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THE ROLE OF STRATEGIC PLANNING
IN THE EVOLUTION OF
COMMAND AND CONTROL SYSTEMS

by

Richard Lee Mallick

March, 1990

Thesis Advisor:

Frank M. Teti

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THE ROLE OF STRATEGIC PLANNING
IN THE EVOLUTION OF
COMMAND AND CONTROL SYSTEMS

by

Richard L. Mallick
Captain, United States Air Force
B.S., Grove City College, 1983

Submitted in partial fulfillment
of the requirements for the degree of

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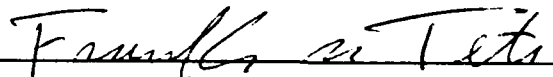
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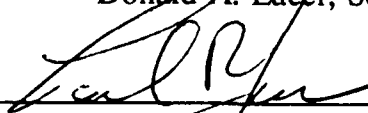
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ABSTRACT

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I. INTRODUCTION

I shall repeat that as far as United States Foreign Policy is concerned, it is based on a least two delusions. The first is the belief that the economic system of the Soviet Union is about to crumble and that the USSR will not succeed in restructuring. The second is calculated on Western superiority in equipment and technology and, eventually, in the military field. These illusions nourish a policy geared toward exhausting socialism through the arms race, so as to dictate terms later. Such is the scheme; it is naive. [Ref. 1:p. 206]

A. BACKGROUND

In his recent book Perestroika, Soviet leader Mikhail Gorbachev laid out his plan for the restructuring of the Soviet Union. He states; "Perestroika is an urgent necessity arising from the profound processes of development in our socialist society" [Ref. 1:p. 1] The Soviet Union has begun a course that would have been unheard of as little as ten years ago. The emphasis of his new policies is the "broad democratization of all aspects of society". [Ref. 1:p. 18] With new developments in Soviet policies, the revolutionary changes in Eastern Europe and the transformation of the international system, the United States is being challenged to shed the "evil empire" image of the Soviet Union.

With so much change taking place in the international environment, the Western world including the U.S. is having to reevaluate its present foreign policy. How should we interpret these changes? What effect should this have on defense planning in the U.S. and with our allies? How will this affect our present military

strategy? Will Gorbachev succeed with his policy of perestroika? If he fails, what will be the impact? Will the Soviet Union be the only principal threat in the next ten to twenty years? So many questions remained unanswered.

The way we answer these questions is going to determine our national and military strategies. Military strategies will determine force structures, weapon systems and tactics, which in turn will determine our Command and Control (C2) systems. The rapidly changing environment is proving to be an exciting but difficult challenge for our military planners. Our long range strategic planners are having to seriously reevaluate the possible futures ten to twenty years from now.

One can conclude that strategic planning has a great impact on the evolution of Command and Control (C2) systems. How we see the threat ten to twenty years from now will determine the types of weapon systems, force structures, and C2 systems we will develop. It is imperative that C2 system planners be intimate with the strategic planning world. With the trend of reduced defense budgets, it is going to be necessary to plan as prudently as possible and field those C2 systems which are cost effective and can be functional in many types of environments.

Present U.S. strategy is geared toward a total war concept with the Soviet Union in the European theater. This threat, though always present, does not appear to be the most likely scenario in the next ten to twenty years. Much is predicated on the success or failure of Soviet leader Mikhail Gorbachev's policies. Independent of Gorbachev's success or failure the trend towards U.S. involvement in Low Intensity Conflict (LIC) continues to mount. The Soviet Union outcome will only

add complexity to the LIC scenarios, but the fact remains that this level of warfare remains to be reckoned with by military planners.

Other nations are expected to rise in military status in the next two decades. Many smaller nations including Third World nations will have highly lethal accurate munitions in their arsenals including nuclear weapons. The international environment is changing rapidly along with our national interests. United States interests have shifted in recent years from being largely Euro-centered to reflect our growing interdependence with other regions. [Ref. 2:p. 4] Military planners responsible for fielding future C2 systems need to look seriously at expanding their view beyond the "conventional war with the Soviet Union on European soil" to a more realistic view of LIC in other areas of the world.

B. PURPOSE AND SCOPE

This thesis addresses the role that strategic planning plays in the evolution of Command and Control system technology. It shows how the view of the world (threat) in years to come influence the C2 systems we field. The following questions will be addressed:

- What is the role of strategic planning in the evolution of C2 systems?
- What will be the most likely threats in ten to twenty years (2000-2010)?
- What type of C2 system technology should we pursue to meet the future threat?

In Chapter II, Command and Control (C2) will be defined. Some basic fundamental concepts of C2 will be explored including the C2: process, system,

system architectures, and requirements. A cursory view of some fielded C2 systems will be looked at to determine the dominate strategic thought guiding the implementation of those systems.

In Chapter III, Strategic planning will be defined with emphasis on the major components. Two strategic planning models will be looked at to examine the process and see the functional relationships between the major components. Futures research will be explored in Chapter IV with a survey of the methods available to the planner for developing alternative futures.

Chapter V will take a look into the future (2000-2010). There will be a brief look at U.S. interests and their impact on the military. The international environment will be examined to see what emerging threats will have the most impact on the U.S. military. Chapter VI will then project the type of military force which will be in place and recommend what C2 systems technology the U.S. should pursue to meet the emerging threats outlined in Chapter V. Chapter VII will be the conclusion.

II. FUNDAMENTALS OF COMMAND AND CONTROL

Command and Control (C2) is a concept that continually takes on new meaning. In its most basic form it is a process. C2 systems are designed with an understanding of the process. C2 systems can be further defined in an architectural sense. A C2 system requirement is developed to achieve a capability or fill a deficiency to accomplish an approved mission. This chapter will explore fundamental C2 concepts including the process, system, system architectures and requirements. Several current C2 systems will be examined to discern what key threats drove those requirements.

A. BASIC COMMAND AND CONTROL CONCEPTS

1. Command and Control (C2)

The Joint Chiefs of Staff Publication 1 (JCS Pub 1) provides a good solid definition of command and control.

Command and control is the exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of the mission. [Ref 3:p. 77]

The concept of C2 is nothing new. The problem of commanding and controlling armed forces...is as old as war itself. [Ref 4:p. 1] Command can be further defined as the "authority that a commander in the military service lawfully exercises over subordinates by virtue of rank or assignment." [Ref 3:p. 76] The term control refers to :

those functions of command involving the composition of subordinate forces, the assignment of tasks, the designation of objectives, and the authoritative direction necessary to accomplish the mission...[Ref 3:p. 262]

Individuals have tried to change the meaning of the definition by adding new variables. As years pass, new letters are added to the acronym. C2 was first expanded to become C3, adding communications to the term; C3I, adding intelligence; C4I, adding computers; and C4I2, adding interoperability, etc.. The additional terms are many times added to C2 because of parochial interests of those involved with communications, computers, or intelligence. In the Army, communications and intelligence are not viewed as separate from, but integral to command and control. [Ref 5:p. 59] For the purposes of this thesis C2 will be the acceptable term. Any mention of C3, C3I, C4I, or any other combination will be those of referenced material.

2. Command and Control System

It is important that a C2 system be defined properly. According to JCS Pub 1, a C2 system consists of the following: the facilities, equipment, communications, procedures, and personnel essential to a commander for planning, directing, and controlling operations of assigned forces pursuant to the missions assigned. [Ref 3:p. 77]

The C2 system should be looked at as an entity. Communications, personnel, equipment, etc.. are all essential items, however they are only a part of the C2 system, they do not stand alone. Communications continue to be at the forefront today because of the great advances in technology and it is something tangible.

Command and control is not tangible, but a radio is. Communications are part of the big picture (system).

Central to the C2 system is the commander. The operational military commander is not merely the user of a C2 system, he is very much a part, if not the dominant element of the C2 system. [Ref 6:p. III-6] The C2 system should be designed to fit the commander like a glove. The ideal command and control system supporting a commander is such:

that the commander knows what goes on, that he receives what is intended for him, and that what he transmits is delivered to the intended addressee, so that the command decisions are made with confidence and are based on information that is complete, true, and up-to-date. [Ref 7:p. 12]

Personnel including the commander, his subordinate commanders, and staff are often neglected in the design of C2 systems. Technical people tend to look at whizbang gadgets available for use in C2 systems rather than the whole complicated feedback control loop which includes human beings. [Ref 8:p. 15] How well the individual fits into the C2 system must be given ample consideration. C2 systems are unique, because the personnel and procedural aspects of a C2 system require complete integration of the human element into system design criteria, something not required of any other kind of system. [Ref 6:p. III-6]

To better understand a C2 system with its integrated components, a parallel can be drawn with the human body system.

With the body, sensors (eyes, ears, nose, fingers, etc.) receive stimuli and the nervous system transmits this to the brain which makes decisions. Then the commands to take action are relayed via the nervous system, from the brain to the limbs. Thus sensors such as radars send information over communication systems to the command center (brain) where commanders make decisions and disseminate the decision back (over the nervous system) to the combat forces (the hands, the fists, the punch). The system of C3 must

be kept in balance to have an effective fighting force, just as the living system must stay in balance to function properly. [Ref 7:p. 33]

In this example a process is taking place. Information is retrieved from the environment. Decisions are made based on that information and disseminated through the proper channels to the appropriate objects. This is an example of a C2 system functioning within the boundaries of a process.

3. Command and Control Process

C2 is a process. Even though computers and advanced communications are something recent, the process of command and control is nothing new. The C2 system is designed with an understanding of the process. One of the most accepted models to describe the C2 process is "Lawson's C2 Process Model" [Ref 9:p. 25].

The sense function corresponds to all data-gathering activities (radar sites, forward observers, photo reconnaissance systems). The process function acts upon these signals to attempt to extract meaning from them. External data, not directly from the environment may be fused with the sensed information to get a clearer picture. The compare function compares the state of the environment, as determined by reports from the process function, with a desired state as specified by some external source. The commander would most likely specify the desired state. Based on this comparison, the decide function determines what should be done to move the actual state to the desired state, and the Act function executes that decision. [Ref 9:p. 25]

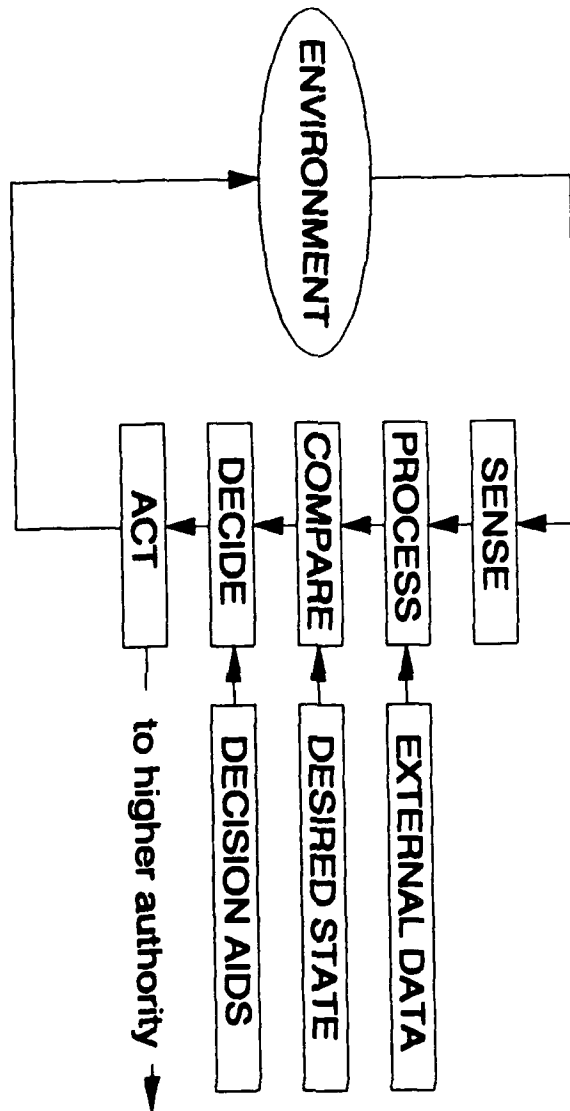


Figure 1 Lawson's Loop

A commander's goal is to make decisions with certainty in the process. The more uncertain the environment, the more risk involved with the decision. His objective is to reduce the uncertainty about the environment in order to make the best decisions. Most analysts contend that more information will bring greater light on the environment and enable commanders to make better decisions. Others see paradoxes emerging from this phenomena.

Sophistication and volume of information transmission may be inversely proportional to, or irrelevant to, what actually is needed in crisis or combat, that is, command information may be demanded or generated on the basis of anxiety rather than function. [Ref 10:p. 54]

The responsibility of the commander is to take the enormous amount of information and extract what is pertinent to his mission. He must have a good understanding of his C2 system and use it to enhance the C2 process. A good commander will recognize that he is in control and not the system, and that the system is there to aid him, not run the show. Some contend that today's C2 systems have not enhanced the C2 process.

Present day military forces, for all the imposing array of electronic gadgetry at their disposal, give no evidence whatsoever of being one whit more capable of dealing with the information needed for the command process than were their predecessors a century or even a millennium ago. [Ref 4:p. 265]

A good understanding of the process is required to enable designers to develop the best C2 systems possible.

