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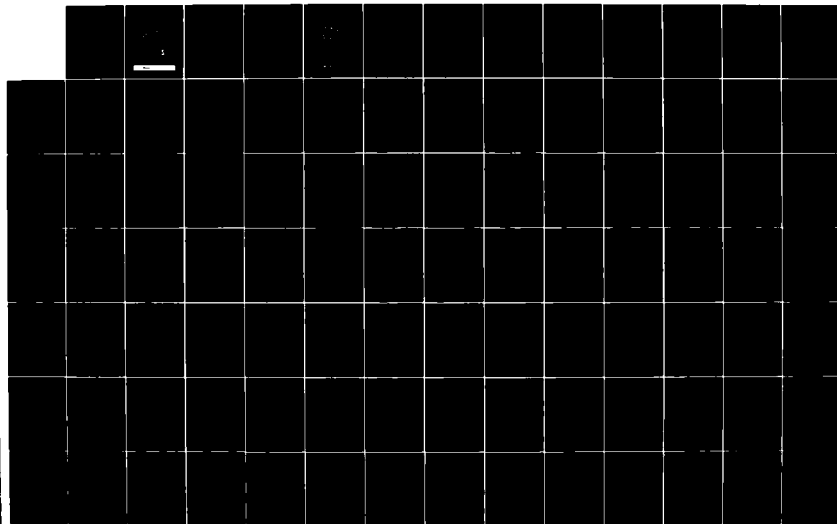
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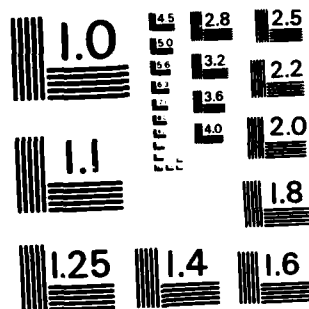
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A Rule-Based Policy-Level Model of Nonsuperpower Behavior in Strategic Conflicts

William Schwabe, Lewis M. Jamison

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December 1982

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PREFACE

This report describes the second-generation, Mark II, version of the Rand Strategy Assessment Center's Scenario Agent, a rule-based, policy-level computer model of international political-military behavior. The work was sponsored by the Director of Net Assessment in the Office of the Secretary of Defense, and by the Defense Nuclear Agency, under contract DNA-001-80-C-0298. Inquiries about and comments on this report are welcomed; they may be made directly to the authors or to Paul K. Davis, Director of the Rand Strategy Assessment Center.

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SUMMARY

This report describes the second-generation Scenario Agent, a rule-based, policy-level computer model of nonsuperpower behavior in strategic conflicts. Scenario Agent is a model within the Rand Strategy Assessment Center (RSAC) war gaming system. The report reviews the work completed on the model, the rationale behind the model's rules, and the need for refinement of the rules.

A primary goal of the RSAC is to model crises and conflicts that could arise between the United States and the Soviet Union, including strategic nuclear war. RSAC analysts are interested in learning more about the role of strategic nuclear forces in deterring war and the role of lesser conflicts as paths to major war. RSAC analysts are also interested in nonnuclear conflicts in their own right, so long as they involve the United States and the Soviet Union as the major contenders.

Because nonsuperpowers can play significant roles in U.S.-Soviet conflicts, the Scenario Agent model describes their possible behavior when that behavior may have a major impact on U.S.-Soviet conflicts.

Some aspects of nonsuperpower behavior could prove crucial in a U.S.-Soviet conflict:

- When or whether they grant access rights to the superpowers, including transit rights and the use of bases from which to launch attacks.
- When or whether they contribute forces to the main conflict.

Scenario Agent's principal output is this information, country by country and move by move. These outputs are then inputs to other parts of the RSAC gaming system, including the Red and Blue Agent models and Force Operations models.

Although this important information could simply be stated in a particular conflict scenario, such an approach could either unduly constrain the moves of the principal actors or could, if the principals proceeded in a manner unanticipated by the scenario drafters, lead to inappropriate nonsuperpower behavior after the first few moves.

To attempt to handle the problem by conventional decision analysis would be impractical because of the extreme complexity and uncertainty of the decision structure in all but the most simplified situations. The approach taken in Scenario Agent is to prescribe sets of rules by which the behavior of nonsuperpowers is determined.

There are many ways such rules could be formulated. Most involve a set of logical if-then statements, with or without factoring chance into

nonsuperpower decisions. Desire for analytic control and replicability led to development of a Scenario Agent that is deterministic, rather than Monte Carlo.

Any of several computer languages, such as FORTRAN, SIMSCRIPT, or INTERLISP, could have been used to code the rules. ROSIE,¹ the artificial-intelligence language used, was selected for its exceptional convenience in developing rule-based programs and because it allows the coded rules to closely resemble English.

Scenario Agent rules are organized as perception-response rule sets. Given the current military situation provided by Force Operations models, perception rules determine the level of threat, level of opportunity, and urgency of decisionmaking that each nonsuperpower perceives in that situation. These perceptions become inputs to response rules that determine whether the countries side with a superpower in the conflict, grant access to superpower armed forces, or involve their own forces in the conflict.

Analysts can control how the model's rules operate (1) by selecting initial nonsuperpower postures, (2) by setting parameters that choose among alternative available response rules, or (3) by revising the rules themselves. Initial nonsuperpower postures entered into the data base can be current real-world postures or other postures hypothesized for some future time. Analysts can set parameters to control how nonsuperpowers respond to threat or opportunity, or assert themselves independently. Both perception and response rules can be changed interactively, either before or during gaming exercises. Records of changes are logged automatically for future reference.

Scenario Agent generates a record of response events with a first-order rationale trace in terms of perceptions. This record is available to analysts during gaming.

Scenario Agent attempts to model those factors that the political scientists consulted believe might have a major effect on important nonsuperpower behavior in conflicts principally between the superpowers. Scenario Agent does *not* attempt to model situations in which nonsuperpowers are the principal adversaries. Hence in an RSAC exercise, analysts might attempt to model a superpower's intervention in a third country or a struggle between NATO and Warsaw Pact countries, but they would not attempt to model a local conflict that did not feature confrontation between the superpowers.

¹ROSIE is a trademark of The Rand Corporation. Scenario Agent is written in ROSIE (Rule-Oriented System for Implementing Expertise), a computer language that closely resembles English. ROSIE is documented by Fain et al. (1981, 1982) and Hayes-Roth et al. (1981).

Additional research and development will be required to refine and augment the current rules and to increase the scope of the rules as more conflict situations are developed for the RSAC gaming system.

ACKNOWLEDGMENTS

The authors wish to express their appreciation for the contributions of the many Rand colleagues who assisted in developing the Mark II version of Scenario Agent.

Paul Davis supported the development effort and offered valuable suggestions for this report. William Jones advised the authors on the use of war gaming in analysis and suggested several interface improvements. James A. Dewar began the Mark II development effort. David Stein suggested information sources for the country interviews and an initial format for the rule sets.

Margaret Krahanbuhl and Mary Morris helped to improve the method for determining country rules and furnished numerous rules concerning Southwest Asia. Alex Alexiev, Rene Herrmann, Norman Levin, and Major Shigeki Nishimura of the Japan Air Force also assisted in developing rules concerning country behavior. Yoav Ben-Horin, Kyong M. Jeon, Constance Lynch, Lorie Mylorie, John Von Oudenaren, and Gary Saymor offered ideas that helped with rule development.

Henry Sowizral advised the authors on ROSIE programming.

David McGarvey and Alan Platt reviewed the manuscript, suffering through modeling jargon the authors had mistakenly come to regard as standard English prose. The reviewers' suggestions on organization and presentation of content were invaluable.

The manuscript was edited by Patricia Bedrosian.

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GLOSSARY

Actor: the one country (or faction) whose behavior is currently being processed, as in "let the actor be Spain."

Advance: change the game-step and game-time, as in "go advance to bc.bd at 0800/100384," meaning to change the present game-point to "bc," the next game-point to "bd," the hour to "0800" (8:00 a.m.), the day to "10," the month to "3" (March), and the year to "84" (1984).

Ally: the superpower ally of a country, as inferred from the country's side or orientation, as in "let the actor's Ally be US."

Assert: a word in the ROSIE language meaning to add what follows to the data base, as in "assert Spain is a player."

Assess-effectiveness of <superpower>¹: the name of a rule set that assesses whether the named superpower is perceived as effective or ineffective in the current situation, as in "go assess-effectiveness of US."

Assess-opportunity: the name of a rule set that assesses the actor's opportunity as compelling, inviting, or indeterminate, as in "go assess-opportunity."

Assess-threat: the name of a rule set that assesses the threat to the actor as grave, indirectly-grave, serious, or indeterminate, as in "go assess-threat."

Battlefield-nuclear: a weapon's type consisting of battlefield nuclear weapons more lethal than atomic demolition munitions.

Blocked: indicates closure of a line of communication, as in "assert Strait-of-Hormuz is blocked."

Blue: indicates the United States, its allies, or interests, as in "display every Blue country" or "let the Blue Mid-East weapon's type be none."

Blue-major: major U.S. combat units are deployed in the country's territory, as in "let the superpower-presence of FRG be Blue-major."

Blue-token: U.S. combat forces are deployed in the country's territory but are so configured and postured that an attack against the country's territory might or might not involve them and, if it did, might or might

¹Angle brackets enclose variable names rather than values; in this case they indicate that the superpower, United States or Soviet Union, must be named.

not be enough to force automatic U.S. escalation, as in "let the superpower-presence of Egypt be Blue-token."

Blue-tripwire: significant U.S. combat forces are deployed in the country's territory and are so configured and postured that an attack against the country's territory would probably involve attacks on them, as in "let Italy's superpower-presence be Blue-tripwire."

Border: indicates geographic proximity, as in "assert USSR is mobilizing on (the border) of Turkey" or "assert Egypt does border on Israel."

Call-up: a level of preparedness in which a country is mobilizing or has mobilized many reserve components of armed forces, as in "let Poland's preparedness be call-up."

CBR: a weapon's type consisting of chemical, biological, or radiation (CBR) weapons, as in "let the Red European weapon's type be CBR."

Change me: expression used in messages from a country to indicate its posture preference, as in "request change me Blue cobelligerent."

Cobelligerent: a level of cooperation in which a country allows the use of its territory by the combat forces of its superpower affiliate (ally) as a launch area for attacks on the territory or forces of a third nation, as in "let the cooperation of UK be cobelligerent."

Compelling: a level of opportunity that strongly motivates a country to become a combatant against a potential enemy, as in "let Israel's opportunity be compelling."

Conflict location: a variable in the military situation in which combat operations are being conducted in or against a country's territory or are being conducted in the body of water indicated, as in "assert each of Iran, Oman and Indian Ocean-is a conflict location."

Conventional: a weapon's type consisting of other than nuclear, battlefield-nuclear, or CBR, as in "let the Blue Mid-East weapon's type be conventional."

Cooperation: an aspect of a country's posture specifying the degree of assistance the country does, or is prepared to, provide its superpower ally in a current conflict situation. The levels of cooperation are non-coordinate, coordinate, cobelligerent, and nuclear-releasor.

Coordinate: a level of cooperation in which a country allows land, sea, or air transit rights for the military forces of the superpower with which it is affiliated, as in "let Cuba's cooperation be coordinate."

Country: a nonsuperpower country or subnational faction, as in "assert each of France, Spain and PLO is a country." All named countries

appear in the Scenario Tableau, but Scenario Agent simulates only those countries also named as players.

Day-count: the number of days between the current game time and a reference date, as in "let the present-time be the day-count of the game-time."

Decide-posture: the name of a rule set that decides the posture of each player by calling upon subordinate rule sets, as in "go decide-posture."

Delay: the delay, computed in days, between the present time and a country's next decision time, as in "let the latest-response-date be the present-time + the actor's delay."

Deny: in the ROSIE language, a word meaning to delete what follows from the data base, as in "deny France is a conflict location."

Determine-alignment: the name of a rule set that determines the actor's superpower ally and opponent, as in "go determine-alignment."

Determine-initially-reliable-response: the name of the rule set that contains the initially reliable response pattern, as in "go determine-initially-reliable-response."

Determine-initially-reluctant-response: the name of the rule set that contains the initially reluctant response pattern, as in "go determine-initially-reluctant-response."

Determine-neutral-response: the name of the rule set that contains the neutral response pattern, as in "go determine-neutral-response."

Determine-opportunistic-response: the name of the rule set that contains the opportunistic response pattern, as in "go determine-opportunistic-response."

Determine-reliable-response: the name of the rule set that contains the reliable response pattern, as in "go determine-reliable-response."

Determine-reluctant-response: the name of the rule set that contains the reluctant response pattern, as in "go determine-reluctant-response."

Determine-situation: the name of the rule set that classifies the current situation as intercontinental war, theater war, or local conflict, as in "go determine-situation."

Economically-dependent: a condition of a country that is dependent on another country or on the continuation of a given situation or condition for the economic well-being of the country, as in "assert Japan is economically-dependent on Strait-of-Hormuz."

European-alerted: a level of European involvement in which a country is preparing for combat operations in Europe, as in "let France's European-involvement be European-alerted."

European-combatant: a level of European involvement in which a country's forces are engaged in combat in Europe, as in "let Canada's European-involvement be European-combatant."

European-involvement: an aspect of a country's posture that describes the involvement of its armed forces in the conflict in Europe; levels of European involvement are European-noncombatant, European-alerted, European-poised, European-mobilizing, European-on-call, European-combatant, and European-nuclear-combatant.

European-mobilizing: a level of European involvement in which a country is mobilizing reinforcements for combat in Europe, as in "if US's European-involvement = European-mobilizing, let GDR's threat be serious."

European-noncombatant: a level of European involvement in which a country is not engaged in nor preparing for combat in Europe.

European-nuclear-combatant: a level of European involvement in which a country is using nuclear weapons in combat in Europe, as in "let France's European-involvement be European-nuclear-combatant."

European-on-call: a level of European involvement in which a country has agreed to become a combatant in Europe if asked by its superpower ally, as in "let Italy's European-involvement be European-on-call."

European-poised: a level of European involvement in which a country has deployed components of its armed forces to initiating positions for combat in Europe, as in "let GDR's European-involvement be European-poised."

Firm: a level of resolve in which a country is very unlikely to change its side, as in "let UK's resolve be firm."

Follower of <country>: a country that will not ordinarily be more cooperative or involve itself more than the country it follows, as in "assert Kuwait is a follower of Saudi.Arabia."

Game-point: a point in the progression of moves during which time is considered to be frozen; a two letter identifier that is part of the game step, as in "let the game-point be bg."

Game-step: a move identifier consisting of the current game point, a period, and the next game point. When initiating a new series of moves, the first letter of the current game point identifies the branch of a

previous analysis, the second letter of the current game point identifies the point of current branching, the first letter of the next game point identifies the new move series, and the second letter of the next game point (usually an "a") identifies the first point in that analysis. Subsequent game steps have the same first letter in both game points; the second letter of the current and next game point progresses alphabetically.

Game-time: time at which a game point hypothetically occurs; written in the form hhmm/ddnnyy, where "hh" is hours (00-23), "mm" is minutes (00-59), "dd" is day (01-31), "nn" is month (01-12), and "yy" is the final two digits of year (00-99), as in "go advance to rw.sa at 0400/011285."

GCC: Gulf Cooperation Council, a group of Persian Gulf states consisting of Bahrain, Kuwait, Oman, Saudi Arabia, Qatar, and the UAE (United Arab Emirates).

Go: in the ROSIE language, a word used to transfer control to a specified rule set, as in "go write-tableau." In the current implementation of ROSIE the use of "go" is optional.

Grave: a level of perceived threat to a country, which viewed narrowly or in terms of its near-term consequences, is equivalent to actual or imminent bombardment or invasion, as in "if the actor is a location of conflict, let the actor's threat be grave."

Indeterminate: default value for threat, opportunity, ally, and opponent, as in "let the actor's threat be indeterminate."

Indirectly-grave: a level of perceived threat to a country, which, viewed broadly or in terms of its long-term consequences, is equivalent to actual or imminent bombardment or invasion.

Indirectly-serious: a level of perceived threat to a country, which, viewed broadly or in terms of its long-term consequences, is equivalent to a potential enemy's preparing for combat.

Initially-reliable: a country's assumed temperament characterized by an initial willingness to comply with its superpower ally's preferences, up to the point at which the superpower asks the country to involve its forces in the conflict, when the country becomes reluctant.

Initially-reluctant: a country's assumed temperament characterized by an initial reluctance to become involved in conflict, changing to willingness to comply with its superpower ally's preferences once the country perceives that the conflict situation is a serious threat to its interests.

Intend-to-attack: an assumed intent of a superpower to attack a specified country, sufficient to cause that country to perceive a grave threat, as in "assert USSR does intend-to-attack Iran."

Intercontinental: a weapon usage applied to a weapon with long-range capability, as in "let the Red intercontinental weapon's type be nuclear."

Intercontinental-war: a situation description for a war being fought on more than one continent, as in "if each of US and USSR is a conflict location, let the situation be intercontinental-war."

Inviting: a perceived opportunity tending to invite a country to prepare for combat against a potential enemy, as in "let Turkey's opportunity be inviting."

Involvement: see Mid-East-involvement and European-involvement.

Latest-response-date: the sum of the present time and the actor's computed delay, given its perceived threat and assumed temperament, as in "if the actor's next-decision-time > the latest-response-date, let the actor's next-decision-time be the latest-response-date."

Leader: a nonsuperpower that other countries follow in the sense of not becoming more involved in a conflict than the leader, as in "assert FRG is a leader and each of Italy and Netherlands is a follower of FRG."

Let: in the ROSIE language, a word meaning to replace an item in the data base with what follows, as in "let Yugoslavia's side be Red." It is equivalent to a "deny" statement followed by an "assert" statement, as in "deny Yugoslavia's side is White" and "assert Yugoslavia's side is Red."

Log: a computer file that records everything appearing on the Scenario Agent operator's video display.

Local-conflict: a situation description for a conflict that may involve no more than one superpower, as in "let the situation be local-conflict."

Match: in the ROSIE language, a word meaning to compare the value of a variable with a specified pattern, as in "match the actor's temperament {reliable} determine-reliable-response," which transfers control to the rule set "determine-reliable-response" if the actor's temperament is reliable.

Mid-East-alerted: a level of Mid-East involvement in which a country is preparing for combat operations in the Mid-East, as in "let France's Mid-East-involvement be Mid-East-alerted."

Mid-East-combatant: a level of Mid-East involvement in which a country's forces are engaged in combat in the Mid-East, as in "let Canada's Mid-East-involvement be Mid-East-combatant."

Mid-East-nuclear-combatant: a level of Mid-East involvement in which a country is using nuclear weapons in combat in the Mid-East, as in "let France's Mid-East-involvement be Mid-East-nuclear-combatant."

Mid-East-involvement: an aspect of a country's posture that describes the involvement of its armed forces in the conflict in the Mid-East; levels of Mid-East involvement are Mid-East-noncombatant, Mid-East-alerted, Mid-East-poised, Mid-East-mobilizing, Mid-East-on-call, Mid-East-combatant, and Mid-East-nuclear-combatant.

Mid-East-mobilizing: a level of Mid-East involvement in which a country is mobilizing reinforcements for combat in the Mid-East, as in "if US's Mid-East-involvement = Mid-East-mobilizing, let GDR's threat be serious."

Mid-East-noncombatant: a level of Mid-East involvement in which a country is not engaged in nor preparing for combat in the Mid-East.

Mid-East-on-call: a level of Mid-East-involvement in which a country has agreed to become a combatant in the Mid-East if asked by its superpower ally, as in "let Italy's Mid-East-involvement be Mid-East-on-call."

Mid-East-poised: a level of Mid-East-involvement in which a country has deployed components of its armed forces to initiating positions for combat in the Mid-East, as in "let GDR's Mid-East-involvement be Mid-East-poised."

Militarily-strong: a level of military strength of a country (excluding superpowers) greater than that of neighbors.

Militarily-average: a level of military strength of a country (excluding superpowers) that is not strong or weak.

Militarily-weak: a level of military strength of a country (excluding superpowers) weaker than that of neighbors.

Mobilized: a level of preparedness in which a country is mobilizing or has mobilized all reserve components of armed forces; conscripting at wartime levels, as in "let France's preparedness be mobilized."

Mobilized on (the border)²of <country>: armed forces of a country are mobilized on the border of the specified country, a factor in threat perception, as in "assert USSR is mobilized on (the border) of Iran."

²The parentheses around "the border" are necessary to avoid ambiguous interpretation in ROSIE.

Moderate: a level of resolve in which a country is relatively unlikely to change its side.

Move: the name of a rule set that determines perception and response of the player specified as the actor, as in "for each leader that is a player, let the actor be that leader and go move."

Neutral: a country's assumed temperament characterized by unwillingness to become involved in conflict unless attacked, as in "if the actor's temperament = neutral, go determine-neutral-response."

Next-decision-time: the computed time in days of a country's next decision to respond to the situation, as in "let the actor's next-decision-time be the present-time."

Noncoordinate: a level of cooperation in which a country is not granting land, sea, or air transit rights for the military forces of either superpower, as in "let France's cooperation be noncoordinate."

Nonsuperpower: a country other than the United States or the Soviet Union.

No-presence: a level of superpower presence in which no military forces of either superpower are stationed in the country.

Normal: a level of preparedness in which a country is not mobilized for war, as in "let Egypt's preparedness be normal."

Nuclear: a weapon's type consisting of nuclear weapons, as in "if the Red intercontinental weapon's type = nuclear, let the situation be intercontinental-war."

Nuclear-capable: a characterization of a country assumed to have independent control over nuclear weapons.

Nuclear conflict location: a country or place where hostile nuclear weapons are being exploded, as in "assert FRG is a nuclear conflict location."

Nuclear-releasor: a level of cooperation in which a country is cooperating to the maximum extent with its superpower ally, including agreeing with its ally on the use of nuclear weapons, as in "if FRG's cooperation = nuclear-releasor, let GDR's threat be grave."

Opponent: the superpower opponent of a country, as inferred from the country's side or orientation, as in "let the actor's Opponent be US."

Opportunity: a perception of benefit in becoming a combatant; levels of opportunity are compelling, inviting, and indeterminate, as in "let Poland's opportunity be indeterminate."

Opportunistic: a country's assumed temperament characterized by inclinations to strike potential enemies, to attempt independent deterrence, and to make accommodations with an overwhelmingly powerful opponent.

Orientation: a country's assumed alignment with respect to broad, long-term political, economic, social, and cultural values; orientation may be Red, Blue, or White, as in "let Qatar's side be Blue and let Qatar's orientation be White."

Player: a country that is being simulated by Scenario Agent. The postures of countries that are not players are not changed by rules, but may be changed by operator intervention. As in "assert each of France and Poland is a player and deny Djibouti is a player."

Posture: a position taken by a country; posture aspects include side, cooperation, European involvement, Mid-East involvement, and preparedness, as in "if there is a posture such that that posture is a preference of (USSR) for Poland...."

Potential-enemy: a country that, by assumption, another country might engage in combat, were there to be a compelling opportunity to do so, as in "assert Greece is a potential-enemy of Turkey."

Preference: expression of a superpower political move, as in "assert each of Blue, cobelligerent and Mid-East combatant is a preference of (US) for each of UK, France, Turkey and Egypt."

Preparedness: an aspect of posture reflecting a country's political and economic preparations for combat. Levels of preparedness are normal, call-up, and mobilized.

Present-time: the day count of the current game time, as in "display the present-time."

Provably true: a ROSIE language term designating something that can be proved true from information in the data base, as in "if 'USSR is a conflict location'³ is not provably true, assert US is not effective in Europe." In this example, if there is nothing in the data base about USSR's being or not being a conflict location, then 'USSR is a conflict location' is not provably true. This is *not* the same as "if USSR is not a conflict location," which is true (to Scenario Agent) only if the data base contains positive information that the USSR is not a conflict location.

Red: indicates the Soviet Union, its allies, or interests, as in "display every Red country" or "let the Red Mid-East weapon's type be none."

³Single quotes (') are used in ROSIE to delimit a simple ROSIE sentence, called a proposition, that can be treated as a data element.

Red-major: major Soviet combat units are deployed in the country's territory, as in "let the superpower-presence of GDR be Red-major."

Red-token: Soviet combat forces are deployed in the country's territory but are so configured and postured that an attack against the country's territory might or might not involve them and, if it did, might or might not be enough to force automatic Soviet escalation, as in "let the superpower-presence of Syria be Red-token."

Red-tripwire: significant Soviet combat forces are deployed in the country's territory and are so configured and postured that an attack against the country's territory would probably involve attacks on them, as in "let Poland's superpower-presence be Red-tripwire."

Reference: reference time from which the present time is computed, as in "let the reference be 0001/010185."

Reliable: a country's assumed temperament characterized by willingness to comply with its superpower ally's preferences.

Reluctant: a country's assumed temperament characterized by relatively slow response that is motivated primarily by perceived threat.

Request: expression used in messages from a country, as in "request change me Blue cobelligerent."

Resolve: an indication of a country's commitment to the side it has taken in the current conflict. The degrees of resolve are firm, moderate, and soft.

Response pattern: a set of response rules associated with a temperament.

Return: in the ROSIE language, a word meaning either (a) to return control to the rule from which the current rule was called or (b) a terminal or printer carriage return. The second meaning applies to use of the word "return" appearing in an expression enclosed in braces, as in "send {the actor, "assessed its posture.", return} and return." In this case the first "return" is a carriage return and the second "return" causes control to return to the calling rule.

ROSIE: Rule-Oriented System for Implementing Expertise, a Rand trademark for the English-like computer programming language used to program the Scenario Agent.

Rule: a computer-executable statement, often of the type "if <condition>, <action>." Scenario Agent is a rule-based model.

Rule set: a collection of rules that may be a ROSIE procedure, generator, or predicate. Similar to "subroutine" or "function" in other computer languages.

Schedule response: the name of a rule set that computes the actor's next decision time, as in "go schedule response."

Scenario Agent: the Rand Strategy Assessment Center (RSAC) model of nonsuperpower behavior.

Scenario country: a country other than the United States or the Soviet Union that is modeled or can be modeled by the Scenario Agent.

Scenario Tableau: an output of Scenario Agent that lists all countries and posture positions and serves as an input to Red and Blue Agents.

Scripted input: a predetermined perception or response that augments or overrides rule-based perception or response.

Send: in the ROSIE language, a word meaning to send what follows to the computer terminal or to a specified computer file, as in "send ("ERROR", return)."

Serious: a level of perceived threat to a country, which, viewed narrowly or in terms of its near-term consequences, is equivalent to a potential enemy's preparing for combat.

Side: an indication of a country's alignment in the current conflict. May be Red, Blue, or White.

Situation: a simple description of the military situation. May be local conflict, theater war, or intercontinental war. As in "let the situation be theater-war."

Soft: a level of resolve in which a country is relatively likely to change its side, as in "let France's resolve be soft."

Strength: a rating of the capability of the country's military forces relative to its regional neighbors and excluding the superpowers. The rating is based on comparative totals of armed forces personnel; levels are militarily-strong, militarily-average, and militarily-weak.

Superpower: the United States or the Soviet Union.

Superpower-presence: a measure of the type and size of superpower armed forces in the territory of a country or in a major body of water. The types of superpower presence are Blue-major, Blue-tripwire, Blue-token, Red-major, Red-tripwire, Red-token, and no-presence.

Tableau: see Scenario Tableau.

Temperament: a simple description of national behavior with which a response pattern (rule set) is associated, as in "let UK's temperament be reliable." A country's temperament can be reliable, reluctant, initially reliable, initially reluctant, neutral, or opportunistic.

Theater-war: a situation description for a level of conflict in which the United States and the Soviet Union are both involved in direct combat, but which is restricted to one theater or region.

Threat: a country's perception of potential harm to its well-being from an event or events in a specific world situation. Threat may be grave, indirectly grave, serious, potentially serious, or indeterminate.

Weapon's type: most lethal (or otherwise most significant) weapon type in use at the current time by a specified side in a specified theater. The types of weapons are nuclear, battlefield nuclear, conventional, and none. As in "let the Red intercontinental weapon's type be none and the Red European-weapon's type be conventional."

White: indicating coincidence of interest with neither superpower; used as a side, indicates coincidence of interest in relation to conflict; used as an orientation, indicates coincidence of interest in relation to economic, political, and cultural interests, as in "display every White country; used in the identification of a weapon's type, indicates non-aligned combatant, as in "let the White Mid-East weapon's type be none."

