstacles) is intended to hurt Blue. Since the terrain is affected, construction may possibly have opposite effects. With superior tactics. Blue may eventually use the bridge that Red installs.

Note we have not covered Transportation. This may contribute directly to π_c by improving mobility of combat elements and therefore the outcome of maneuver. It also contributes to the performance of supply, maintenance, and construction.

Not also that the information-handling functions - Command, Intelligence, and Signal are not covered. These contribute through the τ -factor I bring up in the next chart.

Each Function - -

- CHARACTERISTICS Measure Facets of PERFORMANCE; e.g. Rate of Fire, Lethality, Vehicle Capacity
- CAPABILITY Measures Maximum Rate of PERFORMANCE in Some Defined, Idealized Situation
- POTENTIAL Measures *Attainable* PERFORMANCE in an Actual Situation in a Specified Time Interval
- PERFORMANCE Measures Effect of Potential During Specified Time Interval as Triggered by Command Function

- MEN $W = \text{MANPOWER INVESTMENT}$

- PRODUCTIVITY $\mu = \frac{\text{CAPABILITY}}{\text{MANPOWER INVESTMENT}}$

- EFFICIENCY $\eta = \frac{\text{POTENTIAL IN } \Delta t}{\text{CAPABILITY} \times \Delta t}$

- PACE $\tau = \frac{\text{PERFORMANCE IN } \Delta t}{\text{POTENTIAL IN } \Delta t}$

- Then PERFORMANCE = $W \mu \eta \tau$

- - Has Various Measures

20

CHART 20. - In describing the performance of military elements, we use a standard terminology as shown here. Of course we are most interested in being able to calculate the factors μ , η , and τ .

μ represents the Productivity factor - the extent to which equipment multiplies the functional capability of the men assigned. As an example a 2 1/2-ton truck with a 1 1/2-ton trailer may be considered to have a one-way lift capability of 500 ton-miles per day, whereas a human porter may have a corresponding capability of 1/2 ton-mile per day. But the truck-driver must be backed up by the equivalent of about 1 man to provide fuel, maintenance, etc. Thus the productivity factor of the truck would be roughly 500.

However, the truck is seldom able to use its full capability. The trafficability of available routes may be low, the required lifts may be short, fuel supply may be limited, maintenance requirements may lead to considerable down-time, traffic may slow the achievable speed. All such factors, which are highly situation-dependent, enter into the efficiency factor η . One can describe situations in which human

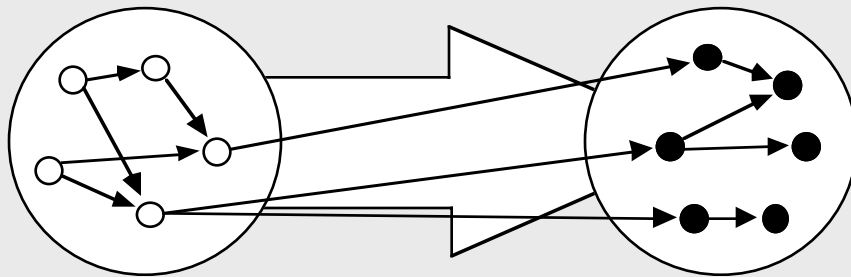
bearers have greater transportation potential than an equal number of men operating and supporting trucks.

Included in the factor η must be a translation of the functional potential to combat potential. This takes the form of a value of the transportation tasks available in terms of their contribution to the selected Blue course of action.

The factor τ , which changes potential to performance, is due to the delays in acquisition of information and formulation and communication of decisions. However, this is not entirely "red tape". The interplay of the opposing Blue and Red courses of action contribute to the delay. For example, if Red brings the highway under intense fire, Blue logically does not order the trucks to proceed until the source of the fire is neutralized.

We have done considerable work in identifying and detailing these factors for functional elements of various kinds. However, when we try to do the same for systems which are collections of elements, we run into the problem of aggregation.

Aggregation - -



- - Presents a Major Problem

21

CHART 21. - All combat and support interactions are really interactions between elements as indicated by the line arrows. However, if we model strictly on the elemental level, we are severely limited as to the size of the conflict we can analyze. What are needed are concepts which can express the interaction of system with system, as symbolized by the broad arrow.

