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STRATEGIC PLANNING, POLARIS, AND TOMAHAWK:
TECHNOLOGICAL IMPERATIVE HYPOTHESES

by

David Thomas Norris

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F. M. Teti

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Strategic Planning, Polaris, and Tomahawk:
Technological Imperative Hypotheses

by

David Thomas Norris
Lieutenant, United States Navy
B.S.M.E., United States Naval Academy, 1981

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ABSTRACT

This thesis examines the force procurement element of the military strategic planning process and is comprised of two parts. First, models are constructed to depict ideal strategic planning. The initial step in each model is the formulation of the national interest. The national interest is defined in terms useful to strategic planners by creating a unique paradigm based on the Constitution. The technological imperative hypothesis is explored as an aberration to the ideal strategic planning process. Second, the technological imperative hypothesis is tested with case studies of the Polaris and the Tomahawk. Even though the hypothesis was disproved in each case, the case studies yielded useful relationships between technology, strategy, and doctrine.

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I. INTRODUCTION

"The most striking and far-reaching trend within the naval profession in recent years has been the emphasis on strategy as the focus of naval thought, planning, resource allocation, and employment."

-James Watkins, ADM, USN (ret), 1986, p. 15

Admiral Watkins' statement described the expanding interest in strategic planning in the 1980s. This resurgence in strategic thinking has led to two unprecedented public policy papers detailing US defense policy: The Maritime Strategy (Watkins, 1986) and National Security Strategy of the United States (The White House, 1987). Both papers addressed the strategic planning process: formulating the national interest, which yields the nation's military strategy, and thus provides the framework for force procurement and war plans.

Strategic planning is the process that links together the three essential building-block elements of defense planning: interests, strategy, and capabilities. This process may be shown in diagrammatic form as:

national interest → military strategy → military capabilities

Of course, this flow path represents the ideal sequence of events. It is axiomatic that multitudes of actors participate in the defense planning process, such as Congress and the bureaucracies. Many of these players have their own

agendas, explicit or hidden, or, at the least, widely diverging viewpoints. In particular, the Net Assessment Office under the Secretary of Defense plays a significant role in the strategic planning process by evaluating US program plans with respect to the Soviet threat.

Debate on these components focuses on how well matched they are with respect to each other. Recently, for instance, Secretary of Defense Caspar Weinberger has concerned himself with the strategy-capabilities issue (Weinberger, 1987, p. 5). At other times in the nuclear age, people have argued the interests-strategy issue, such as whether or not the concept of Assured Destruction was in the national interest (Haley, et al, 1985, p. 93).

The present study will look at both of these facets of strategic planning. First, the concept of national interest will be examined. Should the concept represent the enduring, lofty values of the United States or should it express the platform of a transient elected political leadership? An attempt will be made to define the national interest in terms useful for strategic planning.

Second, it has been hypothesized that another input into weapons procurement is the so-called technological imperative, whereby the technological momentum created by industry and the research and development (R and D) establishments tends to promote weapons procurement not in accordance with established strategy. The technological

imperative critique of US defense planning shifted into full swing during the MIRV and ABM debates of the 1967-1972 period. This paper attempts to explore the technological imperative input into the strategic planning process by examining the decision to procure the Polaris Submarine Launched Ballistic Missile (SLBM) and Tomahawk Submarine Launched Cruise Missile (SLCM) systems through two case studies.

Enunciation of the national interest lies at the level of the highest elected officials of the nation. It is an area where strategic studies scholars tread uncertainly. International relations specialists have largely neglected this area of research since the mid-1960s. Donald Nuechterlein is one of the few contemporary scholars who writes significantly on the national interest, but even his work concentrates mostly on foreign policy, not defense studies. General of the Army Douglas MacArthur, in his 1963 Farewell Address at West Point, advised against those in the profession of arms getting involved in national problems at this high level (MacArthur, 1963). Nevertheless, exploration of this academic area should yield fruitful results and lay the groundwork for probing the strategy-capabilities issue.

The literature on the technological imperative is more rich than that on the national interest. However, nothing was found that analyzed if strategy (in the ideal process) or technology (in the non-ideal process) drove the Polaris Fleet

Ballistic Missile (FBM) program. Michael Armacost (1969), Edmund Beard (1976), Ted Greenwood (1975), and Harvey Sapolsky (1972) have all written well-known case studies of the Polaris and Air Force ICBM programs, but they dealt almost exclusively with the bureaucratic/organizational perspective made famous by Graham Allison (1971) and Morton Halperin (1974).

Since the cruise missile spawned so many variants, both Navy and Air Force, a much more extensive set of studies has been written. Richard Betts (1982), Ronald Huisken (1981), Charles Sorrels (1983), and Kenneth Werrell (1985) have written significant works on the cruise missile. Art and Ockenden (1981), Canfield and Kellet (1978), Gerard Farrell (1981), David Hobbs (1982) and Pfaltzgraff and Davis (1977) have written incisive, but shorter studies. Many of the studies specifically addressed the technological imperative.

This study tests the hypothesis that the technological imperative played a role in the procurement of the Polaris and Tomahawk weapons systems. In each study, the hypothesis was disproved. The study finds that the development and procurement decisions for each weapon were preceded by forceful statements of strategic aims. Moreover, the national interest, as defined in this study, properly supported the strategies which drove the Polaris and Tomahawk decisions. In summary, strategy drove technology in the

Polaris and Tomahawk case studies; technology did not drive strategy, as the technological imperative hypothesis calls for.

II. STRATEGIC PLANNING: A MODEL OF ENDS-WAYS-MEANS

A. THE STRATEGIC PLANNING PROCESS

Alice: "Would you tell me, please, which way I ought to walk from here?"

Cheshire Cat: "That depends a good deal on where you want to get to."

Alice: "I don't care much where--"

Cheshire Cat: "Then it doesn't matter which way you walk."

-Lewis Carroll, pp. 78-79

1. Introduction

Before an operational definition of strategic planning can be arrived at, one must first understand the larger intellectual and practical environment from which it comes: national security affairs. In its broadest sense, national security is the protection of internal values from external threat in a mode consistent with democracy. This academic field evolved out of World War II and the National Security Act of 1947, which created the National Security Council and a multidisciplinary approach to defense. National security affairs, therefore, might be seen as a child of the post-war nuclear era, when national survival depended on integrating all facets of national power -- military, economic, and political.

Since this study will focus on strategy, several definitions are appropriate so as not to confuse strategy with doctrine. John Collins (1982) provided a succinct

definition of military strategy: "The art and science of employing military power ... to attain nation[al] security objectives." (pp. 303-313) Tactics are "the employment of units in combat." (JCS, 1986, p. 359) Tactics essentially implement strategy. Doctrine, on the other hand, implements both strategy and tactics. I.B. Holley, Jr. (1986) defined military doctrine as based on experience and employing inductive inference: "that mode of approach which repeated experience has shown usually works best." (emphasis in original)(p. 2) Doctrine tends to be task- or service-specific, such as, infantry or amphibious doctrine (Matthews, 1987).

2. Functional Description

Strategic planning is the process of developing broad conceptual plans and strategies in support of national policy and allocating resources to achieve those objectives (DON, 1974). Carl Builder (1987) provided an equally valid definition: "the formulation and application of strategy for the planning of future forces." (p. v) In either case, strategic planning is the very essence of the executive function. There is widespread agreement as to the place of planning in the overall administrative process. Steiner (1979) stated that a large bureaucracy has two types of management: "strategic management" at the top of the organization, and "operational management" for the rest of

the organization. Furthermore, strategic planning was the function which supported strategic management. (p. 4)¹

Strategic planning can be broken down according to the following functions:

1. War plans: including plans for war termination and contingency plans for limited conflicts
2. Programming: how much and what kind of weapons and forces to procure. (Tritten, 1987)

The public only sees the force procurement function on a daily basis. To a lesser extent, contingency plans have become publicly debated, especially in light of the Persian Gulf tension.

