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INSTITUTE FOR DEFENSE ANALYSES

Regional Security Application and Checkmate!

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PREFACE

This paper was prepared as part of IDA task entitled, Synthetic Environments for National Security Estimates - Regional Security Application (S.E.N.S.E.-RSA). It is intended to provide an overview of the research necessary to develop a distributed interactive desktop simulation to address so-called complex contingencies as defined by Presidential Decision Directive 56 (PDD-56). It also explores extensions of the R.S.A. work to potentially address multiple crises on a local and global scale under the monkier *Checkmate!*

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CONTENTS

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EXECUTIVE SUMMARY

The collapse of the Soviet Union and the end of the Cold War resulted in a new set of national security challenges for the United States. Instead of focusing on long-standing, well studied threats, U.S. leaders and planners were forced to address a more uncertain and complex world that saw the resurgence of ethnic territorial claims and disputes and the emergence of global terrorism as major concerns. To meet these new types of challenges and resolve the complex, multidisciplinary issues that underlay them, it became increasingly important to examine a full range of crisis response options and to skillfully combine diplomacy, economic leverage, human rights initiatives, and military power in innovative ways.

To assist senior leaders in gaining insights on contemporary complex crisis response planning options IDA established a centrally funded research project called Synthetic Environments for National Security Estimates, or S.E.N.S.E.[TM] This ongoing project seeks to leverage human interactions and computer modeling and tools to provide participants with useful insights on complex multi-disciplinary issues. It's underlying philosophy is to create a seamless virtual environment by leveraging existing commercial and government information technology and modeling capabilities.

As depicted conceptually in Figure ES-1, the S.E.N.S.E. approach focuses on players and the types of decisions that they typically must make in real world complex crises. It also involves emulating, not replicating reality. In this regard, player interactions, in lieu of computer models, provide the basis for emulating established or desirable
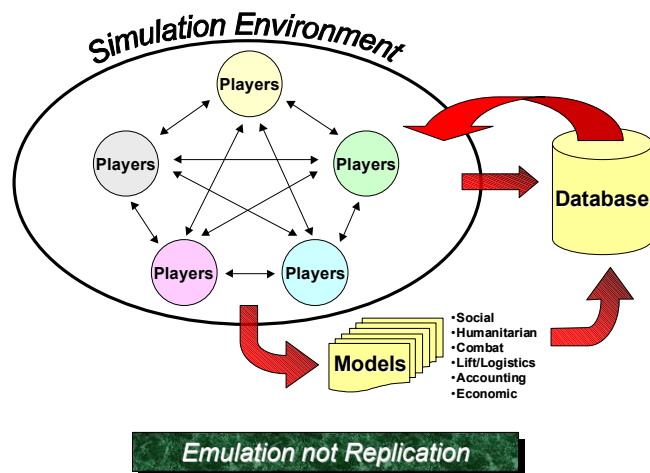
Figure ES-1: S.E.N.S.E. Methodology

cross-institutional interactions and relationships. Computer modeling, tools, and data bases, on the other hand, are employed to change the "player environment" and to emulate processes that are either too complex for humans to accomplish in compressed real time or would require larger numbers of qualified players than are readily available.

Since its inception in 1996, S.E.N.S.E. has evolved into a generalizable architecture for desktop distributed interactive simulation capable of simultaneously addressing economic, social, political, and military issues. To date, two types of environments have been developed and employed—an information warfare simulation and a nation building simulation. The latter was developed at the request of SACEUER to "teach economics 101 without lecturing economics 101" to officials from Balkan and other former Warsaw Pact nations. The George C. Marshall Center and the United States European Command are currently using the nation building simulation to assist governments to understand what is involved when transitioning from centrally planned to market oriented economies.

The results of the initial simulations suggested that S.E.N.S.E could be extended to facilitate senior decision making. Consequently, IDA was tasked to explore, on a level-of-effort basis, the feasibility of developing a prototype PC-based, distributed interactive political, military, economic, and social simulation that provided a reliable and responsive means for assessing different national security policies and options during complex contingencies. In evaluating the feasibility of constructing such a prototype, IDA was to consider using existing DoD models and simulations and to recommend courses of action that would enable such a prototype to be extended and used to support strategic planning assessments and exercises such as the QDR.

The S.E.N.S.E. approach to designing a virtual environment or game provides for an iterative process that begins with a clear definition of what is desired or needed and an understanding of what is possible. To make the most effective use of the DoD resources provided, we focused on ascertaining and understanding the potential scope and complexity of such a simulation from both a functional and a technical perspective. We conclude the following:

1) Recent Presidential Decision Directives in the areas of terrorism, complex contingencies, and domestic infrastructure protection signal the intent of senior U.S. leaders to improve collaborative planning and better integrate the capabilities that are available to meet such challenges.

2) Senior U.S. leaders continue to be hampered by the current lack of a capability that facilitates and fosters collaborative planning and organizational inter-operability among government agencies involved in developing and assessing options, strategies, and plans to contend with such challenges.

3) A S.E.N.S.E.-based virtual distributed interactive environment that sufficiently emulates reality can be constructed and employed to help senior decision makers gain useful insights about the complex and interdependent multi-disciplinary issues associated with such challenges. In this regard:

   (a) A regional S.E.N.S.E. application that addresses specific local and region-wide challenges is possible for use as a training aid for CINCs (e.g., developing options and a plan for dealing with a major natural disaster in a specific city and growing ethnic unrest in other countries in a region).

   (b) A global or strategic S.E.N.S.E. application that addresses multiple simultaneous crises, regional as well as domestic, is also possible for use in assessing and rehearsing policy options for senior decision makers of several agencies. As depicted in Figure ES-2, this approach, called
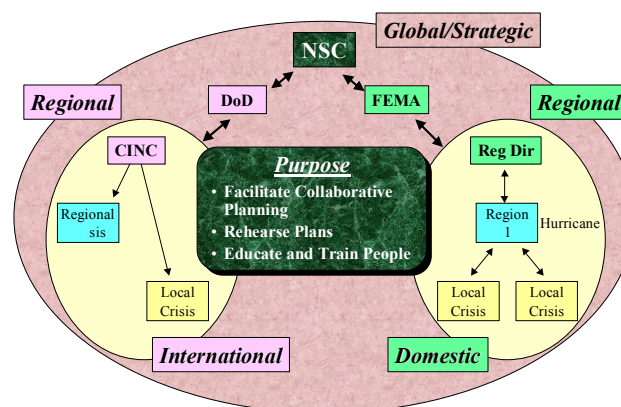
Figure ES-2: *Checkmate!* Focus and Scope

Checkmate!, could entail establishing a global simulation with regional and local tiers that emulates the key players and decision processes of the U.S. crisis action planning and response system for international and domestic crises.

4) In addition to being used to assist to develop and rehearse crisis action planning options and plans, the global S.E.N.S.E. simulation could also be extended to provide the basis for an inter-agency decision support capability. Such a capability could assist collaborative planning and facilitate integration of effort at the national level. It could also enable leaders to run what-if games to test and rehearse potential policy and crisis response options.

5) The technologies necessary to support a regional or global S.E.N.S.E. simulation capability are available on a commercial basis today. Although there are challenges, there are no known technical barriers that would inhibit development

of either a regionally focused or a global or strategic-oriented S.E.N.S.E. application.

After carefully considering the design and development options that are available, we note that the regional and global simulations have many commonalities in terms of processes, decision outputs, and relationships. Moreover, the regional simulation can actually be viewed as a subset of the more encompassing global or strategic simulation. We offer the following recommendations with regard to constructing a prototype that meets immediate needs and has the potential to be extended in the future.

a) The expeditious approach to developing and fielding the most flexible synthetic environment possible is to develop the global simulation using a time-phased evolutionary development approach to control risk and costs. An incremental or phased approach that may be used to design and develop the Checkmate! global simulation capability is depicted conceptually in Figure ES-3.

b) The development of the objective global S.E.N.S.E. application should incorporate distance learning features so that a fully distributable gaming environment is created.

Figure ES-3: *Checkmate!* EvolutionaryApproach
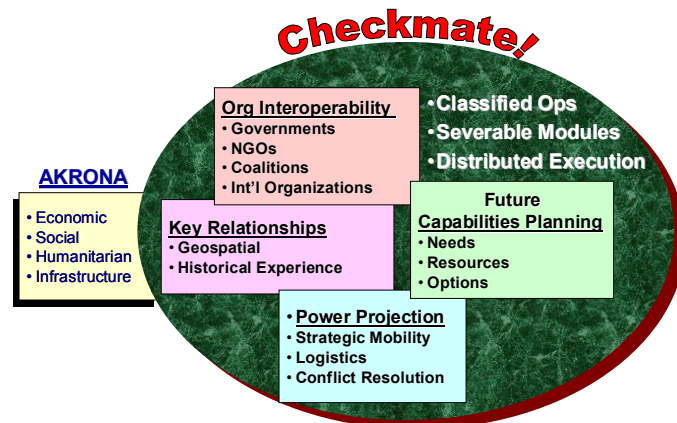
c) Since the distributed gaming environment will provide many of the technical features necessary for an inter-agency deliberative and crisis action planning capability, resources should also be made available to pursue the design and operational prototyping of such a capability.

In sum, S.E.N.S.E. is an extremely powerful tool that can be extended to provide realistic, thought-provoking exercises that help reveal underlying motivations and strategies. It can offer ways to conduct structured "what if" excursions, provide new insights for interpreting intelligence data, and deliver engaging environments that enable senior decision makers to assess alternative crisis response options and rehearse approved plans.

I. OVERVIEW AND NATURE OF THE IDA EFFORT

The end of the Cold War presented the United States with a dramatically different set of national security challenges. While new policies have been developed and implemented to meet these challenges, increased U.S. involvement in operations other than war and emerging domestic security threats recently led the President to direct that our ability to manage complex contingencies be improved. This Chapter presents the major challenges and opportunities that prompted DoD sponsorship of this study, outlines the scope of IDA's tasking, and describes the organization of the paper.

A. POST-COLD WAR ERA CHALLENGES

The collapse of the Soviet Union and the end of the Cold War brought with them a new set of national security challenges for the United States. Instead of focusing on long-standing, well-studied threats to our interests we were forced to address a more uncertain, and in many respects a more demanding world that included the resurgence of ethnic territorial claims and disputes and the emergence of global terrorism as major concerns.

At the same time when the size of the U.S. military was declining, U.S. leaders were faced with the need to shape and implement new policies to address emerging real world needs. Increasingly it became more and more essential to couple diplomacy, economic leverage, and smaller military forces in innovative ways in humanitarian relief, peace making, and peace keeping operations abroad.

The conflicts and disputes that precipitated the need for such operations were more often than not rooted in historical social and religious enmities making them exceedingly difficult to resolve in the short-term. After separating the belligerents and restoring a temporary modicum of peace, we and our allies often found ourselves in the position of having to spearhead the rebuilding of war-torn societies, both physically and institutionally, something we had last attempted on a large scale with the Marshal Plan after the end of WWII.

The rebuilding and reconstruction efforts necessary to restore civil societies invariably involved the need to integrate the efforts of the United Nations, other international organization, and significant numbers of non-governmental organizations. It also led to an urgent need to coordinate numerous U.S. government departments and agencies in new, uncommon ways.

As the number and frequency of U.S. commitments to the new types of security operations increased, original estimates of the time necessary to achieve closure proved to be significantly underestimated—economic support and military forces were needed much longer than initially envisioned. This began to strain the economic assistance budgets set aside for such contingencies and proved taxing for the readiness of our smaller post-Cold War military forces. It was such strains on national resources and the need to more efficiently and adeptly apply both political and material pressures to resolve potentially globally destabilizing foreign conflicts that led the President to direct actions to improve the management of and response to complex contingencies.

B. MODELING AND SIMULATION OPPORTUNITIES

As the complexity of U.S. national security challenges increased, IDA began to explore the hypothesis that advanced modeling and simulation techniques could be employed to gain useful insights on complex, multi-disciplinary issues for senior DoD decision makers. This line of reasoning followed from IDA's experience with modeling and simulation for national security purposes as well as its observation that leading business schools in the United States and Europe were increasing their use of computer games and simulations as a means of teaching the dynamics of business management.

As a result of initial exploratory research in 1996, IDA established a centrally funded research project to explore the feasibility of using modeling and simulation techniques, particularly those dealing with interactive planning and virtual environments, to gain useful insights on national policy-making issues. This project concluded that a systematic framework for crisis identification, avoidance, management, and remediation was technically feasible and could potentially produce valuable insights on complex issues for senior decision makers and their supporting staffs. As a result, the project recommended constructing an interactive framework, or virtual exercise, that would

enable senior decision makers and their supporting staffs to identify potential real world crises, to collaboratively develop and assess response options, and to test and rehearse crisis action plans.

The idea of establishing a virtual environment that enabled senior leaders and staffs to collectively *experience* a complex contingency, including the ability to collaboratively develop and assess crisis response options and examine their implications, became the basis for IDA's ongoing Synthetic Environments for National Security Estimates, or S.E.N.S.E.™, project. The overarching objective of this project is to create a seamless virtual policy making environment from existing heterogeneous capabilities by leveraging available commercial and governmental information system technologies and modeling capabilities.

C.   IDA'S TASKING

The potential of S.E.N.S.E., coupled with DoD's desire to exploit existing modeling and simulation techniques to facilitate senior decision making, resulted in IDA being tasked on a level-of-effort basis to explore the feasibility of developing a prototype PC-based, distributed interactive political, military, economic, and social simulation. This simulation was to be capable of providing reliable and responsive means for assessing different national security policies and options during complex contingencies. IDA was to consider how existing DoD models and simulations might be used to develop such a prototype. And, IDA was to recommend courses of action to further develop the prototype so that it could be used to support strategic planning assessments and exercises such as the Quadrennial Defense Review.

D.   STRUCTURE OF THIS REPORT

In response to the level-of-effort tasking, IDA determined that the most expeditious use of the initial $155,000 provided by DoD would be to undertake a scoping activity to explore the feasibility of applying the S.E.N.S.E. methodology to create a simulated complex contingency environment for policy makers. This paper contains the results of that effort and is organized as follows:

- Chapter II provides essential background material regarding S.E.N.S.E.

- Chapter III discusses the potential to apply the S.E.N.S.E. methodology in concert with other modeling and simulation capabilities to a range of policy issues.

- Chapter IV illustrates how the S.E.N.S.E. approach might be applied to address regional security issues and how it could be used to provide a framework to support U.S. national decision making across a broader range of potential challenges.

- Chapter V provides conclusions and recommendations for further applications of the S.E.N.S.E. methodology and assesses what is feasible and practicable in the near and long term.

- Appendices are used to provide detailed discussions of technical and architectural nuances as well as background information on the characteristics of different types of institutional representations that might be contained in future S.E.N.S.E. simulations.

II. BACKGROUND

Conceptually, the methodology underlying S.E.N.S.E. is to leverage available system technologies and modeling capabilities in order to create a seamless virtual environment that enables senior leaders to experience the challenges associated with exploring and resolving high level policy issues. In order to understand how this methodology could be applied to complex peace operations (complex contingencies) it is instructive to review IDA experience with its first two applications, information warfare and nation building. This Chapter briefly describes the evolution of the S.E.N.S.E. approach focusing on what has been accomplished prior to the current tasking. Additional details and supporting material, particularly technically oriented information, are provided in the appendices to the paper.

A.   OVERVIEW

S.E.N.S.E. began in 1996 as an IDA centrally funded research project. Originally it was intended as a proof-of-concept to demonstrate how to address national security issues beyond the military domain, with an emphasis on economic security. The original focus was on answering the following two questions:

- How can we better understand economic globalization and its impact on traditional notions of security for nation states?
- What are the interrelationships among prosperity, security, and stability in a multipolar world where asymmetric threats and nontraditional security issues must be considered?

Since that time, S.E.N.S.E. has evolved into a generalizable architecture for desktop distributed interactive simulation capable of simultaneously addressing not only economic, but also social, political, and military issues. In this regard, two types of environments have been developed to date—an information warfare simulation and the AKRONA simulation developed at the request of SACEUR.

B. FIRST GENERATION S.E.N.S.E. – INFORMATION WARFARE

In collaboration with Purdue University, an information warfare and transnational corporation game was developed during the summer of 1996 and deployed in conjunction with an IDA sponsored Symposium on Synthetic Economies. The purpose of this "game" was to test the hypothesis that a computer architecture could support interactive role-playing among a host of participants, each pursuing a set of heterogeneous goals. The objective of the game was to enable representatives of governments and businesses to gain useful insights regarding the potential harm that could be inflicted through an information attack by a "terrorist" organization.

1. Simplified Player Roles and Participant Interactions

One of the hallmarks of a S.E.N.S.E. simulation is the way in which player roles are simplified so that interactions focus on critical path issues and policy matters. This does not mean that the simulation itself is simple. Rather, players are provided with automated tools that allow them to quickly identify and evaluate the immediate implications of different courses of action. Whether or not chosen courses of action prove to be effective in the long-term is determined through a process of discovery as the simulation progresses and the success of competing player strategies is revealed. In the information warfare game the following simplified roles were used:

- **transnational firms** pursued profits, paid taxes, and sought to protect themselves against terrorists;
- **households**, simulated via utility functions in the computer, worked and strived to improve their standard of living;
- **governments** raised taxes and provided for the security and well being of their citizens; and
- **terrorists**, collectively referred to as rogue nations, sought to disrupt information infrastructures and undertake blackmail.

To facilitate the interactions of the different player types a notional five-region, five-market world was used containing five governments, five transnational corporations, and a single terrorist cell (Figure 1). The following are some highlights of how the game operated:

- Households were used to clear markets according to different regional utility functions. This led to differentiation in profit rates among regions and markets, and a rationale for transnationals to make home country and foreign investments as well as to trade across borders.

- Governments sought to protect transnational firms within their borders from information warfare attacks from the terrorist cell by changing general security levels via a law enforcement function; the firms themselves individually decided whether or not to purchase additional security.

- To simulate the affects of a terrorist information warfare attack a time and monetary penalty were exacted from victims. To promote play, the exact security level and the level of threat were unknown to defender and attacker, respectively, prior to an attack. The severity of a successful attack was determined by the difference between a defender's security level and an attacker's weapon. A successful attack resulted in a victim's keyboard being frozen for a specified period of time and their cash balance being reduced by a calculated amount.

- Terrorists were also allowed to send ransom notes to potential victims in an attempt to extort monies without resorting to their arsenal. As a result, defenders could, at their own peril, chose to ignore a ransom request or comply and trust the terrorists (who could still attack).[1]

5 Transnationals   5 Markets   5 Governments

Asia

North America   Europe

Terrorists

Terrorists

Rogue Nations

Rest of World
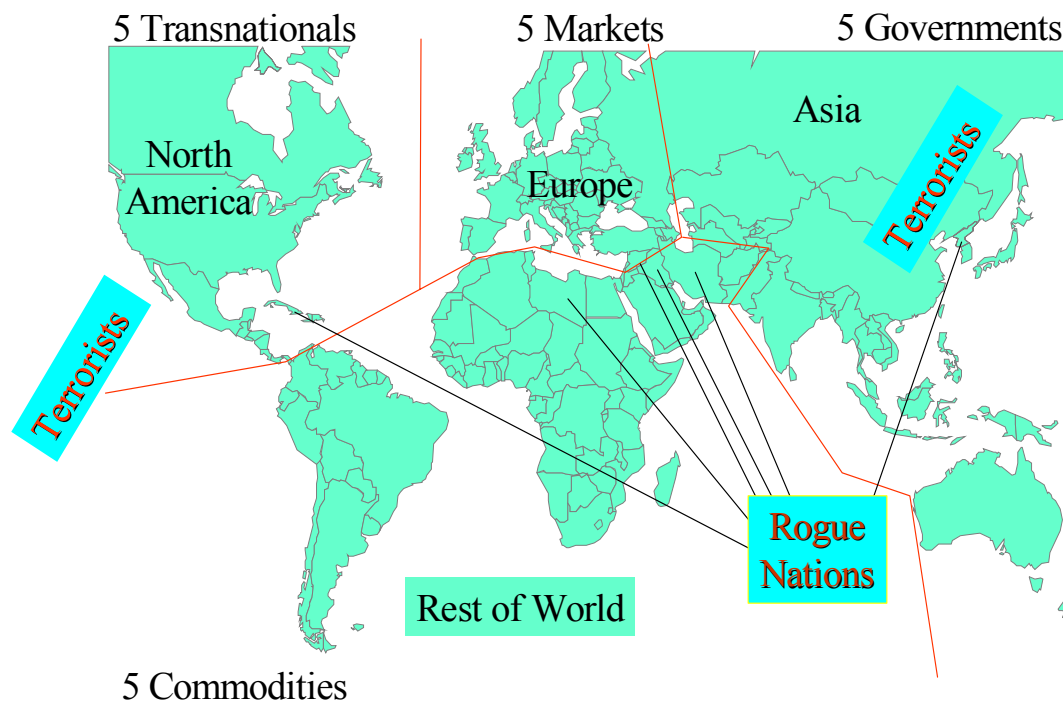
5 Commodities

Figure 1. Regions, Commodities, and Players

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[1] A variant of the game was also tried where all participants could perpetrate terrorist attacks. This demonstrated the flexibility of the gaming paradigm and tested the impact of multiple attacks occurring simultaneously among numerous players.

2. Assessment

The first generation S.E.N.S.E. model and gaming sessions demonstrated that it was possible to leverage available system technologies and modeling capabilities and create an interactive environment that emulated many of the key features and characteristics of complex decision making environments. More specifically stated, as a result of this experience, IDA concluded the following:

- It is possible to construct a distributed interactive accelerated-real-time simulation capable of addressing high-level policy issues.

- The simulation environment need only emulate not replicate the real policy environment in order to convey principles and assist in uncovering critical-path issues.

- Automated tools to handle administrative and estimation activities are essential to simplify course of action analysis and support the rapid decision cycles demanded by accelerated-real-time scenario play.

- Regardless of the construction of a scenario, players interpret the scenario and exhibit behaviors characteristic of their real-world environments during the course of play.

C. SECOND GENERATION S.E.N.S.E.—AKRONA

The second generation S.E.N.S.E. simulation, which has as its centerpiece the fictitious nation of AKRONA, was developed in response to SACEUR's desire to "teach economics 101 without lecturing economics 101." Much more than a training tool, AKRONA provides a modeling and simulation architecture and methodology that may be used to improve cross cultural/disciplinary communication and to gain insights for senior decision makers.

The principles guiding both the technology used to support AKRONA and the types of human interactions encouraged through scenario play derive from extensive work done by DoD in the area of virtual combat modeling. Like many of these models, the AKRONA version of S.E.N.S.E. is a distributed interactive simulation facilitated by a network of computers. While computers are used, courses of action are chosen by participants – decisions are all "human-in-the-loop".

Prior to its first overseas deployment, AKRONA was subjected to two peer reviews by outside experts in the fields of economics, psychology, and peace operations.

In both cases these reviews recommended that the simulation be used with its intended target audiences and challenged IDA to make modifications to introduce additional capabilities into the system. In response to that challenge IDA continues to expand the capabilities of AKRONA to increase the scope of its applicability.