In some cases, the problem is fairly easily solved; for instance the lift capability of a truck company is simply the sum of the lift capabilities of its elements, and its efficiency may be determined by such factors as percent available, percent fuel available, etc. We have some of these, for instance for aggregated fire, and these can be discussed later if desired.

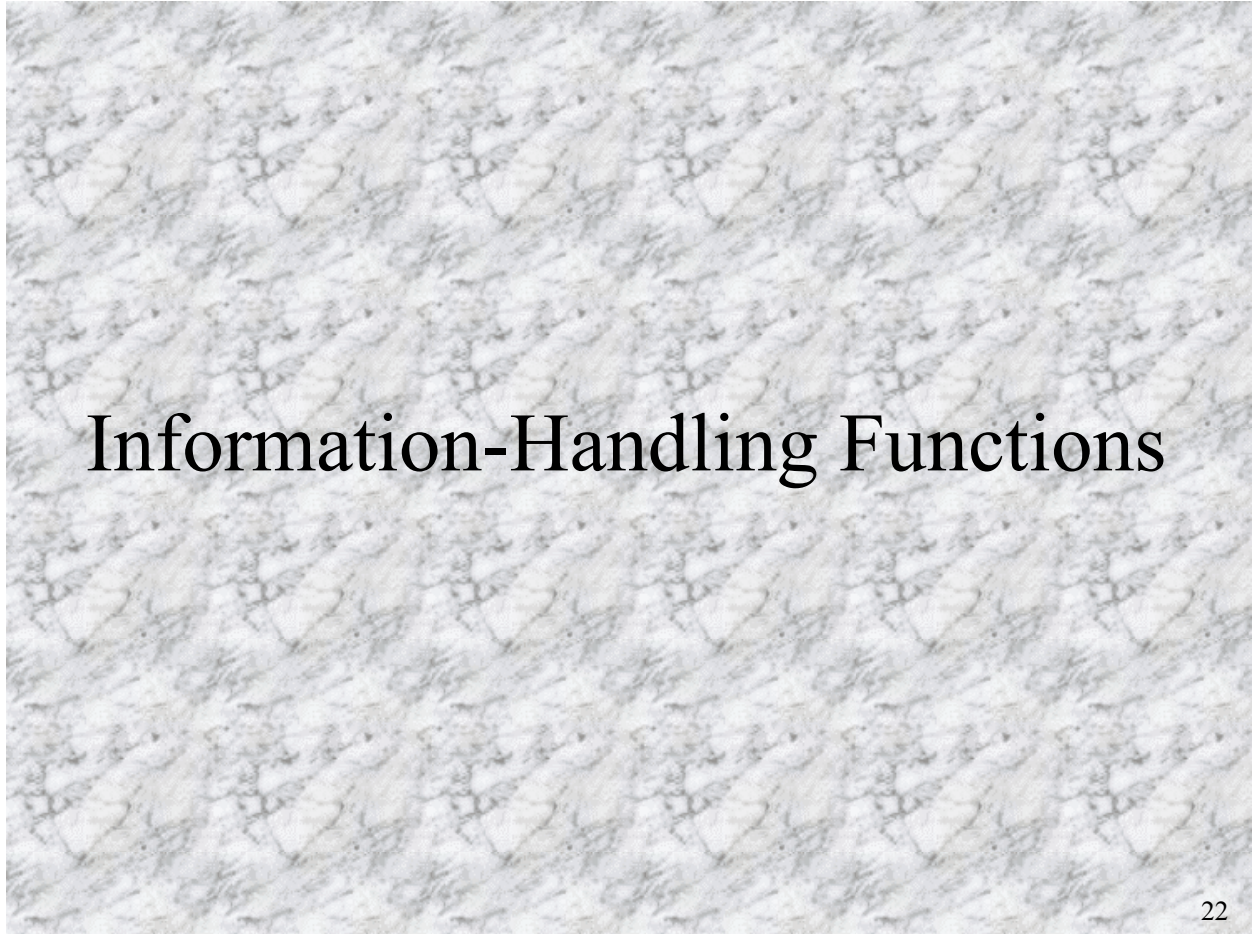
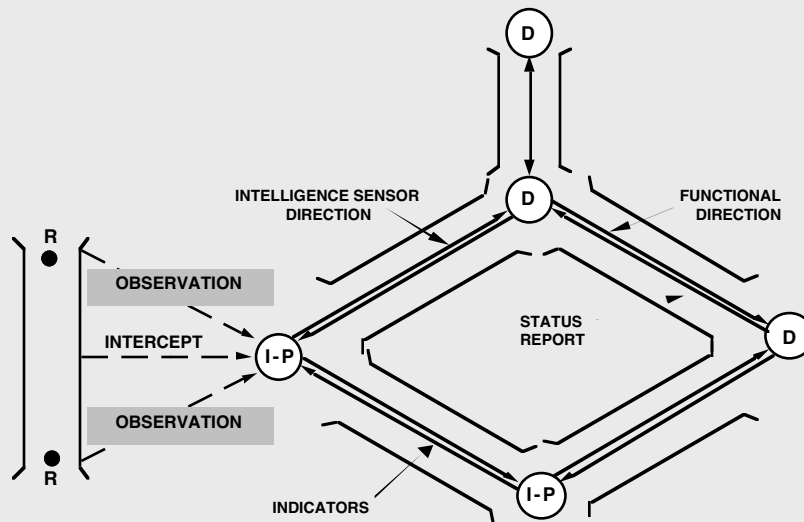


