U. S. AIR FORCE

PROJECT RAND

RESEARCH MEMORANDUM

WAR GAMING METHODOLOGY

M. G. Weiner

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The RAND Corporation
1700 MAIN ST. • SANTA MONICA • CALIFORNIA

SUMMARY

This memorandum explains and discusses the methodology of war gaming as developed and used in the study of limited war situations by The RAND Corporation. The techniques were developed for the study of possible limited wars in the period from 1955 to 1960 in Southeast Asia, the Far East, and the Middle East (the SIERRA project).

Limited war, as the term is used here, includes the full context of air, sea, ground, and logistic actions. Moreover, the nature of limited wars implies a strong interaction of military and political elements, and of economic aspects. The inclusion of these factors requires techniques that allow them to be combined and to interact in diverse ways, a demand that is met by a properly constructed war game exercise.

As a research tool, the war game provides a systematic method for organizing and analyzing large groups of data and many varied factors. It forces decisions to be made, and permits the interactions and relationships among the factors to appear in specific, concrete form. It provides a means of continually checking the credibility and feasibility of the military and political decisions, and is a useful framework for organizing a group and achieving division of effort in a natural "real-life" way.

The author's objectives are to provide a sufficiently detailed study of war gaming methodology to enable the reader to understand the findings and conclusions of limited war studies, and to enable small, balanced staffs to organize and conduct their own limited war studies.

The memorandum includes discussions of the concept of war gaming, preparatory steps for gaming, techniques for two-sided gaming, functions of the player and control teams, the play of the game itself, and analysis

of the play. There are appendixes illustrating the types of background material and planning factors used in war gaming, a comparison of the staff-study and the pre-gaming techniques for shortening the time needed for some phases of gaming, and a sample analysis of decision points from one hypothetical game.

CONTENTS

I. INTRODUCTION

Project SIERRA was established to (a) examine possible limited war situations in Southeast Asia, the Far East, and the Middle East with particular reference to USAF effectiveness, and (b) develop a methodology for the study of such situations by small but balanced staffs.

This report presents the methodology, and is based on several years of development and use of war gaming techniques for the study of limited war situations. The techniques reported here were developed in the Southeast Asia, Far East, and Middle East studies. It is the author's intention in this report to incorporate enough detailed information on war gaming methodology to be of value in:

1. Organizing and conducting limited war games.
2. Providing background for understanding the findings and conclusions from limited war studies.

II. THE WAR GAME CONCEPT

In limited war studies, a full context of air, ground, sea, and logistics actions is required to test properly the use and effectiveness of each type of military operation. In addition, the nature of limited wars implies a strong interaction of military and political elements. Moreover, economic factors may play a critical role. The inclusion of all these factors requires techniques in which they can be combined and allowed to interact in many, varied ways. The war game provides a broad context for including these factors and for allowing their extensive interaction. While the emphasis of the SIERRA war games is on the role of the Air Force, the methodology in this report is broad enough to be applicable to limited war gaming in general.

The technique of war gaming has a long history of usefulness as a training device and a testing device for war plans. As a tool for analysis, war gaming also has a number of attributes:

It provides a systematic method for organizing and analyzing large groups of data and many different factors.

It forces decisions to be made, and permits the interactions and relationships among the factors to appear in specific, concrete form.

It provides a means of continually checking the credibility and feasibility of the military and political decisions and actions taken. Each decision and action is closely scrutinized by the other members of the same side as well as by members of the opposing side(s) and the CONTROL team.

It provides a method for organizing a group and achieving division of effort in a natural (real-life) way.

On the other hand, war gaming must be used with considerable awareness of some of its major limitations:

It possesses no oracular qualities. Its representation of the future is as much open to challenge as that of any other analytic technique.

It involves such aggregation of detail in the gaming process that the very detailed data themselves can seriously distort the over-all picture.

It consists basically of description or observation projected into the future. Attempts can be made to derive general laws and principles, but these principles are only as valuable as the description or observation on which they are based.

The basic technique used by Project SIERRA is the two-sided war game in which two sides representing different interests and objectives interact under a more or less definite set of rules in a hypothetical, limited-war situation. In the development of appropriate gaming techniques, Project SIERRA has differed--at least in degree--from the more conventional war games in a number of ways:

With the inclusion of a large number of military, political, logistic, economic, and other factors it has become necessary to consider the rather extended time period over which these factors interact. Thus, SIERRA war game exercises often start with events preceding the outbreak of the war and continue through the war to some defined termination point. In this respect they are true war games, rather than map maneuvers or games of isolated engagements ("battle" games) which do not involve such large numbers of political, economic, logistic, and other factors.

SIERRA gaming requires specialists for manning the player teams and CONTROL team. The games involve large quantities of data and need seasoned

judgment in planning and executing military, political, logistic, and other actions. To function realistically, the players must have firsthand knowledge of military and political organization, procedure, and doctrine. A typical side or player team consists of specialists in air, ground, naval, political, and logistic operations. To this basic group may be added specialists in economics and intelligence, if the particular game warrants their contributions.

Closely related to the use of specialists within the structure of the game itself is the frequent use of researchers as consultants in a wide variety of special-knowledge fields during a game or its analysis. For SIERRA, a large amount of specialized information, varying from political analyses of the consequences of possible events to weapon and weapon system characteristics, was made available from non-SIERRA members of the RAND staff, and provided timely and economical assistance in many instances.* Similar use of consultants from military establishments, university faculties, and other sources would seem appropriate for small war gaming staffs.

Finally, another important distinction to be made in regard to SIERRA games is the attitude of the players to the exercises. The players consider the games as a form of research, and as such, their activity is focused on identifying and analyzing problems of research interest, not just on "winning the war" for their respective sides.** In this regard, team members are

*The RAND Corporation contains five Divisions: Economics, Engineering, Mathematics, Physics, and Social Science. The variety and scope of studies undertaken for the Air Force by those Divisions provide a rich pool of specialized knowledge from which SIERRA members can draw.

**An approach that in the heat of hypothetical battle is sometimes lost temporarily.

as concerned with the factors and conditions that affect the outcomes of the games, and with the problems generated by these factors and conditions, as they are with the win-or-lose outcomes of the games.

III. PREPARATION FOR WAR GAME EXERCISES

Preparation for SIERRA war gaming is a complex process of closely related parts, some of which may be conducted concurrently. For convenience in description, however, the process has been divided into four parts: (a) selection of the geographical area and the time period to be studied; (b) collection of appropriate data concerning the area; (c) organization and extrapolation of the data; and (d) preparation of the game context.

SELECTION OF THE GEOGRAPHICAL AREA AND THE TIME PERIOD

The objective of the study is, of course, the primary factor in selecting the area to be studied. For SIERRA the main regions of study have been Southeast Asia, the Far East, and the Middle East. Particular areas in the Middle East were selected as worthy of detailed consideration. Each area was one in which:

1. U.S. interests and obligations were sufficiently great that the United States might be forced to intervene militarily.
2. Communist interests were sufficiently great that RED military intervention (in overt or covert form) might reasonably occur.
3. U.S. military intervention might well be on a "limited war" scale.
4. U.S. intervention would likely include elements of the U.S. Air Force.
5. A large number of military, political, logistic, and other factors would have to be considered in any examination of problems of USAF effectiveness.

Particular countries within the Middle East area were chosen because:

1. Communist interests in the country were increasing.
2. Military capabilities, either directly or indirectly through programs of Communist-supplied equipment and personnel, constituted a growing threat to U.S. interests or obligations in the area.

3. At some time in the reasonably near future, the military capabilities of RED or RED-supported forces might become sufficiently great to allow them to undertake military action.

The particular form of military action and the military objectives were not assumed to be the same for each of the game exercises. In some cases large-scale invasion was examined. In others, support of local forces in primarily nationalistic actions such as rebellions was studied. In some cases the objective of military action was regarded as seizure and control of a country or some part of it; in others the objective was considered as less well defined and included such aspects as increasing the political instability of the area, testing U.S. responses, or obtaining broader (international) gains, or long-term objectives.

Selection of a specific time period for study depended on many factors, but primarily on the assumptions made about (a) the magnitude of RED or RED-oriented military and political capability, (b) the objectives of military action, (c) the political situation, and (d) anticipated U.S. reactions.

COLLECTION OF APPROPRIATE DATA

After the locale and the time period have been selected, collection of data begins. Appendix A lists some of the types of data that were collected in SIERRA games and indicates generally the level of detail associated with the various types.

There are no simple prescriptions as to the level of detail to be included in data collection. In general, this is determined by such factors as the objective of the game, the personnel and facilities available, the time available, and the types of findings or results that are desired from the game. It is rarely possible to specify an appropriate level of detail in advance of a game since situations continually arise in the course of play where additional detail is required.

The data are usually collected for each of the countries to be involved in the game, with the degree of detail corresponding very roughly to the importance of the country's role in the game. For example, a game in which two Middle East countries are at war will involve obtaining a large amount of material on these countries, but also might include collecting some material on adjacent countries.

In addition to the types of material collected for each country, a substantial body of data to be used directly in planning military operations is needed. Obtaining these data may involve both collection and development. These military data are the planning factors, as distinct from the bulk of the more general background material, and are used in the actual play of the game. Appendix B lists some of the major types of planning factors used in SIERRA games. Additional planning factors have to be developed in the course of play, since they apply to situations not anticipated before play begins.

Procedure For Data Collection

The amount and the scope of background and planning factor data used in SIERRA war games require an organized approach to the process of data collection. The "collection strategy" developed by SIERRA follows these lines:

1. After selection of the area to be studied, individuals or small groups of the research staff undertake the collection and development of specific portions of the data.

> Example: A military specialist on ground operations collects current information on ground orders of battle, tables of organization and equipment, locations and nature of present military installations, defenses, and so on.

2. This material is then prepared in textual or tabular form for inclusion in a general write-up of the area. The write-up combines the work of several individuals or groups to present a series of "initial sketches" of the countries of the area being considered.

3. The initial sketches are reviewed by all members of the staff to determine if additional information is required, to resolve any contradictions that arise from using different sources of data, and to determine the areas where greater detail is needed.

> Example: The initial sketch of a country indicated that construction of several new road networks was being contemplated. Various sources reported the roads were to be constructed but differed as to the exact routes. Since the location of these roads might be an important factor in future military operations in the area, more detailed information had to be obtained.

4. The expanded and modified material on an area is prepared as a general write-up covering those aspects pertinent to the games.

> Example: For the Middle East area the basic document covered 16 countries in the immediate and associated areas. Each of the countries was discussed under a series of subheadings such as history, geography, people, religion, type of government, political background, economy, resources, external policies and politics, internal policies, and armed forces.

Special Techniques For Data Collection

The great variety of data available makes it obvious that SIERRA personnel could not possibly become experts in all the different categories indicated. Therefore no attempt is made to obtain a detailed knowledge of all aspects of the situation. Some data, such as military data, are collected and developed in great detail. Many of the other data are used simply to obtain a general familiarity with the nature of the area, the problems that exist, the characteristics of the people, etc.

Example: Data on the sociological and educational level and characteristics of a nation are used to estimate the level of technical competence, the types of military and political events to which they might react, etc.

Many of the data are collected and developed only in terms of their effect on military operations.

Example: Economic data, such as information on foreign trade relations, are of interest for their value in determining a country's capability to achieve a rapid military build-up, to carry out extended military operations, to survive the destruction of internal production capacity, etc.

Wherever possible, expert advisers or consultants are asked to provide information in already organized and digested form.

Example: For better understanding of some of the factors involved in the military operations of a particular country an observer who had attended military training exercises there was used to provide a picture of the major military elements, their organization, and defense postures.

The process of collecting and organizing the data required in a SIERRA war game, despite the use of a somewhat systematic approach, and with the special considerations indicated, is not completed with the production of the basic write-up on the area. Throughout the course of play additional and detailed data may be required for special situations that develop in the game. In most of these cases, however, the situations are specific enough so that only a minor collection effort is required.

ORGANIZATION AND EXTRAPOLATION OF THE DATA

Some of the data are not directly useful for the war games. They have to be modified to be appropriate to the time period to be studied, a period usually two to four years in the future.

The two techniques that have been used for this extrapolation of information are pre-gaming and staff-study. Both techniques have certain aspects in common:

1. They require an initial estimate of the intentions of the countries of the area, and a selection of various possible line-ups.

2. They require considerable judgment as to the scope and extent of any build-up by a country planning aggressive action, and as to the scope and extent of any counter build-up by countries that might be objects of aggressive action.

3. They extrapolate the basic military, political, and economic data in line with the estimated intentions.

The Pre-gaming Technique.* This involves a simplified game situation in which a line-up of countries is made. The RED side prepares a tentative plan of its operations indicating the time (in the future) and place of its attack, the objectives, the forces required, and related preparations necessary for the attack.** This plan is then analyzed in great detail to determine what changes in the present military, political, and economic conditions and capabilities would be required to achieve the military posture necessary to carry out the attack.

The analysis is then laid out on a time-scale relating specific aspects of the build-up with calendar time up to the proposed time of attack. It is then re-analyzed in terms of RED's capability of carrying out the proposed build-up in terms of economic, political, logistic, military, and other pertinent factors.

Sometime during the hypothetical build-up (usually after one to six months), the BLUE side is given appropriate intelligence of the RED build-up.

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*The pre-gaming technique has other uses than extrapolating data. It may be used to establish the sequence of political events, to establish the pattern of logistic operations, or, in some cases, to provide an estimate of how the game will develop.

**In this example, RED initiates the action. Depending on the game to be played, either BLUE or RED may start the sequence.

BLUE proposes changes in its military posture or capabilities to counter the build-up.* BLUE preparations to counteract the RED build-up are then subjected to an analysis of military, economic, political, and logistic feasibility similar to the analysis of RED preparation. The BLUE counteractions are reported to RED and RED is allowed to modify its plans. This process is repeated several times until the proposed date for the RED aggressive action is reached.

This sequence of activities is indicated in Fig. 1. The number of cycles of RED and BLUE actions is determined by a number of considerations such as the relative military capabilities of RED and BLUE initially, the proposed length of the build-up period, the RED capability to carry out the build-up, the magnitude and the adequacy of the build-up, and the intelligence exchange.

In the pre-gaming technique, the end phase represents the final status of RED and BLUE at the approximate time that RED is prepared to start military operations against BLUE.** The ultimate positions include all of the major modifications of the basic background and planning factor data over the time period considered. As such, they are judgments about a possible set of military, political, economic, and logistic developments that might take place in the time period. In the judgments are many assumptions, estimates, and hypotheses about future events. The technique, however, does lend some substance to these judgments because many of the assumptions and estimates

*BLUE does not, of course, know the specific RED intentions, objectives, or time scale.

**This time is approximate since the start of the actual war game allows a short period in which final RED and BLUE preparations, redisposition of forces, etc., are allowed. This period is usually from 10 to 20 days before D-day or some weeks after D-day if early stages of the conflict are not relevant to the objectives of the game.

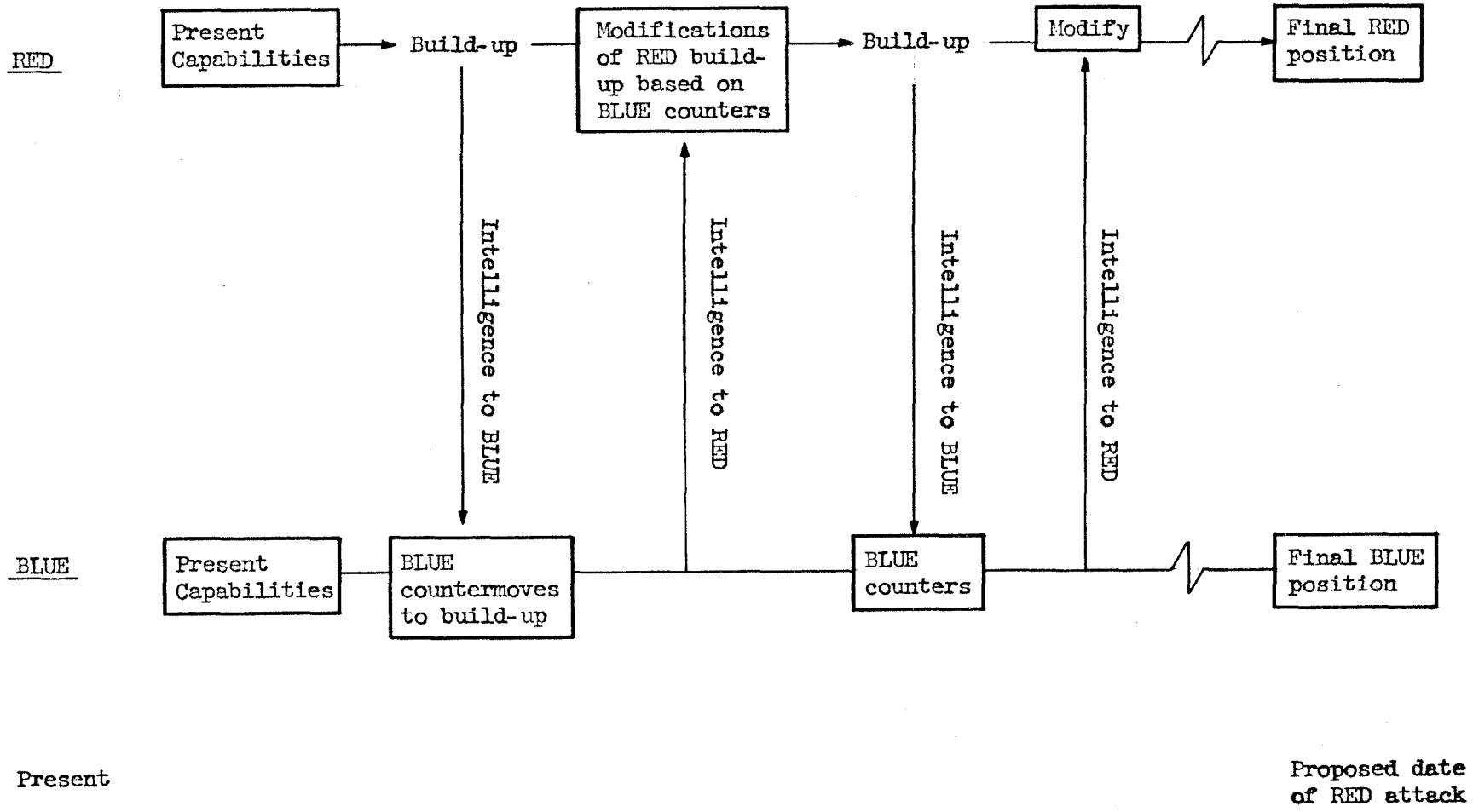

Fig. 1—Sequence of activities (pre-gaming technique)

are made in the context of specific RED and BLUE objectives. Thus there is less of an attempt to predict the future than to examine the feasibility of the build-up on the basis of the assumed objectives. In addition, the specific events in the build-up, the building of additional airfields and roads, the increase in force sizes by additional recruitment and training of military forces, the introduction of new weapons or techniques, and similar actions are subjected to close scrutiny by both RED and BLUE teams and checked for feasibility.

