

TABLE II-11
DESCRIPTIVE STATISTICS WITH STRATIFICATION BY OUTCOME

	Composite Outcome Index			
	Very Fav.	Favorable	Unfavorable	Very Unfav.
RF and PF Strength				
Low Regular	6,830	7,040	7,830	7,780
High Regular	8,230	7,190	7,200	7,540
High Territorial	6,920	6,930	7,240	8,160
Low Territorial	7,210	6,780	7,340	6,710
Total Police Strength				
Low Regular	1,570	1,420	1,830	1,090
High Regular	1,510	1,240	1,030	910
High Territorial	1,920	1,410	1,760	1,210
Low Territorial	1,310	1,700	2,050	2,394
Friendly KIA, Fr. Init.				
Low Regular	19.5	30.4	36.7	51.1
High Regular	30.7	33.0	36.4	33.0
High Territorial	25.6	39.4	35.5	47.7
Low Territorial	29.4	27.5	36.6	20.4
Fr. KIA, Fr. Init./Fr. Str. (1000's)				
Low Regular	1.9	2.8	3.1	4.3
High Regular	2.3	2.6	1.5	2.6
High Territorial	2.4	3.4	3.3	4.0
Low Territorial	2.5	2.7	3.2	2.0
Territorial Force Ratio				
Low Regular	8.57	8.60	7.39	6.99
High Regular	7.99	9.35	9.48	6.83
High Territorial	7.28	6.06	7.38	7.16
Low Territorial	9.72	8.74	7.22	8.57
Enemy Regular Density				
Low Regular	0.47	0.45	0.55	0.78
High Regular	0.60	0.54	0.43	0.49
High Territorial	0.56	0.66	0.48	0.52
Low Territorial	0.51	0.52	0.72	0.40

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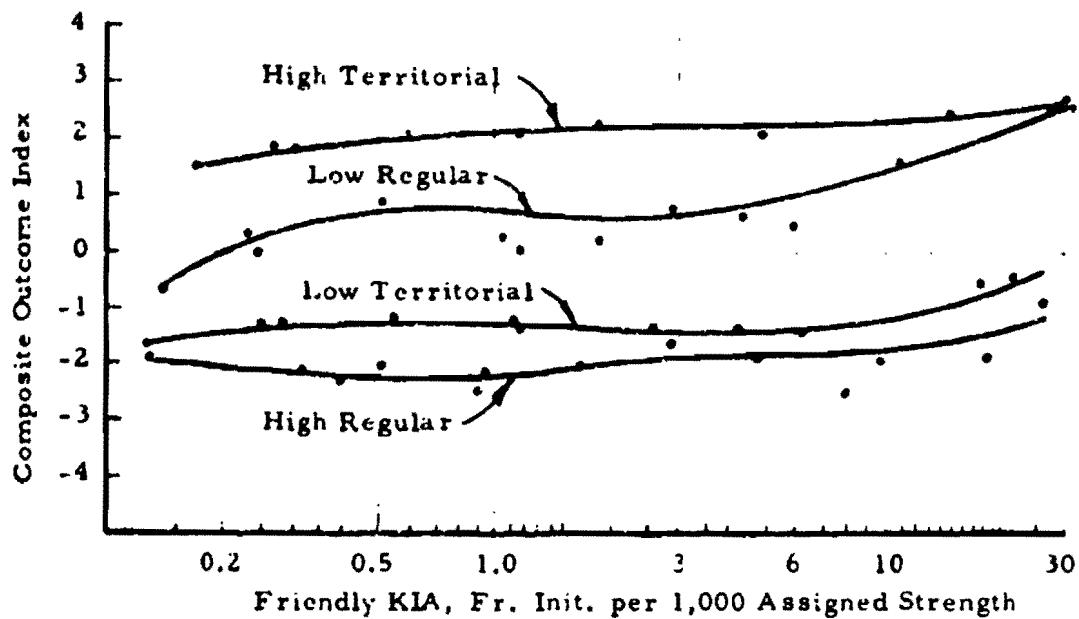


Figure II-25
Outcome Versus Friendly Initiative

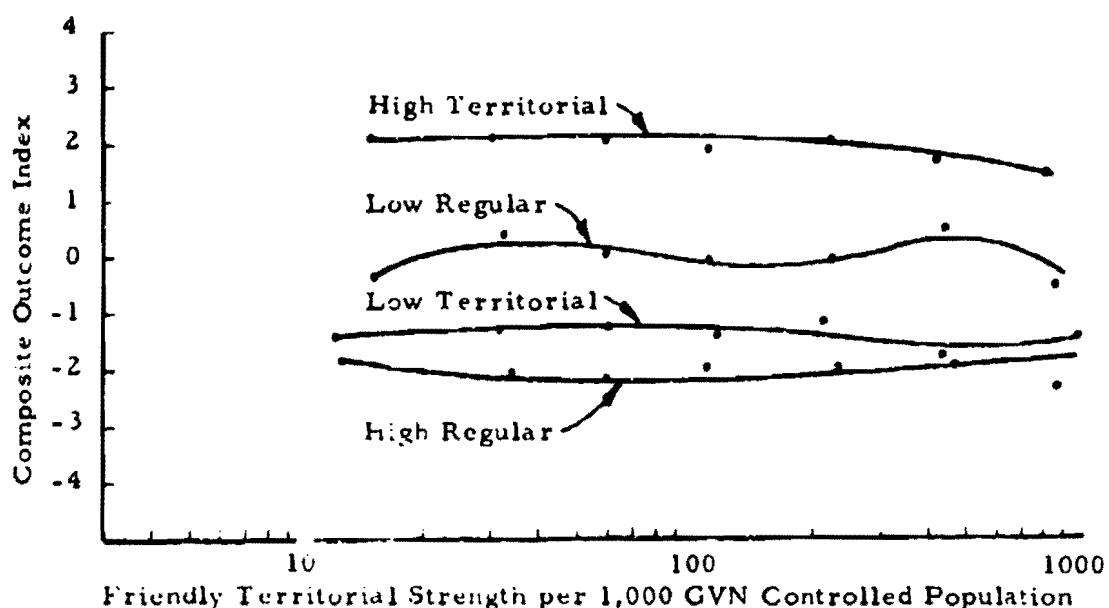


Figure II-26
Outcome Versus Friendly Territorial Strength per 1000's of GVN Control