Write-tableau: the name of a rule set that writes a posture summary (tableau) by country for Red and Blue Agents, as in "go write-tableau."

I. INTRODUCTION

PURPOSE OF THE REPORT

This report describes the second-generation version of Scenario Agent, a rule-based, policy-level computer model of nonsuperpower behavior in strategic conflicts. Scenario Agent is a model within the Rand Strategy Assessment Center (RSAC) war gaming system. The report reviews the work completed on the model, the rationale behind the model's rules, and the need for refinement of the rules.

THE NEED FOR THE MODEL

The RSAC is being developed to improve the quality of analysis of strategic issues by combining the best features of political-military war gaming and analytic modeling. Development activities include automated war gaming, rule-based modeling, and analytically structured campaign analysis. Readers are referred to Davis and Winnefeld (1983) for an overall description of the RSAC.

A primary aim of the RSAC analysts is to model intense crises and conflicts that could arise between the United States and the Soviet Union, including strategic nuclear war. Of special interest is the role of strategic nuclear forces in deterring war and also the role of lesser conflicts as paths to major war. RSAC analysts are also interested in nonnuclear conflicts in their own right, so long as they involve the United States and the Soviet Union as the major contenders.

Other countries can play significant roles in conflicts between the two superpowers, and the Scenario Agent model describes their possible behavior, but only to the extent needed to determine how the superpower conflict develops.

Scenario Agent attempts to model those factors that political scientists believe might have a major effect on important nonsuperpower behavior in conflicts that are principally between the superpowers. Scenario Agent does *not* attempt to model situations in which nonsuperpowers are the principal adversaries. Hence, RSAC might attempt to model a superpower intervention in a third world country or a struggle between NATO and Warsaw Pact countries, but it would not attempt to model a local conflict that did not feature at least one superpower in a leading role.

Nonsuperpower actions believed to be of first-order importance in a conflict between the United States and the Soviet Union include:

- When and whether they grant the superpowers access rights—including transit rights and the use of bases from which to launch attacks.
- When and whether they contribute forces to the main conflict.

Scenario Agent's principal outputs delineate these factors, country by country and move by move. These outputs are then inputs to other parts of the RSAC gaming system.

WORK COMPLETED

The RSAC effort is an on-going research and development program. To date, considerable work in modeling nonsuperpower behavior has been completed, and some gaming using the Scenario Agent model has been conducted.

The Mark I (or first-generation) version of Scenario Agent was demonstrated in January 1981. That work is documented in Dewar, Schwabe, and McNaugher (1982).

Mark II modeling began with a series of interviews of Rand colleagues with expertise in regional security. These interviews were designed to uncover any other features of nonsuperpower behavior that should be modeled, appropriate concepts for nonsuperpower decisionmaking, and rules for transforming Scenario Agent inputs into outputs.

Several alternative designs were considered. These included

- *Reorganized Mark I.* This design would involve simply reorganizing the rules developed for the Mark I demonstration, so that all rules producing a given action would be grouped together. This would improve maintainability of the model somewhat, but because the design would continue to require that groups of countries be processed together, rather than individual countries, including needed country-specific rules became too difficult.
- *Concept Hierarchy.* This design would also allow for the organization rules by the action they produce, but would allow countries to be processed individually. ROSIE¹ language capabilities

¹Scenario Agent is written in ROSIE (Rule-Oriented System for Implementing Expertise), a computer language that closely resembles English. ROSIE is documented by Fain et al. (1981, 1982) and Hayes-Roth et al. (1981). ROSIE is a trademark of The Rand Corporation.

would be exploited more fully, by writing high-level rules using terms operationally defined by lower-level rules. A five-level rule hierarchy was envisioned. The design was rejected, not because of its hierarchical features (which seem desirable), but because of running-time problems, complexity, and the reluctance of experts to consider output actions separately.

- *Empirical-Theoretical.* This design would draw from theoretical work based on empirical studies described in the literature on conflict resolution and strategic warning indicators.² This approach was rejected (1) because the empirical base consists almost entirely of postwar crises of significantly lesser magnitude than those gamed in RSAC exercises and (2) because there was concern that some users might not be comfortable with an unfamiliar theory embedded in the model.
- *Satisficing.* This design would consider risks and benefits of alternative nonsuperpower actions and accept the first alternative in an ordered list that met threshold criteria.³ It was rejected because of lack of consensus on the appropriate algorithm and threshold criteria.
- *Opportunistic.* This design would base nonsuperpower decisions on opportunities to achieve long-standing national goals. It seemed a poor basis for an overall model, but opportunistic rules are included in the final design.
- *Policy-Oriented.* This design would make decisions in accordance with each country's policies on homeland defense, regional security, nuclear deterrence, and energy. Within each of these four policy areas, separate rule sets would be developed to execute particular policies. The particular policies for each nonsuperpower would be set by the analyst, rather than by model rules. The design was rejected because, in practice, it encouraged more distracting theoretical debates about nonsuperpower actions than was desirable for the RSAC.
- *Perception-Decision Style.* This design would allow for the separation of perception and decision. Alternative rule sets would be developed for vigilant, hypervigilant, and avoidant perception patterns or styles (Janis and Mann, 1977). Additional alternative rule sets would be developed for bureaucratic, ideological, and uncommitted decision styles (Steinbruner, 1974). Perception and decision style parameters would be set by the analyst.

²This literature is reviewed in Singer (1981) and Eberwein (1981).

³This is in contrast to optimizing, in which the best alternative is accepted. The concept of satisficing is developed in Simon (1969).

Aspects of this approach affected our work, but as a design it was rejected because of concern that some users would be uncomfortable with its theoretical basis or with use of such terms as hypervigilant. Also, it would require a more complex Scenario Agent than seemed suitable for RSAC applications.

- *Perception-Response*. This is the design that was adopted. It separates perception and response. Perception rules simulate perception of threat, urgency, and opportunity, and they include general and country-specific rules. Response consists of response to threat, response to opportunity, and assertive response (which can include independent deterrence). This design was adopted because it was not wedded to any particular theory, and it combined desirable features from several of the other designs. This preference for an empirical/parametric approach followed from our desire not to encumber RSAC operations with constant arguments about political science theories when RSAC emphasis is on U.S.-Soviet conflict.

The first of three panels was convened in January 1982 to review concepts and alternative Scenario Agent designs. As a result, agreement was reached on which nonsuperpower actions needed to be modeled.

With the selection of the perception-response design, additional interviews were conducted using hypothetical conflict situations to elicit rules appropriate to the design. The rules were then structured so that all countries respond to threat. Analyst selection of each non-superpower's temperament parameter determines which of several threat response rule sets are applied. Opportunistic and assertive response patterns are options under analyst control. These and other major variables are summarized in Table 1. Sections II and III describe the model in detail.

The perception-response design was next reviewed by a panel in April 1982.

A series of illustrative gaming experiments was conducted in the spring of 1982 (these are documented in Winnefeld (1982)). Scenario Agent performed satisfactorily during these games.

Six additional gaming exercises were conducted in June 1982. These exercises were specifically designed to use Scenario Agent to explore the sensitivity of game outcomes to changes in nonsuperpower behavior. They are documented in Schwabe (forthcoming).

A third review panel convened in August 1982 to discuss threat rules and lessons learned from gaming. The review resulted in additional threat categories, improvements to threat rules, and the addition of leader-follower rules.

Table 1

SCENARIO AGENT VARIABLES

Type	Name	Permissible Values
Military situation	Red/Blue intercontinental weapon's type	Nuclear, none
	Red/Blue Mid-East/European weapon's type	Nuclear, battlefield-nuclear, CBR, ^a conventional, none
	Red/Blue superpower-presence	Major, tripwire, token, no presence
	Conflict location	Country/place name
Perception	Threat	Grave, indirectly grave, serious, indirectly serious, indeterminate
	Opportunity	Compelling, inviting, indeterminate
	Next decision time	As computed
Parameter	Orientation	Red, Blue, White
	Temperament	Reliable, reluctant, initially reliable, initially reluctant, neutral
	Leader/follower	Optional, as designated
	Opportunistic	Optional, as designated
	Assertive	Optional, as designated
Response	Side	Red, Blue, White
	Resolve	Firm, moderate, soft
	Cooperation	Noncoordinate, coordinate, cobelligerent, nuclear-releasor
	Mid-East/European involvement	Alerted, poised, mobilizing, on-call, combatant, nuclear combatant
	Preparedness	Normal, call-up, mobilized

^aChemical, biological, or radiation weapons.

ADEQUACY OF THE MODEL

The RSAC is conceived as providing an integrating structure for strategy assessment. The role of Scenario Agent is to introduce effects of international political-military behavior into an analytic structure that also considers effects of force structure and weapons capabilities (from Force Operations models), effects of asymmetries in superpower decisionmaking (from Blue and Red Agents), and effects of event timing (from Systems Monitor).

Scenario Agent is designed to help analysts think deeply about scenario effects by providing an efficient and transparent mechanism for doing so. Given the multidimensional nature of scenarios and the many interrelationships among the political decisions and military actions of the various countries, it is impractical to expect serious scenario work without such a mechanism. The human mind tends to work linearly and to focus implicitly on a few variables. Experience results in subconscious models with far greater complexity, but these models are neither readily accessible nor logically taut. It is an article of faith in our work with Scenario Agent that the process of building formal models, however primitive, will prove to be enlightening and powerful in avoiding the prejudices that have caused many policy errors in the past.

As currently implemented, Scenario Agent does not maintain separate data bases of the political world as seen by Blue and Red, respectively. Separate data bases could be maintained, although they would slow program execution somewhat and would complicate postgame analysis.

The Mark II Scenario Agent appears to be adequate in structure for a broad range of strategy analyses. The standard rules described in this report will have to be refined through use in analyses. Specialized analyses will require augmenting the standard system with alternative rule sets that are more detailed and sophisticated. One of the principal virtues of the Mark II design is that it will accommodate such augmentation readily.

Behavioral Adequacy

By behavioral adequacy we mean whether the national behavior simulated by Scenario Agent is adequate for strategy assessment.

Potentially Significant Behavior. Because the RSAC emphasis is on analyzing strategies for crisis and conflict between the United States and the Soviet Union, as opposed to analysis of peacetime political posturing or analysis of nonsuperpower behavior per se, the design focuses on certain aspects of national posture that could affect the superpower conflict:

- *Side* in a conflict and *resolve* to maintain that side;
- *Cooperation* with superpower requests for logistics access (overflight, transit, and support basing rights) or combat access (authorization to launch attacks from the country's territory);
- National *preparedness* (such as mobilizing reserve forces or industry for war); and
- *Involvement* of nonsuperpower armed forces, to include alerting forces, making them "on-call" to a superpower ally, engaging in combat, or withdrawing from combat.

To date, this relatively small repertoire of actions has been adequate for the elements of strategy assessed in the RSAC.

Monolithic Decisionmaking. Scenario Agent treats governments as monolithic decisionmaking bodies. This treatment is unavoidable, given that we wish to simulate many countries while focusing game play on military aspects of the superpower conflict. For similar reasons (as well as the need for computer efficiency), it would be inappropriate to design separate models for every nonsuperpower. Instead, we have developed rule set modules for a few generic response patterns. The response pattern to be used for each nonsuperpower can be specified by the analyst or can be selected by a rule set. General rule sets have been developed for reliable, reluctant, initially reliable, initially reluctant, and neutral response patterns. These can be augmented by opportunistic and assertive response patterns.

Deterministic Behavior. All RSAC models, including Scenario Agent, are deterministic. Some consideration was given to designing Scenario Agent as a Monte Carlo simulation, but this method was rejected because of a desire for analytic control and replicability and a lack of adequate statistical bases for necessary probability distributions.

Plausible Heuristic Rules. Since there exists no comprehensive and rigorous world model of political-military behavior, we cannot derive an approximation from others' work. Instead, we must use experience and reason to create plausible heuristic rules by hypothesis. We can test the rules by seeing whether they reflect phenomena known or thought to be critical, and by seeing whether model results are plausible when examined case by case. We cannot, however, test the rules against empirical data except to a very limited degree, as there are minimal data on superpower crises in the nuclear era. Thus, it is all the more important to regard the Scenario Agent not as an answer machine or repository of truth, but as a repository for expert opinion and an analytic device for exploring a broad range of plausible scenarios.

It is not difficult to imagine scenarios in which certain of the rules misfire; that is, a threat is perceived or a response taken that is implausible in some situation. It is helpful for political scientists to point out

nuances in situations, but it is neither possible nor desirable to capture all nuances in Scenario Agent rules. It would not be difficult to write a dozen rules on any particular historic antagonism (such as Greece-Turkey, PRC-Taiwan, or Israel-Syria) or other situations if there were a need to do so. For example of this capability, see Rule Set Augmentation, Sec. III.

The currently developed rules illustrate the types of nonsuperpower behavior that can be simulated by the Mark II version of Scenario Agent. Though several of the rules are substantive, we do not claim that they are definitive. We envision that some (perhaps most) RSAC users will choose not to devote their resources to extensive research on and refinement of nonsuperpower behavior rules. Instead, they will choose to use a nominal case set of Scenario Agent rules. We do not yet have sufficient confidence in the currently available rule sets to recommend their use as a standard.

Operational Adequacy

By operational adequacy we mean the adequacy of the way Scenario Agent is operated in RSAC gaming exercises. Operations include both setting up the model's data base, parameters, and rules for gaming and operating the computer terminal.

Data Base Set-Up. Every game begins with an initiating scenario. This requires the entry of initiating data into the Scenario Agent data base. Scenario Agent's standard format output (Scenario Tableau) facilitates specification of initiating scenarios. Current means for setting up the data base appear to be adequate for gaming. Automating data base preparation further would be straightforward.

Parameter Set-Up. Scenario Agent allows an analyst to control scenario development through nonsuperpower actions by specifying five assumptions about each nonsuperpower. These assumptions (with names of input variables underlined) are:

- The basic political, cultural, or economic *orientation* of the country—does it tend to support the objectives of the United States (Blue), the Soviet Union (Red), or neither (White);
- The *temperament* of the country—does it tend to act as a reliable ally, as a reluctant ally, as an initially reliable or initially reluctant ally, or as a neutral country;
- Whether the country is likely to be a *leader* or *follower* of other specified nonsuperpowers;
- Whether the country is likely to be *opportunistic* in initiating combat against specified potential enemies that become disadvantaged; and

- Whether the country is likely to be *assertive* in seeking superpower aid or, if nuclear-capable, in attempting independent deterrence.

Experience to date suggests that these parameters give users adequate control over nonsuperpower behavior for gaming purposes.

Rule Changes. The modular design of Scenario Agent, together with user-friendly features of the ROSIE operating system, make it exceptionally easy to change the rules as necessary for particular gaming exercises.

Terminal Operation. At present, the operator must know the ROSIE language and the Scenario Agent design. In return, the design allows rule changes, rule overrides, and error tracing from the operator's terminal during gaming exercises. This currently requires substantial keyboarding; such operation is appropriate for a research prototype, but not for a final, engineered software system. We are now exploring more efficient displays and editors.

Technical Adequacy

By technical adequacy we mean whether the Scenario Agent computer programs are adequate for the RSAC computer processing system.

The ROSIE computer language was designed for applications such as Scenario Agent—heuristic models whose credibility is essential to their utility. ROSIE enhances credibility by allowing source code to be written in a form that can be read much as English. It provides logical structures that are useful for heuristic modeling. ROSIE has worked well in the Scenario Agent application, except that it executes relatively slowly, its DEC-2060 implementation had rather limited rule and data capacity, and it is somewhat expensive to run. Work is on-going at Rand to improve ROSIE's speed by basing ROSIE on the lower-level C language, rather than on the slower INTERLISP language. ROSIE is currently running on the DEC VAX 11/780 computer, which has greater storage capacity than the DEC-2060, but which is slower. Alternatives to the current ROSIE implementation include reprogramming Scenario Agent in the C language (the language used for the Red and Blue Agent programs) or in a faster C-based version of ROSIE. Both of these alternatives are currently being explored.

Some features of the current design and ultimate requirements are compared in Table 2.

Table 2

CURRENT DESIGN AND ULTIMATE REQUIREMENTS

Aspect of Design	Current	Ultimate Requirement
Decision model	Monolithic national decisionmaker	Same
	Incremental, not goal-directed	Same
	Primarily responsive, but with optional provision for independent agenda	Same, plus more specific national agenda
	Deterministic	Same
Action repertoire	Side, resolve, cooperation, preparedness, and involvement	Same, less preparedness, plus limited force orders and improved coalition dynamics
Knowledge base	Alternative behavioral rules	Expanded and improved
	Country and force data	Same, plus locations of own force foreign deployments, more precise information on enemy, and more information on political, military, and economic dependencies
	Capacity for about 100 rules	Capacity for 500 rules
Execution speed	2-10 minutes to decide posture, depending on time-share load	1 minute or less to decide posture

THE NEED FOR AND ORGANIZATION OF THIS REPORT

As noted above, there is need for further refinement of Scenario Agent rules. Rule refinement will require communication between modelers and political-military specialists. These specialists will need some understanding of Scenario Agent's behavioral design and the behavioral rules they are augmenting, replacing, or otherwise refining. This report fills that need. Section II of the report describes Scenario Agent design in some detail. Its first subsection gives an overview of Scenario Agent's

role in the RSAC gaming system. The second subsection describes Scenario Agent's behavioral design—what national decisions the model can simulate and what concepts it manipulates. Section III of the report describes Scenario Agent's rules and data. It would not ordinarily be reasonable to expect qualitatively oriented specialists to understand source code in a simulation model; however, ROSIE's readability gives nonprogrammers direct access to the code. The first subsection of Sec. III lists and explains all the important rules on threat perception, threat response, urgency perception, opportunity perception, opportunity response, and assertiveness.

As rules are refined, maintenance and reprogramming of the model will be required. This report documents the current model in sufficient detail to serve as a reference for maintenance and reprogramming. The final subsection of Sec. II describes Scenario Agent's technical design. The second subsection of Sec. III describes the service rules. Service rules have little to do with national behavior, but they interact with behavioral rule sets to make the model work. The final subsection of Sec. III describes procedures for changing Scenario Agent rules. Appendix A lists all the Scenario Agent rules. Appendix B lists an entire data base.

The report provides information needed to use the model in RSAC gaming. Section III's description of the rules includes commentary in footnotes pertaining to data required to "feed" the rules. The data base listing in Appendix B should also be helpful in setting up initiating scenario data bases. Information needed to set up behavioral parameters appears in the third subsection of Sec. II, dealing with the model's operational design. Effects of parameters on national behavior are discussed. A more precise understanding of the effects of parametric changes can be obtained by reading the first subsection of Sec. III, dealing with the behavioral rules.

II. SCENARIO AGENT DESIGN

In this section we describe Scenario Agent's role in RSAC gaming; the behavioral design of the model and the rationale behind it; the operational design and interface with the analyst; and the technical design.

SCENARIO AGENT ROLE IN RSAC GAMING¹

The RSAC gaming system enables some or all of the functions traditionally performed by human teams to be performed by computer programs. Computers have been used for several years to assist war gamers with computations, data maintenance, and communication. In RSAC automated war gaming, artificial intelligence computer programs can, with human supervision, substitute for human players. Humans may still play, if desired, and in any case are needed to check program decisions, but using the computer models speeds play, promotes consistency, reduces human error, and improves control.

The basic structure of a traditional political-military war game includes Red and Blue major player teams (representing the United States and the Soviet Union) and a control team. Red and Blue make moves consisting of force orders processed by the control team and requests addressed to the other major player or to nonsuperpowers represented by the control team. Requests may solicit information or action. The control team provides current information on the military situation, generates responses from nonsuperpowers, and advances time.

¹Davis and Winnefeld (1983), which contains a thorough treatment of RSAC capabilities and limitations, amplifies this section. Readers who want detailed information on RSAC capabilities are referred to Steeb and Gillogly (forthcoming) for a description of Mark III Red and Blue Agent control systems; to Jones, LaCasse, and LaCasse (forthcoming) for similar information on the Mark II Red and Blue Agent control systems; to Davis and Williams (1982) for information on Force Operations model; and to Levine and Winnefeld (forthcoming) for information on analytically structured campaign analysis.

Readers interested in the history of RSAC concepts are referred to Jones (1980) for background on escalation space taxonomies; to Graubard and Builder (1980) for the earliest published description of the RSAC; and to Dewar, Schwabe, and McNaugher (1982) for a description of the Mark I Scenario Agent.

New users are encouraged to read Winnefeld (1982) and Schwabe (forthcoming). Winnefeld describes the first series of experiments Rand conducted using the Mark II RSAC. Schwabe describes exploratory research using Scenario Agent to focus on nonsuperpower behavior affecting strategy assessment.

RSAC automated war gaming divides the control team into three parts, as shown in Fig. 1. Force Operations programs process Red and Blue force orders and provide information on the military situation. Scenario Agent provides information on the political situation, processes requests to nonsuperpowers, and generates nonsuperpower responses. Systems Monitor advances time and communicates requests between Red and Blue.

Scenario Agent provides Red and Blue with a tabular summary of the political situation, by country; this is one of the standard inputs to Red and Blue decisionmaking. This summary, called the Scenario Tableau, displays aspects of each country's posture that is assumed to be public

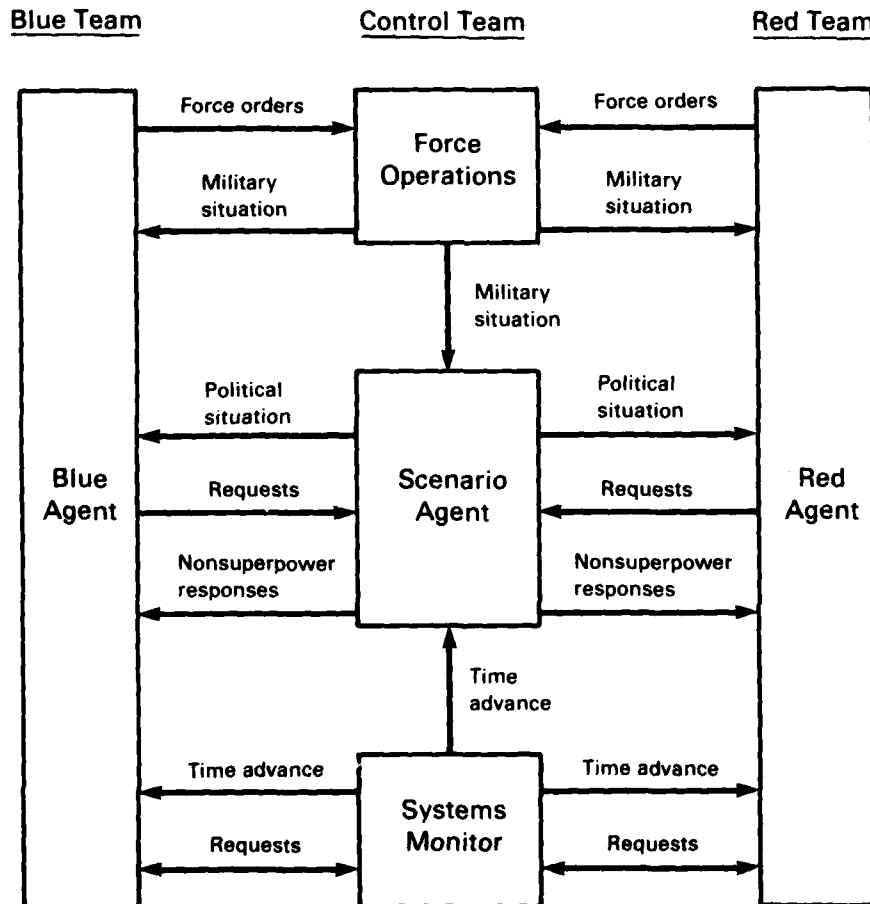


Fig. 1—Structure of RSAC automated political-military gaming

knowledge. Providing information on the political situation is essentially a communications function in which Scenario Agent reformats information already in its data base.

During decisionmaking, Red and Blue may request additional information about nonsuperpowers. Scenario Agent serves as an intelligence source in responding to such requests. In this role Scenario Agent can provide descriptive political estimates or predictive national posture projections conditional on stated assumptions. Descriptive estimates beyond those available in the Scenario Tableau could include a country's broad political or economic orientation, its potential enemies, whether it is opportunistic or assertive, its relationship to regional or other nonsuperpower leadership, its perceived threat and opportunity, and rationale for its current posture. Projections are generally displayed in future hypothetical Scenario Tableau entries for specified countries.

Red and Blue moves may include requests to nonsuperpowers to change their national postures. Acting as the nonsuperpowers, Scenario Agent takes these move requests into account, along with the military situation provided by Force Operations, in determining nonsuperpower response. In processing nonsuperpower moves, Scenario Agent functions the same as in processing requests for intelligence projections, except that the results of a move are entered into the Scenario Agent data base, whereas results of a projection are not.

Scenario Agent generates a record of responses with a first-order rationale trace in terms of perceptions. This record is available to analysts during gaming. Responses are reflected in the new political situation (Scenario Tableau).

Scenario Agent uses many familiar terms but in a relatively precise sense. The familiarity of these terms makes it easier to read through descriptions of the model's design and its rules without stopping to learn precise definitions of the terms. (Some usage, however, is bound to be counterintuitive to some readers. For this reason, a Glossary is provided.)

BEHAVIORAL DESIGN

The behavioral design is the design of national behavior to be simulated by the model.

National decisionmaking is clearly a complex process. It is possible to model national decisionmaking only by making simplifying assumptions that bound the problem. In any attempt to bound a complex process, the challenge is to identify precisely what information is needed and to relate that information to a digestible set of variables that is complete

for the purposes intended. The problem of modeling nonsuperpowers in the RSAC is bounded by the following premises:

- RSAC games deal exclusively with conflict situations of strategic interest to the United States; therefore, the complexity of non-superpower behavior can be reduced to that which is potentially significant to the outcome of such conflicts.
- There is no well-validated theoretical basis for predicting national behavior; therefore, a model based on plausible heuristic rules is preferable to one that is highly theoretical.
- Future national behavior is fundamentally uncertain and controversial; therefore, the model must be able to accommodate alternative parametrically variable behavioral assumptions.
- Scenario Agent is an integral part of the RSAC; therefore, it must be fully compatible with and proportional to other RSAC models.

The design models national behavior in terms of perception and response, as shown in Fig. 2. Many behavioral theories include concepts of perception-response or stimulus-response, but Scenario Agent is not wedded to any one particular theory.

Scenario Agent simulates nonsuperpower behavior as though a country's decisionmaking process consisted of answering the following seven questions:

1. Does the country perceive a threat to itself in the current conflict situation?
2. When should the country respond?
3. Does the country perceive an opportunity in the current conflict situation?

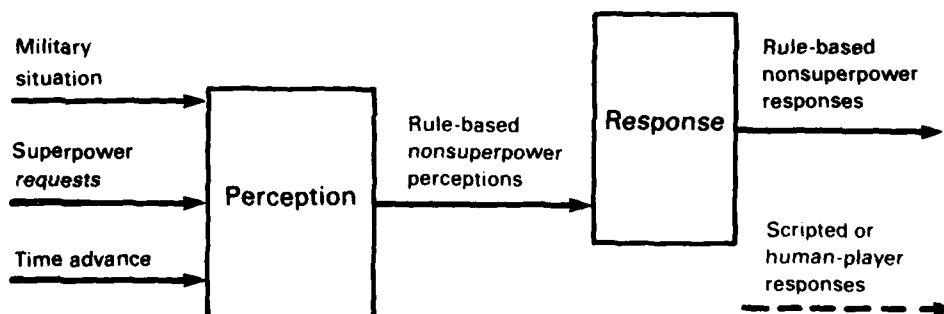


Fig. 2—Perception-response behavioral design

4. Which superpower, if any, should the country side with in the current conflict?
5. To what extent should the country cooperate with its superpower ally by granting access to its territory or facilities for superpower logistics or combat operations?
6. To what extent should the country involve its armed forces in the conflict?
7. What level of national preparedness is appropriate in the current situation?

The first three questions are answered by perception rules; the last four by response rules.

The products of the response rules are changes in the postures of countries, representing the behavior of countries. The posture of a nonsuperpower is the only product of Scenario Agent used by the other RSAC models and will be discussed after perception and response rules.