CHART 22. - I now turn to a brief description of our approach to the information-handling functions - Command, Intelligence, and Signal. We feel that these functions are very probably the most important to realization of combat potential and the most deserving of careful study. This is also the area in which analysis gets the most complex. We have an approach we consider quite promising, but are only in an experimental stage in construction of useful computational models.

Information Handling - -



- - Loops

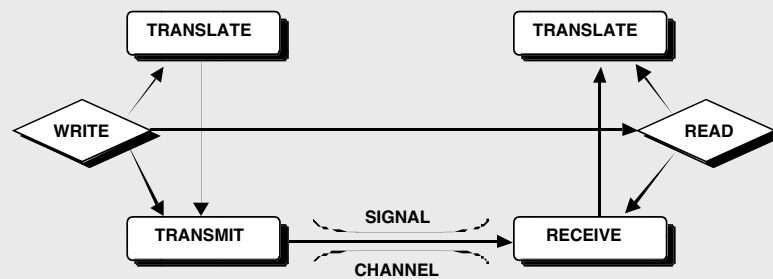
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CHART 23. - This is our picture of the basic types of interchange of information. D represents a command (decision) element ; besides actual commanders, we represent each functional element as incorporating a decision element - the truck driver decides, according to directive information received, what to do with his truck. Each decision element has an associated or incorporated Intelligence-Processing element I-P. All intentional information flow between elements goes through communication channels. These are not the same as signal channels, the relation will be explained later.

Information is obtained from the enemy in two basic ways, by observation and by intercept. Observation depends on sensors (camera, eyeball, radar); intercept involves tapping some enemy communications channel. Bits of information, which we can call "indicators" are combined by the intelligence processors to form items of intelligence, which are passed to the command element. Note the flow of "sensor direction", the intelligence processors can be instructed as to the type of information most needed by command.

Between command elements we have two flows of information. "Status Reports" are very analogous to intelligence - they cover position and current state of Blue units. Of course they are voluntarily furnished (or supposed to be); observation and intercept are not involved. Functional direction - orders and requests - is covered on a later chart.