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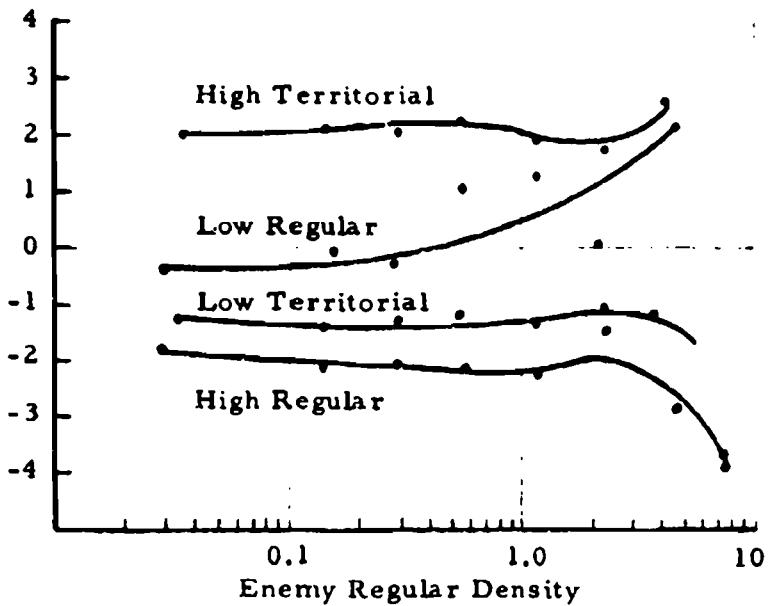


Figure II-27
Outcome Versus Enemy Regular Density

Again friendly strength and initiative were found to be generally unrelated or adversely related to outcomes. One reason for this is illustrated in the scatter plot of friendly KIA's (friendly initiated at time zero versus enemy initiated at time plus three) shown in Figure II-28. Here less than four total friendly KIA per thousand assigned strength make up nearly half the observations. This large concentration of cases at the low end of both scales (very low activity by both sides) dominates the statistical relationships. This aspect of the data seems to almost as strong at high levels of enemy density as at low. Although the data was not included to allow vigorous testing, it might be reasonable to explain this concentration of cases in a sort of "no activity" cluster in terms of enemy intentions.

One way to control for enemy intentions is to assume that when friendly initiative was zero all low cases of enemy initiative were low because the enemy did not choose to act. By excluding all those cases from the relationship it might be possible to approximate the deletion of all cases where the enemy did not intend to initiate action. The result of accepting that logic and extending it to rejection of a decreasing fraction of cases for each increment of friendly initiative does show evidence of an optimum level for friendly

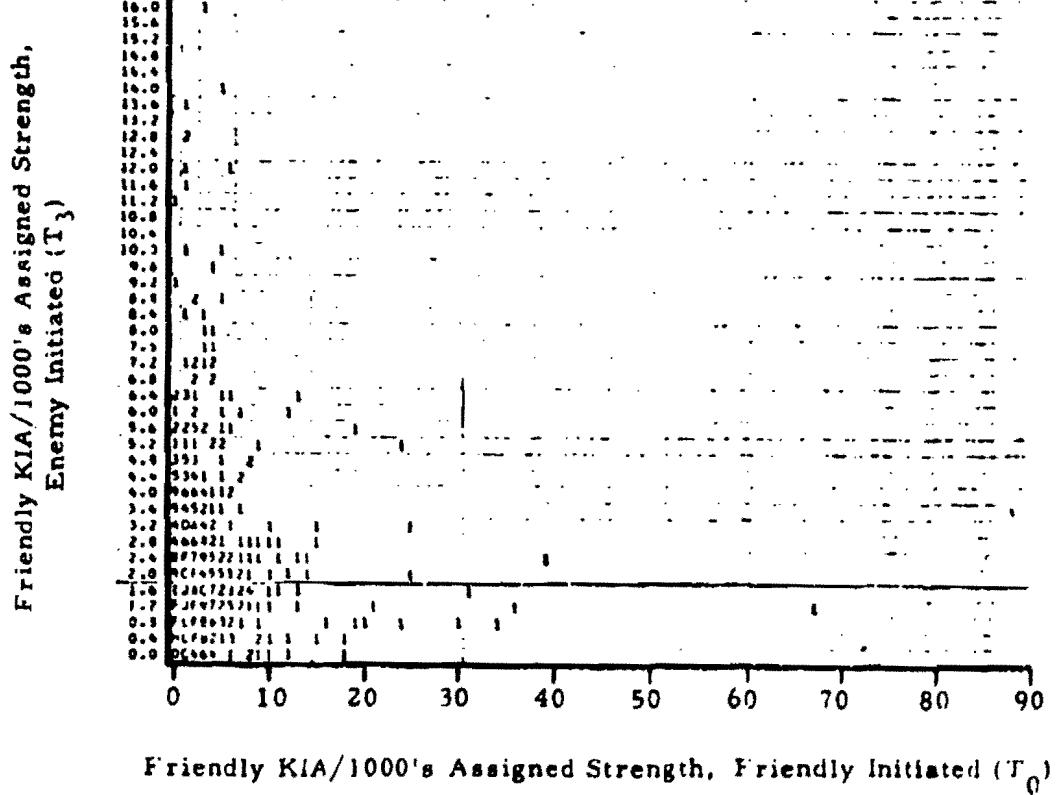


Figure II-28

High Territorial Friendly KIA Rates

initiative. If less than the median level for friendly KIA rate due to enemy initiated action is taken to be the desired outcome, the probabilities of that outcome for the high regular situation derived by the deletion of successively all, 80, 40, and 20 percent of the low cases for the first four ranges of friendly initiative are as shown in Table II-12.