1.   Scope and Goals of the Simulation

Designed to provide a realistic economic experience, the AKRONA version of S.E.N.S.E. has both a private sector and a public sector; the current version of the game supports 24 economic sectors. All sectors are connected to the international economy. Government has control over taxes, tariffs, and can influence investments by the private sector on a sector-by-sector basis. While player economic interactions are tracked and facilitated via the computer network provided by the S.E.N.S.E. architecture, personal interactions are encouraged as part of the course of play.

Learning via personal interactions and responsive feedback from the simulation architecture was central to achieving SACEUR's direction. In this regard, participants are expected to derive the following lessons from a S.E.N.S.E. AKRONA gaming session:

- How a market economy functions;
- The role of entrepreneurs, risk-taking and capital investments;
- The need for a strong legal foundation as the basis for enforcing contracts;
- The critical importance of dialogue among the myriad players in the private and public sectors, as well as the need for transparency to promote confidence, credibility and consensus;
- The role of macroeconomic decisions in affecting economic opportunities;
- The need to balance domestic needs with foreign demands;
- The interplay of defense funding and the national economy;
- How to achieve long-term national prosperity and rising social welfare.

To facilitate learning such lessons and add realism, the nation of AKRONA can be endowed with economic, social, and demographic characteristics that are closely aligned with those of the participant's own environments. Thus, while enabling participants to identify with the environment and problems presented, AKRONA also affords them the opportunity to set aside their biases and to explore without penalty new

workable structures and conventions to deal with a wide range of real world economic and social problems.

2.   Integrated Simulation and Seminar Approach

To facilitate rapid understanding and direct personal involvement, AKRONA employs an integrated simulation and discussion seminar approach. Seminars are employed to provide participants with context and background for scenario orientation and development, while distributed interactive simulation and direct feedback is employed to allow them to test their hypotheses, policies, and strategies. In addition to the direct feedback to the players provided by the game architecture, after action reviews are used to elicit participants' views, provide player-to-player discourse, reinforce important principles and lessons learned, and assist with mutual understanding across ethnic and cultural boundaries.

The AKRONA simulation conducted for the Montenegrins at The Hague provided for a five-day, integrated simulation—seminar approach patterned after that depicted in Table 1.[2]

Table 1. Simulation and Seminar Schedule

Stage-Setting	Recovery	Reconstruction	Development	Reflection
Future worlds	Economies of Recovery	Economics of reconstruction	Economics of development	Stability CCC, Cm/Cr
Spectrum of Power	Strategy (Trade-Offs)	Strategy (Trade-Offs)	Strategy (Trade-Offs)	Reflection/Insights
External/Internal Expectations	Simulation	Simulation	Simulation	After Action Review
National Objectives & Priorities	Simulation	Simulation	Simulation	
Introduction to Simulation	After Action Review	After Action Review	After Action Review	
Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**

3.   The Hague Experience with Montenegrins

The AKRONA simulation at the NATO Consultation Command and Control Agency (NC3A) in The Hague was conducted from February 22 to 26, 1999, at the request of The George C. Marshall Center. The 39 Montenegrin players involved came from a cross-section of their government and private sector. The entire exercise was

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[2] The AKRONA application can be presented in two to three days depending upon one's objectives.

conducted in Serbo-Croatian requiring the use of 10 translators. In order to facilitate initial human-computer interactions so-called "tutor-coaches" from NC3A were trained prior to the game and worked with the Montenegrin players during scenario execution.

The Hague AKRONA simulation included six major player types organized according to economic roles in 12 participant cells. Each cell contained two personal computers, a tutor-coach, a translator, and three or more Montenegrin participants. In addition to the Montenegrin players, professionals from western governments and the private sector participated to represent the interests of international organizations, foreign investors, non-governmental organizations and foreign governments. As noted, some of the NC3A participants served as tutor-coaches and provided real time training for Montenegrin participants; the remaining non-Montenegrin participants used the simulation as a vehicle to provide real-world lessons by making foreign investments, providing external sources of capital, and entering into joint ventures with domestic firms. Table 2 highlights the major types of cells played, the role of each type of cell, and the number of participants that played in each type of cell.

Table 2. Roles and Representative Player Types

Cell Type	Number	Role	Participants
Firm	6	To represent the interests of private sector firms	19 Montenegrins
Bank	1	To provide commercial capital at market rates	4 Montenegrins
Transnational Corporation	1	To represent the interests of foreign investors and lenders	2 Western Investors
Foreign Government	1	To provide both economic and military aid, as well as direct military support	2 Foreign Government Officials
Non-Governmental Organization	1	To represent the interests of non-governmental organizations in general	2 Representatives from non-governmental organizations
International Organization	1	To represent the interests of the World Bank and IMF	2 Foreign government officials
Domestic Government	2	To govern AKRONA through use of a civilian budget, a military budget and the ability to undertake financial operations such as lending and borrowing	18 Montenegrins

The Montenegrin participants displayed a very active and enthusiastic role in the workshops and the simulation. The natural way of learning by doing and seeing the consequences of decisions created an intense positive feeling amongst the participants of having jointly solved a fundamental national problem. The players quickly learned that co-operation, communication, interaction, bargaining, and negotiations are essential ingredients for successful behavior in evolving societies.   The non-threatening, university-style learning atmosphere and the very active audience led to open and frank

discussions and exchanges of views. Further, using experts from Western industry and the financial community was of inestimable value and is currently viewed as a prerequisite for future endeavors.

4.   Participant's Assessments of AKRONA

The response from sophisticated simulation participants, former senior government officials, and well-known academics has been that AKRONA accomplishes its intended task -- to engage participants in an environment that helps convey an understanding of complex interdisciplinary issues. Some comments from participants in the exercise are:

- Sandra Berberovic, Office of the Deputy Prime Minister for Social Issues: "This is an interesting game and I really enjoyed seeing my government work as a team, which is not an opportunity when you work in one Ministry – you do your job and you don't get a chance to see how the whole system functions."

- Mila Kasalica, Bank for Development of Montenegro: "I will try to explain to my colleagues and my collaborators that responsibility is the key to everything. It's not just a phrase – it's really a good thing when you cooperate and you are responsible for your actions."

- Jerome Visser, Manager, Ministry of Defence, The Netherlands: "Well, the most important thing about this simulation is that - unlike other simulations, its very interactive and normally in a simulation you would only see the results after a day and here after 15 minutes you already see what is happening and they have to really anticipate on what is going on in the world and so the learning curve is incredibly steep - and that's very good."

- Stephen Moses, Stephen Moses Interests: "It was very realistic. The people got into their roles and really reacted the way they would react in real life. Many of the decisions we saw them making were very much the kind of thing that we have run into as we've been trying to do business in this part of the world."

- Dr. Colin Bradford, Department of Economics, American University: "I guess the thing that most impresses me frankly is that there's almost a degree of solemnity involved in the way that these people are playing this game. I think they've realised that this AKRONA economy in the end is not just AKRONA but in the back of their minds they are aware that it is a realistic economy and a realistic simulation of what they face at home. So, the thing that most impresses me is the seriousness with which they seem to playing the game and taking the outcome as lessons that they can apply when they return home."

5. Future Plans for AKRONA

Based on the positive feedback from participants, The George C. Marshall Center has requested that IDA support at least four AKRONA simulation and seminar programs in the year 2000 calendar time frame:

- Bosnia Program I (Sarajevo, January 2000)
- Georgia Program I (Washington, D.C., Feburary 2000)
- Montenegro Program II (Location TBD, June 2000)
- Ukraine Program I (Location TBD, August/September 2000)

In addition, SACEUR has requested an additional five billets for the Marshall Center beginning in the year 2001 to support an additional conference team in order to conduct eight to ten AKRONA simulation and seminar programs a year.

D. SUMMARY

Twice peer reviewed by well-known academics, and used in The Hague with representatives from Montenegro, AKRONA has proven to be an extremely useful tool. The Hague exercise, for example, immersed the Montenegrin participants in a simulated democratic free-market society. This experience enabled them to gain invaluable insights regarding the inner workings of a free market-based, competitive economic system. It also reinforced the need for effective communications among governmental, commercial, and non-governmental entities, particularly when the objective is to achieve long-run stability and prosperity. As General Clark pointed out in his interview with Defense News following the simulation: "What we've learned is that you can't achieve stability if you can't achieve prosperity."

In sum, all who have attended S.E.N.S.E. workshops, from senior decision makers to summer interns, have been taken with its ability to engage participants in realistic, thought-provoking exercises that help reveal underlying motivations and overarching strategies. This led DoD to ask IDA to explore the feasibility of extending S.E.N.S.E. to assist in meeting the challenges of the 21st century. In Chapter III we examine the potential to extend the approach from a conceptual perspective. We then illustrate in Chapter IV how the approach might be applied.

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III. EXTENDING THE S.E.N.S.E. APPROACH: CONCEPTUAL DESIGN CONSIDERATIONS

The S.E.N.S.E methodology seeks to leverage human interactions and computer modeling and tools to provide participants with useful insights. Player interactions, in lieu of computer models, provide the basis for emulating established or desirable cross-institutional interactions and relationships. Computer modeling and tools, on the other hand, are employed to emulate processes that are either two complex for humans to accomplish in compressed real time or would require more qualified players than are readily available. In this Chapter, we highlight critical factors and conceptual design interrelationships that must be considered when attempting to extend S.E.N.S.E. to other applications and then discuss each factor individually.

A. FIVE CRITICAL FACTORS AND INTERRELATIONSHIPS

The S.E.N.S.E. methodology for designing a virtual environment or game provides for an iterative process that begins with a clear definition of what to achieve and follows a simple maxim: "be approximately right not exactly wrong!" By incorporating research, smart experimentation, and double-loop-learning (build-exercise-build) top-level design considerations are explored: What are the target participant types? How many levels of play are needed? What is the appropriate time compression? How will computer modeling and support tools be incorporated into scenario play? All of these questions, and many more, must have clear answers if a S.E.N.S.E. simulation is to succeed.

Our experience with the first two S.E.N.S.E. applications suggests that five critical factors and interrelationships are particularly important to answering these types of questions.

1. The conceptual domain, or virtual exercise space, of the simulation must be broadly defined from the outset in order to facilitate possible future extensions and provide flexibility.

2. The organization of the players and the simulation support tools that will be at their disposal must be logical, effective, and relatively simple to comprehend and use.

3. The major roles, responsibilities, and interrelationships of player organizations and entities must be defined and, as appropriate, be capable of being modified as the game progresses and the simulation evolves.

4. To facilitate efficient computer coding, as well as to enhance the ability to accommodate changes and control costs, it is important to establish a player-functionality cross-walk that minimizes the number of distinct computer assisted tools and enablers that must be developed.

5. Time, geo-spatial, and resource constraints must be logically addressed in order to gain useful insights, particularly on complex problems involving many entities and variables.

B.   SIMULATION DOMAIN SPACE

U.S. leaders are confronted with a broad spectrum of contemporary challenges.

In addition to having to guard against threats to our national security interests abroad,
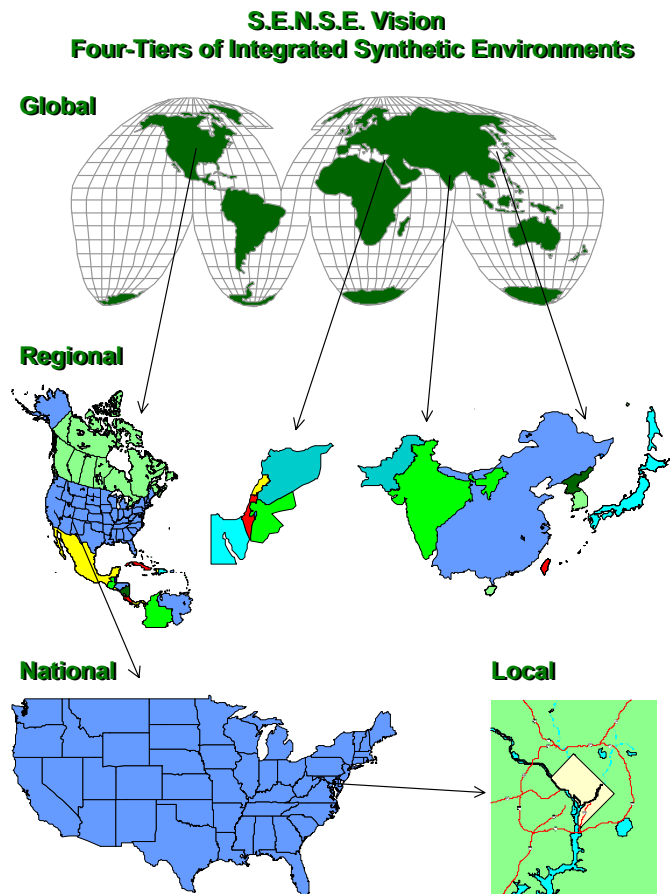

Figure 2. S.E.N.S.E. Domain Spaces

they must also have the capability to quickly marshal resources and provide assistance to those in need during domestic and international disasters. The types of challenges to be

addressed, coupled with the organizational focus of the sponsor, establishes the conceptual domain of the simulation environment or virtual exercise space. This conceptual domain, as Figure 2 suggests, can be exceptionally broad and include the need to simultaneously address crises from a local, regional or global level. Or it can be more focused and address levels individually or simultaneously *as long as the time steps across the different levels and compartments of simulation play are identical.*

Subsequent discussion primarily addresses the architecture for a more inclusive or larger perspective domain or game space involving regional crises and multiple, concurrent, dissimilar crises requiring U.S. leadership action. In addition to being the more difficult challenge, such an effort would provide the United States with the capability to collaboratively develop and assess options and to rehearse approved plans for dealing with multiple simultaneous crises, a *capability we currently lack.* In this regard we discuss the broad spectrum of potential entities and functionalities that might be involved and how geo-spatial considerations might be represented.

C. PLAYER ORGANIZATION AND SIMULATION TOOLS

The organization of players and the tools used to engage in scenario play must be sufficiently flexible to allow easy redefinition of roles and responsibilities during both the design of a scenario as well as during simulation execution. There are, of course, limitations on the extent to which tools and player roles may be reoriented. However, by establishing a skilled design team that can anticipate the types of actions necessary to emulate real-world processes in advance, it is possible to design innovative tools and player roles in a generic way so that their capabilities may be conditioned by databases.

1. Organization of Players and Functions

In order to give both vertical and horizontal flexibility to scenario execution a way of associating functions with players and groups of players is required. This is accomplished by relating functions to so-called USERIDs. That is, the specific functionality accorded a player or players (their role) is directly related to the profile of individual functions associated with the USERID with which they LOGIN to the simulation. A PARTICIPANT in a simulation, therefore, is not a player, but a player

position representing a particular functionality or set of functionalities that is defined by a USERID.

For instance, in the AKRONA simulation a bank PARTICIPANT is able to lend and borrow monies, make cash transfers, repay loans, and set terms for debt products. One or more players may work together as the bank PARTICIPANT, and more than one computer terminal may be used, but the functionalities of each terminal are identical even though a division of labor may be implemented by the players in order to increase their operational efficiency.

In complex scenarios, however, it may be more desirable to segregate the functionalities of PARTICIPANTs due to the nature of activities to be undertaken, the sheer volume of work, or simply to represent organizational boundaries. In such cases it is possible to establish PARTICIPANT CELLs, or CELLs for short. A cell is simply a way of organizing selected PARTICIPANTs so that a set of related tasks can be accomplished with the collective set of functionalities. In general, it is only necessary to define CELLs when the completion of a set of PARTICIPANT tasks is interdependent. This does not mean to imply, however, that all sets of interdependent functions in a scenario need to be organized into CELLs.

For instance, the need for Army, Navy, Air Force, and Marine Corps PARTICIPANTs to each complete the selection of units for a time-phased force deployment list prior to submitting the list to the National Command Authorities for approval could constitute a CELL. However, the need for a bank to approve a loan request before monies can be disbursed to a borrower does not necessarily require that participants be organized into a CELL. In brief, the primary purpose of a CELL is to allow the differentiation of functionalities across PARTICIPANTs sharing a common goal and facing common constraints.

Finally, PARTICIPANTs and CELLs can also be organized into TEAMs. In effect, a TEAM is simply the expression of an organization's structure according to the tools provided for scenario execution. Nations, international and non-governmental organizations, and private firms are all types of TEAMs. Effectively, TEAMs are the way in which political/institutional boundaries are represented in a scenario.

It is important to recognize that the definition of CELLs and TEAMs is intended to be dependent upon scenario design. In the example given of a CELL above, the military services are organized into a single CELL. However, this need not be the case. Rather, each military service might be an individual CELL in some other scenario that is exploring different issues and objectives. Or, each service might be designated as a TEAM. The key is not to think of PARTICIPANT, CELL, and TEAM as a rigid hierarchy, but rather as organizing principles for functionalities and scenario execution (see Figure 3). In the simplest type of scenario, such as the AKRONA game, all three may be synonymous.

TEAM

CELL

PARTICIPANT
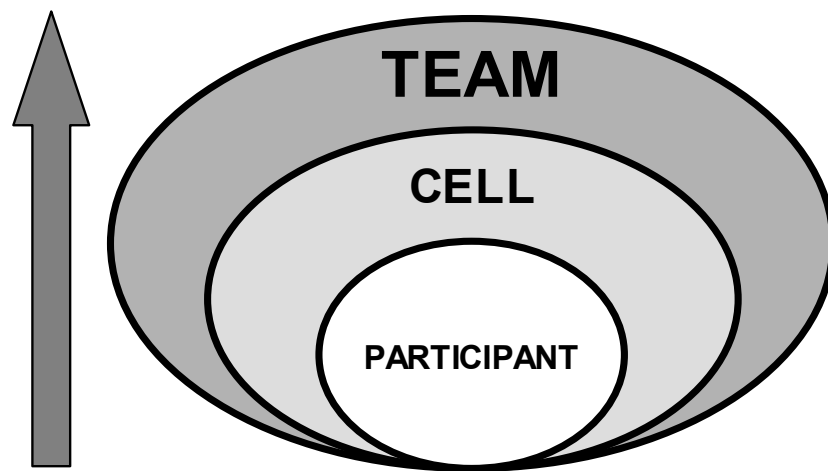
Figure 3. Organization of Players and Functionalities

2. Developing Appropriate Simulation Tools

The different functionalities provided for scenario play are derivative of a set of pre-defined tools (in programming parlance, "objects") within the simulation environment. Broadly speaking, S.E.N.S.E. employs two different types of tools: ENABLERs and FORUMs.

- ENABLER tools provide the ability for PARTICIPANTs to command resources. For instance, specific tools may be designed to allow PARTICIPANTs to do different things such to direct troop movements, to apply for or approve loans, to set tax and tariff rates, or to determine rates of production. All of the tools in the AKRONA game are ENABLERs.

- FORUM tools, by comparison, provide the ability to facilitate political and bureaucratic processes across PARTICIPANTs, CELLs, and TEAMs where

resources are not directly commanded. In similar fashion, these tools may also be designed for different purposes. For instance, one tool may allow players within a PARTICIPANT to function as a legislature, while two different tools may exist to enable communications across the CELLs comprising the NSC and the TEAMs comprising the UN. In brief, the primary purpose of FORUM tools is to facilitate the political fabric of scenario execution.

PARTICIPANTs, CELLs, and TEAMs may each have both ENABLER and FORUM tools at their disposal. Which tools they have is a function of the role designed for them in the execution of a particular simulation scenario. And, experience suggests that the results of deliberative processes employing FORUM tools will frequently generate the need for ENABLER tools of some type.

D. ROLES, RESPONSIBILITIES AND INTERRELATIONSHIPS OF ENTITIES

The list of organizations and actors that might be called upon in different types of crisis scenarios is extensive. With regard to domestic disasters, for example, in addition to identifying a lead US Government agency for each emergency support function (ESF), the Federal Response Plan also identifies coordination responsibilities and highlights general notification processes and information requirements. Joint and combined military operations plans contain even greater detail regarding potential crisis response operations.

For S.E.N.S.E., the issue is not the specific entities engaged in a scenario but the functionalities of the types of organizations or actors (e.g., governments, international organizations, and non-governmental organizations) that might be represented. By developing an exhaustive set of functionalities from which any type of entity in a scenario may be created, the S.E.N.S.E. virtual environment may be used to address a broad spectrum of multiple, concurrent crises. The result of undertaking such a distillation process yields an entity and functionality cross-walk which may be used to uniquely define any type of PARTICIPANT within a given scenario as a composite of non-overlapping (orthogonal) functionalities.

1. Entities

When establishing the types of entities to be represented in the simulation it is important to distinguish the need to emulate versus replicate reality. The former involves

establishing a sufficiently representative framework that enables one to gain useful insights. The latter entails duplicating all aspects of all of the entities (major and minor players) that are involved in decision making. Replication is very resource intensive (expensive) while emulation can be done with significantly fewer resources (more cheaply). As noted earlier, S.E.N.S.E. strives for emulation. Some representative types of organizations that might be emulated in a broad-based virtual environment are highlighted below.

a. Governments

Governing bodies, whether elected or not, have a wide range of activities in which they may participate. The span of control and the exact types of activities allowed is a function of the level of government and the legal system of the geo-political entity in question. That is, the Governor of California may call up the state National Guard, but he/she may not declare war. Conversely, the U.S. Federal Government may regulate inter-state commerce but it may not generally interfere with State decisions to develop industrial parks or provide tax incentives to attract businesses across state lines.

With regard to the types of complex contingencies addressed in PDD 56, national governments provide the bulk of the resources required for all relief and recovery activities. In the United States, for example, although supplemental requests are often submitted to the Congress, the financial resources required are typically reallocated from established funding sources. However, with regard to recovery-reconstruction-development efforts, particularly in war-torn areas, provincial or local governments concerns and agendas must be considered, since they largely determine whether or not global solutions proposed by the United States and others are locally acceptable. Hence, in the Balkans context, how resources are applied in the Bosniac, Croat, Serb, and Kosovar contexts may differ even if the level and kind of aid is the same for each.

b. International Organizations

International organizations essentially are super-state entities to which individual nation-states are members (see Appendix F for examples). In all cases, these types of organizations have some sort of governing body (e.g. a secretariat or executive council), voting rules, and membership "dues" to support their operations. Despite these

similarities, however, the defining characteristics of such organizations can and do differ markedly. For example, some organizations are purely deliberative in nature, while others provide funding and in-kind assistance. Still others have the capability to deploy military forces.

Examples of international organizations include the United Nations (UN), the North Atlantic Treaty Organization (NATO), the Association of Southeast Asian Nations (ASEAN), and the World Trade Organization (WTO). The UN engages in a broad spectrum of social, economic, and military activities; NATO is primarily a military organization, although it does have an economic committee; ASEAN is a political forum without military capabilities; and, WTO is an economic organization driven by political exigencies. Consequently, the similarities and the differences among the organizations being considered in developing a virtual environment must be researched, understood, and applied during design and development.

c. Non-Governmental Organizations

Non-governmental organizations (NGOs) are non-profit entities established in the private sector that provide aid and assistance to regions affected by natural and man-made disasters. They obtain resources from both the private and public sectors although the bulk of their contributions is provided by governments and international organizations. In many cases they use their funding to address special humanitarian needs not supported by governments such as providing trauma care, prostheses, and other specialty medical services. However, a large number of these organizations provide more mundane but exceptionally important tasks such as distributing food and clothing and providing shelter and education to those in need.