B. C2 SYSTEM ARCHITECTURES

In order to build a C2 system, one must understand system architectures. A C2 system architecture is developed to provide a framework for the C2 system to

support the C2 process. The conceptual design of a system often is referred to as the architecture of the system. [Ref 11:p. 67] A C3 architecture is the arrangement of (or process of arranging) the basic elements of a C3 system into an orderly system framework. [Ref 12:p. 81] Again, from JCS Pub 1 a "C2 system" consisted of "facilities, equipment, communications, procedures, and personnel". [Ref 3:p. 77] More specifically, the elements may include "processing resources, storage media, displays/man-machine interface units, data, system and application software, operational procedures and personnel." [Ref 12:p. 82] It is the responsibility of the system designer to arrange those in an orderly manner to best serve the commander.

Commanders must be involved with the design of their architecture and "know the architecture or structure of the generic approach to the C3 process or system for the type of force they command." [Ref 12:p. 81] The conceptual framework from which they work includes "the C3 mission, physical environment, control and flow of information, and representation, interpretation and transformation of information." [Ref 11:p. 68] Problems arise when the system designers get focused on all the high-tech communications equipment available and relinquish the role of mission in designing the architecture. A former commander of a major Service material command indicated:

The services focus on buying things, i.e., on obtaining systems at the hardware/software level (such as radar systems and communications systems) not mission systems like defending the CONUS against air and missile attack or locating and killing enemy tanks in the which the C2 capability involved needs to interface with weapons, platforms, and other C3I systems to some job. [Ref 6:p. III-13]

The complexity of C2 systems demands that many people get involved with the design. The architects should be "the military analysts, planners, researchers and users working together to design an integrated C3 structure that will support a specific military force under anticipated battle situations and conditions." [Ref 12:p. 82] To design a system architecture based solely on the technology available will not cut it in today's fast changing environment. One can begin to understand why the strategic planners should be involved in the designing of the architecture. Mission, future threat, and resource constraints are key ingredients in the design.

In order to design an architecture, a generic framework must be developed. This has been very difficult. The 1987 Defense Science Board Task Force on C2 System Management pointed out that in "tactical and theater command and control systems worldwide" there exists "a continuing absence of an agreed-upon, well understood DOD architecture framework with its well defined interfaces and standards..." [Ref 7:p. 12] Integrating all the elements of the C2 system has grown to be complex with the explosion in computer technology. To understand the interdependencies the system architecture must be broken down into simpler elements. An overall architecture can be subdivided into three distinct sub-architectures: organizational, functional, and physical.

1. Organizational Architecture

An organizational architecture is simply the structure of the organization. It delineates the chain of command showing who is responsible for what task. The organizational chart depicts the architecture. The design of an organization is dependent on many things but the main driving force is the mission. Other variables

in the design would include resources, the threat, physical and organizational technologies. The "one best way" approach has dominated our thinking about organizational structure since the turn of the century. [Ref 13:p. 276] But is there a "one best way" of organizing? Recent management theory has moved away from the "one best way" approach, toward an "it all depends" approach, formally known as "contingency theory." [Ref 13:p. 277]

The "it all depends" approach is based on the premise that "structure should reflect the organization's situation-for example, its age, size, type of production system, the extent to which its environment is complex and dynamic." [Ref 13:p. 277] The environment is dynamic and will give cause to changes in organizational structure. This is especially true in military organizations as the threat continues to change. In developing or changing the organizational structure to satisfy the mission, the designers must consider such things as what are the key coordinating mechanisms, how much standardization should be built into the tasks, should command be centralized or decentralized? The answers to these questions will set into place the organizational architecture. From the organizational architecture the functional architecture can be developed.

2. Functional Architecture

A functional architecture is developed by taking the various mission areas in the organizational architecture and decomposing them into their specific functions.

Functional analyses serve as tools for defining areas of functional agreement, identifying functional requirements, determining interfaces among system components, highlighting system issues, and providing a basis for performing system trades and developing candidate architectures. [Ref 14:p. 1]

There are many functional analysis techniques available. Functional decomposition being the primary one which decomposes primary functions into subfunctions at ever increasing levels of detail. Other techniques which may be utilized include hierarchy trees, flow charts, from/to charts, N2 charts, IDEF models and colored Petri Nets.

A specific function can be depicted by using a function box showing all the inputs, controls, mechanisms and outputs. This is shown as follows:

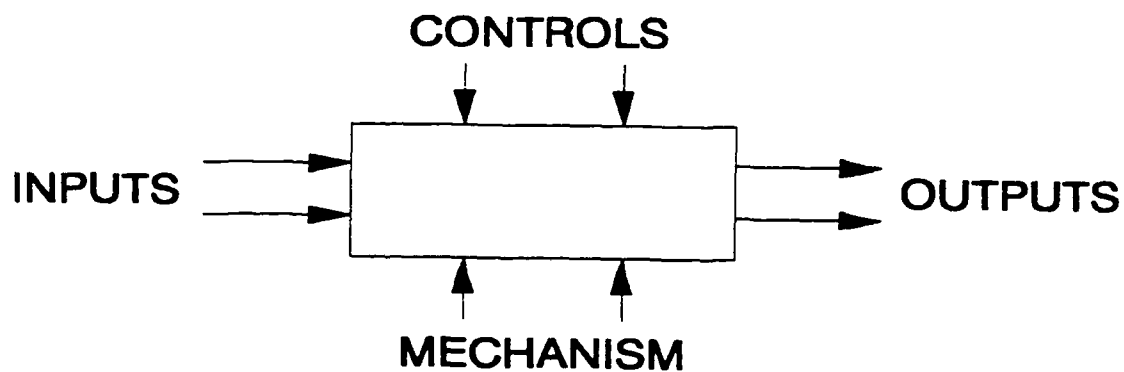


Figure 2 Function Box

A more specific example might be an artillery unit whose responsibility is to put ordinance on target. There are several specific missions or tasks that must be accomplished before the unit can begin firing on the target. The missions can be functionally decomposed into areas such as sensing, processing, deciding and firing. The mission of sensing is to sense the environment for possible targets. The processing function takes the raw data extracted from the sensors and processes it into usable form for the commander to make a decision to fire.

3. Physical Architecture

A physical architecture depicts the specific hardware systems and their physical interrelationships. This would include C2 centers (headquarters), information systems, communication systems and input sources (sensors, messages). [Ref 11:p. 68] It provides a more detailed look at distinct communication links between all the internal and external components that the C2 system must integrate and interact with. It interconnects the various functions which were laid out in the functional architecture to accommodate information flow.

Using the artillery example again. A physical architecture might include a sensor which relays targeting information back to the decision maker (commander) over a radio channel. The function to be performed is to fire on target. The sensor provides the information via a radio link (medium) to the decision maker, a computer processes the information, and the commander makes a decision to fire. The architecture can be mapped to the C2 process (Lawson-Loop).

With the emerging threat requiring more joint operations, one can see how it is important to have a robust, flexible, interoperable architecture in place.

The problem of interoperability between services has moved Congress to emphasize jointness in the acquisition of C2 systems. Each service can no longer go out on their own and purchase C2 systems without coordinating with the other. Those involved with the developing of requirements and the acquisition of the systems to satisfy the requirements have a challenging road ahead.

C. DEVELOPING C2 SYSTEM REQUIREMENTS

One of the most difficult problems when working with C2 systems is defining the requirement to meet the needs of the commander. A requirement is an established need which justifies the allocation of resources to achieve a capability to accomplish approved objectives, missions and tasks. The requirements process must be balanced between the resources available, the technical capability and the mission. The resources are constrained by Congress. The technical capability is determined by the contractors. The mission is governed by such things as national objectives and strategies, and the threat. What makes defining C2 system requirements difficult is changes in:

threat to forces commanded, geography of the theater or type of forces commanded, doctrine, rules of engagement, scenario, battle situation, status of systems being controlled, and especially as commanders and/or their terms of reference change. [Ref 6:p. I-12]

When developing C2 system requirements, the planners must "define a coherent set of long range goals, consistent with and strongly related to national security strategy." [Ref 15:p.10] Some would contend that not enough thought is given to national strategy when developing C2 system requirements:

First, I think we have to think more about national strategy, to learn its jargon and the relationship of C3 to that strategy. Secondly, given the cause and

effect relationship, the effect of C3 systems on strategy and vice versa, we must be very careful not to mislead either ourselves or those who make or implement strategy decisions; mislead in the sense that we, or they, have too rosy a view about the practical realities of what we can do with communications, electronics, computers, etc.. [Ref 16:p. 10]

A strand of fiber runs all the way through from national strategy to the technology required to satisfy the requirement. It is imperative that the C2 system planners see the many interfaces involved when developing the requirements.

The unique requirement of integrating the construct of hardware, software, people and procedures to meet the needs of the commander requires a different approach in the acquisition process. Several studies have proven that traditional acquisition methods will not afford a quality C2 system.

C2 systems cannot be acquired successfully via the traditional approach, wherein a detailed total system requirement and resulting total system definition is established "up front," followed by development of the "total" solution. [Ref 6:p. III-4]

To remedy that problem an approach called evolutionary acquisition was developed.

Evolutionary acquisition is:

a system acquisition strategy in which only a basic or core capability is acquired initially and fielded quickly, based on a short need statement that includes a representative description of the overall capability needed and the architectural framework within which evolution will occur. Subsequent increments or blocks are defined sequentially, based on continuing feedback provided from lessons learned in operational usage, concurrent evaluation of adequacy of hardware/software configuration, and judgments of improvements or increased capabilities that can result from application of new technology where feasible. [Ref 6:p. I-15]

Thus the system is built in blocks or phases allowing for future capabilities. Build a little, test a little. This type of approach is convenient because it accommodates such things as changes in the threat or mission. The requirements process is not a one shot process, but rather a process that is done continuously. Each requirement

must be seen in the "context of its individual contribution to the overall C3I solution matrix in concert with companion systems." [Ref 17:p. xii]

D. A LOOK AT SOME CURRENT C2 SYSTEMS

The evolution of C2 systems is very much contingent upon the mission it is to support. The mission is based on the threat, and our national and military strategies. The objective of this section is to show that the predominant strategy guiding the evolution of C2 systems is based on the strategic nuclear threat and the conventional threat in Europe. When taking a cursory view of the C2 systems that are fielded or in the process of being fielded, one can ascertain the threat and military strategies that drove those requirements.

One of the key issues that has fueled significant growth in the expenditures for C2 systems is the nuclear threat. The ever-present threat posed by nuclear war and our policy of deterrence designed to prevent it have given a major impetus to the dynamic evolution of C2. [Ref 18:p. 73] President Reagan's policies emphasized the need for an enhanced C2 system to support the nuclear strategic mission. In National Security Directive 91, President Reagan directed that the improvement of command, control, and communications systems supporting our strategic forces be the top priority. [Ref 19:p. 30] The services took action to improve connectivity from the sensors to the National Command Authority (NCA) and then to the nuclear forces. "Improved coverage and sensor survivability for attack warning and assessment, and enduring force management" [Ref 19:p. 30] were part of the strategic modernization program.

Some of the key systems to support the President's objectives were the "military strategic/tactical and relay (Milstar) satellite system and the ground wave emergency network (GWEN)." [Ref 19:p. 30]

The Milstar system will provide reliable, jam-resistant, survivable satellite communications for tactical and strategic users. GWEN will provide commanders of strategic forces with the ability to maintain critical continental United States long-range command and control connectivity in both the trans and post-attack phases of conflict. [Ref 19:p. 30]

The priority of strategic C2 systems appear to remain at the top when it comes to C2 system modernization.

Another phenomena that is driving the evolution of C2 systems is the significance of the European theater in our military strategies. More money continues to be poured into Europe to enhance the C2 infrastructure. General Thurman Rogers noted

We have developed a tremendous network of interconnected C3I systems for the European theater, but what happens when we are strategically deployed to a crisis situation in an area of the world where Defense Communications System (DCS) facilities are not available. [Ref 5:p. 58]

With US military strategy geared toward a war with the Soviet Union in the European theater, the C2 systems to support that strategy have been given greater attention.

Systems such as the Joint Surveillance and Target Attack Radar System (JSTARS) and Joint Tactical Information Distribution System (JTIDS) are being developed to strengthen our forces in NATO. JSTARS is an Air Force/Army airborne radar and command and control system being developed to detect, track and direct tactical weapons against stationary or moving ground targets from standoff range. [Ref 19:p. 85] Its development is "motivated by the need for NATO force

to be able to accurately apply conventional weapons at long range to halt, or deter, a Warsaw Pact armored assault against Western Europe without crossing the nuclear threshold." [Ref 19:p. 85] The JTIDS is a digital system that provides secure, jam-resistant channels for transmitting data and voice communications. [Ref 19:p. 89] The JTIDS is being designed to counter the existing electronic countermeasures threat to US communications by Warsaw Pact forces. [Ref 20:p. 2]

E. SUMMARY

Command and Control is a concept that continually takes on new meaning. In its simplest form it is a process. The C2 system is designed with an understanding of the process. A C2 system architecture is developed to provide a framework for the C2 system to support the C2 process. An architecture can be subdivided into three distinct sub-architectures: organizational, functional, and physical. A C2 system requirement is developed to achieve a capability to accomplish an approved mission. These requirements must be "consistent with and strongly related to national security strategy." [Ref 15:p. 10] Requirements must be acquired through an evolutionary approach. C2 system planners must be familiar with the strategic planning process to ensure that future systems will be functional in the most plausible future threat environments. Chapter III will explore strategic planning in greater detail.