The pre-gaming technique permits the military, political, economic, and logistic contexts to develop gradually and many of the initial assumptions or estimates can be isolated for reconsideration if the resulting game indicates that they are critical.

Another advantage of the technique is the simplified transition to the actual war game, resulting from the detailed familiarity with the factors involved that the players develop in the pre-gaming phase.

The Staff-study Technique. In this technique a small group of staff members take the basic data collected previously and develop the conditions of the RED and BLUE sides that will exist at the future date on which RED will undertake aggressive action.* There is no formal interplay of RED and BLUE as the build-up progresses.

In this technique, general RED intentions for some future specified date are established. The military, political, economic, and other requirements or conditions are developed. The requirements are subject to analysis for the build-up time period, and finally, the requirements, as determined by feasibility checks, are translated into capabilities that will exist for

*This type of extrapolation has in some cases been carried out by a single staff member.

the RED and BLUE sides at the approximate date of RED's aggressive action.

Appendix C compares the staff-study and pre-gaming techniques. In general, the pre-gaming technique takes longer since it includes such activities as the preparation and exchange of intelligence information, the determination and analysis of requirements, and the feasibility checks over several cycles.

In a staff study more emphasis is placed on the judgments of the small group of people doing the extrapolations, since the critical scrutiny of the opposing teams is not present. Finally, unless members of the small group become players in the subsequent detailed gaming (sometimes difficult because the staff study is carried out without intelligence restrictions on the RED and BLUE objectives, time scales, and war plans), the players have to become familiar with and review many of the assumptions, estimates, and conclusions.

PREPARATION OF THE GAME CONTEXT

The final step in the preparation phase of SIERRA gaming is to draw together all the various types of data and information into an integrated and coherent set of conditions for playing the game. The conditions and descriptions are the "context" in which the game will be played. It includes much of the data already available from the collection and projection steps as well as any restrictions or limitations that will be observed in the actual play. The main items of the context are:

1. The countries involved in the game and their military forces, facilities, etc.
2. The background events leading up to the outbreak of war.
3. The objectives of each of the countries.

4. The political situation at the start of the war.
5. The military situation at the start of the war.
6. The restrictions or limitations that the sides will initially observe.

The preparation of the context involves the broadest application of judgment on the part of the game designers. Since each context is prepared for a specific game, the judgments are usually unique for that game. However, some aspects or ground rules in preparing the context are fairly general, and each of the items included in the context is subject to two general criteria.

Relevance

This is a measure of the extent to which any component should be included in order to achieve the purpose of the game. Since a major purpose of the SIERRA games was to study USAF effectiveness, much of the context relates to developing a situation in which those factors that influence effectiveness can be studied. Such factors as the military-political nature of conflict, the speed with which it develops, the magnitude or potential magnitude of the conflict, the initial status of USAF forces, the objectives of these forces, the relation of these forces with other U.S. and indigenous forces, and the operational, logistic, command, communication, weapon, and other factors in the situation are important considerations in determining the context.

Credibility

This is a measure of the extent to which any component of the context can be included as probable or plausible. In SIERRA games the notion of credibility represents a judgment that the particular event or situation

could occur under the conditions specified. The group who set up the context are not oracles. They do not presume to judge whether it will occur or that its position on some scale of probabilities can be established.*

Once the context has been completed, the way in which it will be used depends on the type of game that is selected. The following section describes the major techniques of two-sided gaming as used by Project SIERRA.

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*Although it is generally the case that the events or situations that are included are "somewhat high" on such a scale.

IV. TECHNIQUES OF TWO-SIDED GAMING

During the four years that Project SIERRA studied Air Force effectiveness in limited war, a number of different techniques of war gaming were developed. All of them involve the same basic mechanism of an interplay of military, economic, political, and logistic factors in a limited war situation, but the way in which this interplay is achieved varies from technique to technique. Two-sided war games represent the interaction of two teams of players, characteristically called the BLUE team and the RED team, through a CONTROL team.* In the game each team prepares sets of proposed moves and submits them to the CONTROL team. CONTROL determines the outcome of the interplay of the two sides and informs the respective teams. The teams then submit another set of moves and again the outcomes are determined by CONTROL. This process is repeated until some defined termination point is reached.

There are a number of more complex variations based on this relatively simple process. These include the two-sided game with "open" information, the two-sided game with "closed" information and predetermined form, and the two-sided game with "closed" information and situation-determined form.

In each there are differences in the use of the context developed during the preparation phase and in the functions of the player teams and the CONTROL team.**

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*Project SIERRA has also played three-sided war games, using adaptations of the two-sided gaming techniques.

**The gaming phase, as distinct from the preparation phase, can be considered as beginning with the choice of type of game to be played and the assignment of players to the teams.

TWO-SIDED GAME WITH OPEN INFORMATION*

In this type of game the total context developed during the preparation phase is made available to both RED and BLUE sides. Since the context includes the military forces, political and military objectives, and attack times and dispositions of each side, the initial military situation is clear to both sides. The context also includes the limitations and restrictions in size, type,and time of force commitments; weapon and target restrictions, and similar items, so that each side has fairly specific information of the restraints under which it and its opponent must operate.

Knowledge of these major restraints removes many of the uncertainties of planning and executing moves, and the play can lay emphasis on tactical operations and the military outcome of the war based on the capabilities assumed for each side.**

Even with the play dominated by the military capabilities rather than the intentions of both sides, their choice of courses of action remains extremely wide. In addition, the game involves political, economic, and logistic feasibility checks for every move made.

Open-information Game Advantages

The emphasis on military capabilities limits the amount of political play to feasibility checks of military moves and makes the play somewhat faster than some other two-sided games.

This emphasis on military capabilities also permits isolation and identification of some of the more critical factors affecting the employment

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*Also called an "open-scenario" game since the "plot" of each side is available to the opposition.

**In this respect this type of game is somewhat similar to the classical war games of the military establishment.

of military capability, and makes it easier to replay the game with changed assumptions regarding the capability.

The open nature of the game provides a continual check on the limitations of the context so that either side can question the validity or value of any of the conditions imposed.

Open-information Game Disadvantages

Because they are aware of the intentions, objectives, and major restraints on each other, the sides are less likely to carry out contingency planning and to discover its consequences on limiting military operations.

Because of the course of military events, some of the conditions of the context, particularly in the political area, may produce some marked artificialities in the play.

TWO-SIDED GAME WITH CLOSED INFORMATION AND PREDETERMINED FORM*

In this type of game BLUE and RED teams are established and an edited context is made available to each side. The editing of the context for each side consists in removing certain portions that are assumed to be unavailable to that particular side. Thus the BLUE scenario provides all of the information and data about BLUE military-political objectives, military force sizes and dispositions, and includes some information about RED force sizes and dispositions. But it has little or no information about RED military-political objectives or about any restrictions in the forces that will be committed, the weapons to be used, the targets that will be attacked, the time of attack, etc. Thus CONTROL shares with each side some information that is not available to the other side.

*Also called a "closed-scenario" game.

Each side is initially uncertain about the possible moves of the opposition and the restraints that will be observed during the game. The play, as compared with the play of the open-information game, involves greater exploration of moves and their possible military consequences in the face of the existing uncertainties, as well as much more detailed exploration of political feasibility and possible consequences of moves.

An additional aspect of this game is its "predetermined" characteristic. This refers to the fact that the restraints placed on each side by the scenario exert a considerable influence on the course of events in the game. For this reason each of the moves proposed by a side has to be reviewed in detail by the CONTROL team to determine whether the move violates the constraints.*

Closed-information, Predetermined-form Game Advantages

Each side is uncertain regarding the objectives of the opposition and the restraints under which it will operate. This uncertainty, combined with possible disallowal of a move, makes it necessary for each side to do a large amount of contingency planning. This produces a much "richer" gaming situation,** and offers opportunities for identifying and analyzing a greater number of possible courses of action.

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*In specifying the limitations or restrictions that will be observed during the play, the scenario describes only the general nature of the course of events. Thus the CONTROL team rulings as to whether a proposed move violates these constraints represent the translation of the general limitations of the context into the specific situation prevailing at the time, a process that requires both specialized knowledge and skill.

**Uncertainties in the opposition's objectives and restraints obviously decrease for each side as the play progresses.

The necessity of taking into account the major political as well as the military consequences of each move is of considerable value in exploring the political-military nature of limited war.

Closed-information, Predetermined-form Game Disadvantages

Greater time is required to play the game because of the many more contingencies that have to be considered and the more detailed political play. The analysis also becomes more complex, and in general makes the use of judgment more critical.

There is danger that the context prepared before the play will impose restraints that are highly artificial or lack credibility for the particular situations that develop during the play.

TWO-SIDED GAME WITH LIMITED INFORMATION AND SITUATION-DETERMINED FORM

This type of play involves the same initial steps as the preceding type, i.e., the establishing of sides and the use of an edited context. The context does not indicate any restrictions or limitations that will be observed in the play, or the conditions under which they might develop or be removed.

During the course of play, however, each move proposed by a side is considered in detail by the CONTROL team to determine what restraints will be imposed and the reasons or factors that determine the adoption of the restraint.

Similarly after the adoption of a particular constraint, each subsequent move is considered to determine whether the contraint should be removed, and the factors or reasons for removal. Thus the particular constraints

are determined, established, or removed in terms of the specific situation prevailing at the time.*

This type of game has two characteristics that make it particularly useful in research. It identifies the major decision, or "branch" points in the game. These are the points at which each side has several courses of action open to it, and must select one of them. In addition, this type of game leads to some detailed examination of each of the different courses of action open to each side, which in turn helps to determine how any restrictions that are imposed might affect the outcome of the game.

Beyond these characteristics, this type of game has about the same advantages and disadvantages as the closed-information, predetermined-form game.

FACILITIES FOR TWO-SIDED GAMING

The war gaming facilities of Project SIERRA consist of an enclosed group of five rooms, three of which are team rooms (BLUE, RED, and CONTROL) and two of which are for the secretarial staff. Figure 2 is a schematic diagram of the layout of the rooms. Each team room has a large conference table at which the player teams develop and discuss the moves that they will make in the games. The walls of the rooms have a suitable surface for mounting maps and posting or pinning additional information.

The BLUE room and the RED room each have a communication window between it and the CONTROL room for passing written messages, plans, maps, etc. In addition, CONTROL has an intercommunication circuit to RED and to BLUE.

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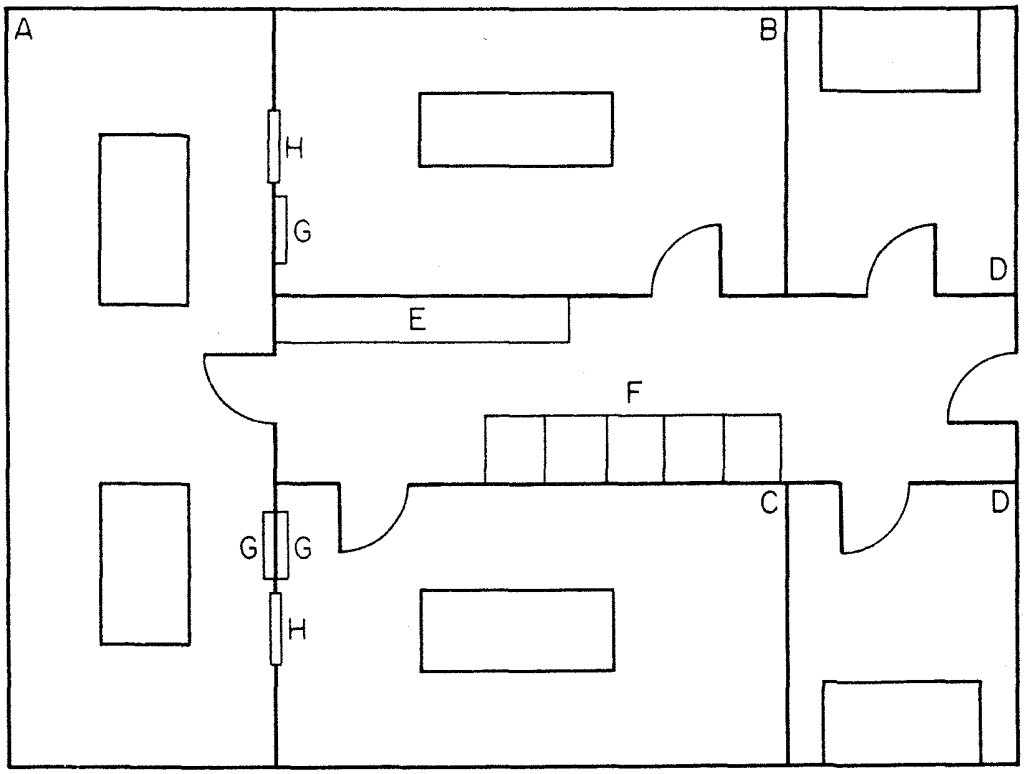
*In some cases a large number of restrictions may be considered in advance of the play, but they are not necessarily "binding" on the subsequent play.



A CONTROL room
B BLUE room
C RED room
D Secretaries offices
E Library case
F Files
G War clocks
H Communication windows

Fig. 2— SIERRA war gaming facilities

Each room has two clocks. One is a conventional clock, and the other is a "war clock." The war clock provides continuously the year, month, day, and hour of the war, and the D-day date. The war clock is controlled from the CONTROL room, and can be operated manually or set to run automatically at a selected rate of speed. It is used to insure a common reference time for all teams.

The hallway contains book cases and file cabinets for materials used in the gaming.