TABLE II-12

HIGH REGULAR EXAMPLE WITH CASE DELETIONS

Enemy Regular Density (Z)	Probabilities of Low KIA to Enemy Initiated Action - (pL)					
$Z \geq 1.6$	0.0	0.23	0.44	0.41	0.41	0.57
$1.6 > Z \geq 0.8$	0.0	0.18	0.48	0.41	0.27	0.25
$0.8 > Z \geq 0.4$	0.0	0.15	0.44	0.59	0.31	No cases
$0.4 > Z \geq 0.2$	0.0	0.18	0.42	0.41	0.50	1.00
$0.2 > Z \geq 0.1$	0.0	0.22	0.17	0.44	1.00	No cases
$0.1 > Z$	0.0	0.17	0.38	No cases	1.00	No cases

$x = 0.0 < x \leq 2.0 < x \leq 5.0 < x \leq 11.5 < x \leq 23.0 < x$
 Friendly KIA Rate, Friendly Initiated (x)

An alternative assumption is that low enemy activity is really a response to low friendly military initiative - that the enemy intentions are based on how hard they are being pressed. Not deleting any of the low cases of both measures of military initiative yields the type of results shown in Table II-13. The high regular situation was selected as the example because it does have the

TABLE II-13

HIGH REGULAR EXAMPLE WITHOUT CASE DELETIONS

Enemy Regular Density (Z)	Probabilities of Low KIA to Enemy Initiated Action - (pL)					
$Z \geq 1.6$	1.00	0.60	0.57	0.46	0.41	0.57
$1.6 > Z \geq 0.8$	0.75	0.52	0.61	0.46	0.27	0.25
$0.8 > Z \geq 0.4$	1.00	0.46	0.56	0.64	0.33	No cases
$0.4 > Z \geq 0.2$	1.00	0.53	0.55	0.46	0.50	1.00
$0.2 > Z \geq 0.1$	0.60	0.59	0.25	0.50	1.00	No cases
$0.1 > Z$	0.00	0.50	0.50	No cases	1.00	No cases

$x = 0.0 < x \leq 2.0 < x \leq 5.0 < x \leq 11.5 < x \leq 23.0 < x$
 Friendly KIA Rate, Friendly Initiated (x)

lowest percentage of cases in the low-low quartile. Thus the "real" impact of friendly initiative should be least distorted by low enemy activity due to chance or design independent of friendly initiative. The results do not say much for a pre-emptive or attrition strategy. The best chances for low enemy initiative seem to be at a zero level of friendly initiative. One way to rationalize these results would be to say that the low-low quartile is explained by enemy activity being deterred by friendly presence or pre-empted by air power with low cost for friendly ground forces. However, the relationships between friendly strength and enemy activity are also weak. Table II-14 also shows that the relationship between outcome and air support is inconsistent. There are some cases in which higher levels of air support seem to be associated with very favorable outcomes (low territorial and high regular), but the opposite is also indicated (low regular and high territorial).

TABLE II-14
OUTCOME VERSUS AIR SUPPORT

	Composite Outcome Index			
	Very Fav.	Favorable	Unfavorable	Very Unfav.
Aerial Interdiction				
Low Regular	76.1	90.2	103.8	87.1
High Regular	99.5	95.9	63.7	84.0
High Territorial	91.8	106.2	97.5	70.6
Low Territorial	132.3	86.8	153.7	61.0
Close Air Support				
Low Regular	142.4	170.4	222.2	140.8
High Regular	225.6	235.2	129.0	181.2
High Territorial	196.5	243.4	168.3	148.8
Low Territorial	266.4	160.0	246.2	92.7

The high regular example can also be used to illustrate a possible optimum solution for friendly initiative if the logic behind deletion of the low-low quartile is followed. Figure II-29 is a plot of friendly KIA rates from friendly initiative at time zero versus total with the enemy initiated component at time three.

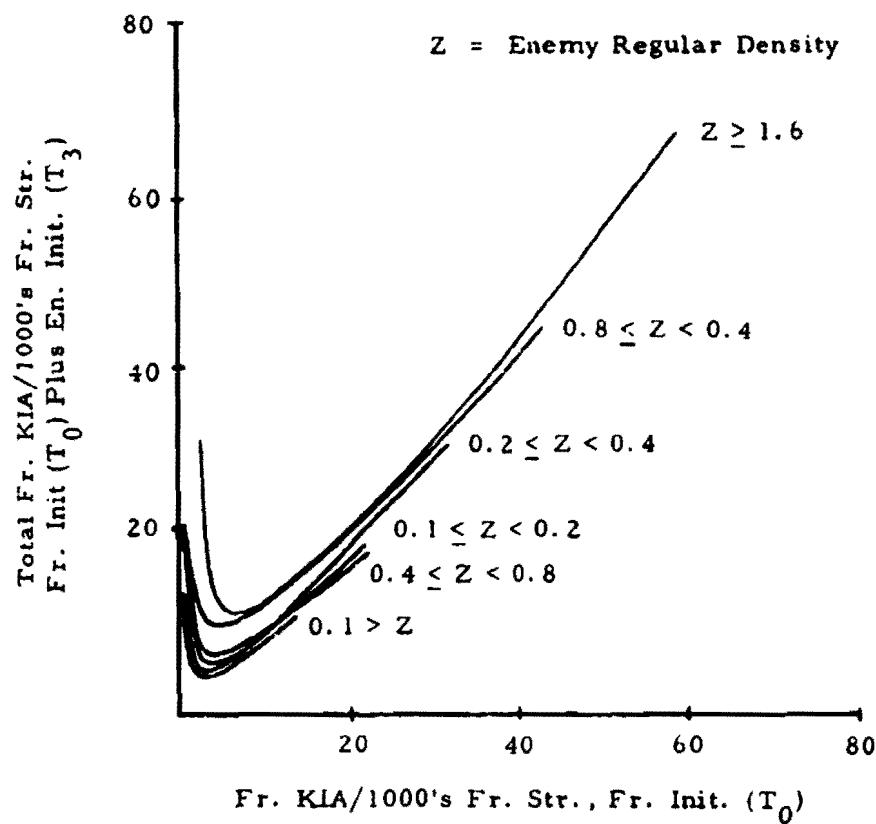


Figure II-29

Total Cost Versus Friendly Initiative

These curves indicate that above a friendly initiative of about five the total is dominated by friendly initiative with one exception. There are indications that at the highest level of enemy density, no level of friendly initiative is going to suppress enemy activity. Apparently that force density means that enemy intention clearly is to assume the initiative.

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32. Nor does friendly initiative appear to be systematically effective in pre-emption of future enemy action as is shown later in Section II.

33. Recovery is measured by the percentage of the offensive related decline regained (or increased) as of June 1972. Only provinces experiencing a decline of at least 10% are included.