Information from other RSAC models is processed by Scenario Agent perception rules to infer perceptions for each nonsuperpower. The perception rules are based on historical precedent, informed opinion, and logic, rather than on any particular theory. The same information on the military situation and superpower political moves is available to all countries, but countries vary in the perceptions they infer from these inputs. Figure 3 shows the structure of nonsuperpower perception. For each nonsuperpower the model applies rules to assess threat, schedule response, assess opportunity, and determine response.

The geopolitical substance of the rules is embedded primarily in the perception rules. The underlying premise is that a good deal more is known about how countries perceive situations than about how they will respond to them. The design allows perception rules to be augmented, varied, or by-passed.²

Nonsuperpower perceptions include threat, opportunity, and next decision date, as listed and defined in Table 3.

Threats can appear in many forms: encroachment on or invasion of territory by external forces; attack on forces outside the country's territory; bombardment of country territory; interdiction of lines of communication; and external economic pressures for deliberate or inadvertent reasons. Scenario Agent incorporates the threats associated with military force and a few that derive from economic factors.

²ROSIE allows the user to build or change Scenario Agent files interactively while an RSAC exercise is being run. Perception changes can be implemented either by adding, deleting, or modifying rules in existing rule sets, by calling new rule sets in addition to or instead of existing rule sets, or by entering overriding perceptions directly at the operator's console keyboard.

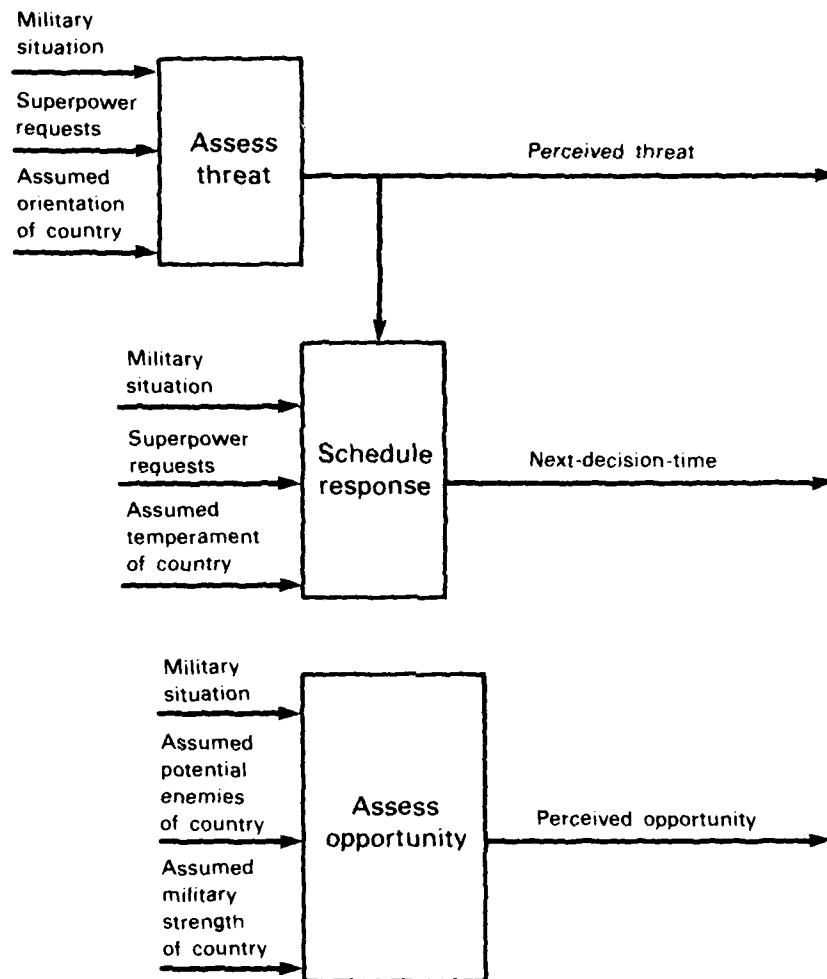


Fig. 3—Structure of nonsuperpower perception

Threat rules address threats applicable to all countries, a specific group of countries, and individual countries. The latter are limited to countries that could play an important role in Mid-East and European conflicts.

The concept of opportunity for a country in decisionmaking can take many forms. Opportunity can be more or less pure, as a goal to be achieved or a gain to be made at the volition of the country, with no consideration of other factors. It can also be a gain or benefit at a given cost, as in negotiated agreements for basing rights in exchange for aid or

Table 3

NONSUPERPOWER PERCEPTION VARIABLES

Name	Value	Definition
Threat	Grave	Equivalent in near-term consequences to bombardment or invasion
	Indirectly-grave	Equivalent in long-term consequences to bombardment or invasion
	Serious	Equivalent in near-term consequences to a potential enemy's preparing for combat
	Indirectly-serious	Equivalent in long-term consequences to a potential enemy's preparing for combat
Opportunity	Indeterminate	None of the above.
	Compelling	An opportunity for the country strongly suggesting an immediate combat response
	Inviting	An opportunity for the country strongly suggesting some immediate military response
	Indeterminate	Neither compelling nor inviting
Next-decision-time	As computed	Date/time of nonsuperpower's next response

defense guarantees. In the latter case, the gain is weighed against some cost that has political, monetary, or security risks to the country. Opportunity can also be considered a negative threat, in which case, rather than being a counterbalance to a cost, that is, a threat, it is added to the threat as a negative factor and thereby reduces the threat. Scenario Agent models opportunity only in the situation of pure gain at the volition of a country.

Country-specific rules concerning opportunity have not been developed; however, individual country reaction to opportunity in current and potential hotspots in the world could be included. National frictions, such as Israel vs the Arab nations, Egypt vs Libya, Syria vs Jordan, Greece vs Turkey, and India vs Pakistan, could all be expressed in conditional terms and in as much detail as desired. International concerns and opportunistic actions resulting from an anti-Western Islamic movement or an aggressive OPEC economic stance could also be incorporated. Inclusion of such elements would require additional rules that would specify the conditions under which countries would change to opportunists.

Response rules use perceptions in accordance with parametric assumptions about country behavior. The response rules determine what change in posture (if any) a country will make in response to its current perceptions. Countries try to make their responses coherent, so we do not separate components of response (side, cooperation, etc.) the way we do perception (threat, urgency, opportunity). Instead, each nonsuperpower's basic response is determined by the response pattern associated with a country's temperament assumed by the analyst. Then, if a country is assumed to be opportunistic or assertive, rule sets associated with those assumptions are applied, sometimes changing what had been decided by rules for a specified temperament. This response structure is depicted in Fig. 4.

Scenario Agent allows a country, regardless of its orientation, to take sides in an issue or not. This provision allows staunch NATO allies, for example, to opt out of assisting their ally, the United States, in a Mid-East crisis. They can concurrently be characterized by Blue orientation but

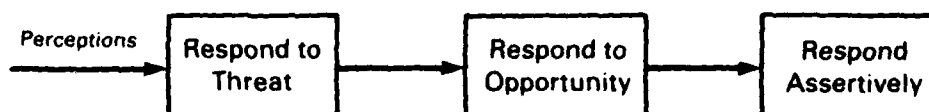


Fig. 4—Structure of nonsuperpower response

White (or neutral) side. The orientation and initial side of each country are specified by the analyst at the start of each game. Scenario rules do not change a country's orientation, but a country's side may change depending on a number of variables, mainly the situation (scope of war), the country's proximity to the region of conflict, and the reliability of the country as an ally.

How a country responds to threat depends on assumptions of (a) orientation, (b) temperament, and (c) leader-follower relationships. Countries respond to perceived opportunity only if they are assumed to be opportunistic. Similarly, they respond assertively only if they are assumed to be assertive.

Alternative response rules are stereotypes of reliable, reluctant, and other behavior. These stereotypes, though simple, suffice for many purposes. An optimistic set of assumptions, for example, would have U.S. allies as reliable, Soviet allies as reluctant, and no countries as opportunistic. A more likely case might be for most Western-oriented countries to be initially reluctant and a few to be opportunistic and assertive. A single change of an assumption about a key nonsuperpower may have significant results. The design allows response rule sets to be alternated, new stereotypes to be written, or rules to be overridden or changed at run time. The aim is to balance substance and flexibility.

Considerable flexibility is offered to the analyst through the parametric assumptions entered at the outset of a gaming exercise. The effects of parametric assumptions on nonsuperpower behavior are explained in detail later in the report; however, Table 4 provides a thumbnail sketch of how an analyst can control nonsuperpower behavior by changing parametric assumptions.

Nonsuperpower response variables are shown in Table 5 together with the values they may take.

OPERATIONAL DESIGN

Scenario Agent is integrated with other RSAC models, with respect both to data interfaces and to operational moves. Figure 5 shows the Scenario Agent design from the perspective of operational integration. Time is advanced when the new game time and game step are established by Systems Monitor. Before determining the situation, Scenario Agent must have inputs from Force Operations, indicating which of the military situation variables have changed since the last move. Scripted inputs are entered before or after deciding policy responses, depending on the nature of the inputs.

Table 4

EFFECTS OF PARAMETRIC ASSUMPTIONS ON NONSUPERPOWER BEHAVIOR

Parameter	Response
Orientation	
Blue	Considers all U.S. requests for support; perceives a Red military presence in its territory as hostile.
Red	Considers all Soviet requests for support; perceives a Blue military presence in its territory as hostile.
White	Declines all superpower requests for support; perceives any superpower military presence in its territory as hostile.
Temperament	
Reliable	Tends to comply with superpower ally requests.
Reluctant	Tends to respond in proportion to its perceived threat.
Initially-reliable	Reliable temperament until asked by its superpower ally to involve its own forces; thereafter reluctant.
Initially-reluctant	Reluctant temperament until it perceives a definite threat to its interests; thereafter reliable.
Neutral	Will not support either superpower until it perceives a grave threat to its interests; thereafter reluctant.
Leader/follower	Follower tends not to cooperate more fully with its superpower ally than its leader is doing.
Opportunistic	Tends to respond to a perceived compelling opportunity by becoming a combatant; responds to a perceived inviting opportunity by alerting its forces.
Assertive	If nuclear-capable, exercises independent nuclear deterrent. If gravely threatened, requests allied nuclear strike against opponent homeland. If abandoned by ally, becomes noncombatant. If aided by ally, becomes reliable.

If rules do not yield adequate results, an analyst may by-pass them by using off-line analysis or by having human teams play desired countries. By either method, the resultant perceptions or responses can be entered parametrically into Scenario Agent's data base, overriding any rule-based perceptions or responses for specified countries. We call such entries "scripted inputs." The responses—whether rule-based or scripted—are provided to Red and Blue Agents. The concept of parametrically overriding rule-based behavior is depicted in Fig. 6. Users may override part or all of the Scenario Agent's standard rules. For example,

Table 5

NONSUPERPOWER RESPONSE VARIABLES

Name	Value	Definition
Side	Red, Blue, or White	Siding with Soviet Union, United States, or neither superpower, respectively, in the current conflict.
Resolve	Firm	Very unlikely to change its side.
	Moderate	Relatively unlikely to change its side.
	Soft	Relatively likely to change its side.
Cooperation	Noncoordinate	Not granting transit rights for the military forces of either superpower.
	Coordinate	Granting logistics access to its ally.
	Cobelligerent	Granting combat access to its ally.
	Nuclear-releasor	Fully cooperating with its ally, including agreeing on use of nuclear weapons.
Preparedness	Normal	Not mobilizing for war.
	Call-up	Mobilizing reserve components of armed forces.
	Mobilized	Mobilizing reserves; conscripting at wartime levels.
Mid-East/ European involvement	Noncombatant	Not engaged in conflict in specified region.
	Alerted	Preparing for combat operations in specified region.
	Poised	Forces deployed to initiating positions for combat in specified region.
	Mobilizing	Mobilizing reinforcements for combat in specified region.
	On-call	Has agreed to become a combatant in specified region if asked by its superpower ally.
	Combatant	Has forces in combat in specified region.
	Nuclear combatant	Is employing nuclear weapons in specified region.

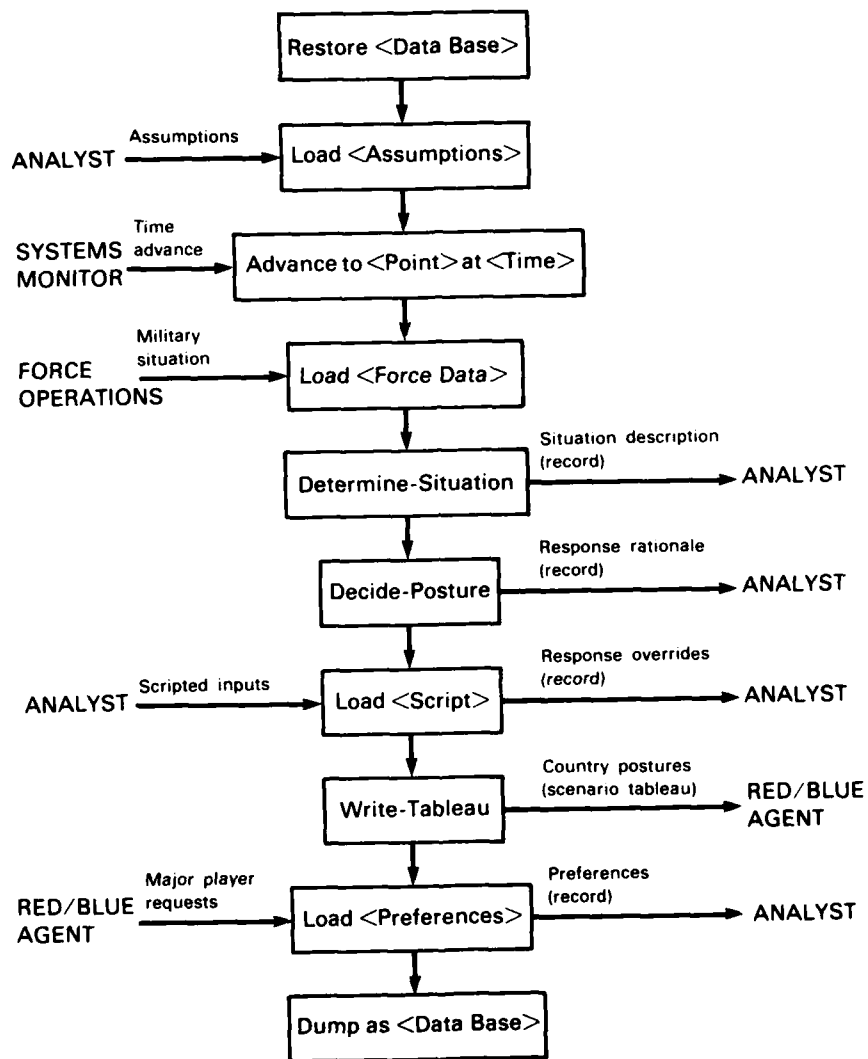


Fig. 5—Scenario Agent operational design

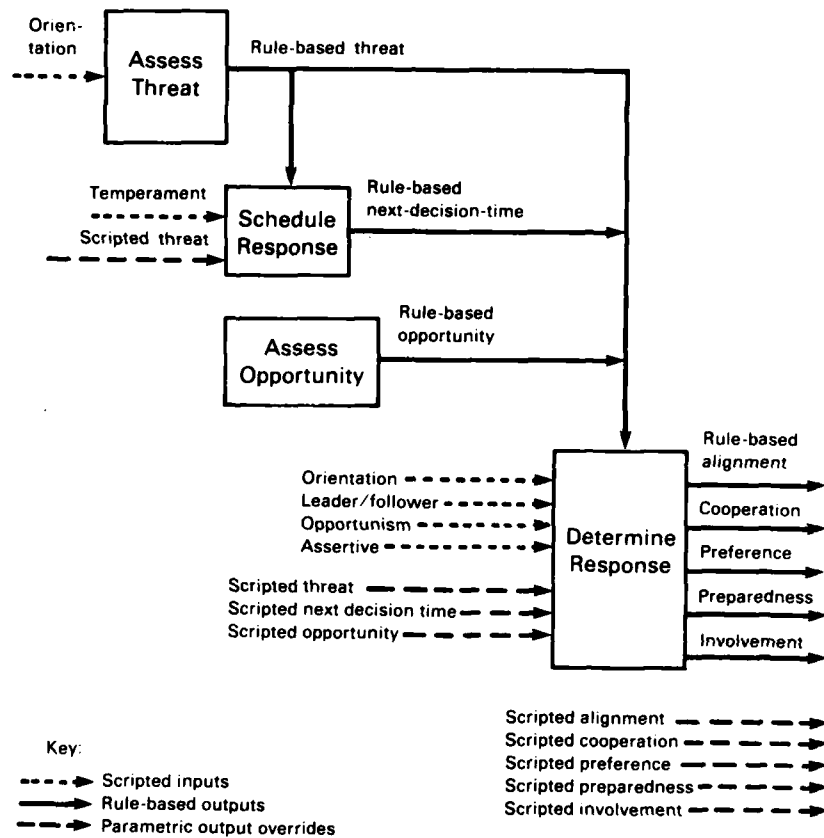


Fig. 6—Overriding rules with scripted inputs

a given analysis may call for a minor country to perceive a grave threat because of subtleties not usually included in the game (e.g., intelligence data). If the standard rules would denote the threat as "serious," an override is necessary. Similarly, the game script may require overrides on reaction time or response. Overrides do not change the rules themselves, and countries do not "remember" whether their perceptions were rule-based or scripted; therefore, overrides do not cause unwanted ripple effects. Obviously, if experience indicates that users choose frequently to override one set of rules, it would be appropriate to change the rules.

Scripted side or cooperation would be entered after rule-based responses. Rule-based perceptions, responses, and other inferences are recorded along with their rationale for use by analysts as the substantive rules are being executed. The following example from a record illus-

brates the first-order rationale for a Kuwait decision first to agree to a U.S. request (because Kuwait is assumed to be a reliable Blue ally) and then to reconsider and limit its compliance with U.S. wishes because it was assumed to be a follower of Saudi regional leadership.

KUWAIT a militarily weak BLUE-oriented reliable ally that had previously decided to maintain peacetime preparedness, to side with neither superpower, to deny superpower access, to decline to involve own forces in Mid-East conflict, to decline to involve own forces in European conflict, perceiving no threat in the situation, noting that 'US does want KUWAIT to "side with US"',³ noting that 'US does want KUWAIT to "allow logistics access"', noting that 'US does want KUWAIT to "call up reserves"', noting that 'US does want KUWAIT to "alert forces for Mid-East combat"', assessed its posture. KUWAIT decided to side with the US because of Ally request. KUWAIT decided to allow logistics access because of Ally request. KUWAIT decided to alert forces for Mid-East combat because of Ally request. KUWAIT decided to decline to involve own forces in Mid-East conflict because SAUDI ARABIA's posture is to decline to involve own forces in Mid-East conflict. KUWAIT decided to call up reserves because of Ally request.

The Scenario Tableau is written after rule-based responses and scripted responses are made. Table 6 shows the format of the Scenario Tableau. In practice, the Tableau summarizes the postures of any desired number of countries. The Scenario Tableau is described further in Jones, LaCasse, and LaCasse (forthcoming).

The program cycles through the list of countries, checking which are being simulated, and designating the one nonsuperpower currently being simulated as "the actor." The program does not necessarily simulate the behavior of all the countries, only those that the analyst has chosen. Countries not simulated appear in the Scenario Tableau, but their postures remain constant unless changed by scripted input.

The perception-response behavioral design has particular heuristic appeal in the RSAC setting. Most of the inputs to perception are provided by other RSAC models. It is relatively straightforward to develop perception rules from these known inputs. Countries that are invaded—to cite an obvious example—perceive a threat. Having identified those responses (posture changes) of interest, we can write response rules to generate them, using national perceptions as input. The relationship between situation to perception to response constitutes a first-order analytic rationale for the response. This first-order rationale is roughly the level of detail dictated by the proportionality premise. As we recognized in the premise on uncertainty, we do not expect agreement about

³In ROSIE language punctuation, "" marks a string of words unchanged by ROSIE when manipulated and `` marks a primitive sentence, or basic sentence.

Table 6

SCENARIO TABLEAU FORMAT

Country	Conflict ^a		Cooperatn	Superpower		Military Prep	Mid-East		European	
	Side			Presence			Invlvmnt		Invlvmnt	
Cuba	White		Noncoord	R.A.Trip_Wire		Normal	Noncombat		Noncombat	
Egypt	White		Noncoord	No_Presence		Normal	Noncombat		Noncombat	
France	White		Noncoord	No_Presence		Normal	Noncombat		Noncombat	
FRG	White		Noncoord	B.Major_Pres		Normal	Noncombat		Noncombat	
GDR	White		Noncoord	R.Major_Pres		Normal	Noncombat		Noncombat	
Hungary	White		Noncoord	R.Major_Pres		Normal	Noncombat		Noncombat	
Iran	X		Noncoord	R.Major_Pres		Call Up	Combatant		Noncombat	
Israel	White		Noncoord	No_Presence		Normal	Noncombat		Noncombat	
Italy	White		Noncoord	B.U.Trip_Wire		Normal	Noncombat		Noncombat	
Libya	White		Noncoord	No_Presence		Normal	Noncombat		Noncombat	
N.Korea	White		Noncoord	No_Presence		Normal	Noncombat		Noncombat	
N.Yemen	White		Noncoord	No_Presence		Normal	Noncombat		Noncombat	
Netherld	White		Noncoord	B.U.Trip_Wire		Normal	Noncombat		Noncombat	
Syria	White		Noncoord	No_Presence		Normal	Noncombat		Noncombat	
Turkey	White		Noncoord	B.A.Trip_Wire		Normal	Noncombat		Noncombat	
UK	White		Noncoord	B.Major_Pres		Normal	Noncombat		Noncombat	
US	B.Firm		Noncoord	B.Major_Pres		Normal	Noncombat		Noncombat	
USSR	R.Firm		Noncoord	R.Major_Pres		Normal	Combatant		Noncombat	
Yugoslav	White		Noncoord	No_Presence		Normal	Noncombat		Noncombat	

^aX in a column marks a conflict location.

national responses in all (or most) cases. We have found that there is more agreement about national perception than about response. This is due, in part, to the more direct linkage between what is perceived and what objectively exists in the situation, and to the less direct linkage between what is perceived and how a country responds. There is so much uncertainty about the relationship between perception and response that we have found it useful to develop alternative response rules, which we group into rule sets representing alternative response patterns. The selection of which response rules to use for a particular country at a particular point in a game is controlled parametrically. That is, the analyst makes behavioral assumptions (or relies on default assumptions) that designate response rules for a particular country.

Modes of Operation

Scenario Agent can be operated in any of five modes (shown in Table 7), depending on the chosen mix of rule-based, scripted, or human-gamed nonsuperpower perception and response.

The simulation mode is well suited for most RSAC analyses. It features rule-based perception and response, no scripted responses, and no human gaming. The verification mode adds scripted responses, but still

Table 7

SCENARIO AGENT MODES OF OPERATION

Feature	Simula- tion	Verifica- tion	Elabora- tion	Documen- tation	Experimen- tation
Rule-based perception	Yes	Yes	Yes	Yes	Yes
Rule-based response	Yes	Yes	No	No	Yes
Scripted response	No	Yes	Yes	Yes	No
Human response	No	No	No	No	Yes

no human players. It can be used either to verify rules with respect to externally developed scenarios that are used as predetermined scripted actions or to verify scripts with respect to the model's rules. The elaboration mode features rule-based perception but not response, scripted response, and no players. It can be used to flesh out predetermined, scripted scenarios by providing rationalized perceptions. The documentation mode is the minimal mode; it uses neither behavioral rules nor human players. It merely documents scripted scenarios in standard RSAC format for use by other RSAC models. The experimentation mode uses the model as an advisor to players, the aim being to develop strategies through man-machine interaction.

Caveats on the Use of Scenario Agent

To date, Scenario Agent has been used, along with other RSAC Mark II models, in 14 game runs. This is a relatively modest experiential base, but the following preliminary lessons may be drawn from it:

- Families of interesting scenarios can be generated by controlling Scenario Agent parametric assumptions.
- Events generated by Scenario Agent should not be regarded as predictions of real events.
- Scenario Agent standard rules are not well suited for normal peacetime crises that pose no real threat of war between superpowers.
- Use of Scenario Agent requires making explicit assumptions; this does not in itself resolve differences in opinion about which assumptions are correct.

TECHNICAL DESIGN

The basic technical design of almost any computer simulation model consists of data input, storage, processing, and output functions, as shown in Fig. 7.

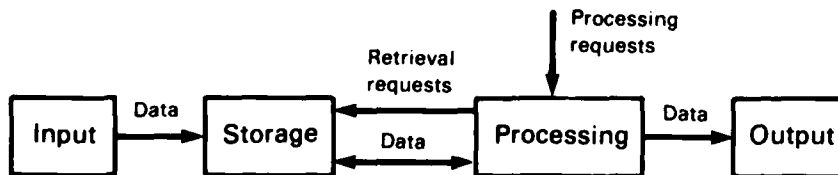


Fig. 7—Basic technical design

In Scenario Agent, data are stored in a data base, and rules by which processing is done are stored in a rule base. Together, the data base and the rule base form the knowledge base. This knowledge base structure is shown in Fig. 8.

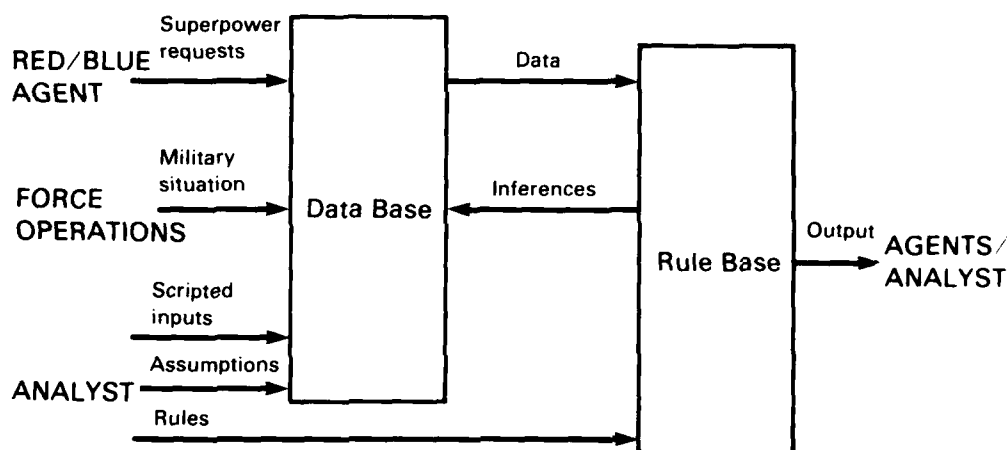


Fig. 8—Structure of Scenario Agent knowledge base

Data Base

The data base contains information about the military situation (also called force data), major player requests, nonsuperpower perceptions, assumptions about countries, and nonsuperpower responses.

Military situation variables include weapon usage, superpower presence, and conflict locations, which may take on the values shown and defined in Table 8. Values of military situation variables at each game step are set by Force Operations.

Superpower requests for nonsuperpower posture changes are communicated by messages. RSA⁴ messages are written in a stylized form described in Dewar, Schwabe, and McNaugher (1982). For entry in the Scenario Agent data base, they are translated into ROSIE statements such as

Assert each of Blue, coordinate and Mid-East combatant is a preference of (US) for Turkey.⁴

⁴The hyphens and parentheses in this sentence are required by ROSIE syntax conventions, as described in Fain et al. (1981).

Table 8

MILITARY SITUATION VARIABLES

Name	Value
Red/Blue intercontinental weapons's type	Nuclear or none
Red/Blue European weapon's type	Nuclear, battlefield-nuclear, conventional, or none
Red/Blue/White Mid-East weapon's type	Nuclear, battlefield-nuclear, conventional, or none
Superpower- presence	Red-major, Blue-major, Red-tripwire, Blue-tripwire, Red-token, Blue-token, or No-presence
Conflict location	Country name

We want to document all bases for inferring threat in the game record, but to use only the most serious of these as inputs for inferring response. This is done by ordering the rules so that tests for the least serious threat (indirectly serious) come first and those for the most serious threat (grave) come last. The computer records each basis for threat as it is determined, but remembers only the last (hence most serious) threat determined.