V. FUNCTIONS OF THE PLAYER TEAMS

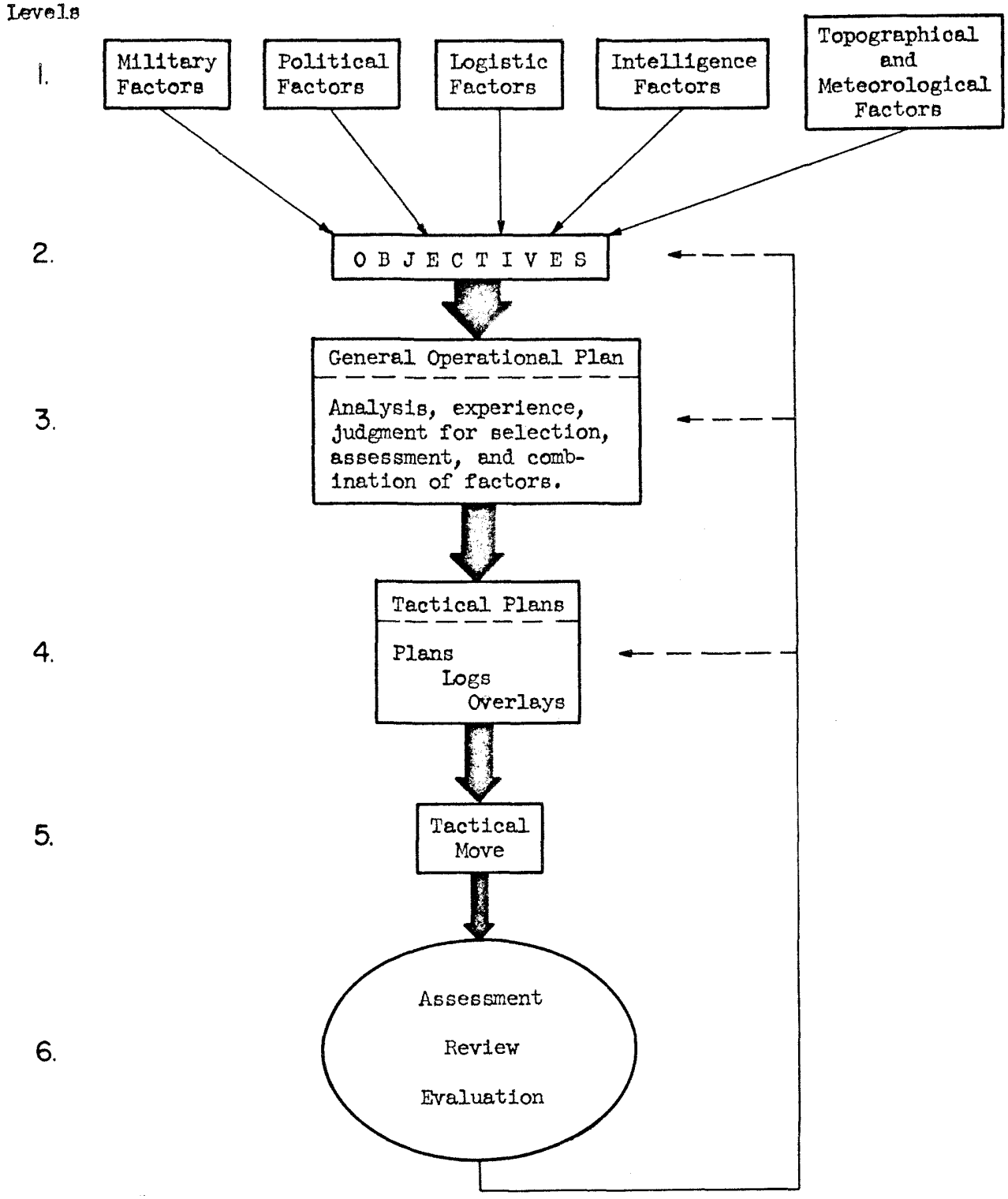
Each SIERRA player team represents one or more countries. In general the BLUE team represents at least one country that is the object of Communist action, plus the United States after it has intervened in the military situation. The RED team represents the country or countries carrying out the action, plus any Communist support from outside the country.

Each player team must establish objectives, assimilate the inputs, formulate plans, and prepare detailed moves in accordance with the plans, carry through the moves, maintain records of the moves, and review the situation at the conclusion of each cycle of operation. Team members will at times operate individually as specialists in one field or another, and at other times, must take part in formulating general plans, coordinating tactical moves, and reviewing the situation. Figure 3 indicates the major steps in a play cycle of a game.*

NATURE OF INPUTS

Unlike many other types of war games in which specific objectives, specific forces, and fixed restrictions govern the fighting of an imaginary battle, SIERRA games deal with a much wider variation of inputs, a larger number of inputs, and a considerably larger geographical area. It is these conditions--the large number of inputs, the scope of the inputs, the projected time scale, and particularly the interaction of the various categories of inputs--that provide the SIERRA players with a tremendously

*While no distinction between RED and BLUE player functions are made here, this should not obscure the fact that there are many differences between the sides in terms of the inputs to the process being described.



Note: CONTROL maintains pipeline into player team operations; normally feeds back information to player teams at Levels 2, 3, and 4.

Fig. 3 —— Schematic diagram of a play cycle

wide range of choices from which to select and develop a specific plan of action. Appendixes A and B list the types of factors that are included as inputs.

PLANNING

The planning activities of a player team in a war game have always been one of the critical aspects of gaming. Arguments about the validity of war gaming as a research tool often center on the fact that the large number of inputs can be ordered or organized in various ways so that, at best, the selected ordering is a matter of judgment by the players--and as such, is fallible. There are a number of ways of answering this argument, but they mainly serve to indicate that the judgment represented in the planning of players has a reasonable basis, and not that it does not take place.*

SIERRA game planning includes three aspects that have a bearing on the validity of the gaming process.

Basing on an Objective

The planning is done in terms of an objective. The player team initially is concerned with defining its mission and over-all strategy. Since a SIERRA-type war game involves political, logistic, and intelligence

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*Among these answers the following are often cited:

a. The judgments made in developing a plan from a large number of inputs are often limited by the characteristics of the inputs and many "questionable" judgments are eliminated on logical grounds.

b. The use of experienced people (experts) or of pooled judgments is an effective method of reducing questionable judgments.

c. A major virtue of the technique of war gaming is that it allows a replay of situations where judgment is critical.

d. It is better to accept the inclusion of judgment than to regard the problem as hopeless and not attempt to solve it.

factors, etc., this is a major task. For example, the BLUE team might consider a large range of choices in terms of both immediate and long-term objectives. Among these might be "stop the ground advance of RED, force RED out of the invaded country, restore the pre-invasion political position of the invaded country, establish a new balance of power in the area," etc. These objectives are neither mutually exclusive nor--in general--does any one of them provide guidance for all the situations that arise in a game.

The objective or objectives selected by a team influence the particular way in which the team orders its inputs, i.e., relates them in an operational plan. The selection of an objective by the players does include considerations of the research objective of the game and is a complex process. In the course of a game it undergoes almost continual review. Since this is the case, it is a primary factor in the planning activities of the team.

Handling Complex Inputs

From the broad nature of the inputs, their number, and interaction, it is clear that no one individual would ordinarily have the necessary background and experience to take them into account in a reasonable way. There are several possible ways of dealing with this problem. One developed and exploited to a great extent in the SIERRA-type games is the use of specialists. As was indicated earlier, the main categories of inputs are military, political, logistic, and intelligence. SIERRA teams commonly contained specialists in these areas of knowledge. The functions of the specialist are manifold, but the major aspects are the introduction of special knowledge and experience into the game (information source), the contributions of and the ability to assess, particular military, political,

etc., factors in the planning of an operation (critical evaluation). The planning activities take advantage of the specialized knowledge available, and at the same time require an integration of the particular points of view represented by the specialists in order to produce a single operations plan. For example, the selection of the team objective must include considerations of the air, ground, and sea capabilities, standard operating procedures, political capabilities and objectives, and logistics capabilities and techniques of the country or countries represented by the team.

For any particular play the relative contribution of each of these areas may differ, and on occasion a situation will arise where compromise between the most reasonable aspects of each of these specialties is required. In fact it is the inclusion of this type of joint planning by the team members that represents one of the major contributions of the SIERRA-type game. Frequently the differences in emphasis that arise between these points of view serve to isolate a problem that can be studied intensively by the gaming process. When the experience of the experts indicates that there are several possible choices of action in an operation, critical problems can then be defined, set up for gaming, and further analyzed.

Handling the Element of Uncertainty

The third aspect of the planning activities is the "uncertainty" with which the player team has to deal. As has been indicated, these uncertainties are quite dependent upon the method and the form of game that is played.

In some games the team may be required to consider many different possibilities, such as the countries that will be involved, the type of weapons, the time scale, and other factors, so that "contingency" planning is particularly pronounced.

At the other extreme are games where many of these conditions are specified in advance and contingency planning is materially reduced. In addition, there is much less emphasis on obtaining information about the activities of the opposition since in this type of game the team is generally aware of the major events that will be allowed to occur. As has been indicated, by reducing the uncertainties with which the team has to deal, the time required to plan a particular operation based upon the input conditions is materially shortened.

Gaming methodology always has to deal with this problem of sacrificing "richness" in planning (taking a wide range of alternatives into account) for more rapid pacing of the game. It should be noted, however, that this richness-versus-pacing problem is somewhat independent of the complexity and number of inputs. It is not so much the problem of detail versus aggregate modeling of inputs, as it is a problem at the planning level, based on the level of detail to be considered by the team in planning.

There are, of course, many additional aspects of the planning activity that must be considered, but these three, the selection of a planning objective, the use of experts, and the degree of uncertainty, are critical ones in gaming of this type.

ROLES OF THE INDIVIDUAL PLAYERS

Another aspect of the function of a player team is the role of the individual players. The players individually bring into the game specific knowledge, skills, and background in their respective areas. The role they play on a team may be, and usually is, broader than their individual experience. For example, in planning a military operation for ground forces, the player with ground experience attempts to deal with the whole

gamut of ground events from the employment of individual troop on ground reconnaissance missions, to the commitment of entire armies on the level of national policy.

This is, in a sense, the vertical dimension of his role--he may represent different echelons of the ground operation from the smallest unit to the entire ground forces available to a nation.*

There also is a horizontal dimension to his role. This is as the commander of a particular level or type of the forces of all of his team's countries.

Figure 4 indicates the dimensions and kinds of problems that might arise for a BLUE ground commander, because of the vertical and horizontal dimensions of his role.

Similarly, the political member of a team represents different echelons of the political operations of the nations of his particular side. He may cover the entire range from head of state to political representatives with the field forces (vertical dimension), as well as the political echelons of several countries (horizontal dimension).

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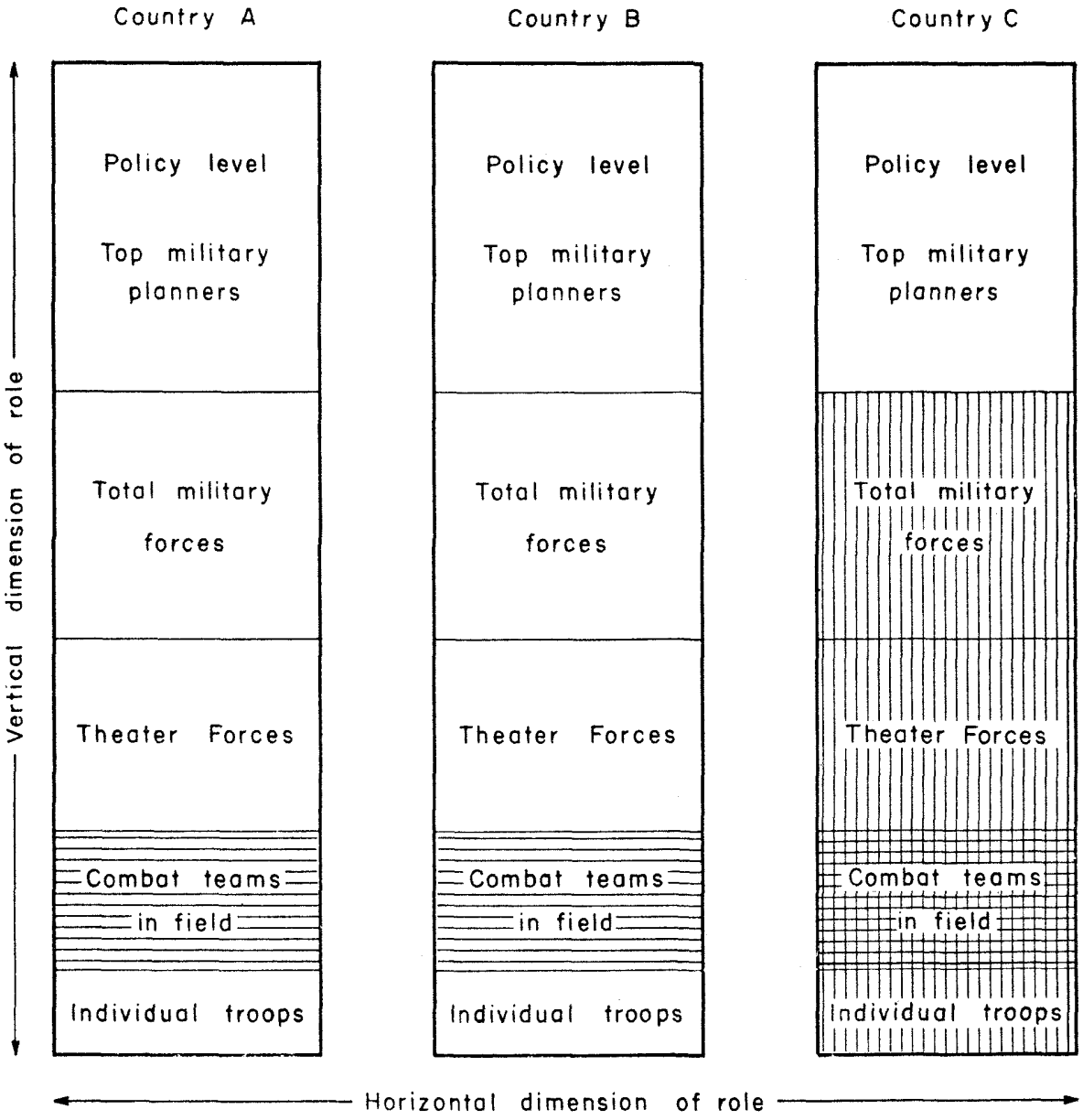
*This does not imply that he plays all these levels continually, but that he has the capability for shifting from one to another as the situation merits. The SIERRA technique occasionally involves shifting players from one side to another (from BLUE to RED and vice versa) between games to provide the players with broad experience in different roles, and with variety.



Illustrative problems:

1. (Vertical) ||||||||||| Can more of the country's forces be committed to this war in view of the world situation?

2. (Horizontal) ≡≡≡ What differences in equipment, training, language, etc. would make the proposed combined operations infeasible?

Fig. 4—The range of dimensions of player roles

From the viewpoint of game methodology the definition of the player's roles is important since any restriction of the echelons that a player represents, in either dimension, must be taken into account by the CONTROL team. If, for example, a military or political player is to be denied certain freedoms of action on the basis that he does not represent the individual or agency capable of taking the action, CONTROL must make this clear, and must include in the gaming some mechanism for relating the restriction in a reasonable way to the action that is being planned. For example, if the political player is to represent all the echelons of a country except the head of state, CONTROL must make and communicate any decisions of the head of state necessary for the political player to participate in the game.

PLAYER TEAM OPERATION

Selection of the Strategic Objective

Initially, each player team is concerned with establishing its over-all (strategic) objective. This may be done prior to the start of play by the context. In this case the player team accepts the specified objective and considers ways of achieving the objective. If, however, the objective is not established by the context, the team must discuss possible objectives and the military-political factors and consequences of the various possibilities considered, i.e. make a strategic estimate of the situation, and select one.

Estimate of the Situation, and the Tactical Objective

When the over-all objective has been established, the tactical objectives* required to achieve the strategic objective have to be selected.**

*Detailed consideration of the concepts of "strategy" and "tactics" are outside the scope of this report. It is not uncommon, however, to find that these concepts, their meanings and implications are part of the player team discussions.

**In some cases, play is set up in a way that allows BLUE to consider "pre-emptive" or "spoiling" actions.

This involves detailed consideration of all the information and planning factors available to a team. It takes the form of a tactical "estimate of the situation" in which the major aspects are:

- o Statement of the mission and its purpose
- o The existing situation, including the characteristics of the area of operations such as terrain, weather, relative combat strengths, intelligence, and timing
- o Enemy capabilities and possible courses of action
- o Own side's capabilities and courses of action
- o Analysis and comparison of enemy's and own side's courses of action

Following this, the team decides on the particular tactical objectives and course of action that it will adopt to attain them. This means a careful consideration of all the possible moves for achieving the tactical objectives. (Later, during the actual play of the game, the success of the tactical move determines the extent to which the estimate of the situation has to be revised. In some cases the way in which the war progresses affects not only the selection of the tactical objective but also the strategic objective established earlier. In these cases a major re-evaluation is required by the team.*)

Preparation of the Detailed Move

An integrated plan, made up of air, ground, and sea plans** is usually prepared. For the course of action adopted, it is made up of detailed, individual moves.

The integrated or over-all plan describes the move that will be attempted, and specifies the war date and time, the forces that will be

*Re-evaluation of strategic objectives is of course a critical event in play of the game.

**If required, logistics and political supplements are added.

committed, the objective or target, and any other special information that may be required. This is supplemented by mission sheets, logs, or overlays and other forms that indicate the specific operations that will be carried out. For example, the air portion of the plan is supplemented by an air mission log that provides the following information for each air strike:

- War date
- Strike number
- Home base
- Number of aircraft
- Type of aircraft
- Armament
- Target
- Take-off time
- Time over target
- Mission and flight profile

Each specific military operation, such as an air strike, is developed in terms of the available planning factors for the particular operation. In many cases the available planning factors have to be reviewed in detail, and in some cases modified so that they will be appropriate for the specific military situation. In addition, a supplement covering non-combat air operations may be included. In this supplement any reconnaissance missions, air deployments, or air logistics would be described in detail. Finally, a plastic overlay showing the aircraft flights and times may be added. Similar supplements for the ground and naval portions of the plan are included as required.

For each plan, the team employs the planning factors to determine whether the move is within its capability, the amount and type of attrition that may occur, the military effects that they may expect, and so on. In addition, the team must be sure that the plan covers all the operations intended, has no inconsistencies, and is in line with the team objectives for that move. Finally it is reviewed interms of political or logistic or

intelligence data that affect the move or subsequent moves related to it.