A Communication Channel - -



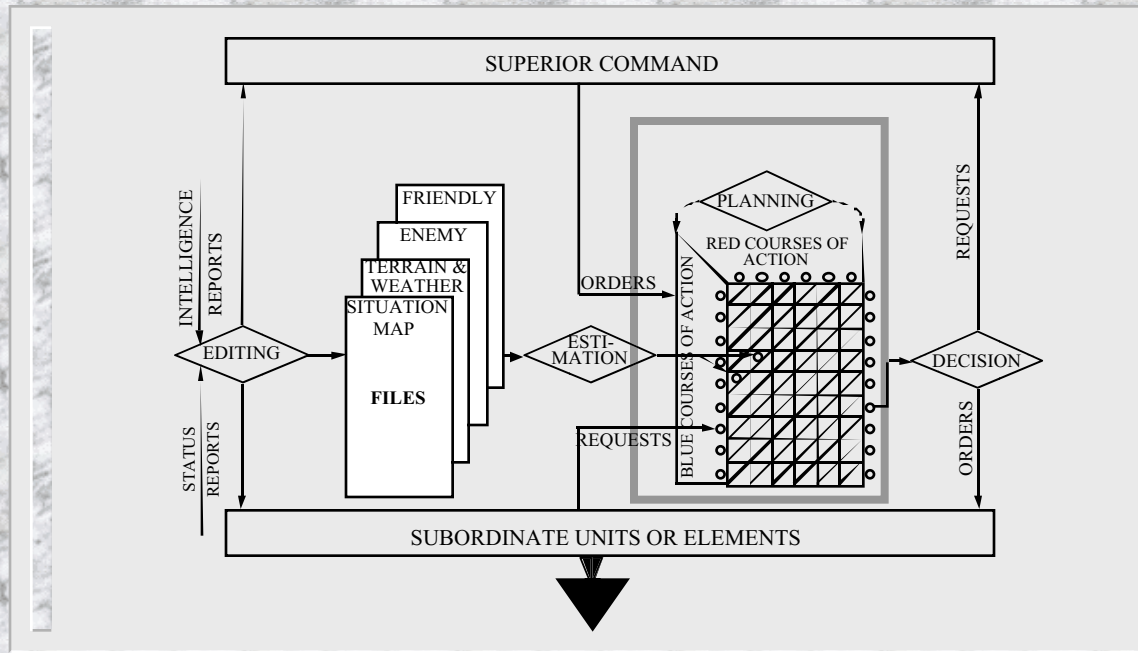
- - Defined

24

CHART 24. - This is our picture of a communication channel, and the alternate methods by which the information may be transferred from a command element which "writes" to another which "reads". Translation may be required, sometimes as encrypting and decrypting, sometimes into a different language, as for machine processing.

We differentiate the signal channel from the communication channel. Signal deals only with methods to propagate messages other than by unaided human voice.

Command Continuously Plans - -



- - & Triggers Performance

25

CHART 25. - We picture a command element as shown on this chart. By an editing process it controls the flow of information out to other command elements and its storage in its own files. This is becoming a very major function because of the very large and rapid flows of information in modern warfare.

Its principle processes are a continuous cycle of planning, estimation, and decision. Based on orders received from higher command, and on the information presented on a situation map it postulates courses of action for itself (Blue) and the opponent (Red). It estimates the probable outcome of each opposed pair of courses of action, and decides which Blue course of action is to be adopted.

We model the estimate as being quantitative, based on an objective function to be described next, and the decision as being normally the selection of a maximin. We recognize that selection of other than a maximin may sometimes produce better results, but at greater risk. Such a procedure for Blue depends on some assumption as to what the opponent is likely to do - we term this "generalship"/

Blue Objective Function - -

$$\pi_{C,B}^B - \pi_{C,R}^B$$

OR ~

$$\left[\sum_{\ell} Q_{\ell}^B \Delta t_{\ell} \right]_{t_1}^{t_2} + \left[\sum_j p_{Rj} \right]_{t_1}^{t_2} V_{Rj}^B - \left[\sum_i p_{Bi} \right]_{t_1}^{t_2} V_{Bi}^B$$

- - Guides Blue's Decisions

26

CHART 26. - The objective function used by Blue in his estimation of the value of courses of action is that shown here. It is actually the difference of combat potentials; we have shown only one Q term because we assume features successfully occupied by Blue are denied to Red, and vice-versa.

The subscript B 's mean "evaluated to implement Blue higher strategy". For any conflict we isolate, it is likely that values assigned by Blue will differ from values assigned by Red; therefore, objectives are only partially opposed and the "game" is not zero-sum. One side actually has an inferior over-all strategy at some level, and this may affect the outcome, even in spite of higher combat potential.