III. FUNDAMENTALS OF STRATEGIC PLANNING

What we don't have today is the long term strategy and plans that will serve as beacons for our decision makers and as our strategic direction for the future. [Ref. 21:p. 23]

A. INTRODUCTION

This chapter provides a framework for the understanding of the strategic planning process. Strategic planning is concerned with both the definition of goals and objectives for an organization, and the design of the functional policies, plans, and organizational structure and systems to achieve those objectives. [Ref 22:p. 3]

In order to define the major elements which compose strategic planning, a general survey of the literature will be presented to see the similarities and the differences in the field. Hence, a consensus definition will be derived and broken down into its key components. Two strategic planning models (Ascher and the Air Force) will be observed to show the functional relationships of the components.

B. STRATEGIC PLANNING - DEFINITION

Strategic planning like command and control is a term that means different things to different people, however there appears to be less deviation in definition which is not the case for C2. Like C2, strategic planning is a process. Its main purpose is to "select future areas of activity and future courses of action for the organization." [Ref 23:p. 4] According to James B. Whittaker in Strategic Planning

in a Rapidly Changing Environment, Strategic planning in the corporate world involves:

analyzing the environment of the firm to determine specific threats and opportunities; evaluating the firm to determine the key skills and resources that could be used to develop a competitive strategy in a given product-market situation; integrating the unique skills and resources with the specific opportunities in the firm's environment; establishing corporate objectives for where the company wants to be at a certain time; and creating a number of corporate policies, plans, programs, and tasks to successfully accomplish the objectives that were established. [Ref 22:p. 4]

This definition clearly shows a step by step process applicable for the corporate world. K. J. Radford in Strategic Planning: An Analytical Approach, shows a similar process. Planning involves:

visualizing possible future situations in which the organization concerned might be involved; placing these situations in an order of preference relative to the objectives of the organization; and considering ways in which the most preferred of the future situations considered can be brought about and the least preferred avoided. [Ref 23:p. 1]

Both of the above definitions are systemic in nature. Some authors contend that too much is made of the systemic aspects of strategic planning. George Steiner in his work, Strategic Planning, states that strategic planning "is more of a thought process, an intellectual exercise, than a prescribed set of processes, procedures, structures, or techniques." [Ref 24:p. 14] He agrees with the other authors that planning means "designing a desired future and identifying ways to bring it about," [Ref 24:p. 14] but he warns planners to be careful not to be so bogged down with the procedural aspects that plans become cast in bronze. Another point that Steiner emphasizes is the need to set specific objectives. He bluntly states, "a strategic planning process will not get very far if at some point specific objectives are not set."

[Ref 24:p. 39] These definitions are systemic, but not rigid and allow the planner some intellectual freedom in the process.

The above definitions were more appropriate to the corporate world although conceptually they can easily be applied to the military. To get the military orientation, the U.S. Army War College published a document, "An Approach to Long-Range Strategic Planning". This document stated that the most common method of strategic planning consists of "identifying a set of fixed interests, juxtaposing them on a fixed environment (or world, or set of conditions) and then creating a strategy for attaining the national interests within the constraints imposed by the environment." [Ref 25:p. 1] Strategic planning is looked at as a methodology.

All four references of strategic planning have some common ground. Although Steiner sees it more of an intellectual exercise or thought process, four significant components are clearly seen; objectives and/or interests, future environment, resources and strategy. These four components are very much entrenched in the other definitions. Radford and Whittaker say pretty much the same thing in a more verbose way. The Army War College document is the most precise. The next section will expand on these four key components of the strategic planning process.

C. COMPONENTS OF STRATEGIC PLANNING

The strategic planning process can be explained more simply if broken down into its most fundamental components. The fundamental components are broken down into objectives, future environment, resources and strategy. Now that these are identified, the next question is; which comes first? Clearly, strategy is last as this

is the output of the strategic planning process. Do we look at the future first, or do we establish objectives first? What about resources?

If the actor has a great deal of influence, developing objectives before looking at alternative futures is reasonable. If the influence is low, it makes more sense to look at the environment and see what opportunities (choice of objectives) are available. [Ref 26:p. 60]

1. Objectives

Good organizational objectives must be established if strategic planning is to be successful. Poorly established objectives will lead to poor strategies. Objectives can be derived from interests. The Army War College model and the Asher model use interests in lieu of objectives as the major component. U.S. national security objectives are statements of broad goals which support and advance national interests. [Ref 27:p. 4] A sequence can be seen. Interests lead to objectives which finally lead to strategies. So in order to establish good objectives, interests need to be stated clearly.

When describing interests the planner must be careful not to be too specific. Specific interests change quickly over time and do not allow much room for uncertainty. The key is to "state the interests at a sufficiently high level of generality that they will not change greatly during the time period under consideration." [Ref 28:p. 22] It is also important that the interests are not too vague, or it will be difficult to establish concrete objectives. An example of a U.S. interest is "the survival of the United States as a free and independent nation, with its fundamental values and institutions intact." [Ref 27:p. 4] A principal objective

which would support our national interest is "to maintain the security of our nation and our allies." [Ref 27:p. 4]

Clearly, interests and objectives provide the framework in which strategy is developed. Many of our problems in developing a grand or military strategy can be attributed to a lack of consensus on what is the national interest. It is very difficult, if not impossible to find individuals in the Executive branch or Congress who come to an agreement on what is the national interest. Many times this can be attributed to parochialism or a fragmented approach to defining interests. This problem will grow as more and more individuals get their hand in the policy-making arena.

2. Future Environment

The projected future environment also plays a crucial role in the planning process. The planner attempts to design a desired future and then identify the ways to bring it about. Designing a future environment is more difficult than it looks. Under this approach the planner assumes some control in shaping the future. A good planner will identify several plausible alternative futures to validate the process. This will be done so that "whenever planning and programming is done it will be accomplished with a realistic consideration of more than just the present world extrapolated in the distant future." [Ref 21:p. 3] It is very dangerous to put all the eggs in one basket when it comes to defining alternative futures. One contention from this author and others is that most strategic planning in the military is centered around a war with the Soviet Union in Europe.

...most military planning being done in the United States and Western Europe assumes that the Soviet Union will remain the predominate adversary for the foreseeable future; hence, there is little point in spending time thinking about emerging adversaries. ...it is time to go through the agonizing process of consideration of other potential adversaries in conjunction with a changing bilateral relationship with the Soviets themselves. [Ref 21:p. 4]

In the military, one of the key drivers in determining force structure, weapon procurement, C2 systems and tactics is the threat. Military intelligence analysts continue to project the future threat to provide justification to Congress for the resources required to adequately meet that threat. With the recent events in the Soviet Union and Eastern Europe, Pentagon planners are having a difficult time justifying to Congress many of its programs. This trend can be expected to continue in the next two decades.

When identifying alternative future environments planners must be careful not to be too fragmented. Problems arise when DOD looks at the future in purely military terms, and the State Department looks at the future in only foreign policy terms. National security planning and programming which is based almost exclusively on expectations of military threats can bankrupt the United States. [Ref 21:p. 21] Politics, economics and social factors must be considered when developing alternative futures. No longer does the military threat stand alone, there are too many other factors spun in the web of national security planning.

3. Resources

Before a worthwhile strategy can be developed the planner must look at the resources that are at his disposal. What resources are going to be required to meet our national interests in the projected future environment? If resources are

constrained, there is no reason to develop a comprehensive strategy that will consume more resources than are available. Understanding this will be extremely important for DOD in the years ahead as Congress in all likelihood will divert resources from defense to social programs as Americans see our national security threatened more by AIDS, drugs and crime.

All three definitions speak about the means necessary to reach their objectives in the future environment. Whittaker's definition talks about "integrating the unique skills and resources with the specific opportunities in the firm's environment." [Ref 22:p. 4] Radford states an organization must "consider ways in which the most preferred of the future situations can be brought about." [Ref 23:p. 1] Clearly from intuition, the "ways" that Radford speaks of is going to be bounded by the resources available within the organization. The Army definition says you "create a strategy for attaining the national interests within the constraints imposed by the environment." The environment also includes those resources that the organization has available to attain the national interests.

Resources encompass much more than money. It also includes such important things as time and level of effort. Within an organization or the military these intangible things are very important. You may have all the money in the world to meet your objectives, but if such things as morale, initiative and corporate cohesion are lacking it may be very difficult to accomplish the objectives. The planner must consider not only the tangible resources but the intangible resources at his disposal as well.

4. Strategy

Developing strategy is the goal of the strategic planning process. Interests are first identified, then alternative future environments are developed, and finally strategy is developed to influence the environment in such a way as to satisfy the interests and objectives. Many times strategy is looked at merely in the military context. This outlook creates fragmentation which was mentioned earlier. A definition of strategy can be found in JCS Pub 1:

The art and science of developing and using political, economic, psychological, and military forces as necessary during peace and war, to afford the maximum support to policies, in order to increase the probabilities and favorable consequences of victory and to lessen the chances of defeat. [Ref 3:p. 350]

Strategy is a term that can be interpreted in many different ways. Gregory D. Foster in his paper "A Conceptual Foundation for the Development of Strategy" characterized strategy as: a paradigm; as a philosophy of global conduct; as an exercise in perceptions management; as a map to the future; as the marriage of ends and means. [Ref 29:p. 17] Some view strategy as an art, while others see it as a science. The JCS definition states it as an art and a science. The scientist would see strategy as a concrete plan with quantifiable measures of performance, whereas, strategy as an art would be more from an intuitive standpoint or as a method of thought.

However the planner views strategy it is imperative that his philosophy is known and everyone in the planning process is onboard so everyone is playing to the same tune. Difficulties arise when planners at the higher levels see strategy merely in their own arena. This has been a common problem in DOD. The individual

services were many times marching to different drumbeats when developing strategy. This is one big reason why the services have interoperability problems with their C2 systems. Their parochial views of seeing the threat and finding the best way to counter it are often done without any coordination. The Army has its plan to meet the threat, so does the Navy and the Air Force. This leads to the services going out and buying their own systems. This approach led to great problems in C2 in the invasion of Grenada.

When developing strategy it is very important to understand what level of strategy you are working from. Is it a purely military strategy or one that uses political and economic muscle also? If it is a military strategy, is it a tactical or theater decision? There are clearly different levels of strategy. Strategy can be broken into more definable levels. Coming to a consensus on what are the levels of strategy is no easy task. Many strategists have their ideas of how the breakdown should be. John M. Collins in Grand Strategy: Practices and Principles, reflects five distinct decision-making levels: grand strategy, military doctrine, strategy, operational art, and tactics. [Ref 30] When developing strategy for war the breakdown may be tactical, operational, and theater. Edward Luttwak in his book Strategy: The Logic of War and Peace, goes further when talking about levels of strategy. He identifies five levels: technical, tactical, operational, theater and grand strategy. [Ref 31]

- **Technical**-The technical interplay of specific weapons and counterweapons. [Ref 31:p. 69]
- **Tactical**-The tactical combat of the forces that employ those particular weapons, and the strengths and weaknesses of those forces derive from all sorts

of intangible and material factors that are very different from the scientific and engineering limitations of weapons. [Ref 31:p. 69]

- Operational-The operational level governs the consequences of what is done or not done tactically. Again the factors conditioned by the logic are different: details of topography or disposition, for example, are now submerged, and it is the overall interaction of the respective schemes of warfare that matters. Events at the operational level can be very large in scale, but never autonomous; they are governed in turn by the broader interaction of the armed forces as whole within the entire theater of warfare, just as battles are merely parts of campaigns. [Ref 31:p. 69]
- Theater Strategy-It is at this higher level of theater strategy that the consequences of single operations are felt in the overall conduct of offense and defense-those overriding military purposes that scarcely figure at the operational level, in which a bombing campaign might be launched by defenders while the aggressor is preoccupied with air defense, and in which an attack can serve to better defend a front while holding operations on some sectors often figure in offensive warfare. [Ref 31:pp. 69-70]
- Grand Strategy-The entire conduct of warfare and peacetime preparation for war are in turn subordinate expressions of national struggles that unfold at the highest level of grand strategy, where all that is military happens within the much broader context of domestic governance, international politics, economic activity, and their ancillaries. Because ultimate ends and basic means are both manifest only at the level of grand strategy, the resource limits of military action are defined at that level, and so its true meaning: even a most successful conquest is only a provisional result that can be overturned by the diplomatic intervention of more powerful states or even repudiated by domestic political decision; by contrast, even a major military debacle can be redeemed by the political transformation it engenders, or undone by the newfound allies that weakness can attract in the usual workings of the balance of power. [Ref 31:p. 70]

This provides an example of the different levels of strategy. Breaking down strategy into levels add more complexity to the strategic planning process. Different strategists have different ideas concerning the levels of strategy. Luttwak was selected to give the reader a feel of one of the more complicated breakdowns.

D. COMPARATIVE STRATEGY - FUNCTIONAL RELATIONSHIPS OF COMPONENTS: THE ASCHER AND AIR FORCE MODELS

To bring more light on strategic planning and its functional relationships, a model can be examined to understand some of the interdependencies involved in the process. There are several models available. The strategic planning model developed in Ascher & Overholts' book Strategic Planning & Forecasting. Political Risk and Economic Opportunity, and the Air Force force structure model will be looked at to highlight these relationships.

1. Ascher and Overholt's Strategic Planning Model

Models are excellent tools which can be used by decision makers to aid in the decision making process. In a strategic planning model the analyst attempts to simulate the future environment so that strategies can be developed and tested to see which ones might be the most prudent to implement. Ascher and Overholt propose two models, one for actors who have little influence over the environment, and a more sophisticated model for actors who have considerable influence over the environment. The more sophisticated model will be explored because of the United States' considerable influence in shaping the environment. Some readers may beg to differ with this opinion based on the recent events in Eastern Europe.