Maintaining Records

Another major function of the player teams is that of keeping game records. Much of the activity of a team is reflected in the written plans and in the logs and overlays that indicate the operational details. However, two additional types of records are generally maintained.

The first type is records that provide move-to-move continuity for the play. These include such material as the airfield status, the number and types of aircraft employed and those available for the next move, the status of aircraft (in or out of commission), ammunition stocks, maintenance operations, map plots of ground and sea dispositions, status of communication facilities, etc.

Related to this type of record is the assessment of the outcome of the planned operations. Because of the continual action and counteraction, each side requires an on-going assessment of the results of certain actions. These assessments, however, are developed and maintained by CONTROL, and the results are provided to the player teams for their use. For example, a side attempting to destroy a complex of airfields by air attack is concerned not only with success in keeping the runways neutralized, but also with the aircraft losses it is incurring in the process. CONTROL provides information on the amount of destruction and the cost of this destruction in aircraft losses over a specified time period. This information is then used by the team to assess the desirability of continuing the particular operation. Parallels exist in areas such as reconnaissance, logistics, etc.

The second type of record is less detailed. It is a summary of the various choices that were considered by the team in planning the move.

These records are of value in reconstructing the conditions that existed at the time a particular move was proposed and the reasons for selecting that move in preference to other possibilities.

Review of Situation

After each move, a player team receives the outcome of the move from CONTROL. It obtains the results of the air, ground, and sea plans and any other pertinent intelligence, logistic, or political information. There are usually some differences between the results expected by the player team from a proposed move and the results that occur, since CONTROL introduces the action of the opposition and the effects of "chance" into the move. In some cases these factors make the move more successful than was anticipated by the team; in other cases the outcome less successful.

The player team must therefore review the move in terms of its original estimate and determine its new position and status. This review of the outcome of the move is written up in the form of "logs," which are brief narrative summaries of the results of the move and the present position of the team. There are logs for the air, ground, and sea actions, and a political log when required. Once the present position and status of the side have been recorded in the logs and reviewed, the team is ready to start the next move.

VI. FUNCTIONS OF THE CONTROL TEAM

The CONTROL team of a SIERRA game generally consists of from five to eight members.* Typically, these would be the game director and his assistant, the air, ground, and sea assessors, and political, logistic, and intelligence advisers.

The game director and his assistant are responsible for game procedures and coordination of the play. The other members of the CONTROL team are responsible for carrying out the evaluations, assessments, and other activities of the team under the guidance of the game director.

The major characteristics of the CONTROL team parallel those of the player team; each member is a specialist in the particular area of the game which he represents, each member wears several different hats, and the members carry out many of their activities jointly.

Figure 5 presents a simplified schematic chart of the relationships between CONTROL and the player teams. The figure indicates that CONTROL obtains inputs from both teams in the form of plans, mission sheets, and overlays, and that it possesses these, returning to each team any results that affect the operations of the team. The main functions of the control team in carrying out this processing are evaluation of plans, assessment of move outcomes, record keeping and data analysis, coordination of play, and "housekeeping" operations.

EVALUATION OF PLANS

CONTROL must evaluate the coordinated series of air, ground, and sea plans prepared by the player teams for each move in the game. In this

*With each player team having from four to six members. Thus, the gaming staff consists of from 13 to 20 members, plus several secretaries.

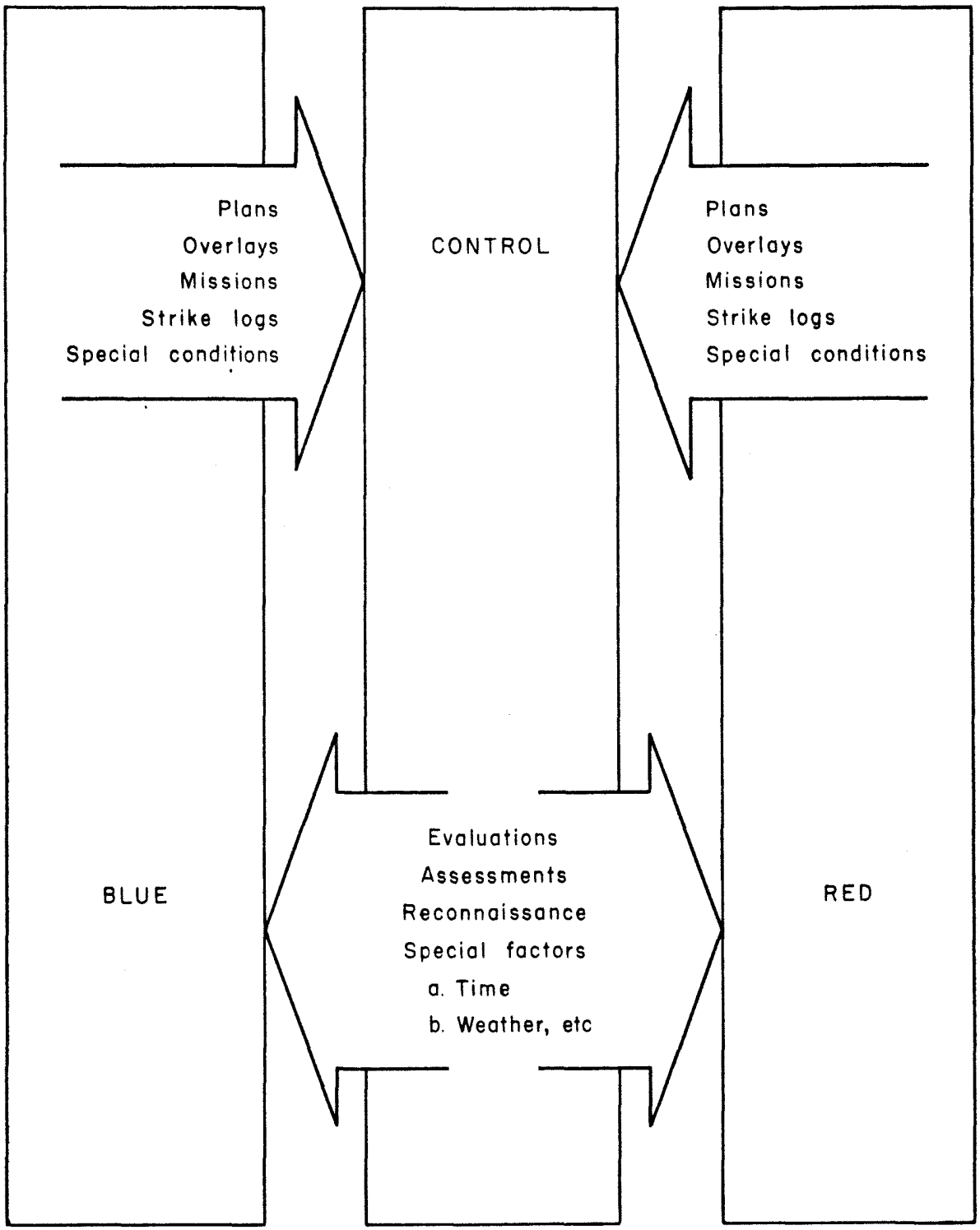


Fig. 5 — Player team and CONTROL interactions

evaluation process, CONTROL reviews the strategic and tactical plans submitted by the teams and decides whether they will be allowed to carry them out.*

In general terms, the specific proposed plan must be related to an objective of the player team, which in turn should stem from the research objective of the war game. In addition, the various aspects of the plans are considered in terms of relevance and credibility. The evaluation is in this way similar to the judgment exercised in preparing a game scenario. Frequently, when a move involves a major change in objective for one of the player teams, CONTROL discusses the plans in detail with members of the team to determine the specific reasons for the change. In some cases additional political, military, technical, or logistic backup is developed by a team to support the plan. In some situations outside specialists in one or more of these areas are brought into the discussions to aid in the evaluation.

Depending on the complexity of the plan, or the extent to which the plan involves a major change in the political or military objectives of a team, the evaluation process may vary from a short-time, somewhat routine activity to a longer, more detailed consideration of the plan and its implications for the subsequent course of the game and the research objectives.

In general the initial moves of a game require a longer and more detailed evaluation than later moves. In the first moves, the teams (a) must become familiar with the "general" situation; (b) must consider a wide choice of objectives; (c) are less familiar with the details of forces,

*Whether a strategic plan is prepared by the team, or is specified in the context, depends on the type of game being played.

terrain, and other factors of the situation, and (d) are setting the pattern for subsequent military, political, and logistic operations that, once established, may be executed in later moves without requiring detailed evaluation.

After evaluation, CONTROL decides to allow or disallow the plan in whole or in part.* If the plan is disallowed the player team prepares another series of plans in which a new move is proposed. After an allowed move, CONTROL assesses the outcome of the move.

ASSESSMENT OF MOVE OUTCOME

Assessment in a SIERRA war game is the process in which CONTROL determines the outcome of a move.** The three major types of assessment are political, combat, and non-combat (including reconnaissance, logistics, and "administrative" operations).

Political Assessment

This assessment involves specifying the outcomes of any political or political-military move made in the play. It is done by specialists in political science who are familiar with the political aspects of the geographic area of the game. Political assessment may be compared to the evaluation function mentioned previously, in which CONTROL considers the political consequences of each plan submitted by a player team.

In the assessment process, the particular set of political outcomes that will be represented in the game are spelled out in detail. These include the political responses made by the nations involved in the war

*In some cases a "conditional" approval of the plan is made, pending information on its effect on the next series of moves in the play.

**The combination of evaluation of a move and assessment of a move is called "adjudication."

situation, the responses of other nations and of the United Nations if this is part of the game situation, the intensity of the responses, some of the anticipated consequences of the responses, and the changes that will occur in the political or political-military conditions of the game.*

The political assessments are then reviewed by the CONTROL team to determine what information will be provided to each of the player teams. This information is then transmitted to the teams as political announcements, messages, and proclamations, which may be in the form of CONTROL rulings on the outcome of the plan, or announcements, or proclamations of one player team to the other. In cases such as major changes in the objectives of one player team the political assessments may involve extended and detailed consideration of the possible outcomes. Therefore, the information provided to the player teams is usually in highly abbreviated form and includes only those items that directly affect the political-military play.

Combat Assessment

The assessment of combat outcomes is, in terms of time, the major function of CONTROL. After plans submitted by the player teams have been evaluated and accepted as a game move, the player teams provide the necessary detailed information on how the particular military operation will be carried out. The information, in the form of logs, overlays, and mission sheets, comes to CONTROL from both teams so that the interplay of forces can be assessed and established.

*Most of these matters represent the considered judgments of the political specialists in the game and are frequently supported by written justifications for the particular assessments made.

Combat assessment includes checking the information provided by the teams, establishing the battles that occur, and computing or judging the outcome of the battles.

Checking Information from the Player Teams. CONTROL reviews the logs, mission sheets, and overlays to determine whether all pertinent information as to force, mission, disposition, firepower, etc., is provided. The information is also checked to determine whether the moves indicated are within the capability of the player teams and whether appropriate conditions exist for the move (weather, terrain, knowledge of target location, etc.). Figure 6 diagrams some of the factors that are reviewed by CONTROL in determining whether an air-play combat move can be made.*

The planning factors collected in the preparation phase are used as the basis for making any rulings on the move. In those cases where suitable planning factors do not exist in the standard military references the ones developed by SIERRA personnel with the aid of appropriate consultants are used. The development of these planning factors involves a combination of analytic studies, historical data, and the judgments of specialists. In cases where the planning factors are particularly controversial, several different values may be used to determine whether they produce major differences in the outcome.

Establishing the Battles that Occur. After the information on combat moves has been received and checked for each of the player teams, the actions of the teams are compared to determine the interplay of combat forces. The size and disposition of the forces, the time, nature, and location of the contact, etc., are determined for each contact. This is done for each of

*Although an air-play example is used, similar steps occur for ground and sea play, with appropriate modifications.

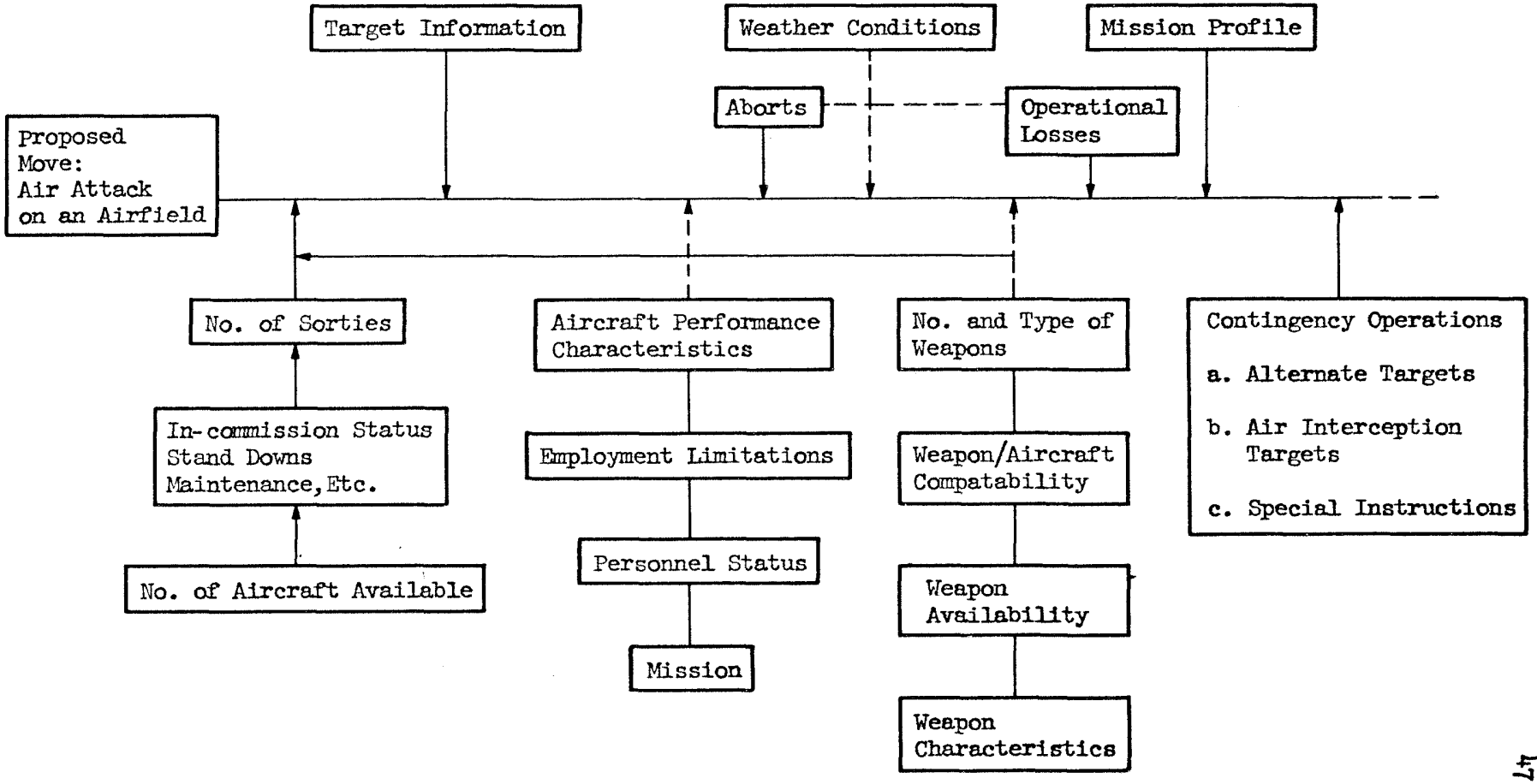


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Fig. 6— Types of factors in air strike assessment (pre-target)

the air, ground, and sea moves. On this basis the complete picture of combat interplays is developed. Figure 7 illustrates the types of factors that enter into establishing combat interplays in an air strike on an airfield.

Computing or Judging Outcomes of Battles. The judging of battle outcomes involves the use of the appropriate planning factors and the introduction of "chance" effects to determine the losses, delays, or damage suffered by each side. This requires the application of the planning factors to specific situations. The numerical values of the planning factors frequently require modification in order to make them fit the specific situation to which they are applied. This is the task of the various specialists of the CONTROL team.

In adjusting the standard factors for the special situation, it is frequently necessary to treat the situation in great detail. For example, a situation in which air-delivered nuclear weapons are used against ground forces may require a large-scale map showing specific ground unit locations, dispositions, types of cover, percentage of troops under various types of cover, wind patterns, proximity of civilian personnel, etc. Over this will be superimposed the actual ground zero of the weapons, and specific computations will be carried out for each of the pertinent conditions. In many cases CONTROL and the player teams must work together to be sure that all pertinent information is included.