There are literally hundreds if not thousands of NGOs in operation today worldwide (see Appendix F for examples). The larger, "generalist" NGOs such as CARE, Catholic Relief Services, OXFAM, and World Vision have sufficient funds of their own to immediately launch limited response operations when crises first arise. They are diverse enough to perform literally all aspects of relief including the provision of food, shelter, water, medical assistance, and medical care. Recently, in response to the growing number of civil and ethnic conflicts worldwide, these larger NGOs are

developing broader capacities to strengthen civil society, address conflict resolution, and promote reconstruction. Their overarching strategy is to stress "holistic" approaches to re-establish local management authorities as a way to address the challenges of recovery, and they provide long-term support to development assistance programs.

d. For Profit Corporations

For profit corporations are central to reconstruction and development in post conflict environments. In market economies firms provide the source and impetus for economic growth and capital accumulation. The challenge for post-conflict planners is to create an environment that is attractive to investors that does not exploit and alienate the indigenous population. Hence, while there are institutional and market characteristics that must be met before capital will be put at risk in a post conflict setting, there are also societal norms that must be understood and not contravened in order for foreign capital and enterprises to be welcomed in a post-conflict environment.

The institutional characteristics of an environment attractive to foreign capital include enforceable contracts, levels of risk commensurate with potential rates of return, and transparent business and accounting practices. These provide for the regular conduct of commerce by guaranteeing that a right of recourse exists and that business representations are not fraudulent. The market characteristics of an attractive environment include low inflation, real interest rates commensurate with the domestic availability of capital, stable exchange rates, and government fiscal responsibility. These ensure that opportunities for making money are not transitory or subject to the whim of the public sector. Finally, in order for a foreign business or investment to be welcomed in a post-conflict environment its mangers must demonstrate that positive local benefits will accrue. For instance, the employment of indigenous persons, the use of local materials, balanced hiring practices from among contending ethnic groups, and a willingness to reinvest some portion of profits in the domestic economy would all be seen as attractive.

e. Military Organizations and Capabilities

While clearly a part of government, military organizations tend to have a character uniquely different from civilian agencies as a result of their mission and the

types and quantities of resources at their disposal. For instance, AKRONA distinguishes military actors from their civilian counterparts within the domestic government structure. The degree to which this distinction is upheld in other S.E.N.S.E. simulations, however, is a function of the need to account for military activities apart from civil ones. That is, if a simulation is run where the actual composition of military forces is not important then military expenditures could be treated simply as a lump sum. At the other end of the spectrum, detailed civil agency emulations could be constructed should their internal decision making processes be important to scenario play.

There are, however, some uniquely military capabilities that, should their emulation be desired, cannot simply be lumped in with civilian entity functionalities. These include the need for warfighting adjudication, force deployment and readiness, force structure and composition, lift and logistics, as well as changes in technological capabilities over time. Particularly in the area of complex contingencies, where NGOs and international organizations interact closely with military forces, there is a need to account for many aspects of the military not found in more traditional warfighting simulations. In particular, combat support and combat service support elements who undertake civil support missions (e.g. infrastructure repair, training, communications support) must be adequately represented within scenario play as they are exceptionally important to the successful outcome of peace operations.

f. Rogue Nation-States and Terrorists

The information warfare prototype S.E.N.S.E. game included emulation of a terrorist cell and a rogue state. In many ways the functioning of these cells was to act as a spoiler for other PARTICIPANTS. As mentioned, their role was to undertake attacks against governments and industries that would lead to unforeseen resource costs. In this way they resembled traditional "control cells" in political-military games, with one big difference--the terrorist and rogue state cell players functioned autonomously making their own decisions on when and how to attack their targets. They were not used as scripted "scenario injects."

It is particularly important to understand why S.E.N.S.E. simulations treat adversaries in identically the same way as all other players. This is because the purpose

of the simulation environment is to gain insights about the behaviors of different PARTICIPANT types and under what conditions they act. As such, by treating all PARTICIPANT types autonomously -- allowing them to decide how to act without outside influence -- the players themselves gain insights about how and why decisions are made from different perspectives. The purpose of after action reviews, such as those done for both the information warfare and AKRONA simulations, is to trade insights among players to gain better mutual understanding of how people are likely to react in different types of situations.

2. Functionalities

While the explicit mission of the different types of entities in a regional or global security scenario will differ significantly, they may have a large number of functions in common. That is, the United Nations may provide grants (transfer cash) to NGOs to support humanitarian relief operations while the U.S. Government might provide foreign military aid. Even though the ends are quite different the means are essentially the same. Figure 4 presents a simple depiction of the interactions of players and underlying modeling constructs that would be involved in an regional security simulation to help us understand just how the wide range of diverse functions and agendas would need to be interrelated in such a simulation.

Note that at the core of the diagram is a database (represented by the hexagon) that is used to store all of the information for the simulation. Arrayed around the database are various types of models and/or other simulations (rounded boxes) that are used to drive various types of social, economic, warfighting, natural, and other events.
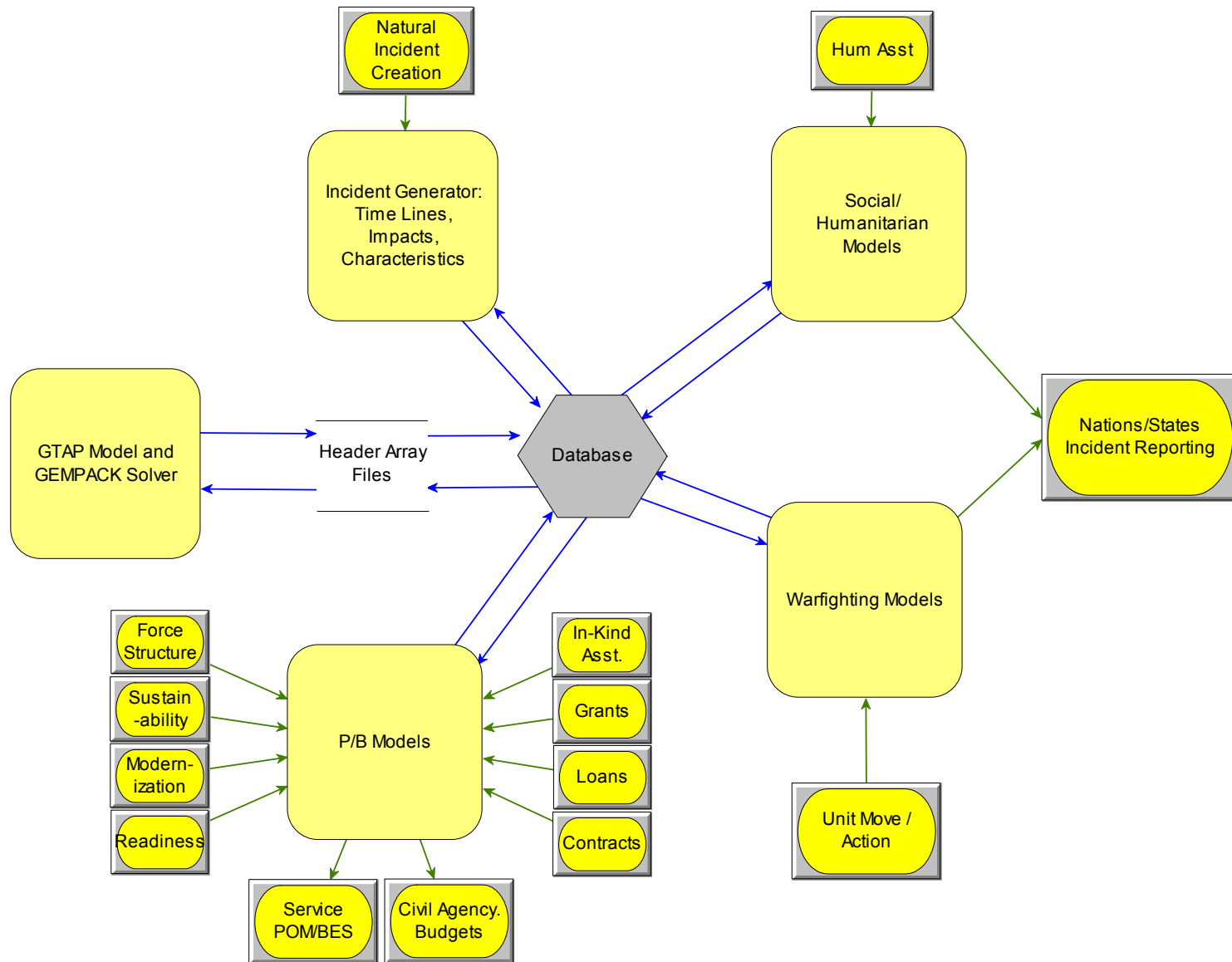
Figure 4. Model-Player Relationships and Interactions

26

Arrayed around each of these are player inputs (rectangular boxes containing ovals).[3] During the course of a simulation all player inputs that are schedule-driven (occur at regular intervals) are collected and then processed simultaneously by the underlying models. At the same time, event-driven player inputs are processed immediately regardless of the time step of the simulation.

For instance, in the AKRONA game player decisions regarding tax and tariff rates, budgets, foreign aid, and so forth are processed at the same time at the end of each month. These are schedule-driven activities in the simulation. Meanwhile, during each monthly period cash transfers, bank loans, loan approval and rejections take place as soon as players make a decision. These are event driven activities.

The distinction between event and schedule driven activities in the simulation offers a convenient way to discuss the functional attributes required for a regional or even a global strategy (multiple concurrent dissimilar crisis) simulation.

a. Event-Driven Processes

What is an event? Is it a single action on the part of a player? Is it the culmination of multiple actions by a single player? Could it be the result of actions of the part of many players? Of course the answer is, yes to all of these. In fact, in a S.E.N.S.E. simulation an event is actually the culmination of a process that leads to a state change in the simulation environment.

For instance, in the AKRONA game the development of a business plan leads players to interact with the simulation database and to devise strategies using the business plan development tool (window). No event actually takes place, however, until a player completes and submits a business plan. That is, there is a deliberative process that involves the selection of alternatives and the calculation of possible end-states, but there is no impact on the simulation environment until decisions are made and a plan is submitted by the player(s).

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[3] Note that while the diagram depicts player inputs being entered directly into various models, in most cases player inputs are first stored in the database and then called by the models in a pre-determined sequence.

Taking this example a step further, in the AKRONA simulation players can request loans as part of their business plans. However, even though a loan has been requested and submitted as part of a business plan, none of the underlying economic and social models in the simulation are affected until a lender approves the loan application. Hence, it is possible that many players may collaborate during the course of a simulation time period but that the end result will be no change in the simulation environment. An analogy in military virtual simulations such as SIMNET is the aiming of a gun without pulling the trigger.

In the broader sense then, event-driven activities are a function of processes undertaken by players and facilitated by the S.E.N.S.E. software. Once acted upon by the entity having the power and authority to decide, individual processes produce a state change in the simulation. Five types of event-driven processes could be incorporated into a simulation. These processes—political and group decision making (forums); resource allocation; military engagement and operations; internal governance; and intelligence and information security operations—are discussed in more detail in Appendix A.

b. Schedule-Driven Processes

Schedule-driven processes are activated by the simulation time clock or "scheduler." Each time period they collect and process all of the information entered by players for the state of scenario execution at the given time step. Social, economic, and resource processes are some of the types of schedule-driven processes that will be part of a regional security or higher level simulation. Incidents, such as natural disasters, however, could easily be introduced into scenario play through the use of a master events list such as that depicted in Table 3.

Once introduced by a control element or master schedule, the magnitude and impact of a disaster, including time lines and physical impacts, could be driven by an automated process (model) that tracks changes to the physical environment over time. This model, or "incident generator," must be equipped so that it will provide different results for different types of natural disasters over different periods of time and with varying magnitudes of affect (Figure 5). Hence, forest fires, tsunamis, earthquakes,
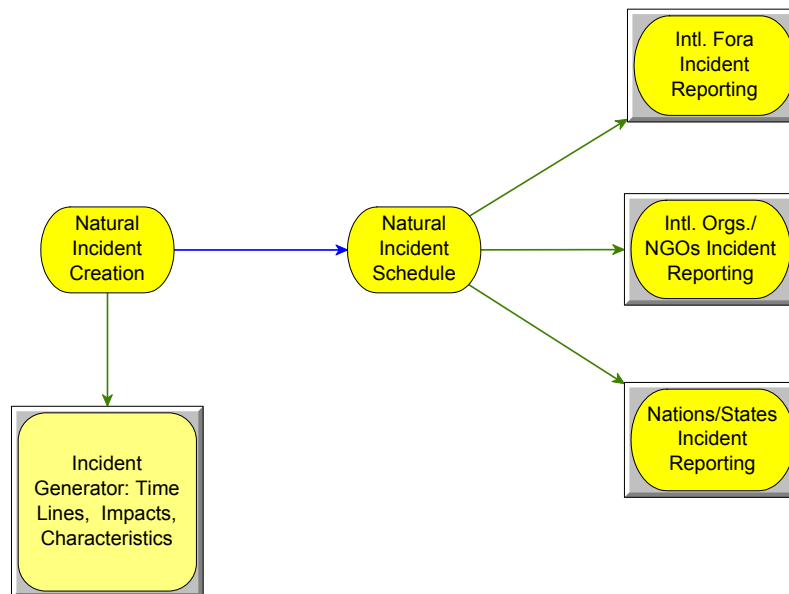
Figure 5. Natural Incident Generation and Reporting

floods, hurricanes, and other events must be handled so that their duration and intensity is commensurate with what would be realistically experienced.

Particularly important for the simulation are the different reporting paths for incidents (natural or man-made). In the real world different organizations have different means for finding out what is happening as a crisis unfolds, and this must be mirrored in the simulation. Hence, governments will receive information from official, "back channels," and intelligence sources, while NGO's will rely mostly on informal sources. The press will also play a large role in reporting incidents, so provisions must be made for the fourth estate. And, the accuracy of information received from different sources will vary, so a means to emulate reliability of reporting must be designed.

In the AKRONA game social and humanitarian factors are processed at the end of each time period and the results reported back to the players. Only general types of impacts are provided. In a regional security application, however, considerably greater detail may be desired including data on specific conflict-related maladies, mortality rates by cohorts, and types of crimes committed. In addition there may be a need to represent levels of social unrest and to incorporate tensions among contending ethnic, religious, or minority factions. To some extent such information could be generated by a control cell, but given the multiplicity of factors involved, some sort of model or analytical framework

to process the information autonomously or to serve as an aid to the control cell would be preferable in our view.

In addition to the foregoing, other types of schedule driven processes and models will be required in order to provide a realistic experience for players. In this regard, we believe that there will be a need to develop and incorporate warfighting, programing and budgeting, economic, and social/humanitarian models in a simulation that seeks to address potential 21st century challenges to U.S. national security. A discussion of the foregoing models and their potential application(s) is provided in Appendix D.

Table 3. Illustrative Natural and Man-Made Disasters

	CONUS	FRG-ITAL	FSU-RUS	China	Japan	India	SWA	Africa	SAmerica
Natural Disasters	Hurr-E EarthQ-W Torn/Fld-Cen	Volcano-Italy	Famine Drought	Typhoon EarthQ-C Famine	Tidal W Famine	Tidal W Famine	Tidal Wave Famine	Famine Draught Epidemic	Tidal W Famine
C/B/N Incidents	NYC-B East Port-B/C Gulf Port-C West Port-B Los Ang-B Mil Bases-C/B	Mil Bases-B	Reactor-N C Wpn Inc		Subway-B Tokyo-B Bases-C/B		Kurds-C/B Israel-C/B Bases-C/B SArab-C Turkey-B		
Cyber War	NYSE DOD Electric Grid Trans Ntwk	Stock Exch Mil Forces Electric Grid Trans Net			Stock Exch Mil Forces Electric Grid Trans Net				Stock Exch Elec Grid
Civil Dist/Riots	Miami Los Angelos NYC South	Berlin/Bonn Frank/Mun Rome/Pisa Aviano	Moscow Kiev ?? ??	Beijing Singapore ?? Ctry'side	Tokyo Osaka Okinawa	New Delhi ???	Iran Iraq Yemen Turkey	Congo Coast-E Coast-W Cape	Chile Venezuela Brazil
Civil Wars			X	X X				X X X	X
Ethnic Clashes			Balkans			X	Kurds-Iraq	S Africa	
Other				N. Korea Implodes Malacca Straits Closed Phillipine Insurrection Panama Canal Closed					

E.   SAMPLE ENTITY AND FUNCTION CROSS-WALK

As mentioned above, the goal of examining entities and distilling their non-overlapping attributes is to create a set of functionalities from which all of the different types of PARTICIPANTS necessary for a scenario may be constructed. A sample entity and functionality cross-walk is presented in Table 4.

Table 4. Sample Entity and Functionality Cross-Walk

	International Organizations	Governments	Non-Governmental Organizations	For-Profit Corporations
Financial & Marketplace				
Transfer Cash	X	X	X	X
Make Loans	X	X	X	X
Take Out/Repay Loans		X	X	X
Purchase/Sell Equity		X	X	X
Purchase/Sell Goods & Services		X	X	X
Influence Market Prices		X	X	X
Political & Group				
Vote in Forums	X	X	X	
Introduce Issues	X	X	X	
Make/Execute Budgets		X		
Set Tax/Tariff Rates		X		
Control Sector Entry		X		
Influence Interest Rates	X	X		X
Influence Exchange Rates	X	X		X
Control Public Sector Wages		X		
Nationalize/Regulate Industries		X		
Military Engagement & Maneuver				
Order Military Engagements	X	X		
Move Units	X	X		
Reassign Units	X	X		
Transportation, Lift, and Logistics				
Identify/Select Military Forces	X	X		
Schedule/Execute Force Movements	X	X		
Schedule/Execute Force Lift	X	X		
Communications				
Telephone	X	X	X	X
Video Teleconferencing	X	X		X
Email	X	X	X	X
Custom Reporting Instruments	X	X	X	X

The importance of the entity and functionality cross-walk cannot be underestimated. In fact it is central to creating the *institutional interoperability* necessary for successful cross-organizational communication. This is because it is essential that the design, content, and interpretation of the screens used either for simulation or actual operational purposes be the same across all parties involved in a S.E.N.S.E. activity. In this way the synthetic environment becomes a common denominator for discussion, deliberation, and execution -- it helps avoid misunderstandings.

F.   TIME, GEO-SPATIAL, AND RESOURCE CONSTRAINTS

In order to explore the Nth order consequences of policy decisions in an orderly fashion, it is necessary to explicitly address time, space, and resource constraints in the simulation environment. This means that all players must be treated equally according to the time dimension, but differently according to their endowments with regard to spatial and resource constrains.

For example, the ability to transport military forces rapidly to a global trouble spot differs significantly among nations because of the availability of strategic mobility assets and the geolocation or relative proximity of each nation to the crisis. Accordingly, in order to gain useful insights on such challenges, the simulation design and environment employed must faithfully depict the realistic capabilities of individual nations while providing a common time step.

In order to bring together the military, political, social, and economic aspects of a complex contingency within a geospatial context, we propose to use a stylized simplified geospatial system consisting of differentiated regions. A very basic example of such a system is presented in Figure 6. Note that within a region (designated by a number within a hexagon) terrain and foliage are homogenous. Population centers, utility infrastructures, and transportation systems could be added on a geographic basis, or simply represented on a regional basis. Perhaps most important, however, is the assumption that the boundaries are configured so that terrestrial movement from one to another adjoining regions takes the same amount of time for the entire geospatial representation. That is, if it takes one day to move from region 1 to 2, it will also take one day to move from region 1 to region 3, 4, 5, or 6. It would take two days to move from region 1 to 7 or from region 4 to 6, etc.

The advantage of using such a simplified geospatial representation is manyfold in pursuit of the objectives of a regional or global simulation. For instance, it keeps the simulation participants working at the strategic level rather than allowing them to get bogged down in operational details. That is, we want to know whether or not peacekeepers will be allowed so-called "hot pursuit" of guerrillas across national boundaries, not how to plan such an operation. This type of representation also

"combines" the military, social, economic, and political factors on a geographic basis forcing players to contend with a mix of issues, many of which will fall outside of their traditional modes of operation. And, it allows players to immediately understand the temporal aspects of their decisions through simple inspection of the graphic without recourse to complex calculations.
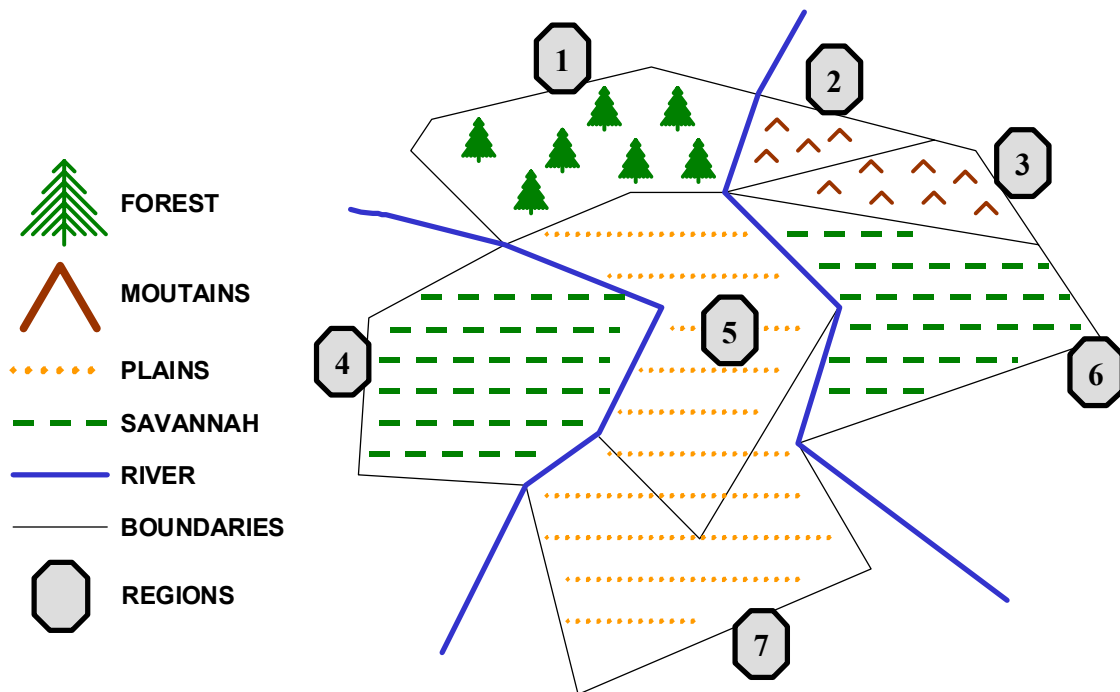
Figure 6. Example of Stylized Simplified Geospatial System

One issue to be resolved is how to allow other types of geospatial representations to be combined with a regional or global application. For instance, there may be a desire on the part of the military to play a sub-game with operational details, or to combine a more robust battle adjudication capability with a regional scenario. To enable this, the simulation architecture will need to be High Level Architecture (HLA) compliant (see Appendix C). Perhaps more important than the geospatial dimension will be the temporal one in this regard.

G. SUMMARY

In order to create a synthetic decision making environment capable of addressing the disparate cross disciplinary issues facing senior decision makers it is necessary to correctly scope the domain space from the outset. This includes the careful definition of

player functions and their organization as PARTICIPANTS, CELLS, and TEAMS. Next, roles, responsibilities, and entity interrelationships must be crafted to afford players maximum latitude during scenario execution.   Finally, event and schedule driven processes must be defined to facilitate the flow of activities and actions.

