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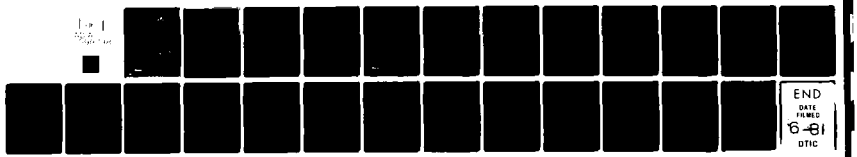

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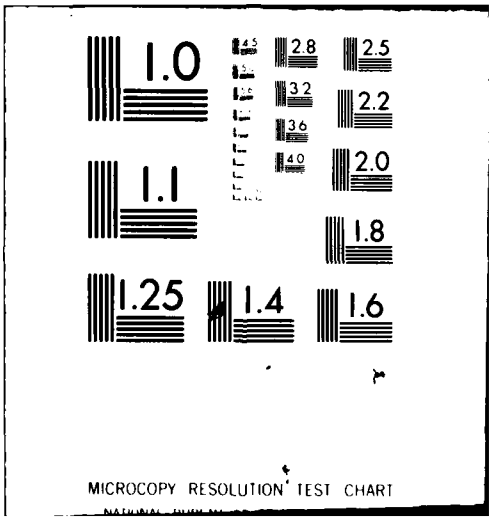
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A RAND NOTE

LEVEL II

RAND'S STRATEGIC ASSESSMENT CENTER: AN OVERVIEW OF THE CONCEPT

Morlie H. Graubard, Carl H. Builder

September 1980

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Prepared For

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Rand's Strategic Assessment Center is a new research facility designed for the development and testing of improved methodologies for the analysis of strategic forces. This note describes the concepts and objectives that have guided the facility design and the methodological developments during the first year. The methodology to be demonstrated in the facility during January 1981, uses the flexible structure of conflict gaming, but resorts to the discipline of analytic models to control the behavior of the game teams. The combination is expected to provide an improved method for the analysis of strategic forces--one with richer contexts and clearer relationships between inputs and outputs than is now available through any single analytical technique.

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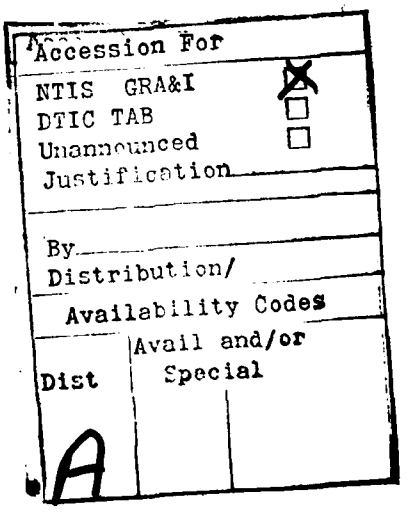

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PREFACE

This note describes the basic ideas and objectives that motivate a current research project at The Rand Corporation designed to develop a new framework for strategic analysis. It is intended to help those who are not directly associated with the project gain a quick and general sense of the content and thrust of the work as a basis for judging their further interest in its progress. Preparation of this note was supported by the Defense Nuclear Agency.

SUMMARY

Rand is currently engaged in research to develop a new methodology for the analysis of strategic forces, under contract with the Defense Nuclear Agency. This research is now oriented toward demonstrating the feasibility and utility of the methodology in January 1981.

The basic concepts guiding this effort have their origins in the familiar tools of strategic analysis: conflict gaming and computer models. Both have their limitations and advantages, their advocates and skeptics; and both have left their mark upon the style and content of strategic thought. With games, it is often impossible to relate inputs and outputs, even though the game structure permits considerable flexibility in both. With analytical models, the relationship between inputs and outputs may be clearer, but the model structure seldom permits much flexibility in either. Gaming provides participants with an experiential basis for evaluating decisionmaking; computer models provide for the synthesis of quantitative data. Together they should offer more than the sum of their separate contributions; but their combination to date has been mostly limited to the use of computer models to support the analysis of military operations in conflict gaming.