34. In this study of change patterns a significant change is defined as being greater than one standard deviation above or below the mean quarterly change.

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- The Impact of Tactical Air Support on Battle Outcomes in South Vietnam, Working Paper of December 1972.

SECTION III
EVALUATION

Introduction

There are two primary areas of concern for this evaluation - the Vietnam data base and the research carried out during this project. The data question can be separated into several parts. The problems of storage and recovery along with screening for completeness and accuracy have constituted at least a third of the effort on this project. The available data, the data management procedures, data quality, and the reasoning behind the decisions, the use, rejection, or aggregation of various data elements are all discussed in detail in Volume II of this report. Another question about the data simply asks if the collection of thousands of data elements was necessary. There is no straight answer to that question. This project has made use of several hundred data elements, but only in aggregate form to measure general concepts such as friendly or enemy, offense or defense, large or small, etc. because the research problems have not involved specifics such as comparing the relative utilities of alternative communications concepts for the PF. Such specific problems should have been considered in planning future military assistance programs and the data is there. If the question about data necessity is stated in terms of what the Secretary of Defense needed to monitor and evaluate the current situation and trends in the war, the obvious answer is that a much smaller data collection is adequate. Perhaps no more than five aggregate indices need concern the high level decision maker if his concern is only to know how things went last month. A set of some 36 measures aggregated on a quarterly basis has been selected as most useful for province level study of the war. This data is defined and included in Volume III of this report.

Evaluation of the research carried out will be the main subject of this discussion. Each major research topic will be evaluated as appropriate for the elements of the problem formulation, problem solution, and interpretation stages of the operations research procedure. There are four elements to the problem formulation. Some explicit statement of the operational objective(s) is the first. The research strategy also needs to specify the alternative means for achieving the objective. The comparison of alternatives was not as much a part of the work on this project as was simply asking the data for evidence that a single alternative could be systematically associated

with the attainment of the objective. A step beyond specification of objectives and alternatives is to establish criteria for evaluating how well or if the objectives are reached. Then comes the element that often sends the analyst back to reconsideration of the first three. It is easier to say the objective is to win the battle using all appropriate means at a minimum cost than it is to find compatible measures of all the factors at work in the system. Once the problem can be expressed in terms of a hypothesis about how one or more courses of action are expected to impact on some terminal conditions, there are at least four ways in which to proceed with the problem solution. One could begin by asking if the expectations are in concurrence with theory. This was not explicitly done here, but did play an important role in the problem formulation. Nor were any tests (field or laboratory) or simulations performed other than to check the sensitivity of some models used to represent the system. The main approach used to solve the problems can be termed empiricism. The research sought to find out what the three thousand province-month observations said about confirming or denying certain expectations. Finally, the research had to face the issue of interpreting the meaning of how the data fit expectations. More often than not this took the work right back to problem formulation asking if the data may not have been accurately measuring the objectives and alternatives or what key element of the system was omitted to produce such divergence between expectation and result.

ARVN Performance

Problem Formulation - The examples presented for this work used attrition of enemy forces as the operational objective for ARVN units. The alternatives were the different units with the evaluation criteria being the attrition expected of the average unit for a given mission and combat environment.

Problem Solution - Both theory and empiricism were employed. Theory was introduced by using the factors cited by field observers to explain variation in performance as the inputs to multiple regression models of attrition.

Interpretation - Finding that the differences between divisions were less than generally believed and that the First Division was not best brought this work back to a search for better data. It is not clear that different data would have produced more credible findings. The approach has merit because it does avoid judgment as to how good a unit is in comparison to what the evaluator

thinks a U.S. unit would be (in spite of vastly different situations and motivations). Were the work to be repeated, an effort should be made to partition along mission as well as war type lines. For each unit mission a different set of operational objectives would be appropriate. For instance:

<u>Mission</u>	<u>Operational Objectives</u>
Combat Operations	Enemy attrition from friendly initiative Reduced future enemy action
Defense	Reduced (deterring) enemy action Enemy attrition on enemy initiatives
Active Pacification	Enemy attrition Reduction of contested population Expansion of area under GVN control
Static Pacification	Same as defense plus... Increased participation of RF, PT, and PSDF in passive and active roles.

Description

Problem Formulation - The objective of this aspect of the work was to provide a basis for selecting measures of key factors believed to play a role in the war. The alternatives for this objective were simply the available data elements. The criteria for selection of data elements as key indicators or components of composite indices were substantive meaning and simplicity. The research sought to include the maximum amount of substance and explanation of variance in a minimum number of measures.

Problem Solution - Inputs to this work were selected on the basis of what event or condition is being reported and not having excessive zero observations. For example, the data element U.S. large unit battalion days was included because it is a measure of the general concept "friendly activity". Crew served weapons lost by third-country forces is a data element consisting of nearly all zero observations and relatively little substantive interest unless someone wanted to plan for future third-country crew served weapon requirements. Rather than delete the second example as a data element, it was aggregated with all friendly force crew served weapons lost as a possible measure of the same general concept "friendly activity". This form of selection, aggregation, and organization of data elements by general concept was still too complex for comprehension or use in models of expectations. Factor analysis was employed to identify the major patterns of variance over time and across provinces.

Interpretation - Simply finding that the data elements measuring enemy activity fall into three independent patterns or that variance in military presence and activity across provinces can be reduced to scores on two dimensions was of considerable interest. It provided a relatively simple way to examine the war at province level without having to scan 44 observations for hundreds of data elements. Province averages for the four categorizations of the war seem to be an improvement over aggregating provinces into military regions. This is especially true if some relatively inactive provinces can be excluded. When every province is forced into one of four categories the scheme breaks down. An Giang is really no more like Phu Bon than it is like Chuong Thien. Some of the parsimony provided by going to key indicators or composite indices of a pattern of variance over time also has limitations. A U.S. and ARVN "battalion day" are not equivalent, even though the use of total friendly battalion days assumes as much when it is used to measure friendly large unit activity. However, from another perspective the error introduced is probably small because U.S. battalion days are found in only a small fraction of the total province-month observations. Just how to use the descriptive findings must ultimately depend on the decision problem being researched. If nothing more, the descriptive work performed offers future analysts a better perspective for making choices when they must fit hundreds of data elements into a ten parameter model.