Because the S.E.N.S.E. methodology is player-centric, relying upon human-in-the-loop inputs for critical decisions, the extent to which models and automated decision tools are integrated into scenario execution is a prime consideration. Extending the work done for the Information Warfare and AKRONA simulations opens up the possibility to develop and deploy not only collaborative decision making games, but compressed time simulations capable of assisting in answering "what if" questions for rapidly moving policy environments.

IV. EXTENDING S.E.N.S.E:
EXAMPLES OF POTENTIAL APPLICATIONS

In previous discussion we noted that the S.E.N.S.E. approach and methodology could be applied to gain insights on local, regional, and global crises. In this Chapter we begin by highlighting some important differences and distinctions between the AKRONA game and these extensions of S.E.N.S.E. We then briefly summarize the key features and potential implications of a regional security application termed *R.S.A.* and a National Security Council (NSC) level gaming, collaborative planning, and crisis response application called *Checkmate!*. We close with our assessment of the challenges associated with extending the S.E.N.S.E. approach and methodology to such applications.

A.   IMPORTANT DIFFERENCES AND DISTINCTIONS

There are many different levels that could be represented within the S.E.N.S.E. framework. Figure 7 illustrates three different tiers currently envisioned: local, regional, and strategic.
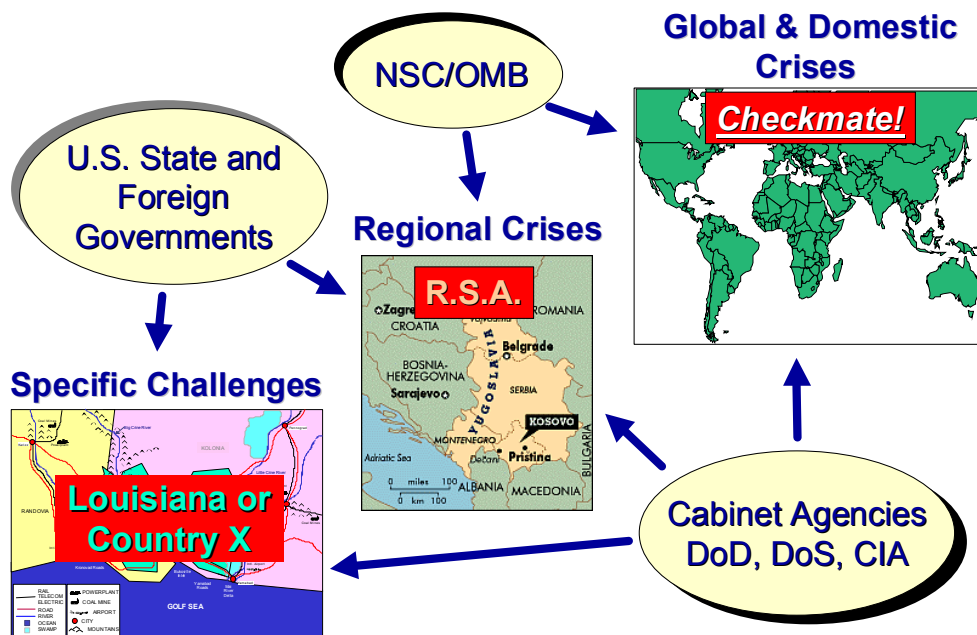

Figure 7. Different Possible Levels for S.E.N.S.E.

In order to understand the types of extensions possible for S.E.N.S.E. it is important to remember that the currently deployed AKRONA game was developed with a very narrow mission in mind—economics and governance in the Balkans. To accomplish that mission it was not necessary to develop geospatial, conflict, or analytical capabilities for use in gaining insights on real-world issues. All this changes, however, when we move from a fictitious country to emulating support of deliberate and crisis action planning.

- **Geospatial and Multi-site Capabilities.** The first two generations of S.E.N.S.E., the Information Warfare and AKRONA games, addressed specific challenges through a simplified, non geospatial, single site implementation of the methodology and architecture. In contrast, the Local Crisis, R.S.A. and *Checkmate!* applications would add the geospatial and multi-site dimensions in order to address a broader range of issues and simultaneously reach a larger audience. Moreover, *Checkmate!* would be designed to allow multiple crises, foreign and domestic, to be addressed sequentially or simultaneously from the NSC down to the Joint Task Force level.

- **Economics 101 vs National Security Challenges and Options.** The AKRONA game is fundamentally an economic one. The Local Crisis, R.S.A., and *Checkmate!* applications are envisioned as national security simulations where the economic component is used to address a broader range of issues to provide a means for simulating the impacts of natural and man-made disasters, embargoes, bombing campaigns, and assessing overall social stability.

- **Gaming and Assessment Capability.** Finally, unlike AKRONA, the Local Crisis, R.S.A., and *Checkmate!* extensions would be designed to provide either a gaming or an assessment environment. In the gaming role, they would serve as means to help identify and rehearse the inter- and intra-institutional arrangements necessary to swiftly and decisively address crises as they unfold in order to contain them and minimize their impacts. As assessment tools, they all could be fed real-time intelligence and other information in order to create a "parallel" virtual reality useful for doing "what if" assessments and for engaging in quick response games as part of course of action analysis and crisis response planning.

B. *R.S.A.*—REGIONAL SECURITY APPLICATION

The primary purpose of *R.S.A.* is to enable geographic CINCs, their supporting staffs, and component commanders to gain useful insights on potential complex contingencies before they occur and to facilitate collaborative planning for such exigencies. As depicted in Figure 8, such a game could address a regional crisis, a specific local crisis (domestic or manmade disaster), or a combination of the two.
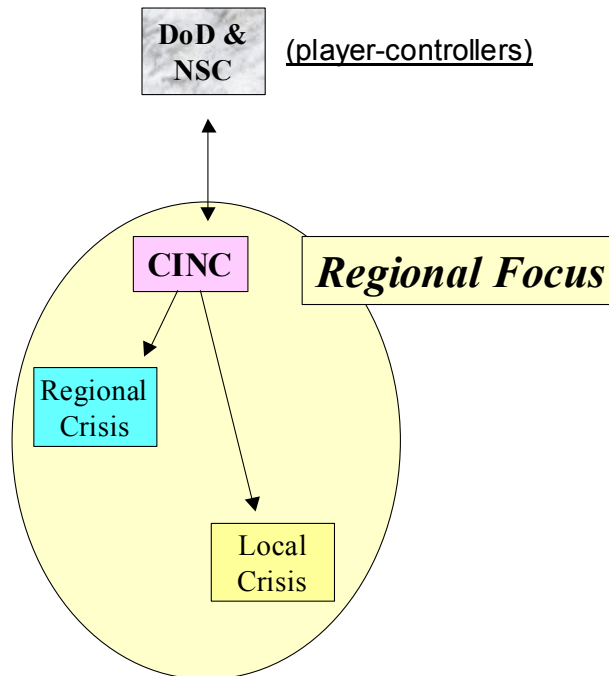
Figure 8. R.S.A. Focus and Scope

1. **Potential Design Goals and Areas of Interest**

    The broad design goals of such a simulation could include the following:

- Facilitate collaborative planning within U.S. unified commands;
- Promote a common understanding with and among allies and potential or actual coalition partners;
- Provide a convenient and sufficiently realistic means for assessing options, rehearsing approved operational plans, and crisis action planning; and
- Enable plans to be quickly reassessed and adjusted in light of ongoing operational experience and changes in objectives and forces available.

    To facilitate design and development efforts, it will be particularly important to establish a clear understanding of the types of issues and areas of interest most important to the geographic CINCs' individually and collectively. These issues and interests might encompass a broad range of concerns such as those highlighted in Table 9. (A fuller description of the types of issues that might need to be addressed in such an application is provided in Appendix E .)

    As Table 9 suggests, in order to develop a viable virtual policy making environment game, game designers must consider a wide variety of traditional

diplomatic, territorial, military, and humanitarian issues, and a host of "soft," unquantifiable issues we group together as "Political Implications." Equally important, they must also create a common set of metrics to address these types of issues.

Table 9. Potential Areas of Interest and Concern

Diplomacy
  • negotiations
  • sanctions
  • treaties
  • threats
Territorial Issues
  • control
  • constraints
  • contention
Military Activities
  • ground
  • air
  • sea
Humanitarian Problems
  • refugees
  • food, shelter, health
  • law & order
  • seasons

Common Metrics
  • refugees
  • destroyed housing
  • temporary dwellings
  • required calories
  • malnutrition
  • disease
  • deaths
  • criminal activities
Political Implications
  • moral imperatives
  • international responses
  • conflicting agendas
  • aid programs
  • organizational priorities
  • military intervention
  • sanctions

2.   Process Mapping—an Illustrative DoD-Centric Example

To foster a sense of reality, the simulation environment must realistically emulate the internal decision making processes of key organizational entities and the interactions among those entities. An illustrative example of a highly simplified DoD-centric process requiring direct U.S. response to an unforeseen incident is illustrated in Figure 10 and described below. Similar maps would have to be developed and interrelated for all major player entities.

- After being notified of an unforeseen incident by a CINC, the DoD-NSC CELL tasks the responsible CINC to provide a situation assessment, develop potential courses of action, and make recommendations for NCA consideration.

- As part of the assessment process, the CINC obtains input from the ambassador and members of country teams, the combatant command staff, component commanders, host nation principals and representatives of other nations in the area of responsibility, and other organizations, to include the intelligence community.

- The DoD-NCA CELL reviews the CINC's initial assessment and recommendations and provides guidance. In addition to highlighting Administration policy goals/objectives and direction regarding items of interest such as civilian casualties and collateral damage, the DoD-NCA CELL directs the CINC to submit a plan for achieving the Administration's objectives with regard to the incident within a specified time frame.

- The CINC develops and submits a recommended plan for review and approval. Automated decision support tools are provided to facilitate development of the plan's major phases and time lines, forces, and projected buildup of force capabilities given lift constraints/capabilities and the distances involved.

- The NCA provides additional guidance that requires the proposed plan to be refined, resubmitted, and tested via a dress rehearsal.

- Satisfied with the results of the rehearsal, the NCA orders U.S. forces to deploy and announces U.S. intentions publicly regarding the incident.
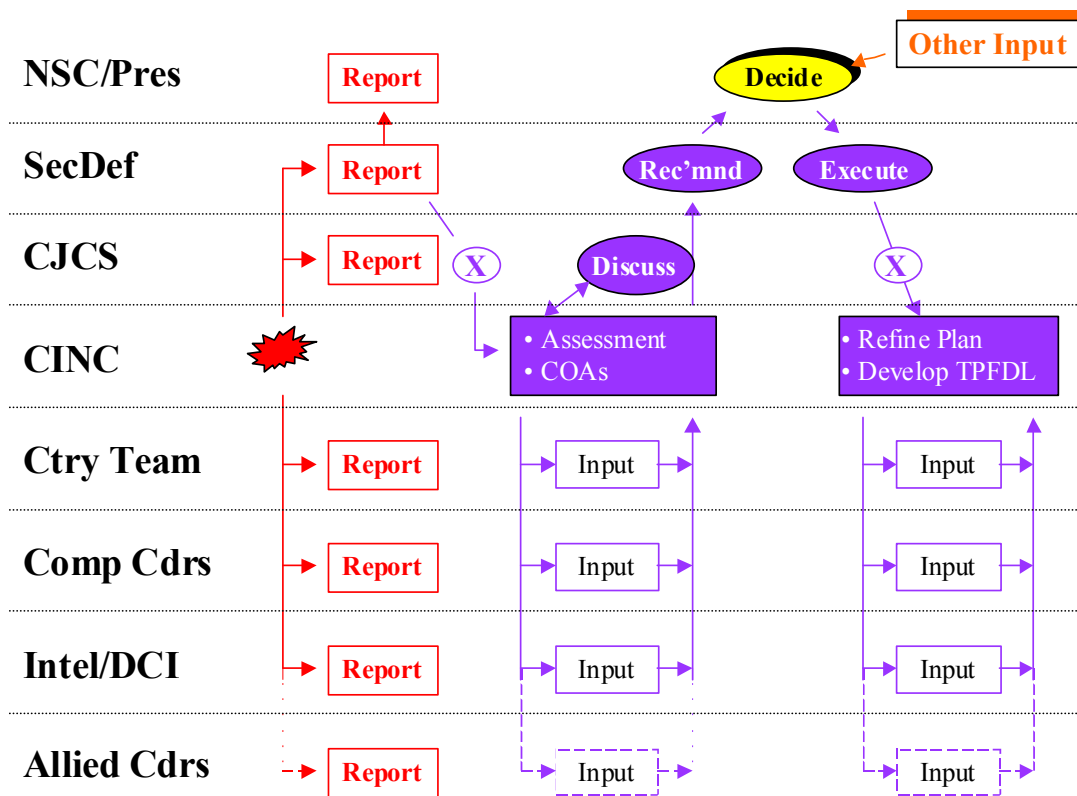
Figure 10. Overview of R.S.A. Operational Framework

At this juncture the simulation can end or continue. If it continues, the deployed forces would engage in military operations after their arrival, restore a modicum of peace at some cost to local infrastructure and civilian casualties, and seek to disengage and transition to a UN sponsored peacekeeping force.[4]

Of course this DoD-Centric example, while conceptually illustrative, is admittedly overly simplistic because contemporary complex contingencies involve much more than just military actions—the financial and other types of resources needed to support such operations often prove to be exceptionally difficult to obtain in a timely manner. As well, new inter-institutional relationships must be forged to successfully pursue foreign policy goals, particularly with international and non-governmental organizations.

In this regard, Figure 11 illustrates the generic types of resources that could be controlled by international organizations and non-governmental organizations in such a simulation. In this example, players develop an action plan in response to an incident. This plan could incorporate one or more types of assistance (e.g., grants, loans, etc.) targeted at specific types of problems or areas (e.g., refugee assistance, education/training, infrastructure development, etc.). To complete the circle, metrics and computer-assisted modeling are required to provide players with direct feedback regarding the results of their decisions over time.

Figure 11. Illustrative Responses of International and Non-Governmental Organizations to a Major Crisis

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4   This is intended to be illustrative of the types of actions/events that would have to be designed into such a virtual environment.

3. Computer-Assisted Decision Support Tools

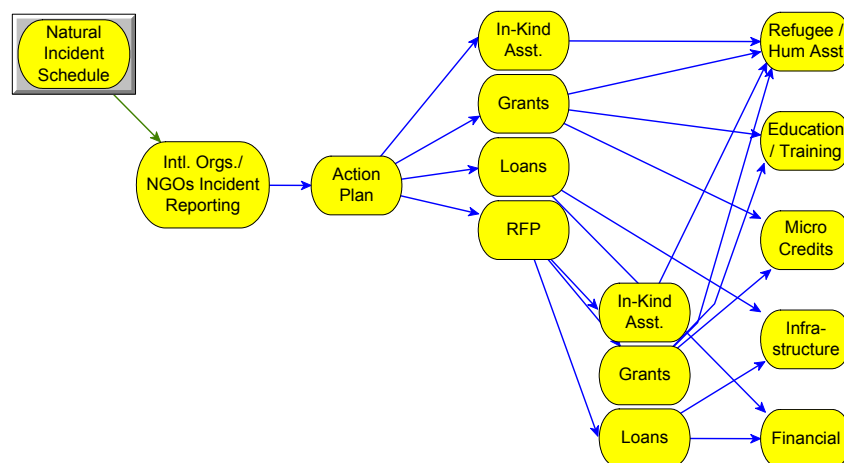In addition to representing the inner workings of complex entities, the S.E.N.S.E. approach requires the creation and use of a relatively small number of simple, generic computer-assisted decision support tools that facilitate effective game play. For instance, the ability to rapidly project military power throughout the world is central to current U.S. national security and national military strategies.

The speed with which we are able to respond to a crisis, however, is limited by many factors including the availability of strategic lift, domestic and foreign transportation infrastructures, transit rights, and so forth. Further, when we engage in coalition operations, we often provide strategic mobility support for our allies and coalition partners. In the deliberate planning process, detailed computer models and programs that take considerable time to set up and run are typically used to calculate deployment flows and arrival dates for military operations. For simulations, however, there is a need to simplify this calculation process so that the approximate impacts (results) from decisions can be known quickly in order to facilitate accelerated-real-time gaming as well as to provide flexible and responsive decision support tools for real-world crisis action.

A simplified approach to calculating lift capacity and arrival times for military forces and other types of physical assets such as relief supplies and equipment that would provide the approximations necessary for both gaming and real-time decision making is depicted in Figure 12. This method seeks to approximate important relationships, particularly those that exist among time, distance, transportation and lift assets available, and movement constraints. As such, it uses simple constructs to simulate the affects of port, rail, road, and airport throughputs on both an unimproved and improved basis.[5] Most if not all of the information necessary to support this model is already available in DoD databases. We believe that this model, or some variation of it, would enable decision makers to quickly produce the "approximately right" answers that are so essential to rapidly exploring crisis response options in accelerated time game play or in support of real world crisis action planning.
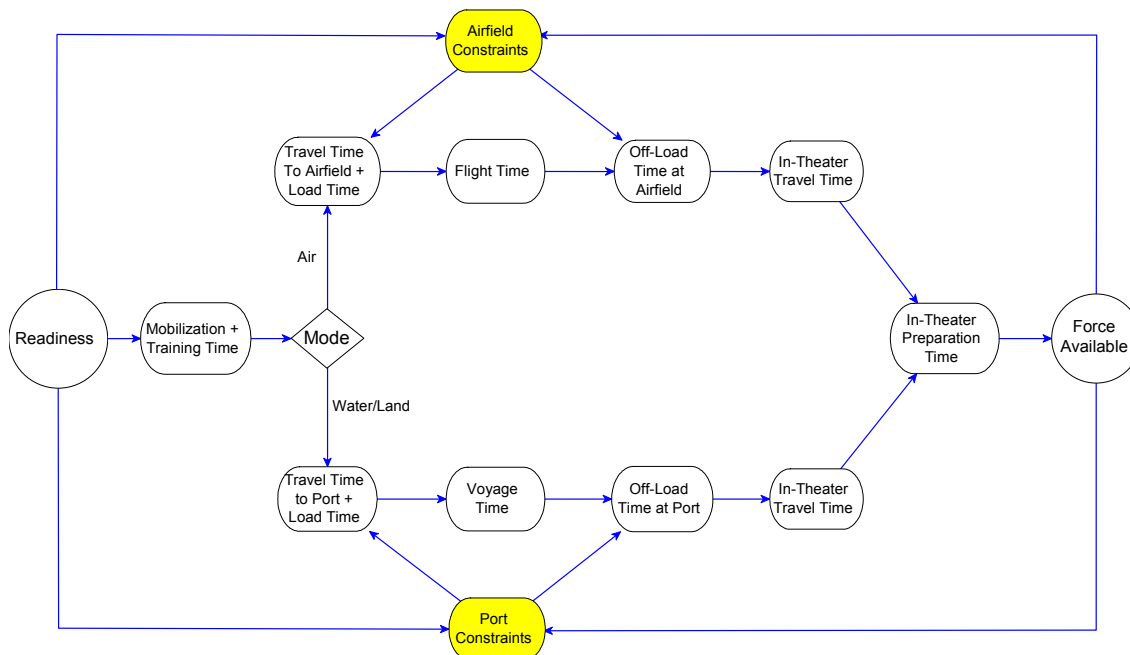
Figure 12. Conceptual Process for Addressing Strategic Mobility Issues

C.   *CHECKMATE!*

The primary purpose of *Checkmate!* is to enable senior decision makers at the local, regional, and national levels to gain important insights on very complex and interdependent issues, to include the challenges associated with having to respond to simultaneous, dissimilar crises at home and abroad. As depicted in Figure 13 such a simulation could address a number of concurrent local crises, or regional crises, with both domestic and international ramifications.
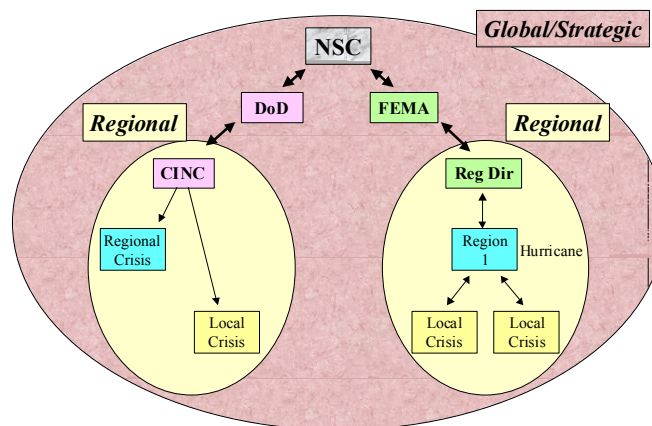
Figure 13. *Checkmate!* Focus and Scope

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[5] Because the availability of supplies and the size of stocks will also be an issue (e.g. limitations on the number of precision guided munitions), similar constructs will have to be created.

1.   **Potential Design Goals and Areas of Interest**

In addition to encompassing the goals and interests of R.S.A., the broader design goals and areas of interest for a *Checkmate!* simulation could include the following:

- Enable senior leaders at the national, regional, and local levels to gain useful insights on critical issues associated with responding to one or more concurrent crises;
- Provide a convenient and sufficiently realistic means for assessing crisis response options and developing and rehearsing crisis action plans at the NSC and major Department/Agency levels;
- Provide an effective and efficient means for training and educating future senior leaders.

Because of the need to address a broad range of interests, such as those noted previously in Table 3, the designers and developers of *Checkmate!* must clearly understand the types of insights and questions of interest to decision makers at the NSC and Departmental levels. These questions, for example, could include the following:

- What are the likely reactions of indigenous leaders and populations to various types of diplomatic pressures, military intervention, embargoes and trade sanctions, and other punitive measures?
- What types of policies or actions on the part of the U.S. or its allies will lead to the stabilization/destabilization of a government of political party?
- What are the likely long-term health, economic, and military implications of different courses of action?

The above list, though incomplete, nonetheless highlights the challenges confronting the designers and developers of such an application and underscores the importance of establishing a broad-based expert team to undertake such a project.