Rule Base

The rule base consists of behavior rules and service rules. Behavior rules embody knowledge and opinion about international behavior in conflict situations. They are written in the following modular rule sets:

- *To Schedule Response:* schedules each nonsuperpower's response in terms of number of days after a reference date.
- *To Determine-Situation:* characterizes the situation as intercontinental war, theater war, or local conflict.
- *To Decide-Posture:* assesses the effectiveness of both superpowers and calls on each nonsuperpower to move.

- *To Assess-Effectiveness of Superpower:* assesses each superpower's effectiveness in Europe and Mid-East.
- *To Move:* records prior posture of the nonsuperpower being simulated, calls on threat, opportunity, scheduling, and response rules.
- *To Assess-Threat:* perceives each nonsuperpower's threat as grave, indirectly grave, serious, indirectly serious, or indeterminate.
- *To Assess-Opportunity:* perceives each nonsuperpower's opportunity as compelling, inviting, or indeterminate.
- *To Determine-Response:* calls on the response rule set appropriate for each nonsuperpower's assumed temperament.
- *To Determine-Reliable-Response:* determines response primarily on the basis of the expressed preferences of the superpower with which the nonsuperpower has sided or is oriented toward.
- *To Determine-Reluctant-Response:* determines response primarily on the basis of perceived threat.
- *To Determine-Initially-Reliable-Response:* behaves as a reliable ally until a serious threat is perceived, when it behaves as a reluctant nonsuperpower.
- *To Determine-Initially-Reluctant-Response:* behaves as a reluctant nonsuperpower until a serious threat is perceived, when it behaves as a reliable ally.
- *To Determine-Neutral-Response:* tends not to support military operations of either superpower.
- *To Determine-Opportunistic-Response:* in addition to behaving in accordance with its temperament, may prepare for combat or enter combat in response to a perceived opportunity to gain advantage over a potential enemy.
- *To Determine-Assertive-Response:* in addition to behaving in accordance with its temperament, may attempt to exercise independent deterrence or may seek an accommodation.

Behavior rules are discussed in detail in Sec. III. Appendix A contains a complete ROSIE listing of all rule sets.

Service rules provide inputs to substantive rules and they generate outputs for other RSAC models. Service rule sets include:

- *To Advance to Point at Time:* advances game time and game step.
- *To Determine-Alignment:* infers superpower ally and opponent for each nonsuperpower from its rule-based or scripted side or its assumed orientation.

- *To Generate Day-Count of Date-Time-Group:* converts a date-time-group to number of days before or after a parametric reference date, often a planned D-Day.
- *To Generate Days in Month for Year:* generates number of days in each month, used in computing the value of "present-date" in simulated time.
- *To Record:* generates a record of nonsuperpower perceptions and responses with their rationale.
- *To Write-Tableau:* generates a summary tableau of nonsuperpower policy positions for use by Red and Blue Agent models.

Rule Set Control Flow Hierarchy

Figure 9 shows how control is transferred between rule sets. Each box in Fig. 9 represents a rule set. The four rule sets on the top row are usually evoked directly by an operator at a keyboard. The sequence is from left to right, as indicated by the arrows. Thus, the top row of Fig. 9 is a simplified version of the operational design shown in Fig. 6. Rule sets shown in blocks beneath the top row are ordinarily called up by programmed statements in the higher-level rule sets. For example, "move" is called by "decide-posture." We say "ordinarily" because any of the rule sets can be called up directly by an operator. Such direct calls are useful for exploring the effects of assumption changes on a particular country, for tracing rule inferences, and for recovering from run-time errors.

III. SCENARIO AGENT RULES AND DATA

In this section we discuss the current Scenario Agent rule base and data base. We are not writing just for computer modelers and war gamers. Rather, we are hoping to make this model accessible to strategists, policy analysts, and political scientists. We do this for two reasons. First, the ultimate credibility and utility of Scenario Agent depends on our being able to capture the ideas of experts in rules and data. For experts to provide feedback, they must be able to understand what is in the model, which requires that we be able to explain it to them. Explanation of the model is facilitated by its being written in ROSIE, an English-like language designed especially for models whose credibility seems crucial (Hayes-Roth et al., 1981, p. 1). Our experience has shown that the experts with whom we must communicate can understand ROSIE statements, but that we need to help focus their attention on particular rules and data statements, rather than turn them loose to roam through an extensive rule base. Our second reason for wanting to make the source code of the model accessible to a broader audience is to provide an example of qualitative computer modeling for readers who may want to use such techniques in their own work or in work they commission.

READING ROSIE

ROSIE reads much like English. A few conventions are different, however, and warrant noting before we begin to discuss Scenario Agent rules and data statements.

Most ROSIE punctuation resembles English, but there are some special conventions. Everything within square brackets ([and]) in a ROSIE statement is a non-executable comment. Parentheses are used in ROSIE, much as they are in algebra or in FORTRAN, to indicate order of operations and to avoid ambiguity. ROSIE, like most computer languages (and unlike English), cannot tolerate ambiguity. Apostrophes are used as in English to show association, as in "Spain's temperament." Pairs of apostrophes (') enclose simple ROSIE sentences called propositions, which are treated as data elements by the computer; these apostrophes can be ignored by the reader. Quotation marks (") are used to enclose other types of data elements that programmers call "strings." ROSIE distinguishes between upper and lower case only in strings.

Braces ({ and }) appear in some of the rules, notably in "match" and "send" statements. "Match" statements call for matching a specified variable against whatever is enclosed in braces; if a match is found, the action that follows (up to the semicolon or period) is executed. "Send" statements cause whatever is enclosed in braces to be sent to the operator's display or to a specified computer file.

The equal sign (=) should be read "is," and a tilde followed by an equal sign (~=) should be read "isn't." These are used to show identity, rather than a characteristic. English uses "is" for both purposes, as in "if the actor is Spain" and "if the actor is a leader." ROSIE would express these as "if the actor = Spain" and "if the actor is a leader."

ROSIE uses a few words that will appear strange to many readers. The word "provably," for example, is not a misspelling of "probably." "Provably true" refers to a proposition that can be proved to be true from information in the Scenario Agent data base. It is needed because ROSIE employs a three-valued logic, in which a proposition that is not in the data base is neither provably true nor provably false. "Dribble" is another strange ROSIE word. It is used in such memorable lines as "dribble to the name {the game-point, ".log"}," which means to record everything subsequently appearing on the computer terminal in a file whose name is the current game point followed by a period and the word "log."

In what follows, computer executable ROSIE statements are written in italics. We use angle brackets (< and >) to enclose variable names, where actual program execution would require a variable value (a parameter) be inserted.

Nonsuperpower behavior in Scenario Agent depends on both rules and data. Both are entered as ROSIE statements. To keep the distinction between rules and data clear, we quote rules in the text and data statements in footnotes. We discuss some alternative rules in the text.

Rules are organized into rule sets that have a title line, a header, and an ending line. These "administrative" lines are of little interest to the general reader and are deleted from the rule description in this section but are included in Appendix A, which is a complete listing of current Scenario Agent rules. The order of rules in a rule set is essential to proper execution of a program but may confuse nonprogrammers. Threat rules, for example, are ordered with the least important threats first, because the computer remembers only the last threat determined. We want that to be the most important threat, so the rules for the more important threats must be executed last. In this section we group rules for ease of reading; in Appendix A they appear in the order the computer needs them.

Appendix B lists a complete data base.

BEHAVIORAL RULES AND DATA

Threat plays a central role in nonsuperpower behavior, as modeled by Scenario Agent. Perceived threat is an input to urgency perception and to the main body of response rules—those that are selected by the temperament parameter. After discussing threat perception, urgency perception, and response to threat, we will discuss additional optional behavior, which includes opportunity perception, response to opportunity, perception of superpower effectiveness, and assertiveness.

Threat Perception Rules

Scenario Agent models threat perception in intense crisis and conflict situations rather than in peacetime. Responses to threat relate to military operations and operational readiness rather than to military budgets or procurement.

Certain situations are threatening to all countries at any time. These situations include being invaded, bombarded, or blockaded. Other situations may be threatening only to certain countries or only at certain times. For example, blockage of the Strait of Hormuz might threaten Persian Gulf oil suppliers or consumers but not remote supplier countries such as Venezuela. As another example, Egypt hosted a Soviet military presence for several years without perceiving it as threatening; under Egypt's present policy, however, a Soviet military presence there would be perceived as a threat.

Threat to a country is inferred from situational data, not from the combined effects of its prior or lesser threat perceptions. That is, satisfying multiple criteria for perception of serious threat does not, in itself, produce perception of grave threat. A scheme such as inferring a grave threat from some number of separate serious threats could lead to problems as new threat rules were added.

Scenario Agent's current threat rules are both illustrative and substantive. They illustrate types of situations that may be threatening to nonsuperpowers and how corresponding threat perceptions can be modeled. The current threat rules embody some political, military, and economic substance; we do not, however, claim they are definitive or complete. Such claims could be made only in the context of particular problems under investigation.

Threat from Invasion or Attack. Being attacked (a conflict location) or being invaded by a hostile superpower constitutes a grave threat. Recall that a grave threat is defined as one having near-term consequences equivalent to actual or imminent bombardment or invasion. These rules, then, are practically tautological, but they serve as benchmarks for other rules.

*If the actor is a conflict location,¹
 let the actor's threat be grave and record
 grave [threat] as "being a conflict location".*

*If the actor's Ally $\sim$ [isn't] USSR²
 and the actor's superpower-presence = [is] Red-
 major,
 let the actor's threat be grave and record
 grave [threat] as "major Red force in its
 territory".*

*If the actor's Ally $\sim$ [isn't] US and the actor's
 superpower-presence = [is] Blue-major,
 let the actor's threat be grave and record
 grave [threat] as "major Blue force in its
 territory".*

Each threat rule—and many other rules—contains the phrase "record <something> as <something>." This is a call to a service rule set, "to record x as y," which records a first-order rationale for game events. If, for example, the Soviet Union invaded the FRG, the record would contain the entry "FRG ... perceiving a grave threat in major Red force in its territory...."

Threat from Attack on Ally. An attack on any NATO or Warsaw Pact country can be viewed as an indirectly grave threat to other members of the respective alliance. Recall that an indirectly grave threat is one with long-term consequences equivalent to actual or imminent bombardment or invasion.

*If 'the actor is a [conflict] location'
 is not provably true
 (if the actor is [a] NATO [country])³
 and some NATO country (x) is a conflict
 location,*

¹Conflict locations are part of the initiating scenario and are updated by information from Force Operations. Data entries are of the form: *assert <country> is a conflict location.*

²A service rule set, "to determine-alignment," determines the actor's ally and opponent as being the United States, Soviet Union, or indeterminate, as a function of the actor's side and orientation. Here, both Blue-aligned and nonaligned countries would perceive a grave threat from a major Red presence.

³NATO members are identified by the following data base entry: *Assert each of Belgium, Netherlands, Luxembourg, Canada, Denmark, FRG, Greece, Iceland, Italy, Norway, Portugal, Turkey, UK and US is a NATO country.* Warsaw Pact countries are identified by the statement: *Assert each of Bulgaria, Czechoslovakia, GDR, Hungary, Poland, Romania and USSR is a Warsaw Pact country.*

*let the actor's threat be indirectly-grave
and record indirectly-grave as the string
{ "attack against ", (x) },
otherwise if the actor is [a Warsaw] Pact
[country] and some Warsaw Pact country (x) is
a conflict location,
let the actor's threat be indirectly-grave
and record indirectly-grave as the string
{ "attack against ", (x) }.*

Similarly, an attack on the leader of one's coalition can be viewed as an indirectly grave threat.⁴

*If the actor is a follower of (some leader such
that that leader's threat = [is] grave),
let the actor's threat be indirectly-grave and
record indirectly-grave as the string { "grave
threat to ", that leader }.*

Threat from Hostile Superpower Presence. Groups of countries, such as some in the Mid-East, see threats from a major presence of Red forces in neighboring countries. Egypt and the UAE see an indirectly serious threat if major Red forces move into South Yemen—because of the sizable stores of Soviet materiel there. Recall that an indirectly serious threat is one that is equivalent in the long term to a potential enemy's preparing for combat.

*If S.Yemen's superpower-presence = [is] Red-
major⁵
and 'the actor is a [conflict] location' is not
provably true,
if the actor = [is] one of Egypt or UAE⁶
(let the actor's threat be indirectly-
serious and record indirectly-serious*

⁴Examples of statements that define leader-follower relationships are: *Assert each of Czechoslovakia, FRG, Saudi.Arabia and UK is a leader. Assert each of Bahrain, Kuwait, Qatar and UAE is a follower of Saudi.Arabia. Assert each of Belgium, Denmark, France, Iceland, Italy, Luxembourg, and Netherlands is a follower of FRG. Assert each of Romania and Yugoslavia is a follower of Czechoslovakia. Assert Canada is a follower of UK.*

⁵If S.Yemen is not defined in the data base, this rule cannot fire. This rule does not need to know that S.Yemen is a country, where it is located, or anything else about it, except its superpower presence. At the present time there is a small Soviet presence in South Yemen, which could be entered as: *Let S.Yemen's superpower-presence be Red-token.*

⁶For Egypt or the UAE to be processed as the actor, it must be defined in the data base as a player, as in: *Assert each of Egypt and UAE is a player.* This rule does not require that Egypt or UAE be defined as countries, though they must be defined as such to appear in the Tableau output.

[threat] as "Soviet manning of pre-positioned equipment in S.Yemen").

Countries bordering on South Yemen could see an indirectly grave threat in a major Soviet presence in South Yemen.

*If S.Yemen's superpower-presence = [is] Red-major and 'the actor is a [conflict] location' is not provably true,
if the actor = [is] one of N.Yemen, Oman or Saudi.Arabia
(let the actor's threat be indirectly-grave and record indirectly-grave [threat] as "major Soviet presence on border").*

Saudi Arabia and Israel see a serious threat if major Red forces move into Libya. Recall that a serious threat is one viewed in the near term as equivalent to a potential enemy's preparing for combat. The rationale, as indicated in the rule, is that the forces are assumed to be manning prepositioned Soviet equipment there, presumably for a major intervention in the region.

*If Libya's superpower-presence = [is] Red-major and 'the actor is a [conflict] location' is not provably true,
if the actor = [is] one of Saudi.Arabia or Israel
(let the actor's threat be indirectly-serious and record indirectly-serious [threat] as "Soviet manning of pre-positioned equipment in Libya").⁷*

Egypt and the Sudan, bordering as they do on Libya, would perceive an indirectly grave threat in a major Soviet presence in Libya.

*If Libya's superpower-presence = [is] Red-major and 'the actor is a [conflict] location' is not provably true,
if the actor = [is] one of Egypt or Sudan
(let the actor's threat be indirectly-grave and record indirectly-grave [threat] as "major Soviet presence on border").*

⁷If we assume no initial Soviet military presence in Libya, we enter: *Let Libya's superpower-presence be no-presence.*

Djibouti's critical location at the Red Sea opening to the Indian Ocean opposite the Red-dominated South Yemen, and the possibility of a French withdrawal from Djibouti, raise the fear in Egypt and Saudi Arabia of possible Red encroachment in Djibouti. Egypt also fears that such a Red force would threaten Sudan and present a possible second front (with Libya) to the Egyptians.

*If Djibouti's superpower-presence = [is] Red-major and the actor = [is] one of Egypt or Saudi.Arabia,
let the actor's threat be indirectly-serious
and record indirectly-serious [threat] as "Red forces in Djibouti".*

The individual concerns of key countries about the presence of Red forces in certain neighboring countries are expressed in rules for GCC* members and Turkey.

*If the actor is [a] GCC [country],
if (Iran's superpower-presence = [is] Red-major or Iraq's superpower-presence = [is] Red-major or Pakistan's superpower-presence = [is] Red-major or Syria's superpower-presence = [is] Red-major or Turkey's superpower-presence = [is] Red-major),
let the actor's threat be indirectly-serious and record indirectly-serious [threat] as "introduction of major USSR forces in region".*

*If the actor = [is] Turkey,
if (Iran's superpower-presence = [is] Red-major or Iraq's superpower-presence = [is] Red-major or Saudi.Arabia's superpower-presence = [is] Red-major or Pakistan's superpower-presence = [is] Red-major or Syria's superpower-presence = [is] Red-major),
let the actor's threat be indirectly-serious and record indirectly-serious*

*The GCC (Gulf Cooperation Council) is defined by the statement: *Assert each of Saudi.Arabia, Bahrain, Kuwait, Oman, Qatar and UAE is a GCC country.* Any desired bloc of countries can be established in this manner. Scenario Agent's structure allows a country concurrent membership in more than one bloc.

[threat] as "introduction of major USSR forces in region".⁹

Countries on the Arabian Sea or Persian Gulf could be seriously threatened by a major Red naval presence in those waters.

*If the actor = [is] a GCC country and (Persian-Gulf's Red-presence = [is] Red-major or Arabian-Sea's Red-presence = [is] Red-major),
let the actor's threat be serious and record
serious [threat] as "major Red naval presence in Gulf or Arabian Sea".*

Libya might perceive an indirectly grave threat in a major U.S. presence in Egypt.

*If Egypt's superpower-presence = [is] Blue-major
and 'the actor is a [conflict] location' is not
provably true,
if the actor = [is] Libya
(let the actor's threat be indirectly-grave
and record indirectly-grave [threat] as
"major US presence on border").*

Threat from Hostile Preparations. Countries perceive an indirectly grave threat if the Soviet Union is mobilized on their border. This applies to any country, including Warsaw Pact members.

*If USSR is mobilized on (the border) of the actor,¹⁰
let the actor's threat be indirectly-grave and
record indirectly-grave [threat] as "Soviet
mobilization on its border".*

Israel's neighbors feel threatened if Israel independently raises its force involvement level above alerted.

⁹If this particular set of countries were considered to behave similarly in many respects, it might be efficient to define them as a bloc or set, as was done for the GCC countries. Note the important difference between "or" and "and" conjunctions in rules. "Or" rules can fire in a case such as this one, even if some of the data are missing—for instance, if there were nothing about Syria in the data base. "And" rules, on the other hand, will not fire unless the appropriate information about each country is in the data base.

¹⁰Such mobilization information is provided by Force Operations and is entered in the form: *Assert USSR is mobilized on (the border) of <country>*. ROSIE requires the parentheses to avoid ambiguity.

If Israel's side = [is] White and Israel's Mid-East-involvement = [is] one of Mid-East-combatant, Mid-East-nuclear-combatant, Mid-East-mobilized or Mid-East-poised and 'the actor is a [conflict] location' is not provably true, if the actor = [is] one of Egypt, Iraq, Lebanon or Saudi.Arabia (let the actor's threat be indirectly-serious and record indirectly-serious [threat] as "Israeli involvement level").

As long as Syria and Jordan are not on good terms with Israel, they would have reason to view Israel's independent involvement at above an alerted level as an indirectly grave threat.

If Israel's side = [is] White and Israel's Mid-East-involvement = [is] one of Mid-East-combatant, Mid-East-nuclear-combatant, Mid-East-mobilized or Mid-East-poised and 'the actor is a [conflict] location' is not provably true, if the actor = [is] one of Syria or Jordan (let the actor's threat be indirectly-grave and record indirectly-grave [threat] as "Israeli involvement level").

If Greece or Turkey go to an advanced level of national preparedness independently of the United States, the other perceives a serious threat.

If the actor = [is] Turkey and Greece's preparedness $\sim$ [isn't] normal and US's European-involvement = [is] European-noncombatant, let the actor's threat be serious and record serious [threat] as "Greek preparedness".

If the actor = [is] Greece and Turkey's preparedness $\sim$ [isn't] normal and US's European-involvement = [is] European-noncombatant and US's Mid-East-involvement = [is] Mid-East-noncombatant, let the actor's threat be serious and record serious [threat] as "Turkish preparedness".

The intent of these rules is to account for the historic antagonism between Greece and Turkey. It is not difficult to imagine scenarios in which these rules misfire; that is, Greece or Turkey would not or should

not perceive a threat from the other's preparedness in some particular situation. It is helpful for political scientists to point out such subtleties, but it is not always possible or desirable to capture all nuances in Scenario Agent rules. It would not be difficult to write a dozen rules on Greek-Turkish behavior, but there is no need to do so, unless the problem being analyzed demands it. Scenario Agent has been designed so that if rules misfire it is apparent from the game record (which is displayed on the operator's console). The design also makes it easy to change an offensive rule on the fly. This is generally more efficient than trying to model in advance all the subtlety one knows exists in actual international relations.

Threat from Hostile Intent. Credible intelligence to the effect that a superpower intends to attack can also be the basis for a country's perception of grave threat. Such intelligence would be input from Force Operations or from the analyst.¹¹

*If USSR does intend-to-attack the actor,
let the actor's threat be grave and record
grave [threat] as "USSR intent to attack",
otherwise if US does intend-to-attack the actor,
let the actor's threat be grave and record
grave [threat] as "US intent to attack".*

Threat from LOC Interdiction. Several countries would be seriously threatened by blockage of trade routes upon which they are economically dependent.¹²

*If Strait-of-Hormuz is blocked and the actor is
economically-dependent on Strait-of-Hormuz,
let the actor's threat be indirectly-serious
and record serious [threat] as "economic
losses from Hormuz blockage".*

*If Suez-Canal is blocked and the actor is
economically-dependent on Suez-Canal,*

¹¹Such intelligence is entered as: *Assert <superpower> does intend to attack <country>.*

¹²These dependencies are entered as: *Assert each of Bahrain, Belgium, Denmark, France, FRG, Iran, Italy, Iraq, Japan, Kuwait, Luxembourg, Netherlands, Qatar, Saudi Arabia and UAE is economically-dependent on Strait-of-Hormuz. Assert each of Djibouti, Egypt, Ethiopia, France, Jordan, N.Yemen, Saudi Arabia and Sudan is economically-dependent on (each of Bab-al-Mandab and Suez Canal).* If these are not blocked, no data entry is needed. Blockage is entered by statements such as: *Assert Suez-Canal is blocked.*

*let the actor's threat be indirectly-serious
and record serious [threat] as "economic
losses from Suez Canal blockage".*

*If Bab-al-Mandab is blocked
and the actor is economically-dependent on Bab-al-Mandab
[French forces continue to operate from Djibouti],
let the actor's threat be indirectly-serious
and record serious [threat] as
"economic losses from Bab-al-Mandab blockage".*

Countries such as the United Kingdom and France, which have deployed naval forces, could be threatened by combat at sea.

*If the actor = [is] one of UK or France
(if Indian-Ocean is a conflict location,
let the actor's threat be serious and
record serious [threat] as "Indian Ocean
combat",
and if Mediterranean is a conflict location,
let the actor's threat be serious and
record serious [threat] as "Mediterranean
combat",
and if North-Atlantic is a conflict location,
let the actor's threat be serious and
record serious [threat] as "North Atlantic
combat").*

Threat from Combat Attrition. No matter what the other circumstances, there is a serious threat in being a combatant, in that one's forces are being attrited. The recent war between Iraq and Iran is an example: Iraq created a serious threat to itself by becoming a combatant.

*If 'the actor is a [conflict] location' is not
provably true and (the actor's Mid-East-
involvement = [is] one of Mid-East-combatant or
Mid-East-nuclear-combatant or the actor's
European-involvement = [is] one of European-
combatant or European-nuclear-combatant),
let the actor's threat be serious and record
serious [threat] as "attrition from out-of-
country combat".*

Indeterminate Threat. Indeterminate threat is the default condition if no specific threat is perceived.

Let the actor's threat be indeterminate.

Urgency Perception Rules

Urgency is reflected in the next decision time, as computed by the rule set called "to schedule response."

Certain events demand immediate response. Coming under enemy attack is one such event. Force Operations does not tell Scenario Agent directly that a country has just been attacked; rather, it informs Scenario Agent that the country currently being processed is now a conflict location. If the country is not already a combatant, it is usually valid to assume that it was not previously under attack, so its next decision is scheduled with no delay. A subsequently executed response rule will probably cause the country to become a combatant. Later in the game the country may still be a conflict location, but this particular rule will no longer apply, as the country will probably already have taken the action demanding immediate attention, becoming a combatant.¹⁴

*If the actor is a conflict location and ((the actor's Mid-East-involvement $\sim$ [isn't] Mid-East-combatant and the actor is located in Mid-East)¹⁴
or (the actor's European-involvement $\sim$ [isn't] European-combatant and the actor is located in Europe)),
let the actor's delay be 0 and the actor's next-decision-time be the present-time and return.¹⁵*

If the conditions of this rule are met, the action is taken and control returns to the calling rule (in this case a rule in "advance to <point> at <time>") without processing rules that follow in this rule set. Otherwise, the actor's decisionmaking delay is computed as a function of its temperament and most recently perceived threat. More serious threats reduce the delay, which is expressed in days. In the rule as presently written, delay can range from two to 28 days.

*Match the actor's temperament:
{reluctant}*

¹⁴An alternative (and more direct) rule would be "if the actor was not a conflict location and the actor is [now] a conflict location..." This formulation was rejected because it would require enlarging the data base, storing the data item "was was not a conflict location." ROSIE does permit use of "was" and "did" as indicators of past tense but does not permit use of the "ed" suffix to verbs to indicate past tense.

¹⁵Regional locations of actors are defined by statements such as the following: *Assert Canada is located in North America. Assert Czechoslovakia is located in Europe. Assert Egypt is located in Mid East. Assert Turkey is located in each of Europe and Mid East.*

¹⁶"Return" here means to return control to the calling rule.

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(match the actor's threat:
{grave}
  let the actor's delay be 2;
{indirectly-grave}
  let the actor's delay be 4;
{serious}
  let the actor's delay be 14;
{indirectly-serious}
  let the actor's delay be 20;
{indeterminate}
  let the actor's delay be 28);
{reliable}
(match the actor's threat:
{grave}
  let the actor's delay be 2;
{indirectly-grave}
  let the actor's delay be 2;
{serious}
  let the actor's delay be 4;
{indirectly-serious}
  let the actor's delay be 10;
{indeterminate}
  let the actor's delay be 14);
{initially-reluctant}
(match the actor's threat:
{grave}
  let the actor's delay be 2;
{indirectly-grave}
  let the actor's delay be 2;
{serious}
  let the actor's delay be 4;
{indirectly-serious}
  let the actor's delay be 20;
{indeterminate}
  let the actor's delay be 28);
{initially-reliable}
(match the actor's threat:
{grave}
  let the actor's delay be 2;
{indirectly-grave}
  let the actor's delay be 4;
{serious}
  let the actor's delay be 14;

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{indirectly-serious}
let the actor's delay be 14;
{indeterminate}
let the actor's delay be 10);
{neutral}
(match the actor's threat:
{grave}
let the actor's delay be 2;
{indirectly-grave}
let the actor's delay be 4;
{serious}
let the actor's delay be 10;
{indirectly-serious}
let the actor's delay be 12;
{indeterminate}
let the actor's delay be 14).

Warsaw Pact members respond without delay to Soviet requests. Otherwise, countries halve their delay if they receive a posture preference request from the United States or Soviet Union.¹⁶

If any posture is a preference of (one of US or USSR) for the actor,
if the actor is [a Warsaw] Pact [country]
let the actor's delay be 0
otherwise
let the actor's delay be (the actor's delay / 2).

If a next decision time has previously been computed, the next decision time is revised to be the earliest of the former value or the sum of the present time and the actor's delay. Otherwise, if a next decision time has not previously been computed (that is, this is the actor's first move in the game), its next decision time is the present-time.

Let the latest-response-date be (the present-time
+ (the actor's delay)).

If the actor has a next-decision-time
(if the actor's next-decision-time > the
latest-response-date
let the actor's next-decision-time be the
latest-response-date

¹⁶Preference messages are entered in the form illustrated by: *Assert each of Blue, cobelligerent and Mid-East-on-call is a preference of (US) for each of Turkey, Egypt and Saudi Arabia.*

otherwise
do nothing)
otherwise
let the actor's next-decision-time be the
present-time.

Response to Threat

A nonsuperpower responds during Scenario Agent's move (as indicated by Systems Monitor), provided its next decision time is equal to or earlier than the present time. When that occurs, a service rule set uses the player's temperament to determine which alternative response pattern rule set to execute.