3. Relationship of Interest, Strategy, and Capabilities

The strategic planning functions are applied in the context of the interest, strategy, capabilities discussed earlier; this shorthand notation is reproduced as Figure 1.

Interest —————> Strategy —————> Capabilities

Fig. 1 Military Strategic Planning Model

Interests describe the common purposes of the United States, i.e., its national goals and overseas commitments. These are the ends toward which policy is created. Strategy in

¹ No textbooks exist on military strategic planning. Also, the Library of Congress subject catalog cross-references only business topics under the strategic planning heading.

this context represents military strategy, "the manner in which military power should be developed and applied to achieve national objectives...." (JCS, 1986, p. 228)

Capabilities represent the weapons systems and force levels needed to support military strategy. The arrows indicate the direction in which these elements influence or should influence each other.

Not surprisingly, Figure 1 is exactly parallel to the business paradigm of strategic planning. Robert Hayes (1985) discussed the traditional model (Figure 2) and offered two arguments to justify its sequence.

Ends → Ways → Means

Fig. 2 Business Strategic Planning Model

First, managers (strategic planners in the military) must know the organization's objectives before they can generate programs to achieve them. Hayes used the Lewis Carroll quote printed above to illustrate this point. Second, the desire to maximize efficient use of resources drives the conventional sequence. (p. 112)

The concrete link between these three components of national security is the budget. However the budget also provides the major constraint. In reality, the nation's limited resources may impose a budgetary ceiling which affects strategy and forces the refinement or cancellation of national security interests. Olvey (1984) called this the

domestic policy approach to decision-making; furthermore, resource constraints may ultimately affect even national values. (p. 47)

Figure 1 is a useful tool in understanding the national security strategy of the United States. As with any conceptual model, it can be modified to illustrate certain relationships. The Secretary of Defense's Annual Report to the Congress Fiscal Year 1988 (DOD, 1987, p. 15), for example, added the net assessment function, as shown in Figure 3:

Interest → Threat → Strategy → Capabilities

Fig. 3 Threat-based Strategic Planning Model

4. Decision-making Models

Military strategy is a broad term; presently it describes the US strategy of deterrence through credible response. Four separate services make up this military strategy. Figure 4 suggests a way to view the contribution and input of each service:

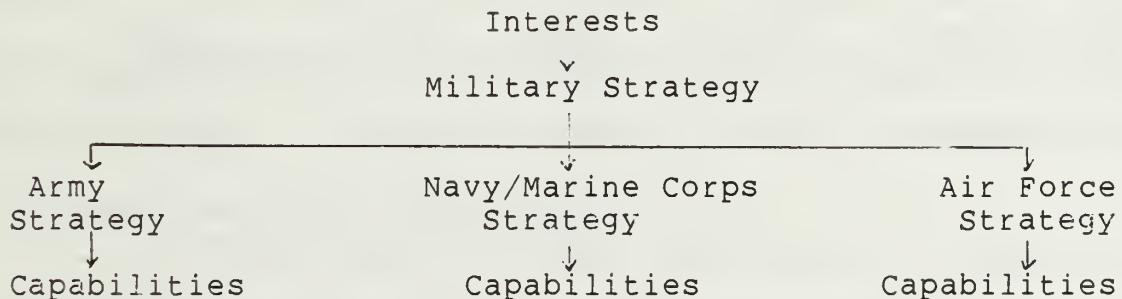


Fig. 4 Service-based Decision-making Model

A major defect in Figure 1 was that almost every military capability could have evolved from the military strategy of deterrence. Figure 4 shows that individual services should have a strategy to determine their force procurement. This model suffers from several flaws: first, does or should each service have its own strategy, or should it correctly be called doctrine? Second, in today's environment of joint arms warfare, no one service is likely to perform according to its own strategy or doctrine. Instead, for example, the Army and Air Force will fight together in Europe. Indeed, one could argue that in the nuclear age, individual services exist only to provide an administrative function of providing, maintaining, and training the forces.

This discussion ends with a final iteration of the interest-strategy-capability model. Figure 5 corrects Figure 4's two shortcomings by employing unified and specified commands (not all commands are shown).

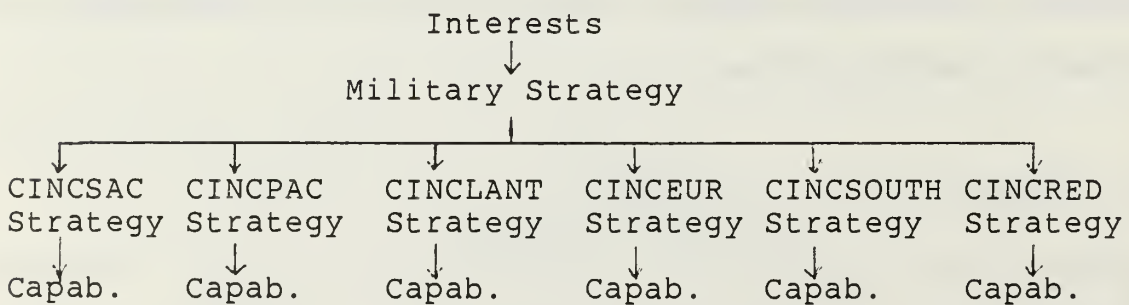


Fig. 5 Operational Commander-based Decision-making Model

The Strategic Air Command (SAC) is a specified command with distinct hardware requirements that lends itself well to this model. The unified commands, while not having the distinct capabilities requirements as a specified command, each have their own strategy. Strategy also is the correct concept, compared to doctrine which implies single service (Collins, 1982, p. 308). Furthermore, the Commanders-in-Chief (CINC) of these commands have lately been playing a more important role in the budget process (JCS, 1987, p. 88).

5. Conclusion

These models serve to round out this brief discussion on strategic planning. One common thread linked each model: The primacy of national security interests; it underlies the entire process of strategic planning. The business community certainly comprehends the significance of articulating the mission of an organization. Peter Drucker wrote that the primary task of an organization's senior leaders is to ask and answer the question. "What is our business and what should it be?" (Steiner, 1979, p.6) Indeed, a major theme in Hitch and McKean's (1960) landmark book, The Economics of Defense in the Nuclear Age, was to ask the right question (p. 48).

The next section of this paper seeks to answer this question for the United States in terms useful to a strategic planner. Even if no such answer can be arrived at, the

derivation and exposition of the national security interest should be beneficial to those charged with protecting and enhancing it. The strategic planner should understand that his specialty provides the link "between the hardware and tactics of our forces, military and diplomatic, to the core values of our nation...." (Roncolato, 1983, p. 33)

B. THE ENDS OF STRATEGIC PLANNING: THE NATIONAL INTEREST

"We do not scrap the Constitution because learned judges cannot agree on the interpretation of its provisions. All profound moral doctrine is broad enough so that its particular application generates controversy as is manifest in the old saying about the devil's ability to quote Scripture to his own purpose."

-T. Taylor, 1970, p. 16

1. Introduction

As an academic concept, the national interest does not have the enduring nobility of the Constitution; it has almost been scrapped. Yet it lives on in political speeches and government documents. People invoke it to justify the nation's action, but few actually know what it means.

The last section showed that national interest is at the apex of a pyramid from which strategy and capabilities flow. This section will explore in detail its meaning. In the first part, national interest will be differentiated from its sister term public interest. Next, a review of the international relations and strategic studies literature will be conducted. Third, the complex, often philosophical process of formulating the national interest will be treated.