Before describing the model certain critical problems with strategic planning must be addressed. Three of the most basic problems the planner deals with are:

- **Uncertainty** - Coping with the uncertainty resulting from inadequate knowledge and excessive complexity.

- Self-fulfilling and self-defeating prophecies - Coping with the fact that conditions are not fixed externally but are strongly affected by decisions.
- Fragmentation - Coping with the fragmentation of the policy-planning process into isolated regional and functional groups. [Ref 28:p. 21]

The first thing which must be accomplished in the model is the establishing of interests. This step in the process is often overlooked and given little attention. Describing interests in the face of uncertainty is the easiest part of the problem. [Ref 28:p. 22] When describing interests the planner must be careful not to be too specific. Specific interests change quickly over time and do not allow much room for uncertainty. Listing the interests is the first step. Interests are sometime intertwined with one another so tradeoffs with each of the interests may be required. After listing the interests the planner must:

second, attempt to weight the interests; third, evaluate the interest in the specific region and time period of interest; and fourth, comprehend as well as possible the ways in which the different interests complement and contradict one another. [Ref 28:p. 24]

After listing the interests, analysis of the future environment can begin. Describing the future environment in the face of uncertainty is a formidable problem. One principal solution to irreducible uncertainty is to project several alternative possible environments. [Ref 28:p. 26] An alternative future environment is a "description of a possible future state of events relevant to the planning object." [Ref 26:p. 50] It must be emphasized that an alternative future environment does not connote prediction, but rather is a tool that is used to systematically think about the future. In developing these environments the authors say that they "should be sufficiently few to be intellectually manageable, but sufficiently numerous to display

most of the important alternative outcomes of the trends in the world." [Ref 28:p. 26]

The Ascher and Overholt model conceptualizes the environment into three parts; Core, Environment 1...n, and Exogenous contingencies. These can be defined as:

- Core - the portion of the environment the actor can largely control relative to his interests or that is stable regardless of his actions.
- Environments 1...n - those portions of the environment that are distinct from each other and from the core and over which the actor has less influence.
- Exogenous contingencies - random, uncontrollable, or unpredictable events. [Ref 26:p. 57]

Simply stated the environment consists of deterministic elements (Core), possible elements (environments 1...n), and unpredictable elements (Exogenous Contingencies) [Ref 26:p. 57]

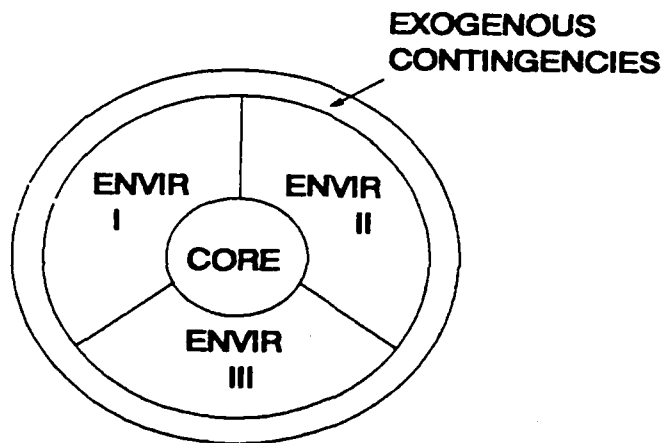


Figure 3 Ascher Model (Environments)

The next step in the model is to take the defined interests and project them on the environments to develop a strategy. Ascher & Overholt come up with an overall strategy which is made up of three parts: core strategy, basic strategy, and hedging strategy. The core strategy is developed to deal with the core environment, that part of the environment common to all of the projected environments. The core strategy consists of those actions that will achieve the actor's interests in the core environment. A core strategy is necessarily abstract and extremely flexible. [Ref 28:p. 31] Core strategies tend to be simple and straightforward and many times may constitute a national doctrine such as the Truman Doctrine.

The basic strategy has a dual purpose "to influence the environment toward the optimal one (hereafter called the basic environment) and to facilitate success within that optimal environment." [Ref 28:p. 30] Formulation of a basic strategy thus involves:

- Choice of a preferred environment.
- Design of a strategy for getting into the preferred environment.
- Design of a strategy for succeeding in the preferred environment. [Ref 28:p. 34]

The preferred environment chosen should be one that is practical and has a relatively high degree of certainty that it can be attained.

The hedging strategy is designed to deal with contingencies for which neither the core strategy nor the combination of core strategy and basic strategy is adequate. [Ref 28:p. 34] An example of a contingency which may not have been planned for is the historic change taking place in the Eastern Bloc nations. The

more comprehensive the basic strategy, the less likely it will be to develop an ad hoc hedging strategy. The following figure pictorially describes the Ascher & Overholt strategic planning model.

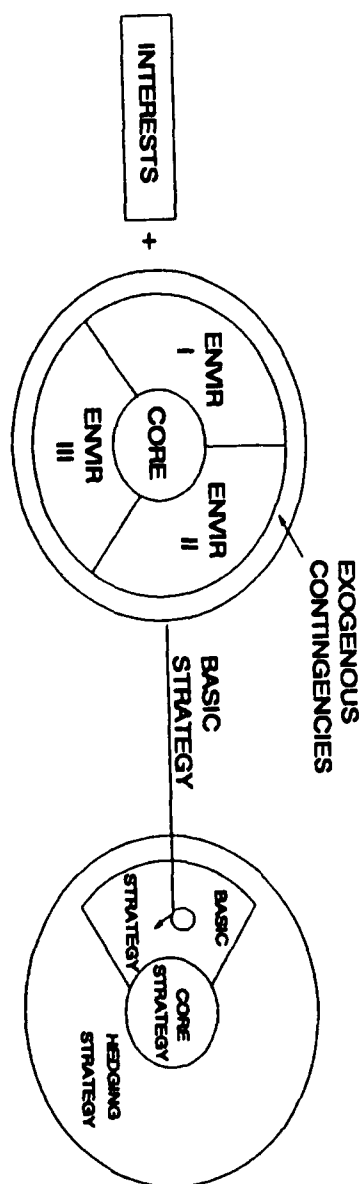


Figure 4 Ascher Model

2. The Air Force Model

The Air Force has long been a leader in strategic planning in DOD. It uses a variety of models to determine force structure, weapons procurement, and strategy among other things. Lt Col John Stewart in his work "Methods for Developing Alternative Futures and Long-Range Planning" interviewed Air Staff planners on methods for strategic planning. One example the Air Force uses for force structure development is the Air Force force structure development model.

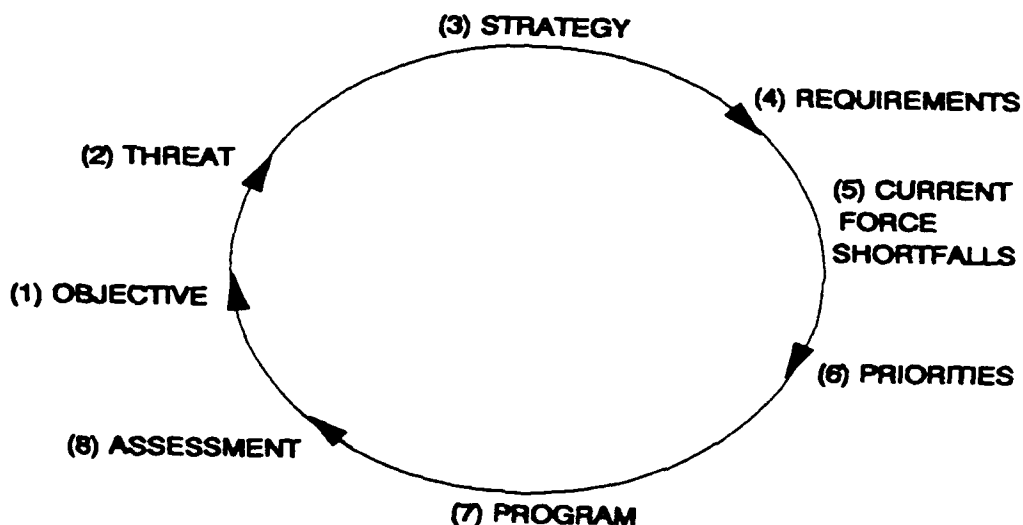


Figure 5 Air Force Model

The first step in the model is the development of objectives. Once the objectives are developed, they are compared to the threat. Based on that comparison a strategy is developed to meet the threat. Necessary force structure requirements are then developed to meet the goals of the strategy. These requirements are compared to current force levels to determine shortfalls. These shortfalls are then prioritized and become part of the acquisition program. The final step is an assessment of the acquisition program relative to the original objective. [Ref 26:p. 58] The process is an iterative one.

A notable feature of this Air Force model is that it is objectives, threat, and strategy-driven. [Ref 26:p. 59] These elements come from other planning processes such as the Defense Guidance and the JCS and DIA intelligence reports which specify the threat. Nothing is mentioned of alternative futures, however it can be assumed that the alternative futures are constrained by the threat and fiscal restraints. The fundamental building blocks in this model are threat and resources. There are similarities in both models such as establishing objectives up front. The Ascher and Overholt model is a little more specific in generating alternative futures. The point is that there are many models available to the planner. These two are just a few of the many available. The planner must choose one that is pertinent to his situation and one that he is comfortable with. Hopefully, this provides a better understanding of the functional relationships that exist between objectives, future environment and strategy.

E. SUMMARY

Strategic planning is a discipline that is gaining greater notoriety with the rapidly changing events. With a great change in the threat and projected decreases in the defense budget, it is going to be imperative that our military planners field systems that are functional in many types of environments. Getting the most bang for the buck is going to be even more critical in the years to come. Tomorrow's C2 systems must be interoperable and functional in many environments. Strategic planning models need to be developed that are responsive to the changes taking place. Identifying those changes in the future environment is going to be a greater challenge. With the changes in Eastern Europe, planners are going to have to stretch their imaginations beyond a war with the Soviet Union on European soil. The future appears bright and dynamic for the strategic planner. The next chapter will survey a few of the techniques available for developing alternative futures.

IV. DEVELOPING ALTERNATIVE FUTURES

This chapter will define and analyze the history of Futures Research. Several methods which futurists use for developing alternative futures will be discussed in some detail to provide a feel of what is available to the planner. These will include Trend Extrapolation, Genius Forecasting and Scenario building. Other methods in the spectrum which may be used will be briefly defined including regression analysis, leading indicators, complex models and the Delphi technique.

A. INTRODUCTION/HISTORY

Coming up with plausible alternative futures is a difficult but exciting exercise that stretches the intellect. It requires a unique individual with a creative imagination who is not limited to only extrapolating the present into the future. Developing alternative futures "forces the mind out of the lets plan for the most likely future which is so common yet so intellectually restrictive." [Ref 26 p. 4] The future is no longer something that can be ascertained easily. The changes that are taking place in Eastern Europe bear witness to the fact that the environment is changing rapidly. Futurist Olaf Helmer states:

The future is no longer viewed as unique, foreseeable, and inevitable; instead, it is realized that there are a multitude of possible futures, with associated probabilities that can be estimated and, to some extent, manipulated. [Ref 32: p. 17]

Futures research and synonymous terms futurology and futuristics, and those who perform (futurists) is not something new. In fact, some of the earliest futures

research can be dated back to the U.S. Army Air Force when Gen "Hap" Arnold "commissioned a study Toward New Horizons (completed in 1947) on future military technological capabilities." [Ref 33:p. 9] The military establishments were the pioneers in futures research and they "continue to provide extensive support to futures-oriented research." [Ref 33:p. 10] Futurology takes as its point of departure:

A belief in the laws of nature as postulated by modern physical and social science; and all of the methods used by futurists in attempting to forecast the future are based on the regularities of physical and social behavior postulated by modern science. [Ref 33:p. 16]

Futurists are more concerned with identifying possible alternative futures and assessing their probabilities of materializing, rather than predicting the course of particular sets of events. Futures research is utilized to aid the planner. All planners are therefore necessarily de facto descriptive futurists. [Ref 33:p. 24] There are many futures research methods available to assist the planner in identifying alternative futures. It is the planner who must decide which method is most applicable and will bring about the most plausible alternative futures.

B. TREND EXTRAPOLATION

Trend extrapolation is one of the most obvious and simple techniques available. It assumes that what has been happening in the past will continue to happen and that the direction of change and the rate of change can be extrapolated into the future. [Ref 33:p. 20] Trend extrapolation has many limitations but it is popular because it is rather quick, inexpensive, and does not require a great understanding of causal factors. It is a good starting point if the planner does not have familiarity with any of the other methods.

Trend extrapolation is an empirical analysis and "forces a decision on exactly what problem is of concern and on how that problem can be indexed numerically." [Ref 34:p. 250] The numbers do the talking because of a lack of understanding of the causal relationships. Understanding causal factors require rigorous intellectual thought. The planner must realize that these statistical time-series which are used to plot trend lines is not infallible. A trend in the past does not guarantee that the trend will continue into the future, however, understanding the trend can provide greater knowledge of likely developments. Most planners:

who engage in trend extrapolation are not so naive as to believe that trends must necessarily continue in the future as in the past. What is being posited is rather that certain causes are operating to produce certain effects and that unless one can find reason to believe that these causes will cease to operate as they have in the past, one must assume predictions based on this method will vary with one's assessment of the causes of existing trends and the likely stability of these causes. [Ref 33:p. 21]

Trend extrapolation continues to be the most widely used technique for developing alternative futures. It is many times used as part of a larger model. Its utility lies in its ability to be predictive with limited success. If one wants to understand the causal relationships, more vigorous analysis should take place. Used in the context of being used with other techniques, trend extrapolation is a good and rough prediction of the future and should be part of the planner's bag of tools.