Our methodological approach is designed to marry the best of each tool into an interactive framework--a framework that can be used to develop the military and political context for the analysis of strategic force operations. We have adopted the structure of a game, but we have replaced the game teams with players (or agents) whose behavior is rule-programmed through extensive use of computers. That prospect is exciting, because it offers the opportunity to make conflict gaming a much more controllable and transparent tool for strategic analysis. The result retains much of the rich contextual complexity of gaming, but without losing the reproducibility and traceability afforded in analytic models. Moreover, the discipline of

rule-programming the players has required important changes in the game structure, changes that promise greater flexibility for exploring alternative concepts and testing the sensitivities of the parameters and assumptions about strategic conflict.

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FIGURES

I. INTRODUCTION

This note describes the concepts and activities currently associated with Rand's Strategic Assessment Center. The concepts are important because they represent a very innovative and exciting new methodological approach to strategic analysis. The research activities undertaken in pursuit of those concepts are the initial, rudimentary steps necessary for demonstrating the promise of the methodology in January 1981. Both the concepts and the activities deserve attention now if the promise and the price of improved methods for analyzing strategic forces are to be appreciated.

The purpose of this note is to provide a general acquaintance with the fundamental ideas that now guide research within Rand's Strategic Assessment Center and where those ideas are pointed in the short term. The implementation of those ideas in equipment, computer programs, and gaming procedures is currently in a high state of flux, hence, there would be no durable value in describing them here. For those interested in the technical approaches being pursued in implementing these ideas, direct contact with the authors is recommended.

The background events leading up to Rand's Strategic Assessment Center and to the contracted research on improved methods for analysis of strategic forces are outlined very briefly in the next section of this note. The conceptual approach we have adopted as a logical response to those background events is then developed. The scheduled demonstration of that approach, in January 1981, is described in the following section. In the final section, we briefly speculate on what lies ahead, in terms of development efforts and intellectual horizons.

II. BACKGROUND

Rand's Strategic Assessment Center was originally conceived several years ago as part of a proposal for a national research center to expand and revitalize U.S. strategic thinking. That concept was stimulated by the conjunction of at least two interrelated perceptions:

1. The adversely shifting balance between U.S. and Soviet military capabilities; and
2. The increasingly apparent limitations in the scope and depth of U.S. strategy and strategic thought.

The original concept envisaged a federally sponsored research center with the necessary long-term dedication to the intellectual processes required for the evolution of broad strategies for national security. It called for more sophisticated thought about:

1. Asymmetries in U.S. and Soviet interests, perceptions, and objectives;
2. The full panoply of forces and operations constituting military power; and
3. The relevancy of military power throughout a wide range of future contingencies and circumstances.

The first opportunity to pursue that agenda came a year ago, when the Defense Nuclear Agency requested proposals for improved methods for analyzing strategic forces. They sought a contractor who would develop a framework for analysis that could be transferred to the government for use by a variety of agencies with diverse interests and purposes. For example, some might want to use the methodologies to explore the effects of force characteristics on different measures of the strategic balance; while others might want to examine the effects of various tactics on war outcomes, or scenarios on perceptions. Thus, the requested improvements were aimed at a broad enrichment of force assessments with respect to:

1. The variety of scenarios and their evolutions;
2. The perceptions of adversaries and their allies; and
3. The range of military forces that might be brought to bear.

The request acknowledged that the breadth of considerations and the flexibility of application being sought in the new methodologies were probably outside the realm of conventional computer models, simulators, and gaming facilities.

The major complaints against current analytic models of strategic conflict, such as the arsenal or force exchange models, are:

1. The use of a few simple, static measures of force effectiveness;
2. Their application to a narrow range of military forces having common exchange parameters;
3. The presumption of a few rather shallow and highly stylized scenarios focusing on force exchanges; and
4. The absence of much of the complexity and reality of allied and adversary perceptions or motives.

Despite these limitations, the advantages of current analytic models of strategic conflict are considerable:

1. Assumptions are usually explicit or explicable--at least in the simpler models;
2. Relationships--causes and effects--are either defined or can be determined; and
3. Results can usually be independently reproduced and verified.