Non-combat Assessment

CONTROL also must assess the results of non-combat moves of each of the sides. These moves may vary widely, and include deployment of forces into the theater or within the theater where no enemy contacts occur,

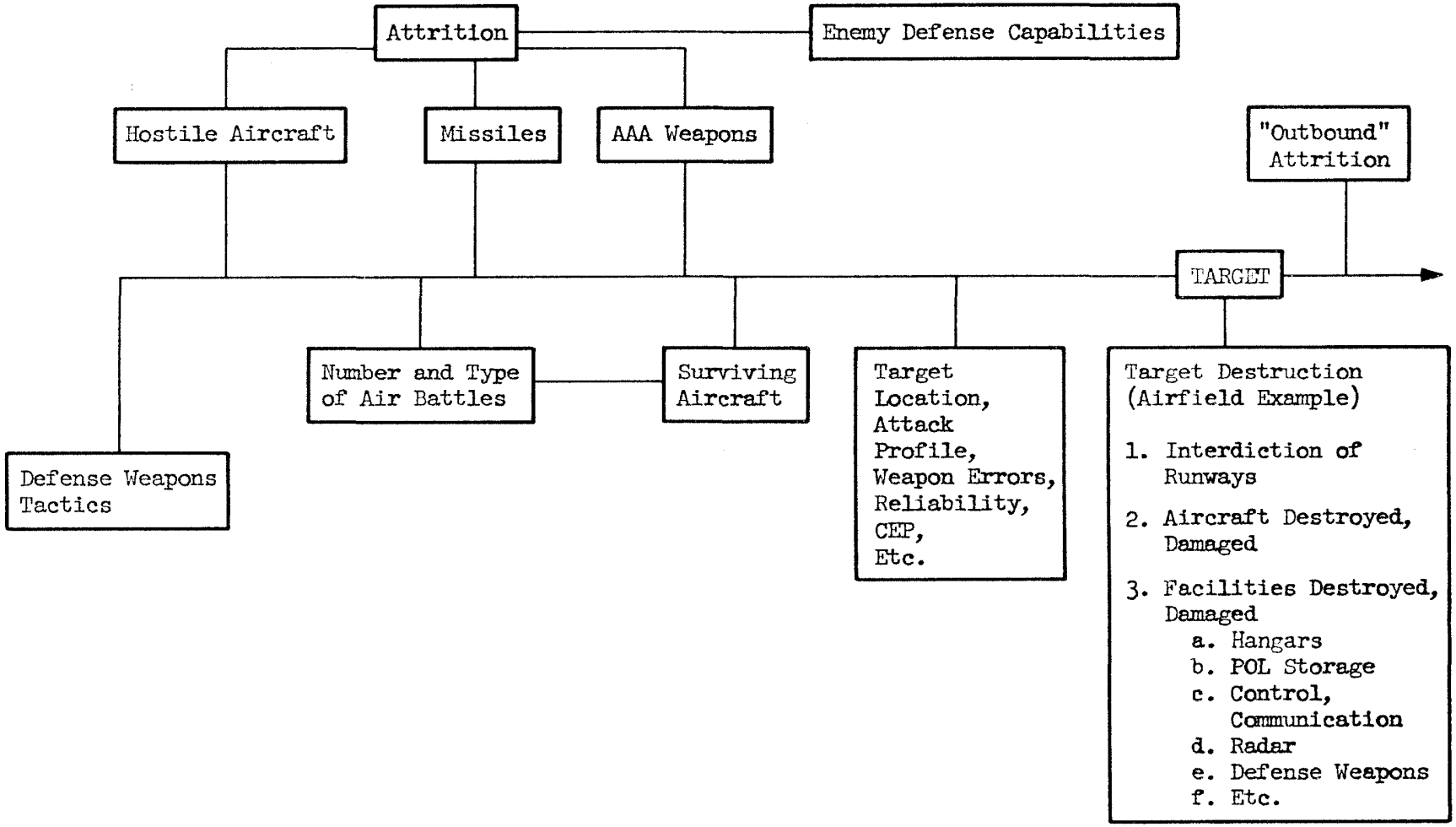

Fig. 7 — Types of factors in air strike assessment

logistic operations, schedules, redeployment of forces not in contact, establishment of supply areas and command and control centers, air-ground liaison efforts, etc.

For each of these moves appropriate planning factors, time estimates, and organizational, technical, and logistic data are used. On the basis of these factors CONTROL determines the outcome of the move, the degree of success achieved, the time delays that develop, and similar data.

A large portion of non-combat assessment is concerned with reconnaissance and intelligence activity. For each such move, CONTROL must supply to each side the results of the reconnaissance or intelligence operations. The intelligence data may come from reconnaissance operations, for example, photo missions, or from the combat interplays. In general, SIERRA games have used three types of modification on intelligence information:

- Denial, in which one side is not allowed to have any information. Many political decisions, rear-area redeployments, night moves, etc., fall in this category.
- Delay, in which one side receives information sometime after occurrence. Most information passed from CONTROL to the player teams has involved some time delay.
- Distortion, in which the intelligence information may be degraded (some information is omitted), upgraded (more information is given than the situation warrants, as for example, in overly optimistic pilot reports), or incorrect (the report is false).

Intelligence play in SIERRA games is carried out under the ground rule that the player teams do not receive unevaluated intelligence. This is because the player teams are not large enough to do their own intelligence evaluation. Therefore, CONTROL passes information that is presumed to have been evaluated prior to receipt. In addition, since the player teams represent many different echelons, each of which would ordinarily have access to different degrees or types of intelligence information,

CONTROL usually specifies the specific echelon to which the evaluated information is available, as well as the time of its receipt.

MAINTAINING THE INTEGRITY OF THE PLAY

Because CONTROL has the only complete picture of the operations of both sides it must continually check and coordinate the positions of the forces, time factors, and other aspects of play. For example, a ground attack may be launched by one side with the intent of reaching its objective at a specified time. In the interval between the planning of the attack and its execution, a portion of the opposing forces may have withdrawn, so that the attack achieves its objective at a much earlier time. This type of interaction between the opposing forces needs to be assessed and the results forwarded to the sides for any desired alterations in subsequent planning.

Another area in which the CONTROL team is required to maintain the integrity of the time and space scaling of the game may be described as the area of "operational realism." In this case, CONTROL is in a position to check the anticipated objective of a mission against events that may develop while it is in progress. For example, an air strike against a target may encounter air opposition which affects the results, or may encounter a more lucrative target than its assigned target. In such instances, CONTROL informs the appropriate side and elicits any change in the planned operation, such as diverting aircraft to the new target, jettisoning bombs or auxiliary fuel tanks, etc.

Another major function of CONTROL in the maintenance of integrity is the task of directing the game along certain lines. Here, however, it is not operational realism that is involved, but the experimental design of

the game series. CONTROL may have to disallow certain actions of either side, or force certain actions to occur in order to achieve the purpose for which the game was intended. Specific examples of this are provided in Appendix D.

RECORD KEEPING AND DATA ANALYSIS

As a game progresses, CONTROL accrues a large number of records of various types. Among these are the statements of major objectives, plans, detailed operations of each side, and specific assessments. These records serve two major purposes. They are used by the BLUE and RED teams to plan later operations, and they are the source of data for backing up any general findings arising from the studies.

Team Use of Records and Data

In the course of a war game each side attempts to carry out various operations in the face of enemy opposition. The continual action and counteraction make it necessary for each side to have an on-going assessment of the results of certain actions. This CONTROL accomplishes, passing the pertinent information to either side. The records are maintained, however, by CONTROL (see Player Team Operation in Sec. V). These assessments are made for combat, reconnaissance, logistics, and other operations. In all such cases the CONTROL team functions as a group of operations analysts attached to the side, and provides feedback on the results of various operations over time. Most of CONTROL's functions in this area serve to relieve each side from keeping detailed records and analyses so that the player teams may concentrate on planning subsequent actions.

Record Keeping for Use in Reports

War games of the SIERRA type generally produce two types of findings: There are broad findings in regard to Air Force posture, procedures, etc., that are somewhat independent of the specific operations in the play, and detailed findings that are highly conditioned by the specific developments of the play. An example of the first type might be: "limited wars in the area being studied require rapid nuclear response if RED is to be denied major gains." An example of the second type might be: "under the conditions of this game, a BLUE capability of more than 150 HE sorties per day is required to severely disrupt RED supply lines."

Both kinds of conclusions require extensive record keeping, although the types of records may differ somewhat. For the general conclusion, the game may serve as the source of the conclusion but several games under somewhat differing conditions may be required to determine whether it has a wide application. In this case the game "history" may be the major portion of the records, so that questions posed by the conclusion can be examined from the viewpoint of several possible courses of events. In the second type, the conclusion may be based on data in the logs, assessment sheets, etc., accumulated during the play of the game or series of games. The functions of CONTROL thus include both the record keeping of broader historical developments of the game, i.e., material on the context from which the conclusion is drawn, and the analysis of the accumulated data on specific operations.

ADDITIONAL FUNCTIONS OF CONTROL

CONTROL also has a number of functions generally concerned with supporting the major function discussed earlier. These are "housekeeping"

functions in a broad sense, and range from the determination of factors involved in the play of the game, such as weather, to bringing consultants into the game to handle particular problems.

VII. PLAY OF THE WAR GAME

The basic unit of SIERRA war game play is the move cycle. This represents one complete round of moves by BLUE and RED and the evaluation and assessment by CONTROL. Figure 8 diagrams a typical move cycle. Each move cycle covers a specified amount of war time.* The initial move cycles of a war game of the SIERRA type differ somewhat from subsequent cycles since both sides spend time becoming familiar with the general situation, i.e., the conditions and circumstances, strategic objectives and considerations, etc., of the situation as presented in the context.

DETAILED PROCEDURES FOR BLUE AND RED

After becoming familiar with the general situation the two sides analyze the special situation, i.e., the immediate military problem, and its associated political, logistic, and other aspects. The special situation is either derived from the context or is provided directly by CONTROL.

For each move cycle, RED and BLUE must go through the following detailed procedures:

1. Develop the military-political objective of the team.
   a. Examination of political situation.
   b. Review of political constraints or limitations.
   c. Examination of own military posture and capabilities, including status and disposition of forces, status of facilities, relative combat strengths, etc.
   d. Evaluation of intelligence information.
   e. Evaluation of logistic situation and requirements.
   f. Evaluation of terrain and weather considerations.
2. Prepare statement of objective, including reasons.

*The length of war time represented by a move cycle will vary. In general it is one day of war. The length of real time required to play a move cycle also varies.

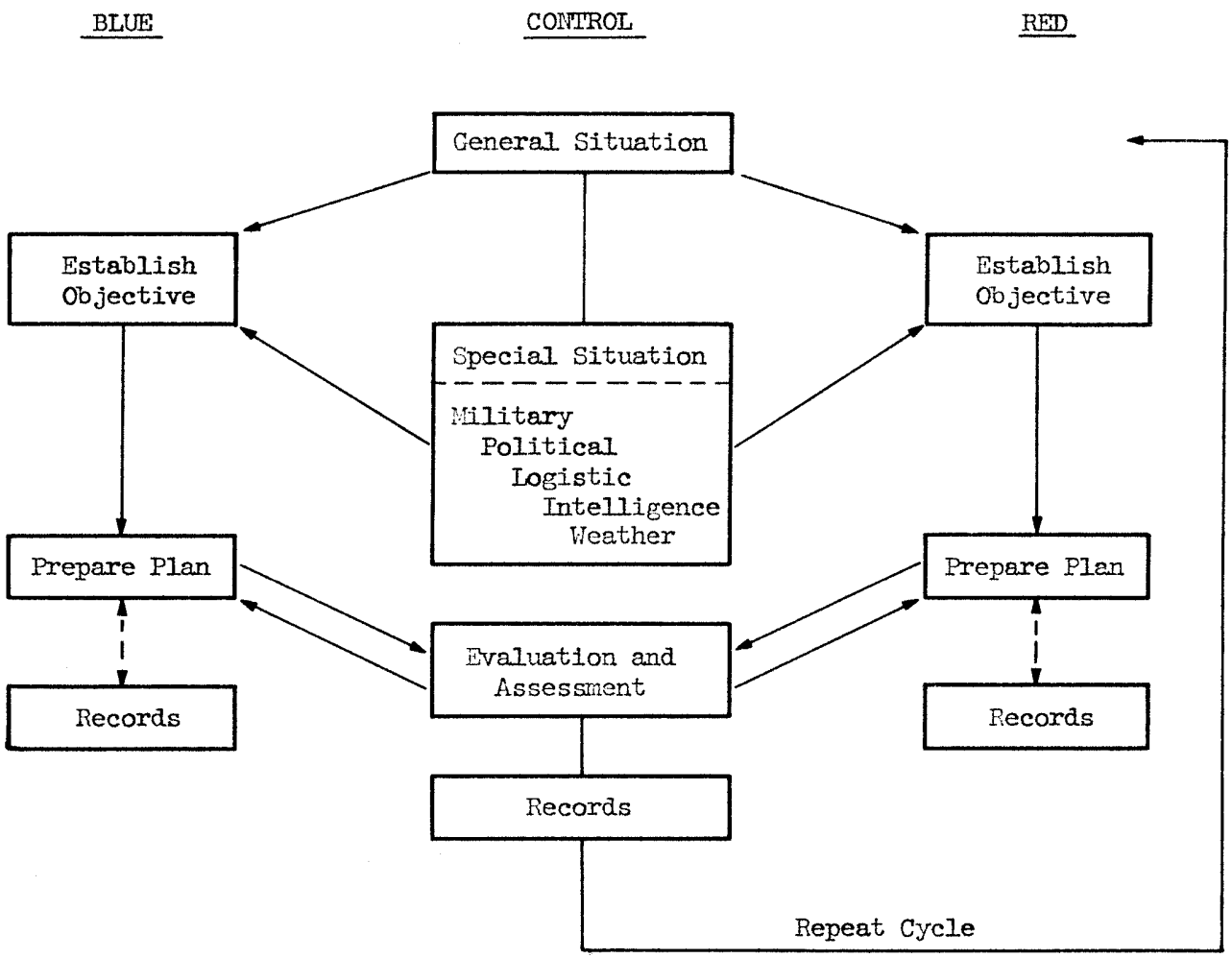

Fig. 8 – Move cycle diagram

3. Prepare general plan.*
   a. Statement of mission and purpose.
   b. Analysis of existing situation including:
      Characteristics of the area of operations, such as weather, terrain, etc.
      Capabilities of own forces.
      Capabilities of enemy forces.
   c. Own courses of action.
   d. Enemy courses of action.
   e. Analysis of opposing courses of action.
   f. Decision.
4. Present general plan and decision to CONTROL.**
5. Receive agreement on plan from CONTROL.
6. Prepare detailed tactical plans,*** indicating:
   a. Forces that will be employed.
   b. Objectives or targets.
   c. Time and nature of action.
   d. Special information.
7. Prepare logs, overlays, mission sheets, etc., to supplement plan.
8. Indicate any other actions to be taken, including:
   a. Deployments or redeployments.
   b. Reconnaissance operations.
   c. Logistics operations.
   d. Administrative moves.
   e. Public announcements or messages to be sent.
   f. Political arrangements and method of achieving them.
9. Submit detailed plan to CONTROL.
10. File any records necessary for later analysis.

DETAILED PROCEDURES FOR CONTROL

For each move cycle, the CONTROL team as a whole must go through the following detailed procedures:

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*This is a team "Estimate of the Situation," and plan. It is a general statement of what the team intends to do. The detailed plan of specific air, ground, sea, logistics, political, etc., moves is frequently not prepared until after CONTROL evaluation of the general plan.

**This is done by briefing CONTROL or writing the plan in very synoptic fashion. CONTROL evaluates the plan to determine whether the move will be allowed. If the plan is disallowed the side will repeat the previous steps, or some portion of them.

***The detailed tactical plan, as indicated earlier, is actually an integrated and coordinated set of individual plans for air, ground, sea, and political operation, with logistic supplements.

1. Provide BLUE and RED with all information necessary to start move.
   a. Intelligence information on forces, locations, reconnaissance, etc.
   b. Weather information.
   c. Special political constraints operating.
   d. Logistics conditions.
   e. Special information.
2. Receive general plan from BLUE and RED.
   a. Determine political feasibility with guidance of political adviser.
   b. If constraints are violated or new ones imposed, return plan for modification.
3. Confer with BLUE and RED (if necessary) to clarify political situation.
4. Receive detailed tactical plan from BLUE and RED.

Once the general plan has been approved, the subsequent steps involved different activities for each of the assessors and advisers of CONTROL.

Air Assessor

1. Obtain air portion of tactical plan (air plan).
2. Review weather, operational conditions, etc.
3. Coordinate air actions with other actions (particularly ground action).
4. Review plan in terms of forces available, status of forces, mission profiles, target conditions, etc.
5. Match air plans of BLUE and RED to determine if combat occurs.
6. Compute outcomes of air actions, or air-ground actions.
7. Prepare intelligence situation to be forwarded to BLUE and RED.

Ground Assessor

1. Obtain ground portion of tactical plan (ground plan).
2. Review weather, operational conditions, etc.
3. Coordinate ground actions with other actions (particularly air and logistics).
4. Review terrain and movement factors.
5. Review plan in terms of forces available, status of forces, missions, objectives, etc.
6. Match ground plans of BLUE and RED.
7. Compute or assess outcomes of ground actions or air-ground actions (with air assessor).
8. Prepare intelligence situation to be forwarded to BLUE and RED.