Finally, the national interest will be addressed in the context of the Constitution. It will be argued that the concept of national interest should not have been scrapped, but rather treated like that other famous "idea" with varying interpretations: the Constitution.

2. The National Interest v. Public Interest

By convention, in the field of political science, national and public interest define two different ideas. A contemporary scholar (Donald Nuechterlein, 1978 and 1979) has defined the national interest as "the aspirations and goals of sovereign entities in the international arena." (1978, p. 1)

1) The International Encyclopedia of the Social Sciences defined public interest as "a continuum that represents the values, aspirations, and objectives of the community of polity." (Sills, 1968, vol 13, p. 171) Therefore, in common usage, national interest applies to foreign policy goals and public interest applies to domestic policy goals. Johansen (1980) defined an interest wider in scope than national and public interest combined: the human interest. This concept incorporates all the world's aspirations and is supported by the Globalists school of international relations.

The state's coercive power backs up each set of interests. The armed forces and economic sanctions enforce or defend national interest. The regulatory agencies (through the criminal justice system), the civil justice system, fiscal, and monetary policies support the public

interest. Additionally, common usage ascribes police/fire protection, sewer/water districts, and parks/recreation departments to the public interest.

National and public interest are normally treated as discrete topics with no concept relating them. Barry (1962), however, introduced the phrase "common interest" to describe all the interests shared in a nation (p. 197). Weinberger used the phrase "national security interest" to define goals typically assigned to "national interest" (1987, p.9). The White House publication The National Security Strategy of the United States of America chose the more traditional term "national interest" in its discussion of goals and purposes (White House, 1987). Nevertheless, national security affairs is an interdisciplinary field, and should include both national interest and public interest.

The two expressions of a state's aspirations have not enjoyed equal success in the literature. The Library of Congress subject headings have no listing for national interest. On the other hand, it has a full listing for public interest, including cross-references to public interest law, class action suits, and whistle-blowing. (Library of Congress, pp. 2171, 2601)

3. Explanation of the National Interest

The review of the literature on national interest will focus on two viewpoints. The first is from the international relation community. These scholars originated

study into this field to answer a persistent question among students of foreign policy: What makes sovereign nations behave as they do? The other view point is from the area of strategic studies. This is an interdisciplinary group consisting of military historians, traditional strategists, and nuclear strategists.

a. International Relations

Sondermann (1977) wrote that the attempt to distinguish between different tribes or city-states began during the days of Greek civilization. Early forms of the concept of national interest evolved from the phrase raison d'état, meaning reason of state, and advanced into the theme of national honor.

National interest gained its widest use from the Realist school of international relations led by Hans Morgenthau following WW II. This school believed that nations should act on the basis of furthering their own power. It eschewed moral principles, e.g. those espoused by Woodrow Wilson, as an impetus for a state's foreign policy. Morgenthau wrote:

"The illusion that a nation can escape, if it wants to, from power politics into a realm where action is guided by moral principles rather than by consideration of power is deeply rooted in the American mind." (1951, p. 10)

Morgenthau's equating of national interest with protection and enhancement of a state's power came under attack. He answered the critics charges that his version was

too vague and open to interpretation by comparing it to the "general welfare" of the Constitution. That is to say, the term has its own innate meaning but its content varies with political tradition. He summarized this by writing that the national interest had two elements, a permanent, logical element and a variable element. (Morgenthau, 1952, pp. 971-972)

Another Realist, Robert Osgood (1953), contributed a more specific set of motives for US foreign policy (in order of decreasing priority):

1. survival: territorial integrity and government institutions
2. vital interest: protection of citizens and commerce overseas
3. self-sufficiency
4. national prestige
5. national aggrandizement. (Osgood, pp. 5-6)

Osgood substituted the term "national self-interest" for national interest and defined it as "a state of affairs valued solely for its benefit to the nation." This contrasted with his definition of ideals: "state of affairs worthy of achievement by virtue of its universal moral values." (p. 4)

Morgenthau and Osgood both treated the role of morality in formulating the national interest defensively.

Robinson (1969) succinctly summarized Morgenthau:

"Thinking in terms of the national interest is morally necessary, for the state...has no moral right to risk sacrifice of the nation for the sake of certain moral principles. Instead, its highest moral principle must be survival, for the state is entrusted with the very lives of its citizens...." (Robinson, p. 186)

Osgood considers ideals and national self interest as not mutually exclusive. His ideals are based on John Locke's natural rights philosophy and contrasts this sharply with the Idealists' call for "peace, goodwill and justice" which would require national self sacrifice, in contradiction of natural rights.

In the 1960's the Behavioralist school attacked the concept of national interest on the grounds that it was not objective. This school attempted to study foreign policy on the basis of empirical methods. Rosenau (1969) reduced the argument over national interest to "objective" versus "subjective." He considered this debate essentially unresolvable since it rested on philosophical issues that "each researcher must resolve for himself." (p. 168) Rosenau criticized the Realist school because it seemed to require an objective truth. Rosenau felt that the national interest was "a pluralistic set of subjective preferences that change whenever the requirements and aspirations of the nation's members change." (1971, p. 242)

Kaplan (1969) delved into the debate with his version of objective and subjective national interest. He stated that "the interest of a nation is to satisfy national needs." (p. 168) Seabury (1973) used a somewhat circular argument; he called the national interest a "frame of reference" for reviewing a foreign policy whose goal was to protect the state's "interests, the welfare, and the secure

survival of its land and people." (p. 22) Holsti (1983) has written a current textbook on international relations which noted that a long debate has existed on the meaning of national interest. He concluded that the term is too vague for use in assessing foreign policy and redefined it as "the objectives" of a nation. (p. 123)

Nuechterlein is one of the few contemporary international relations scholars to have devoted most of his professional energy to the study of the national interest. His matrix for the evaluation of the national interest in a given crisis situation has provided the foundation for numerous books and articles.

National Interests and Presidential Leadership (Nuechterlein, 1978) was an attempt to resurrect the concept of national interest from the academic depths of the 1960s and 1970s. He credited the Vietnam experience with awakening the need in foreign policy scholars to find improved methods of determining US goals. Nuechterlein distinguished three important reasons for the weakness of national interest as an academic field. First, the current emphasis on interdependence theory in foreign relations has shifted the focus of international relations away from nation-states and their national interests. Many scholars believe that the interest of the state should remain on a level below that of supra-national organizations, e.g. the UN. Second, there exists a rejection of the Realist's emphasis on power for

evaluating a nation-state's foreign policy goals. Third, the term national interest is not specific enough for any usefulness in the rigorous methodology of modern social sciences. (1978, p. xiii)

Categorizing Nuechterlein into the Realist or the Behavioralist school is difficult. He criticized the shortcomings of the Realists' interpretation of national interest, particularly its rejection of the role of public opinion and the political process. He defined four national interests as follows (not in any order and not mutually exclusive):

1. "defense" -- survival of the state
2. "economic" -- promotion of material well-being
3. "world order" -- calm world environment
4. "ideological" -- nation's values

At any given time, a nation may perceive a threat to these interests in varying degrees. Hence, four intensities were proposed as follows:

1. "survival" -- state's existence threatened
2. "vital" -- threat of military action involved
3. "major" -- issues that threaten to become
vital
4. "peripheral" -- interests of private citizens
abroad

Survival issues are relatively easy to discern; they normally apply only to defense interests. However, the vital interests tend to be difficult to determine. Vital and major issues are the day-to-day issues of strategic planners who are involved with contingency plans. Nuechterlein proposed a means of evaluating costs and benefits to

ascertain whether an interest is vital, i.e., threatening to require the possible use of military force to resolve. The four interests and intensities were constructed in a matrix (Figure 6) to visually aid potential decision-makers. To use, the decision-maker places an "X" or "US" in the applicable four blocks out of the 16; a "USSR" or "NK" (North Korea), for example, may also be placed in the matrix as applicable. In this manner, one may assess the US national interest in a crisis with respect to the adversary.