C. GENIUS FORECASTING

No matter what technique the planner uses, there is no substitute for rigorous intellectual thought. Many great thinkers such as Asimov, Mead and Kahn who have a knack for looking into the future have added credibility to futures research. Their contribution to the field have resulted in a methodology called Genius Forecasting.

Genius forecasting is what results when a well-informed and bright individual examines the present and past and makes predictions about the future based on his own judgments. [Ref 33:p. 22] This does not say that the genius forecaster does not use some of the more developed techniques, but rather that "the final product is blended and evaluated by the individual forecaster in terms of his own sense of the direction in which the world is going." [Ref 33:p. 22]

The problem with genius forecasting lies with the fallibility of the individual. No individual has a complete grasp of the past historical events or can see into the future. The credibility of the genius forecast rests entirely on the individual doing it. This technique assumes that "the human mind presumably can detect subtleties of meaning that other approaches, which require categorization and formal measurement , cannot capture." [Ref 28:p. 85]

The attitude among the futures research community is to avoid genius forecasting as much as possible and utilize the many other credible methods available. Genius forecasting has an uneven record as a predictive method. [Ref 26:p 81] These shortcomings however, do not negate the contribution of genius forecasting to futures research. This method offers an innovative way to look out into the future without getting weighed down with some of the more mundane methods. The intellectual vigor that bright individuals have to offer can only enhance the process.

D. SCENARIO BUILDING

A method which is gaining popular support within the Department of Defense (DOD) is scenario building. Scenarios were developed for use in a recent revision

of the Joint Long-Range Strategic Appraisal, the DOD document which looks 10-20 years into the future. The Army has come out with a futures report which describe "four future alternative world scenarios (environments) that are plausible, realistic, and appropriate for Army planning." [Ref 35:p. 1] Herman Kahn, one of the more influential practitioners of scenario building describes scenarios as:

hypothetical sequences of events constructed for the purpose of focusing attention on causal processes and decision points. They answer two kinds of questions: (1) Precisely how might some hypothetical situation come about, step by step? and (2) What alternatives exist, for each actor, at each step, for preventing, diverting, or facilitating the process. [Ref 36:p. 6]

Scenario building is not a method in and of itself but rather uses other methods such as trend extrapolation, simulation, Delphi technique, etc... to develop scenarios. Scenarios are hypothetical in nature since the future is unknowable. They are not intended to be a prediction but rather a narrative or sketch that paints the environment at some near or far off time. The validity of methods used to build plausible scenarios is generally determined by a consensus of expert opinion. [Ref 35:p. 2] The methods utilized are generally qualitative in nature, however quantitative methods may be used if applicable. Methods are chosen to attempt to be "multifaceted and holistic in their approach to the future." [Ref 34:p. 226] The more comprehensive the scenario the better.

When developing scenarios, guidelines should be established to allow for the development of the most plausible alternatives. The Army used four guidelines to develop scenarios for the years 2005 and 2020 in their Futures Report at the Army War College:

- The logic and assumptions of the scenarios must be plausible over time.
- The scenarios must focus on issues relevant to Army interests.
- The scenarios must include valid trends and key variables that are realistic and challenge traditional Army stationing, training, doctrine, and employment concepts.
- The scenarios must be free of disruptive, aberrant, catastrophic, and anomalous events that would nullify their usefulness for long-range planning. [Ref 35:p. 3]

Adhering to simple guidelines such as the ones above will enable planners to develop more realistic scenarios.

Scenarios like the other methods contain flaws, especially since the other methods may be used in developing the scenario. A large amount of individual judgement is used in developing scenarios which takes us back to the problem with genius forecasting; the credibility of the scenario depends on the credibility of those building the scenarios. The selling point for scenarios lies in its adaptability to utilize some of the other methods to create specific scenarios tailored to the planning object.

E. OTHER METHODS

Several other methods which may be used for developing alternative futures include the following:

- **Regression Analysis**-The prediction of one trend or event based on its relationship with one or more other trends. The analysis will make possible predictions about events (the probabilities that events will or will not occur) through several variants of regression analysis, such as discriminate function analysis or probit analysis. [Ref 28:p. 71]

- **Leading Indicators**-A more modest variant of the regression approach. The direction of change in the trend under examination is presumed to depend on, or at least to be signaled by, earlier changes in the directions of other trends. Leading indicators are often used in economic forecasting. [Ref 28:p. 74]
- **Complex Models**-Encompass a wide range of approaches that have one thing in common: they specify two or more explicit propositions that share at least one factor or variable. Econometric models are distinguished by their reliance on equations whose constants are estimated on the basis of existing, actual data. [Ref 28:p. 75]
- **Delphi Technique**-An interactive method, which avoids face-to-face intimidation and groupthink by using several rounds of written questionnaires that give the participants feedback on what the others say and why they differ in their opinions. The comprehensiveness of considerations taken into account by each of the participants is likely to be enhanced. [Ref 28: p. 87]

These definitions provide a cursory view of the spectrum of methods available to develop alternative futures.

F. SUMMARY

Many methods are available to the planner. He must choose a method or combination of methods to help him paint a picture of the future so that strategies can be developed. Criterion for choosing a method must be developed. Such properties as plausibility, explicitness, comprehensiveness and simplicity should be considered. The method selected should be one that matches the planner's temperament and job. Some methods such as leading indicators and trend extrapolation would be more useful for economic forecasting. Some individuals are more scientific in nature and would be more comfortable with quantitative methods, while the creative intellectual might use genius forecasting or the Delphi technique. This chapter attempted to briefly expose the reader to several of the methods

available. There are many sources available which can provide a more detail study of the methods discussed in this chapter. Chapter V looks into the 21st century to examine the national interest and the threat.

V. BEYOND THE 21ST CENTURY: EMERGING THREATS AND THE NATIONAL INTEREST

In the next two decades the security environment facing the United States will change as a result of both broad economic, demographic, and military trends that are already taking shape, and specific shocks and discontinuities that, at present, can be recognized only as possibilities. [Ref 37:p. 1]

A. INTRODUCTION

This chapter challenges the traditional way by which DOD does threat assessments by taking a more comprehensive view of the national interest, and by going beyond the traditional view of the Soviet Union as our primary threat to a more multi-dimensional characterization of the threat. This chapter looks at several issues impacting the national interests in the 21st century including the future economy and some emerging social problems. Secondly, it projects the most likely international threats facing our nation in the year 2000. The Soviet threat will be briefly looked at followed by three of the more plausible threats the military may have to respond to: narcotics trafficking, low intensity conflict (LIC) in the Persian Gulf, and ballistic missile proliferation. Finally, instability as a threat will be briefly addressed. The findings from this chapter will be utilized in Chapter VI to identify the types of C2 systems DOD should pursue.

Strategy, military posture, weapons systems and the command and control systems that support them are constrained by the national interest, resources available, and the future threat environment. These are the fundamental building blocks in the development of strategy. Resources are interwoven in the national

interest. If national security is a major priority in the national interest then defense will grab a bigger share of the federal budget. Determining the national interest in the years ahead is a much easier exercise than determining the future threat environment.

B. THE NATIONAL INTEREST

Identifying national interests should be the first thing done in the strategic planning process. The interests should be stated at a high level of generality so that they won't change much during the time period under consideration. In the National Security Strategy of the United States written in 1987, five interests were identified:

- The survival of the United States as a free and independent nation, with its fundamental values and institutions intact.
- A healthy and growing U.S. economy.
- The growth of freedom, democratic institutions, and free market economies throughout the world, linked by a fair and open international trading system.
- A stable and secure world, free of major threats to U.S. interests.
- The health and vigor of U.S. alliance relationships. [Ref 27:p. 4]

In this document it is stated that our national security strategy is based on "a solid understanding of U.S. interests and objectives and a realistic approach to dealing with the Soviet Union and other threats to U.S. security." [Ref 27:p. 4] Two key points about this statement need to be amplified. A solid understanding of U.S. interests is required, and the Soviet Union is seen as the principal threat to our national security. The questions which must be considered are: Will these interests

be the same in the year 2000, and second, will the Soviet Union be our primary threat?

"A healthy and growing economy" [Ref 27:p. 4] is listed as the U.S.'s number two interest. Clearly, the number one interest of "the survival of the U.S. as a free independent nation" [Ref 27:p. 4] will remain number one, but will the state of the economy and other emerging factors overshadow the number one interest because of our perception of a decrease in the Soviet threat? The answer to this question will have a direct impact on our military posture.

1. The Future U.S. Economy

Trying to envisage the future of the U.S. economy alone is difficult and inevitably shrouded in uncertainty. [Ref 38:p. 2] The most accepted and practical indicators of the strength of the U.S. economy is the GNP. The Rand Corporation has developed some GNP projections for the Future Security Environment Working Group of the Commission on Integrated Long-Term Strategy. Two important points about the estimates are important to note: first, the growth rates reflected in the following estimates are derived rather than assumed; second, the estimated GNP figures for the period 1987-2010 are intended to be consistent with the actual GNP figures for 1950-1986. [Ref 38:p. 3]

The average annual growth rate for the United States is estimated at 2.6 percent per year, which will give us a \$4.682 trillion GNP in 1990, a \$6.072 trillion GNP in 2000, and a \$7.859 trillion GNP in 2010. [Ref 38:p. 4] An interesting observation from the Rand Report should be noted; by 2010, the combined national products of the East Asian countries (Japan, China, South Korea, and Taiwan) will

exceed the GNP of the U.S. (8.5 trillion 1986 U.S. dollars versus 7.9 trillion for the United States). [Ref 38:p. 6] This gradual shift in economic power to the Pacific rim may well shift our national interest emphasis from Western Europe to the Far East.

One thing remains certain; the U.S. will continue to exert considerable economic influence in the international economy. Whether or not a 2.6 percent growth rate is accurate, an even smaller growth rate will still put us ahead of the pack. This author projects a smaller growth rate in the economy somewhere between one and two percent per year. Too many large problems loom over our head which will not be resolved in the near future. The federal deficit will continue to be large and sap much needed capital from industry which will mean less capital for research & development (R&D) and modernization. The U.S. personal savings rate will pick up some in the 90s but will be further behind other developed nations in the year 2000. How government, industry and the American people respond to these issues in the 90s will greatly influence the state of our economy in the year 2000 and beyond.

2. Emerging Social Problems

The contemporary national interest is part of a much larger context which goes beyond protecting our borders from foreign powers. Social problems which took a back seat in the Reagan years on the policy agenda will threaten our national security in the next two decades. Across the nation the public is calling on the federal government to solve many of our social woes. No longer does the American public see the Soviet Union as the primary threat to their security but rather they

see a multi-dimensional threat. They see drugs, crime, AIDS, the environment, and care for the elderly as imminent dangers facing our nation. With the recent events in the Soviet Union and Eastern Europe, the public and elected officials will call for a reduction in the defense budget, and more funds appropriated to resolve our social problems.

In recent polls the drug problem has been considered the number one problem facing our society. Drugs will continue to be a large problem into the 21st century consuming an increasing share of the federal budget. Demand for drugs will decrease some in the 90s but there will continue to be a large market for the drug dealers. The public will ask for increased resources to fight this menacing problem. The military will be tasked to share an increased responsibility in this war on drugs. This will have an impact on force structure, tactics, missions and C2 systems.

Another trend that may affect the future security environment is the rising incidence of AIDS in many areas of the world. [Ref 37:p. 11] The U.S. government will find itself spending more money to combat this epidemic. The cost of health care for this problem is estimated to rise to \$70 billion by 2000 if current levels of care are continued. [Ref 37:p. 11] That level of spending will consume a large share of the federal budget. The AIDS problem will also cause other nations to prohibit access to basing facilities to prevent further spreading of the virus by U.S. servicemen.

Drugs and AIDS are two of the more major problems that will affect our national security and influence our national interests. Other problems such as crime, the environment, and the elderly must also be considered in the national security

equation. The point of this section is to emphasize how the state of the economy and social issues will guide our national interests and have a direct impact on federal spending and the posture of the future military. The other key factor in deriving strategy; the threat, will be discussed next.

C. EMERGING STRATEGIC THREATS (INTERNATIONAL ENVIRONMENT)

Trying to determine the threat ten to twenty years into the future is probably the most difficult part in the strategic planning process. Recent events in Eastern Europe attest to the fact that we live in a volatile world that can change rapidly. In surveying the literature, this author found no one who predicted the collapsing of communism in Eastern Europe so soon. Despite the volatility in the international environment it is imperative that planners attempt to anticipate the threat as best they can. This section is an attempt to do that.

The international environment is large and the potential threats to our national security are immense. The Soviet Union has predominately been viewed as the major threat to our security. U.S. military strategy has been centered around a war with the Warsaw Pact in Central Europe. The Soviet Union will continue to be our major military competitor based on the size of its past investments and its trend toward strategic modernization and its intense effort in R&D. The questions which must be asked; will the Soviets continue to be the most likely threat to our national security or will other threats emerge that will create greater instability and require a response from our military? The next section addresses the Soviet threat briefly, and then centers on three of the more likely threats our military will have to respond to in the years 2000 and beyond.