Sea Assessor

1. Obtain sea portion of tactical plan (sea plan).
2. Review weather, operational situation, etc.
3. Coordinate sea actions with other actions (naval air action assessments are done by air assessor).
4. Review plan in terms of forces available, status of forces, missions, time phasing, etc.
5. Match sea actions of BLUE and RED.
6. Compute outcome of sea actions, including logistics portions.
7. Prepare intelligence situation to be forwarded to BLUE and RED.

Logistics Advisor

1. Obtain logistics portion of tactical plan, or logistics requirements as indicated by air, ground, and sea portions of plan.
2. Establish requirements, and availability of strategic logistic support, war potential of theater, etc.
3. Compute major classes of supply required by BLUE and RED.
4. Establish consumption and replacement requirements for BLUE and RED.
5. Establish transportation requirements and availability.
6. Establish maintenance and replacement rates.
7. Time-phase all logistics moves to determine feasibility.
8. Confer with BLUE or RED if any logistics operations are in question.
9. Review tactical situation to ascertain whether logistics plans are in accord with tactical requirements.
10. Maintain logistics record of receipts and expenditures.

Game Director, with Team

Following the individual assessment of the air, ground, sea, and logistics moves, the remaining activities are carried out by the entire CONTROL team under the direction of the game director or his assistant.

1. Review separate assessments of air, ground, sea, and logistics.
2. Prepare integrated intelligence picture on outcome of move.
3. Provide BLUE and RED with outcome of move and obtain concurrence. If concurrence is not obtained, review move to determine nature of differences, repeating any detailed procedures required.
4. Provide BLUE and RED with final decisions on outcome of move.
5. Record data and decisions, file logs, plans, overlays, etc.
6. Start new cycle.

SPECIAL ASPECTS OF PLAY

The detailed procedures for playing the SIERRA-type war game occasionally produce situations where CONTROL must re-examine the game as a whole to decide on the "ruling" that it will make for a particular move. For example, at some point in the play of the game the BLUE side may indicate that it can continue the campaign with the forces it has available but that it also considers this point as one in which the commitment of a portion of their strategic forces would be of great advantage. CONTROL must decide on whether it will allow BLUE to commit a portion of its strategic forces at this point. Such points are called "decision" or "branch" points since they represent points in the play of the game where a choice among two or more major courses of action exists for a side.*

Upon reaching a branch point, CONTROL must decide on one of the choices. There are no rigid rules on how to make selections at these points, but the SIERRA games have generally invoked two principles as guides**--the "principle

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*These "branch" points result from a number of types of choices that may develop during play. The main ones are:

1. Choice of the type or number of weapons used. Perhaps the biggest items in this category are the choice of non-nuclear or nuclear weapons, or of "tactical" or "strategic" weapons.
2. Choice of the number and type of targets. This would include the shifting from purely military targets to non-military targets, etc.
3. Choice of number and type of forces used. The choices include using "tactical" versus "strategic" forces, or shifting from "organized" forces to "guerrilla" forces, etc.
4. Choice of the combat area involved. This includes increasing the number of countries involved in the war, or the areas in which the war is being fought.
5. Choice of type of objective, such as "restoring the status quo," "punishing the aggressor," etc.

**The rationale for deciding which branch to follow at a choice point is particularly important in games used as research devices. It is less important in games used for training or similar purposes.

of relevancy," and the "principle of the lesser included event."

The Principle of Relevancy

The principle of relevancy in its simplest form states that at any given choice or branch point, some events are more relevant than others to the purpose of the war game. Thus, at any choice point the branch that moves in the direction of the more revelant events is selected. It should be noted that relevancy is defined in terms of the purpose of the game rather than in terms of "reality." The difficulty in defining a choice in terms of realism, i.e., choosing the branch that is most credible, is the fact that there is no single realism in a war game. Thus, although it is frequently possible to indicate that some choices seem "more credible" than others in a war game, it is impossible to specify what will occur in the real world. Although one of the functions of the specialists on a player team is to establish a relative priority of events in terms of how realistic they are, a second group of specialists may select different priorities when presented with the same situation. Since credibility is such a tender vessel for determining the choice between alternative events, SIERRA frequently uses a different approach. First, the proposed course of action, or plan, at a branch point must meet certain tests of feasibility (military, political, logistic, etc.). This tends to eliminate some choices, but still may leave others open. At this time, the principle of relevancy is invoked: choose the branch that is most relevant in terms of the over-all results desired from the research. In other words, by substituting relevance for credibility, the method avoids the problem of THE reality (i.e., predicting the future) and provides considerable freedom within the framework of the research.*

*Note that these are similar to, and overlap with, the notions of "relevence" and "credibility" that were used in preparing the context for the game.

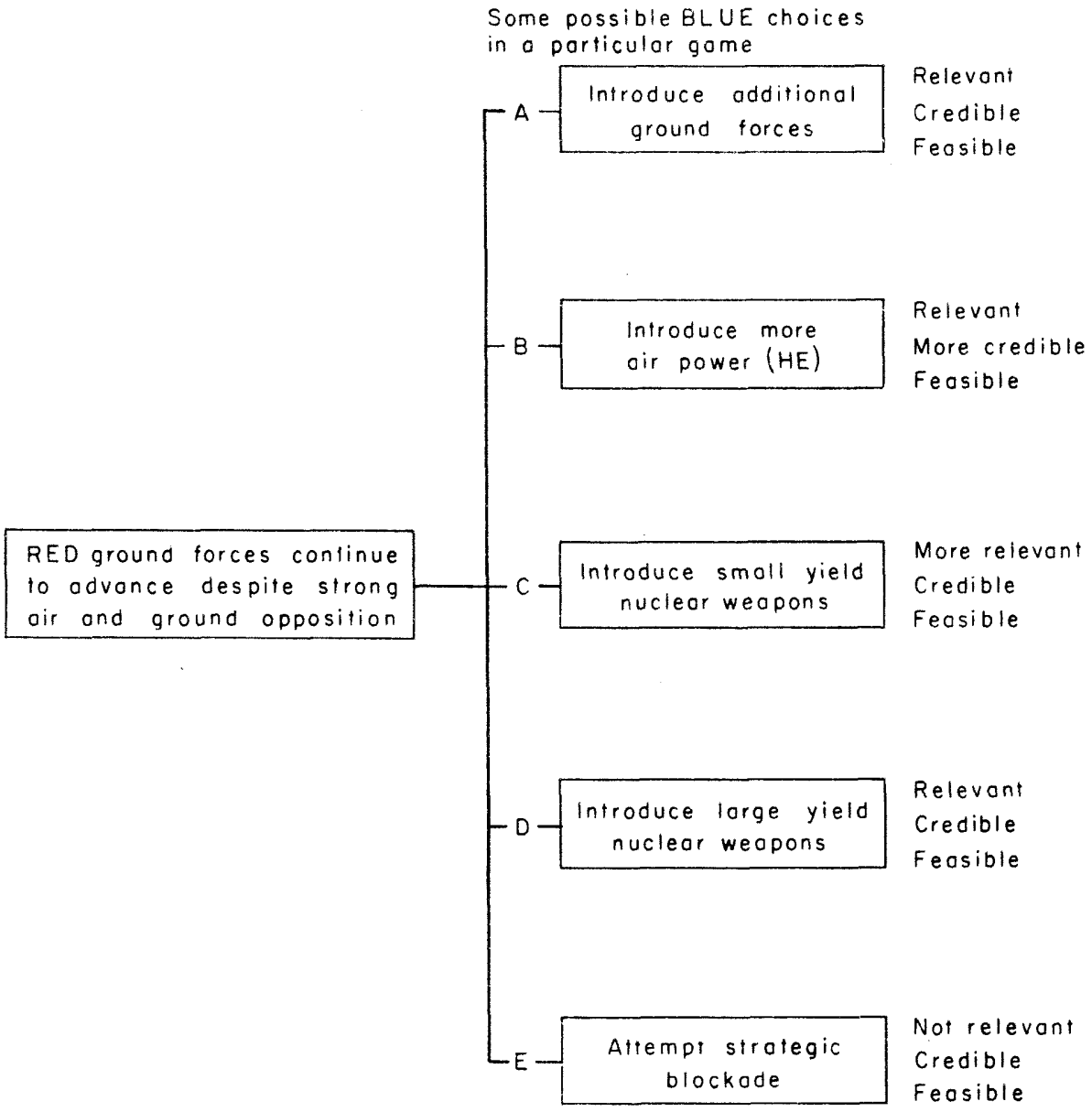

Fig. 9—Schematic of a branch point and the choice criteria

Figure 9 is a simplified example of a choice made on this basis. C, which is less "credible" than B, but in line with the research objective of investigating the use of nuclear weapons in limited war, was chosen. B, the more credible choice, will be chosen in a replay of the

game. All of the choices were feasible.

The Principle of the Lesser Included Event

In addition to evaluating the choice to be allowed at any branch point on the basis of the relevancy of the choice, the SIERRA game also adds a second principle. Briefly stated, this principle means that if at any branch point the proposed plan would lead to the termination of the game, it is rejected. This principle is employed with great caution, however, since it could in theory produce an interminable war game. Rather the principle is interpreted to mean that the preferred choice at a branch point is one that would force the game to deal with a more complex solution, and would provide more data and material for the analysis of the game, and for the conclusions that may be drawn from it.

For example, in a particular war game the choice point was the number of air bases available to one of the sides. It would be difficult to state the number that would in fact be available if the war being gamed actually took place; credible assumptions ranged from 3 to 8 bases available. In this case, a low number of bases was chosen on the assumption that if the side were able to carry out a successful military operation with a few bases, it would also be successful with a greater number, but the action would terminate sooner. Also, the lower number of bases provided a greater possibility of subsequent problems arising. In Fig. 9, C is the lesser included choice of the pair C and D.

In a sense, this principle states that if the side can deal with the more difficult military situation, it can deal with a less difficult situation. These two principles are used by CONTROL in the selection of choices to be gamed when a choice point is reached. These principles, as stated

above, are, of course, only guide lines in the selection of choices, since carrying them to the limit on a rational basis would lead to absurdity. This second principle is particularly applicable when the gaming is done on a series basis, i.e., when any one game is part of an interrelated series, and the selection of a particular branch in one game may not hold for the next game of the series.

TECHNIQUES FOR CONTROLLING GAME PLAY

Documentation

The records that are developed and maintained during a game assist materially in control of the play. There is probably no single set of records that characterizes an entire game, because of the variety of behavior and events that occur in the course of a game. Nevertheless, the two major types of records cover most games in a general way. These two types of game records are those concerned with planning activities and the justification of plans, and those concerned with specific operations. The second type is much more specific, since these records must serve as inputs to the assessment process by CONTROL. The example in Sec. V shows the type of specific information that is required in such a record. For each air strike, for example, approximately ten items of information were required. This is characteristic of the type of formal records kept at the specific operations level. Such detailed record keeping obviously allows fairly precise knowledge of operations being carried out by both sides at any point in the game.

The records of planning activities are much less formal. Planning activities often involve so much judgment by specialists that only very rarely are all of the factors and inputs spelled out in detail. Theoretically,

it should be possible to maintain formal records of the planning process, but even an approximately comprehensive set of records is rare. This is particularly true in a closed-information game, in which each player team provides not a single plan, but a variety of contingency plans. If each of these had to include specific operational details such as size, location, logistic support, and timing of each ground, air, and naval unit--as well as the entire roster of political events--the game would proceed at an extremely slow pace. On the other hand, to ignore all planning alternatives but the one actually represented in the operations of a player team would be to forfeit many of the possible variation points that can develop during play.

For a workable compromise, the player team may submit a general plan in which various choices are stated in a broad manner. After CONTROL has approved the general plan, the player team translates the accepted plan into operational detail.

Thus it follows that a thorough understanding of the planning phase is much more difficult than a thorough understanding at any point in the operational or play phase. However, without some understanding of the factors and conditions affecting a plan or operation, any attempt to control the game might result in considerable difficulty in terms of both the research goal and the players' reactions.

In addition to the formal records of operational moves and assessments, and the write-ups of the planning activities, records of a third type are maintained. These describe the control decisions within the context of the play current at the time. This set of records, with the time ordering of events in the game and the factors involved in the selection of one branch rather than another, is of particular importance when more than one

game in one area is to be played. These records make it much easier, in going back to a particular point to replay the game on a different plan, to recreate the circumstances prevailing at the time.

CONTROL and Player Team Interactions

The second aspect of game control involves the interaction of CONTROL and the player teams during the planning activities. As has been indicated, the player teams operate under considerable uncertainty at the beginning of a closed-information game because of the large number of possible events and circumstances that must be considered. Naturally the teams attempt to reduce this uncertainty by using all the information they can obtain in the course of the game. This information comes from two sources, the rulings of CONTROL, and the actions of the opposition as mediated by CONTROL (in this type of game the two player teams do not interact directly). Thus CONTROL is, directly and indirectly, the source of information for a player team. It is not altogether unexpected that the teams should, in their attempts to reduce some of the uncertainties, deliberately probe CONTROL. It is outside the scope of this paper to consider all the techniques--overt and covert--by which a player team can attempt to extract information from CONTROL. It is sufficient to point out that this possibility exists and to indicate that CONTROL has several responsibilities in this regard. It must avoid releasing information either prematurely or in such a precise manner as to be deleterious to the planning and operations of the player teams. CONTROL must equally be careful not to provide information or indications that are subject to such markedly erroneous interpretations as

to cause the team to plan for events that will not arise in the course of the game.

There are two mechanisms frequently employed to reduce these difficulties. The first of these is the routinization of the relationships between CONTROL and the player teams. As has been indicated, the use of formal records as communication devices is one example of this routinization. Among the other methods are physical separation of the three teams, and fixed times of communication, for example, a regular meeting schedule for the player teams and CONTROL. This routinization, however, is a means rather than an end, and should be flexible enough to allow the player teams to raise questions and discuss plans with CONTROL when the plans are under active consideration.

The second mechanism is the use of detailed feedback between the player teams and CONTROL in situations where a player team might misinterpret rulings because of the limited amount of information it gets at the time of the ruling. Elaboration of a ruling is often needed to make it clear, and to prevent the player team from planning against eventualities that will not take place.

Pacing of the Game

There are two kinds of pacing. One is the speed of the play in real time, i.e., the number of days or weeks of actual gaming. The second is the speed of events in game time. Since the first of these is essentially an administrative problem having to do with the time, personnel, facilities, etc., available to the research project to carry out a particular game or series, it will not be considered except to reiterate that it is strongly influenced by the game technique that is used. The second of these, game pacing, is a complex problem, and much reliance must be placed upon judgment.

A few typical examples will serve to indicate what is involved in game pacing.

Consider the time required for a government to react to a set of events occurring at some distance away. If the decision to be made is a major one, as for example whether it will support another government in fighting a limited war, many aspects must be considered before a decision is reached. Among these are the problems of getting accurate information rapidly on the events that are taking place, evaluating this information, conferring with other agencies or governments that would be affected by this action, and obtaining appropriate agreement on the reasons for and effects of the action. The time needed for making a decision will depend also on such factors as the gravity of the situation, the state of preparedness of the government, prior events that would have a bearing on the decision, etc.

Or consider the case in which ground forces of one team are trying to reach a particular objective as rapidly as possible. Here again there are many factors that must be taken into account: the size of the opposing forces, the armament, the terrain and weather, the previous actions in which they have been engaged, the importance of the objective, the willingness to incur casualties, etc.

In both of these cases and in many others that arise in the course of a war game, CONTROL is responsible for producing appropriate numerical values--a process that involves considerable judgment. The values selected strongly affect the plans of the player team, and thus the pace of events in the game.

The same care is needed by CONTROL in the handling of reconnaissance activities. Since both player teams depend heavily on the use of

reconnaissance information for planning and for action, it is important that delay factors and degradations in the processing and evaluation of this information be included in a realistic and judicious manner, since unwise handling of the information may inadvertently benefit one side and also affect the pace of the game.

A third important aspect of pacing deals with the occurrence of "unique" events. All war games involve unique events in the sense that they represent imaginary situations and attempt to portray the conditions, actions, and reactions that take place. War games that are specifically oriented towards exploring new problems, procedures, types of hardware, etc., that deal with future time periods or that involve political evaluations and actions, etc., will include many unique situations and circumstances. This is one of the merits of war gaming, since through these explorations of unique situations and events it is possible to obtain insight into problems of planning, tactics, force-employment, hardware, politics, etc.

There is, however, another type of unique event that can, in theory at least, affect the events of a war game. This type is similar to what the fiction writer calls "acts of God," and which in a war game, would include such things as an accidental explosion of an ammunition dump, an unintentional nuclear explosion, the death or assassination of military or political leaders, etc. It also includes deliberate, unorthodox actions by either side. In the real world these events do occur and it might be possible to include them in a war game on a probability basis, but the effect of such events on both the outcome and the pace of a game is so poorly understood that they are generally excluded altogether. However, it is sometimes difficult to draw the line between events that should be

permitted (such as some novel tactic for delivering weapons) and those that should be excluded (such as assassination of political or military leaders). Here, again, CONTROL has the responsibility for making the choice.