A standard response rule set has been developed for each of the five primary assumed temperaments: reliable, reluctant, initially reliable, initially reluctant, and neutral. Each response rule set is a crude stereotype, purposely simple to provide standard cases that are not difficult to understand. The principle that guides a reliable country is unquestioning loyalty to its superpower ally. Of course, no real state is reliable in every case. Even the closest of allies, such as the United States and United Kingdom, part company on occasion. But as a first-order approximation, most Warsaw Pact and several NATO countries are reliable in many scenarios; they will do whatever the Soviet Union and United States, respectively, ask them to do. The opposite case is that of the reluctant country. It responds only in proportion to the threat it perceives. The reluctant temperament is not uncommon, and it is a cause for concern for military planners. Examples include the failure of several U.S. allies to support U.S. objectives in Vietnam. A key uncertainty in Southwest Asia contingency planning may be whether Turkey is a reliable or reluctant ally. It is not uncommon for a state to be reliable or reluctant when no real threat is perceived, but to go to the other extreme when a serious threat materializes. Initially reliable countries comply with superpower ally preferences as long as they are not asked to involve their own armed forces in the conflict, but become reluctant when they are asked. That does not mean they necessarily drop out entirely. Rather, they become slower to respond, and they refuse to escalate to a higher state of cooperation or involvement than the threat warrants. That is, they have a dampening effect which may come at a particularly bad time for their superpower ally, who may be relying on continuation of the initially reliable response pattern. Of course, as in real life, the superpower does not know other countries' real temperament. A concern in planning joint operations with third world allies is that they may be initially reliable but may balk when the going gets

tough. The fourth temperament and response pattern is initially reluctant. It changes from reluctant to reliable when perceived threat becomes serious. France, for example, might stay out of a war in Europe if it were reluctant and not invaded or bombarded. Although initially reluctant, however, it would become a combatant if Soviet forces were on its border or if nuclear weapons were in use in Europe.¹⁷ These temperament differences are summarized in Table 9.

Reliable Response Pattern. Reliable countries respond to super-power ally preferences by means of the following rules.

*If the actor's Ally = [is] indeterminate,
send {return, the actor, "IS A RELIABLE ALLY OF
AN UNSPECIFIED SUPERPOWER", return, "CHANGE
TEMPERAMENT OR ORIENTATION; SPECIFY ACTOR; GO
MOVE", return} and let the actor be dummy [to
prevent preference purge by decide-policy] and
let the actor's delay be 999 and return.*

*If there is a side (s) such that (s) is a
preference of (the actor's Ally) for the actor,
let the actor's side be (s) and record (the
actor's side) as "Ally request".*

*If there is a cooperation (c) such that (c) is a
preference of (the actor's Ally) for the actor,
unless (c) = [is] nuclear-releaser and the
actor's threat = [is] indeterminate,
let the actor's cooperation be (c) and
record (the actor's cooperation) as "Ally
request".*

*If there is a Mid-East-involvement (x) such that
(x) is a preference of (the actor's Ally) for the
actor,
let the actor's Mid-East-involvement be (x)
and record (the actor's Mid-East-involvement)
as "of Ally request".*

*If there is a European-involvement (x) such that
(x) is a preference of (the actor's Ally) for the
actor,*

¹⁷The switchover from reluctant to reliable can be varied by changes in threat perception rules. If, for example, France were to perceive a serious threat as the Warsaw Pact mobilized on its border, or as the FRG became involved in Europe as a combatant, then an initially reluctant France would become reliable.

Table 9

SUMMARY OF DIFFERENCES IN TEMPERAMENTS

Temperament	Initial Behavior	Event Prompting Change	Subsequent Behavior
Reliable	Complies with superpower ally	None	Complies with superpower ally
Reluctant	Responds in proportion to perceived threat	None	Responds in proportion to perceived threat
Initially Reliable	Complies with superpower ally	Ally preference for involvement of country forces	Responds in proportion to perceived threat
Initially Reluctant	Responds in proportion to perceived threat	Perception of higher-level threat	Complies with superpower ally
Neutral	Refuses to support either superpower	Perception of grave threat	Responds in proportion to perceived threat

let the actor's European-involvement be (x)
and record (the actor's European-involvement)
as "of Ally request".

If the actor is a follower of some country
(if the actor's side $\sim$ [isn't] that country's
side,

let the actor's side be that country's side
and record (the actor's side) as the string
{that country, "'s posture is to ", the
record-form of (the actor's side)},
and if the actor's cooperation $\sim$ [isn't]
noncoordinate

(if that country's cooperation = [is]
noncoordinate,

let the actor's cooperation be
noncoordinate and record (the actor's
cooperation) as the string {that
country, "'s posture is to ", the
record-form of (noncoordinate)},

otherwise if that country's cooperation =
[is] coordinate and the actor's cooperation
 $\sim$ [isn't] coordinate,

let the actor's cooperation be
coordinate and record (the actor's
cooperation) as the string {that
country, "'s posture is to ", the
record-form of (coordinate)}

and if the actor's Mid-East-involvement $\sim$ [isn't] Mid-East-noncombatant

(if that country's Mid-East-involvement =
[is] Mid-East-noncombatant,

let the actor's Mid-East-involvement be
Mid-East-noncombatant and record Mid-
East-noncombatant as the string {that
country, "'s posture is to ", the
record-form of (that country's Mid-East-
involvement)},

otherwise if the actor's Mid-East-
involvement = [is] Mid-East-on-call and
that country's Mid-East-involvement $\sim$ [isn't] Mid-East-on-call and that country's
Mid-East-involvement $\sim$ [isn't] Mid-East-
combatant,

let the actor's Mid-East-involvement be that country's Mid-East-involvement and record (the actor's Mid-East-involvement) as the string {that country, "s posture is to ", the record-form of (that country's Mid-East-involvement))}

and if the actor's European-involvement $\sim$ [isn't] European-noncombatant

(if that country's European-involvement = [is] European-noncombatant,

let the actor's European-involvement be European-noncombatant and record European-noncombatant as the string {that country, "s posture is to ", the record-form of (that country's European-involvement))},

otherwise if the actor's European-involvement = [is] European-on-call and that country's European-involvement $\sim$ [isn't] European-on-call and that country's European-involvement $\sim$ [isn't] European-combatant,

let the actor's European-involvement be that country's European-involvement and record (the actor's European-involvement) as the string {that country, "s posture is to ", the record-form of (that country's European-involvement))}).

Reliable countries that are on-call, having already committed their forces on-call, automatically become combatants if their superpower ally does so. This rule is necessary for efficient RSAC operations, to avoid having to schedule a separate move for Red or Blue Agents simply to "call" their on-call allies to become combatants.

If the actor's Mid-East-involvement is Mid-East-on-call and the actor's ally's Mid-East-involvement is Mid-East-combatant,

let the actor's Mid-East-involvement be Mid-East-combatant and record (the actor's Mid-East-involvement) as "of call implicit in Ally becoming combatant".

*If the actor's European-involvement is European-on-call and the actor's ally's European-involvement is European-combatant,
let the actor's European-involvement be European-combatant and record (the actor's European-involvement) as "of call implicit in Ally becoming combatant".*

*If the actor is located in Europe,
if the actor's European-involvement = [is] one of European-on-call or European-combatant and the actor's preparedness $\sim$ [isn't] mobilized
let the actor's preparedness be mobilized.*

*If there is a preparedness (x) such that (x) is a preference of (the actor's Ally) for the actor,
let the actor's preparedness be (x) and record (the actor's preparedness) as "of Ally request",
otherwise if the actor's threat = [is] one of grave or indirectly-grave,
let the actor's preparedness be mobilized,
otherwise if the actor's threat = [is] serious
and the actor's preparedness $\sim$ [isn't] mobilized
and the actor's preparedness $\sim$ [isn't] call-up,
let the actor's preparedness be call-up.*

*If there is a superpower-presence (x) such that (x) is a preference of (the actor's Ally) for the actor,
let the actor's superpower presence be (x) and record (the actor's superpower-presence) as "of Ally request",
otherwise if the actor's threat = [is] grave and the actor's strength = [is] militarily-weak,
if the actor's Ally = [is] US and the actor's superpower-presence $\sim$ [isn't] Blue-major
(send {return, "FROM ", the actor, " TO BLUE: REQUEST CHANGE ME BLUE MAJOR-PRESENCE", return})
otherwise if the actor's Ally = [is] USSR and the actor's superpower-presence $\sim$ [isn't] Red-major*

(send {return, "FROM ", the actor, " TO
RED: REQUEST CHANGE ME RED MAJOR-
PRESENCE", return}).

*If the actor is a conflict location
(if the actor is located in Europe and the
actor's European-involvement ~ = [isn't] one of
European-combatant or European-nuclear-
combatant,
let the actor's European-involvement be
European-combatant and record (European-
combatant) as 'the actor was a conflict-
location',
otherwise if the actor is located in Mid-East
and the actor's Mid-East-involvement ~ =
[isn't] one of Mid-East-combatant or Mid-East-
nuclear-combatant,
let the actor's Mid-East-involvement be
Mid-East-combatant and record (Mid-East-
combatant) as 'the actor was a conflict-
location').*

Reluctant Response Pattern. Placing one's forces on-call to an ally is the epitome of reliable behavior. It is, therefore, considered inconsistent for a player whose forces are on-call to be reluctant. Having forces on call is considered *de facto* proof that the actor has changed its temperament to reliable.

*If the actor's Mid-East-involvement = [is] Mid-
East-on-call or the actor's European-involvement
= [is] European-on-call,
let the actor's temperament be reliable and
determine-reliable-response and return.*

If no threat is perceived, reluctant countries do nothing.

*If the actor's threat = [is] indeterminate,
return.*

*If '(the actor's Ally) is effective in Europe' is
not provably true and the actor is located in
Europe and the European-involvement of (the
actor's Opponent) = European-nuclear-combatant
and noncoordinate is a preference of (the actor's
Opponent) for the actor,
let the actor's side be White and record (each
of White and noncoordinate) as "opportunity to*

limit damage" and send {the actor, "has ceased to be a player.", return} and deny the actor is a player and return.

If '(the actor's Ally) is effective in Mid-East' is not provably true and the actor is located in Mid-East and the Mid-East-involvement of (the actor's Opponent) = Mid-East-nuclear-combatant and noncoordinate is a preference of (the actor's Opponent) for the actor, let the actor's side be White and record (each of White and noncoordinate) as "opportunity to limit damage" and send {the actor, "has ceased to be a player.", return} and deny the actor is a player and return.

If there is a threat, they will side with their superpower ally if asked.

If there is a side (s) such that (s) is a preference of (the actor's Ally) for the actor, let the actor's side be (s) and record (s) as "of threat and Ally request".

Reluctant countries will grant base and transit rights for staging and attack launch from their territory if there is a serious threat, but they grant nuclear release only if the threat is grave.

Only when facing an indirectly grave or a grave threat will a reluctant country either allow a superpower to launch attacks from its territory or release nuclear weapons stored in its territory.

If there is a cooperation (c) such that (c) is a preference of (the actor's Ally) for the actor, unless (c) = [is] one of cobelligerent or nuclear-releasor and the actor's threat ~=[isn't] one of indirectly-grave or grave, let the actor's cooperation be (c) and record (the actor's cooperation) as "Ally request".

Reluctant countries are careful about their state of preparedness, lest premature call-up of reserves or full mobilization precipitate domestic or foreign difficulties.

If there is a preparedness (p) such that (p) is a preference of (the actor's Ally) for the actor,

*let the actor's preparedness be (p) and record
 (p) as "of threat and Ally request",
 otherwise if the actor's threat = [is] one of
 grave or indirectly-grave,
 let the actor's preparedness be mobilized,
 otherwise if the actor's threat = [is] serious
 and the actor's preparedness $\sim$ = [isn't] mobilized
 and the actor's preparedness $\sim$ = [isn't] serious,
 let the actor's preparedness be call-up.*

Reluctant countries recognize the need for superpower cooperation and presence when there is a threat, but they are more conservative in their requests than are reliable countries. They recognize dangers in inviting any major superpower presence into their territory. Saudi Arabia may be a country fitting this description. The experience of Afghanistan illustrates why this reluctance may be a good policy from the nonsuperpower's point of view.

*If the actor's threat = [is] grave and the
 actor's strength = [is] militarily-weak,
 if the actor's Ally = [is] US and the actor's
 superpower-presence $\sim$ = [isn't] Blue-major and
 the actor's superpower-presence $\sim$ = [isn't]
 Blue-tripwire
 (send {return, "FROM ", the actor, " TO
 BLUE: REQUEST CHANGE ME BLUE TRIPWIRE",
 return})
 otherwise if the actor's Ally = [is] USSR and
 the actor's superpower-presence $\sim$ = [isn't]
 Red-major and the actor's superpower-presence
 $\sim$ = [isn't] Red-tripwire
 (send {return, "FROM ", the actor, "TO RED:
 REQUEST CHANGE ME RED TRIPWIRE", return}).*

*If the actor's threat = [is] one of grave or
 indirectly-grave
 (if the actor is located in Mid-East
 (if there is a Mid-East-involvement (x)
 such that (x) is a preference of (the
 actor's Ally) for the actor
 (let the actor's Mid-East-involvement be
 (x) and record (x) as "of grave threat
 and Ally request"))*

otherwise if the actor is located in Europe
 (if there is a European-involvement (x)
 such that (x) is a preference of (the
 actor's Ally) for the actor
 (let the actor's European-involvement be
 (x) and record (x) as "of grave threat
 and Ally request"))
 and if there is a superpower-presence (x) such
 that (x) is a preference of (the actor's Ally)
 for the actor,
 let the actor's superpower-presence be (x)
 and record (x) as "of grave threat and Ally
 request").

If the actor is a follower of some country
 (if the actor's side $\sim$ [isn't] that country's
 side,
 let the actor's side be that country's side
 and record (the actor's side) as the string
 {that country, "'s posture is to ", the
 record-form of (the actor's side)},
 and if the actor's cooperation $\sim$ [isn't]
 noncoordinate
 (if that country's cooperation = [is]
 noncoordinate,
 let the actor's cooperation be
 noncoordinate and record (the actor's
 cooperation) as the string {that country,
 "'s posture is to ", the record-form of
 (noncoordinate)},
 otherwise if that country's cooperation =
 [is] coordinate and the actor's cooperation
 $\sim$ [isn't] coordinate,
 let the actor's cooperation be coordinate
 and record (the actor's cooperation) as
 the string {that country, "'s posture is
 to ", the record-form of (coordinate)})
 and if the actor's Mid-East-involvement $\sim$ [isn't]
 Mid-East-noncombatant
 (if that country's Mid-East-involvement =
 [is] Mid-East-noncombatant,
 let the actor's Mid-East-involvement be
 Mid-East-noncombatant and record Mid-
 East-noncombatant as the string {that

country, "s posture is to ", the record-form of (that country's Mid-East-involvement)),
 otherwise if the actor's Mid-East-involvement = [is] Mid-East-on-call and that country's Mid-East-involvement $\sim$ = [isn't] Mid-East-on-call and that country's Mid-East-involvement $\sim$ = [isn't] Mid-East-combatant,
 let the actor's Mid-East-involvement be that country's Mid-East-involvement and record (the actor's Mid-East-involvement) as the string {that country, "s posture is to ", the record-form of (that country's Mid-East-involvement))}
 and if the actor's European-involvement $\sim$ = [isn't] European-noncombatant
 (if that country's European-involvement = [is] European-noncombatant,
 let the actor's European-involvement be European-noncombatant and record European-noncombatant as the string {that country, "s posture is to ", the record-form of (that country's European-involvement))},
 otherwise if the actor's European-involvement = [is] European-on-call and that country's European-involvement $\sim$ = [isn't] European-on-call and that country's European-involvement $\sim$ = [isn't] European-combatant,
 let the actor's European-involvement be that country's European-involvement and record (the actor's European-involvement) as the string {that country, "s posture is to ", the record-form of (that country's European-involvement))}).

If any intercontinental weapon's type = [is] nuclear and 'the actor is a [conflict] location' is not provably true,

let the actor's temperament be neutral and let the actor's resolve be firm and let the actor's side be White and let the actor's cooperation

be noncoordinate and send {the actor, " adopted a neutral temperament.", return} and determine-neutral-response and return.

*If the actor is a conflict location
 (if the actor is located in Europe and the actor's European-involvement ~= [isn't] one of European-combatant or European-nuclear-combatant,
 let the actor's European-involvement be European-combatant and record (European-combatant) as 'the actor was a conflict-location',
 otherwise if the actor is located in Mid-East and the actor's Mid-East-involvement ~= [isn't] one of Mid-East-combatant or Mid-East-nuclear-combatant,
 let the actor's Mid-East-involvement be Mid-East-combatant and record (Mid-East-combatant) as 'the actor was a conflict-location').*

Neutral Response Pattern. The neutral response pattern is a minimal response. The actor takes no action on indirectly serious threats, hoping they will not require action. The actor calls up reserves if it perceives a serious or indirectly grave threat. Unless it perceives a grave threat, it will comply with no superpower request. If it perceives a grave threat, it changes its temperament to reluctant, permitting it to defend itself if invaded. If its orientation is White, when it becomes reluctant, it will continue not to cooperate with superpowers. If Blue- or Red-oriented, it will support the appropriate superpower after it becomes reluctant.

*If the actor's threat = [is] grave,
 let the actor's temperament be reluctant and determine-reluctant-response and return.*

*If the actor's threat = [is] one of indirectly-grave or serious and the actor's preparedness = [is] normal,
 let the actor's preparedness be call-up and record call-up as "threat exists".*

Initially Reliable Response Pattern. The initially reliable response rule set simply tests for whether the country's superpower ally has asked

it to involve its forces in the conflict. If so, the country behaves as a reluctant ally; if not, it behaves as a reliable ally, complying with super-power ally requests for side and cooperation.

Initially Reluctant Response Pattern. Similarly, the initially reluctant response rule set tests for whether the country has perceived a serious or grave threat. If it has, the country behaves as a reliable ally; if not, it behaves as a reluctant ally.

Opportunity Perception Rules

If a player is opportunistic, perceived opportunity can prompt military action. Compelling opportunity tends to prompt an immediate combat response. Inviting opportunity tends to prompt an immediate military response short of combat.

A country that is not a conflict location and is not already a combatant perceives a compelling opportunity in joining battle already under way in the territory of a relatively weak potential enemy.¹⁸

*If 'the actor is a [conflict] location' is not
provably true
(if the actor's European-involvement ~=
[isn't] European-combatant and there is a
country such that (that country is a
potential-enemy of the actor and that country
is located in Europe and that country's
strength ~= [isn't] militarily-strong and that
country is a [conflict] location),
let the actor's opportunity be compelling
and record compelling [opportunity] as the
string {that country, "'s already being
under attack"} and return,
otherwise if the actor's Mid-East-involvement
~= [isn't] Mid-East-combatant and there is a
country such that (that country is a
potential-enemy of the actor and that country
is located in Mid-East and that country's
strength ~= [isn't] militarily-strong and that
country is a [conflict] location),
let the actor's opportunity be compelling
and record compelling [opportunity] as*

¹⁸Potential enemies are defined in the data base by means of statements such as: As
sert Syria is a potential enemy of Israel.

the string {that country, "s already being under attack"} and return).

Another compelling opportunity arises if both superpower homelands are conflict locations (hence they are unlikely to act effectively as regional policemen) and the actor has a potential enemy that is relatively weak. The standard rule restricts this to the Mid-East, where opportunistic countries might see in superpower distraction elsewhere an opportunity to settle old scores.

If US is a [conflict] location and USSR is a [conflict] location and the actor's strength = [is] militarily-strong and the actor is located in Mid-East and there is a country such that (that country is a potential-enemy of the actor and that country is located in Mid-East and that country's strength $\sim$ [isn't] militarily-strong), let the actor's opportunity be compelling and record compelling [opportunity] as the string {"superpower distraction plus ", the actor, "s being militarily-superior to ", that country} and return.

An inviting opportunity could arise for a player if, in a situation short of intercontinental war, it were closely allied to a superpower and had a relatively weak potential enemy.

If the situation $\sim$ [isn't] intercontinental-war and (the actor's cooperation = [is] cobelligerent or European-combatant is a preference of (the actor's Ally) for the actor) and there is a country such that (that country is a potential-enemy of the actor and that country is located in Europe and that country's strength $\sim$ [isn't] militarily-strong), let the actor's opportunity be inviting and record inviting [opportunity] as the string {the actor's Ally, "s willingness to sponsor combat against ", e} and return.

If the situation $\sim$ [isn't] intercontinental-war and 'the actor is a [conflict] location' is not provably true and there is a country such that (that country is a potential-enemy of the actor and the Ally of that country $\sim$ [isn't] the Ally of (the actor) and (that country's Mid-East-

involvement = [is] Mid-East-combatant or that country's European-involvement = [is] European-combatant)),

let the actor's opportunity be inviting and record inviting [opportunity] as the string {that country, "is fighting against interests of", the actor} and return.

There is an implicit assumption here regarding how and why war coalitions form. A superpower coalition leader wants minor player support (evidenced by the superpower's asking for combat access or direct involvement in the previous rules). Minor players presumably want something in return for their cooperation or involvement. Scenario Agent does not incorporate a full menu of minor player objectives. Minor player objectives are currently limited to dealing with potential enemies. The implicit assumption here is that superpowers needing minor player support will reciprocally support (or at least not hinder) minor player efforts to settle accounts with their potential enemies.

The default opportunity, like the default threat, is indeterminate.

Let the actor's opportunity be indeterminate.

Opportunity Response Rules

An opportunistic player may be reluctant or reliable with respect to its superpower ally's principal concerns but will also have its own agenda which may be opposed by the superpower. Compelling opportunities prompt opportunistic actors to become combatants. Inviting opportunities prompt them to go on alert.

General rules for the opportunistic country cite the conditions that would prompt a country to see an inviting or a compelling opportunity to attack its potential enemy. First, the enemy must be in the same region and not militarily strong. Second, one of three conditions must exist: the country is strongly in support (is a cobelligerent) of an ally in a conflict and the potential enemy is a location of conflict; or the enemy is not in conflict but the country's ally wants the country to attack the enemy; or both allies are diverted by multitheater war between themselves and by inference are not inclined or strong enough to inhibit the country in an attack on its enemy. The ROSIE text for these rules is as follows.

Unless the actor's threat = [is] one of grave or indirectly-grave

*(if the actor is located in Mid-East,
 if the actor's opportunity = [is]
 compelling
 (let the actor's Mid-East-involvement be
 Mid-East-combatant and record Mid-East-
 combatant as "compelling Mid-East
 opportunity exists")
 otherwise if the actor's opportunity = [is]
 inviting
 (let the actor's Mid-East-involvement be
 Mid-East-alerted and record Mid-East-
 combatant as "inviting Mid-East
 opportunity exists"),
 and if the actor is located in Europe,
 if the actor's opportunity = [is] compelling
 (let the actor's European-involvement be
 European-combatant and record European-
 combatant as "compelling European
 opportunity exists")
 otherwise if the actor's opportunity = [is]
 inviting
 (let the actor's European-involvement be
 European-alerted and record European-
 combatant as "inviting European
 opportunity exists"))).*

Effectiveness Perception Rules

We can now examine "to assess-effectiveness of superpower," which was called by rules 2 and 3 in "to decide-posture." The first rule in this rule set is a prudent default assumption that nonsuperpowers generally regard superpowers as effective.

*Assert the superpower is effective in every
 region.*

If, however, the superpower's homeland is under intercontinental nuclear attack, it is assumed (from the nonsuperpower perspective) to be ineffective. As a first-order approximation, nonsuperpowers do not make distinctions as to which superpower is winning a central nuclear exchange. This is because effectiveness is presently used in Scenario Agent in the sense of a superpower's effectiveness as an ally to the nonsuperpower. The assumption here is that a superpower ally whose homeland is under intercontinental nuclear attack cannot be counted

upon to provide much assistance to its nonsuperpower allies; hence, it is not effective.

If the situation = [is] intercontinental-war and the superpower is a nuclear conflict location, deny the superpower is effective in every region and record (the superpower) as "is ineffective because under nuclear attack" and return.

During review of this rule, a question was raised as to whether it might cause a Warsaw Pact country to do something it might regret. The reviewer had in mind a scenario in which the Soviet Union were under nuclear attack, and a satellite country such as Hungary concluded through this rule that the Soviet Union was ineffective, ceased to support it, and was subsequently crushed by the Red Army still within its borders. The answer to the question is "yes, the actor might do something it might regret," just as countries in the real world do things they come to regret.¹⁹

Note the distinction in three-value logic (mentioned above) between "deny the superpower is effective" and "assert the superpower is not effective." If we deny something, that something is neither provably true nor provably false. If we assert something is "not," that something is provably false.²⁰

U.S. effectiveness in the Mid-East is assumed to be dependent on securing at least logistics access from an Eastern Atlantic ally (Portugal, Spain, or the United Kingdom), an Eastern Mediterranean ally (Egypt, Israel, or Turkey), and a Persian Gulf ally (Saudi Arabia or Oman). Here, Mid-East effectiveness is rather narrowly defined in terms of power projection into the Persian Gulf. An analyst should review this rule and change it, as appropriate, to the problem at hand.

¹⁹If one wanted this not to happen, the rule could be changed to read "if the situation = {is} intercontinental-war and the superpower is a nuclear conflict location, for each player such that that player's superpower-presence = [is] no-presence, deny the superpower is effective for (that player) in every region...." This formulation would increase the size of the data base, in that it would require storing superpower effectiveness information for each player, which is not presently done. It would also require rewording every rule that makes use of superpower effectiveness to the form "<superpower> is effective for <player> in <region>," rather than "<superpower> is effective in <region>."

²⁰This rule was written in the "deny" form rather than in the "assert not" form because the former deletes items from the data base, but the latter adds items to it. The larger the data base, the slower the model. The beauty of the awkward (in the English sense) statement "is provably true" to a programmer is that it permits inference from information that is *not* in the data base.

If USSR's Mid-East-involvement $\sim =$ [isn't] Mid-East-noncombatant and (Portugal's cooperation = [is] noncoordinate and Spain's cooperation = [is] noncoordinate and UK's cooperation = [is] noncoordinate) or (Egypt's cooperation = [is] noncoordinate and Israel's cooperation = [is] noncoordinate and Turkey's cooperation = [is] noncoordinate) or (Saudi.Arabia's cooperation = [is] noncoordinate and Oman's cooperation = [is] noncoordinate)),
 deny US is effective in Mid-East and record US
 as "is ineffective in Mid-East because of lack
 of ally support".²¹

Similarly, the effectiveness of U.S. power projection into Europe depends on access to Dutch or Belgian seaports and to bases in the FRG.

If USSR's European-involvement $\sim =$ [isn't] European-noncombatant and (Netherlands's cooperation = [is] noncoordinate and Belgium's cooperation = [is] noncoordinate) or FRG's cooperation = [is] noncoordinate),
 deny US is effective in Europe and record US
 as "is ineffective in Europe because of lack
 of ally support".

The following rule is representative of effectiveness rules that could be developed for specific problems. In this case, the rule relies on information on the German FEBA (Forward Edge of the Battle Area) from Force Operations.²² This rule says that if the Western forces are losing in the FRG and the United States has not attacked the Soviet homeland, the United States is not effective in Europe.

²¹Caution: if a user were not interested in one of these countries in a particular analysis and deleted it or its cooperation from the Scenario Agent data base in the interests of efficiency, this rule would *never* fire because '<that country's> cooperation = noncoordinate' would not be provably true.

²²Specifically, the rule requires knowledge of whether the German FEBA is west of the Rhine River and whether the FEBA is moving quickly westward. This assumes that there is one and only one FEBA in Germany and that Force Operations can determine if it is west of the Rhine. It also assumes that Force Operations and Scenario Agent both have the same understanding of what is meant by "moving quickly westward," for example, moving at a speed of 20 km or more per day. Force Operations will not know the information requirements of this or similar Scenario Agent rules unless informed by someone with knowledge of and responsibility for Scenario Agent.

If FRG is a nuclear conflict location and 'USSR is a [conflict] location' is not provably true and the German FEBA is west of the Rhine and the German FEBA is moving-quickly-westward, deny US is effective in Europe and record US as "is ineffective in defending FRG" and return.

Assertive Response Rules

If the actor did seek aid from (the actor's Ally) at some time such that ((the present-time - that time) >= 4),

(if there is a posture such that that posture is a preference of (the actor's Ally) for the actor,

let the actor's temperament be reliable and the actor's side be the side of (the actor's Ally) and record (the actor's side) as "Ally implicitly offered aid" and let the actor's resolve be firm and deny the actor is assertive and determine-reliable-response and return,

otherwise,

let the actor's side be White and let the actor's resolve be firm and let the actor's cooperation be noncoordinate and let the actor's European-involvement be European-noncombatant and record European-noncombatant as "Ally not responsive to grave threat" and let the actor's Mid-East-involvement be Mid-East-noncombatant and record Mid-East-noncombatant as "Ally not responsive to grave threat" and deny the actor is a player and return).