1. Soviet Threat

The overall Soviet strategy has been to use its increased military power to negate that of the United States and to employ it as a coercive factor in diplomacy vis-a-vis its neighbors in order to preserve and extend the Soviet empire. [Ref 39:p. 13] Will the Soviets continue on with this strategy of expanding its empire via their military machine? The poor health of their economy will prevent them from continuing on the path of increased military spending. Soviet leaders have recognized that a stronger economy is necessary if they are to remain a world power in the years ahead. Soviet leader Mikhail Gorbachev is looking for breathing space to permit the necessary domestic reforms and allow for future modernization of the military.

The Soviets are very concerned that if their economy does not pick up that the U.S. will widen the technology gap. Soviet experts now stress the need to emphasize qualitative improvements- in the sense of exploiting advanced technologies in force planning and military concepts. [Ref 40:p. 43] They will emphasize the qualitative modernization of their military, while at the same time push for initiatives in arms-control and threat reduction. Senior Soviet military personnel are now holding aloft the qualitative modernization of the Soviet Armed Forces as a scientifically established and politically-oriented goal. [Ref 40:p. 39]

Soviet military planners will emphasize key technologies such as improved C3I which include reconnaissance, surveillance, target acquisition and battle management. They will also be concentrating R&D efforts in advanced conventional and physical-principal weapons systems. The Soviets recognize that the scope and

speed of war will change in the years ahead with the advent of precision guided munitions and weapons utilizing lasers and directed energy. They will continue to exploit space for military applications. It is evident that the Soviets recognize the impact of high-technology initiatives on the future battlefield. This thinking will guide their strategies and military posture in the years to come.

The Soviet Union will continue to be our greatest threat regardless of the success or failure of Mikhail Gorbachev. Although they are rethinking their philosophy towards capitalism and the U.S., they will not change their views about the legitimacy of capitalism and the destiny of socialism as the leader in a new world order. It must be emphasized that they will be the only nation in the world with the capability to destroy the United States in the year 2000. We must be cautious and prudent with the changes taking place in the Soviet Union and in Eastern Europe. Even though they are the greatest threat, doubts remain if they will be the most likely threat. This author sees other threats to our national security more probable in the years ahead.

2. Narcotics Trafficking

Narcotics trafficking out of Latin America represents the most dangerous threat to U.S. national security interests since the Cuban Missile Crisis of 1962. [Ref 41:p. 27] This threat breeds violence, promotes instability and threatens governing institutions wherever it is found. The type of instability that is generated from this enormous threat to national security is a breeding ground for low intensity conflict (LIC). The illicit production of drugs is a major threat to U.S. interests today and

will continue to be so for the immediate future (and more than likely into the 21st century). [Ref 41:p. 32]

U.S. consumption of illegal drugs from Latin America and Southwest Asia is not only threatening our survival as a nation, but the very nations who supply them. American consumers provide more of the money that underwrites illicit drug production, processing, and trafficking worldwide than any other nationality. [Ref 42:p. 63] This consumption of illegal drugs not only undermines our society and the values we hold dear, but it funnels enormous amounts of cash into the hands of thugs and criminals who are many times declared enemies of this country. The illegal use of drugs has a staggering effect on our economy.

Credible estimates of the aggregate annual financial impact of U.S. drug consumption--taking into account lost productivity, clinical costs, public information campaigns, and expenditures within the law enforcement, court, and penal systems, as well as efforts abroad to interdict smugglers and to eradicate the plants--approximate expenditures each year for national defense. [Ref 42:p. 64]

The American public has recognized the drug problem as the number one problem facing our nation, and have called on the president to provide aggressive leadership to tackle this menacing problem. The president in his 1991 budget gave a substantial increase in funding to ameliorate this problem. It was the biggest increase for any specific program in the budget. The new drug strategy called for an increased role by the U.S. military. This increased role will be "larger, nationally and regionally coordinated and intended to assist the law enforcement agencies and local governments to delay, disrupt and destroy all stages of illicit drug production and distribution." [Ref 41:p. 29]

The U.S. military will find itself involved with a new threat to national security to which it is unaccustomed. This new threat falls in the realm of LIC, however there are some key differences between drug trafficking and past experiences with LIC. The main difference being; that drug traffickers are not politically motivated, but rather money motivated. The drug kingpins see themselves as astute businessmen taking advantage of the law of supply and demand. Their main objective is not to overthrow a government or for that matter run one, but rather they are motivated by the huge profits that come from the distribution and sale of their product.

A formidable problem lies in their ability to build a large security apparatus around them to prevent their government or any other foreign government such as the U.S. from penetrating their organization. Cocaine trafficking is a particularly poisonous form of LIC in that the traffickers are ruthless, organized and innovative, and they possess resources that would be the envy of any guerrilla movement. [Ref 41:p. 29] Colombia is a nation that has been ravaged by the ruthless drug cartels. Half of Colombia's supreme court justices, and more than two dozen other judges have been assassinated, as have the editor of the nation's second-largest newspaper and hundreds of police officers. [Ref 42:p. 68]

Because of the cartels' large coffers of U.S. dollars generated by the profits of their product, they will continue to buy state of the art military equipment to support their organization. There have even been recent reports of their intention to acquire surface to air missiles (SAM) which can be acquired in the international arms market. Other problems will arise when these cartels line

themselves up with politically motivated terrorist and insurgent organizations. These thug like organizations are hired to provide security to the drug traffickers. The traffickers have used the proven tools of psychological operations--ethnocentrism, armed propaganda and money--to gain the support of the population in their area of operations [Ref 41:p. 29].

Another obstacle that the U.S. will have to overcome is the extensive signals intelligence (SIGINT) apparatus the cartels have in place. The traffickers spend an estimated \$125 million per year on SIGINT technology and equipment. [Ref 41:p. 31] With this equipment the traffickers are able to intercept U.S government communications which allows them to be one step ahead of the law enforcement agencies. This has been a very big problem in the past as U.S. government agencies many times used unsecured communications.

The drug war is presently underway, however this problem will not go away immediately. There have been some substantial progress made under the president's new drug strategy, but it's only the tip of the iceberg. This problem will continue to jeopardize national security in the 21st century and beyond. The U.S. military will continue to find itself taking on bigger roles to eliminate the drug problem. New tactics will need to be developed by the military. C2 systems will play a very important part in fighting this war on drugs as new technologies are developed.

3. Low Intensity Conflict (LIC) in the Persian Gulf

At the turn of the century the U.S. will continue to find its interests threatened in many areas of the world by LIC. LIC refers to insurgencies, organized

terrorism, paramilitary crime, sabotage, and other forms of violence in a shadow area between peace and open warfare involving larger units. [Ref 43:p. 26] This is a type of warfare that U.S. armed services normally don't prepare for. The traditional American view of war has centered around a direct engagement with a foreign force utilizing all the resources available to decisively defeat it by combat operations. LIC calls for intrinsically indirect operations, that is, support for objectives fundamentally political, economic, or psychological in nature [Ref 43:p. 26].

This type of warfare is being waged today on many fronts and will continue well into the 21st century. Volatile areas, primarily Third World countries will be the staging areas for LIC. Areas as close as our backyard (Central America) will be ripe for this type of conflict. As population growth rates and unemployment increases, many nations like Mexico will pose serious risks to political and social stability which will in-turn affect immigration to the U.S. One area with the greatest potential for instability and LIC which this thesis will focus on is the Persian Gulf region.

The Persian Gulf region is an area rich in history and oil. Our fundamental interest in the Gulf has lain and continues to lie in assuring secure access to its oil. [Ref 44:p. 91] Even though the U.S. has taken some significant measures in developing a stronger energy policy since the devastating oil embargo of 1973, we are and will continue to be very dependent on Persian Gulf oil well into the 21st century. Our allies in Europe and in Japan will also have a very strong interest in this area as they will import upwards from eighty percent of their requirements from the area. Another embargo or even worse yet, the takeover of

the oil fields by a hostile regime could prove devastating to the West. We must have solid policies in place to prevent this from happening.

The biggest threat to this region albeit the most unlikely is the Soviet Union. If the Soviets were to disrupt the flow of oil and capture a sizeable part of the huge cash flow the Gulf generates, the balance of power would shift in their favor. They have always regarded this area of the world as critical to their national security, and have a strategic advantage by virtue of its geographical proximity to the gulf. With a much more capable airlift and access to better airfields, it is not unthinkable for them to put a large amount of forces on the ground rapidly before we would have adequate time to block them.

The Arab-Israeli conflict will continue to provide the Palestinian Liberation Organization (PLO) and other radical islamic factions incentive for terrorist acts against Israeli and U.S. interests. The U.S. will support a sovereign Israel. Israel has strong historical ties to this region and will not give up the land they have fought for. Giving up the Golan heights, West Bank, and the Gaza strip will jeopardize Israeli security. These ties go all the way back when God divided the land between the twelve tribes of Jacob. If anything, the Israelis believe they have rights to more land then they presently occupy. Much of Syria, Lebanon, and Jordan once belonged to the Jewish people.

The Arab frustration with Israel will be vented against not only Israel but also the U.S. who will be Israel's main supporter. Terrorism will continue to reign in that area with U.S. interests targeted. The oil industry will be at risk. American citizens in country and abroad will be potential targets. Further efforts will be made

to establish terrorist activity in the U.S. The U.S. will find itself in unenviable positions as it supports Israel.

Another threat which will create instability in the region will be the war between Iran and Iraq. Both nations will find their patience wearing thin with each other and inevitably end up in war. Religious differences, territorial disputes, navigational rights along with intense bitterness from the last war will be the kindle which starts the fire. In the year 2000 both nations will have highly lethal weapons including nuclear weapons. The threat of escalation will have to be reckoned with. U.S. interests- primarily the secure access of oil will be in jeopardy.

The Persian Gulf will be one of the most unstable regions of the world. The Arab-Israeli conflict will provide the fuel for further tensions. Several of the Middle East nations will be led by radical factions of the Islamic faith. As we have seen in the past, it is not uncommon for them to sacrifice lives including their own for their cause. This trend will continue in the future. The problem grows larger as these radical nations obtain highly lethal munitions including nuclear weapons. The U.S. military may be called on to secure access to the oil supply and protect other U.S. interests in the region. The level of conflict in all likelihood will be low. Ballistic missile proliferation which will be a problem in the Persian Gulf as well as in other areas will be examined next.

4. Ballistic Missile Proliferation

The global proliferation of ballistic missiles in volatile regions such as the Middle East, South America and South Asia will be one of the more frightening threats the U.S. will contend with in the 21st century. Central Intelligence Agency

director William Webster has testified openly to Congress that more than 15 developing nations will be producing their own ballistic missiles within the next decade. [Ref 45:p. 44] In Discriminate Deterrence, the commission reported that forty or more countries in Europe, Asia, the Middle East and elsewhere will have the technical wherewithal to build arsenals of nuclear weapons within a few years. [Ref 43:p. 10]

Presently, technology which can be used for both peaceful space launches as well as ballistic missiles is being exported to a growing number of countries, including those known to have committed acts of terrorism. Several European companies are known to have provided equipment and technical assistance to Third World ballistic missile programs. Because of the increase of nuclear power plants across the globe, many countries are in possession of fissile material or have the means to produce it. This creates a potential for the development of atomic bombs by many poorer Third World countries.

This phenomena will have a great impact on the balance of power. No longer will the U.S. and the Soviet Union have a monopoly on highly accurate strategic weapons. No longer will these two powers dictate the flow of arms. China is now the number two exporter of short range tactical ballistic missiles behind the Soviet Union. Many lesser powers will have sizable arsenals including chemical weapons and short-range or even medium-range missiles. [Ref 43:p. 9] These lethal arsenals will prove to make it much more riskier and difficult for the superpowers to intervene in regional conflicts. More cooperation and diplomacy will be required to resolve tensions in many Third World countries.

The main cause of this explosive spread of high-tech weapons is their successful use in the Iran-Iraq War. [Ref 46:p. 40] Many Third World countries watched this war closely and saw the effect that ballistic missiles had on the outcome of the war. This war also showed that less developed countries had the capability to use modern weaponry and be effective. Despite some heavy losses, Iraq emerged as the victor largely in part to ballistic missiles. Today, Iraq has one of the largest ballistic missile arsenals in the Middle East and a robust missile development program [Ref 46:p. 43].

The Soviets continue to be the major exporter of these deadly weapons. Most of the Third World countries were introduced to this technology by the Soviets. The Soviets have transferred their new and more accurate SS-21 missile (120 kilometers) to Syria, North Yemen, South Yemen, and possibly Libya. [Ref 47:p. 17-18] Other countries such as Brazil, Argentina, and Egypt have entered this lucrative market. Many of these nations are burdened with debt, so the sale of ballistic missiles brings much needed hard currency. The oil-producing nations are the best prospects for purchases because they have the hard currency to spend. India and Pakistan are in a missile race. This race will create further instability in that region.