SPECIAL VARIANTS OF PLAY

Several special methods of play have been developed to expedite the gaming, and to handle special situations. Comments on three of these, the projection, the meshing, and the series methods, follow.

Projection Method

This method is used in those games that have reached a stage of development at which the available choices of further action and the consequences of these actions seem reasonably clear. Under these circumstances it is often possible for one or both the player teams and CONTROL to spell out the possible subsequent course of events without detailed gaming. This projection of events is frequently used when the time available to game some of the interesting choices of action is limited. Such a projection, despite possible questions of adequacy, is often preferrable to no consideration of the choices, since it expands the domain from which conclusions can be drawn.

Meshing Method

In many games a branch point may be reached which is so critical that a subsequent game is required. At some time after the first game is concluded, a subsequent game is begun at the branch point, but pursuing another choice of action. The conditions up to the branch point are essentially the same, i.e., the new game is "meshed" with the basic game. The new game is called a "variant."

The meshing of two games from a single branch point is not necessarily a directly connected procedure, since in any game the planning and subsequent operations carried out by a player team have different time scales. For example, a plan to attack an airfield complex with HE weapons may have considerably different logistic antecedents than one in which the airfields are to be attacked by nuclear weapons. If the critical alternative is to be the airfield attack with these two different types of weapons, certain aspects may have to be included in the meshed variant that were not involved in the original play; for example, the logistics of the nuclear weapons. Nevertheless, the meshing of two games, even with this qualification, is considerably more economical than playing an entirely new game.

This meshing of a variant with a basic game at any one of various critical points depends almost entirely, if it is to be effective, on the records that have been kept of the game and on an analysis of the events leading up to the choice. Without these, the basic game and variant(s) might well fail to match.

Series Method

While projection and meshing methods allow various extensions of the basic game to be made, they do not change the initial conditions or situation under which the game was played. Changing these conditions produces another game. Project SIERRA has used the research technique of playing several games in the same area, but under somewhat different initial conditions or assumptions. This produces a "series" of games,* which thus broaden the research base for any conclusions that may be drawn from the work.

*The first game in a particular area generally gives RED a heavy advantage, and is used as a scale-setting game. Subsequent games in the series change the BLUE response to determine the effect of such changes on the outcome of the war.

A major advantage of this method is acquisition of a considerable amount of data and experience* on military operations in the area being studied. Further, the data and experience acquired in the early games of a series make it possible to use two other types of play in later games of the series. These are "joint-adjudication" and "seminar."

Joint-adjudication Play. In this type of play the opposing teams plan their proposed tactical operations separately, but over an extended period of the war. Discussion of their plans, determination and resolution of the interplays, and assessment of results are done in joint meeting of BLUE, RED, and CONTROL around a war map. This method gains some speed, because of the extended move cycle and reductions in paper work, and takes full advantage of the experience of the staff in the relationship between the military features of the area and the forces involved. On the other hand, the method sacrifices considerable detail and practically eliminates the play of intelligence.

Seminar Play. Here, the opposing teams and CONTROL work together around a war map from the beginning of the game. They propose operations, plot the interplays, determine feasibility, and assess results in the open. This permits great speed of play, but involves further sacrifice of detailed analysis, and eliminates intelligence play.

Another advantage of the series method is that it allows parts of different games in the series to be combined in various ways for detailed examination. For example, one game may examine the effects of using a particular force such as a wing of tactical bombers, whereas another game in the series may include a wing of strategic bombers. To examine the

*Since the games represent hypothetical wars, the experience is called "synthetic experience."

effect of a combined force of both tactical and strategic bombers may now be possible without playing a new game, since the information on sortie capabilities, weapons, weapons effects, etc., for the hypothetical situation is already available. This is called the "building-block" technique. By allowing different possible combinations in the series of games to be examined, the technique extends the range of cases from which conclusions can be drawn.

VIII. ANALYSIS OF THE GAME

During the course of a game a large amount of data of many kinds is accumulated. Each move cycle involves actions taken by both sides. If there are a large number of moves, there may be a sizable body of data about the allocations of friendly forces, weapons, and resources, the objectives of the allocations, the enemy allocation of forces, weapons and resources and their objectives, and the outcome of each interplay. If the gaming situation is very broad, these military move cycles will be accompanied by logistic, political, intelligence, and economic moves and outcomes.

There are several types and modifications of analyses that apply to data from the gaming process. Since each game is set up with a particular objective or research purpose, the analysis usually examines this area first. Four general types of analysis will be discussed.

Over-all Evaluation

This is a very common type of analysis, and is often handled by writing a critical narrative, showing how the actions contributed to the final outcome. In the narrative the actions and counteraction of both sides are indicated, and the various conditions, circumstances, reasons, and effects of the actions are indicated.* This synthetic history serves several functions. It may be reviewed to estimate the effect of specific actions taken by each side on the outcome. In many cases the precise contribution of each action to the outcome cannot be isolated, but general distinctions

*This type of analysis produces a game history similar to the histories of actual military campaigns.

between "important" and "less important" moves can be made. In this way some of the major choice or decision points can be revealed. Some of the choices of action may be regarded as important enough to require new games. In other cases they may lead to "side studies" of certain moves that can be examined outside of the game situation. Appendix D presents a sample analysis of such important events and decision points.

A second function of the narrative is to provide a test bed for examining the possible effects of changing some of the initial assumptions of the game. For example, in one series of games it was assumed that Country A would support Country B in the event of an attack by a hostile neighbor. By reviewing the narrative it is possible to determine the extent of Country A's contribution to the campaign in terms of such factors as the numbers of airfields used, sorties flown, ground forces committed, ground forces engaged, the amount of the hostile neighbor's military strength committed against Country A, etc. By considering the various ways and times in which Country A contributed to the campaign it is possible to obtain a crude evaluation of the significance of its contribution to the outcome of the war. On the basis of this it may be possible to determine whether approximately the same sequence of events would take place if Country A did not support Country B, or whether another entire game would be required to examine the effect of not including A.*

One-aspect Analysis

A portion of the data may also be used to examine some particular aspect of the play. For example, the air play of the game may be analyzed to determine such information as the number of times there were opportunities

*This function is actually a very rough form of "sensitivity" analysis.

to commit air, number of sorties flown, types of missions flown, logistic requirements to obtain a given level of effectiveness, number of casualties produced per sortie, etc. This type of analysis uses the data as "synthetic war experience" and allows conclusions to be drawn as if the situation actually occurred. Many different analyses of this type may be made.

Causative-factor Analysis

Analysis may be concerned with the factors governing the employment of specific forces. These factors might include political restrictions, availability of appropriate intelligence, weather and terrain conditions, etc. Often, as specific situations develop in the game, the factors are studied for their influence on the employment of forces. For example, if an immediate nuclear strike against enemy ground forces was considered, among the factors that would be analyzed are the decision time required to authorize such a strike, the intelligence data required, the coordination with friendly ground forces so that they could exploit the strike, etc.

Another approach sometimes used is that of looking at specific situations to determine the requirements for making more effective the use of existing weapons or weapons systems. These requirements might involve technical modification of the system, such as changing the bomb-carrying capacity, extending the range, etc.* Or they might involve modifying tactical procedures for existing systems, such as setting up an aerial command post procedure for coordinating nuclear strikes.

*The games serve to define such "requirements" for the specific situation only. They do not indicate the types of modifications that might be advantageous. This had to be done in a separate study by people with appropriate technical knowledge.

Problem-identification Analysis

This type of analysis is used to identify and to study problems arising in the course of the game. These are generally cases in which the present state of our political, military, logistic, and other categories of knowledge is inadequate to meet the problems that arise in the deployment, employment, or operation of forces or weapons, such as the effects of weapons on which no combat data are available.

All the preceding types of analysis can occur in a single game. As a series of games progresses, additional situations for analysis develop. In addition, a series provides the basis for drawing more general conclusions.

Appendix A

TYPES OF BACKGROUND MATERIAL

MILITARY DATA

1. Military Data.
   a. Orders of battle, strength, composition, location.
   b. Auxiliary forces: guard units, security forces, guerrillas.
   c. Operational characteristics, doctrine, level of training.
   d. Combat capabilities, employment and deployment capabilities, mobilization, reserves.
2. Military policies and traditions.
3. Military structure, command structure, organization.
4. Military installations.
   a. Airfield characteristics, equipment, defenses.
   b. Ports and naval facilities, capabilities.
   c. Supply, storage, repair depots, and facilities.
5. Logistic systems, support, and procedures.
6. Communications and electronics equipment and procedures.
7. Transportation facilities and capabilities.

POLITICAL DATA

1. Strategic importance.
2. Government structure and operations.
3. Historical traditions and cultural patterns.
4. Political factions, strengths, objectives, and organization.
5. International relations, treaties, pacts, etc.
6. Sociological, educational, scientific, and technical characteristics.

ECONOMIC DATA

1. National economy.
   a. Budgetary policies and status.
   b. Basis of economy and stability.
   c. Production facilities, capabilities, and rates.
   d. Labor employment, skills, and capabilities.
   e. Major resources and economic potential.

2. International economic relations.
   a. Trade relations, foreign assets.
   b. Economic-military pacts, treaties.
   c. Operating structure and characteristics.

GEOGRAPHIC AND METEOROLOGICAL DATA

1. Terrain, roads, railroads, waterways, passes, coastlines, etc.

2. Population, industrial, and agricultural characteristics.

3. Climate, weather, wind patterns, tides, etc.

Appendix B

TYPES OF PLANNING FACTORS

AIR FACTORS

1. Weapon characteristics, by aircraft or missile type and mission.
   a. Dimensions.
   b. Speeds and altitudes.
   c. Ranges and radii.
   d. Type and quantity of armament.
   e. Weights.
   f. Cargo capacities.
   g. Electronics.
   h. Personnel

2. Operating Factors.
   a. Sortie or firing capability and rates.
   b. Abort rates.
   c. Operational loss (non-combat) rates.
   d. Maintenance, repair, and salvage rates.
   e. Bombing accuracy factors.
   f. Weapon selection and vulnerability factors.
   g. Logistics requirements.
      Personnel.
      Food.
      Equipment (individual, organizational, special).
      POL.
      Ammunition.

GROUND FACTORS

1. Force characteristics, by type.
   a. Organization.
   b. Personnel, equipment, and vehicles.
   c. Weapons.

2. Operating factors by type and mission.
   a. March and movement rates.
   b. Weapon firing rates.
   c. Maintenance, repair, and salvage rates.
   d. Loss and replacement rates (non-combat).
   e. Training requirements and facilities.
   f. Logistic requirements and rates.
      Personnel.
      Food.
      Equipment (individual, organizational, special).
      POL.
      Ammunition.

g. Special operations capabilities.
    Airlift and drop capacities.
    Guerrilla and irregular operations.
    Amphibious operations.

NAVAL FACTORS

1. Ship characteristics, by type and mission.
    a. Dimensions.
    b. Speed and endurance.
    c. Type and quantity of armament.
    d. Tonnage.
    e. Cargo capacities.
    f. Electronics.
    g. Personnel.

(1A Naval aircraft or missile characteristics, similar to air operations.)

2. Operating factors.
    a. Weapon firing rates.
    b. Vulnerability and damage effects.
    c. Maintenance, repair, and salvage rates.
    d. Logistic requirements.
        Personnel.
        Food.
        Equipment (individual, organizational, special).
        POL.
        Ammunition.

(2A Naval aircraft or missile operating factors similar to air operations.)

LOGISTIC FACTORS

1. Consumption requirements and supply rates.
    a. Personnel.
    b. Food.
    c. Equipment (individual, organizational, special).
    d. POL.
    e. Ammunition.

2. Construction, reconstruction, and maintenance requirements and rates.
    a. Locations and capacities of transportation routes, port facilities, lines of communication, etc.
    b. Facilities, airfields, radar sites, etc.

3. Transportation rates and mobility.
    a. Vehicles, including those for airlift of troops and supplies.
    b. Ships.
    c. Porters and animals.

4. Deployment rates and schedules.
   a. Air movements.
   b. Ground forces.
   c. Sea and undersea.

WEATHER FACTORS

1. Division of area into climatic regions in terms of:
   a. Frequency and type of precipitation.
   b. Frequency and type of cloud cover.
   c. Wind directions and velocities.
   d. Visibility.
   e. Light data (time of earliest light, sunrise, sunset, last light, moonrise, and moonset).

RECONNAISSANCE AND INTELLIGENCE FACTORS

1. Strategic intelligence.
   a. Types, forms, and sources.
   b. Reliability.
   c. Delays, distortions.

2. Combat intelligence.
   a. Reconnaissance equipment capabilities.
   b. Reproduction and transmission rate and times.
   c. Processing and action times, delays and accuracies.
   d. Detection and identification factors for:
      Type of action.
      Nature of contact of forces.
      Friendly or unfriendly territory.
      Agent nets and special operations.

WEAPONS EFFECTS AND BATTLE OUTCOMES: NON-NUCLEAR

1. Air operations.
   a. Air-battle kill probabilities for:
      Types of attacker, defender.
      Weather Conditions.
      Armament.
      Type of attack.
      GCI, A-I.
      Number of passes.
   b. Missile and antiaircraft effectiveness for:
      Type of weapon or weapon system.
      Emplacement conditions.
      Type of attack.
      Weather conditions.
      Operational status.
   c. Air-ground attack factors.
      Type of attacker.
      Type of attack and CEP.

Armament.
Target and target condition.
Effects.
Facilities, installations, and supply routes destroyed or damaged.
Personnel casualties.
Equipment or vehicle losses.
Delay or denial times.

2. Ground operations.
   a. Ground combat factors.
      Size and type of forces.
      Dispositions and density.
      Types of engagement.
         Covering and security.
         Attack.
         Defense.
         Pursuit.
         Retirement and delay.
      Firepower.
      Terrain and weather factors.
      Effects on combat and support units.
         Personnel casualties.
         Equipment or vehicle losses.
         Weapons losses.
         Delay or denial times.
         Capability to continue offensive or defensive operations.

3. Sea operations.
   a. Sea combat factors, excluding naval air operations.
      Size and type of forces.
      Disposition and density.
      Types of operations.
         Surface.
         Subsurface.
         Mining.
         Amphibious.
         Convoy.
      Volume and rate of fire.
      Weather.
      Effects.
         Units lost or damaged.
         Time out of action.
         Personnel, equipment, and supply losses.

WEAPON EFFECTS AND BATTLE OUTCOMES: NUCLEAR

In addition to the non-nuclear factors the following factors have to be included:

1. Weapon radii and yield.

2. Type of burst.

3. Types of effect.
   a. Blasts.
   b. Thermal radiation.
   c. Nuclear radiation.
   d. Fallout.

4. Target characteristics, vulnerability and sensitivity.

5. Decontamination capability times and rates.

Appendix C

COMPARISON OF STAFF-STUDY AND PRE-GAMING TECHNIQUES

A step-by-step comparison of the staff-study and pre-gaming techniques for planning a war game is shown in Table 1 on the following pages.

Table 1

COMPARISON OF STAFF-STUDY AND PRE-GAMING TECHNIQUES

Step	Illustration	Staff-study Technique	Pre-gaming Technique
1. Establish RED intentions (for a specified future date).	RED plans all-out attack on neighboring country in two years.	Judgment.	Judgment.
2. RED plan for carrying out intention.	RED prepares war plan to accomplish objective.	Specific plan not prepared.	RED side prepares plan.
3. Military, economic, political, logistic, etc., requirements determined from objective.	RED indicates size of military force, political conditions, economic production, logistic operations required, etc.	General requirements specified.	Plan translated into specific requirements.
4. Requirement analyzed to determine feasibility of achievement in time period.	RED's capability for carrying out preparations (such as build-up of armed forces) in terms of present status.	Side studies of feasibility.	Side studies of feasibility.
5. Rate of build-up during specified time period.	Program for type and rate of build-up for various elements of armed forces.	Capability at end of build-up phase specified; rate determined as generally feasible, but not indicated in detail.	Specific status of capability at definite times during build-up period.
6. Status of build-up at specified time in period passed to BLUE.	BLUE receives intelligence report on appropriate aspects of RED build-up.	Not included directly, but may be part of Step 5.	Intelligence picture received, reviewed, and analyzed for consequences on BLUE status.