Another, but less widely used, method for strategic analysis is gaming. Political-military games, using the basic team structure shown in Figure 1, have been used to explore many crisis and conflict issues that are not yet tractable through formal models. The adversary teams, typically RED and BLUE representing the Soviet Union

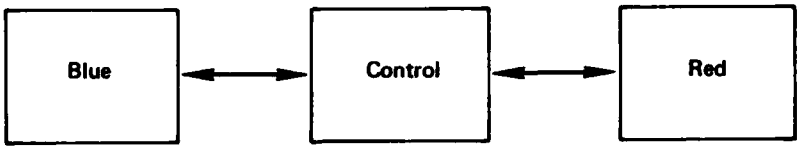

Fig. 1 Structure for a Conventional Political-Military Game

and the United States,* are free-playing teams of people who assess a hypothetical situation posed to them by the control team and then decide upon a move or course of action, which may involve both political and military initiatives. The control team supplies the adversary teams with any necessary information, interprets their moves, and synthesizes the next hypothetical situation for them to confront.

Political-military gaming of strategic conflict can overcome most of the limitations described above for analytic models, but at the price of losing most of the advantages. Traditional gaming can introduce a rich menu of forces, measures of effectiveness, scenarios, and perceptions--only by relinquishing almost all control over the underlying assumptions, relationships, and reproducibility of the results to the individual judgments and caprices of the players. This makes it difficult or impossible to apply the results directly to the assessment of policy, program, or operational choices.

In effect, the current analytic models and traditional political-military games represent opposite extremes of a spectrum of advantages and limitations. The requested improvement called for a solution that is more than a simple compromise between those two extremes: It called for the best of both--the richness and flexibility associated with games, and the reproducibility and

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*Of course, more complex political-military games have been designed, incorporating multiple teams representing multiple independent actors, but the dynamics are essentially the same as portrayed in this simple example.

transparency obtainable with analytical models. The problem posed, then, was how to introduce the desired enrichment without making the analytic results unsuitable for policymaking because of their complexity, or lack of credibility, generality, and reproducibility.

III. RAND'S CONCEPTUAL APPROACH

Our basic idea was to retain the rich and flexible structure of a game, but to program or automate any or all of the players, so that the game can be made as transparent and reproducible as an analytic model. That idea is based upon three important assumptions:

1. Computer and artificial intelligence technologies now make it possible to consider programming every player, at least for some modest range of play;
2. Programming the behavior of players in a game should assist in making the results of games more transparent and reproducible;
3. The decision to direct or automate selectively any particular combination of players will permit flexible gaming arrangements for a wide variety of users and analytical purposes.

By programming or automating a player, we mean that each game team becomes an agent whose actions or behavior can be substantially prescribed by rules and consistently reproduced. Initially, the agents might consist of teams of people working with a combination of written procedures, catalogs, and interactive computer programs. But eventually, we expect that most of the procedures and catalogs can be computerized, permitting a few human technicians to employ very large libraries of behavior for play.

Conceptually, the notion of automating game play, though interesting, was neither unique or new. Computerized games are widely available, and automated players are now acknowledged as competent for games like chess and backgammon. For some time, computers have been used to support political-military games, especially for the planning and analysis of military operations. As experience with computer-supported gaming built up, some of those involved in designing and directing games began to speculate on the operational or behavioral codes necessary to program the adversary teams. At the same time,

researchers at Rand and elsewhere have theorized about the operational codes required to explain historic Soviet decisionmaking in crisis/conflict situations as a means of exploring anticipated Soviet actions or reactions. Thus, sufficient interest and experimental data have accumulated through years of gaming and speculating about political-military decisionmaking to encourage us in the prospects for modeling some of the diverse perceptions of how the adversary teams might respond in various situations.

But the interest in programming the adversary teams has not been motivated solely by a desire to codify behavior. It springs in equal measure from some of the perceived shortcomings of free-play political-military gaming. In such games, it is often impossible to relate expert inputs to game outcomes. By making the behavior of teams explicit, we have the opportunity to trace the relationship between inputs and outcomes.

Furthermore, our experience in gaming has revealed that there are some actions that teams will just not initiate. For example, free-play teams exhibit extreme reluctance (amounting to refusal) to initiate nuclear conflict. If gaming (as opposed to invoking) the initiation of nuclear conflict holds any analytical value, it might only be possible with a programmed player.