U.S. forces operating in the Mediterranean Sea, Persian Gulf, and off of North Africa and South Asia will be in the range of many Third World missiles. Many of our overseas bases will be vulnerable to such attacks. Nations such as Libya, Syria and Iraq will pose the greatest threats. These threats are not without merit, Libya has already fired missiles at a U.S. communications base on the Italian island of Lampedusa. Fortunately their missiles fell short, however we may not be

so lucky in the future as they get their hands on more advanced systems. Forward-deployed ships and those with prepositioned supplies for U.S. forces will be sitting ducks for missiles with adequate range and accuracy. [Ref 46:p. 52]

Israel, our strongest ally in the Middle East will be subject to short and medium range ballistic missiles on many fronts. Missiles from Syria, Iraq, Saudi Arabia, Egypt and Libya will be well within striking distance of Tel Aviv. Many of these missiles will be armed with chemical weapon warheads, and possibly nuclear warheads. As these weapons come into the hands of radical Islamic regimes, a Arab-Israeli war could prove to be a holocaust.

Ballistic missile technology in the hands of many unstable Third World nations will prove to be one of the most dangerous threats the U.S. will face in the years ahead. The acquiring of nuclear weapons by these countries will give them leverage over existing nuclear powers. It will be much more difficult for us or the Soviet Union to intervene in regional conflicts. The further escalation of these weapons will be a great problem our country will face in the future.

5. Instability as a Threat

One of the basic problems the strategic planner faces is uncertainty in the future environment. This uncertainty is a result of inadequate knowledge and excessive complexity within the environment under scrutiny. Woven within that uncertainty is instability. Instability is a dangerous threat which is difficult to ascertain. The aforementioned threats have a good likelihood of surfacing based on present conditions and trends. But what about those threats that one cannot predict

and falls within the category of exogenous events which are random, uncontrollable, or unpredictable.

Trying to predict Central Europe five even one year from now is difficult. Events are moving rapidly. No longer is it clear who are enemies are. Can we depend on the Warsaw Pact countries who are changing colors to a more democratic society to support a Soviet invasion into Germany? Will a unified Germany be neutral or will they be a NATO ally? Even though the changing conditions in Eastern Europe and the Soviet Union are favorable to our interests it creates havoc in trying to plan for the future. It is a much more stable environment when we know precisely where the threat is, as in the cold war days. This trend of volatility and instability in the threat environment is going to continue in the years ahead. Strategic planners must bear this in mind and make the most of it.

D. SUMMARY

The first decade of the new millennium will be a very different world than we see today. No longer will the U.S. and Soviet Union dominate the globe. Many new powers such as Japan, China, and India will emerge sharing that power. The U.S. will continue to lead the world economy, but our edge will decrease further with Japan and China closing in. America's national interests will be somewhat different. Our focus will be directed inward as we try to tackle problems like AIDS, drugs, the national debt, and care for the increased elderly population. With a less threatening Soviet Union and Warsaw Pact, the U.S. military will find itself a much smaller force. Much of the funds used for the military will be diverted to solve the many domestic problems our nation will face.

The Soviets will be a much more benign threat, however, they will not cease from strategic modernization and the implementation of advance technology in their military organization. Threats on different fronts will pose the greatest threat to American interests and will be a great source of irritation. The U.S. military will find itself more involved in the drug wars. The Persian Gulf will be a great area of volatility and instability - a breeding ground for low intensity conflict. The proliferation of ballistic missile technology and nuclear warheads will be the most frightening threat this nation will have to face. Instability in the environment will add complexity to the threat. Our interests and these emerging threats will paint the posture of our military in the next two decades. Command and Control systems will be a very integral part of tomorrow's military. The next chapter will explore the type of C2 systems technology our military should pursue.

VI. THE FUTURE FORCE AND C2 SYSTEM TECHNOLOGY

A. INTRODUCTION

The perception of future threats to national security will dictate the resources applied to defense. This will in turn structure the posture of future military forces. This chapter will examine the character of the future U.S. military. The threat and resources along with emerging technology will be the key determinants in this future military. These determinants will impact size, weaponry, tactics, and the organization. Secondly, future C2 systems technology will be recommended as solutions to the threat within the parameters of the future force.

With an apparent diminishing Soviet threat and growing internal social problems, the U.S. military will find itself with reduced defense budgets. More and more of the federal budget will be apportioned to those internal problems that are new threats to national security such as drugs, AIDS, crime, and care for the large elderly population. Small negative growth in the defense budget with the most optimistic projection of zero percent growth will be expected in the next two decades. Congress has repeatedly demonstrated that in the absence of a crisis it is prone to cut back on defense- and then to spend heavily when the next crisis comes along [Ref 43:p. 58].

B. FUTURE U.S. MILITARY FORCE

1. Size

The U.S. military in the year 2000 will be smaller than the one in 1990. The corporate world and government service will be competing with the military in acquiring sharper technically-oriented talent. The U.S. will find itself having a difficult time acquiring volunteers in the dwindling category of 17-21 year old males. The future force will require a much more technically competent soldier. With decreased defense budgets and less people eligible for military service, the military will find itself evolving into a much smaller force emphasizing greater flexibility.

Brigades will, in most cases, replace divisions as major maneuver groups, although divisions will remain as resource centers. [Ref 48:p. 15] The trend will be towards a more fully equipped reserve force to compliment the active force. The effectiveness of the active 21st century force will be improved, principally, by late 20th century technological achievements in mobility, weapons, and communications as well as by new concepts for land, sea, air, and space combat. [Ref 49:p. 7] The military will be a much lighter, rapidly deployable force relying heavily on high technology weapons.

2. Weapons/Technology

Even with constrained budgets, the trend is going to be towards high technology initiatives. The Air Force will continue to be committed to high technology as the touchstone of combat capability ...even under increasing budgetary duress. [Ref 50:p. 47] Air Force Systems Command has come up with some future

concepts beyond the turn of the century which include "robotic air vehicles, automated attack systems, advanced air superiority missiles, high-altitude long endurance vehicles, laser communications systems, high-power microwave weapons, and stealthy transport airplanes." [Ref 51:p. 32]

Weaponry will be much "smarter", that is, able to apply damage in a much more discriminate fashion minimizing collateral damage to civilians. Directed energy weapons utilizing high-power microwaves and lasers will begin to enter the inventories in the first decade of the new millennium. Guidance systems will become so accurate within the next twenty years as to make strategic weapons armed with conventional ordinance an attractive option. [Ref 52:p. II-13]

The use of space will be an integral part of tomorrow's military. Many new technologies will be offshoots of the Strategic Defense Initiative (SDI). This author projects a partial strategic shield will be in place early in the 21st century. Cheaper satellites will be available to place in space in a short notice. These satellites will be used to replace some of the communication and intelligence gathering functions accomplished by overseas bases. New space technology as well as advances in other fields will guide the strategy and force structure of tomorrow. Much of this new technology will be tied to greater advances in computer technology.

3. Tactics/Organization

With new threats appearing on many different fronts coupled with advanced weaponry in the hands of smaller hostile forces, the U.S. military will place increased emphasis in training for the range of conflict in the middle to low intensity level. This will in turn affect tactics and organization. The future force will

be professionally well-trained and -equipped and capable of countering threats over the entire conflict spectrum and defeating, as appropriate, an adversary almost anywhere in earth and space [Ref 49:p. 12].

The requirement to be able to deploy and strike quickly will be dependent on advanced intelligence, target acquisition, and surveillance technology. The future battlefield will be characterized by a higher degree of complexity and uncertainty and will afford greater opportunity for officers at lower levels to make tactical decisions. Even though future command and control systems will provide the capability to put the rear commander in the foxhole, it is more likely that command will become more decentralized to account for the increased uncertainty and complexity.

Lighter military organizations will be dependent on accurate munitions, timely intelligence, and effective C2 systems. Joint operations will be the approach to most missions. With increased speed and longer range weapons, the battlefield will become much smaller. This will require a greater integration of tactics between all the services. Hence, the division between services will become less and less as we move to a more purple suit (joint) mentality in the next two decades. Special operations forces will become much more important in the future as we deal with contingencies such as terrorism, narcotics trafficking, and other forms of LIC.

4. Other Considerations

Our military strategy which rests on the forward deployment of troops ready to oppose invading armies and backed by strong reserves will be hard to implement. This will arise from our difficulty of obtaining agreement for overseas

bases and overflight rights. Fewer resources will be available for U.S. security assistance programs. Moreover, this coupled with increased nationalism by many Third World nations will result in increased tensions and a more unstable environment.

U.S. community infrastructures (economies, politics, demographics, resources, and others) will inhibit military stationing requirements and installation activities and investments. [Ref 35:p. 31] Communities which once derived their economic welfare from military bases will have diversified their economies and become less dependent on the military base for economic benefit. Furthermore, with a more environmentally oriented populace, the military will find itself in a more adversarial relationship with the local communities when it comes to base expansion and military exercises.

The state of the economy, emerging technology, demographic trends, the rise of nationalism in the Third World, and public attitudes toward the U.S. military will have a considerable influence in shaping tomorrow's military. Some will have more influence than others. It is imperative that today's planners take these factors into account and harness both the positive and negative to develop the strongest force possible. The 21st century force will be smaller and more reliant on C2 systems to take up the slack. With budget constraints, C2 systems will need to be developed that can be functional in the most likely threat environments. The next section will address this issue.

C. FUTURE C2 SYSTEMS

C2 systems are developed to support a specific force under anticipated battle conditions. The organization, mission, resources, and the threat are the parameters in which the C2 system is designed. The 21st century military organization will be more technology oriented rather than manpower intensive. Missions will be more joint oriented utilizing resources from all the services. Resources will be constrained, so the military will have to learn to get by on less. The final variable in the equation- the threat, will be multi-faceted.

Systems which support the defense of Europe against a Soviet attack should continue to be upgraded. This threat, though diminished will not go away. Strategic C2 systems supporting our nuclear systems should also be upgraded. However, increased attention should be given to the more likely threats outlined in the previous chapter. C2 systems will be an integral part in responding to drug trafficking, LIC in the Persian Gulf, and ballistic missile proliferation. This next section identifies those technologies which we should pursue to meet those threats.

1. Narcotics Trafficking

The best way to eliminate narcotics trafficking is to curb demand. The drug cartels rely heavily on the laws of supply and demand. President Barco of Columbia challenged President Bush at the recent drug summit to go to the heart of the problem by taking every action necessary to fight demand in the U.S. Although the U.S. government is on an extensive campaign to reduce demand, demand for illegal narcotics will continue in the next two decades. Other strategies must be developed.

The U.S. will find it very difficult to use military intervention in these Latin American countries to combat the drug problem. With the recent invasion in Panama, and rising nationalism, the Latin American countries are very sensitive about any military action by the U.S. However, the U.S. military will be called on to use some of its high-technology equipment to assist the civilian agencies in this effort. Because of the large DOD budget for R&D in comparison to the other civilian agencies, many defense oriented technologies can be applied to the drug war, especially in communications and information processing. Several ways the U.S. can go head on with this problem is by interdiction, going after narcofunding, and clamping down on precursor chemicals used in making the narcotics.

The best place to interdict would be at the processing plants where the illegal narcotics are manufactured. This would have to be accomplished by national police and security forces. The U.S. could provide bio-mechanical sensor technology which utilizes miniature mechanical devices built into silicon chips by photolithographic and anisotropic etching processes. This technology which should come to fruition by the 21st century could be used to sense (detect) the illegal narcotics at these hidden processing plants.

Narcotics processing centers are very dependent upon air support. A strategy that also aimed at gaining and maintaining superiority over contiguous air space could inflict severe damage upon the narcotraffickers. [Ref 42:p. 69] The U.S. could assist the nationals with increased surveillance by providing a netted-radar environment to establish control over its airspace. This information then could be linked down to local command centers as well as U.S. command centers. This

linkage could be provided by new Light Satellite (LIGHTSAT) technology. [Ref 42:p. 69] LIGHTSATs are much smaller, cheaper, and can be put into orbit quickly. LIGHTSATs would provide secure communications and sensor readout to the key decision makers in the drug producing countries. This would also alert U.S. officials of possible smuggling along the borders.

Secure communications is a must if this war is to be waged successfully. The U.S. government has provided the enemy with large amounts of intelligence and operational information through the use of unsecured communications. [Ref 41:p. 31] The drug cartels have invested heavily in SIGINT technology and equipment. This capability has frustrated U.S. backed local efforts to locate them. More money should be spent first to secure U.S. and U.S. backed agents communication, both voice and data, and second, to increase the agents capability to intercept the drug traffickers communication. The U.S. military has heavily invested in communications security (COMSEC) technology and continues to upgrade it. They could provide the appropriate equipment, logistics, and training if necessary.

Timely intelligence is critical to diffuse the extensive operations of the drug traffickers. Fundamental to gathering effective intelligence is the ability to process enormous amounts of information quickly. To aid the intelligence community, the U.S. should continue to pursue "advanced information-processing systems enabling us and our friends to store, sort, retrieve, and collate enormous amounts of data" [Ref 42:p. 72] about drug traffickers. Present systems are fragmented at best and do not provide the necessary intelligence to keep drug agents one step ahead of the traffickers. The fusion of information is key to success.

Fusing information from human-, communications-, electronic-, imagery- and photo-intelligence sources will provide a much clearer picture of the threat. The U.S. military continues to fund extensive intelligence fusion programs. Expertise and technology in this area could aid the war on drugs.

Integrating all these technologies into a functional system is the difficult part of the equation. Making sure the right information gets to the right person at the right time is the goal of any drug C2 system. Integrating military assets with other drug agencies, both U.S. and foreign without compromising security will require a systems engineering methodology. This will require extensive coordination between all agencies. The U.S. military will have a lot to offer by way of surveillance, sensor, and computer processing technology. These technologies should be pursued by the military and integrated into the war on drugs. Much of what can be used in the drug war will also be functional in other areas of LIC especially terrorism.