RVNAF Composition

Problem Formulation - Increased population under GVN control was the operational objective to be realized from various combinations of ARVN, RF, and PF strength as alternatives. The criterion was implicit in that the force mix associated with an expected maximum GVN control was the research objective. Not reaching that research objective was initially believed due to defects in the problem formulation. The objective should have been measured as a percent of the population under GVN control to compensate for differences in province size. The score for GVN control either as a total or a percentage may not be the best measure of the operational objective for optimizing the mix of ARVN, RF, and PF because the GVN control model includes the presence of local GVN security forces making it biased toward reflecting PF strength. The use of multiplicative interaction terms was handy for finding an optimum, but it may not be the best representation of the interaction between two types of forces. Expressing each force type as a percent of the total might have been better. Many of these questions were explored in later

work on the relationships between military presence and activity and various measures of the outcome. The results of that work make it clear that not finding an optimum force mix can not be blamed on only the design. There probably aren't any optimum military solutions.

Problem Solution - The use of regression models including the second order and interaction terms was neat for finding out if an optimum solution existed. Alternative models were not tested extensively with the same data set, but several of the bivariate relationships were examined carefully. Finding that ARVN strength tended to have a negative relationship with GVN control led to work with the cross-lagged correlations. This introduction of time lags showed that changed to GVN control led ARVN strength. A decline to GVN control is followed by increased ARVN strength.

Interpretation - As already noted in some detail not finding an optimum mix was interpreted a problem with the measures and model selected. Presentation of the results as sets of sensitivity curves had interesting possibilities not fully realized because of lack of confidence in the models. The current situation in a province with 1,500 ARVN; 2,000 RF; 5,000 PF and 4,000 people under GVN control could be plotted as shown in figure III-1. In this example the 5,000 PF do not go with the 40,000 people actually under

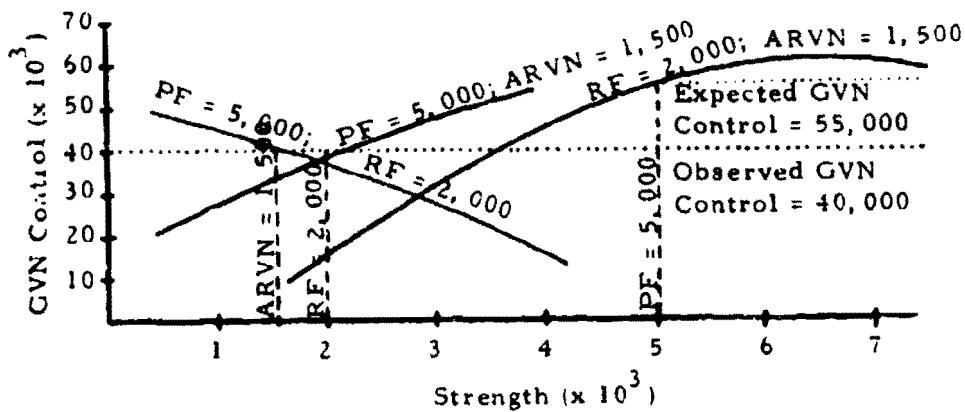


Figure III-1
Sample Use of Sensitivity Curves

GVN control. Something could be wrong with either the effectiveness or employment of the PF to make the observed effect of 5,000 equivalent to only about 3,500. The results of this work also led to some study of extreme cases. In this study very large increases or decreases in GVN control were compared to various measures of military presence and activity. It disclosed several interesting effects. Large increases are understandably related to starting at low or moderate levels of GVN control. It is easier to register gains when there is more room for improvement. Large declines are easily explained by enemy activity, but friendly military activity does not account for large increases to GVN control. The processes are not reversible. Finally, there were indications that low level enemy activity such as terrorism have a catalytic effect in that they tend to be associated with gains in GVN control rather than declines.

Village Programs

Problem Formulation - This work involved several different iterations of the problem formulation and solution. The operational objectives were those of the "other war". Rural development through village self help was expected to gain popular behavior and attitudes favorable to the GVN and erode those favorable to the VC. Because the program efforts are very diverse and the available data in the HES deals with broad categories rather than specific development efforts, most of the analysis considered the alternatives to be development in general versus military initiative by either side. Even when the most detail possible in separate HES questions was studied the development activity was measured in general terms only (i. e., frequency of agriculture cadre visits as opposed to a specific measure such as units of hog cholera vaccine administered). The approach of a cease-fire brought a shift in the work from asking if village programs were effective or a waste of resources to concern for what programs were desirable for the post cease-fire period. The research design considered many levels of detail ranging from all hamlets to provinces aggregated by war type. The measures examined also ranged from some 90 HES questions to a half dozen composite indices. The work can be said to have been persistent in trying everything even though it was not very efficient.

Problem Solution - The methods employed were as varied as the levels of detail examined. Cross-sectional analyses examined the relationships expressed by rank order correlation statistics as well as by the correspondence shown by three colored hamlet plots. Rank order correlation was

SECTION IV

CONCLUSIONS

Can the application of multivariate analysis techniques to aggregate data such as that available from Vietnam provide useful assistance to decisionmakers? Yes it can, even though many of the results of the Bendix program were of the negative variety and those that were positive emerged as less than convincing. This evaluation is trapped in the conflict between the need to be positive and assertive in order to be given attention and the awareness of how "soft" some of the data is, the analytical assumptions that were "bent" along the way, and how one might have proceeded differently given two years of hindsight. Another bind exists between the need for a clear and concise statement of results and their implications and the need to build credibility by presenting the complex details leading up to those results that were not intuitively pleasing. Finally, the particular nature of the available data and the large size of the data base combined to produce the most important defect in the utility of the data and analysis methods as quantitative decision aids. Very few decisions need to be made in three months, six months or a year. Most seem to have a time frame of a week or two at most (and some were "needed yesterday"). The work on this project has shown that a three month response time is hard to meet and when the time is not taken to carefully review all the data and check the various manipulations of that data, errors creep in.

These areas of compromise between what was needed or desired and what was possible become the basis for this evaluation of both the work performed and what might have been done:

- Did the data actually represent the substantive concepts being examined?
- Did the methods employed accurately disclose the relationships in a useful form?
- Did the interpretation of results bring clarity to an admittedly complex phenomenon?
- Did the effort to clarify complexity conceal any significant limitations or sensitivity of the analysis?
- Did the level of detail examined strike an appropriate balance between the complexity of the problem and the time available to produce results?