The following rules have been developed to model independent deterrence:

*If the actor is nuclear-capable
and the actor's orientation $\sim =$ [isn't] Red
(if the actor's threat = [is] grave
and the actor is located in Europe*

and the actor's European-involvement $\sim =$ [isn't]
 European-nuclear-combatant,
 let the actor's European-involvement be
 European-nuclear-combatant and record
 European-nuclear-combatant as "grave threat
 demands full response",
 otherwise if the actor's threat = [is] one of
 indirectly-grave or serious and (the Red
 European weapon's type = [is] nuclear or FRG
 is a conflict location),
 if the actor's temperament = [is] reliable
 send {return, "FROM: ", the actor, " TO:
 USSR", return, "DEMAND REVERSE
 ESCALATION", return}
 otherwise
 send {return, "FROM: ", the actor, " TO:
 USSR", return, "DEMAND YOU NOT ESCALATE
 ARENA", return}).

If the actor's threat = [is] grave and the
 actor's side = [is] Blue and the actor is located
 in Europe and USSR's European-involvement = [is]
 one of European-combatant or European-nuclear-
 combatant and 'USSR is a [conflict] location' is
 not provably true,
 send {return, "FROM: ", the actor, " TO: US",
 return, "REQUEST NUCLEAR STRIKE AGAINST USSR",
 return} and assert the actor did seek aid from
 (US) at the present-time.

If the actor's threat = [is] grave and the
 actor's side = [is] White,
 (if the actor's orientation = [is] Blue,
 send {return, "FROM: ", the actor, " TO:
 US", return, "REQUEST CHANGE ME BLUE
 COBELLIGERENT", return} and assert the
 actor did seek aid from (US) at the
 present-time,
 otherwise if the actor's orientation = [is]
 Red,
 send {return, "FROM: ", the actor, " TO:
 USSR", return, "REQUEST CHANGE ME RED
 COBELLIGERENT", return} and assert the
 actor did seek aid from (USSR) at the
 present-time).

SERVICE RULES AND DATA

Service rules control execution of the model. They do not contain political-military substance, but they must be understood by anyone running the model or changing its rules. They will be discussed in the order they are normally called on during the course of an RSAC gaming exercise.

To Advance to Point at Time

When Systems Monitor advances game time, it also establishes a game point. The distinction is that game time is the date and time at which the move is assumed to take place, whereas game point uniquely identifies a move in a specific gaming exercise. If, for example, events at 0800 on 1 January 1990 were gamed under five different sets of assumptions, each of the five moves would have the same game time but different game points. The Scenario Agent operator advances to a new game time and game point by entering "advance to <point> at <time>," where angle brackets are not entered on the keyboard, but are used here to indicate variable names or parameters. The values of <point> and <time> are provided by Systems Monitor.

The purpose of "to advance to point at time" is to schedule the next decision for each player for whom a superpower has expressed a preference, to start a log recording events of the new move, and to advance game time. This service rule set need not be discussed further here, but it is listed in Appendix A.

To Generate Day-Count of Date-Time-Group

This rule set counts the number of days from an entering argument to a reference date. It differs from all the rule sets discussed so far, in that it is a so-called generator rule set, whereas the others are so-called procedure rule sets. ROSIE generators produce data when they are called. Such data are not stored in the data base in the same way data are stored through assertions.

The user can cause the day-count to be displayed by entering a statement of the form *display the day-count of <date-time-group>*, where the date-time-group is of the form hhmm/ddmmyy, as in 0800/150984 (8:00 a.m. on 15 September 1984).

To Generate Days in Month for Year

This generator is used by "day-count" to determine how many days are in a given month.

To Determine-Situation

When the new military situation has been received from Force Operations, Scenario Agent's move begins. The first step is to determine whether the situation represents intercontinental war, theater war, or local conflict.

*If some intercontinental weapon's type $\sim$ [isn't]
none or (some European weapon's type $\sim$ [isn't]
none and some Mid-East weapon's type $\sim$ [isn't]
none),
let the situation be intercontinental-war and
go record situation as "intercontinental war",
otherwise if the Red European weapon's type $\sim$ [isn't]
none and the Blue European weapon's type
 $\sim$ [isn't] none,
let the situation be theater-war and go record
situation as "theater war in Europe",
otherwise if the Red Mid-East weapon's type $\sim$ [isn't]
none and the Blue Mid-East weapon's type
 $\sim$ [isn't] none,
let the situation be theater-war and go record
situation as "theater war in Mid-East",
otherwise (let the situation be local-conflict
and go record situation as "local conflict").*

That one rule completes this particular rule set. The first line is a double negative: if some intercontinental weapon's type (it could be the Red or Blue intercontinental weapon) is not none (meaning it is conventional, CBR, or nuclear), then do what the rest of the rule says. In other words, if either superpower has launched any of its designated intercontinental weapons (most of which, of course, are nuclear), the situation is intercontinental war. But the next two lines tell us (and the computer) that an alternative definition for intercontinental war holds if some superpower weapons are in use in *both* the European and Mid-East theaters. If either definition of intercontinental war applies, this rule has served its purpose and the computer does not consider what follows "otherwise." Instead, it makes a data base entry and records the event in a log for the operator and for postrun analysis. If, on

the other hand, neither condition for intercontinental war currently holds, the rule asks if *both* superpowers are using weapons in any one theater. If so, the situation is theater war. Otherwise, the situation is local conflict. The purpose of this rule is to characterize "the situation" once per move, rather than once or more often per player per move.

To Record X as Y

This rule set provides information for the user to analyze. If it is entered from "to determine-situation," the following rule executes. Non-programmers need not concern themselves with the intricacies of the rule.

If the x = situation,
send {return, "At ", the game-time, ", day ",
the present-time, ", the situation was ", the
y, ". ", return, "The US had previously decided
to ", the record-form of (US's preparedness),
", ", return, "to ", the record-form of US's
Mid-East-involvement), ", ", return, "and to ",
the record-form of (US's European-
involvement), ". ", return, "The USSR had
previously decided to ", the record-form of
(USSR's preparedness), ", ", return, "to ", the
record-form of (USSR's Mid-East-involvement),
", ", return, "and to ", the record-form of
(USSR's European-involvement), ". ", return,
return, "Conflict locations were:", return}
and send {every [conflict] location, return}
and send {return, "Current weapon usage was:",
return, return} and for each weapon send {that
weapon, "--", that weapon's type, return} and
return.

The above rule produces a console display similar to the following:

At 0800/030990, day -28, the situation was local conflict. The US had previously decided to maintain peacetime preparedness, to decline to involve own forces in Mid-East conflict, and to decline to involve own forces in European conflict. The USSR had previously decided to maintain peacetime preparedness, to mobilize reinforcements for Mid-East combat, and to decline to involve own forces in European conflict.

Conflict locations were:

IRAN
RFACTION
WFACTION

Current weapon usage was:

RED INTERCONTINENTAL WEAPON—NONE
BLUE INTERCONTINENTAL WEAPON—NONE
RED EUROPEAN WEAPON—NONE
BLUE EUROPEAN WEAPON—NONE
RED MID-EAST WEAPON—NONE
BLUE MID-EAST WEAPON—NONE
WHITE MID-EAST WEAPON—NONE

As a player's move is processed, its status and decisions are recorded. This begins with identification of the actor by the following rule:

*If the x = actor,
send {return, the y , " , a " , the record-form of
(the actor's strength), " , the actor's
orientation, "oriented " , the record-form of
(the actor's temperament), return, "that had
previously decided to " , the record-form of (the
actor's preparedness), " , return, "to " , the
record-form of (the actor's side), " , return,
"to " , the record-form of (the actor's
cooperation), " , return, "to " , the record-
form of (the actor's Mid-East-involvement), " ,
return, "and to " , the record-form of (the
actor's European-involvement), " , return} and
return.*

The above rule produces the following type of display:

KUWAIT, a militarily weak BLUE-oriented reliable ally that had previously decided to maintain peacetime preparedness, to side with neither superpower, to deny superpower access, to decline to involve own forces in Mid-East conflict, and to decline to involve own forces in European conflict,

As threat is assessed and responses are determined, the following rule is used to generate a record: ♦

Match the x:

*{preference} send {"noting that ", the y, ",",
return};*

*{schedule} send {"planned to assess its posture
in ", (the actor's next-decision-time - the
present-time), " day(s).", return};*

*{grave} send {"perceiving a grave threat in ",
the y, ",", return};*

*{indirectly-grave} send {"perceiving an
indirectly grave threat in ", the y, ",",
return};*

*{serious} send {"perceiving a serious threat
in ", the y, ",", return};*

*{indirectly-serious} send {"perceiving an
indirectly-serious threat in ", the y, ",",
return};*

*{indeterminate-threat} send {"perceiving an
indeterminate threat in the situation, ", return};*

*{compelling} send {"perceiving a compelling
opportunity in ", the y, ",", return};*

*{inviting} send {"perceiving an inviting
opportunity in ", the y, ",", return};*

*{script} send {return, "SCRIPTED ACTION: ", the
y, return};*

*{decision} send {"assessed its posture.",
return};*

*default: send {the actor, " decided to ", the
record-form of the x, " because ", the y, ".",
return};*

This completes the record of the actor's move, as in:

KUWAIT, a militarily weak BLUE-oriented reliable ally that had previously decided to maintain peacetime preparedness, to side with neither superpower, to deny superpower access, to decline to involve own forces in Mid-East conflict, and to decline to

involve own forces in European conflict, perceiving an indeterminate threat in the situation, noting that 'US does want KUWAIT to "side with the US"', noting that 'US does want KUWAIT to "allow logistics access"', assessed its posture. KUWAIT decided to side with the US because Ally request. KUWAIT decided to allow logistics access because Ally request.

To Decide-Posture

The next step in processing a Scenario Agent move is to enter "decide-posture," which begins by assessing effectiveness of both superpowers.

Go assess-effectiveness of US.

Go assess-effectiveness of USSR.

Recall that the defined possibilities are that either superpower is effective or not effective in the Mid-East or in Europe.

Next, "to decide-posture" cycles through the leaders that are players, designates each in turn as the actor, and tells that actor to make its move. It is important that leaders move before their followers, because followers check their leader's posture before committing themselves to cooperate with a superpower.

*For each leader that is a player,
let the actor be that leader
and go move.*

We shall defer examining "move," to finish discussing "decide-posture." Looking ahead, however, "move" calls for threat perception, next decision scheduling, and response determination by the actor.

Returning to "decide-posture," the next rule calls for the rest of the players (those that are not leaders) to move.

*For each player,
unless that player is a leader,
let the actor be that player
and go move.*

To Move

Recall that "to move" is normally called by "to decide-posture." It is a one-rule rule set. It exists as a separate rule set to facilitate recovering from errors of omission in updating the data base going into a new

AD-A130 275

A RULE-BASED POLICY-LEVEL MODEL OF NONSUPERPOWER
BEHAVIOR IN STRATEGIC CONFLICTS(U) RAND CORP SANTA
MONICA CA W SCHWABE ET AL. DEC 82 RAND/R-2982-DNA

2/2

UNCLASSIFIED

DNA001-80-C-0298

F/G 5/4

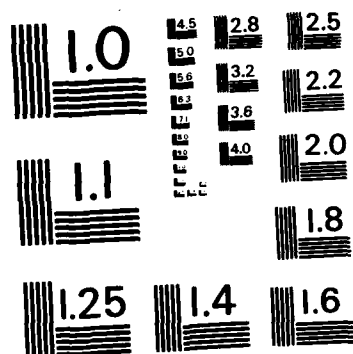
NL

END

DATE
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6 83

DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Scenario Agent move. If the record produced by "decide-posture" shows something amiss in Spain's response, for example, it is much easier and faster to correct the data and enter "let the actor be Spain and move" than it is to reprocess all the players (which is what entering "decide-posture" would do).

Go record (actor) as the actor and go determine-alignment and go assess-threat and go schedule response and

(if the actor's next-decision-time > the present-time

go record (schedule) as the actor's next-decision-time

otherwise (go assess-opportunity and for each preference (p) of (US) for the actor

go record (preference) as 'US does want (the actor) to (the record-form of p)'

and for each preference (p) of (USSR) for the actor

go record (preference) as 'USSR does want (the actor) to (the record-form of p)'

and go record (decision) as (the actor's next-decision-time) and go determine-response and deny every preference of (US) for the actor is a preference of (US) for the actor and deny every preference of (USSR) for the actor is a preference of (USSR) for the actor and let the actor's next-decision-time be (the present-time + the delay of (the actor)))).

We shall defer discussion of "determine-alignment."

"Move" calls for the actor to determine its response only if the actor's next decision time is numerically less than or equal to the present time. That is, actors do not respond yet if their next decision time is still in the future.

After the futurity check, the rule has the actor record superpower preferences (requests via messages), determine response, and forget about the superpower preferences (once acted upon). Keeping previously considered messages would clutter up the data base and slow execution—just as it does in real bureaucracies. Analysts using Scenario Agent need to be aware that the minor players discard messages once considered (whether complied with or not), so they can prompt the major players to resubmit requests, if appropriate.

Thus far, we have been discussing the actor's delay and its next decision time as though they were sufficient to determine when the actor assesses its posture. That would be true if the present time (game time) were advanced at small increments, but it is more typical for Systems Monitor to advance time in large enough increments that the minor players do not get a chance to assess their postures as frequently as their next decision times would suggest. If, for example, Italy's next decision time is day 43, but Systems Monitor advances time from day 40 to day 54, Italy makes its next decision on day 54 on the basis of the military situation on day 54. If, however, time were advanced from day 40 to day 41, Italy would not make a decision on day 41, but would have to wait at least until day 43. Time advance in gaming is not an insignificant matter.

To Determine-Alignment

"To determine-alignment" simply determines which superpower is the actor's ally and which its opponent. If the actor has chosen a side in the current conflict (Red or Blue), ally and opponent can be inferred from the side. If not (the actor's side is White), then ally and opponent are inferred from orientation. If both side and orientation are White, the actor is truly nonaligned, and its ally and opponent are indeterminate.

To Determine-Response

"To determine-response" uses temperament to determine which response pattern rule set to call. It also determines the actor's resolve. Resolve appears in the Scenario Tableau, but is not used as an input to any of the standard rules for determining responses.

Match the actor's temperament:

{reliable} let the actor's resolve be firm and go determine-reliable-response;

{reluctant} let the actor's resolve be moderate and go determine-reluctant-response;

{initially-reliable} let the actor's resolve be soft and go determine-initially-reliable-response;

{initially-reluctant} let the actor's resolve be soft and go determine-initially-reluctant-response;

*{neutral} let the actor's resolve be firm and go
determine-neutral-response.*

After one of the alternative temperament-driven response pattern rule sets is applied, "to determine-response" calls on opportunistic or assertive rule sets (if the analyst has previously asserted that the actor is opportunistic or assertive).

*If the actor is opportunistic,
go determine-opportunistic-response.*

*If the actor is assertive,
go determine-assertive-response.*

To Write-Tableau

Scenario Agent rules can be changed to suit users' needs, but the data crossing an output interface cannot be changed unless the program on the other side of the interface is also changed. More specifically, the format of the Scenario Tableau cannot be changed without having to change Red and Blue Agent models accordingly. To facilitate changes to Scenario Agent without necessitating changes to Red and Blue, we designed a rule set, "to write-tableau," to do nothing but translate information currently used in Scenario Agent into the form expected by Red and Blue Agents. When, for example, we added the European-nuclear-combatant involvement level, we did not require an immediate change in Red or Blue. Instead, we simply added the following sentence to a file called "tableau-form":

*Let the tableau-form of European-nuclear-
combatant be "combatant".²³*

In other words, Red and Blue see a nuclear-combatant as a combatant. Later, if Red and Blue Agent developers want to make a distinction between nuclear combatants and other combatants, we need only change the appropriate line in file "tableau-form."

RULE SET AUGMENTATION

As emphasized throughout this report, Scenario Agent is intended to be highly flexible. The Mark II rules are controversial as well as incom-

²³ROSIE requires that the period be outside the quotation mark.

plete, but the structure accommodates changes readily. To illustrate this, suppose after some research a user wants a set of war games that characterizes the NATO allies as having a more complex behavior pattern that shifts from reluctant to reliable and then to a new behavior type, "yielding." We will call this pattern "ultimately yielding." What would he physically have to do? In other words, what does it mean to say the model is flexible?

The user might first construct something like Fig. 10 to clarify his own thinking and to explain it to others. Here the country responds reliably until the United States requests that it grant nuclear release or that it become on-call or a combatant in Europe, at which point it begins to behave reluctantly. Reluctant behavior continues unless and until the country becomes a location of nuclear conflict. If that happens and there is a major Blue presence in the country's territory, then it again becomes reliable. If, on the other hand, it is a location of nuclear conflict and does not have a major Blue presence, it becomes yielding.

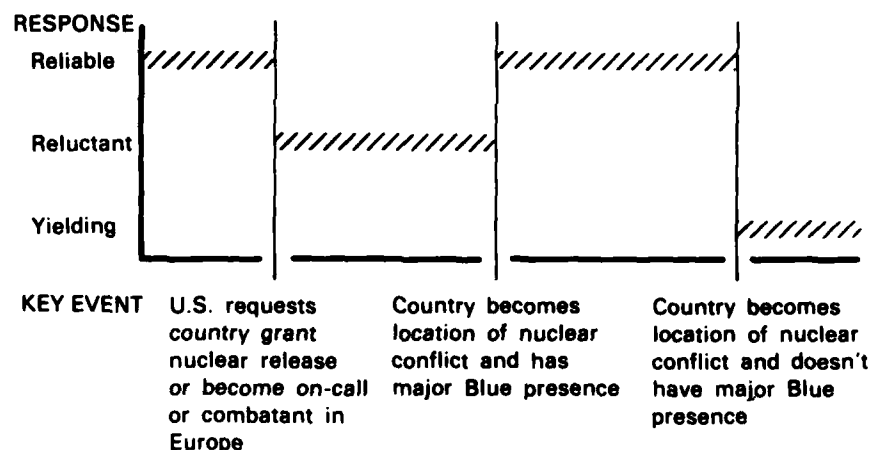


Fig. 10—Ultimately yielding response pattern

The ultimately yielding response pattern sketched in Fig. 10 would be translated into the following ROSIE statements:

To determine-ultimately-yielding-response:

*If the actor is a location of nuclear conflict,
 if the actor's superpower presence = [is] Blue
 major
 go determine-reliable-response
 otherwise go determine-yielding-response,*

*otherwise if European on-call is a preference of
(US) for the actor
go determine-reluctant-response
otherwise if European combatant is a preference
of (US) for the actor
go determine-reluctant-response
otherwise if nuclear-releasor is a preference of
(US) for the actor
go determine-reluctant-response
otherwise go determine-reliable-response.*

End.

The next step in augmentation would be to write a rule set for the new "yielding" response, the rule set called in the ultimately yielding response pattern if the country becomes a location of nuclear conflict and has no major Blue presence. The user would type the following statements and save them as a computer file that might be called "determine-yielding-response."

To determine-yielding-response:

*If White is a preference of (the actor's
Opponent) for the actor,
let the actor's side be White and go record
(the actor's side) as "Opponent preference".*

*If noncoordinate is a preference of (the actor's
Opponent) for the actor,
let the actor's cooperation be noncoordinate
and go record (the actor's cooperation) as
"Opponent preference".*

*If European noncombatant is a preference of (the
actor's Opponent) for the actor,
let the actor's European involvement be
European noncombatant and go record (the
actor's European involvement) as "Opponent
preference".*

End.

The standard Mark II rule set "to determine-response" checks country temperament to determine which of the response behavior patterns to execute. The rule set presently expects temperament to be one of reliable, reluctant, initially reliable, or initially reluctant. The user must

create a new temperament to evoke the new rule set "to determine-ultimately-yielding-response." If the user named this new temperament "changeable," the first rule in "to determine-response" would be changed to read

Match the actor's temperament:

```
{reliable}
  let the actor's resolve be firm and go
  determine-reliable-ally-response;
  :
{changeable}
  let the actor's resolve be soft and go
  determine-ultimately-yielding-response.
```

The user would then bring the Scenario Agent on-line and type precisely the following, using English-like statements and without having to worry about the usual complications arising in computer work (e.g., unintended ripple effects throughout a program or the need to redefine the size of arrays). This ability to avoid usual computer problems is a hallmark of Rand's artificial intelligence language, ROSIE.

Parse each of determine-response, determine-ultimately-yielding-response and determine-yielding-response.²⁴

Compile each of determine-response, determine-ultimately-yielding-response and determine-yielding-response.²⁵

At this point, the modification is complete. All that remains is to make the assumption that the newly defined temperament applies to some NATO members. If the user assumed it applies to all NATO members except the United States, he would type

```
For each country such that that country ~=
[isn't] US,
  let that country's temperament be
  changeable.
```

²⁴This causes ROSIE to process the previously created rule sets, checking for syntax errors and ambiguities and translating the statements into the lower-level INTERLISP language.

²⁵ROSIE can operate either as an interpreter or compiler. Compilation is optional. Compiled rule sets are executed more efficiently.

If the user really liked this response pattern for the Western allies, he could make it a permanent part of the Scenario Agent by typing

Clear database.

Save as agent.

This would make the augmented version available for other users to choose at the outset of a game. Otherwise, the model would not be changed permanently (it would revert back to the regular Mark II version at the end of the on-line session), though the files created during the on-line session would still be available.

IV. CONCLUSIONS

The Scenario Agent model is a critical component of the RSAC automated war gaming system. It provides information about nonsuperpower national postures that Blue and Red Agent models need to simulate the decisionmaking of the United States and the Soviet Union, respectively.

RSAC multiscenario analysis requires that Scenario Agent provide the controlled, systematic variation of nonsuperpower behavior needed to produce families of related scenarios. Behavior can be precisely controlled by transparent, deterministic rules. And it can be varied systematically by control parameters or by changing the model's rules interactively.

The model is transparent in two respects: The program is understandable line by line, and it is comprehensible in its totality. The Scenario Agent program is understandable because it is written in an English-like language (ROSIE) and because it uses relatively familiar terms for the names of variables and their values (such as "threat" and "serious," respectively). The program is comprehensible because its rules are organized into rule sets that perform recognizable functions, because the names of the rule sets are reasonably familiar, and because the program generates a first-order trace of its logic as the program executes. Military strategists, planners, and other observers can rely substantially on their intuition to comprehend what Scenario Agent means by behavior patterns such as "assess threat" and "determine initially reluctant response." They can spot-check the Scenario Agent rationale trace to verify that the model is operating as they intuitively suspect. When there is a disparity between the rationale trace and an observer's intuition, the observer can easily display the appropriate program rules, which (as we have noted) are in a form that is understandable line by line. If this still does not satisfy the observer, the game move can be rerun under different parametric assumptions or existing rules can be changed.

Experience with Scenario Agent to date has led us to the conclusion that the model's structure is adequate to support analysis using RSAC automated war gaming, but that the rule base must be refined for general analytic use and should probably be augmented for analysis of specific problems. We have confidence in the structure because it is quite general, was adequate to provide the information called for by Mark II Blue and Red Agent rules, performed well during a course of illustrative gaming experiments, and is expandable. The rule base was tested in the

gaming experiments and was assessed during the writing and review of this report. However, we are not yet satisfied that the rule base is adequately complete to support general strategy analysis. Further research in FY 1983 will assess rule base completeness and suggest rule refinement and augmentation. We expect that specific problems will require special rule augmentation, which we believe the model can accommodate.

Scenario Agent in its Mark II form appears to be well suited to analysts who want to think deeply about scenario effects but need an efficient and transparent mechanism for doing so. Given the multidimensional nature of scenarios and the many interrelationships that exist among the political decisions and military actions of the various players, it is impractical to expect serious scenario work without such a mechanism. The human mind tends to work linearly, focus implicitly on a few variables, and be inadvertently inconsistent with other variables in complex situations. Human experience constructs mental models with far greater complexity than Scenario Agent, but mental models are not readily accessible, directly communicable, nor (necessarily) logically taut. It is an article of faith in our work with Scenario Agent that the process of building formal models, however primitive, will prove to be enlightening and powerful in avoiding prejudices that have caused policy errors in the past.

Appendix A

SCENARIO AGENT RULE BASE LISTING

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This appendix is a complete listing of the Mark II Scenario Agent rule base. It is provided mainly to enable programmer-analysts to maintain the program or to implement it on other computers hosting ROSIE. The listing contains some ROSIE language constructs not explained earlier in the report. We use footnotes to explain many of these constructs as they appear in the program listing; however, Fain et al. (1981) provide a more complete explanation of ROSIE syntax and semantics.

We have tried to make the logic of Scenario Agent rules easier to follow by indenting logically subordinate conditions and actions. ROSIE allows indentation but does not require it. We have also tried to improve readability by splitting lines of text more or less as in ordinary English. This does not violate ROSIE conventions as long as there is a carriage return (which is invisible to the reader) precisely at the end of each line. The carriage return ensures that unwanted blank spaces are not inserted into strings and hyphenated words split between two lines of text.

When loaded into the computer, each rule set heading printed here in bold type is the first line of the rule set. ROSIE requires that these rule set headings end with a colon (:). Additionally, *each rule set must end with a line reading: "End."*

TO ADVANCE TO POINT AT TIME

[1] For each player (p) such that (any posture) is a preference of (one of US or USSR) for (p),
let the actor be (p) and schedule response.

[2] Match the point against {1 letter (bind c1), 1 letter (bind c2), ".", 1 letter (bind n1), 1 letter (bind n2)} and let the game-branch be c1 and let the game-point be c2 and let the next-game-branch be n1 and let the next-game-point be n2.¹

[3] Dribble to the name {the game-branch, the game-point, "-", the next-game-branch, the next-game-point, ".log"}.²

¹Matching and binding are explained in Fain et al. (1981). What this rule does is divide the point (a variable string of the form xx.xx) into four single-letter parts that are used to identify output files.

²This rule causes everything subsequently appearing on the operator's console screen to be recorded in a file whose name is a composite of the game point identifiers and the word "log."

- [4] Let the game-time be the time.
- [5] Let the present-time be the day-count of the time.

TO ASSESS-EFFECTIVENESS OF SUPERPOWER

- [1] Assert the superpower is effective in every region.
- [2] If the situation = intercontinental-war and the superpower is a nuclear conflict location,
deny the superpower is effective in every region
and record (the superpower) as "is ineffective
because under nuclear attack" and return.
- [3] If the superpower = USSR, return.
- [4] If USSR's Mid-East-involvement $\sim$ = Mid-East-
noncombatant and ((Portugal's cooperation =
noncoordinate and Spain's cooperation = noncoordinate)
or (Egypt's cooperation = noncoordinate and Turkey's
cooperation = noncoordinate) or (Saudi.Arabia's
cooperation = noncoordinate and Oman's cooperation =
noncoordinate)),
deny US is effective in Mid-East and record US as
"is ineffective in Mid-East because of lack of ally
support".
- [5] If USSR's European-involvement $\sim$ = European-
noncombatant and ((Netherlands's cooperation =
noncoordinate and Belgium's cooperation =
noncoordinate) or (FRG's cooperation = noncoordinate)),
deny US is effective in Europe and record US as "is
ineffective in Europe because of lack of ally
support".
- [6] If FRG is a nuclear conflict location and 'USSR is
a [conflict] location' is not provably true and the
German FEBA is west of the Rhine and the German FEBA
is moving-quickly-westward,
deny US is effective in Europe and record US as "is
ineffective in defending FRG" and return.

TO ASSESS-OPPORTUNITY

[1] If 'the actor is a [conflict] location' is not provably true

(if the actor's European-involvement $\sim$ European-combatant and there is a country such that (that country is a potential-enemy of the actor and that country is located in Europe and that country's strength $\sim$ militarily-strong and that country is a [conflict] location),

let the actor's opportunity be compelling and record compelling [opportunity] as the string {that country, "s already being under attack"} and return,

otherwise if the actor's Mid-East-involvement $\sim$ Mid-East-combatant and there is a country such that (that country is a potential-enemy of the actor and that country is located in Mid-East and that country's strength $\sim$ militarily-strong and that country is a [conflict] location),

let the actor's opportunity be compelling and record compelling [opportunity] as the string {that country, "s already being under attack"} and return).