2. LIC in the Persian Gulf

LIC in the Persian Gulf region- one of the most likely threats that may require some type of U.S. military intervention poses several strategic constraints. The great distance and geopolitical factors present time and space limitations on military deployment. Further compound this with the fact that there exists a limited C2 or intelligence infrastructure in this region, and the U.S. is faced with a strategic dilemma. How do we communicate within this theater? Advanced technologies for command, control, communications, intelligence, and training will offer us more effective ways to cope with LIC and to help Third World friends [Ref 42:p. 71].

U.S. Central Command (CENTCOM) has responsibility for this volatile area. Presently, all operations in the Persian Gulf are sustained through the Commander, Joint Task Force, Middle East (CJTFME). The majority of voice and data connectivity with CENTCOM headquarters is on-board the CJTFME command ship. The challenge is to provide high-capacity, secure and reliable communications from multiple shore entry points to the command ship [Ref 53:p. 50].

Some of the more likely scenarios that the U.S. may face in this region in the years to come include: terrorism against U.S. citizens and property including hostage taking, attempted coups against U.S. friendly governments, military assistance to Israel, and defense against ballistic missile attack on U.S. military assets. It is within the plausibility of these threats that we should plan future C2 systems taking into account the limited C2 infrastructure in this region.

The first thing which should be done is the creating of a robust, survivable, theater-wide communications capability in this region. The Defense Communications Agency (DCA) is presently taking initiative to fill this void by developing a "mixture of fixed and tactical, transportable communications equipment organized into three major and minor nodes. [Ref 53:p. 51] This will enable commands within the area to be tied into the Defense Communications System (DCS) providing voice and data circuits to CENTCOM headquarters and the National Command Authorities (NCA). This entry in the DCS will be accomplished through terrestrial, HF radio, and satellite mediums.

To enhance DCA's initiative, several other technologies should be pursued to create a more robust C2 infrastructure and provide better responsiveness to the

most likely future threats. Because of the large amount of terrorist activity in this region, the U.S. should pursue the development of a "network of sensors and information processors that will monitor the activities of hostile groups or individuals and provide for the security of friends." [Ref 42:p. 73] During the next twenty years, the use of smart electronic cards for reliable identification of individuals and vehicles, as well as for on-person medical, training, financial, and other records, may become pervasive. [Ref 42:p. 73] Integrating these sensors with advanced information-processing systems may provide timely intelligence of terrorist activity and serve as an effective deterrent.

Continuous, wide-area surveillance is one of the most important capabilities that the U.S. could bring to bear in a LIC. [Ref 54:p. 30] Surveillance includes a myriad of activities from active radar detection which tracks ship and aircraft movements, to locating enemy forces or terrorists and their associated command centers. Surveillance would provide timely tactical intelligence. Several systems which should be pursued to provide this surveillance include: "low-cost space systems, long-endurance airships and aircraft, and robotic reconnaissance vehicles that allow day and night monitoring of large areas, regardless of weather or terrain." [Ref 42:p. 72] With advances in communications, sensors, airframe and engine technology it is feasible to produce a long range airborne vehicle which could serve in reconnaissance and communications relay roles. One drawback to this technology would be the vulnerability to missile attack.

LIGHTSAT technology would be appropriate in this region to combat LIC. One characteristic of these LIGHTSATs especially attractive for LIC is that

they could be put under the direct control of the on-scene commander, and have the data read out directly to him using low-cost, transportable ground stations. [Ref 54:p. 34] LIGHTSATs could provide secure intelligence and be integrated with the appropriate sensor systems. Also, information could be passed between unmanned vehicles and airships to the ground using these satellites as relays. They can be quickly placed in space without a heavy booster. One drawback is the longevity of the LIGHTSAT. However, in all likelihood they would be used for selected contingencies.

Utilizing the advances in sensor, surveillance, satellite, and airship technology can enhance the proposed DCS infrastructure upgrade. In this area of the world, intelligence is the precious commodity. Being one step ahead of the terrorist or enemy could provide the U.S. the ability to preempt an attack through other than military means. Effective intelligence systems will be a key factor in creating a more stable environment in the Persian Gulf.

3. Ballistic Missile Proliferation

The proliferation of ballistic missiles will be seen at strategic and tactical levels with most of the activity in tactical ballistic missile inventories which are shorter in range. These short range ballistic missiles will continue to be available in Third World nations which are not covered in force or missile reduction talks. To defend against both strategic and tactical missiles and minimize the threat, effort is being made to implement active defenses. The Joint Tactical Missile Defense (JTMD) management office in Huntsville, Alabama, is taking the initiative for tactical missile defenses, while the SDI program is providing the framework for strategic defenses. Both efforts rely heavily on C2 systems.

A tactical missile defense special task force identified four conceptual tactical missile defense operational elements:

- Active defense to destroy tactical missiles in flight, thus preventing successful attacks against critical resources and adding uncertainty to enemy planning.
- Passive defense measures to degrade the enemy's ability to target U.S. and allied forces, to reduce vulnerability to an enemy attack and to reconstitute and recover the capability to conduct combat operations following an attack.
- Attack operations to destroy and disrupt tactical missile launch platforms and their supporting command and control (C2) and logistic structures, thus precluding or degrading enemy launch operations.
- C3I for tactical missile defense operations to coordinate and integrate the exercise of authority and direction by commanders over forces assigned missile defense tasks. [Ref 55:p. 45]

The C3I system is seen as the force multiplier for the tactical missile defense operations by virtue of its ability to synergistically increase the combat worth

of missile defense to a value greater than the sum of the individual elements. This force multiplier characteristic of C3I is essential to the operational concepts of fighting and winning the short-range ballistic missile threat anywhere in the world [Ref 55:p. 45].

The C3I system supporting tactical missile defense operations can be broken into three major components. A network of sensors utilizing IMINT, SIGINT, and other national assets; C2 nodes where intelligence data from the sensors is integrated with other intelligence data from battlefield areas; and the communications systems which provide data distribution between weapons controllers, the sensor network and the C2 nodes. Current C3I systems supporting missile defenses are not enduring. They are inflexible, vulnerable to single point failures, easily targeted, and lack the capability to disseminate data in support of C2 operations in a semi-automated or automated system [Ref 55:p. 47].

Several areas should be pursued to create a more robust, flexible C2 system supporting tactical missile defenses. Sensor systems should be upgraded incorporating the latest state of the art technology. Fusion centers need to be developed which will take advantage of the large amounts of intelligence from various sensors and integrate them into a coherent picture of the threat. More emphasis should be placed on secure, jam-resistant multinodal distribution systems which will prevent system failure should one node be knocked out. Finally, general communications systems capabilities supporting missile defenses should be integrated networks capable of voice, data, graphics and imagery traffic that is transparent to

the user. [Ref 55:p. 47] The evolving Integrated Services Digital Network (ISDN) technology should be exploited for missile defense applications.

At the strategic level, the SDI program is addressing missile defenses. The goal of the Strategic Defense Initiative Office (SDIO) is "to conduct a vigorous research and technology development program that could help to eliminate the threat of ballistic missiles and provide increased U.S. and allied security. [Ref 56:p. II-13] Long-range ballistic missiles pose the greatest danger to the Continental United States (CONUS). The SDIO is attempting to ameliorate that threat.

Fundamental to successful strategic defense is C2. The appropriate terminology for C2 in the SDI program is Battle Management/Command, Control, and Communications or BM/C3. The key technologies that make up the BM/C3 system are processors, software, networks, communications, and man-machine interface/decision aids. One study indicated that much of the technology required to implement the fundamental requirements of SDI BM/C3 either exists in a developed state or is nearing development [Ref 57:p. xiii].

Processor technology is a critical area which should take advantage of the advances in chip manufacturing. A key factor in the development of processors for SDI will be security. Software will prove to be the long pole in fielding an adequate defense shield. The increasing complexity of SDI will require advancements in software technology beyond what is available today. [Ref 14:p. xvi] Advanced network topology and routing will have to be developed to sustain the large amount of space, airborne and ground based elements in the SDI system. The design of communications mediums must emphasize speed; protection against jamming,

nuclear radiation and direct attack; and high signal to noise ratios. Of even greater importance, SDI BM/C3 must be evolved together with the complete SDI architecture to capture the strengths of evolving BM/C3 technology and to avoid weaknesses inherent in complexity, which can result if system design decisions do not fully take into account the impact on BM/C3 [Ref 57:p. xiii].

D. SUMMARY

The U.S. military at the beginning of the 21st century will be lighter, more mobile and expected to respond to conflict at all ranges of the spectrum. U.S. strategy will seek to maximize technological advantages. [Ref 43:p. 21] Joint operations will be more commonplace. Weapons will be smarter and much more accurate; thus, shrinking the battlefield. More weight will be placed on intelligence, reconnaissance, and C2 to account for the smaller forces.

To combat narcotics trafficking and other forms of LIC, C2 systems should be built around advanced sensor, and information processing technologies. The fusion of large amounts of information will be required to give a clear picture of the threat. Effort should continue to be expended in LIGHTSAT and airship technology to increase flexibility and surveillance capability. The military must continue to develop ballistic missile defenses against both the tactical and strategic threat. The SDI program should continue to be funded. Many new technologies will be offshoots of this program and will be used in other military applications.

VII. CONCLUSION

Command and Control (C2) systems are designed to enable a commander to plan, direct, and control the operations of his forces in accordance with the assigned mission. The C2 system has many components among which include communications, procedures, and personnel. These components are integrated into an effective architecture for the sole purpose of supporting the commander in meeting his mission. If the architecture is deficient in meeting the goals and objectives of the mission, then a requirement must be established to satisfy the deficiency.

Requirements must be balanced among resources, technology, and the mission. It is difficult to develop good requirements and identify solutions because of the constant changes in resources, technology, and mission. Resources change year to year depending on the whim of Congress. Engineers are constantly pushing technology to the limits to come up with the best black box. The mission continues to change as the threat changes. The challenge at hand is to harness these changes to a constructive end.

Strategic planning provides a systematic approach to guiding the constant change of the C2 systems requirements process. The fundamental components of strategic planning include interests, future environment, resources, and strategy. There is a logical progression from the highest levels (interests) down to the level this thesis is concerned with (what type of C2 systems technology should be pursued)

that a C2 system planner can follow by utilizing the strategic planning components in some type of strategic planning model.

The first thing which is accomplished is the establishing of interests. This is not in the domain of the C2 system planner. The second step is to project alternative future environments which include threats to national security, both military and non-military. Once the most plausible future environments (threats) are identified, the next step is to project the interests on the future environment to develop a national strategy. The national strategy will be made up of many components including a military strategy. The military strategy will then be further broken down into specific missions. The final step is to determine what type of C2 system will be required to satisfy the demands of the mission. This whole process is within the confines of the available resources.

One of the key determinants of the military's future mission and the C2 systems that support it, is the future threat. The threat in the year 2000 will be different than in 1990. The Soviet Union will remain our most formidable foe, however they will not present the greatest threat to our national security. New threats have emerged and will continue to pose problems to our national security and military planners. The U.S. military will become increasingly involved in the drug wars, being tasked to provide surveillance and interdiction assets. The Persian Gulf will prove to be the international hotbed of terrorism and other forms of low intensity conflict possibly requiring a U.S. military response. Ballistic missiles will become available to many Third World nations jeopardizing American interests

abroad. This will create a greater degree of instability and weaken the influential hands of the major powers.

On the home-front, the defense budget will become smaller as more funding will be put toward emerging social problems including AIDS, education, drugs, the environment, and care for the elderly. This will force DOD to move towards a lighter military more dependent on technology. C2 systems characterized as force multipliers will become more significant as the military is asked to do more with less.

The explosion in surveillance, sensor, and information processing technology should be exploited for military applications in these new threat environments. This technology should be incorporated into systems that can be functional in many threat environments. Systems that are developed for NATO should be able to function in LIC in the Persian Gulf. Fusion systems that are developed for integrating a picture of the threat in Central Europe should be capable of assimilating data in the drug wars to paint a picture of that threat. C2 systems developed for SDI should also be functional in environments where shorter range ballistic missiles pose the greatest danger.

Military planners must expand their view of the threat. This author strongly agrees with the assessment of the threat given by the Commission on Integrated Long-Term Strategy. We should emphasize a wider range of contingencies than the two extreme threats that have long dominated our alliance policy and force planning: the massive Warsaw Pact attack on Central Europe and an all-out Soviet nuclear attack. [Ref 43:p. 2] Pentagon planners must continue the move toward a more

mobile, versatile force capable of deterring aggression discriminately over a wide range of attacks.

Those responsible for fielding the technology of tomorrow's C2 systems need to be in concert with the changing face of the environment. Cognizant of the new emerging threats on multiple fronts coupled with the reality of smaller defense budgets, C2 system planners must make every effort to implement systems that will be functional over a large spectrum of conflict. The future is shrouded in uncertainty, but we must make every effort to manage that uncertainty as best as possible. National security remains the protection of internal values from the external threat. The major uncertainty of the future is that the threat has changed and so must we.

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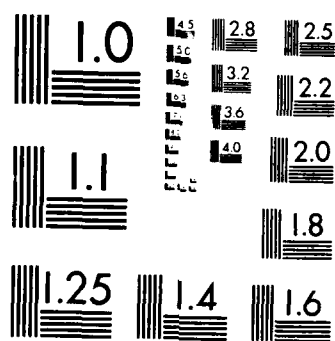
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