Consider first the problem of "softness" in the data. From the onset of the project the question of data quality was one of major concern. Approximately a third of the effort was devoted to the screening and management of the data base. The purpose of the descriptive analyses was to identify the relevant substantive concepts and the most appropriate data elements for use in composite indices or as key indicators. With the exception of the data on friendly casualties which tend to be low, all data elements for military activities used in the study represent events or conditions which seem to have been reported accurately. Even though friendly casualties may be understated, this measure correlates very strongly with most other measures of friendly activity such as weapons lost or captured, enemy casualties, mission days, contacts, etc. Therefore, friendly killed in friendly initiated action probably does accurately represent the level of friendly offense. However, it would have been easier to interpret if the measure could have been the proportion of available resources allocated to offense, but differences in reporting small and large unit activity would not permit the construction of this measure. The indices constructed from aggregate responses to HES questions are also open to question. Economic strength might be better represented by some combination of a price index and average family income, but this is not available on a monthly province level basis. In the end, a combination of the status of local markets and the quantity and variety of goods available is probably representative of as much accuracy and detail on a country-wide scale as one can find anywhere.

The subject of HES data leads into the problem of selecting the appropriate method. The basic issue concerns the meaning and use of an aggregate score of, say 2.6, derived from many question responses having weights of 0, 1, 2, 3, and 4 where the interval between each weight is not necessarily equal. If the method employed assumes that the intervals were equal, as was the case in the analysis of time series data for the village program question, error could be introduced if the results are interpreted as meaning a unit of change in the independent variable will yield a proportional change in the dependent variable. This type of interpretation was not made. Instead, the interpretation and application of time series analysis results was restricted to comparisons across provinces. Some findings with regard to the relative strength of relationships between economic stimulation (ordinal scale) or friendly offense (interval scale) and political influence (ordinal scale) are questionable. However, the relatively low and sometimes adverse apparent impact of friendly offense is supported by the same low relationships with other outcome measures which are also interval data. Additional support for the use of parametric methods with ordinal data was derived by a comparison of the results obtained with both rank-order and product moment correlation routines. Finally, extensive testing of the relationships was carried out on a cross-sectional basis using non-parametric methods before going into the time series work.

The need to develop clear and concise interpretations from extensive analysis of rather complex phenomena tended to be at odds with the data and method questions. It would have been desirable to interpret the results with a statement that doing "x" will produce "b" change in "y". Or that for a threat of "z" enemy density the probability of a favorable outcome is a maximum with "r" friendly regular troops allocating "o" percent of their time to offensive operations with "t" friendly territorial troops per 1000 people under GVN control. Such prescriptive interpretations were diligently sought, but were either not found or were without meaning. Frequently, the data for "x" and "y" had to be an abstract index so the best that could be said of the results was that the relationship between "x" and "y" was strong, moderate, weak or nil; was linear or subject to saturation and threshold effects; was reversible or not; and was clearly or ambiguously causal in nature. With regard to outcome, many alternatives were considered. Unfortunately, this war has been one of recurring episodes. There is no data element labeled "win/lose". The GVN control score developed by the Vietnam Special Studies Group does tell something about the status of opposing military forces relative to the population. Gains on this index can be assumed to be favorable and declines unfavorable. There are measures of both the frequency and intensity of enemy activity for which declines or at least below average experience could be considered generally favorable. One problem is that a very good month in one province might be the worst ever in another. However, by allowing the standards of favorability to be based on the unique experience of each province, it did seem reasonable to construct a composite index from the GVN control and enemy activity measures. Then the analysis did not yield the clear relationships between future outcome and friendly presence or activity that could have been given a useful interpretation. There are at least four reasons or interpretations. The composite outcome index may have no meaning. The choice of analysis method failed to show the true relationships. Or if the negative results are valid, it was because there were many observations of high friendly presence and activity where the enemy threat was low, or conversely, there were many observations where the enemy activity was much lower than could be expected from enemy presence even though friendly presence and activity was also low. Study of more than 500 scatter plots makes the latter interpretation seem most likely. The probability of high enemy activity was so low that increased friendly presence or activity does little to reduce it. In short it was not possible to concisely interpret something that could not be found.

Because so few simple and intuitively pleasing interpretations were possible, there was little problem of concealment or distortion of results. If anything, it has been necessary to report too many examples of the detailed, complex results. During the descriptive work the effort to compensate for seasonal variation yielded a fairly simple finding that was easy to misinterpret. It was found that seasonal variation did not change the basic structure of the patterns of variation over time. This did not mean that there are no seasonal effects. It means only that the eight variables that best describe military presence and activity in the dry season are just as valid for the wet season. Forces tend to do the same thing in either season—just more or less. A similar confusion was experienced when it was found that security did not strongly influence the relationship between economic strength and political influence. If anything, the relationship is stronger under conditions of low security, but this may be an artifact of the level of economic strength that goes with low security. In any event, the conclusion was not that security in itself is unimportant to political influence; it only meant that the payoff of economic strength in terms of popular behavior was largely independent of security. On the other hand, hamlets with really low security do not even get into the data, so the results should not be interpreted as a mandate to improve the economy of all hamlets without regard to enemy threat or safety of the RD cadre team given the job.

The problem of response time has been most vexing from the onset. Just the process of acquiring and updating the data base has taken far longer than ever anticipated. By the time a tape is obtained, read, and the data screened and merged with existing data several weeks slip by even if no problems are encountered. Then there are the seemingly unavoidable instances of the garbled tape, wrong label, wrong code book, or the key data element not being present. Working with province level, monthly data has produced problems not apparent with data aggregated by military region. It simply takes time to find and deal with a province whose population increases 250 percent in one month. If this sort of error is found after population has been used as a variable for several months, it is unpleasant to calculate the lost time and effort. A fair estimate of time requirements for the various elements of a 20 variable research design using some 100 data elements from the raw data is as follows:

- Update and screen basic data file(s) - three weeks
- Problem formulation and variable specification - two weeks
- Variable/index construction and screening - two weeks

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- Review of descriptive statistics and scatter plots - one week
- Revision of research design and variable selection - (two weeks)
- Initial analysis/modeling - two weeks
- Preliminary interpretation and analysis reiteration(s) - three weeks
- Draft report and interpretation - two weeks