The idea of programming the behavior of a control team, however, poses a severe challenge. In the traditional political-military game, the control team provides several different and demanding functions:

1. The source of political and military information typically provided to decisionmaking bodies by their staffs;
2. The interpreter and arbiter of worldwide political and military actions instigated by the adversary teams;
3. The initiator of worldwide political and military events to stimulate the adversary teams and advance the purposes of the game;
4. The coordinator for all game communications; and
5. The keeper of the game records and clock;

Our idea here was to split the control functions up into three separate agents as shown in Figure 2. This structure is unique in two ways:

1. It breaks up the complex functions of the traditional control team into tasks that appear to be programmable or governable by explicit rules; and
2. It creates two additional, independent agents of a stature comparable to the adversary agents.

The Force Operations Agent (FORCE) is the agent responsible for all information, planning, and execution of military operations, worldwide, for the adversaries. FORCE will be supported by a computer

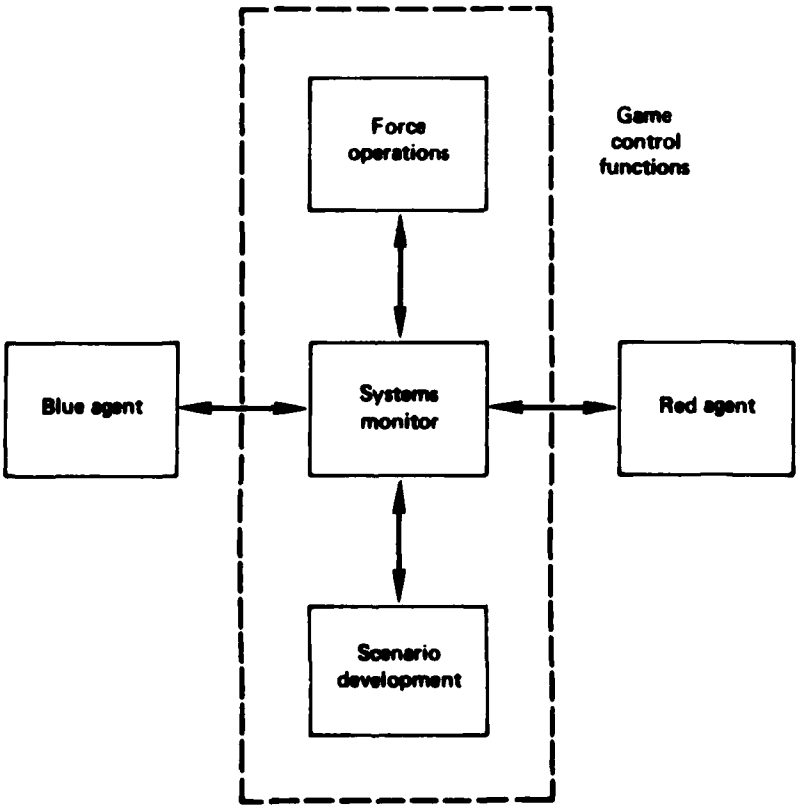


Fig. 2 Game Structure Proposed for Programmed Agents

program with the capability to display force and target status, both actual and projected, in response to commands for force generation, deployment, and use. The structure of this program is modular, so that force operations of various kinds and levels of detail can be selectively included. Separate data bases are maintained to reflect the potential differences in perceptions between the adversary agents and actual force operations.

The Scenario Development Agent (SCENARIO) is the agent responsible for all political information and actions, as required to portray the worldwide political situation to the adversaries. The programs supporting SCENARIO will include a computer-driven "tableau" of categorical data regarding the international affiliations, commitments, and activities for each national (or subnational) entity that may be involved in an ongoing conflict situation. Like FORCE, SCENARIO will maintain separate data bases for each adversary agent. Consequently, the tableau can provide situational information to guide or control the actions of the adversary agents. It can also be used by the adversaries to evaluate or interpret world reaction to their activities--their military or diplomatic successes and failures.