2.   **Process Mapping—Some Illustrative Examples**

Because it would essentially provide a means for addressing multiple regions of interest simultaneously, *Checkmate!* would inherently involve mapping the internal decision support processes of the federal departments and agencies of those who participate in NSC-level deliberations. In this regard, Figure 14 provides a more detailed depiction of a DoD-centric crisis action planning process involving an NSC-directed action to explore potential options for responding to a potential or an actual incident or crisis. In this example, the DoD-NSC control CELL of the R.S.A. extension
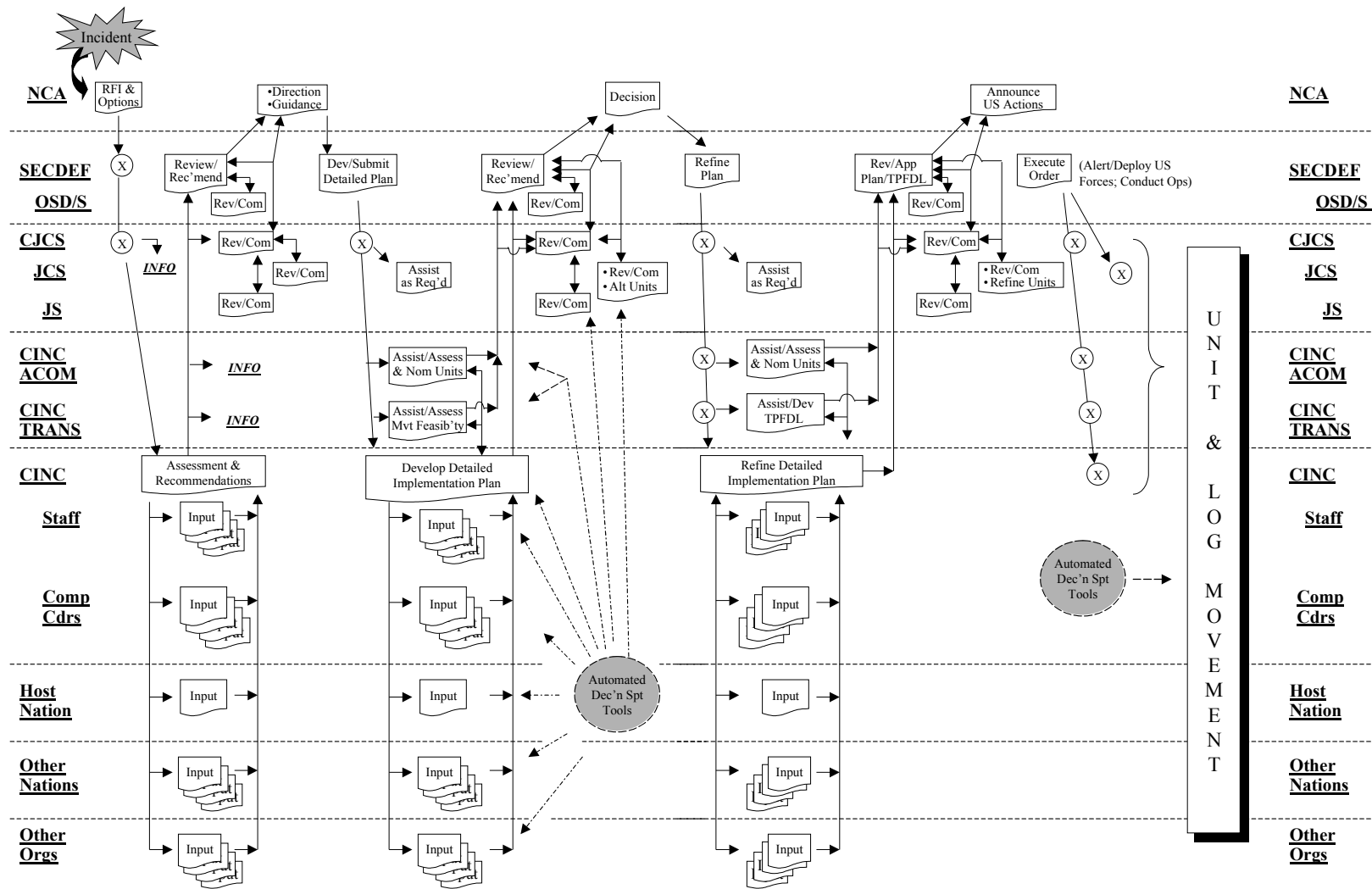
Figure 14. Illustrative DoD-Centric Crisis Action Planning Process

44

is decomposed into its major principles and their supporting staffs (e.g., SecDef and OSD Staff, CJCS and Joint Staff, and the Military Services).

In addition to the above and the examples discussed in the R.S.A. section, *Checkmate!* could also be designed to address both long-term and short-term issues of potential consequence. In this regard, Figure 15 illustrates two types of generic processes that might be incorporated into a *Checkmate!* simulation environment.

The upper flow diagram is a simplified depiction of a resource (capabilities) planning and budgeting process for U.S. civil and defense agencies; the lower diagram is a simplified depiction of how civil and defense agencies might be represented for crisis response activities.[6] To promote realism and completeness, similar generic processes would have to be developed to represent those of the foreign governments played in the game.

3. Computer-Assisted Decision Support Tools

In addition to incorporating the tools developed to support local and regionally focused simulations (e.g., the strategic mobility planning tool depicted in Figure 16), the *Checkmate!* application would have to incorporate a suite of tools that enables "players" to gain useful insights on the potential consequences (or risks) of applying available capabilities to competing actual or potential needs. Three additional decision support tools needed to provide such a capability are highlighted in subsequent discussion.

To facilitate comparative assessments and promote uniformity of effort across major organizational boundaries, it would be beneficial to standardize other key reporting and decision support tools. Figure 17, displays an illustrative incident reporting format that could be used at all three simulation tiers—local, regional, and national levels. Figure 18, on the other hand, provides an example of a decision support tool that could be used by NGO and other players to develop options and to decide what humanitarian assistance support will be provided to people during a crisis.

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[6] Note that both processes contain an executive branch and a legislative branch component, which therefore means that these entities and their interaction(s) would have to be represented in such simulation in some fashion.
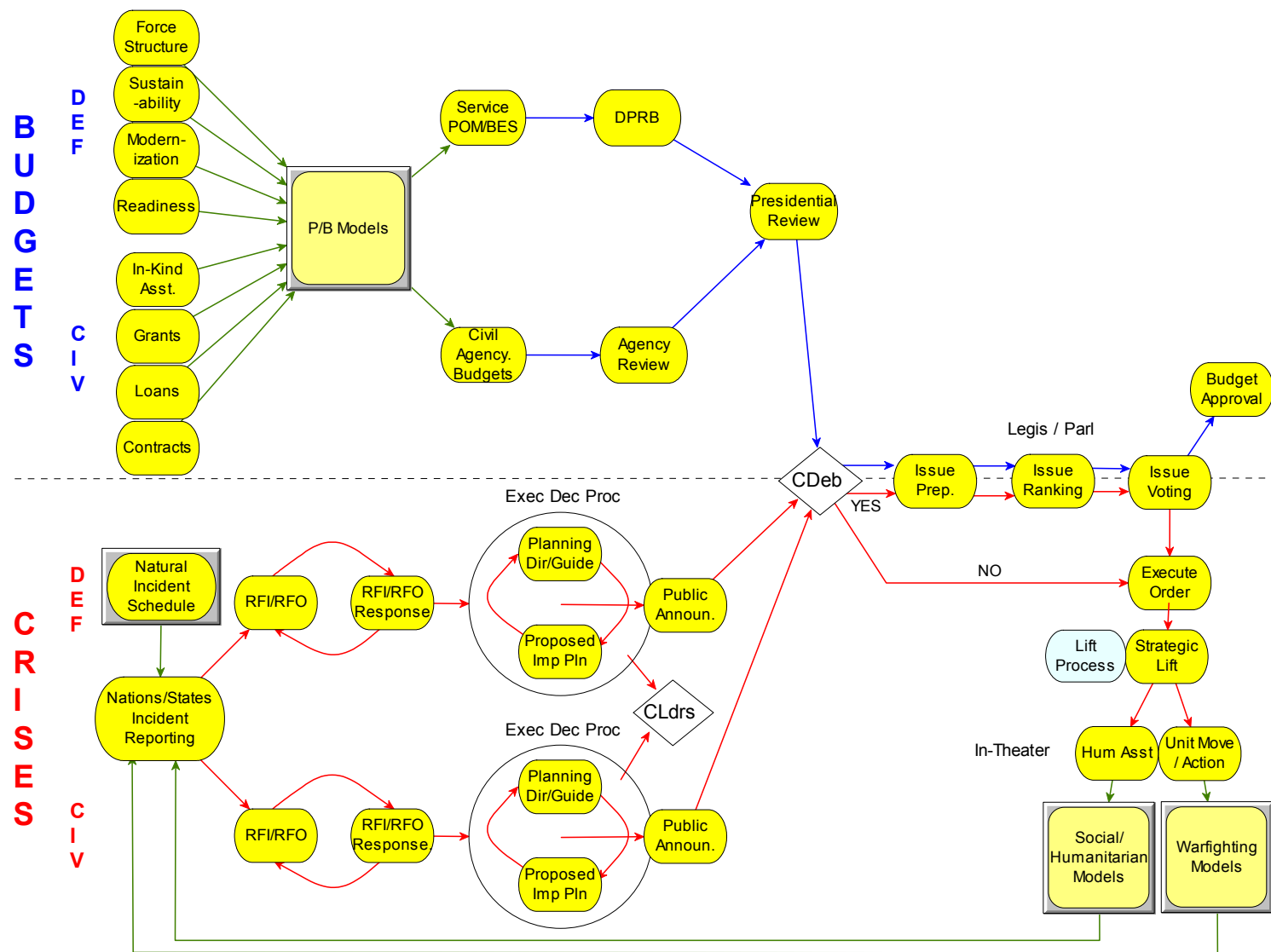
Figure 15. Illustrative Resource (Capabilities) Planning and Crisis Response Processes

INCIDENT REPORT

TO: [_____]

SUBJECT: [_____]

SUMMARY

Summary of Incident Report   Scrollable

DETAILS

According to various sources:
Type of Incident and Magnitude
Casualties
Duration
Physical Destruction
Estimated Costs of Physical Damage
Information Sources
Scrollable

ASSESSMENT

Scrollable

RECOMMENDATIONS

Scrollable

PRIORITY

FLASH	
URGENT	X
IMMEDIATE	
ROUTINE	

CLASSIFICATION

IMPORTANT	
SENSITIVE	
MOST SENSITIVE	X

COMPARTMENT

A	
B	
C	X

CANCEL
SUBMIT
CLOSE

INCIDENT_RPT

Figure 16. Illustrative Incident Reporting Format

IN-KIND HUMANITARIAN ASSISTANCE

TO: | Drop-Down List Box |
TITLE: | |
START: yymmdd
END: yymmdd

PROGRAM DESCRIPTION

Summary of Actions   Scrollable

Scrollable

	UNITS	QTY	COST
FOOD	Meals		
CLOTHING	Items		
SANITATION	Fac/1000		
SHELTER	SqM		
MEDICAL, PERS	Persons		
MEDICAL, EQPT	Pkgs		
MEDICAL, DRUGS	Pkgs		
EDUCATION	Teachers		
TRAINING	Instructors		
TRANSPORTATION	Persons		

| CANCEL | SUBMIT | CLOSE |

IN_KIND

Figure 17. Illustrative Decision Support Tool for Humanitarian Assistance

AIR FORCE UNIT RECOMMENDATION

CONTINGENCY NAME: | Drop Down List Box

COMMAND ELEMENT: | Drop Down List Box | Air Expeditionary Force, Wing, Squadron

COMBAT FORCES

FORCES RECOMMENDED

REQUIRED DELIVERY DATE

FIGHTER/ATTACK AIRCRAFT
Aircraft Type

F-15 A/B/C/D (Air-Air)
F-15 E (Air-Air/Air-Grnd)
F-16 C/D (Air-Air/Air-Grnd
F-117A Attack
A-10 Close Air Support

Unit Size

Wing
Squadron
Section

Number of Units Required

CONVENTIONAL BOMBERS
Aircraft Type

B-52
B-1
B-2

Unit Size

Wing
Squadron
Section

Number of Units Required

AIRBORNE RECON & SURVEIL
Aircraft Type

E-3 AWACS (Standoff)
E-8 JSTARS (Standoff)
U-2 (Standoff)
RC-135 (Standoff)
F-16 (TARPS) (Penetrating)

Number of Units Required

SPECIALIZED SUPPORT
Unit Type

POLICIES RECOMMENDED

Aerial Port
Prime Beef
Red Horse

Unit Size

Squadron
Detachment

Number of Units Required

AF_REC

Figure 18. Illustrative Force Capabilities Planning Tool

The third example of an automated support tool, shown in Figure 18, would enable a regional CINC to quickly develop a recommended unit deployment list for a proposed operation.[7] In this particular example, players can select the aircraft type and size unit desired, the number of units recommended, and the required in-theater delivery date of each of the major force elements they have selected. The information from this standard screen or display would be used by all players, thereby facilitating national-level comparisons between currently committed and available resources, the anticipated forces needed by a CINC to accomplish a new crisis response mission, and other potential needs. The foregoing information, of course, is essential to making informed judgements on strategic risk.

D.   POTENTIAL IMPLICATIONS OF *R.S.A.* AND *CHECKMATE!*

Designed to be used either as gaming or assessment environments, both R.S.A. and *Checkmate!* could be used prior to and during crises.

1.   Prior to Crises

Before a crisis begins to unfold, R.S.A. and *Checkmate!* could be used to help analysts and decision makers understand what to look for, what the key decision factors affecting outcomes might be, and how alternative futures might evolve. In this regard they would facilitate understanding information from different knowledge domains, enable people to develop and refine intelligence collection requirements, and provide a mechanism for quickly assessing potential options and alternative futures.

- **Understanding Information from Different Knowledge Domains.** The timely availability of enormous amounts of data from a wide variety of sources is a reality. How to effectively use these data to make informed decisions—how to array data so that they become information—is much less clear. Particularly difficult is the task of taking data from different "knowledge domains" (different communities such as defense, economics, science, business, psychology, etc.) and using them for effective crisis management. Understanding what the data mean and what an analyst looks at largely depends upon an individual's background and experience. In this regard, *R.S.A.* and *Checkmate!* would become a invaluable learning tool if they were integrated and used in normal day-to-day operations rather than being used as a crisis-only tool.

- **Developing and Refining Intelligence Collection Requirements.** Because of the deluge of data from sensors and sources, there is an ever growing need to be able to focus on what is essential and what is of minor importance or irrelevant.

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[7] Although the example shown relates specifically to US Air Force capabilities and forces, it is indicative of the types of tools that could be created to facilitate compressed-time crisis response planning simulations.

In this regard, both applications would aid analysts and decision makers in separating "the wheat from the chaff." They also would offer them a broad range of opportunities to understand the strategic relevance of their work and how to focus intelligence collection resources on the imperatives.

- **Assessing Possible Alternative Futures and Outcomes.** The two extensions could also serve as a convenient means for quickly immersing the nation's senior leadership in a potential complex crisis before it ever occurs. In concert with other information tools, they would allow decision makers to experience for themselves the potential or alternative outcomes of analytical assumptions, knowns, inferences, and recommended courses of action. As such, the two applications would provide convenient mechanisms for assessing the implications of alternative courses of action, and the consideration of a series of moves, counter moves, and counter-counter moves.

2. **During Crises**

By their very nature, crises imply extremely short decision cycle times. In this regard, both R.S.A. and *Checkmate!* would provide a convenient way of rapidly constructing and testing different hypotheses based upon "knowns" and "inferences." Capable of combining live, virtual, and constructive actors, they would facilitate speculative "thought experiments," incorporating inputs from decision makers and also provide a means of testing alternative hypotheses, fostering inter-agency interoperability, and formulating alternative scenarios—rehearsing plans.

- **Testing Alternative Hypothesis.** Because crises are multi-dimensional and therefore very complex, a way is needed to test hypotheses on the fly. Both applications would employ compressed real time, allowing decision makers to work through the consequences of events quickly and to assess many different courses of action in order to identify low risk, high leverage strategies. In this regard, off-the-shelf, generic courses of action might be employed during a crisis as initial conditions or first approximations, thereby providing an instant orientation for analysts and decision makers involved in the real world situation.

- **Fostering Inter-Agency Interoperability.** Teamwork is also critical to successfully bringing a crisis to closure. By fostering inter-agency networks and improving interagency working relationships before a crisis, the two extensions would inherently improve our ability to address crises as they arise. In addition, through scenario play and rehearsal, institutional and individual positions can be mapped-out before hand, and a common "language" for discussing the particularities of a crisis can be worked-out in advance.

- **Formulating Scenarios and Rehearsing Plans.** In any crisis, data and information must be quickly distilled to identify the decision factors that are most likely to influence outcomes. In addition to sensitizing people to the need to

triage information, the two applications would enable the formulation of scenarios to assist analysts in identifying threats and to improve the interpretation of intelligence and other data available to them. They would also provide opportunities for staff experts and senior decision makers to interact prior to crises and to rehearse and refine crisis action plans.

E. CHALLENGES ASSOCIATED WITH IMPLEMENTING R.S.A. AND *CHECKMATE!*

The foregoing discussion raises an important issue: How much new development must be undertaken to create each of these new tiers? The short answer to this is that the amount of additional development required will be a function of what is readily available and our ability to develop a flexible, multi-purpose architecture that will make use of existing capabilities.

Specifically, in the economic arena there may little need to develop new modeling and simulation. Rather, a large number of constructs already exist and have been validated. On the other hand, there is a need to develop the ability to support individual simulations, while also integrating their functioning and results. AKRONA is a proof of principle that this can be done for a single model, and that this model can be used simultaneously by many participants as the heart of a distributed simulation. However, as S.E.N.S.E. is intended to be *experiential* and not predictive, significant efforts will need to be applied to validating the application of economic principles for simulation purposes.

Further, our research clearly suggests that there are also a host of opportunities for incorporating non-economic simulations as part of S.E.N.S.E. For example, for military engagements JCATS, JWARS, and other combat models could be used, with the results being fed back into the economic and socio-political dimensions of the simulation. Similarly, budgeting and cost models, such as DRMM and COST, are available but may need to be rewritten so they could be easily integrated into the S.E.N.S.E. architecture. As well, there are many command and control tools being developed by ongoing efforts, such as the Adaptive Course of Action (ACOA) program, that might find use in more advanced and ambitious applications of the S.E.N.S.E. paradigm.

F.   SUMMARY

Rather than being a paper exercise, R.S.A. and *Checkmate!* would provide a virtual decision making framework that would enable senior leaders and their supporting staffs to collaboratively _experience_ crises to include developing crisis response options and strategies. Equally important, they would inherently provide a means for unifying organizational efforts and addressing the complex political/economic/security issues that characterize the post-Cold War era. In sum, they essentially would provide a capability to gain invaluable in sights on complex interdependent issues that is lacking today.

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V. CONCLUDING REMARKS AND RECOMMENDATIONS

U.S. leaders have been confronted with an increasing number of non-traditional security challenges since the end of the Cold War. Many of these challenges have their origins in historical social, religious, and ethnic enmities making them difficult to resolve. Consequently, in trying to resolve such situations, U.S. leaders have had to first gain an understanding of the nuances of unfolding crises before they could employ the diplomatic, economic, and military elements of national power that have been at their disposal. Moreover, such situations were inherently complex involving a range of political, economic, societal, and military considerations. This placed a premium on innovative approaches, collaborative planning, and integration of effort, all of which are difficult to achieve in the U.S. governmental structure.

As we look towards the future, there is every reason to believe that these types of challenges will continue and may even increase in number. Moreover, the potential for disenchanted or aggrieved parties to attempt to leverage asymmetric approaches against the United States is much more likely than in the past in the minds of many strategists and future thinkers. Simply put, there is every reason to believe that the challenges of the 21st century will be every bit as demanding as those of the recent past.

A.   CONCLUSIONS

1) The promulgation of Presidential Decision Directives in the areas of terrorism, complex contingencies, and domestic infrastructure protection are indicative of the intent of senior U.S. leaders to improve collaborative planning and better integrate the capabilities that are available to meet such challenges.

2) The objectives and efforts of senior U.S. leaders continue to be hampered by the current lack of a capability that facilitates and fosters collaborative planning and organizational inter-operability among government agencies involved in developing and assessing options, strategies, and plans for contending with such challenges.

3) A S.E.N.S.E.-based virtual distributed interactive environment that sufficiently emulates reality can be constructed and employed to help senior decision makers gain useful insights about very complex and interdependent issues. In this regard:

a) Opportunities exist to extend the S.E.N.S.E. methodology beyond its current use as a nation-building exercise. A regional S.E.N.S.E. application is possible for use as a training aid for CINCs. A global or strategic S.E.N.S.E. application addressing multiple simultaneous crises, regional as well as domestic, is also possible for use as an aid in assessing and rehearsing policy options for senior decision makers of several agencies. Both applications could be used as an aid in facilitating and testing—rehearsing approved planning options and plans.

b) In addition to the gaming possibilities of S.E.N.S.E., the methodology may also be extended to provide the basis for an inter-agency decision support capability. Such a capability would support and facilitate collaborative planning and integration of effort at the national level and also be capable of running what-if games in order to test and rehearse policy and crisis response options.

4) The technologies necessary to support a regional or global S.E.N.S.E. simulation capability are available on a commercial basis today.

B. RECOMMENDATIONS

1) Given the commonalities between a regional and global S.E.N.S.E. simulation capability (the former in reality is a subset of the latter), the expeditious approach to developing and fielding the most flexible synthetic environment possible is to skip the regional and proceed directly to develop the global simulation.

2) The development of the objective global S.E.N.S.E. application should incorporate distance learning features so that a fully distributable gaming environment is created.

3) Since the distributed gaming environment will provide many of the technical features necessary to experiment with the development of an inter-agency deliberative and crisis action planning capability, resources should also be made available to pursue the design and operational prototyping of such a capability.

APPENDIX A:
EVENT-DRIVEN PROCESSES

In this appendix we briefly highlight five major types of event-driven processes that could be employed in a simulation, particularly one that addresses regional issues or multiple complex crises and the development of appropriate options to meet such challenges.

A.   POLITICAL AND GROUP PROCESSES (FORUMS)

In order to support the interaction of players within and among different political and operational groupings a set of tools capable of facilitating group processes will be needed. While a large number of commercial off-the-shelf group ware tools currently exist, their integration into S.E.N.S.E. would be difficult both technically and pedagogically. Such tools are proprietary in design and generally not amenable to modification for other computing environments. And, in most cases they are complex and difficult to use requiring a professionally trained facilitator to operate them correctly. For the types of simulations that are of interest (local disaster response through global crisis response options) a simple suite of tools that can be readily tailored for the specific actions allowed during a broad range of scenarios is needed.

In this regard, for entities that function according to group processes (forums), a means must be provided to facilitate voting and promulgating decisions. Note that this should not be construed to mean simple majority voting. For instance, the U.S. Congress votes according to simple majority, two-thirds majority, and three-quarters majority, depending upon the type of legislation under consideration. Thus, game designers seeking to emulate U.S. Congressional realities have to address and decide how to handle such nuances and differences. Further, in the extreme, "voting" on the National Security Council is by a single individual, the President, even though issues are discussed among members of the Council. Finally, it is important to recognize up front that non-US Government and other organizations have materially different rules for determining a

majority and deciding an issue, including the requirement in NATO that all nations agree on an issue (unanimity).

While the act of voting is simple, automating a process whereby issues may be raised, addressed, revised, resubmitted, and finally voted is not because, as the forgoing suggests, this requires creating a flexible group support tool that can be easily tailored to accommodate a large number of different situations. Furthermore, since different forums operate according to different procedural rules, the tool must be easily conformable while retaining a common look and feel across applications. Said differently, the tool that is created must essentially be "transparent" enough so that individuals involved in multiple forums can easily transition back and forth among them. It also must be robust enough so that it enables group processes to operate efficiently and effectively, something that is particularly important when using compressed time play periods (e.g., 5 minutes equals 1 month).