An Intelligence Processor - -

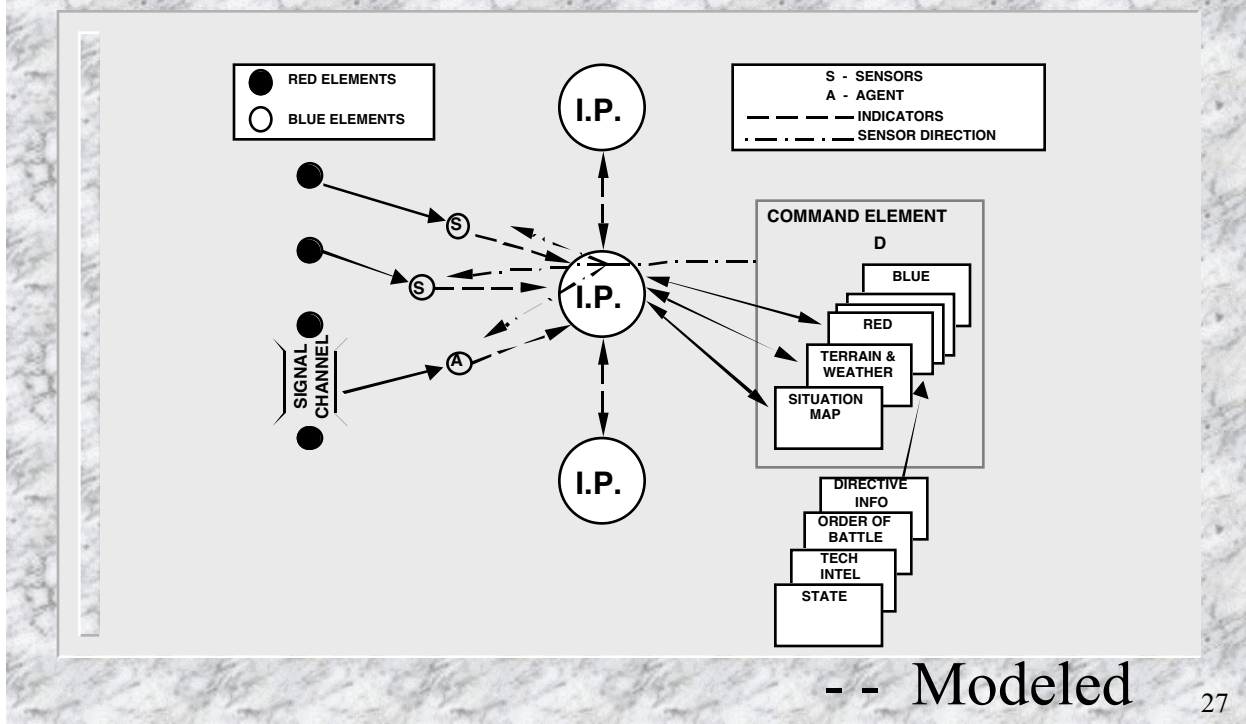


CHART 27. - This is our descriptive model of an intelligence processor. It is responsible for the files on Red and on Terrain and Weather, and responsible for the Red portion of the situation map. It gets "indicators" from sensors, agents, or other intelligence processors, and by internal processes of editing and inference, fills the files. Also, once command has outlined a Blue course of action, it can identify critical voids in the files and use a process of sensor direction to direct the search for the necessary information.

Note that the "Red" file is subdivided into four sub-files. Red directive information would be most valuable. It comes primarily by the agent route, though it is sometimes possible to draw valid inferences from Red's observed actions. The Order of Battle file, which identifies the Red units and elements which have been previously associated, is of particular utility in sensor direction. The Technical Intelligence file, which can use a great deal of intelligence collected prior to the conflict, deals with the capabilities of the Red elements identified. Information as to the state (position, supply, maintenance, etc.) of these elements aids in estimating their current potentials.