Intensities

survival vital major peripheral

defense

Interests economic

world order

ideological

Fig. 6 Nuechterlein's National Interest Matrix

b. Strategic Studies

Strategic studies scholars approach the national interest from a different perspective. Nevertheless some overlap between the two fields exist. For instance, Nuechterlein and Rosenau both presented papers at a 1982 National Security Affairs Conference. Nuechterlein presented his matrix but proposed a more specific set of US national

interests based on geography. In order of decreasing priority, his list is as follows:

1. North and Central America, northern South America
2. Western Europe, Egypt, and Israel
3. USSR
4. East Asia (excluding Korea)
5. South America
6. Mid East and Persian Gulf
7. Africa. (Heyns, p. 29)

Rosenau maintained that construction of a coherent national strategy was not possible and proposed continuing on an ad hoc basis (Heyns, p. 30).

Weigley (1973) observed that the formulation of American strategy has broadened from the Clausewitzian concept of military strategy to the present-day national strategy, due to the suffocating threat of worldwide communism. Accordingly, post-WW II US strategy should encompass "the use of the nation's total resources to defend and advance the national interest." (p. xix) Craig and Gilbert (1986) were even more emphatic that military strategy of the past was unsuitable for today. They said that raison d'état has become an important component of strategy and it included "rational determination of a nation's vital interests...." (p. 863)

Ken Booth (1978) has looked at the unique American perspective of war and peace. He criticized the inflexible nature of some nation's supposedly coherent national interests. For instance, the German 1914 Schlieffen

Plan and Britain's 1956 Suez debacle were examples where clear interests led to aggressive actions. Booth cited the US containment theory and its corollary, the domino theory, as another example. He concluded that "it is but one step from having a highly developed sense of threat to engaging in preemptive strategies...." (p. 8)

Of the strategic studies scholars, John Collins has written most widely on the idea of national interest. He utilized the term grand strategy as a level of national action higher than national strategy. The development of grand strategy included four interactive components. First, national security interests were "highly generalized abstractions that reflect each state's basic wants and needs." (1973, p. 1) These were by necessity ambiguous because, while all US citizens concur on defending the Constitution's goals, no one can agree on a specific plan (1973, p. xxiv) .

Second, national security objectives were simply "what a country is trying to do" and have a time span associated with them. Third, national security policies were "a set of ground rules" for implementing or determining national security interests. Finally, national security commitments designated specific claims to US resources, such as geographic regions. (Collins, 1973, pp. 3-4)

Harry Summers (1982) has analyzed US national security strategy during the Vietnam War. He cited the three

primary tasks assigned by the Congress to the US Armed Forces (through the various National Security Acts of 1947 - 1959):

1. defend territorial integrity
2. guarantee domestic security
3. protect and enhance US national interests, including the security of areas vital to those interests. (p. 183)

The US has invoked the last mission the most often to send armed forces overseas. Summers criticized the situation in Vietnam where there was no consensus on what interests were being protected or enhanced.

One of the foremost strategists of the nuclear age, Bernard Brodie, was more concerned with nuclear war and its prevention in The Absolute Weapon (1946) than the formulation of national interest. However his abhorrence of war led him to criticize an idea sometimes confused with national interest:

"The wholesale conversion of mankind away from those parochial attitudes bound up in nationalism is a consummation devoutly to be wished, and where possible, to be actively promoted." (p. 22)

Later, Brodie developed the argument that deterrence would enable a well-defended nation to pursue its true security (p. 107).

Henry Kissinger devoted the last chapter of Nuclear Weapons and Foreign Policy (1957) to "the need for doctrine." He wrote that "the value of power depends above all on the purposes for which it is to be used," but did not address the issue of national purpose. (p. 403) His concern

was directed toward the need for an national strategy and US organizational and cultural obstacles to it.

Samuel Huntington (1961) discussed an issue related to national interest which occurred in the late 1950s: the debate over national purpose. This discussion dissolved in a similar fashion as the national interest debate because people could not agree on national goals beyond territorial defense and below the generalities of the Constitution. He succinctly summed up the dilemma: "Purpose demands priorities; priorities require choice; choice means controversy." (p. 442)

The fundamental concept of Lockean government affected the formulation of national security goals, according to Huntington. Locke, and Abraham Lincoln in the Gettysburg Address, assumed that government by the people meant an identity of interests between the two. However, international relations is by definition one of government versus government competition for prestige, influence, etc. Therefore, "the individual in society has little interest in these stakes so long as his government maintains the minimum prerequisites of security and order." (p. 443)

A discussion of strategists that excluded Clausewitz and Mahan would be incomplete. Clausewitz's On War dealt almost exclusively with the act of war itself

and its three political objectives: destroying the enemy's military, conquering his country, and subduing the enemy's will (p. 123). However, he wrote during the period where wars were, for the first time, being carried out on behalf of the "affairs of State." Clausewitz was undecided whether this would always be the case, as he believed it should, or "whether a separation of the interests of the Government from those of the people will again gradually arise." (p. 386) Rapaport, in his introduction to On War, summarized Clausewitz's philosophy of international relations as follows:

"Since among the goals of all states is that of increasing their own power at the expense of that of other states, the interests of states ... are always in conflict.... Therefore war is a normal phase in the relations among states." (emphasis in original)(Clausewitz, p. 631)

Mahan's writings reflected the era of American expansion following the Spanish-American War. In 1900 he wrote:

"The first law of states, as of men, is self-preservation - a term which cannot be narrowed to the bare tenure of a stationary round of existence.... Growth is a property of healthful life... but it does not imply the right to insure by just means whatsoever contributes to national progress." (Mahan, p. 543)

Livezey (1981) devoted an entire chapter of Mahan on Sea Power to Mahan's concept of the national interest and probed Mahan's view that "nations operated ... according to national interests and moral sentiments." (Livezey, p. 281)

4. Determining the National Interest

The research thus far has progressed along the lines of explaining the need for strategic planners to understand the national interest and reviewing various conceptions of it. The scholars reviewed here have given their version of it, criticized it, or at least acknowledged it as a facet of foreign and defense policy. None of the scholars delved into the origins of the national interest, perhaps because the origins of an ambiguous subject would be even more murky than the subject itself.

Morgenthau, Collins, and Huntington mentioned that national interests were derived somehow from the Constitution. Others stated that the national interest derived from the national identity and morals. The former involves a discussion of political philosophy; the latter of ethics and philosophy. These topics together require a knowledge of metaphysics for a satisfactory explication.

One can readily see that formulation of the national interest can occur at several levels of thought. Frank Teti has proposed a model of knowledge-making that incorporated and simplified the various plateaus of the national interest:

1. metaphysical: concern for the ultimate basis of knowledge
2. world view: romanticism, culture, national character, idealism
3. theoretical: specific theories of politics, economics, sociology, theology, military science
4. societal: the collective memory of society

5. action: the reality of state's behavior in the international environment
6. institutionalization: repetitive action becomes accepted. (Teti, 1987)

Most scholars reviewed in the previous section confined their views to levels five and six; Clausewitz developed a theory of war that fits into level three. The Declaration of Independence and Constitution incorporated level four views of tyranny under George III and level three political philosophy theories of John Locke. Woodrow Wilson appeared to have determined foreign policy at level two by dreaming of Idealism. Level one lies at the very heart of any political issue: right v. wrong, absolutism v. relativism, intuition v. empiricism, deism v. theism, idealism v. materialism, and what is v. what ought to be.