The Systems Monitor (MONITOR), in the central position of this new game structure, retains the traditional control team functions of the communications, records, and time coordinator. This agent will be supported by several software packages including message handling and text processing.

The adversary agents (RED and BLUE) will be supported by "control" programs that provide conditional instructions for both political and military actions based upon a categorization of the situations they face. The situation categories include such elements as the parties involved in the conflict, its location, the current strategic nuclear ratio, and local superpower involvement. The relative weights assigned to each of the elements reflect an explicit set of assumptions about adversarial objectives and behavior. Ultimately we intend to build extensive libraries of alternative behavior sets. The data required to complete each of the elements in the program obviously come from the other agents in the game. Consequently, the adversary agents have the ability to access computer-displayed data from FORCE, SCENARIO, and MONITOR.

IV. DEMONSTRATING RAND'S APPROACH

Reducing our conceptual approach to practical use for government agencies in a suitable facility is obviously an ambitious and costly undertaking. It represents a major innovation in gaming and will tax the state of the art in computer and artificial intelligence technology. At the outset, we estimated that it might take three to five years and more than ten million dollars to provide a mature gaming facility for sustained government operation.

Given the acknowledged risks, Rand was asked to demonstrate the salient features of its approach in a first-year contractual effort. An alternative approach to improved methods for the analysis of strategic forces, proposed by Science Applications, Incorporated, was also funded by the Defense Nuclear Agency. The Systems Planning Corporation was awarded a contract to assist in comparative evaluation of the two alternative approaches.

To demonstrate many of the potential applications of Rand's new approach would require a high level of development in each of the programmed agents. That is well beyond the time and money resources available in this first year's effort. We have elected to concentrate our initial development efforts on the RED agent to demonstrate the critical feasibility of programming an adversary agent. Secondary efforts have been devoted to programming for the SCENARIO and FORCE agents. Partly for these reasons, we plan to run our demonstrations with a free-playing BLUE team.

Given a free-playing BLUE team, with the remaining agents programmed, we should be able to demonstrate the use of the facility and its capabilities to explore preferred U.S. strategies for the deployment and use of strategic forces in potentially escalating conflict situations. The exploration will consist of a series of games (and branches of games) in which the free-playing BLUE team will be able to try different actions at different points (of their choice) in the game. If the experiences in this trial-and-error search for preferred outcomes lead inferentially to a strategy for the deployment and use of U.S. strategic forces, we will then attempt to test the

robustness of that strategy against alternative behaviorial programs for the RED agent as an illustration of the explicit testing capabilities we think are inherent in this approach.

Aside from demonstrating the feasibility of our methodology, we intend to show that we can place the exercise in a rich contextual background that is capable of moving the players through a wide and useful range of:

1. Crisis and conflict contingencies, including
   a. Third-area conflicts,
   b. Major theater conflicts, both conventional and nuclear,
   c. Limited and major intercontinental conflicts, and
   d. Aftermath phases of nuclear war;
2. Military force operations, including
   a. Conventional as well as nuclear,
   b. Tactical as well as strategic,
   c. Reinforcement, support, and projection as well as combat; and
3. Scenarios, both initiating and branching options.

The demonstration of Rand's approach will be conducted during the period of 12-16 January 1981, in a new experimental facility located in Santa Monica, California. The facility has been configured and equipped especially for gaming with computer-supported, rule-programmed agents. The facility layout is represented in Figure 3. The facility floors are at two levels to permit observation of all activities from one location. The four programmed agents for the planned demonstration games are located on the lower level, separated by open-topped partitions (since their decisions will be governed by programs, absolute soundproofing between these agents is not required). The observation deck and the free-play team room is located on a level above the automated agents. Observers are able to watch through one-way glass both the free-playing team and, on the lower level, the programmed agents.