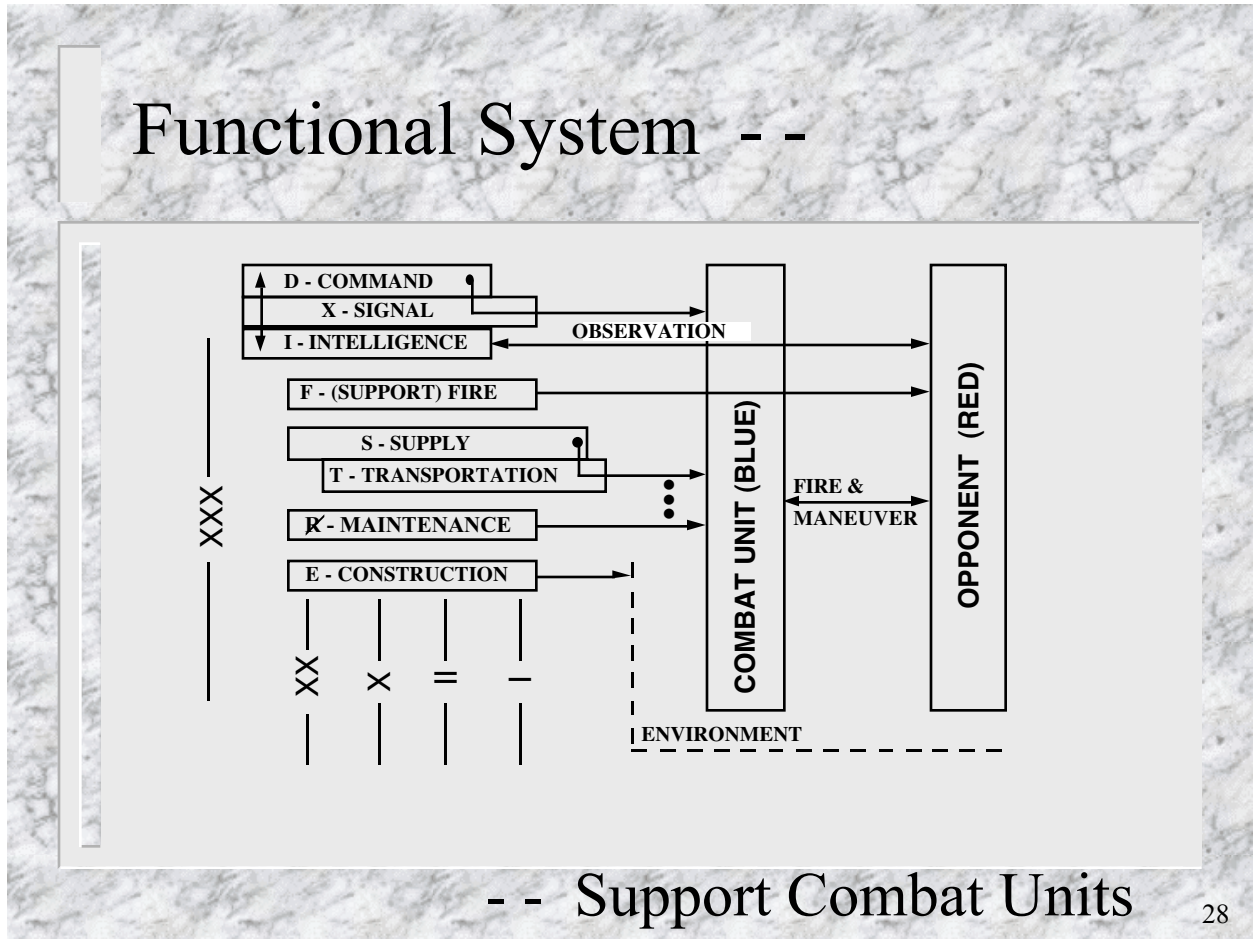


CHART 28. - (Repeat of Chart 6) To summarize:

The "systems" to be incorporated in a force can be considered as combat systems (either elements or units) supported by functional systems as shown here. Our descriptive model of combat enables us to select a system for quantitative analysis, place it in its total environment and determine its contribution to the combat potential of the force. When this contribution to combat potential is divided by invested manpower, we get a productivity index, which we consider a valid measure of the combat worth of a proposed system.

In closing this section of the briefing, may I remind you I have been outlining only a Descriptive Model of Combat. To show that this can indeed be transformed into useful computational models, we will now describe a practical application which has been completed.