Figure A-1, below, illustrates the types of processes that a group voting and issue reconciliation tool must be able to handle. This includes not only simple voting, but also the introduction, ranking and editing of issues brought up by different players. In addition, once an issue is decided a mechanism must exist that allows the decision to be promulgated so that other players may act upon or respond to it.
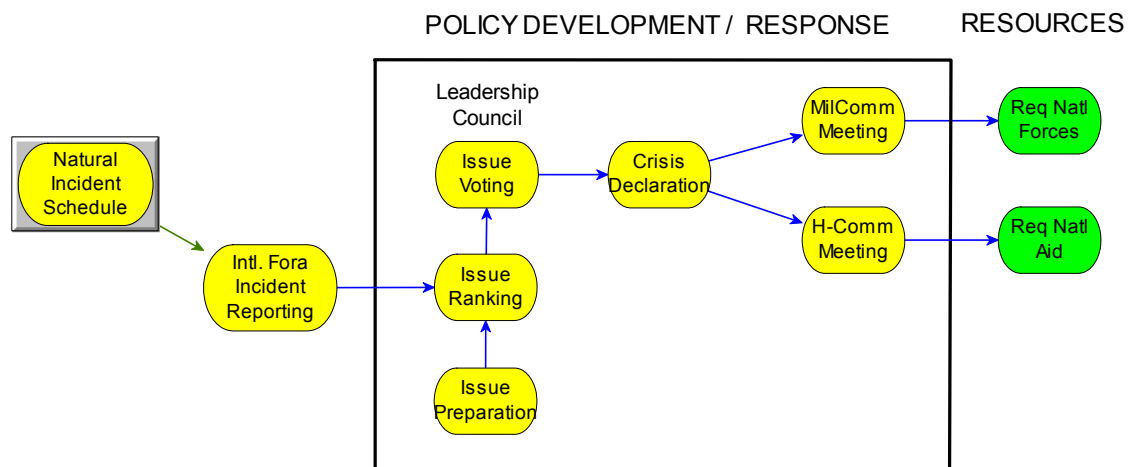

Figure A-1. Example of Decision Processes for International Forum Response to a Natural Disaster (NATO)

In sum, in order to support the decision processes envisioned in a regional security application, or one that addresses strategic planning options for concurrent crises, game designers and developers must strive to meet the following minimum requirements:

- A flexible, multipurpose voting tool must be created. In addition to automatically adjusting to the procedural rules of different groups, this tool must also be transparent and enable players involved in different groups to participate in each group's activities without extensive training.

- An issue preparation, introduction, editing, and tracking tool must be developed. This tool must be sufficiently generic so that it may be used by different groups and decision processes.

- Finally, an "announcement" or "proclamation" tool is needed to communicate decisions to one or more players, player groups, and/or all players simultaneously.

B.   RESOURCE REALLOCATION PROCESSES

The decisions taken by individuals or groups of players generally lead to some sort of reallocation of resources within a simulation scenario. Such resources are not limited to money and may include military assets, in-kind relief aid, personnel, and other tangibles. Broadly speaking, the types of resources of interest in simulations can be categorized as either financial or physical in nature. Financial resources are assumed to be able to move instantaneously across space without a limitation on the size of a transaction. Physical resources, on the other hand, have both a time-space relationship and a capacity constraint on their movement. It is likely that player entities (e.g. international organizations, non-governmental organizations, and governments) will have influence or have control over both.

1.   Financial Resources

AKRONA essentially focused on the individual entrepreneur and used six firms to determine the overall level of private sector investment in the economy. This approach was taken because AKRONA is designed to teach foreign audiences about the role of the entrepreneur in a market economy from a "hands on" perspective.

For regional security and higher applications, however, there is a need to refocus attention away from the individual entrepreneur and onto the issue of aggregate domestic

and foreign capital investment. In particular, the role of the "global" investor in providing the basis for economic recovery and development will probably be of interest. At the same time, the global marketplace and the affects of domestic and government policies in the areas of taxes, tariffs, and interest and exchange rates will need to be more central to a regional or global simulation. Finally, to add realism to scenarios, it may be desirable to introduce some sort of financial market impacts (stocks, bonds, arbitrage).

2.   Physical Resources

From the physical resource perspective, there is no corollary in AKRONA. However, the issue of how to represent the movement of physical assets is particularly important to address in regional or higher level applications. In fact, in order to represent reality, it is important to accurately reflect the types of constraints likely to exist during a complex contingency, such as transportation asset availability and aerial and seaport capacity issues. A high fidelity approach to modeling these simulation attributes is not required, however, if the purpose of the simulation is to give players an overall strategic or "macro" view of events and constraints.

3.   Summary

The generic processes highlighted in the foregoing discussion could be applied across a host of player entities with only the underlying resource types and quantities being altered. This idea of creating "generic applications" that fulfill multiple needs is central to extending S.E.N.S.E. to a broader range of applications. In this regard, at a minimum, the financial resource and the physical resource reallocation tools need to be developed:

Financial Resource Reallocation Tools Required
- Money transfer
- Creation and repayment of debts (loans as well as bonds)
- Equity investments (stocks)
- Arbitrage (currency)

Physical Resource Reallocation Tools
- Transfer, purchase, and sale
- Movement time lines and constraints
- Storage
- Consumption

C. MILITARY ENGAGEMENT AND MANEUVER PROCESSES

While AKRONA provides for minimal input, an explicit and more involved role for the military establishment is required in applications addressing broader issues such as developing and assessing national crisis response options. The functionalities associated with the types of broader-scale simulations we envision, however, are significantly different from those found in a traditional wargame. This is because the point of such simulations is not to adjudicate friendly and enemy losses as a result of combat, but rather to gain useful insights on complex multi-faceted issues involving military, political, economic, and social considerations. Hence, while some sort of adjudication is necessary, the end objectives do not require that such adjudication be either detailed or precise. More specifically stated, the primary purpose of extending the S.E.N.S.E. approach is not to address how to position and maneuver military units, but rather to gain useful insights on the role that military units might play in different complex crisis scenarios.

In this regard, a regional security application must capture the non-traditional roles into which the military may be thrust during a peace operation. This means that the virtual environment must enable players to interact and gain useful insights regarding the potential interactions of an indigenous population and foreign actors, including NGOs, media, terrorists, and others. To simulate realism, the game may also include the need for the military to temporarily assume responsibilities for governance, judicial processes, and dispute resolution. All of this suggests that a regional security application will probably have to provide selected "military players" with a menu of functionalitites that is far broader than those associated with their traditional training and military charters.

D. INTERNAL DECISION PROCESSES FOR GOVERNING ENTITIES

Within each entity in a game there is a need to represent and facilitate internal decision processes. Although different from the forum processes discussed earlier, the type of support tool required for this purpose may involve the use of forum tools. The types of internal decision processes involved here include real-world governing activities such as how to allocate scarce resources among competing needs. Budget deliberations, military mobilizations, and natural disaster responses are examples of these types of

internal governance activities that must be accommodated in a game. This essentially means that tools will need to be constructed that will enable players to emulate their real world decision making processes..

E.   INTELLIGENCE AND INFORMATION SECURITY PROCESSES

The final area we single out for attention in this report is that of intelligence and information security. Both areas will become increasingly important given the nature and character of the challenges confronting the United States and the world's entry into the Information Age.

Recent experiences demonstrate that providing intelligence support to peace operations, or to any coalition operation for that matter, is an exceptionally difficult task primarily because intelligence information is generally compartmented within national boundaries. Moving such information among different national actors in a timely manner has proven to be an almost impossible task. One of the advantages of the S.E.N.S.E. architecture is that it may be possible for intelligence information to be "shared" across compartments within a government and among several governments. This could be done indirectly as a result of the actions taken by players in the course of carrying out their strategies. In effect, players would be able to observe each other's actions and thereby intuit the rationale behind them.

APPENDIX B:
ECONOMIC MODELS

In this appendix we briefly highlight some of the economic modeling issues and that must be addressed when constructing future S.E.N.S.E. simulation, and focus on GTAP as one possible solution for long-term equilibrium assessments for international trade and commerce.

In the AKRONA version of S.E.N.S.E., the following were the key issues that the simulation had to address:

- Provide the players with a feel for the types of strategic and operational decisions faced by private entrepreneurs and managers. A key aspect of this is an introduction to standard tools such as business plans and conceptual notions like rates of return.

- Provide linkages between government decisions and private sector behavior and performance. This involves variables such as taxes and tariffs, subsidies, government expenditures.

- Provide a consistent framework for aggregating the micro level actions and outcomes into national level macroeconomic statistics. Since the exercises were designed, at least in part, to teach policy making at the national level, we needed to generate metrics for social and economic performance.

Given these goals, we chose to adopt a simple input output paradigm for organizing the AKRONA economy. By using an input output model, we could provide the economic environment with a sufficient level of detail (24 different industries/sectors) along with a rich set of micro level interactions (across industrial sectors). Production and investment decisions in one area of the economy could cascade in a realistic fashion through the rest of the economy. At the same time, we allowed the firms to set their own prices and quantities. This provided a level of tension and a sense of the ebb and flow of markets that proved to be essential to the learning experience.

The one aspect of the game where we were constrained by resources was in the area of regional and international trade. Though we had given some thoughts to developing a regional model with sophisticated model of trade between regions and

across the rest of the world, it was clear that this would significantly increase the complexity and the technical risk in the development process. As a consequence, we chose to model trade in a straightforward but highly abstract fashion. Specifically, the level of imports and exports in a sector is determined purely as a function of the domestic price in that sector.

As demonstrated by the reactions we have received over the past year, the AKRONA game has been very successful in providing an exciting and educational experience for the participants. The simulation helps reinforce the basic notions of how a market economy and its institutions function in a way that standard seminars and class room exercises cannot accomplish.

Despite the appeal of the AKRONA game, it is immediately apparent that the design choices we selected for developing the AKRONA economy would prevent us from adopting it wholesale for the RSA application. There were areas in the AKRONA game, such as firm level decision making, where the complexity was far more than what would be necessary. At the same time, there are other areas, such as regional and international trade, where greater detail and less abstraction would be needed to draw out some of the important issues that may arise in a RSA game.

One approach we could have taken would be to develop, as we did for the AKRONA game, an economic modeling system to suit the specific requirements of the RSA application. However, given the scope of this effort, such and undertaking, while it offers the greatest amount of flexibility, would be very time consuming and expensive. Instead, we decided to look for a publicly or commercially available product that, with suitable modifications, would meet the requirements of RSA. We have identified the Global Trade Analysis Project (GTAP) as a promising candidate to serve as the backbone of the RSA economic system. (See Appendix D)

APPENDIX C:
COMPUTER-RELATED INFORMATION

In this appendix we provide amplifying information on the computer architecture and integrating languages, the computing environment, and the communications and reporting alternatives we currently believe are associated with extending S.E.N.S.E. to a broader range of applications.

A. COMPUTER ARCHITECTURES AND INTEGRATING LANGUAGES

1. High Level Architecture

In general, compliance with DoD's High Level Architecture, or HLA, is required for all simulations funded beyond the year 2000. This should not pose a challenge for extending S.E.N.S.E. as the sole interface for the simulation is an ODBC database (in the case of AKRONA and the three specific extensions we envision, an Oracle database). Furthermore, timing issues are handled explicitly through a single time-step scheduling mechanism. Hence, we have every reason to believe that the architecture envisioned for the extended applications will be capable of being easily federated with other simulation and gaming environments.

2. Common Operating Environment

There may be a desire to federate an extended application with existing command and control systems, such as the Global Command and Control System (GCCS). Use of HLA will facilitate this federation if this is determined to be the best course to follow, all things considered.

In this regard, however, it also may be desirable to integrate portions of GCCS, such as the Common Operational Picture (COP), with R.S.A. for gaming purposes outside the formal command and control environment. In this case, there may be a need to adopt the Defense Information Infrastructure Common Operating Environment for some or all of the R.S.A. computers. This may also lead to a need to segment R.S.A.

software so that it is DII COE compliant.8   While this is not currently envisioned, software development must account for such an eventuality.

3.   LISP

After FORTRAN, LISP is the second oldest "high level" programming language. Originally developed for use in artificial intelligence work, and considered arcane by many programmers, it has recently experienced a renaissance as so-called "glueware." That is, it is now being used to help software companies develop large scale programming systems (systems of systems).

LISP's advantages include its facility to literally re-write itself during execution, extremely flexible syntax, and for large programs the ability to recompile only altered programming segments. For these reasons some large aerospace and telecommunications firms are today using LISP as a way to manage and integrate their large engineering and communications systems.   Should R.S.A. begin to grow in size and scope, and particularly if Checkmate! is pursued, LISP may be useful for both configuration control and HLA compliance.

B.   COMPUTING ENVIRONMENT

A simple client-server computing environment is used for the AKRONA simulation. In general, depicted schematically in Figure C-1, is intended for single-site collaboration to encourage team building and the growth of inter-personal relationships among foreign participants. The prominent architectural features of this simulation are the intensive use of stored procedures alongside custom-written C code. The stored procedures handle database-intensive operations such as accounting relationships, while the C code specializes in numerically-intensive operations (market clearing algorithms) and "scheduling."

The technical characteristics of the hardware and software currently used at IDA for the AKRONA game are as follows:

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8 This also applies to the *Local Disaster* and *Checkmate* types of applications.

Hardware: 2 Sun UltraSparc 60 Servers:
- 360 MHz
- 500MB RAM
- 9 GB Disk
- Solaris 2.6 Operating System

12 WINTEL PCs
- 266 MHz
- 64MB RAM
- 4GB Disk
- Windows NT Operating System

12 WINTEL Laptops
- 266 MHz
- 64MB RAM
- 4GB Disk
- Windows NT Operating System

2 Cabletron Switches
- 24 Port
- 10/100 Mbit Ethernet

Software: Oracle 8i Database on Ultrasparcs
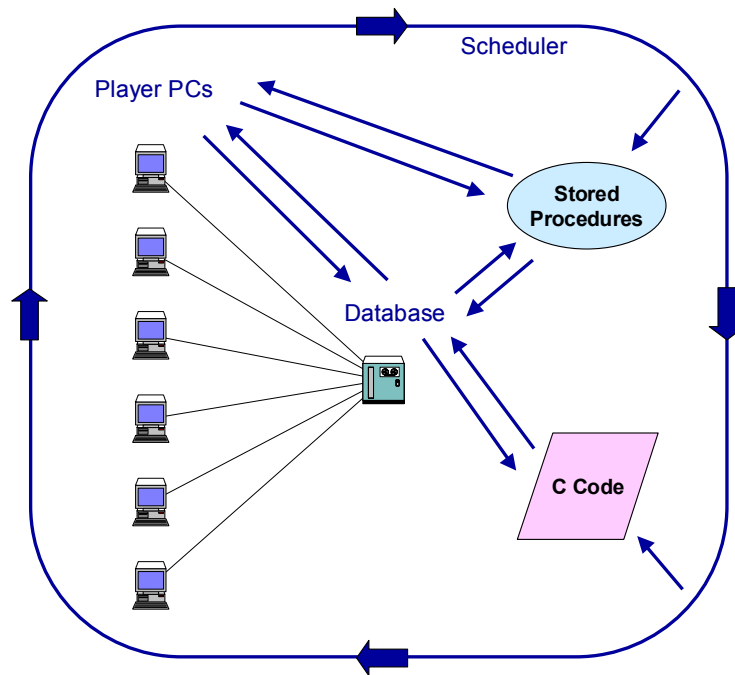PowerBuilder 7.0 on Clients
ANSI C Programming Language (GNU)

Figure C-1. AKRONA Computer Architecture

For R.S.A. and Checkmate! a much more complex computing environment is envisioned. This is primarily because both applications must be capable of supporting simultaneous multiple site operations. Figure C-2 illustrates a possible architecture for these types of simulation environments which includes options for accessing a super computer, large data storage (RAID), the incorporation of various programming languages, and the use of LISP as a means to provide configuration control and software management.

The computing environment depicted above is, of course, more of a desired conceptual end state than an initial foray into distributed gaming environments. We believe, however, that the environment selected needs to be

- **expandable** (able to add more users),
- **extensible** (able to add new features), an
- **scalable** (able to add more computing power and sites) without recourse to rewriting significant portions of the code.

C. COMMUNICATIONS AND REPORTING

At the heart of any S.E.N.S.E. exercise is the notion that inter-player communications is key to scenario development and execution and to individual learning. In the AKRONA game, virtually all communication is person-to-person--a conscious decision was made not to implement electronic means of communication so that inter-personal contacts among foreign would be maximized. If the S.E.N.S.E. architecture is to be enabled as a distributed simulation across many geographically separated organizations and facilities, however, one or more types of electronic communications capabilities will be required.

Our preliminary research suggests that three complementary types of electronic communication candidates could be employed for this purpose. These are:

- Simple telephone and perhaps desktop video teleconferencing could be used to allow players to "ring each other up."
- Electronic mail (email) is probably indispensable.
- And, custom reporting instruments, such as information requests/responses, execute orders, diplomatic cables, and so forth could be implemented in the database to track formal exchanges of information.
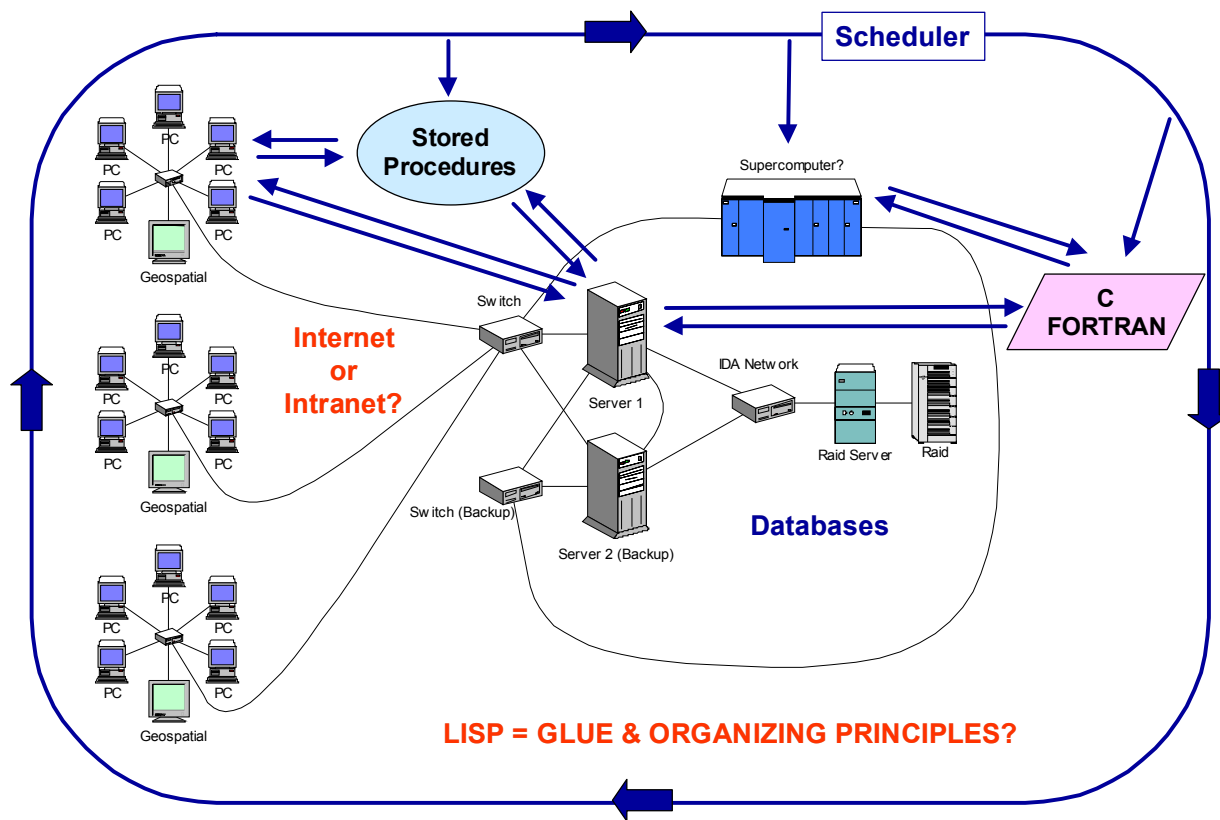
Figure C-2. Possible S.E.N.S.E. Computing Environment for R.S.A. or Checkmate!

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Appendix D:
Other Existing Computer Simulation Efforts

There are numerous analytical constructs, tools, and research products that potentially could be employed in extending S.E.N.S.E. to address a broader set of areas and interests. Our initial research suggests that the computer simulation efforts highlighted in this appendix may be particularly promising in this regard.

A. DEPLOYABLE EXERCISE SUPPORT (DEXES)[9]

DEXES, developed and employed in seven exercises by US SOUTHCOM, is a simulation program designed to support analysis and training for Military Operations Other Than War (MOOTW)."

Based on a dynamic mathematical model of society, this model encompasses economic, social, political, and public health variables and generates the societal reactions to actions taken (or not taken) by the peacekeeping forces, hostile military and political players, and non-governmental organizations. It also provides players via charts, tables and graphs, continuous feedback regarding the current state of society.

> "Events in the game can be scripted in advance, by means of a simple spreadsheet which gives the event description, its day and time, and its direct consequences. Special non-scripted events may also be created, which are triggered either randomly or whenever a specified situation or condition is encountered. Actions that each unit can take are detailed in another spreadsheet, as are the essential characteristics and capabilities of each type of unit."

> "As the simulation unfolds, scripted and triggered events occur, and military units and other entities take actions in response. All events and actions have consequences that are automatically implemented as changes in the state variables of the underlying model of society. Changes in any one state variable cause further changes in other variables, as the indirect effects of an action ripple through the causal web of the model. In this way analysts and trainees can see the long-run consequences of their actions."

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[9] This section is based on information on DEXES obtained from a World Wide Web site at:
www.rof.net/yp/corrales/models/MOOTW/DEXES.html

B.   DIAMOND

DIAMOND is a high level representation of OOTW operations so its scope is broad and the level of unit and entity aggregation is high. The primary focus is on the campaign level aspects of OOTW and it is intended, eventually, to form the apex of a hierarchy of OOTW models.

Not intended to be a stand-alone tool for the evaluation of campaign level operational analysis of OOTW, DIAMOND is actually one part of a wide ranging tool set. That tool set includes wargaming models, simple historically based troop-to-task models, detailed logistic and communication models, political-military gaming, and interactive models such as the Land Formation Model (LFM).

DIAMOND, however, is not capable of representing political decisions. Such decisions are documented prior to their implementation in the simulation. It provides outcomes for the different operational effectiveness of varying force structures in the prosecution of a campaign. Once an initial base case is developed using the model then variations can be assessed quickly with little additional overhead on time and resources. Data are output in formats suitable for subsequent analysis.

C.   ADAPTIVE COURSE OF ACTION (DARPA/DISA)[10]

The Adaptive Course of Action or ACOA project sponsored jointly by the Defense Advanced Research Projects Agency (DARPA) and the Defense Information Systems Agency (DISA), is intended to facilitate real-time decision making during a crisis. In this regard it is being designed to provide historical databases containing past courses of action for similar crises as quick references for decision makers, desktop video teleconferencing, graphical situation displays, and other crisis management tools.

The target audience for the system is the Global Command and Control System (GCCS) community. In this regard, S.E.N.S.E. extensions such as R.S.A., might be used as an exercise driver for ACOA or, alternatively, ACOA might be incorporated into later versions of R.S.A. as a player resource or tool.

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[10] World Wide Web Site at: www.isx.com/newwebpage/isxcorp/programs/ACOA.html

D.   DEFENSE RESOURCE MANAGEMENT MODEL

The Defense Resource Management Model (DRMM), developed for the Office of Program Analysis and Evaluation OSD Staff, is a force structure and budgeting tool that allows users to explore trade-offs among different force postures. It is currently in use by a variety of east European nations as a way to examine their defense resource needs in the Post-Cold War era.