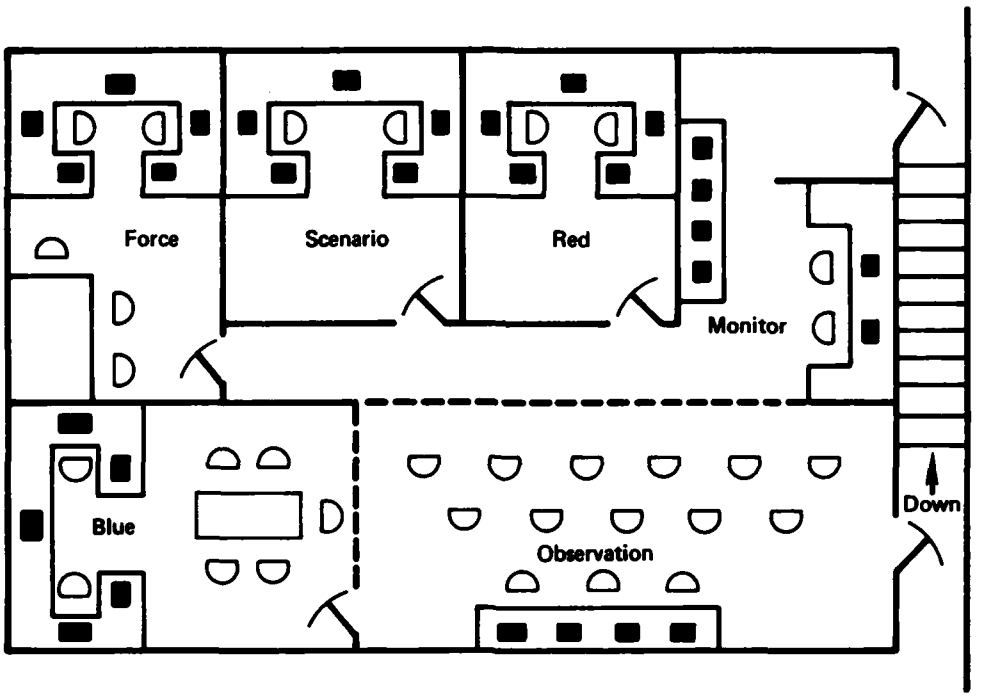


Fig. 3 Layout of Experimental Gaming Facility

The facility is equipped with about 30 interactive computer consoles for the use of the programmed agents, free-playing team, and observers. These consoles provide continuous access to about six software packages on three different computers. There are provisions on the observation deck to display any of the programmed agent activities on large-screen monitors. A number of printing consoles throughout the facility provide hard-copies of game messages and data transmissions. The demonstration games will require about 15 members of the Rand staff, most of whom will be acting as interfaces between the various computer programs. The facility is designed for about 12 observers and four participants on the free-playing team.

V. LOOKING AHEAD

If the concepts we have proposed for gaming with programmed agents serve as a useful framework for analyzing strategic force operations, and if we successfully demonstrate that concept during the third week of January 1981, we anticipate that there will be a follow-on development program for a full-scale gaming facility for the government. We would expect the experimental demonstration facility to remain in Santa Monica and to be used for developmental research. But the first full-scale facility would probably be assembled in Rand's Washington facilities for eventual transfer to the government, at a site of their selection.