This adds up to some 15 to 17 calendar weeks for an analyst, research assistant and about half time for a computer programmer. It assumes results that generally conform to the expectations and no serious data problems. If there are surprises, the time span can easily double. Another factor that can add to the time factor is a revision of the objectives too late or after the research becomes overly entrenched in the original data set. While it is easy to see that much time was lost on wrong approaches or simply asking the wrong questions of the wrong data, there may have been no way to learn this without trying. One way to reduce time requirements is to be less ambitious. Aggregate the data by military region and quarter or even by country-wide annual observations. It may well be that province-months are not the best level of analysis. For one data set, the Pacification Attitude Analysis System (PAAS) data, individual respondents should yield the most reliable findings. At the other extreme, the student of Vietnamese history in the next century may find a very clear picture by observing Southeast Asia at ten year intervals. That is probably a ridiculous comment, but it does underscore the importance for seeking a satisfactory compromise between the decision problem, research strategy, data, and the available time and resources.

The experience with the Analysis of Vietnamization project does not offer any simple formula for how to reach that compromise. It began as a fishing expedition into the sea of Vietnam data. Some good catches were made, but not all have been easily digested. Some likely sources of better catches have been identified, but the really big one seems to have escaped. In the end, the Government, other researchers, and possibly even the Vietnamese will realize some advantage from this experience.

After arming the fuze on this report with the final comments on friendly initiative in the preceding section, it is fitting that the concluding remarks draw upon the work of a wiser and more successful analyst. In approaching the evaluation task guidance was sought in text books on operations analysis and the self criticism appearing periodically in Operations Research and the Military Operations Research Symposium Proceedings over the past ten years. Also uncovered in this review of the literature was E. S. Quade's book Analysis for Military Decisions.⁴ The concluding portion of Quade's critique seems appropriate here.

From the 29 precepts for conducting operations research:

- "1. The design of the analysis is crucial. . ."
- "3. The investigation may require many cycles or passes at the problem. . ."
- "5. Detailed treatment usually should come late in the study, . . ."
- "8. In all analysis, the use of models is inevitable... However, . . . The analyst must be more interested in the real world problem than in the idealized model..."
- "9. For most phenomena there are many possible representations; . . ."
- "12. Computations with models... are frequently valuable not because they prove results, but because they lead to more and better analysis at the intuitive level."
- "16. A study that attempts to influence policy must make a convincing comparison of alternatives. . ."
- "20. Insofar as possible, a systems analyst should try to use the methods of science and to establish the same traditions. He should be objective and quantitative; all his calculations, assumptions, data, and judgments should be made explicit and subject to duplication, checking, criticism, and disagreement."
- "22. Inquiry can never be complete. . ."

E. S. Quade (ed.), Analysis for Military Decisions, Rand Corp., Santa Monica, Rand McNally & Co., Chicago, 1964.

compared with product moment correlation results. Correlation and regression were employed with time series data. Work with regression models attempted to incorporate the non-linear and interaction effects observed on scatter plots. Eventually, a form of causal path analysis might have sorted out the unique contributions of each factor in the "system" explaining popular behavior. But there were too many likely paths and too many provinces for the time and resources available. Furthermore, a precise interpretation of how the process worked in each province was considered less important than the application of the analysis results to the practical problem of post cease fire planning.

Interpretation - Application of several analysis methods to several large data sets produced more statistics, graphs, and map plots than could ever be interpreted in detail. What started as a few simple tests from which the scope and methods were to be reduced to the most promising few measures and techniques grew into trying all approaches on all the data. There were several reasons for this growth rather than narrowing of scope. A basic reason was discovery that use of only the composite indices allowed errors to be introduced if the component questions were not screened for every case. As long as it was necessary to examine all the questions it was just as easy to obtain statistics on all the bivariate relationships at the same time. Another reason for continuing to examine relationships found to be nil in the sample tests was a suspicion that the sample may not have been representative, or the apparent independence was simply not credible. The tests on a cross-sectional basis were finally narrowed down to a dozen plausible hypotheses and reported in terms of, "it is generally confirmed, but..." The time-series analysis dealt with fewer parameters, but it ultimately treated each of the 44 provinces separately. From an academic perspective, it would be desirable to carry this work on through the development of 44 causal path models. Incidentally, the "processes" are similar in most provinces in the sense that rural development seems to work in general, but in detail every province is a little unique. In the end the analysis concluded with the tabulation of all the apparently valid causal linkages. Instead of interpreting the results as a set of models, the differences between provinces were translated into the different implications these results should have for future development efforts. The final product was a set of recommendations for allocation of post ceasefire development effort.

1972 Offensive

Problem Formulation - This work was actually a number of separate efforts to provide some rapid systematic evaluations of the situation and its implications. To a large degree the research was oriented toward providing description rather than solutions to operational problems. Thus, it is not practical to tabulate objectives, alternatives, criteria, and measures. There were decision problems that the results eventually obtained can support. For example, the work on attrition models could be used to estimate the course of action for various amounts and rates of ARVN reinforcement facing the 1972 or possible future NVA offensives in northern MRI. Any decisions regarding how to help the GVN deal with the offensive could have benefited from the descriptions placing the 1972 activity and its consequences in a long term perspective.

Problem Solution - Both theory and empiricism played a role in this work. Adaptations of Lanchester attrition models were used in what amounted to simulations for the purpose of finding values for the time interval, exchange and commitment ratios, and assigning strength limits that would make the model fit the observed data. Correlation and regression were used in other parts of the work, but simple tabular summaries produced the clearest descriptions.

Interpretation - The delays in acquisition of data made the results too late to be of practical value for the assessment of events during 1972. Therefore, little more was said by way of interpretation other than that the attrition models have promise. That the offensive was largely an NVA affair and did not achieve more than setting pacification back a year is not news to those close to the scene. However, the review of published accounts of the battles in order to make estimates of the missing data did show this perspective of the offensive and its impact is not widely held.

Friendly Initiative

Problem Formulation - This task is related to the question of enemy offensive because the basic premise was that friendly initiative will pre-empt enemy activity. Assuming this to be true the friendly commander should want to know how much initiative is enough because more than enough could be more costly than to little. The operational objective here was one of minimizing

the friendly battle costs. The alternatives considered were various levels of activity, support, and strengths. Measures important to the problem also included the threat and general nature of the war.