By feeding DRMM with actual data on forces, estimates can be made regarding projected unit support, maintenance, manning, and procurement costs, as well as the need for different types of installations and personnel specialties. DRMM, or a DRMM-like capability, could be incorporated into an extension of S.E.N.S.E. to enable development of fiscally constrained outyear plans and programs during a simulation. DRMM is written in FoxPro, and its incorporation will likely require some recoding to be incorporated into the S.E.N.S.E architecture.

E.   CONTINGENCY OPERATIONS SUPPORT TOOL

Contingency Operations Support Tool (COST) is being developed for the Office of the DoD Comptroller to provide cost estimation support for complex contingencies. Based upon so-called "type unit characteristics" data, COST enables analysts to enter estimated contingency operations requirements and derive projected overall dollar costs. Incorporating COST or a COST-like capability into the S.E.N.S.E architecture would enable players to examine the dollar impacts of their decisions both during scenario execution and at the conclusion of a scenario. Written in Microsoft Access and Visual Basic, COST will also require some recoding to be incorporated into the S.E.N.S.E. architecture.

F.   CONCEPTUAL MODEL OF PEACE OPERATIONS

The purpose of this work was to develop an inversion of the Conceptual Model of Peace Operations (CMPO) that would facilitate the development of the design of the DIAMOND model by CORDA/CDA and POPP. Inversion is meant to include the primary listing of organizations and units and their characteristics (behaviours). This is an inversion of the CMPO since the CMPO is functionally oriented with organizations and behaviours second.

The CMPO, as used for this work, contains 476 tasks that are in relation to the functional decomposition, currently using 198 of the original CMPO functions. In addition to the functions and tasks, there are 152 distinct organization types and 88 provisional behaviours. The analysis presented used all functions, tasks and behaviours, but deselected 71 of the organizations types as too specific or not related to the DIAMOND objectives. The remaining 81 organizations include those from the annex to the design document and some additions.

The process is best described in terms of the tables and queries of the accompanying ACCESS 97 Data Base (tasks and orgs). This data base currently contains seven (7) tables and one query. These are described next.

G.   GLOBAL TRADE ANALYSIS PROJECT (PURDUE UNIVERSITY)[11]

The Global Trade Analysis Project (GTAP) is a package of modeling tools and data available from Purdue University. In existence since the late eighties, it employs a state of the art applied general equilibrium (AGE) approach to modeling the world economy and relies on a global network of research economists to continuously improve and update the system.[12] By imposing a theoretically consistent framework on the data, AGE models provide a more rigorous and complete analysis of policy problems than other ad-hoc or partial equilibrium approaches.

GTAP's main database is capable of disaggregating global economic activity into 45 regions and 50 industries. Software tools are available for choosing the precise degree of aggregation required for each application. GTAP has been used in numerous peer reviewed studies of international trade and related topics. In addition, by using a licensed version of GEMPACK, one could alter and/or augment the basic modeling equations used in GTAP.[13] A state-of-the-art effort, it employs relies upon non-linear optimization software for its solution (IDA is using the GEMPACK package supported by Monash University, Australia).

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[11] World Wide Web site: www.agecon.purdue.edu/gtap/index.htm
[12]   AGE models are also known as computable general equilibrium (CGE) models.
[13] GEMPACK, available separately from xxxx University in Australia, is a software package for computing the solutions to large scale non-linear systems. A stripped down version of GEMPACK is used by GTAP to compute its solutions.

In general, due to the highly computationally intensive nature of large non-linear systems, most applications of GTAP are done on an aggregated basis with no more than 10 to 20 sectors and commodities. IDA benchmarks of the model suggest that the time and resources required for solution increases exponentially with the level of disaggregation. A 10x10 solution took 8 seconds, a 20x20 solution took 200 seconds, and a 45x50 solution was beyond the current computational resources of the system on which the experiment was run.

The economic dimension of S.E.N.S.E. games would benefit from the incorporation of GTAP or a GTAP-like capability, although there are limitations to the types of analyses that may be run with the software (see Appendix B). Some programming would need to be done to federate GTAP with S.E.N.S.E. as the former system is written in FORTRAN and uses special "header array" files for storage rather than a database.

There are, however, a few aspects of the standard GTAP model that may require some modifications. GTAP is a static model. It is designed to compute the medium run to long run outcomes to changes in policy and other exogenous variables (e.g., changes in the labor supply and natural resources, etc.) Since an important aspect of S.E.N.S.E. is the dynamic interaction and feedback between the game and the players, care must be taken in melding the two. More narrowly, there are certain disequilibrium behaviour such as Keynesian unemployment and capital flight that may be of interest in an regional or higher level S.E.N.S.E. application.[14] Unmodified, GTAP will not allow us to address those questions because it is an equilibrium model focused on real activity.

The following table is a summary of several important policy issues or problems that one would like to address in a RSA application, along with our assessment as to whether they could be implemented using GTAP as it is currently configured.

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[14] Strictly speaking, there are equilibrium models of financial panic that one could attempt to graft onto GTAP. We simply wish to note that such monetary phenomenon are very different from the sorts of real activity modeled in GTAP.

Table D-1. Summary of GTAP Capabilities

Application	A	B	C
Taxes and tariffs	✓		
Changes in endowment (labor, land, physical capital)	✓		
Changes in government expenditure	✓		
Import quotas		✓	
Embargoes		✓	
Supply disruptions (e.g. oil shock)		✓	
Monetary Policy			✓
Areas of international finance such as exchange rate determination			✓

A: Issues that can be addressed directly by manipulating existing model parameters

B: Issues that can be addressed indirectly by introducing changes in existing model closures

C: Issues that *cannot* be addressed by GTAP as currently configured

H.   COMMON OPERATIONAL PICTURE

To extend S.E.N.S.E. to a broader range of areas and interests will require the incorporation of a geospatial tool that allows players to review the disposition of assets and resources on a regional or global basis. One candidate for this role is the Common Operational Picture (COP) of the Global Command and Control System (GCCS). The COP provides a way to display icons on a two-dimensional map that is up-dated as a simulation progresses. These icons are queryable (can be clicked) to reveal details about the object in question.

The computational and programming overhead for COP is considerable, requiring installation of the Defense Information Infrastructure (DII) Common Operating Environment. Further, there currently is no way to establish a simple interface to an ODBC database although there currently is a High Level Architecture Runtime Interface for the COP, however the hardware and storage requirements for running the system may make it beyond the means of many potential users of an R.S.A. application.

I.   EDGE VISUALIZATION TECHNOLOGIES

An alternative to the GCCS COP is the EDGE geo-spatial visualization software sold by Autometric, Inc. Capable of running on a 450 MHz personal computer and operating from an ODBC compliant database, this tool allows users to literally "fly around" in a geo-spatial environment populated by database generated icons. It is also an "intelligent" geo-spatial software meaning that maps and imagery are automatically ortho-rectified so that no significant preparation of geo-spatial products is required.

J.   PLANNING DECISION SUPPORT SYSTEM (PDSS)

PDSS is a software tool developed by the staff of the National Defense University (NDU) War Gaming and Simulation Center (WSGC) to facilitate the planning activities of interagency simulation participants. Designed to promote discussion, focus attention on the process, and shape the substance of a coordinated Interagency Complex Contingency Operations Plan, PDSS also can be used in real contingency planning exercises involving actual complex situations.

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APPENDIX E
SCENARIO FOUNDATIONS

At the very heart of PDD 56 is the notion that a cross-disciplinary approach is needed to overcome conflicts whose roots are borne by historical ethnic, religious, and social enmities. While such conflicts are certainly not new to U.S. policy makers, the long-term commitments and level of civil-military agency collaboration required to adequately address the types of problems encountered are quite new. An understanding of the context in which such conflicts flourish, and the types of actors involved, is an indispensable backdrop for any RSA scenario.

The design of the RSA must take into consideration a variety of real-world factors in order to faithfully represent the types of issues, contending agendas, and constraints likely to be encountered as crises unfold. Not only must we understand what leads up to crises, but also the range of desired end-states possible for a multitude of potential scenarios so as not to limit simulation play and policy prescriptions.

A.   CONVENTIONAL PEACEKEEPING OPERATIONS

During the cold war, peace operations evolved from violent circumstances (e.g., the Congo and Korea) to situations where first a cease fire was negotiated, then an agreement was established to put in place peacekeepers to maintain neutral zones between two hostile forces (e.g., Cyprus, Dominican Republic, the Sinai). While the United States upholds the ideal of the "melting pot" and the need to respect minorities, the rest of the world considers this view "naïve" and accepts ethnic and national hostilities as a matter of fact. Thus normality in most locations is the period between the eruption of hostilities where leaders have agreed it is in their best interests to either live separately or use peaceful means to resolve differences. In those zones where conflict cannot be resolved, the use of peacekeepers has permitted many years of peace to be enjoyed by their populations.

Full, normal, internationally-recognized governments operate in the countries where peacekeepers have traditionally been established. The peacekeepers are subject to the laws of these states, although various degrees of diplomatic immunity are accorded them. The population of these countries is subject to their governments and their rule of law. The principal of national sovereignty is totally applicable and respected by the international community.

In some situations rebel factions within a country were backed by external forces, such as one of the super powers, as part of the bi-polarity of the cold war. If the conflict that ensued did not result in an overthrow of the central government, cease fires were negotiated until some more permanent settlement could be arranged. In these cases (e.g., Laos 1962-4, Lebanon 1982) peacekeeping interventions amounted to monitoring the cease fire and reporting violations. These were often dangerous operations due to the periodic outbreak of hostilities.

Although, in principal, peacekeepers placed in civil war countries were to be strictly neutral, at times they took partisan positions or were seen by rebel factions as hostile because they allied with one side in the conflict (e.g., American troops in Lebanon and Cuban forces in Angola in the 1980s). In such cases, the peacekeepers did not contribute to a larger mission of restoring peace but maintained a status quo that met the political objectives of their sponsors. Such situations were fragile and not the standard that the international community wish to emulate today.

Internal conflicts also created refugee flows across international borders. At times peacekeepers were sent to zones set aside for refugees in order to restore order and provide security assurances (e.g., Gaza). In such cases the principal mandate of the UN High Commission for Refugees (UNHCR) was to provide assistance to the refugees under the protection of peacekeepers when necessary.

B.   **HUMANITARIAN ASSISTANCE INTERVENTIONS**

The early post-cold war period saw in two highly successful interventions for the purpose of providing humanitarian assistance to Internally-Displaced Persons (IDPs), post- Gulf War Northern Iraq for the Kurds (early 1991) and failed-state Somalia (late 1991) to feed starving populations affected by a drought. Both operations met strong

international and domestic approval and seemed to signal a change away from a previous foreign policy to intervene only in U.S. national security interests. The unfortunate military event in Somalia in 1992 sharply curtailed this new foreign policy venture.

Subsequent events, however, have demonstrated a continuing need for military-assisted interventions primarily for humanitarian reasons (e.g., Rwanda in 1994 and Hurricane Mitch in Central America in 1998). The American population continues to be revolted by scenes of devastation, genocide and starving children, and has almost single-mindedly implored its political leaders to either provide assistance, stop war-related suffering, or both. This has led to a tension within U.S. foreign policy which has traditionally focused on events in which a "U.S. national security interest" prevailed, and more recent humanitarian activities (e.g., the prevention of genocide in Rwanda) where clear benefits to these security interests were not evident.

According to the notion of sovereignty, it is the governments of nations struck by natural or man-made disasters that have the prime responsibility to provide the humanitarian assistance required for their remediation. In some cases this has led to the establishment of "disaster response committees" in particularly vulnerable areas of the world. Frequently the organization of these committees extends down to the province and community level. Hence, in order to take advantage of extant networks, the intervening community must utilize those institutions already put in place by the host nation. However, there are factors that inhibit many of the indigenous organizations from being capable performers:

- Natural disasters in particular, but also coups d'etat and sudden escalations of rebel activities, tend to traumatize governments and populations in affected countries. Human and physical resources are severely taxed and needs are often beyond the capability of the host nation to respond quickly.

- For domestic political reasons, governments are almost always unwilling to admit that adequate preparations were not made or responses are not adequate. The difference between public statements and decisive action is often great.

- Assessments are frequently inadequate, thus the information base for making decisions at senior levels is weak. Excellent, experienced judgment is needed on how to obtain the most pertinent information and how to detect the reliable information from the generally incomplete, anecdotal information available.

- Transportation constraints are generally the most important, both for assessment purposes and for commodity delivery.

- Health and medical requirements are the most crucial. Local facilities should be supported to the maximum extent; bringing in mobile external facilities is usually not advisable.

- Transparency and accountability are often neglected, but can be crucial to achieving credibility on the part of both the host government and the international community.

- Joint host country-international assistance central coordination facilities with adequate information exchange and communications capacities are vital. The use of Geographic Information System (GIS) technology and data bases is rapidly being developed to be helpful in support of humanitarian assistance coordination. It is unlikely that the host country authorities assigned to manage the emergency will be knowledgeable in any information systems technology useful for coordination, and special efforts will be needed to assist them to learn and use it.

- In case the rule of law is not equally applied to minorities and/or human rights abuses are partly a cause of the emergency, security measures will become a rapid priority.

- NGOs are particularly alert to situations in which providing humanitarian assistance can be disruptive or harmful to the overall mission. Ignoring the "Do No Harm" aspects of humanitarian assistance, e.g., assisting the perpetrators of the 1994 Rwanda genocide in the Goma refugee camp, can contribute to increased conflict.

C. **PEACE OPERATIONS UNDER AN AGREEMENT, HOSTILE CONDITIONS**

The most frequent peace operations in the 1990's have been under a peace agreement, very often coerced (e.g., Rambouillet and subsequent bombing in Kosovo in 1999, Dayton Accords following NATO strikes in Bosnia in 1995, thirteen agreements for Liberia 1984-96 for ECOMOG peace operations which included frequent outbreaks of conflict between ECOMOG and Liberian forces). These operations have been very difficult to undertake. While peace has been maintained, hostilities have continued and the rule of law sufficiently acceptable to assure the establishment of a stable peace is elusive.

The growing number of new interventions without solution is stressing the capacity and willingness of countries capable of supporting peace operations to commit to providing assistance. The longer they continue, the more assertive the international

community is becoming in creating institutions required to make more serious progress toward a stable peace. The alternative is not to intervene and permit conflicts to grow and fester until they are larger, when they cross international boundaries and become even more difficult to intervene without the use of severe force. The host country structures which are critical in working constructively for stability are the following:

- **The Ministries of Finance and Planing.** An essential ingredient of achieving stability is an economy which provides employment, permits an improving living standard and quality of life, overcomes equity problems between segments of the population, and works toward integrating the national economy into a regional economy. Investment planning in a transparent manner demonstrates an accountability of the government to the population. Contrary to some popular statements implying that all other ingredients will come together if the economy is re-established, a thriving economy is a necessary but not sufficient factor in achieving a stable peace.

- **A National Bank.** Monetary stability provides a basis for stable economic growth.

- **A Police Force accountable to the community.** Police under the authority of political leaders tend to abuse basic freedoms. This is weakest link in a return to an acceptable normality.

- **An Independent Judiciary.**

- **A Ministry of Defense under civilian authority.** Military commanders and troops who are not politically neutral and who have vested interests in commercial or other economic activities are impediments to the peace process. Actions to gain the constructive cooperation of the military toward supporting peace building actions has been largely ignored in most peace operations as "outside the mission" mandate. But this is an equally important weak link hindering progress toward normality.

- **Political Parties.** Creation of democracies requires the establishment of a multiparty political system which is often opposed/obstructed by faction leaders. Ethnic-based political parties do not contribute to long-term stability.

- **Government Policies Supporting Achievement of Peace.** Perhaps the most critical ingredient to creating peace remains the commitment of leaders. The international community is increasingly finding ways to confront leaders who do not actively establish and direct efforts that demonstrate results. (For example, in Bosnia one top political leader was dismissed by the High Representative.)

- **An Active Civil Society.** An authoritarian government tends to be abusive. The creation of a balancing group of people representing popular interests to either work cooperatively with the government (e.g., Sierra Leone 1997-99) or to call for transparency and accountability by the government, can be a powerful force toward stability. This is no easy task, however, and little experience exists to date

as a model. The potential pitfalls are numerous. The protection of civil society leaders is absolutely necessary.

D.   FAILED STATES AND PEACE ENFORCEMENT

Afghanistan, Bosnia in 1992-5, Haiti in 1993-4, and Somalia are examples of failed states where governments responsible to their populations did/do not exist. Northern Iraq was a region within a rogue state that became a failed-state region following the Gulf War. Afghanistan is an example of a country that has been largely left alone by the international community.   UN forces (UNPROFOR) were deployed to Bosnia to provide protection for humanitarian assistance, but were not effective in establishing or maintaining peace.   An international intervention into Somalia was required to create peace, initially an outstanding success for humanitarian assistance purposes, but it became a failure in peacekeeping.

For expeditious reasons, intervention in failed states is done without a negotiated peace agreement. In most of these deployments the local authorities are not considered the legitimate governing authority. (Traditional authority structures are considered more legitimate than warlord/faction leaders.) Either cooperative or assertive accommodations are made with the local authorities. Local authorities are organized according to varying structures, and accommodate intervening forces through different forms of agreements:

- When the Bosnian provincial government declared independence from Yugoslavia, but did not have the ministerial offices, a currency, a military, nor experience in acting as a sovereign nation.   An immediate eruption into war prohibited establishing most of these "normal" functions, yet ministers were appointed. They had minimal staff and resources to carry out their functions. The Bosnian government's priority was conducting the war for independence. Parallel authorities were created in the Croate and Serb territories of Bosnia, each with the aim of creating hegemony for its ethnic group. The international community, moving from one territory to another, was required to negotiate passage with these local authorities through multiple check-points. The degree of assertiveness possible by the militarily or permitted to be used was highly politically contentious throughout the UNPROFOR period. As a result, UNPROFOR was generally considered marginally satisfactory for providing humanitarian assistance protection but a failure at establishing peace.

- In Somalia the NGO community was providing humanitarian assistance in force during the 1991 famine. They were employing their own security guards and accepting gross extortion (the CARE president indicated 85% losses) in order to save the lives of the starving.   The feuding factions were permitting these

operations (for their expeditious reasons), but the international community was outraged. Thus the military deployed to provide the security, a senior diplomat "informed" the faction leaders. The subsequent full deployment to establish peace and hopefully create a "normal" state was in two stages. The first stage was a coalition of international forces to land and take charge. A senior diplomat led the communications with the two faction leaders, Aideed and Ali Mahdi. This operation was transferred to UN management in the second stage, under which the communications process gradually broke down. It was when the intervening forces put neutrality aside and attempted to defeat Aideed that catastrophe resulted, leading to the eventual withdrawal of the peace operations.

- In Haiti the imminence of a total invasion to overthrow the authoritarian government and replace it with the exiled democratically elected president led to the suppression of the population causing an exodus of "boat people." The need for a military solution was averted through negotiations resulting in a relatively peaceful troop landing. The establishment of a democratic-style government required significant changes in national administration which were extremely slow in coming. Critical to this was dismissing the existing police force and training an entirely new one. The intervening forces became the enforcement arm of the returned president. Yet the conditions of poverty for the population were and remain endemic and a dilemma for all. The international community provided humanitarian and some economic assistance, but little assistance in governance. Lethargic leadership in a resource-poor country remains a problem that does not seem to be solvable under current conditions.

- Peacekeeping in Cambodia in the 1980s was highly complex. The Khmer Rouge which committed the atrocities were nevertheless in total charge of their country in the 1975 to early 1980s period, thus was accepted in the United Nations. A domestic revolt put a Vietnam-supported faction in power in Pnom Phen, but the Khmer Rouge controlled much of the countryside, exploiting natural resources to maintain its power. Peace operations supported an extended series of negotiations to achieve a democratically-elected government with negotiations that included opposition groups to the Vietnam-supported faction. This process isolated and ignored the Khmer Rouge. The result has been a tenuous power-sharing and the collapse of the Khmer Rouge. The cooperation by the neighboring nations in Southeast Asia has been a crucial ingredient to assisting this process work over a period of many years, one of the few which shows hope for a final success.

Similar to Asia and the Middle East during the past four decades, today Africa is presenting severe challenges to peace operations. The nations in the Horn of Africa (Somalia, Ethiopia, Eritrea, Uganda, Sudan, Rwanda, Burundi) have extremely fragile governments (Somalia remains a failed state with only parts of it at peace). The governments of the central African states (the Democratic Republic of the Congo - DROC, Congo/Brazzaville and Angola) are in pieces even though a number of nations have contributed troops to the DROC, or have taken sides with the government or rebel

factions. Eastern Africa has conflicts in Sierra Leone, Liberia, Guinea, and Guinea-Bissau, each involving other countries in the region.

The Organization of African Unity (OAU) has a role for the continent in providing a forum for discussions on establishing peace, but is extremely weak and virtually powerless to implement peace programs. Alternatively, African regional organizations have been engaged. The most active is the Economic Community of West African States (ECOWAS) which has established peace enforcement forces (ECOMOG - Military Operations Group) to intervene in Liberia, Sierra Leone and Guinea-Bissau. The Southern Africa Development Council (SADC) has played a role in the central and southern Africa region, a role which also includes troop contributions but which is still evolving.

The African Crisis Response Initiative (ACRI) is a U.S. initiative to train African peacekeepers, and the UK and France have equivalent efforts ongoing. The long-term purpose is to develop the capacity of African governments to respond to their own regional peace operations requirements. Thus joint deployments with regional governments into peace operations are a potentially significant future option. This would represent a new kind of peace operation that would need to be developed to achieve optimum effectiveness.

E.   PROTECTORATES

The UN Charter contains many provisions for "trusteeships," a vestige of the post-WWII period that lead to the creation of the United Nations. These trusteeships convey an international legal authority to various nations to govern isolated areas of the world (e.g., Puerto Rico, Guam, and the Marianas Islands for the U.S.). In the early 1960s (subsequent to the creation of the UN), most colonial powers granted independence to these "colonies". The international community, since then, has fled from having an interest in being assigned "trusteeship" responsibility. Yet the concept is frequently mentioned in the context of today's failed states.

Beginning with the Brcko clause in the Dayton Accords the concept of a "protectorate" arose. Brcko was the most critically disputed territory of Bosnia, originally a Muslim city, that was completely occupied by the Serbs during the war (the

Muslim population was "cleansed") because it guarded a narrow pathway used to supply Serb forces in western Bosnia. An international supervisor was named to govern Brcko until more permanent arrangements could be negotiated. As a result, a decision to grant governance to either side has been the equivalent to re-igniting the war. Brcko remains an international protectorate. This has permitted a gradual process of:

- minority refugee return, including construction of new housing,
- establishment of a joint Serb-Muslim mayor's office,
- establishment of and training a mixed police force,
- integration of schools, and
- mixed municipal management.

Kosovo is now a protectorate, with different dilemmas:

- The local population consists of ethnic Albanians: more than 90% of the population desires independence, an objective not shared by the occupying international community and politically fraught with dangers for the region.[15] For this reason alone, reintegration of Kosovo back into the Federal Republic of Yugoslavia (FRY) is highly problematic.

- Albanians, who were the victims of ethnic cleansing during the conflict, are now themselves perpetrators of ethnic violence.