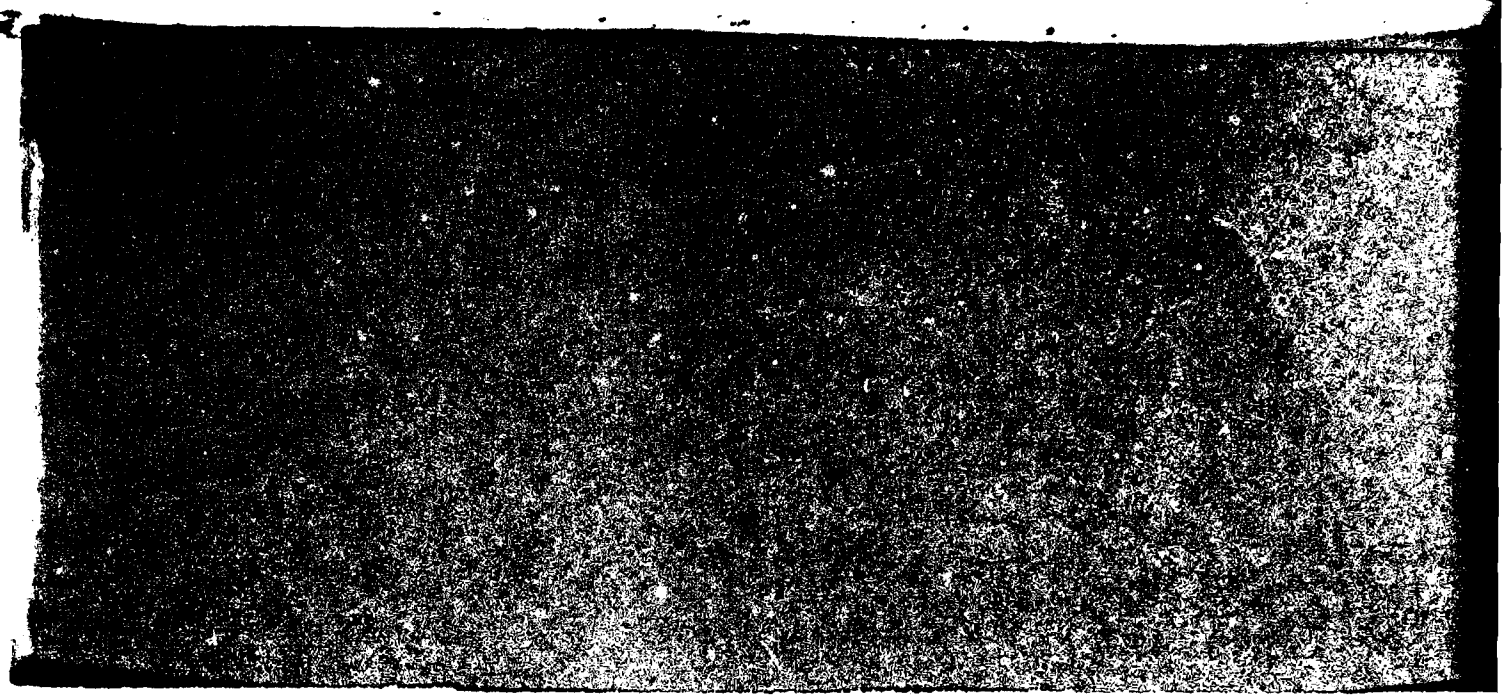
At this juncture, our energy, intellectual capital, and time are all oriented toward developing the necessary methodological constructs to support this new analytical technique. But even at this early stage we are beginning to perceive some of the ways in which this methodology could be exercised. While two basic modes of operation--exploring alternatives and testing sensitivities--are already apparent, we see many permutations because we will have the ability to selectively automate any or all of the agents. Moreover, with automated agents, we have the ability to operate with electronically connected, geographically dispersed teams. Given these capabilities, some interesting options become apparent and feasible:

1. By actively directing (free-playing) the BLUE agent, with all the other agents in their automated or programmed mode, it should be possible to explore--in a systematic, transparent, and reproducible way--options for the use of U.S. strategic forces under different circumstances and adversary behavior;
2. By playing FORCE, with all the other agents programmed, it should be possible to test different force structures or characteristics under controlled conditions for force-use plans and adversary behavior;

3. By playing RED, it should be possible to test the robustness of U.S. forces and plans against a variety of Soviet perceptions and initiatives; and
4. By playing SCENARIO, it should be possible to explore the importance of various political and military actions that might be undertaken by third parties to a strategic conflict between the Soviet Union and the United States.

If used in this way, the application and capabilities of the methodology are much closer to traditional analytical models than they are to gaming. While the structure and much of the nomenclature associated with this methodology have their origins in gaming, the interchangeable combination of people and computer programs in teams or agents represents a new and flexible analytical framework. At one extreme, a single analyst might exercise the methodology by manipulating the programmed agents to explore a particular issue under explicit contextual assumptions about adversary and alliance behavior, about force capabilities, etc. At the other extreme, several teams of people--including planners and decisionmakers--might direct the agents simultaneously in an exercise that would approach the character of the traditional political-military game.

When the new facility is up and running--even at its rudimentary stage for demonstration--some of us think that the horizons of our own strategic thinking are going to start expanding very rapidly. For we will have the means, the discipline, and the language in this structure to probe some very fundamental questions about why we have strategic forces and what differences they make under what kinds of circumstances.



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