Table 1 -- continued

7. BLUE may react to RED preparations by military, political, economic, etc., changes or actions.	BLUE increases defense preparations and steps up rate of preparation.	Not included directly, but may be part of Step 5.	BLUE prepares plan for opposing or counteracting RED build-up.
8. (Similar to Step 3) Military, economic, political, logistic, etc., requirements determined for BLUE plan (if reaction is of nature to justify such considerations).	BLUE indicates any changes in size of military force, etc., required. (Redeployments of existing forces in face of build-up, etc., do not usually require detailed determination of requirements.)	Not included directly.	Plan translated into specific requirements if necessary.
9. (Similar to Step 4) BLUE requirements analyzed to determine feasibility.	Capability for carrying out counteractions investigated.	Not included directly.	Side studies of feasibility.
10. (Similar to Step 5) Rate of BLUE counteraction during time period specified.	Program for time and rate of counteraction for various elements of armed forces.	Not included directly.	Specific status of counteraction at definite time during period.
11. (Similar to Step 6) Status of BLUE counteractions at definite time in period passed to RED.	RED receives intelligence report on BLUE counteractions.	Not included directly.	Intelligence picture received, reviewed, and analyzed for consequences on RED status.
12-16. (RED may modify original plans, requirements, time scale, nature, and type of preparations, etc.) (Steps 2-6 are repeated as second cycle with modifications as appropriate.)	----	----	----

Table 1

17-18. (Second cycle of BLUE counteractions--similar to steps 7-11, with modifications as appropriate.)	----
19. Repeat of cycles as necessary for length of time period. Final status of RED and BLUE at date specified in Step 1.	

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Final military, political, economic, logistic status (Step 5).	Final military, political, economic, logistic status.	

Appendix D

ANALYSIS OF DECISION POINTS FOR A HYPOTHETICAL NUCLEAR WAR

SCENARIO

The scenario is built up of assumptions of various kinds, and relates to varied factors and aspects, which are listed below under five categories for convenience in discussion. It should be emphasized, however, that most of the statements are assumptions, not facts.

The General Situation

The year is 1961. Massive infusions of RED arms, materiel and cadres have given RED-1, a satellite country, a first-class fighting force.

Confident of a swift and easy victory, RED-1 unexpectedly attacks its neighbor, BLUE-1. BLUE-1 calls on the UN and the United States for assistance in driving out the aggressor. The UN begins discussion on a plan to investigate the situation, and the United States takes immediate action to aid BLUE-1.

Principal Political Factors

The United States is committed by treaty to preserve the territorial integrity of BLUE-1. The President can use whatever forces and weapons seem necessary to accomplish this.

Although nuclear weapons have not been used in warfare since 1945, American leaders have begun to think of them only as more destructive than conventional weapons, not as inherently different.

The USAF has retained bases in countries adjoining BLUE-1.

RED is not known to have provided the satellite country, RED-1, with nuclear weapons and has not trained its air force in the use of nuclear weapons.

Rationale for RED's Action and War Aims

RED-1 is almost totally dependent upon RED. Its economy has been tied to hers by means of trade agreements; its army contains RED cadres, uses RED equipment, and has adopted RED doctrine.

RED encourages RED-1 to invade BLUE-1, hoping that such an attack will severely embarrassthe United States, and also that it will provide an indication of the firmness of U.S. resolve vis-a-vis her treaty obligations. Regardless of the outcome of the invasion, RED believes that her long-term objectives in the area will be furthered.

RED-1 regards the establishment of a subservient government in the capital of BLUE-1 as a minimum war aim.

Rationale for BLUE's Action and War Aims

U.S. military aid to BLUE-1 has strengthened it, but BLUE-1 is still no match for RED-1.

The strategic importance of the area is so great that the United States would like to eradicate RED influence from that area. Failing that, the United States is determined to prevent any extension of this influence. The United States has announced that nuclear weapons will be used in peripheral war if necessary. The United States is pretty well convinced but not certain that RED will let RED-1 go down the drain rather than risk becoming embroiled in a general war. The U.S. war aim would be a restoration of present national boundaries. USAF units are in a normal peacetime state of readiness.

Special Game Assumptions

RED-1 accepts the thesis that U.S. tactical nuclear weapons should be considered as nothing more than an extension of conventional weapons to

a higher range of explosive power; the fact that the source of power is nuclear and not chemical is of no significance. Consequently, RED-1 troops will be assumed to fight with resolution.

The RED-1 army has considered the possibility that the United States will employ nuclear weapons, and the RED-1 army has been trained for this contingency under RED supervision. However, the army will not necessarily deploy in nuclear posture until it believes that the U.S. decision to use nuclear weapons is imminent.

Targets will be strictly military. Every effort will be made to keep civilian casualties low. All weapons will be of a relatively low yield.

The U.S. decision to commit armed forces will be immediate. There will be some delay in the decision to introduce nuclear weapons because of the difficulties of decision and the hope that during the delay, the threat of nuclear weapons will clear the situation.

SUMMARY OF EVENTS

The game started with the late stages of RED-1 preparations for an invasion of BLUE-1. On May 1, 1961, RED-1 ground forces, incorporating some RED equipment and personnel, crossed the border and started a drive on the capital of BLUE-1, which is about 30 miles from the BLUE-1 border. RED-1 aircraft attacked BLUE-1 airfields. The forces of BLUE-1 moved to defend the capital and to resist the air attacks. BLUE-1 requested intervention by the United States under existing treaty provisions. It also requested action by the United Nations. The United States committed TAC and naval forces, which entered combat on approximately D + 2. Meantime, RED-1 ground forces, including one armored division, supported by air attacks, continued their drive on the capital of BLUE-1. However, combined attacks by indigenous and U.S. air caused heavy losses to RED-1 air forces. By the evening of D + 2 the

RED-1 air forces evacuated their remaining aircraft to RED territory. The ground advance continued and the United States made the decision to use nuclear weapons to prevent the capture of the BLUE-1 capital. On the morning of D + 3 TAC forces dropped nuclear weapons on RED-1 ground troops and airfields. The attacks destroyed the RED-1 air bases, but were unable to stop the RED-1 ground troops, which were close to the capital and making a strong drive to enter the city. A second attack with nuclear weapons on RED-1 ground forces later the same morning also failed to prevent RED-1 from covering the few remaining miles to the capital, and in the afternoon of D + 3 these forces entered the city.

STRUCTURE OF THE GAME

Table 2 indicates some of the main events of the game. It goes as far as D + 3, and the fall of the capital.* It does not include, however, any of the military and political plans of both sides that were considered during the course of the games, and it is only through a consideration of these that it is possible to present all the major decision points. These are indicated in Table 3, which also goes to the fall of the capital.

Table 3 covers a large number of events of different types, and these are indicated in different ways. First, the chart indicates the main military and political actions of both sides.** These events are presented for each day of the war, but are only roughly arranged in order for each day.

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*The fall of the capital is chosen as the limiting event in this paper for two reasons. The development of play up to that point is sufficient to illustrate the use of the critical narratives for analysis, and it is also the point in the game in which both the BLUE and RED teams undertook a major review of their respective positions.

**Using a conventional notation scheme the actions of the RED side are in capitals, and those of the BLUE side in lower case.

Table 2

MAIN EVENTS OF GAME

Day	Ground Action	Air Action	Sea Action	Political Action
D	RED-1 ATTACKS BLUE-1 BLUE-1 moves to defend capital	RED-1 ATTACKS AIRFIELDS Indigenous BLUE-1 air attacks RED-1		BLUE-1 requests U.S. support
D + 1	RED-1 ATTACK CONTINUES MAJOR BORDER CITY CAPTURED	TAC (CASF) moves to theater	U.S. fleet moves in Fleet air attacks RED-1 airfields	U.S. announces support
D + 2	BLUE-1 units forced back RED-1 PUSHES FORWARD TOWARD CAPITAL	U.S. and Indigenous BLUE-1 air attack RED-1 airfields and ground forces RED-1 AIR FORCE EVACUATES	Fleet air continues attacks	U.S. authorizes use of nuclear weapons
D + 3	RED-1 CAPTURES SECOND MAJOR CITY CAPITAL FALLS	U.S. Air drops nuclear weapons on RED-1 ground forces and airfields	Fleet redeploys against possible RED nuclear attack	RED-1 PROPOSES CEASE-FIRE WITH CAPTURE OF CAPITAL

They fall into three groups:

Group 1. Plans or actions that represented, in the judgment of the player teams and CONTROL, major decision points at which other branches (courses of action) might have occurred. These are set in solid line boxes, [ ].

Group 2. Plans or actions that were disallowed by CONTROL, based on the situation at the time. They were not generally regarded as major branch points. These events are set in broken line boxes, [ ].

Group 3. Actions where choices existed at the option of the particular player team involved, and where the action was chosen as the most appropriate in view of the existing situation. These are indicated by underlining, _____ .

Table 3 lists more than 100 major events. The Group 1 events are the most important to this study. Most of these events will be discussed to indicate briefly why they are major branch points. The discussion is, however, intended to be illustrative only.

The RED-1 Build-up

The game postulated a RED-directed build-up of RED-1 forces and a large-scale invasion of BLUE-1. There were a number of actions that might have been taken by BLUE if they had been allowed to react to the build-up over a long time period, including the build-up of a counterforce. Also, the invasion might have come in ways other than as a large-scale attack, such as subversive activities by RED-provoked rioting in the capital, and the commitment of smaller forces in the guise of stabilizing an unstable situation in the BLUE-1 country. Also, had BLUE been allowed to react during the build-up on the basis of known RED intents, extensive positioning of defense forces might have been undertaken.

Table 3

GAME EVENTS: BRANCH POINTS, DISALLOWED PLANS, AND CHOICES

Day	Ground Action	Air Action	Sea Action	Political Action
D	RED-1 BUILD-UP ATTACK BLUE-1 Holding action Defense of capital BLUE-1 reinforcements called up	RECCE BLUE-1 AIRFIELDS Recce RED ATTACK AIRFIELDS GROUND SUPPORT MISSIONS Ground support	BLOCK FLEET Fleet moves forward Charter trawlers	Request outside assistance A/C Request U.S. support Warning of nuclear use; authorization U.S. commitment of forces
D - 1	PUSH ON CAPITAL MAJOR BORDER CITY (AIRFIELD) CAPTURED BLUE-1 troops oppose advance Reinforcements move in	PARATROOP DROP GROUND SUPPORT MISSIONS Commit TAC, SAC, Navy ATTACK AIRFIELDS SOME GROUND SUPPORT Tactical forces to theater Strategic forces to nearby bases Deployment of radar Nuclear attack SAC "catastrophic" situation	SUBMARINE AIR ATTACK FLEET SUBMARINES "RETIRE" Fleet use of nuclears Fleet recce by air Fleet air attacks airfield	REQUEST FOR NUCLEAR WEAPON USE STOCKPILE OF NUCLEARS IN RED-1 U.S. announcement to intervene Use of theater bases authorized No theater bases except staging

Table 3 — continued

		Use of small civil A/C for recce Attach to ground forces USE OF OTHER RED-1 AIRFIELDS Night (flare) recce of part of RED-1		
D-2	BLUE-1 UNITS FORCED BACK INTO MOUNTAIN AREA CONTINUE ATTACK TOWARD CAPITAL Defense of capital assessed as having "short" delay capability Nuclear weapons desired since no REDS in capital (review of situation) HEAVY PUSH ON CAPITAL	STAGE A/C INTERNATIONAL LAW QUESTION Airfield, ground support GROUND SUPPORT EVACUATION EVACUATION AFTER MISSION: TOUCHDOWN BUILD AIRFIELD DECOYS INCREASE IN FORCE WITH RED A/C Day, night recce of battle area Recce (flash) of part of RED-1	SUBMARINES WITHDRAWN Naval air support Fleet in same (approx.) position After nuclear alert, order dispersal Move operating area to west SURFACE SHIPS IN PORT SUBMARINE FORCE IN SAME POSITION	Request for nuclear authorization Authorization for nuclear use Warning — Delay time Token show Effective military use Announce use of nuclears "Prepare for consequences" "Estimate" RED A/C evacuated: Request internment—No nuclear airfield attacks promised WARN GROUND FORCES OF IMPENDING NUCLEAR ATTACK—ORDER RAPID PUSH, DISPERSAL IN DAY

Table 3 — continued

D - 3	CONTINUE ATTACK TOWARD CAPITAL	Disperse A/C to nearby bases (cont.)	Redeployment of fleet to range of RED-1 airfields	Fleet alert to attack if nuclears used against them
	SECOND MAJOR CITY CAPTURED	Air defense increased, include "ramming" tactics	SURFACE, SUBMARINE FORCE IN SAME LOCATIONS	Request authorization for use of B-47 with nuclear weapons
	NIGHT MOVEMENT, IN OPEN AND WITH "CUDDLE" TACTICS	Move B-47's		Request additional B-47's from ZI
	PREPARATION FOR PARATROOP REDEPLOYMENT	Photo (flash) recce of ground area for nuclear planning airfields under "continual" observation.		RECEIVE AUTHORIZATION FOR USE OF NUCLEARS
		Multi-megaton drop on ground troops		CEASE-FIRE PROPOSAL
		High explosive attack on airfield etc.		Special variation i Washington evaluation ii Delay of 0400 airfield strike iii Hold 1000 ground strike
		ATTACKS FROM RED ON GROUND FORCES (TOUCHDOWN)		ATTACK ON NEARBY BASES WITH NUCLEAR WEAPONS
	PARATROOP DROP	PARATROOP DROP (CHANGED TIME)		ATTACK ON FLEET WITH NUCLEAR WEAPONS
	CONTINUE MOVE ON CAPITAL LESS LOSSES TIMING	Nuclear drop of kiloton weapons on ground troops, air burst		Evaluation of situation to continue nuclear attacks on troops during day (shift in tactics of use of nuclear weapons)
	ENCIRCLES PART OF BLUE-1 TROOPS	Nuclear drop kiloton on RED-1 airfields		
		Recce of ground: damage assessed	Fleet moves eastward	

Table 3 — continued

		Nuclear weapon drop on ground troops 1000	
		Nuclear weapon drop on ground troops 1500+	
	CAPITAL FALLS		

CEASE-FIRE PROPOSAL AFTER CAPTURE OF CAPITAL

Defense of Capital

The defense of the capital became a focal point in the war. Many of the plans and actions of both sides stemmed from the BLUE-1 commitment to hold the city. The status of the capital served as a reasonably objective basis for each side to evaluate the progress of the war, and to act accordingly. In conjunction with possible reactions to the RED-1 build-up, there were a number of possible choices regarding the defense of the capital.

U.S. Intervention and Commitment of Forces

The number of possible force commitments as to type, size, composition, etc., by the United States, is one of the major aspects of the game and a number of choices were studied, including some using non-nuclear forces.

RED Submarine and Air Attack on Fleet

The proposed attack presents a variety of choices that involve considerations of sanctuary, central war, deterrence, etc. Most of these raise the level of violence of the war even in a non-nuclear attack (such as was proposed) and particularly in the case of nuclear attack. The choices involve broad political-military problems for intensive study independent of the context of the specific war game.

Fleet Use of Nuclear Weapons

This point is one of the choices of U.S. weapon commitments and, as has been indicated, is part of the general investigation of responses to limited war. It also relates to the questions raised under the point immediately preceding this one.

Use of Neighboring Bases

The choices raised at this point deal with the U.S. system of overseas

bases and treaty obligations as well as logistics, force mobility, etc. Involved are choices in the size and type of forces committed.

Use of Strategic Forces for Nuclear Attack in Limited War

This choice includes both general problems of a broad military-political nature and more detailed problems of strategic force capability for various kinds of support operations.

U.S. Authorization To Use Nuclear Weapons

The particular choices of concern in this game dealt with the U.S. choices of providing RED-1 with explicit warning of use of nuclear weapons, with the use of a token drop, or with an initial drop of a type and size necessary to be militarily effective.

Evacuation of RED-1 Air and U.S. Request for Internment

The choices at this point included problems of air strategy, counter-air campaigns, destruction of airfields, extension of the war, as well as political aspects of sanctuary, international law on internment, and operational problems of staging and reconnaissance.

U.S. Authorization to Use Nuclear Weapons, and Timing of Their Use

The choices at this point involved considerations of limits on number of weapons and yields, on target restriction, reconnaissance, air-ground coordination, and air tactics, as well as the political considerations of the first listed point.

RED Use of Nuclear Weapons Against Nearby BLUE Bases and the Fleet

This branch point raises all the choices inherent in bilateral use of nuclear weapons in limited war--from the restricted problems of capability

to the general ones of control of level of violence and central war.

RED Cease-fire Proposal

The choices at this point are both military and political in nature, although the political ones predominate. On the military side they include the alternatives involved in continuing the war, such as (a) use of nuclear weapons in an interdiction campaign, (b) strategic attack on RED-1, and (c) commitment of additional forces, including ground troops, etc.

VARIANTS OF THE BASIC GAME

The preceding list of decision or branch points in the hypothetical game ranges from the more purely military problems of force commitment and deployment, base location, weapon delivery systems, weapon size and number, target planning, target restrictions, reconnaissance, etc., to political-military problems of sanctuaries, authorization for use of non-combatant air bases, cease-fire offers, etc.

Although almost all the points are worthy of detailed consideration, only a few can be selected for detailed study. Since a number of the branches involve interrelated considerations, the following might be chosen to cover most of the areas.

1. Earlier use of nuclear weapons (with restrictions on number and yield).
2. Defense of the BLUE-1 capital.
3. Assessment of the use of other yields, specifically a drop of megaton weapons.
4. Bilateral use of nuclear weapons.
5. Nuclear intervention by the United States without the use of theater bases.
6. The effect of the cease-fire proposal, and choices in continuing the war.