Teti's model provides a way of organizing thought on the national interest. It channels the thought process into looking at means (levels one to four) and ends (levels five and six). Also the model is structured similar to the "levels of analysis" pyramid of international relations that looks at state's behavior at three levels based on increasing number of variables: systemic, nation-state, and idiosyncratic.

A full discussion of levels one through four is beyond the scope of this paper. A hasty tour through pertinent metaphysical ideas will provide some flavor of the complex means associated with policy making. Several authors are

relevant, though, for the interested student of levels two through four. Frankel (1969), Shy (1976), Van Dyke (1962), and Hall (1976) address national culture and values. Hamilton, Jay, and Madison (1937), McCloskey and Zaller (1984), Nobel prize-winning economist Milton Friedman (1962), St. Thomas Aquinas (1947), and Becker (1970) expound on the theory of democracies and Christian teachings on Just War. Political commentators and journalists serve as society's memory bank. Publishing magnate Henry Luce (1941), Walter Lippman (1943 and 1955), Destler, Gelb, and Lake (1984), Theodore White (1982 and 1986), and Will (1978 and 1987) mirror the current issues of society.

A discussion of metaphysics may begin with Aristotle. His idea of the mean between too much and too little illustrated the difference between objective and relative. The mean between "excess" and "deficiency" of a thing or issue was objectively the same for everyone, but not relatively. For example, the mean between eating 5000 calories of food and 500 calories of food per day is the same objectively: 2750 calories. However, for a professional football player it may not be enough and for a race horse jockey it may still be too much. Therefore, an individual should follow the mean, of say, moral virtue, but recognize that it is different for each individual. (p. 190)

Irving Kristol (1987) has noted a shift in the terms morals and ethics. The terms used to be almost synonymous.

But in the last half century, morals have lost out in popularity. The old subject of moral philosophy attempted to justify, without reference to divine inspiration, the major precepts of the Judeo-Christian moral code. Today, ethics are "value-free" and the subject of ethics probes only "logical contradictions" and "logical dilemmas." Kristol criticized the teaching of ethics without value judgements. Although Kristol wrote his essay in the context of graduate business education, the issues apply equally well to politicians, civil servants, and military officers.

A recent bestseller, The Closing of the American Mind (Bloom, 1987), recommended that Americans study more philosophy; such understanding could improve the declining fortunes of America. This idea is gaining popularity in the education reform movement and may have particular relevance to strategic planners.

Individuals in national security affairs tend to have their primary education in engineering, the hard sciences (physics, chemistry, math, computers), or the social sciences (business administration, political science/international relations, economics). The humanities (philosophy, history, literature, ethics) are not strongly represented among modern technocrats. A recent San Jose Mercury News (1987) editorial linked the two: "As the sciences provide the means, the humanities guide us to choose the right ends." The

humanities allows one to understand levels one through four of Teti's model.

Understanding philosophy and agreeing on its precepts are still two different items. This lays the foundation for the ultimate dilemma: how can a nation exist that does not agree on either the means or the ends? It is common to say that most Americans agree on the ends, and that the Democrats and Republicans hash out differences of means. But conservative commentator Patrick Buchanan (1987) claimed that "Americans of Left and Right no longer share the same religion, the same values, the same codes of morality, we only inhabit the same piece of land."

5. The Constitution and the US National Interest

Previous section headings have included the term "the national interest." Long explanations of the concept of national interest are behind the reader. Now it is necessary to expound on "the US national interest".

Intellectuals tend to bemoan the loss of certitude in today's world. However, in one area, certitude does exist in the US -- that the Constitution is the highest law of the land. The fact that it is higher than the politician's constituents is amply demonstrated by the oath of office that each federal office holder and elected official swears. People interpret the Constitution differently, hence the need for a Supreme Court; but all agree that it is the supreme law of the land.

The natural rights philosophy identified the fundamental condition of equality among men as a right passed down from God. Thomas Jefferson borrowed heavily from Locke's natural rights philosophy when he authored the Declaration of Independence (Becker, 1970); the Constitution is also based on the natural rights philosophy (Adler, 1987).

To Mahan, the national interest had two distinct elements -- political and moral. For purposes of this essay, "political" means the politico-military-diplomatic routine of the US government. The "moral" sentiment is based on John Locke's natural rights philosophy, as expressed in the Declaration of Independence and Constitution. Since the Constitution is the supreme law and comprises the moral principles of John Locke, the moral component of the national interest is based on the Constitution and is superior to the political component.

Lincoln's Gettysburg Address is another bastion of certitude. No one denies that the US government is "of the people, by the people, and for the people." Furthermore, the Declaration of Independence represents truth in the US. It states that governments are instituted for the protection of certain inalienable rights, such as life, liberty, and the pursuit of happiness.

These rights could not be protected if a state allowed itself to fall victim to another state's aggression. US Catholic Bishops (1986) wrote that, based on St. Thomas

Aquinas' Just War criteria (1947), states not only have a right to defend their populace, they have an obligation to defend:

"A people threatened with an unjust aggression, or already its victim, may not remain passively indifferent...." (emphasis added)(p. 242)

Therefore, this argument leads inescapably to the conclusion that self preservation is and ought to be the primary function of a state; its foremost national interest.

This thought process has profound implications for the study of national interest. If self-preservation based on moral laws is the primary state task, then a new national interest-public interest paradigm can be constructed. Since the highest goal of a state is self-preservation, national security interest is the name assigned to the Constitutionally-based moral component. Figure 7 has a didactic value useful in formulating the succeeding arguments.

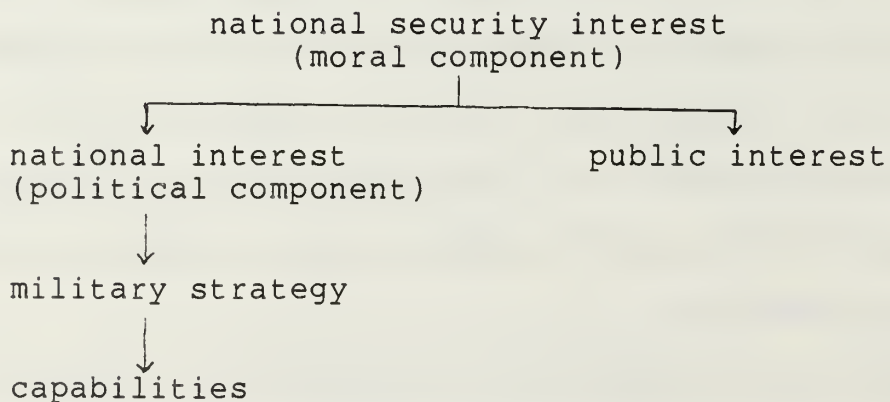


Fig. 7 Constitutional Paradigm of the National Security Interest

The national security interests of the US represent enduring goals of both the nation and the state and include self-preservation. These national security interests are striking in their simplicity and come directly out of the Preamble to the Constitution:

1. establish justice
2. insure domestic tranquility
3. provide for the common defense
4. promote the general welfare
5. secure the blessings of liberty to ourselves and our posterity.

Because these national security interests are based explicitly on the Constitution, they embody rare consensus among the conflicting groups of Walter Lippmann's The Public Philosophy (1955): the people (voters) and THE PEOPLE (the collective society) (pp. 32-36). The national security interests represent certitude in a fragmented nation-state with precious little of it.