Problem Solution - Again the research relied on empiricism letting the observed data produce the answers. Only the answers were not the ones expected by the basic premise. Regression models were rejected in favor of looking at smaller and smaller subsets of the data. When friendly initiative alone emerged as generally counter productive as far as having an optimum level is concerned, the research focused on finding what conditions or combination of conditions tend to explain favorable outcomes. As with much of the other work done on a multivariate basis, the results are distorted by too much interdependence among the "independent" measures. It is easy for the statistics to summarize what appears to be going on, but even the introduction of time lags does not produce easy answers as to why. At best the work can be useful for applying other methods to different measures in search of the same answers.

Interpretation - How does one tell the Department of Defense that military initiative in Vietnam had no systematic utility? A finding that aerial interdiction is essentially unrelated to any measure of outcome other than aircraft losses has no value unless someone will pay attention. When this pattern of findings began to emerge from the early work, the research design and selection of measures were blamed. The data set finally used was an attempt to meet anticipated rejection of the findings. Strengths and activity were normalized, the data was partitioned according to enemy threat, and provinces were treated as separate cases, but the only consistent interpretation possible is that NVA and VC forces have been reacting to friendly strength and initiative. Only an assumption that a proportion of the province-months should be deleted because the enemy did not act because he didn't intend to will show a limited positive impact for friendly initiative. The last multivariate attempt used a form of discriminant analysis to evaluate what combination of measures best accounts for favorable or unfavorable outcomes. Here the military theory finds at least partial confirmation. In order of strength, these measures of friendly strength and activity are:

- Close Air Support - low explaining very unfavorable outcomes
- Friendly Initiative - high explaining very unfavorable outcomes
- Overall Force Ratio - generally as expected
- ARVN/VNMC Strength - the opposite of expectations
- Territorial Strength per 1,000 People Under GVN Control - the opposite of expectations

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There does seem to be potential for finding acceptable guidelines for the use of friendly resources in the data. Unfortunately, time ran out on this project before they could be confirmed and made into explicit recommendations.

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- "24. Real uncertainty that cannot be removed by further analysis is always present in any study of the real world. . . ."
- "25. In a complex real-world problem, full optimization over the entire scope of the problem is ordinarily beyond the capability of analysis;"

From the 31 questions for the decision makers using operations research:

- "1. Does the project leader appear to have a fair background knowledge of the subject area?"
- "2. Does the preliminary formulation show an understanding of what needs to be done to fill in the gaps in our knowledge?"
- "3. Is the (research) process an organized one?"
- "4. What is the purpose of the analysis?"
- "5. Who is doing the analysis?" (Are there vested interests).
- "6. What decision is the analysis concerned with?"
- "7. Who must make the decision?"
- "8. When must or should the decision be made?"
- "9. What alternative . . . courses of action are considered. . . .?"
- "10. Does the analysis ignore any related factors that should be considered jointly with the problems in the analysis?"
- "11. Are all the alternative actions considered in the analysis really possible?"
- "12. Does the analysis ignore any consequence of the decision?"
- "13. Are the assumptions explicitly stated?"
- "14. Do the decision making criteria appear reasonable?"
- "15. Does the systems analyst fully disclose his subjective judgments?"
- "16. Are the results of the analysis presented in a useful form?"

- "19. Are the limitations of the analysis, as well as its good features, pointed out clearly and candidly?"
- "21. Are the conclusions intuitively satisfying?"
- "23. Is the significant problem being considered, . . . ?"
- "25. What contingencies were considered?"
- "26. Are enemy or competitor reactions explicitly taken into account?"
- "28. Were the assumptions of the model made explicit?"
- "29. Is the model adequate?"
- "30. Does the study give consideration to other possible models?"
- "31. Are the recommendations made with full recognition of the uncertainties involved?"

Given a more intimate knowledge of the intentions, difficulties, and complete results of the Analysis of Vietnamization Project than can be presented in this lengthy abstract of the work, the author and principal investigator concludes that the work rates a good score on the precepts and questions raised by Quade. Many of the answers sought were not found. This is not necessarily a defect in either the methods or the data. The negative as well as positive findings have been reported. If this type of approach had been applied consistently since the early stages of the war, the work on substantive questions might have been more timely, and responsive. At this time there are many "what if" questions for decision makers to which the results of this project can and should be applied. As the Department of Defense recovers from the changes forced by the Vietnam experience it is hoped that this empirical approach to learning from the past will receive at least equal attention with the anecdotal approach.

SECTION V

REFERENCES

Introduction

This listing of references covers a wide range of materials extending from theoretical works on the subject of revolutionary warfare to various reports prepared by the Bendix analysis staff during the project. It is not meant to be a complete bibliography of the Vietnam War. Only the books, papers, and data sources used in the planning and interpretation of the analyses are included. Many journal articles, papers, and news reports are not included even though they were routinely reviewed for information and ideas during the course of the work. For example, specific references to the several boxes of articles from the New York Times, Washington Post, Far Eastern Economic Review, Air University Review, Military Review, Aviation Week and Space Digest, etc. are not included in this listing even though they were routinely clipped and incorporated in the file of background data. Other sources in this same category include various pamphlets and periodic reports issued by the U. S. Departments of State and Defense and the Government of the Republic of Vietnam. Some references are included for reports of the lessons learned, combat experiences, combat after action report, and senior officer debriefing report categories because of their role in providing the analysis staff with a sampling of the "combat lore" and operational perspectives of those charged with responsibility for the day to day conduct of the war.

This study was oriented to apply various data and data analysis methods to understanding the processes at work in this conflict. Therefore, almost all of the references used except for the data source documentation served as only general background information. This is reflected by the organization of references into eight categories of background information plus other quantitative work and some analysis method documentation. Several categories of reports and papers resulting from the project are listed and briefly described. All the technical reports with a "BSR" number assigned were given the same distribution as this final report and should be available to qualified requesters from the Defense Documentation Center. Some references are also made to draft working papers and memoranda which are not generally available. They represent the development of research strategy, interaction with the study users at OASD(SA) Regional Programs, and miscellaneous efforts overtaken by events or incorporated in subsequent technical or final report volumes. They are included here simply to complete the documentation of the project work.

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