- Local authority structures are divided between the resistance army, seen as heroes in the war for autonomy, and the previous leaders who probably provide the most rational leadership toward a return to local, national and regional stability. Neither is able (or perhaps willing) to control the vindictive and criminal elements of the population.

- Applying the lessons learned from previous peace operations, the international community is establishing and training a mixed ethnic police force that will be supervised by the protectorate authorities. The disposition and management of this police force will be absolutely crucial to creating a sustainable peace for Kosovo. The international community is also moving slowly and cautiously with a process of holding elections in order to pass authority into the hands of local leaders. Holding "free and fair" elections at the moment is impossible. A climate of hostility among differing Albanian factions has led to threats on lives, a climate which does not bode well for the "free and fair" conditions needed. In addition, no political party will be able to gain support without promoting independence, a solution the international community can't support at the moment.

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[15] Montenegro, the last remaining province in the Former Yugoslavia, is also leaning towards declaring independence from Serbia.

- The solution in Kosovo is very dependent on the governance of the Former Republic of Yugoslavia (FRY). The international community hope is that FRY governance will change and create conditions for a healthy autonomy for Kosovo within FRY.

East Timor has become a protectorate, although matters there appear far closer to a final resolution than in the Balkans.

- The UN determined years ago that East Timor had the right to be given independence if a popular referendum indicated it was the will of the population. The referendum confirmed this desire and the peace intervention establishes the authority to make it happen.

- The suppression of the minority dissidents who had the military power to assert its will is thus internationally sanctioned.

- The vote of the Indonesian government to permit independence clears the way for a reconciliation and normalization process.

- The election of a new government appears to be a straightforward process. Reconciliation with the militias causing the violence will be a challenge, but a withdrawal of support for them from the Indonesian military will overcome the most significant constraint.

F.   TRIBUNALS; TRUTH AND RECONCILIATION COMMISSIONS

One accepted definition of stability is "order with justice". It is the "justice" aspect of this that is the most problematic. A return to "order" after atrocities or genocide has been committed causes many press for a "justice" that is often very difficult to attain. One reason for this, the perpetrators of the atrocities are often a part of the solution. As a result, various measures have been implemented to address the "justice" issue. In the post-dictatorship Latin America period, for example, the expression, "all should be known, not all prosecuted" was coined. This opened the way to seek information on those missing during authoritarian rule and gathering data on events during those periods. It also left open to judgment at any time what criminal activity should be prosecuted without requiring that everything be investigated.

Temporary international tribunals are now established for Bosnia and Rwanda. The Bosnia tribunal is also being extended to include Kosovo. These tribunals, although controversial in terms of their lasting effect, have stimulated the initiative to create a permanent International Criminal Court (ICC), a process nearly completed. The requirements the international investigations into genocide and atrocities place on

peacekeepers has been significant. Protection of sites of atrocities and of the forensic experts and other investigators is an important duty.

The much higher profile aspect of tribunals is the role of peacekeepers in the arrest of individuals indicted by the tribunal to be brought for trial. Because authorities responsible for peacekeeping have not come to terms with this responsibility some arrests are made while others are avoided. The killings and deaths that resulted from attempts to arrest Aideed in Somolia weigh heavily on the minds of commanders who see as their first obligation the end of violence and restoration of public order. However, while the failure to make arrests is a short-term palliative, in the longer-run the failure to make arrests risks leaving war criminals at large to continue to subvert the peace process. This issue needs to be better resolved to assure a more effective peace process.

The South Africa "Truth and Reconciliation Commission" has been a model for the world. Providing amnesty to those who confess to committing crimes in the past has been a highly expeditious way to address "justice". While the revealed truth has left victims and victims' relatives chagrined, the nation has accepted this means of addressing "justice" issues. Thus the question arises of whether this South African process is replicable elsewhere.

Efforts are under way to create a Truth and Reconciliation Commission in Bosnia. One NGO has been conducting seminars at local levels on this for about three years with some success. Making it a national institution when the political institutions are still not committed to a multiethnic state has not yet proved possible. This idea is also being actively discussed in many post-conflict countries (e.g., Sierra Leone, Rwanda, Kosovo, Liberia, East Timor). The principle purpose to be served is to give the population a forum to address the three core elements of post-conflict trauma: truth-telling, forgiveness and reconciliation. Each is a key step. Without these steps being taken, a sense of "justice" can be lost, only to resurface in the next generation with a new outbreak of conflict. The vicious cycle continues unless parents and political leaders train the younger generation to resolve their differences using peaceful methods.

G.   FUTURE OPERATIONS—NEW CHALLENGES

The Cold War period was characterized by intense competition between the two superpowers.   Instability in any part of the world attracted high profile attention immediately to determine how the events could be influenced.   Little was ignored.   This resulted in instability being very short-lived.   Dictatorships were tolerated if they were "on our side" and voted with the U.S. in the UN.   Subversion of dictatorships allied with the other side was part of the international intrigue during this period.   The world thus became highly structured politically.   The number of fragile democracies was limited.

Today's world is much more laissez faire.   Many contradictory forces are at play. Authoritarian regimes tend to achieve stability while at the same time creating conditions for instability.   Development assistance is withheld from authoritarian regimes unless a path to democracy is charted and implemented, yet democratic leadership qualities have to be learned well since instability results when it is learned poorly.   The world powers who were previously interested in distant nations "in the national interest" find it much more difficult to explain that domestically today, yet the arrival of a "global economy" means neglect of a potential future market may be regretted later.   Ignoring a limited, intrastate conflict in its early stages anywhere in the world may result in being forced to address it an a more severe stage later.

Given the natural propensity for leaders in a world not experienced in making democracies work to resort to violence, a turbulent next decade can be expected. Speculating on the future, while at best is only an educated guess, can be helpful in anticipating "worst case" scenarios.   Projecting the cycle of violence experienced in the decade of the 1990's into the first decade of the twenty-first century, the following examples are feasible:

1. **A broadening of intrastate conflicts across borders to limited inter-state conflic**ts.   This is already occurring in Africa, e.g., Ethiopia-Eritrea, Uganda-Rwanda-DROC, Liberia-Sierra Leone.   It could also occur in other parts of the world, e.g., the Former Soviet Union, Iran-Afghanistan.   International conflicts are clearly more serious than intrastate conflicts, yet even these might not attract interventions unless substantial human suffering results from the conflicts, which is highly likely.   A simple approach for peacekeeping would be to restore and protect the former boundaries.   This would ignore the rationale that spurred the

conflicts and the possible inappropriateness of boundaries that may have been arbitrarily established initially, many years ago.

2. **An increasing use of the protectorate model.** The cost of maintaining peacekeepers in increasing numbers of locations for long periods of time may lead to a perfection of the use of protectorates. This could include a broadening of the military mandate to perform law enforcement and functions which might normally be considered martial law. It could mean a more significant use of civil affairs officers at critical times and appointing appropriate local officials into positions of authority, similar to the post-WWII Germany and Japan experience. This would assure more reliable progress toward achieving a stable peace.

3. **A collapse into civil strife of more highly populated nations.** To date, the levels of population in the uprooted strife-torn countries have been generally at the level of around one million. This has been within the capacity of the world's resources to provide sufficient humanitarian assistance. If Indonesia with a population of 200 million collapses, for example, many in urban areas would be totally helpless. Tens of millions of persons at-risk population is *beyond* the existing capacity to provide humanitarian assistance. This would require either extraordinary measures far beyond any previous experiences, or decisions not to assist due to limited resources, i.e., triage. No one has prepared for that possibility to date.

4. **The use of weapons of mass destruction (WMD) in other countries.** The U.S. has begun preparations for domestic measures to prevent or respond to the use of these weapons domestically. The possibility of WMD in other countries would cause calamities equal to the atrocities of the 1990s, with a similar public reaction to provide humanitarian assistance. Neither international organizations nor NGOs, however, have made any preparations for such events. For example, the U.S. Naval War College has conducted a simulation of a limited nuclear exchange between India and Pakistan. This would result in humanitarian assistance conditions extremely different from any previously faced.

Those who have said that each new deployment has been different from the past experiences have been partly right. Kosovo was not Bosnia, which was not Rwanda, which was not Somalia, which was not Northern Iraq. Future scenarios are also likely to be different. It would be unfortunate to have to face more serious emergencies in the future. It could be considered irresponsible not to conduct "what if" simulations if any of the scenarios described above have even a small chance of occurring, then something similar actually does occur.

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APPENDIX F
HUMANITARIAN POLICY AND ORGANIZATIONS

Demands on human rights and humanitarian assistance organizations increased considerably during the 1990s. This led to the establishment of new institutions, both within the Non-Government Organization (NGO) community and within the United Nations, the World Bank, and government agencies. In this Appendix we highlight some important chronological changes and then summarize the key features of major organizational entities involved in establishing policy and implementing programs on human rights and humanitarian assistance.

A.   IMPORTANT CHANGES

Chronologically, the most prominent changes that occurred in the decade of the 1990s and highlighted below:

1992

- USAID established the Bureau of Humanitarian Response (USAID/BHR) combining food and disaster assistance.

- The European Community established the European Community Humanitarian Office (ECHO).

1993

- UN established the Department of Humanitarian Affairs (UN/DHA), and in 1997 changed the name to the Office for Coordination of Humanitarian Affairs (UN/OCHA).

- USAID established the Office of Transition Initiatives (USAID/BHR/OTI).

1995

- UNDP established the Office of Emergency Response to respond to immediate post-conflict reconstruction needs.

1996

- The World Bank established the Post-Conflict Reconstruction office.

- The UN established the Human Rights Commission (UN/HRC).

In addition, the UN High Commission for Refugees (UNHCR), stung by criticism of its inaction toward the Kurds in the 1991 crisis in Northern Iraq, changed its mandate. Its previous mandate limited it to provide assistance to refugees only, i.e., those fleeing across national borders. Subsequently, UNHCR revised its mandate to provide assistance also to Internally Displaced Persons (IDPs), and this now represents a significant portion of its work.

B.   THE UNITED NATIONS

1.   New York

- **Security Council (UNSC)** - The UNSC is composed of the Permanent Five (US, Russia, France, the UK and China) plus a few other countries representing all the geographic regions of the world, named on a rotating basis. It is chaired also on a rotating basis by one of its members. It authorizes Resolutions that provide the overall guidance to international action in conflict countries. The Resolution is a major, definitive decision document issued only when the UNSC vote is unanimous, and is used by all member countries as guidance for defining their actions.

- **Secretary General (UNSG) -** The Secretary General operates under the instructions of the member countries of the UN. For crisis situations, he is guided by the UNSC resolutions and names "lead agency" among specialized UN agencies to take the lead in any given crisis country over other UN specialized agencies.

- **UN PeaceKeeping Office (UN/PKO)** - Under the Secretary General (SecGen), it manages military activities to implement UNSC decisions. The PKO is one of the few UN offices directly under the SecGen that has important implementation responsibilities, including all UN Peacekeeping operations. Funded by assessed contributions from member states, which has been controversial with US legislators.

- **UN Political Liaison Office (UN/PLO) -** Under the SecGen, it manages political coordination activities to implement UNSC decisions.

- **UN Office for Coordination of Humanitarian Affairs (UN/OCHA) -** Under the SecGen, it coordinates humanitarian assessments and political aspects of humanitarian assistance programs.

- **UN Resident Representative (UN ResRep) -** Individual appointed by the SecGen to reside in country to manage UN activities and coordinate international activities.

- **UN Secretary General's Special Representative (SRSG) -** Individual appointed to reside in conflict country to manage UN activities and coordinate international activities during crisis periods. The UN ResRep is generally withdrawn during these emergencies. The SRSG Might also reside externally.

2. Specialized Agencies

- **High Commission for Refugees (UNHCR)** - Provides assistance to refugees and IDPs. UNHCR is the largest of the specialized UN agencies, thus is most often named as "lead agency" in a conflict country. Funding is provided through special appeals to donors for voluntary contributions to each crisis. It has stockpiles of basic commodities needed (e.g., plastic sheeting, water containers, blankets, tools). Its headquarters are in Geneva.

- **World Food Program (WFP) -** Provides food assistance in crises. Occasionally named as "lead agency". Food and funding is provided through special appeals to donors for voluntary contributions, an appeal which is frequently part of the UNHCR appeal. When a crisis is pending, it attempts to "pre-position" food stocks to be ready to move in rapidly. Its headquarters are in Rome.

- **World Health Organization (WHO) -** Provides coordination among medical and health organizations in response to crises. This includes "medical kits" from stockpiles that consist of the basic medical requirements for emergencies, the number of kits provided depending on the size of the emergency. It will be the "lead agency" for crises which are solely health or medical, i.e., epidemics. Its headquarters are in Geneva.

- **United Nations International Children's Education Fund (UNICEF) -** Provides assistance directed toward children in emergencies, most frequently immunization campaigns. It is funded through annual voluntary contributions. and is very responsive in crisis situations. Its headquarters are in New York.

- **United Nations Development Program (UNDP) -** Provides reconstruction assistance. Funded through annual voluntary contributions. Its headquarters are in New York.

- **United Nations Education, Social and Cultural Organization (UNESCO) -** Has recently begun to provide assistance to educate children in refugee camps and early in post-conflict countries. Its headquarters are in Geneva.

- **War Torn Societies Project (UNRISD/WTSP) -** The UN Research on International Social Development office has begun applied research projects in conflict countries. Its headquarters are in Geneva.

C. OTHER INTERNATIONAL ORGANIZATIONS

1. Global Organizations

- **World Bank -** Provides technical expertise and some funding (through voluntary contributions to trust funds) for immediate post-conflict reconstruction activities. Frequently requested to coordinate reconstruction efforts among donors because of its immense potential for funding through its normal loan programs once stability is achieved. Its headquarters are in Washington, DC.

- **International Committee of the Red Cross (ICRC) -** ICRC is both an International Organization and an NGO. It receives considerable funding from international donors, including the Swiss government, yet it also has significant

private funding. It specializes in working in strict neutrality across conflict borders, often in the most hazardous locations. It also specializes in visiting prisoners of war to provide information to families and reuniting families. It is also a part of a sister organization, the International Federation of Red Cross, Red Crescent (IFRC).

- **Food and Agriculture Organization (FAO) -** Has established a Global Early Warning System (GEWS) to warn of crop shortfalls which could lead to famine. Does not participate in humanitarian assistance programs. Its headquarters are in Rome.

- **International Organization for Migration (IOM) -** Provides much of the implementation assistance for UNHCR's programs and accepts contracts to implement a variety of other humanitarian assistance programs from various donors. Its headquarters are in Geneva.

2. Regional Organizations (Examples)

- **Organization for Security and Cooperation in Europe (OSCE)** - This organization evolved from its predecessor CSCE (the "Helsinki Process) in 1995 to be political coordination arm for Eastern Europe issues following the end of the Cold War. Has been given responsibility for staffing the Office of the High Representative in post-Dayton Accords Bosnia.

- **Organization of African Unity (OAU) -** African continental organization responsible for coordinating African political affairs. Its headquarters are in Addis Ababa, Ethiopia.

- **Organization of American States (OAS) -** Responsible for coordinating the political affairs for the Americas.

- **Association of South East Asian Nations (ASEAN) -** Responsible for coordinating political and economic development affairs in Southeast Asia.

- **Economic Community Of West African States (ECOWAS) -** Responsible for coordination of political and economic development affairs of 16 west African nations. Has also established ECOMOG, a regional military force deployed for peace making and peacekeeping in Liberia, Sierra Leone and Guinea-Bissau. Its headquarters are in Abidjan, Cote D'Ivoire.

D. BILATERAL AND OTHER DONOR ORGANIZATIONS (EXAMPLES)

1. United States

- **State Department Program for Refugees and Population (PRM) -** Provides funds for UNHCR refugee and IDP programs through annual appropriations from Congress.

- **US Agency for International Development Bureau for Humanitarian Response (USAID/BHR)**

  - ➢ **Office of Foreign Disaster Assistance (OFDA) -** Provides funds for immediate relief and reconstruction assistance through annual appropriations

from Congress, including notwithstanding legislation permitting rapid dispersal. Field Disaster Assistance Response Teams (DARTs) delegated authority to provide grants to NGOs in-country.

- ➢ **Food For Peace (FFP) -** Provides food in cooperation with USDA from food stocks available in the US and funds to the WFP. Annual congressional appropriations.

- ➢ **Office of Transition Initiatives (OTI) -** Provides assistance to short-term, high political impact activities to support a return to stability. Funded from same budget item which supports OFDA.

- **US Agency for International Development - Other Bureaus**

  - ➢ **Geographic bureaus -** Provides reconstruction funding, often through special appropriations, e.g., supplementals, and uses annual development assistance funds to implement conflict prevention programs (new and experimental to date).

  - ➢ **Democracy/Governance -** Provides funds for election support, democratization activities such as formation of political parties and strengthening civil society, and technical support to governments to increase government transparency and accountability.

- **Department of Defense -** Provides limited funds for support for humanitarian assistance programs both conducted directly by DOD and in support of UNHCR, NGOs and other humanitarian organizations.

- **Centers for Disease Control (CDC) - CDC provides expertise to support** assessments and provide advice on epidemics. Its advice is highly sought after and very authoritative.

2. **Other Bilateral Donors (Examples)**

- **European Community Humanitarian Office (ECHO) -** Provides bulk of European Community humanitarian assistance funding.

- **Canada International Development Assistance (CIDA) -** Provides funds from the Canadian government for development and humanitarian assistance.

- **Department for International Development (DfID) -** British economic and humanitarian assistance office, separate from the Ministry of Foreign Affairs.

- **Danish International Development Assistance (DANIDA) -** Denmark government's economic and humanitarian assistance office.

3. **Other Donors (Examples)**

- **Soros Foundation -** Through the Open Society Program, one wealthy individual, George Soros, has provides significant funding in Eastern Europe oriented toward establishing stable democracies with valid opposition groups and free media.

- **Carnegie Commission on Preventing Deadly Conflict -** Provides funds to study conflicts, conflict prevention and case studies on past efforts to respond to conflicts.

- **Clingendael Institute -** Netherlands institution which provides funds to study conflicts and their solutions.

- **Multinational Corporations -** Most large corporations provide support to humanitarian assistance in one manner or another. This is not systematic and assistance to conflict prevention is not a high priority. For example, oil companies in Angola provide funds for social projects benefiting the general population. Initiatives to approach private corporations are encouraged.

E.   INTERNATIONAL NON-GOVERNMENT ORGANIZATIONS (NGOS)

1.   Generalist Relief and Development NGOs (Examples)

- **World Vision International -** Active in approximately 90 countries with support from donors in 16 countries. Highly decentralized with all offices part of an international "partnership". In the U.S., it is the largest privately-financed NGO through an extensive child sponsorship program. Some private funding obtained for relief activities, but most relief and reconstruction activities are funded from public donors. Taking steps to integrate relief, reconstruction, reconciliation and transition programs in a holistic approach.

- **Cooperative for American Remittances Everywhere (CARE) -** Established during WWII as a relief organization, it now engages in extensive development activities and has expanded into a large international organization. In the U.S., it is the largest NGO because of its large publicly-funded food aid programs, for which it has been the leading NGO.

- **Catholic Relief Services (CRS) -** The relief and development arm of the Catholic Church which benefits from significant private funding. The strength of CRS is that it operates in most countries within the indigenous church organizations, or the local CARITAS, which includes extensive networks. Has established Peace and Justice offices advocating the rule of law in some conflict countries.

- **International Rescue Services (IRS) -** Confines itself generally to relief and reconstruction work in conflict countries, thus is able to respond rapidly and is often a lead NGO in the most difficult places.

- **Adventist Development and Relief Agency (ADRA) -** Active in approximately 150 countries. Has established highly respected medical facilities and hospitals in several countries as one of its strengths.

- **Save the Children Foundation (SCF) -** The British SCF has considerable support for performing strategic analysis and has the UK government's confidence as a lead NGO.

- **OXFAM -** Although an international NGO, it is a UK-centered NGO which has developed an exceptional reputation for high quality studies and analyses of international crises.

- **Norwegian People's Aid (NPA) -** This is just one example of the several Nordic NGOs which are active in highly sensitive areas and performing a wide range of activities needed in these emergencies. NPA is a leader among Nordic NGOs in working in cooperation with the military.

2. **Specialized NGOs (Examples)**

- **Human Rights Watch -** Specializes in monitoring and reporting on human rights abuses. Its extensive reports are equally respected as the annual State Department reports on this subject, and often more detailed.

- **Amnesty International (AI) -** Monitors and reports on human rights abuses, and specializes in making attempts to release political prisoners and specific individuals which have been imprisoned and accused not for crimes but for beliefs in opposition to a regime.

- **International Alert (IA) -** A UK NGO which specializes in conflict resolution activities.

- **Search for Common Ground (SCG) -** A U.S. NGO which specializes in conflict resolution work, with special attention on the use of the media.

- **International Foundation for Election Support (IFES) -** Specializes in providing technical support for preparing for and conducting elections. Has recently begun to branch out into strengthening civil society activities given the recognition that elections alone don't create democracies.

- **National Democratic Initiative (NDI); National Endowment for Democracy (NED) -** These are two U.S. NGOs which specialize in providing technical assistance and support for the creation of political parties to form a legitimate multi-party democracy. They are also beginning to branch out into other related activities.

- **Medecins Sans Frontiers (MSF); International Medical Corps (IMC) -** Both specialize in providing medical assistance. MSF began in France after the Biafra war and has expanded to Belgium, Holland and the U.S. IMC is a U.S. NGO established more recently.

- **The Carter Center -** Based on the unique prestige of former President Jimmy Carter, he is able to lead negotiation missions to reach peace terms between feuding factions and preside over election monitoring missions.

- **Handicapped International -** Specializes in providing prosthetics and other assistance to victims of conflict who have lost limbs.

- **Center for East European Legal Initiatives (CEELI) -** Specializes in providing legal assistance for incipient institutions in East European countries.

- **World Conference on Religion and Peace (WCRP) -** Has established Inter-Religious Commissions (IRCs) in countries which have religious-based ethnic conflict (e.g., Bosnia, Kosovo, Sierra Leone, Liberia, Nigeria), and provides support to the IRCs efforts to work toward peace.

- **Clowns Without Borders -** A Spanish NGO specializing in bringing joy and laughter to war victims. (Provided just to show the wide range of specialized NGOs, many very small and short-lived, with highly specific purposes.)

APPENDIX G
INFORMATION BRIEFINGS AND DISCUSSIONS

In an effort to incorporate current thinking by senior government policy makers, IDA was tasked to present the S.E.N.S.E. concept to a wide range of audiences to determine if the approach suits their needs. In general responses were very positive. The following forums and individuals were briefed:

Individuals

- LTG Burnette, DCINC, Joint Forces Command
- MG Close, Director J7
- MG Gibson, Deputy Director J8
- BG Dayton, Director, Europe & NATO, J5
- Mr. Moore, Director, JTASC
- Dr. Smith, Deputy Director for Science and Technology, CIA,
- Dr. Eddington, Director, DARPA/DISA JPO
- Dr. Gordon, NIO for Economics, CIA
- Ms. D'Andrea, Science & Technology Director, Joint Warfare Analysis Center
- Dr. Kjonnerad, Senior Fellow, National Defense University

Conferences and Groups

- Central Intelligence Agency, Office of Transnational Issues
- NATO Modeling & Simulation Conference
- PfP Symposium on Computer Aided Systems for Peace Support Operations
- Asia-Pacific Center for Security Studies

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