The national interests of the US now no longer seek to aspire to the heights of glittering generalities that masquerade as enduring values. Instead they are politically derived, just as the Constitution allows. The US national interest is what the President proclaims and the Congress approves and may also be a compromise between the two, again, just as the Constitution allows. The US national interest also may be changed by Presidential election, just as the Constitution allows. The US national interest may be wrong, just as the Constitution allows. The White House has

published a set of national interests that fit into the Constitutional paradigm presented here:

1. The survival of the United States as a free and independent nation....
2. A healthy and growing economy.
3. The growth of freedom, democratic institutions, and free market economies....
4. A stable and secure world....
5. The health and vigor of U.S. alliance relationships." (The White House, 1987)

This formulation of the national interest is different from the standard terminology of international relations and strategic studies scholars. Most search for a national interest that does not change with Presidential elections. But in reality, the national interest does change. This fact is the key difference between the national security interest and the national interest. Jimmy Carter's national interest was founded on human rights; his priority was completely overturned by the Ronald Reagan (Vance, 1986). Many scholars have striven for a national interest that is not wrong. But Senator Warren Rudman (Republican of New Hampshire) declared in the Iran-Contra hearings on 13 July 1987 that the American people have the Constitutional right to be wrong. In summary, the national interest can be changed, be wrong, and be subjected to the vagaries of the American political process.

While different from most versions of national interest, the Figure 7 paradigm is somewhat similar to Collins' grand strategy components. The national security

interests as defined here concern protection and enhancement of five items in the Preamble to the Constitution and occupy a level above grand strategy. The national interest, explicitly spelled out by the White House, is synonymous with Collins' national security interests. The White House's national security objectives, which evolved from the national interest, are equivalent to Collins' national security objectives. However, the terminology used in Figure 7 differs from Weinberger's. His national security interests (values and geographical assets) are equivalent to the national interests used in Figure 7 and the White House (Weinberger, 1987, p. 9).

Clearly the national interest and national security interest terms deserve standardization. Without it, an effective model of strategic planning cannot be developed. Figure 7 provides such a basis for standardization. This formulation allow the Congress and Executive to invoke national interest to describe their own vision of US foreign and defense issues. Figure 7 also imposes a measure of symmetry on national and public interest; each are politically derived from the electoral process and are subordinate to the enduring goals of the nation, the national security interests.

6. Criticism of the Constitutional Paradigm

The critics may charge that this has been a clever academic exercise to disabuse any substantive meaning from

the term national interest; it ended the debate without ever having solved the issue. Some criticism is justifiable. The Behavioralists would still not be satisfied with The White House promulgation of the national interest. The Realists might object to advancing the cause of free market economies instead of power and influence. The Globalists would complain that The White House version is too nationalistic.

More cynical students of political science or history, and lawyers steeped in the adversarial process, may argue that the Constitution is not set in concrete. They would argue that the confirmation hearings of Judge Robert Bork amply demonstrated the hazards involved in viewing the Constitution as the Founding Fathers did. Judge Bork, an adherent of "original intent," even conceded that "constitutional intent is somewhat indeterminate or unclear" and inevitably generates conflicts in the "application of written words to modern circumstances...." (Kramer, 1987, p. 20) Nevertheless, the Taylor quote at the beginning of this chapter answers all criticisms.

Historians may point to how President Lincoln raised Army troops in May 1861 in direct violation of the Constitution, which assigns that function solely to the Congress. Later in the Civil War, Lincoln again violated the Constitution by disbursing Treasury funds to three private citizens for the purpose of procuring desperately needed military supplies. (Binkley, 1962, pp. 136-139)

Congressman Lincoln even accused President Polk of "unconstitutionally" starting the 1848 Mexican War (Sandburg, 1926, p. 367).

Regardless of these potential criticisms of the new paradigm, the concept remains viable for strategic planners. A strategic planner, like a business manager, needs to develop strategies to marshal resources based on a clear set of objectives (Hayes, p. 112). This paradigm shows the planner the source, right or wrong, for those objectives: the national interests articulated by the President.

One could argue that just because a given objective is the nation's stated policy, that does not mean that it is in the national interest. DeTocqueville solved this conceptual dilemma in the 1830s. He observed that a democracy promotes the well-being of the greatest number. Therefore, even though the majority who supports legislation are "subject to error ... they cannot have an interest opposed to their own advantage." (emphasis added)(p. 238)

The next section will show an example of the strategic planning process working from the bottom up, instead of from the top down, as portrayed in Figure 7. This aberration in strategic planning is called the technological imperative. Under this hypothesis, national interest and strategy evolve after the capability is created.

C. STRATEGIC PLANNING IN REVERSE: THE TECHNOLOGICAL IMPERATIVE

"In the councils of government we must guard against unwarranted influence, whether sought or unsought, by the military-industrial complex."

-President Eisenhower, 1961

1. History of Military Technology

In his Farewell Address of January 1961, President Eisenhower made his famous warning against the military-industrial complex. Although pundits took his statement out of context from a rambling speech, Eisenhower was really trying to recognize the fact that until World War II, the US had a relatively small defense industry. So how did nations apply scientific innovations to the military in the centuries before WW II? The role of technological change on military affairs in this era illustrates essential points regarding technology and strategy, and, as will be seen, technology-doctrine and technology-tactics.

From antiquity to medieval times, most new weapons evolved from craftsmen or inventors. Since nation-states did not exist, a rational process involving government formulation of national interest and military strategy did not exist. The development process was short, and the planning crude. For instance, Bernard Brodie (1973) wrote that if a soldier developed a weapon, he did it in response to a combat problem arising out of battlefield tactics. If an inventor developed one, it was the result of new metallurgical applications. (p. 8)

Moral principles also played a role in weapons development. In 1139, Pope Innocent II prohibited the use of the hand crossbow because it was "hateful to God and unfit for Christians." (Brodie, 1973, p. 35) Also, Brodie discovered that the father of the science of ballistics, mindful of the potential of his knowledge, refused to divulge his calculations until his country faced imminent invasion (1973, p. 10).

The 1500s witnessed a period of major advances in naval and maritime capability. The invention of the compass and other improvements in open-ocean navigation led to sailing ships and exploration. This produced a revolution in naval warfare by ending the 2,000 year reliance on the oar-propelled galley. At about the same time, gunpowder achieved wide acceptance. The marriage of open-ocean sailing ships with long-range gunnery permitted the divorce of naval strategy from land strategy. (Dupuy, 1980, p. 119)

The Treaty of Westphalia in 1648 marked the beginning of a new era in military affairs. The modern system of nation-states forced standardization of military equipment and establishment of military hierarchies (Brodie, 1973, p. 75). The 17th century also saw the publication of Sir Isaac Newton's Principia which ushered in the Age of Reason and accelerated technological innovation.

Weapons development was slow, however, until the Industrial Revolution. Many innovations of truly strategic

import in this era evolved out of civilian technology; the telegraph and railroad, for instance, facilitated the control and movement of vast quantities of men and material over long distances. In naval warfare, steam power, which grew from a need to pump water out of English coal mines, forced countries to begin thinking strategically about overseas coaling stations (Dupuy, p. 203).

The evolution of the submarine, on the other hand, illustrated the development of strictly military technology. Although Leonardo da Vinci received credit for the first submarine design, David Bushnell constructed the first successful combat submarine in 1773, which was used in the American Revolution. A quarter century later, Robert Fulton made a four-man submarine for Napoleon. By World War I, the submarine was an accepted weapon of naval warfare. Its evolution, from concept design to acceptance, required almost 400 years.