[2] If US is a [conflict] location and USSR is a [conflict] location and the actor's strength = militarily-strong and the actor is located in Mid-East and there is a country such that (that country is a potential-enemy of the actor and that country is located in Mid-East and that country's strength $\sim$ militarily-strong),

let the actor's opportunity be compelling and record compelling [opportunity] as the string {"superpower distraction plus", the actor, "s being militarily-superior to", that country} and return.

[3] If the situation $\sim$ intercontinental-war and (the actor's cooperation = cobelligerent or European-combatant is a preference of (the actor's Ally) for the actor) and there is a country such that (that country is a potential-enemy of the actor and that country is located in Europe and that country's strength $\sim$ militarily-strong),

let the actor's opportunity be inviting and record inviting [opportunity] as the string {the actor's Ally, "s willingness to sponsor combat against", that country} and return.

- [4] If the situation $\sim$ = intercontinental-war and 'the actor is a [conflict] location' is not provably true and there is a country such that (that country is a potential-enemy of the actor and the Ally of that country $\sim$ = the Ally of (the actor) and (that country's Mid-East-involvement = Mid-East-combatant or that country's European-involvement = European-combatant)),
 let the actor's opportunity be inviting and record inviting [opportunity] as the string {that country, "is fighting against interests of", the actor} and return.
- [5] Let the actor's opportunity be indeterminate.

TO ASSESS-THREAT

- [1] Let the actor's threat be indeterminate.
- [2] If S.Yemen's superpower-presence = Red-major and 'the actor is a [conflict] location' is not provably true,
 if the actor = one of Egypt or UAE
 (let the actor's threat be indirectly-serious and record indirectly-serious [threat] as "Soviet manning of pre-positioned equipment in S.Yemen").
- [3] If Libya's superpower-presence = Red-major and 'the actor is a [conflict] location' is not provably true,
 if the actor = one of Saudi.Arabia or Israel
 (let the actor's threat be indirectly-serious and record indirectly-serious [threat] as "Soviet manning of pre-positioned equipment in S.Yemen").
- [4] If Djibouti's superpower-presence = Red-major and the actor = one of Egypt or Saudi.Arabia,
 let the actor's threat be indirectly-serious and

record indirectly-serious [threat] as "Red forces in Djibouti".

[5] If the actor is [a] GCC [country],
 if (Iran's superpower-presence = Red-major or
 Iraq's superpower-presence = Red-major or
 Pakistan's superpower-presence = Red-major or
 Syria's superpower-presence = Red-major or Turkey's
 superpower-presence = Red-major),
 let the actor's threat be indirectly-serious and
 record indirectly-serious [threat] as
 "introduction of major USSR forces in region".

[6] If the actor = Turkey,
 if (Iran's superpower-presence = Red-major or
 Iraq's superpower-presence = Red-major or
 Saudi.Arabia's superpower-presence = Red-major or
 Pakistan's superpower-presence = Red-major or
 Syria's superpower-presence = Red-major),
 let the actor's threat be indirectly-serious and
 record indirectly-serious [threat] as
 "introduction of major USSR forces in region".

[7] If Israel's side = White and Israel's Mid-East-
 involvement = one of Mid-East-combatant, Mid-East-
 nuclear-combatant, Mid-East-mobilized or Mid-East-
 poised and 'the actor is a [conflict] location' is not
 provably true,
 if the actor = one of Egypt, Iraq, Lebanon or
 Saudi.Arabia
 (let the actor's threat be indirectly-serious
 and record indirectly-serious [threat] as
 "Israeli involvement level").

[8] If Strait-of-Hormuz is blocked and the actor is
 economically-dependent on Strait-of-Hormuz,
 let the actor's threat be indirectly-serious and
 record serious [threat] as "economic losses from
 Hormuz blockage".

[9] If Suez-Canal is blocked and the actor is
 economically-dependent on Suez-Canal,
 let the actor's threat be indirectly-serious and
 record serious [threat] as "economic losses from
 Suez Canal blockage".

[10] If Bab-al-Mandab is blocked and the actor is economically-dependent on Bab-al-Mandab [French forces continue to operate from Djibouti],

let the actor's threat be indirectly-serious and record serious [threat] as "economic losses from Bab-al-Mandab blockage".

[11] If 'the actor is a [conflict] location' is not provably true and (the actor's Mid-East-involvement = one of Mid-East-combatant or Mid-East-nuclear-combatant or the actor's European-involvement = one of European-combatant or European-nuclear-combatant),

let the actor's threat be serious and record serious [threat] as "attrition from out-of-country combat".

[12] If the actor = a GCC country and (Persian-Gulf's Red-presence = Red-major or Arabian-Sea's Red-presence = Red-major),

let the actor's threat be serious and record serious [threat] as "major Red naval presence in Gulf or Arabian Sea".

[13] If the actor = one of UK or France and (if Indian-Ocean is a conflict location,

let the actor's threat be serious and record serious [threat] as "Indian Ocean combat",

and if Mediterranean is a conflict location,

let the actor's threat be serious and record serious [threat] as "Mediterranean combat",

and if North-Atlantic is a conflict location,

let the actor's threat be serious and record serious [threat] as "North Atlantic combat").

[14] If the actor = Turkey and Greece's preparedness ~ = normal and US's European-involvement = European-noncombatant,

let the actor's threat be serious and record serious [threat] as "Greek preparedness".

[15] If the actor = Greece and Turkey's preparedness ~ = normal and US's European-involvement = European-noncombatant and US's Mid-East-involvement = Mid-East-noncombatant,

let the actor's threat be serious and record serious [threat] as "Turkish preparedness".

[16] If Libya's superpower-presence = Red-major and 'the actor is a [conflict] location' is not provably true,

if the actor = one of Egypt or Sudan
(let the actor's threat be indirectly-grave and record indirectly-grave [threat] as "major Soviet presence on border").

[17] If USSR is mobilized on (the border) of the actor,

let the actor's threat be indirectly-grave and record indirectly-grave [threat] as "Soviet mobilization on its border".

[18] If Israel's side = White and Israel's Mid-East-involvement = one of Mid-East-combatant, Mid-East-nuclear-combatant, Mid-East-mobilized or Mid-East-poised and 'the actor is a [conflict] location' is not provably true,

if the actor = one of Syria or Jordan
(let the actor's threat be indirectly-grave and record indirectly-grave [threat] as "Israeli involvement level").

[19] If S.Yemen's superpower-presence = Red-major and 'the actor is a [conflict] location' is not provably true,

if the actor = one of N.Yemen, Oman or Saudi.Arabia
(let the actor's threat be indirectly-grave and record indirectly-grave [threat] as "major Soviet presence on border").

[20] If Egypt's superpower-presence = Blue-major and 'the actor is a [conflict] location' is not provably true,

if the actor = Libya
(let the actor's threat be indirectly-grave and record indirectly-grave [threat] as "major US presence on border").

[21] If 'the actor is a [conflict] location' is not provably true

(if the actor is [a] NATO [country] and some NATO country (x) is a conflict location,
let the actor's threat be indirectly-grave and

record indirectly-grave as the string {"attack
against", (x)},
otherwise if the actor is [a Warsaw] Pact [country]
and some Warsaw Pact country (x) is a conflict
location,
let the actor's threat be indirectly-grave and
record indirectly-grave as the string {"attack
against", (x)}).

[22] If the actor is a follower of (some leader such
that that leader's threat = grave),
let the actor's threat be indirectly-grave and
record indirectly-grave as the string {"grave
threat to", that leader}.

[23] If the actor is a conflict location,
let the actor's threat be grave and record grave
[threat] as "being a conflict location".

[24] If the actor's Ally $\sim$ USSR and the actor's
superpower-presence = Red-major,
let the actor's threat be grave and record grave
[threat] as "major Red force in its territory".

[25] If the actor's Ally $\sim$ US and the actor's
superpower-presence = Blue-major,
let the actor's threat be grave and record grave
[threat] as "major Blue force in its territory".

[26] If USSR does intend-to-attack the actor,
let the actor's threat be grave and record grave
[threat] as "USSR intent to attack",
otherwise if US does intend-to-attack the actor,
let the actor's threat be grave and record grave
[threat] as "US intent to attack".

[27] If the actor's threat = indeterminate,
record indeterminate-threat as "".

TO DECIDE-POSTURE

[1] Send {return, "Starting to decide posture at",
the date, return}.

- [2] Go assess-effectiveness of US.
- [3] Go assess-effectiveness of USSR.
- [4] For each leader that is a player,
let the actor be that leader
and move.
- [5] For each player,
unless that player is a leader,
let the actor be that player
and move.
- [6] Send {return, "Completed deciding posture at",
the date, return}.

TO DECIDE YEAR IS LONG

Private fraction.³

- [1] match (the year / 4) against {0 or more numbers,
".", 0 or more numbers (bind x to the number)} and let
x be the fraction.
- [2] if the fraction = 0 conclude true.
- [3] conclude false.

TO DETERMINE-ALIGNMENT

- [1] Match the actor's side:
 - {Red}
 - let the actor's Ally be USSR
 - and let the actor's Opponent be US;
 - {Blue}
 - let the actor's Ally be US
 - and let the actor's Opponent be USSR;

³This designates a variable called "fraction" as private to this rule set, i.e., it is not entered in the global data base.

{White}

(match the actor's orientation:

{Red}

let the actor's Ally be USSR
and let the actor's Opponent be US;

{Blue}

let the actor's Ally be US
and let the actor's Opponent be USSR;

{White}

let the actor's Ally be indeterminate and let
the actor's Opponent be indeterminate).

TO DETERMINE-ASSERTIVE-RESPONSE

[1] If the actor did seek aid from (the actor's Ally)
at some time such that ((the present-time-that time)
>=4),⁴

(if there is a posture such that that posture is a
preference of (the actor's Ally) for the actor,
let the actor's temperament be reliable and the
actor's side be the side of (the actor's Ally)
and record (the actor's side) as "Ally
implicitly offered aid" and let the actor's
resolve be firm and deny the actor is assertive
and determine-reliable-response and return,
otherwise,
let the actor's side be White and let the
actor's resolve be firm and let the actor's
cooperation be noncoordinate and let the actor's
European-involvement be European-noncombatant
and record European-noncombatant as "Ally not
responsive to grave threat" and let the actor's
Mid-East-involvement be Mid-East-noncombatant
and record Mid-East-noncombatant as "Ally not
responsive to grave threat" and deny the actor
is a player and return).

⁴That is, if the actor sought aid four or more days ago.

[2] If the actor is nuclear-capable and the actor's orientation $\sim$ Red

(if the actor's threat = grave and the actor is located in Europe and the actor's European-involvement $\sim$ European-nuclear-combatant, let the actor's European-involvement be European-nuclear-combatant and record European-nuclear-combatant as "grave threat demands full response",

otherwise if the actor's threat = one of indirectly-grave or serious and (the Red European weapon's type = nuclear or FRG is a conflict location),

if the actor's temperament = reliable
 send {return, "FROM:", the actor, "TO: USSR", return, "DEMAND REVERSE ESCALATION", return}

otherwise
 send {return, "FROM:", the actor, "TO: USSR", return, "DEMAND YOU NOT ESCALATE ARENA", return}).

[3] If the actor's threat = grave and the actor's side = Blue and the actor is located in Europe and USSR's European-involvement = one of European-combatant or European-nuclear-combatant and 'USSR is a [conflict] location' is not provably true,

send {return, "FROM:", the actor, "TO: US", return, "REQUEST NUCLEAR STRIKE AGAINST USSR", return} and assert the actor did seek aid from (US) at the present-time.

[4] If the actor's threat = grave and the actor's side = White,

(if the actor's orientation = Blue,
 send {return, "FROM:", the actor, "TO: US", return, "REQUEST CHANGE ME BLUE COBELLIGERENT", return} and assert the actor did seek aid from (US) at the present-time,

otherwise if the actor's orientation = Red,
 send {return, "FROM:", the actor, "TO: USSR", return, "REQUEST CHANGE ME RED COBELLIGERENT", return} and assert the actor did seek aid from (USSR) at the present-time).

TO DETERMINE-INITIALLY-RELIABLE-RESPONSE

[1] If there is a Mid-East-involvement (x) such that (x) is a preference of (the actor's Ally) for the actor,
 let the actor's temperament be reluctant and go determine-reluctant-response,
 otherwise if there is a European-involvement (y) such that (y) is a preference of (the actor's Ally) for the actor,
 let the actor's temperament be reluctant and go determine-reluctant-response,
 otherwise go determine-reliable-response.

TO DETERMINE-INITIALLY-RELUCTANT-RESPONSE

[1] If the actor's threat = one of grave or serious,
 let the actor's temperament be reliable
 and go determine-reliable-response,
 otherwise go determine-reluctant-response.

TO DETERMINE-NEUTRAL-RESPONSE

[1] If the actor's threat = grave,
 let the actor's temperament be reluctant and determine-reluctant-response and return.
 [2] If the actor's threat = one of indirectly-grave or serious and the actor's preparedness = normal,
 let the actor's preparedness be call-up and record call-up as "threat exists".

TO DETERMINE-OPPORTUNISTIC-RESPONSE

[1] Unless the actor's threat = one of grave or indirectly-grave
 (if the actor is located in Mid-East,
 if the actor's opportunity = compelling
 (let the actor's Mid-East-involvement be Mid-

East-combatant and record Mid-East-combatant
 as "compelling Mid-East opportunity exists")
 otherwise if the actor's opportunity = inviting
 (let the actor's Mid-East-involvement be Mid-
 East-alerted and record Mid-East-combatant as
 "inviting Mid-East opportunity exists"),
 and if the actor is located in Europe,
 if the actor's opportunity = compelling
 (let the actor's European-involvement be
 European-combatant and record European-
 combatant as "compelling European opportunity
 exists")
 otherwise if the actor's opportunity = inviting
 (let the actor's European-involvement be
 European-alerted and record European-
 combatant as "inviting European opportunity
 exists")).

TO DETERMINE-RELIABLE-RESPONSE

- [1] If the actor's Ally = indeterminate,
 send {return, the actor, " IS A RELIABLE ALLY OF AN
 UNSPECIFIED SUPERPOWER", return, "CHANGE TEMPERAMENT
 OR ORIENTATION; SPECIFY ACTOR; GO DETERMINE-
 RESPONSE", return} and let the actor be dummy [to
 prevent preference purge by decide-policy] and let
 the actor's delay be 999 and return.
- [2] If there is a side (s) such that (s) is a
 preference of (the actor's Ally) for the actor,
 let the actor's side be (s) and record (the actor's
 side) as "Ally request".
- [3] If there is a cooperation (c) such that (c) is a
 preference of (the actor's Ally) for the actor,
 unless (c) = nuclear-releasor and the actor's
 threat = indeterminate,
 let the actor's cooperation be (c) and record
 (the actor's cooperation) as "Ally request".
- [4] If there is a Mid-East-involvement (x) such that
 (x) is a preference of (the actor's Ally) for the
 actor,

let the actor's Mid-East-involvement be (x) and
record (the actor's Mid-East-involvement) as "of
Ally request".

[5] If there is a European-involvement (x) such that
(x) is a preference of (the actor's Ally) for the
actor,

let the actor's European-involvement be (x) and
record (the actor's European-involvement) as "of
Ally request".

[6] If the actor is a follower of some country

(if the actor's side $\sim$ that country's side,
let the actor's side be that country's side and
record (the actor's side) as the string {that
country, "s posture is to ", the record-form of
(the actor's side)},

and if the actor's cooperation $\sim$ noncoordinate
(if that country's cooperation = noncoordinate,
let the actor's cooperation be noncoordinate
and record (the actor's cooperation) as the
string {that country, "s posture is to ",
the record-form of (noncoordinate)}),
otherwise if that country's cooperation =
coordinate and the actor's cooperation $\sim$
coordinate,

let the actor's cooperation be coordinate and
record (the actor's cooperation) as the
string {that country, "s posture is to ",
the record-form of (coordinate)}),

and if the actor's Mid-East-involvement $\sim$ Mid-
East-noncombatant

(if that country's Mid-East-involvement = Mid-
East-noncombatant,

let the actor's Mid-East-involvement be Mid-
East-noncombatant and record Mid-East-
noncombatant as the string {that country, "s
posture is to ", the record-form of (that
country's Mid-East-involvement)}),

otherwise if the actor's Mid-East-involvement =
Mid-East-on-call and that country's Mid-East-
involvement $\sim$ Mid-East-on-call and that
country's Mid-East-involvement $\sim$ Mid-East-
combatant,

let the actor's Mid-East-involvement be that country's Mid-East-involvement and record (the actor's Mid-East-involvement) as the string {that country, "s posture is to ", the record-form of (that country's Mid-East-involvement))}

and if the actor's European-involvement $\sim$ = European-noncombatant

(if that country's European-involvement = European-noncombatant,

let the actor's European-involvement be European-noncombatant and record European-noncombatant as the string {that country, "s posture is to ", the record-form of (that country's European-involvement))},

otherwise if the actor's European-involvement = European-on-call and that country's European-involvement $\sim$ = European-on-call and that country's European-involvement $\sim$ = European-combatant,

let the actor's European-involvement be that country's European-involvement and record (the actor's European-involvement) as the string {that country, "s posture is to ", the record-form of (that country's European-involvement))}).

[7] If the actor's Mid-East-involvement is Mid-East-on-call and the actor's ally's Mid-East-involvement is Mid-East-combatant,

let the actor's Mid-East-involvement be Mid-East-combatant and record (the actor's Mid-East-involvement) as "of call implicit in Ally becoming combatant".

[8] If the actor's European-involvement is European-on-call and the actor's ally's European-involvement is European-combatant,

let the actor's European-involvement be European-combatant and record (the actor's European-involvement) as "of call implicit in Ally becoming combatant".

[9] If the actor is located in Europe,
 if the actor's European-involvement = one of
 European-on-call or European-combatant and the
 actor's preparedness $\sim$ = mobilized
 let the actor's preparedness be mobilized.

[10] If there is a preparedness (x) such that (x) is a
 preference of (the actor's Ally) for the actor,
 let the actor's preparedness be (x) and record (the
 actor's preparedness) as "of Ally request",
 otherwise if the actor's threat = one of grave or
 indirectly-grave,
 let the actor's preparedness be mobilized,
 otherwise if the actor's threat = serious and the
 actor's preparedness $\sim$ = mobilized and the actor's
 preparedness $\sim$ = call-up,
 let the actor's preparedness be call-up.

[11] If there is a superpower-presence (x) such that
 (x) is a preference of (the actor's Ally) for the
 actor,
 let the actor's superpower-presence be (x) and
 record (the actor's superpower-presence) as "of
 Ally request",
 otherwise if the actor's threat = grave and the
 actor's strength = militarily-weak,
 if the actor's Ally = US and the actor's
 superpower-presence $\sim$ = Blue-major
 (send {return, "FROM ", the actor, " TO BLUE:
 REQUEST CHANGE ME BLUE MAJOR-PRESENCE", return})
 otherwise if the actor's Ally = USSR and the
 actor's superpower-presence $\sim$ = Red-major
 (send {return, "FROM ", the actor, " TO RED:
 REQUEST CHANGE ME RED MAJOR-PRESENCE", return}).

[12] If the actor is a conflict location
 (if the actor is located in Europe and the actor's
 European-involvement $\sim$ = one of European-combatant
 or European-nuclear-combatant,
 let the actor's European-involvement be
 European-combatant and record (European-
 combatant) as 'the actor was a conflict-
 location',

otherwise if the actor is located in Mid-East and the actor's Mid-East-involvement $\sim$ one of Mid-East-combatant or Mid-East-nuclear-combatant, let the actor's Mid-East-involvement be Mid-East-combatant and record (Mid-East-combatant) as 'the actor was a conflict-location'.

TO DETERMINE-RELUCTANT-RESPONSE

[1] If the actor's Mid-East-involvement = Mid-East-on-call or the actor's European-involvement = European-on-call,

let the actor's temperament be reliable and determine-reliable-response and return.

[2] If the actor's threat = indeterminate, return.

[3] If '(the actor's Ally) is effective in Europe' is not provably true and the actor is located in Europe and the European-involvement of (the actor's Opponent) = European-nuclear-combatant and noncoordinate is a preference of (the actor's Opponent) for the actor, let the actor's side be White and record (each of White and noncoordinate) as "opportunity to limit damage" and send {the actor, "has ceased to be a player.", return} and deny the actor is a player and return.

[4] If '(the actor's Ally) is effective in Mid-East' is not provably true and the actor is located in Mid-East and the Mid-East-involvement of (the actor's Opponent) = Mid-East-nuclear-combatant and noncoordinate is a preference of (the actor's Opponent) for the actor,

let the actor's side be White and record (each of White and noncoordinate) as "opportunity to limit damage" and send {the actor, "has ceased to be a player.", return} and deny the actor is a player and return.

[5] If there is a side (s) such that (s) is a preference of (the actor's Ally) for the actor,

let the actor's side be (s) and record (s) as "of threat and Ally request".

[6] If there is a cooperation (c) such that (c) is a preference of (the actor's Ally) for the actor, unless (c) = one of cobelligerent or nuclear-releasor and the actor's threat $\sim$ = one of indirectly-grave or grave, let the actor's cooperation be (c) and record (the actor's cooperation) as "Ally request".

[7] If there is a preparedness (p) such that (p) is a preference of (the actor's Ally) for the actor, let the actor's preparedness be (p) and record (p) as "of threat and Ally request", otherwise if the actor's threat = one of grave or indirectly-grave, let the actor's preparedness be mobilized, otherwise if the actor's threat = serious and the actor's preparedness $\sim$ = mobilized and the actor's preparedness $\sim$ = serious, let the actor's preparedness be call-up.

[8] If the actor's threat = grave and the actor's strength = militarily-weak, if the actor's Ally = US and the actor's superpower-presence $\sim$ = Blue-major and the actor's superpower-presence $\sim$ = Blue-tripwire (send {return, "FROM ", the actor, " TO BLUE: REQUEST CHANGE ME BLUE TRIPWIRE", return}) otherwise if the actor's Ally = USSR and the actor's superpower-presence $\sim$ = Red-major and the actor's superpower-presence $\sim$ = Red-tripwire (send {return, "FROM ", the actor, " TO RED: REQUEST CHANGE ME RED TRIPWIRE", return}).

[9] If the actor's threat = one of grave or indirectly-grave (if the actor is located in Mid-East (if there is a Mid-East-involvement (x) such that (x) is a preference of (the actor's Ally) for the actor (let the actor's Mid-East-involvement be (x) and record (x) as "of grave threat and Ally request"))

otherwise if the actor is located in Europe
 (if there is a European-involvement (x) such
 that (x) is a preference of (the actor's Ally)
 for the actor
 (let the actor's European-involvement be (x)
 and record (x) as "of grave threat and Ally
 request"))
 and if there is a superpower-presence (x) such that
 (x) is a preference of (the actor's Ally) for the
 actor,
 let the actor's superpower-presence be (x) and
 record (x) as "of grave threat and Ally
 request").

- [10] If the actor is a follower of some country
 (if the actor's side $\sim$ that country's side,
 let the actor's side be that country's side and
 record (the actor's side) as the string {that
 country, "s posture is to ", the record-form of
 (the actor's side)},
 and if the actor's cooperation $\sim$ noncoordinate
 (if that country's cooperation = noncoordinate,
 let the actor's cooperation be noncoordinate
 and record (the actor's cooperation) as the
 string {that country, "s posture is to ",
 the record-form of (noncoordinate)},
 otherwise if that country's cooperation =
 coordinate and the actor's cooperation $\sim$
 coordinate,
 let the actor's cooperation be coordinate and
 record (the actor's cooperation) as the
 string {that country, "s posture is to ",
 the record-form of (coordinate)})
 and if the actor's Mid-East-involvement $\sim$ Mid-
 East-noncombatant
 (if that country's Mid-East-involvement = Mid-
 East-noncombatant,
 let the actor's Mid-East-involvement be Mid-
 East-noncombatant and record Mid-East-
 noncombatant as the string {that country, "s
 posture is to ", the record-form of (that
 country's Mid-East-involvement)},
 otherwise if the actor's Mid-East-involvement =
 Mid-East-on-call and that country's Mid-East-

involvement $\sim$ Mid-East-on-call and that
country's Mid-East-involvement $\sim$ Mid-East-
combatant,

let the actor's Mid-East-involvement be that
country's Mid-East-involvement and record
(the actor's Mid-East-involvement) as the
string {that country, "s posture is to ",
the record-form of (that country's Mid-East-
involvement))}

and if the actor's European-involvement $\sim$ =
European-noncombatant

(if that country's European-involvement =
European-noncombatant,

let the actor's European-involvement be
European-noncombatant and record European-
noncombatant as the string {that country, "s
posture is to ", the record-form of (that
country's European-involvement))},

otherwise if the actor's European-involvement =
European-on-call and that country's European-
involvement $\sim$ = European-on-call and that
country's European-involvement $\sim$ = European-
combatant,

let the actor's European-involvement be that
country's European-involvement and record
(the actor's European-involvement) as the
string {that country, "s posture is to ",
the record-form of (that country's European-
involvement))}).

[11] If any intercontinental weapon's type = nuclear
and 'the actor is a [conflict] location' is not
provably true,

let the actor's temperament be neutral and let the
actor's resolve be firm and let the actor's side be
White and let the actor's cooperation be
noncoordinate and send {the actor, " adopted a
neutral temperament.", return} and determine-
neutral-response and return.

[12] If the actor is a conflict location

(if the actor is located in Europe and the actor's
European-involvement $\sim$ = one of European-combatant
or European-nuclear-combatant,

let the actor's European-involvement be
European-combatant and record (European-
combatant) as 'the actor was a conflict-
location',

otherwise if the actor is located in Mid-East and
the actor's Mid-East-involvement $\sim$ = one of Mid-
East-combatant or Mid-East-nuclear-combatant,
let the actor's Mid-East-involvement be Mid-
East-combatant and record (Mid-East-combatant)
as 'the actor was a conflict-location').

TO DETERMINE-RESPONSE

[1] Match the actor's temperament:

{reliable} let the actor's resolve be firm and go
determine-reliable-response;

{reluctant} let the actor's resolve be moderate and go
determine-reluctant-response;

{initially-reliable} let the actor's resolve be soft
and go determine-initially-reliable-response;

{initially-reluctant} let the actor's resolve be soft
and go determine-initially-reluctant-response;

{neutral} let the actor's resolve be firm and go
determine-neutral-response.

[2] If the actor is opportunistic,
determine-opportunistic-response.

[3] If the actor is assertive,
determine-assertive-response.

TO DETERMINE-SITUATION

[1] If some intercontinental weapon's type $\sim$ = none or
(some European weapon's type $\sim$ = none and some Mid-East
weapon's type $\sim$ = none),

let the situation be intercontinental-war and
record situation as "intercontinental war",

otherwise if the Red European weapon's type $\sim$ none
 and the Blue European weapon's type $\sim$ none,
 let the situation be theater-war and record
 situation as "theater war in Europe",
 otherwise if the Red Mid-East weapon's type $\sim$ none
 and the Blue Mid-East weapon's type $\sim$ none,
 let the situation be theater-war and record
 situation as "theater war in Mid-East",
 otherwise (let the situation be local-conflict and
 record situation as "local conflict").

TO GENERATE DAY-COUNT OF DATE-TIME-GROUP

Private day, month, year, time, ref-day, ref-month,
 ref-year, ref-time.

[1] Match the date-time-group against { 4 numbers,
 "/", 2 numbers (bind d to the number), 2 numbers (bind
 mo to the number), 2 numbers (bind y to the number) }
 and let d be the day and mo be the month and y be the
 year.

[2] Match the reference against {4 numbers, "/", 2
 numbers (bind d to the number), 2 numbers (bind mo to
 the number), 2 numbers (bind y to the number)} and let
 the ref-day be d and the ref-month be mo and the ref-
 year be y.

[Step 1: compute the number of days so far this
 month.]

[3] Let (the day - 1) be the time.

[Step 2: add in number of days from 1 Jan this yr to
 beginning of month.]

[4] While the month $\sim$ 1,
 let the month - 1 be the month and (the time + (the
 days in (the month) for (the year))) be the time.

[Step 3: add in the number of days in years (except
 leap) since 1981.]

[5] Let the time + ((the year - 81) * 365) be the
 time.

[Step 4: the number of leap days since then.]

[6] If the month > 2 let the year be (the year + 1).

[7] Let the time + (the floor of ((the year - 81)/4)) be the time.⁵

[Step 1: compute the number of days so far this month.]