In World War I military science and technology had reached a point of complexity where governments began to get involved. For the first time, technical achievements were accomplished by "teams working under pressure to solve specific weapons problems." (Brodie, 1973, p. 172) This trend accelerated during the interwar years with the British development of radar.

Holley (1986) observed that Britain's work on radar in the 1930s demonstrated both technological and doctrinal

foresight. Sir Henry Tizard led an Air Ministry committee in 1934 to generate solutions to the Luftwaffe bomber threat. Tizard pursued a little understood characteristic of radio waves for two years and produced a radar with a 75 mile range. But Tizard went beyond his charter as a member of a scientific advisory committee and coordinated the development of tactical doctrine for its use. Through his initiative, the Royal Air Force had a workable radar system and a doctrine to guide pilots and air controllers in time for WW II. (pp. 28-32)

While radar defined the state of the art in the interwar years, military research and development establishments also pursued low technology. One example of how low technology made a difference in strategy concerns aircraft drop tanks for fuel. Drop tanks would allow fighters to escort the longer-range bombers all the way to the target. This concept travelled up the chain of command but was rejected in May 1939 because the Army Air Corps thought bombers did not need escort. The idea was resurrected in 1941 and used successfully throughout the war. The delay, however, in introducing drop tanks nearly invalidated the doctrine of precision daylight bombing, "the premise on which the whole prevailing air power strategy rested." (Holley, 1985, p. 21)

By World War II, entire national scientific and technological resources were mobilized under direct and

indirect government supervision to support the war effort. The capstone of this effort was the Manhattan Project. Its history is too well known to repeat here, but overall it sheds some additional light on the strategy-technology issue. Collins (1973) wrote that no national leadership before WW II could have pursued an atomic bomb based on a military strategy that called for such an enormous increase in destructive power. He concluded that "Project Manhattan followed the discovery of uranium fission, not vice versa." (emphasis in original)(Collins, 1973, p. 206)

Although this capsule description of weapons development can hardly do justice to a significant historical field, it provides the background for some compelling issues. First, some of the most strategic innovations, such as the railroad and telegraph, came from civilian technology, not military. One notes the same situation today with computers, an invention that has had far-reaching consequences for the military, but hardly falls under the category of technological imperative. Superconductivity is another civilian-led field which may affect future military weapons (Johnson, 1987). Second, technical progress is clearly capable of generating changes in tactics, doctrine, and administration. For instance, steam ships created a demand for a skilled engineering officer corps, allowed straight line navigation across the ocean, and introduced "crossing the T" into naval tactics (Dupuy, p. 204).

Third, weapons innovations generally do not produce a wholesale change in military strategy. Mahan argued his case for seapower in The Influence of Sea Power Upon History, 1660-1783 using historical examples of sailing ships. Aside from coaling stations, the introduction of steam ships did not change a maritime nation's military strategy much from protecting commerce and sailing powerful battle fleets. On the other hand, when technology does affect high level military strategy, such as precision day-light strategic bombing and the nuclear attacks on Japan, it seems to occur during wartime.

Fourth, the question of which came first, technology or strategy (or doctrine or tactics) assumes a chicken and egg quality. For instance, Sir Henry Tizard was assigned to solve a military problem by searching for suitable technology, i.e. strategy was driving the pursuit of technology. But someone (Dr. Robert Watson-Watt of the National Physics Laboratory) had to sell Tizard on the existence and potential of radio wave detection. Therefore, the technological imperative school would blame Watson-Watt for "fueling the arms race." Lastly, and most importantly, technology affects warfare at different levels -- strategic, doctrinal, and tactical.

2. The Technological Imperative

a. Description

Ralph Lapp, a physicist formerly with the Manhattan Project, is the elder statesman of the "technological imperative" school. The technological imperative goes by many names, such as technological momentum or technological determinism. It describes the process by which technology allegedly acquires a life of its own and compels man to procure the latest technology for its own sake. Lapp wrote in 1970 of the technological imperative: "when technology beckons, man is helpless." (p. 178)

The concept of technological momentum received its earliest articulation long before its official debut in the ABM/MIRV debate of the late 1960s. The French political author Raymond Aron, reflecting in 1954 on the massive destruction of World War I, hinted at it when he wrote that "technical excess" over the years had elevated ideology into a major war objective. That is to say, only amorphous principles such as self-determination could justify the absurd destruction of the war. (p. 26)

Of course weapons improvement was an ongoing process long before the late 1960s. The technological imperative school tends to not distinguish between routine weapons improvement and radical conceptual advancement based on new principles. For instance, the MIRV technology which

evolved the technological imperative criticism was already partially in existence in the form of Multiple Reentry Vehicles (MRV).

President Eisenhower's Farewell Address contained more than just the well-known warning about the military-industrial complex. He also warned of: "the equal and opposite danger that public policy could itself become the captive of a scientific-technological elite." (National Archives, p. 1039) This represents a notable turnaround for Eisenhower, since he told his first Special Assistant for Science and Technology, James Killian, Jr., that staff scientists were the only genuinely altruistic group that worked in Washington (Kistiakowsky, 1976, p. liii).

Lockheed prepared a 1961 Technical Report which elaborated on technological momentum. The report offered several ways of viewing US defense planning; among them was this statement:

"Arms developed in the United States stem largely not from farsighted and prior development of policy requirements reconciled with general state-of-the-art projections, but rather from the pressure of invention, profit seeking in a semifree (sic) enterprise system, special interests, and biased concepts of requirements supported by technological enthusiasm...." (Barclay, p. 12)

At the time Lockheed was in a unique position to analyze the defense planning process; it was at the forefront of ICBM and space satellite technology and, therefore, was sensitive to America's attitudes in the post-Sputnik and missile-gap era.

In 1970 the ABM, MIRV, and arms control issues coalesced into the theme for the 10th Annual Pugwash Conference: "The Impact of New Technologies on the Arms Race." Participants sought to distinguish between "stabilizing" and "destabilizing" weapons technologies which fueled what they described as an "action-reaction" arms race. Technology, they believed, was a force that eroded "political control over doomsday." (Greenwood, 1971, p. 12) Also in 1970, Herbert York argued that "technological hardsell" brought on an overreaction in weapons procurement (p. 24).

Lapp popularized the issue in his 1970 book, Arms Beyond Doubt: The Tyranny of Weapons Technology. He earned his credentials as a physicist against nuclear weapons in 1962 with Kill and Overkill. His 1970 work argued the case for the effects of imperious technology with metaphors and scathing criticism. The technicians, he wrote, who designed nuclear warheads were men "of an engineering mentality, which is little educated to a sense of social responsibility." (Lapp, 1970, p. 5)

Of the Manhattan Project, he argued that its original charter was to develop a workable atomic weapon before Germany. However, once the Allies defeated Germany on 8 May 1945, he lamented, the US continued the project without a thought. Lapp concluded that: "If the A-bomb could be made, it would be made." (1970, p. 173) Lapp summed up his view on defense planning as follows:

"Somewhere along this road to destruction, man lost his way and let his steps be guided by the compass of technology. Whenever a new weapon possibility beckoned, society meekly moved in this direction, without questioning the consequences. The natural sciences, for so long supreme in the grandeur of their isolation, became the great dictators of weapons events." (1970, p. 3)

Literature on technological determinism waned following the 1972 SALT I and ABM arms control agreements. During the ensuing detente period, US strategic forces remained at a plateau, the arms control/technological determinist advocates held influential positions in government, and the aerospace industry fell on hard times following the end of the Vietnam War and the Apollo Program.