[8] Let (the ref-day - 1) be the ref-time.

[Step 2: add in number of days from 1 Jan this yr to beginning of month.]

[9] While the ref-month $\neq 1$,
 let the ref-month - 1 be the ref-month and (the
 ref-time + (the days in (the ref-month) for (the
 ref-year))) be the ref-time.

[Step 3: add in the number of days in years (except leap) since 1981.]

[10] Let the ref-time + ((the ref-year - 81) * 365) be the ref-time.

[Step 4: the number of leap days since then.]

[11] If the ref-month < 2 let the ref-year be (the ref-year + 1).

[12] Let the ref-time + (the floor of ((the ref-year - 81)/4)) be the ref-time.

[13] Let the time be (the time - the ref-time).

[14] Assert the time is a number.

[15] Produce the time and return.

TO GENERATE DAYS IN MONTH FOR YEAR

[1] If the month = 1 (produce 31 and return).

⁵There is a ROSIE system rule set to generate the floor of a number, i.e., the integer part of a number. See Fain et al. (1981, p. 135).

- [2] If the month = 2 and the year is long
(produce 29 and return).
- [3] If the month = 2 and the year is not long
(produce 28 and return).
- [4] If the month = 3 (produce 31 and return).
- [5] If the month = 4 (produce 30 and return).
- [6] If the month = 5 (produce 31 and return).
- [7] If the month = 6 (produce 30 and return).
- [8] If the month = 7 (produce 31 and return).
- [9] If the month = 8 (produce 31 and return).
- [10] If the month = 9 (produce 30 and return).
- [11] If the month = 10 (produce 31 and return).
- [12] If the month = 11 (produce 30 and return).
- [13] if the month = 12 (produce 31 and return).
- [14] Produce "ERROR days" and return.

TO GENERATE MOD OF X WITH Y

- [1] Produce the $x - (y * \text{the floor of } (x / y))$ and return.

TO MOVE

- [1] Go record (actor) as the actor and determine-alignment and assess-threat and schedule response and (if the actor's next-decision-time > the present-time record (schedule) as the actor's next-decision-time otherwise (assess-opportunity and for each preference (p) of (US) for the actor record (preference) as 'US does want (the actor) to (the record-form of p)' and for each preference (p) of (USSR) for the actor

record (preference) as 'USSR does want (the actor) to
 (the record-form of p)
 and record (decision) as (the actor's next-decision-time)
 and determine-response
 and deny every preference of (US) for the actor
 is a preference of (US) for the actor
 and deny every preference of (USSR) for the actor
 is a preference of (USSR) for the actor
 and let the actor's next-decision-time be
 (the present-time + the delay of (the actor))).

TO RECORD X AS Y

- [1] If the x = situation,
 send {return, "At ", the game-time, ", day ", the
 present-time, ", the situation was ", the y, ":",
 return, "The US had previously decided to ", the
 record-form of (US's preparedness), ":", return,
 "to ", the record-form of (US's Mid-East-
 involvement), ":", return, "and to ", the record-
 form of (US's European-involvement), ":", return,
 "The USSR had previously decided to ", the record-
 form of (USSR's preparedness), ":", return, "to ",
 the record-form of (USSR's Mid-East-involvement),
 ":", return, "and to ", the record-form of (USSR's
 European-involvement), ":", return, return,
 "Conflict locations were", return} and send {every
 [conflict] location, return} and send {return,
 "Current weapon usage was", return, return} and for
 each weapon
 send {that weapon, "—", that weapon's type,
 return} and return.
- [2] If the x = one of US or USSR,
 send {return, the x, " ", the y, ":", return}
 and return.
- [3] If the x = actor,
 send {return, the y, " a ", the record-form of
 (the actor's strength), " ", the actor's
 orientation, "-oriented ", the record-form of (the
 actor's temperament), return, "that had previously
 decided to ", the record-form of (the actor's

preparedness), ",", return, "to ", the record-form of (the actor's side), ",", return, "to ", the record-form of (the actor's cooperation), ",", return, "to ", the record-form of (the actor's Mid-East-involvement), ",", return, "and to ", the record-form of (the actor's European-involvement), ",", return} and return.

[4] Match the x:

{preference} send {"noting that ", the y, ",", return};

{schedule} send {"planned to assess its posture in ", (the actor's next-decision-time - the present-time), "day(s).", return};

{grave} send {"perceiving a grave threat in ", the y, ",", return};

{indirectly-grave} send {"perceiving an indirectly-grave threat in ", the y, ",", return};

{serious} send {"perceiving a serious threat in ", the y, ",", return};

{indirectly-serious} send {"perceiving an indirectly-serious threat in ", the y, ",", return};

{indeterminate-threat} send {"perceiving an indeterminate threat in the situation.", return};

{compelling} send {"perceiving a compelling opportunity in ", the y, ",", return};

{inviting} send {"perceiving an inviting opportunity in ", the y, ",", return};

{script} send {return, "SCRIPTED ACTION: ", the y, return};

{decision} send {"assessed its posture.", return};

default: send {the actor, " decided to ", the record-form of the x, " because ", the y, ",", return}.

TO SCHEDULE RESPONSE

Private latest-response-date.

[1] If the actor is a conflict location and ((the actor's Mid-East-involvement $\sim$ Mid-East-combatant and the actor is located in Mid-East) or (the actor's European-involvement $\sim$ European-combatant and the actor is located in Europe)),

let the actor's delay be 0 and the actor's next-decision-time be the present-time and return.

[2] Match the actor's temperament:

{reluctant}

(match the actor's threat:

{grave}

let the actor's delay be 2;

{indirectly-grave}

let the actor's delay be 4;

{serious}

let the actor's delay be 14;

{indirectly-serious}

let the actor's delay be 20;

{indeterminate}

let the actor's delay be 28);

{reliable}

(match the actor's threat:

{grave}

let the actor's delay be 2;

{indirectly-grave}

let the actor's delay be 2;

{serious}

let the actor's delay be 4;

{indirectly-serious}

let the actor's delay be 10;

{indeterminate}

let the actor's delay be 14);

{initially-reluctant}

(match the actor's threat:

{grave}

let the actor's delay be 2;

{indirectly-grave}

let the actor's delay be 2;

```

{serious}
  let the actor's delay be 4;
{indirectly-serious}
  let the actor's delay be 20;
{indeterminate}
  let the actor's delay be 28);

{initially-reliable}
  (match the actor's threat:
    {grave}
      let the actor's delay be 2;
    {indirectly-grave}
      let the actor's delay be 4;
    {serious}
      let the actor's delay be 14;
    {indirectly-serious}
      let the actor's delay be 14;
    {indeterminate}
      let the actor's delay be 10);

{neutral}
  (match the actor's threat:
    {grave}
      let the actor's delay be 2;
    {indirectly-grave}
      let the actor's delay be 4;
    {serious}
      let the actor's delay be 10;
    {indirectly-serious}
      let the actor's delay be 12;
    {indeterminate}
      let the actor's delay be 14).

[3] If any posture is a preference of (one of US or
USSR) for the actor,
  if the actor is [a Warsaw] Pact [country]
    let the actor's delay be 0
  otherwise let the actor's delay be (the actor's
delay / 2).

[4] Let the latest-response-date be (the present-time
+ (the actor's delay)).

[5] If the actor has a next-decision-time
  (if the actor's next-decision-time > the latest-

```

```

response-date
  let the actor's next-decision-time be the
  latest-response-date
  otherwise do nothing)
otherwise let the actor's next-decision-time be the
present-time.

```

TO WRITE-TABLEAU

Private item, firmness, location-status.

```
[1] Send {return, return, " POLITICAL SITUATION ", the
game-branch, the game-point, ".", the next-game-
branch, the next-game-point, " PREPARED: ", the date,
return, return, " Conflict Super Power Military Mid-
East European", return, "Country| Side Cooperatn
Presence Prep Invlvmnt Invlvmnt", return, "--
-----
=", return}.
```

```

[2] For each country,
let the actor be that country
and if the actor is a [conflict] location
    let the location-status be " X "
otherwise let the location-status be " "
and if the actor's cooperation = noncoordinate
    (if the actor's Mid-East-involvement = Mid-East-on-
    call or the actor's European-involvement =
    European-on-call
        (let the actor's cooperation be coordinate))
and if the actor's side = White and the actor's
cooperation ~= noncoordinate
    (if the actor's orientation ~= White
        (let the actor's side be the actor's
        orientation)
    otherwise (send {return, "ENTER SIDE OF", the
    actor, " AS RED OR BLUE", return} and describe the
    actor and send {return, "==">"} and read
    {anything (bind foo6 to the name), return} and (match
    foo:

```

"Foo" is a dummy variable.

```

{RED} let the actor's side be Red; {BLUE} let
the actor's side be Blue; default: send {return,
"VERIFY SIDE AND COOPERATION OF", the actor,
"IN FINISHED TABLEAU.", return}}))
and if the actor's side = White
  let the firmness be ""
otherwise let the firmness be the tableau-form of (the
actor's resolve) and let the item be the string {the
tableau-form of (the actor), the location-status, the
tableau-form of (the actor's side), the firmness, the
tableau-form of (the actor's cooperation), the
tableau-form of (the actor's superpower-presence), the
tableau-form of (the actor's preparedness), the
tableau-form of (the actor's Mid-East-involvement), the
tableau-form of (the actor's European-
involvement),
return} and send {the item}.

```

Appendix B

SCENARIO AGENT DATA BASE LISTING

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This appendix contains a listing of ROSIE statements that, when loaded in a computer hosting ROSIE, make up a complete, illustrative Scenario Agent data base.

RECORD-FORM

[rule 1] Let the record-form of Red be "side with the USSR".

[rule 2] Let the record-form of White be "side with neither superpower".

[rule 3] Let the record-form of Blue be "side with the US".

[rule 4] Let the record-form of militarily-strong be "militarily strong".

[rule 5] Let the record-form of militarily-average be "militarily average".

[rule 6] Let the record-form of militarily-weak be "militarily weak".

[rule 7] Let the record-form of reluctant be "reluctant country".

[rule 8] Let the record-form of reliable be "reliable ally".

[rule 9] Let the record-form of neutral be "neutral country".

[rule 10] Let the record-form of noncoordinate be "deny superpower access".

[rule 11] Let the record-form of coordinate be "allow logistics access".

[rule 12] Let the record-form of cobelligerent be "allow combat access".

[rule 13] Let the record-form of nuclear-releasor be "cooperate fully".

[rule 14] Let the record-form of normal be "maintain peacetime preparedness".

[rule 15] Let the record-form of call-up be "call up reserves".

[rule 16] Let the record-form of mobilized be "mobilize fully".

[rule 17] Let the record-form of Mid-East-noncombatant be "decline to involve own forces in Mid-East conflict".

[rule 18] Let the record-form of Mid-East-on-call be "place forces on call for Mid-East conflict".

[rule 19] Let the record-form of Mid-East-alerted be "alert forces for Mid-East combat".

[rule 20] Let the record-form of European-poised be "poise forces for European combat".

[rule 21] Let the record-form of Mid-East-mobilizing be "mobilize reinforcements for Mid-East combat".

[rule 22] Let the record-form of Mid-East-combatant be "join combat in Mid-East".

[rule 23] Let the record-form of Mid-East-nuclear-combatant be "employ nuclear forces in Mid-East combat".

[rule 24] Let the record-form of European-noncombatant be "decline to involve own forces in European conflict".

[rule 25] Let the record-form of European-on-call be "place forces on call for European conflict".

[rule 26] Let the record-form of European-alerted be "alert forces for European combat".

[rule 27] Let the record-form of European-poised be "poise forces for European combat".

[rule 28] Let the record-form of European-mobilizing be "mobilize reinforcements for European combat".

[rule 29] Let the record-form of European-combatant be "join combat in Europe".

[rule 30] Let the record-form of European-nuclear-combatant be "employ nuclear forces in European combat".

STD-COUNTRIES

[rule 1] Assert each of Afghanistan, Algeria, Austria, Bahrain, Belgium, Bulgaria, Canada, Cuba, Czechoslovakia, Denmark, Djibouti, Egypt, Finland, France, FRG, GDR, Greece, Hungary, Iceland, Iran, Iraq, Israel, Italy, Japan, Jordan, Kuwait, Lebanon, Libya, Luxembourg, Mongolia, Morocco, N.Korea, N.Yemen, Netherlands, Norway, Oman, Pakistan, Poland, Portugal, PRC, Qatar, Romania, S.Korea, S.Yemen, Saudi.Arabia, Spain, Sweden, Syria, Turkey, UAE, UK, US, USSR, Yugoslavia, Rfaction, Wfaction and Bfaction is a country.

[rule 2] Let every country's resolve be moderate.

[rule 3] Let the resolve of (each of US and USSR) be firm.

STD-ECONOMICS

[rule 1] Assert each of Bahrain, Belgium, Denmark, France, FRG, Iran, Italy, Iraq, Japan, Kuwait, Luxembourg, Netherlands, Qatar, Saudi.Arabia and UAE is economically-dependent on Strait-of-Hormuz.

[rule 2] Assert each of Djibouti, Egypt, Ethiopia, France, Jordan, N.Yemen, Saudi.Arabia and Sudan is economically-dependent on (each of Bab-al-Mandab and Suez-Canal).

[rule 3] Assert Israel is economically-dependent on US.

STD-FOLLOWERS

[rule 1] Assert each of Czechoslovakia, FRG, Saudi.Arabia and UK is a leader.

[rule 2] Assert each of Bahrain, Kuwait, Qatar and UAE is a follower of Saudi.Arabia.

[rule 3] Assert each of Belgium, Denmark, France, Iceland, Italy, Luxembourg, and Netherlands is a follower of FRG.

[rule 4] Assert each of Romania and Yugoslavia is a follower of Czechoslovakia.

[rule 5] Assert Canada is a follower of UK.

STD-GEOGRAPHY

[rule 1] Let the border be border.

[rule 2] Let the Warsaw Pact be Warsaw Pact.

[rule 3] Let the Mid-East be Mid-East.

[rule 4] Let the Rhine be Rhine.

[rule 5] Let the German FEBA be German FEBA.

[rule 6] Assert each of Norway, Finland, FRG, Austria, Yugoslavia, Greece, Turkey, Iran, Afghanistan and PRC does border on the Warsaw Pact.

[rule 7] Assert each of Algeria, Bahrain, Egypt, Iran, Israel, Kuwait, Libya, Morocco, N.Yemen, Oman, Qatar, Saudi.Arabia, S.Yemen, Syria, Turkey and UAE is located in Mid-East.

[rule 8] Assert each of Rfaction, Bfaction and Wfaction is located in Mid-East.

[rule 9] Assert each of Belgium, Bulgaria, Czechoslovakia, Denmark, France, FRG, GDR, Greece, Hungary, Iceland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Spain, Turkey, UK and Yugoslavia is located in Europe.

[rule 10] Assert Canada is located in North-America.

STD-MEMBERSHIP

[rule 1] Assert each of Belgium, Netherlands, Luxembourg, Canada, Denmark, FRG, Greece, Iceland, Italy, Norway, Portugal, Turkey, UK and US is [a] NATO [country].

[rule 2] Assert each of Bulgaria, Czechoslovakia, GDR, Hungary, Poland, Romania and USSR is [a] Warsaw Pact [country].

[rule 3] Assert each of Bahrain, Qatar, Saudi.Arabia, UAE, Kuwait and Oman is [a] GCC [country].

STD-OPPORTUNISM

[rule 1] Assert each of Israel and France is opportunistic.

[rule 2] Assert Syria is a potential-enemy of Israel.

[rule 3] Assert each of France, FRG and UK is assertive.

STD-ORIENTATION

[rule 1] Let every player's orientation be White.

[rule 2] Let the orientation of each of Bahrain, Belgium, Canada, Denmark, Egypt, France, FRG, Greece, Iceland, Israel, Italy, Japan, Kuwait, Luxembourg, Netherlands, Norway, Oman, Pakistan, Portugal, Qatar, Saudi.Arabia, S.Korea, Spain, Turkey, UAE, UK and US be Blue.

[rule 3] Let the orientation of each of Afghanistan, Bulgaria, Cuba, Czechoslovakia, GDR, Hungary, N.Korea, Poland, Romania and USSR be Red.

[rule 4] Let every country's side be White.

[rule 5] Let US's side be Blue.

[rule 6] Let USSR's side be Red.

STD-PLAYERS

[rule 1] Assert each of Bahrain, Belgium, Bulgaria, Canada, Czechoslovakia, Denmark, Egypt, France, FRG, GDR, Greece, Hungary, Iceland, Iraq, Israel, Italy, Kuwait, Libya, Luxembourg, Netherlands, Norway, Oman, Poland, Portugal, Qatar, Romania, S.Yemen, Saudi.Arabia, Spain, Syria, Turkey, UAE, UK, Yugoslavia, Rfaction, Wfaction and Bfaction is a player.

[rule 2] Let every player's threat be indeterminate.

[rule 3] Let every player's opportunity be indeterminate.

STD-POSTURES

[rule 1] Assert each of Red, Blue and White is a side.

[rule 2] Assert each of noncoordinate, coordinate, cobelligerent and nuclear-releasor is a cooperation.

[rule 3] Assert each of normal, call-up and mobilized is a preparedness.

[rule 4] Assert each of Mid-East-noncombatant, Mid-East-on-call, Mid-East-alerted, Mid-East-mobilizing, Mid-East-poised, Mid-East-combatant and Mid-East-nuclear-combatant is a Mid-East-involvement.

[rule 5] Assert each of European-noncombatant, European-on-call, European-alerted, European-poised, European-mobilizing, European-combatant and European-nuclear-combatant is a European-involvement.

[rule 6] Assert each of no-presence, Blue-major, Red-major, Blue-tripwire, Red-tripwire, Blue-token and Red-token is a superpower-presence.

[rule 7] Assert each of Red, Blue, White, Noncoordinate, Coordinate, Cobelligerent, Nuclear-releasor, Normal, Call-up, Mobilized, Mid-East-noncombatant, Mid-East-on-call, Mid-East-alerted, Mid-East-mobilizing, Mid-East-poised, Mid-East-combatant,

Mid-East-nuclear-combatant, European-noncombatant, European-on-call, European-alerted, European-poised, European-mobilizing, European-combatant, European-nuclear-combatant, No-presence, Red-token, Blue-token, Red-tripwire, Blue-tripwire, Red-major and Blue-major is a posture.

[rule 8] Let the preparedness of every country be normal.

[rule 9] Let the cooperation of every country be noncoordinate.

[rule 10] Let the Mid-East-involvement of every country be Mid-East-noncombatant.

[rule 11] Let the European-involvement of every country be European-noncombatant.

STD-PRESENCE

[rule 1] Let the superpower-presence of every country be no-presence.

[rule 2] Let the superpower-presence of (each of FRG, Japan, S.Korea, UK and US) be Blue-major.

[rule 3] Let the superpower-presence of (each of Greece, Iceland, Italy, Netherlands, Portugal and Spain) be Blue-tripwire.

[rule 4] Let the superpower-presence of Turkey be Blue-token.

[rule 5] Let the superpower-presence of (each of Afghanistan, Czechoslovakia, GDR, Hungary, Poland and USSR) be Red-major.

[rule 6] Let the superpower-presence of (each of Angola, Cuba and S.Yemen) be Red-token.

[rule 7] Let the Red-presence of Indian-Ocean be Red-tripwire.

[rule 8] Let the Blue-presence of Indian-Ocean be Blue-tripwire.

[rule 9] Let the Red-presence of Arabian-Sea be no-presence.

[rule 10] Let the Blue-presence of Arabian-Sea be no-presence.

[rule 11] Let the Red-presence of Red-Sea be no-presence.

[rule 12] Let the Blue-presence of Red-Sea be no-presence.

STD-STRENGTH

[rule 1] Let the strength of every country be militarily-average.

[rule 2] Let the strength of each of Egypt, France, FRG, GDR, Israel, N.Korea, PRC, S.Korea, Turkey, US and USSR be militarily-strong.

[rule 3] Let the strength of each of Bahrain, Belgium, Denmark, Djibouti, Iceland, Kuwait, Lebanon, Luxembourg, Netherlands, N.Yemen, Norway, Oman, Portugal, Qatar and S.Yemen be militarily-weak.

STD-TEMPERAMENT

[rule 1] Let the temperament of every player be reluctant.

[rule 2] Let the temperament of (every Pact player and every NATO player) be reliable.

STD-WEAPONS

[rule 1] Assert Red intercontinental weapon is a Red intercontinental weapon.¹

¹This allows keyboard entry of commands such as "display every Red weapon" to pick up the Red intercontinental weapon.

[rule 2] Assert Blue intercontinental weapon is a Blue intercontinental weapon.

[rule 3] Assert Red European weapon is a Red European weapon.

[rule 4] Assert Blue European weapon is a Blue European weapon.

[rule 5] Assert Red Mid-East weapon is a Red Mid-East weapon.

[rule 6] Assert Blue Mid-East weapon is a Blue Mid-East weapon.

[rule 7] Assert White Mid-East weapon is a White Mid-East weapon.

[rule 8] Let the Red intercontinental weapon's type be none.

[rule 9] Let the Red European weapon's type be none.

[rule 10] Let the Red Mid-East weapon's type be none.

[rule 11] Let the Blue intercontinental weapon's type be none.

[rule 12] Let the Blue European weapon's type be none.

[rule 13] Let the Blue Mid-East weapon's type be none.

[rule 14] Let the White Mid-East weapon's type be none.

[rule 15] Assert each of France and UK is nuclear-capable.

TABLEAU-FORM

[rule 1] Let the tableau-form of White be "White".

[rule 2] Let the tableau-form of Blue be "B".

[rule 3] Let the tableau-form of Red be "R".

[rule 4] Let the tableau-form of Noncoordinate be
"Noncoord□".²

[rule 5] Let the tableau-form of Coordinate be
"Coordin.□".

[rule 6] Let the tableau-form of Cobelligerent be
"Cobellig□".

[rule 7] Let the tableau-form of Nuclear-releasor be
"Nuc.rels□".

[rule 8] Let the tableau-form of Normal be "Normal□□".

[rule 9] Let the tableau-form of Call-up be
"Call__Up□".

[rule 10] Let the tableau-form of Mobilized be
"Mobilzd□".

[rule 11] Let the tableau-form of Mid-East-
noncombatant be "Noncombat□".

[rule 12] Let the tableau-form of Mid-East-on-call be
"On__Call□□□".

[rule 13] Let the tableau-form of Mid-East-alerted be
"Alerted□□□".

[rule 14] Let the tableau-form of Mid-East-poised be
"Poised□□□□".

[rule 15] Let the tableau-form of Mid-East-mobilizing
be "Mobilizing□".

[rule 16] Let the tableau-form of Mid-East-combatant
be "Combatant□".

[rule 17] Let the tableau-form of Mid-East-nuclear-
combatant be "Combatant□".

[rule 18] Let the tableau-form of European-
noncombatant be "Noncombat".

[rule 19] Let the tableau-form of European-on-call be
"On__Call□□□".

²The symbol □ represents blanks necessary for proper alignment of columns in the Scenario Tableau.

[rule 20] Let the tableau-form of European-alerted be
"Alerted □ □".

[rule 21] Let the tableau-form of European-poised be
"Poised □ □ □".

[rule 22] Let the tableau-form of European-mobilizing
be "Mobilizing".

[rule 23] Let the tableau-form of European-combatant
be "Combatant".

[rule 24] Let the tableau-form of European-nuclear-
combatant be "Combatant".

[rule 25] Let the tableau-form of Soft be "Soft □".

[rule 26] Let the tableau-form of Moderate be "Mod. □".

[rule 27] Let the tableau-form of Firm be "Firm □".

[rule 28] Let the tableau-form of Afghanistan be
"Afghanis".

[rule 29] Let the tableau-form of Algeria be
"Algeria □".

[rule 30] Let the tableau-form of Austria be
"Austria □".

[rule 31] Let the tableau-form of Bahrain be
"Bahrain □".

[rule 32] Let the tableau-form of Belgium be
"Belgium □".

[rule 33] Let the tableau-form of Bulgaria be
"Bulgaria".

[rule 34] Let the tableau-form of Canada be
"Canada □ □".

[rule 35] Let the tableau-form of Cuba be "Cuba □ □ □ □".

[rule 36] Let the tableau-form of Czechoslovakia
be "Czech □ □ □".

[rule 37] Let the tableau-form of Denmark be
"Denmark □".

[rule 38] Let the tableau-form of Djibouti be "Djibouti".

[rule 39] Let the tableau-form of Egypt be "Egypt□□□".

[rule 40] Let the tableau-form of Finland be "Finland□".

[rule 41] Let the tableau-form of France be "France□□".

[rule 42] Let the tableau-form of FRG be "FRG□□□□□".

[rule 43] Let the tableau-form of GDR be "GDR□□□□□".

[rule 44] Let the tableau-form of Greece be "Greece□□".

[rule 45] Let the tableau-form of Hungary be "Hungary□".

[rule 46] Let the tableau-form of Iceland be "Iceland□".

[rule 47] Let the tableau-form of Iran be "Iran□□□□".

[rule 48] Let the tableau-form of Iraq be "Iraq□□□□".

[rule 49] Let the tableau-form of Israel be "Israel□□".

[rule 50] Let the tableau-form of Italy be "Italy□□□□".

[rule 51] Let the tableau-form of Japan be "Japan□□□□".

[rule 52] Let the tableau-form of Jordan be "Jordan□□".

[rule 53] Let the tableau-form of Kuwait be "Kuwait□□".

[rule 54] Let the tableau-form of Lebanon be "Lebanon□".

[rule 55] Let the tableau-form of Libya be "Libya□□□□".

[rule 56] Let the tableau-form of Luxembourg be "Luxemburg".

[rule 57] Let the tableau-form of Mongolia be "Mongolia".

[rule 58] Let the tableau-form of Morocco be
"Morocco□".

[rule 59] Let the tableau-form of N.Korea be
"N.Korea□".

[rule 60] Let the tableau-form of Netherlands be
"Netherld".

[rule 61] Let the tableau-form of N.Yemen be
"N.Yemen□".

[rule 62] Let the tableau-form of Norway be
"Norway□□".

[rule 63] Let the tableau-form of Oman be "Oman□□□□".

[rule 64] Let the tableau-form of Pakistan be
"Pakistan".

[rule 65] Let the tableau-form of Poland be
"Poland□□".

[rule 66] Let the tableau-form of Portugal be
"Portugal".
"Portugal".

[rule 67] Let the tableau-form of PRC be "PRC□□□□□".

[rule 68] Let the tableau-form of Qatar be "Qatar□□□".

[rule 69] Let the tableau-form of Romania be
"Rumania□".

[rule 70] Let the tableau-form of S.Korea be
"S.Korea□".

[rule 71] Let the tableau-form of S.Yemen be
"S.Yemen□".

[rule 72] Let the tableau-form of Saudi.Arabia be
"Saudi□Ar".

[rule 73] Let the tableau-form of Spain be "Spain□□□".

[rule 74] Let the tableau-form of Sweden be
"Sweden□□".

[rule 75] Let the tableau-form of Syria be "Syria□□□".

[rule 76] Let the tableau-form of Turkey be
"Turkey□□".

[rule 77] Let the tableau-form of UAE be "UAE□□□□□".

[rule 78] Let the tableau-form of UK be "UK□□□□□□".

[rule 79] Let the tableau-form of US be "US□□□□□□".

[rule 80] Let the tableau-form of USSR be "USSR□□□□□".

[rule 81] Let the tableau-form of Yugoslavia be
"Yugoslav".

[rule 82] Let the tableau-form of Rfaction be
"Rfaction".

[rule 83] Let the tableau-form of Bfaction be
"Bfaction".

[rule 84] Let the tableau-form of Wfaction be
"Wfaction".

[rule 85] Let the tableau-form of no-presence be
"No__Presence□□□".

[rule 86] Let the tableau-form of Red-tripwire be
"R.U.Trip__Wire□".

[rule 87] Let the tableau-form of Red-major be
"R.Major__Pres□□".

[rule 88] Let the tableau-form of Red-token be
"R.A.Trip__Wire□".

[rule 89] Let the tableau-form of Blue-tripwire be
"B.U.Trip__Wire□".

[rule 90] Let the tableau-form of Blue-major be
"B.Major__Pres□□".

[rule 91] Let the tableau-form of Blue-token be
"B.A.Trip__Wire□".

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