By the late 1970s, the B-1 bomber, cruise missile, Trident program, and SALT II debate caused public attention to be focused on strategic weapons procurement once again. One analyst wrote that "development of military capabilities has a momentum" and that justification for weapons' use is not formulated until afterwards." (Molineu, 1978, p. 16) A former British defense official echoed this sentiment:

"During the twenty years or so that I myself was professionally involved in these matters, weapons came first and rationalizations and policies followed." (Zuckerman, 1984, p. 7)

Colin Gray (1982) addressed three non-exclusive propositions for relating technology, strategic theory, and national policy. One of those ideas was the technological imperative, which he defined as technical change which

ultimately generates "congruent theoretical and policy changes." (p. 16) Although no advocate of the technological imperative school, Gray contended that a poorly defined military doctrine or defense policy could lead to a "relatively permissive environment" for weapons research (p. 19).

The most recent contribution to the literature on technological imperative was published by Thee (1986). The author argued that technological momentum shaped strategy and that modern military technology has led the world astray (p. 1). Furthermore, the long gestation period of new weapons, over 10 years, gave weapons "a momentum quite impervious to socio-political restraint." (p. 16)

Proponents of the technological imperative school tend to disparingly view technology and the arms race as an inevitable phenomenon. However, this viewpoint has several shortcomings. First, the fact that technology is not an inevitable phenomenon is demonstrated by the Soviet Union, which forecasts technology and includes it in its long range planning. Also, responding to enemy weapons improvements may be in a state's national interest. A government would be negligent to not counter a hostile adversary's new weapon.

Several related defense issues do not fall under the category of technological imperative. For instance, there is little debate about the US policy to rely on technology to meet the Soviet overwhelming conventional

weapon threat. The Secretary of Defense formalized this in 1987 with his policy of "competitive strategies," which is designed to take advantage of US technical leads over the Soviets (DOD, 1987, pp. 65-69). Second, debate on force levels once a weapon has been selected includes a different set of arguments, such as whether the government may be overreacting to an enemy threat (Ball, 1980, and Kuenne, 1966). Lastly, the scientist's influence on major policy decisions, e.g., nuclear test ban debate, is a more general issue than the quite specific technological imperative (Wohlstetter, 1963).

b. Causes

The technological imperative supposedly causes defense planners to acquire exotic new technologies without consideration of military strategy or national interests. What might be the underlying causes of such a condition?

Four reasons exist to explain the technological imperative. First, former Secretary of Defense Brown wrote that "uncertainty is necessarily the lot of the planner, since he deals with the future." (1967, p. 277) This compels defense planners to choose flexible weapons to meet future needs. The obvious downside of creating multipurpose weapons is that a weapon may turn out to be most useful for a nonexistent mission (Head, 1978, p. 547).

Second, the adversarial process defines the US democratic process. One is either an advocate of a cause,

program, or bill, or one is a critic of it. In the case of weapons procurement, it is hardly a novel idea that organizations push to have their programs approved (Ball, 1980, p. xvi). Specifically, four groups endorse new weapons development:

1. defense contractors,
2. scientists at Defense and Energy labs,
3. military strategists at think tanks,
4. Department of Defense "in house" technical experts.
(Thee, 1986, p. 17)

Thee, like other technological determinists, tends to lay the blame on the military-industrial complex. However, one could also make the case that the Congress and the White House belong on the list.

Third, the US has a comparative advantage in technology over the Soviet Union. Also, the US and Western democracies cannot meet the Soviet threat man for man and weapon for weapon. Therefore the US "substitutes technology for manpower" and, thus, technology has a tendency to influence both strategy and doctrine. (Head, 1978, p. 548)

3. Summary

One of the criticisms by the military reform movement is that a decoupling exists among military technology, military strategy, and operational concepts (Sanders, 1985, p. 157). For instance, US defense critic Edward Luttwak wrote that without a national strategy, "unguided technical ambition will overwhelm defense planning." (Luttwak, 1981, p. 16) Cogent strategic planning requires a formulation of

the national interest and military strategy; the technological imperative destroys the rationality of the process.

The technological imperative issue only lends itself to multi-service strategic weapons. Nuclear weapons and their delivery vehicles have direct and permanent links with military strategy and national interest. Single service conventional weapons do not have this link; they mostly affect doctrine, not strategy.

The implications of technology driving doctrine are not as severe as technology driving strategy. For instance, if an engineer discovered a radically new way for a torpedo to measure doppler (a characteristic of sound waves), this might affect anti-submarine warfare (ASW) doctrine. This would be a welcome improvement to the submarine community, but would hardly affect the nation's military strategy. On the other hand if this same engineer discovered a radically new method of non-acoustic submarine detection, this could completely revise the way strategists think of finding the enemy's and protecting our own FBM submarines, i.e. would affect military strategy. Therefore, the technology-doctrine and technology-tactics relationships do not fall under the technological-imperative rubric.

In a sense, tactics are designed to make up for the shortcomings of new weapons. Even without shortcomings, the military expects to develop new tactics and doctrine based on

new hardware. For instance, one US Navy admiral stated that his generation was passing to the next generation new weapons, such as the Vertical Launch System for missiles; the goal of the latter group was to determine the best ways to deploy it. (Metcalf, 1987) Vice Admiral Metcalf's observation is entirely accurate and supports the contention that technology-doctrine and technology-tactics interaction is not a harmful relationship. It also illustrates another deficiency in Figure 4 -- the need for a feedback loop from capabilities to service doctrine.

The next section will consist of a case study of the Polaris FBM system. As a strategic weapons system that grew out of an exciting period in US technological development, it provides a means of testing the validity of the technological imperative case.

III. THE POLARIS: A CASE STUDY

"Move deterrence out to sea,
Where real estate is free,
And where it's far away from me."

-Ralph Lapp, 1962, p. 75

A. INTRODUCTION

Polaris lends itself to a study of national interest and technological imperative for several reasons. First, it is a strategic nuclear weapon. Instead of affecting or evolving from strictly US Navy doctrine or tactics, it has distinct links to the nation's military strategy. Second, the Polaris system is narrow in scope, which allows effective analysis. The development of the ICBM, while illustrating the same concepts, would have been unwieldy, since that task would include the Atlas, Thor, Jupiter, Titan, Minuteman, and Polaris projects. Lastly, Polaris represents more than just an exercise in weapons procurement, e.g., a debate on force levels with respect to a limited budget. It represents one of the largest technological advancements ever attempted by the US Government (Sapolsky, 1972, p. 160). In short, Polaris promises a useful test of the validity of the technological imperative.

B. CHRONOLOGY

1. 1946-1953

History of the Navy's ballistic missile program began in 1946. By that time, the US had set up German rocket scientists in its government laboratories. The Germans, led by Dr. Werner Von Braun, possessed proven expertise in both types of missile design -- cruise missiles (as represented by the V-1 "buzz" bomb) and ballistic missiles (V-2 missile). These Germans had also experimented with launching a V-2 from a submarine, but Army-Navy rivalry killed the project.

By 1946, the US Navy was looking at guided missiles as a means of deflecting attacks on the Navy's usefulness in the nuclear age (Baldwin, 1946, p. 19). However, most of the technical work on ballistic missiles was marred either directly or indirectly by pernicious interservice rivalry. For instance, the Army Air Force and Army argued over whether a ballistic missile was a flying weapon or artillery (Perry, 1967, p. 3). The Army Air Force and Navy worked out an agreement on roles and missions regarding nuclear weapons in the Key West and Newport Conferences of 1947. Unfortunately, controversy erupted between the Army Air Force and Navy regarding the inaccurate B-36 bomber and the accurate carrier aviation in the late 1940s. (Sapolsky, 1972, p. 5)

The US at that time held a monopoly on nuclear weapons and their means of delivery. This advantage led the US into a false sense of security regarding missile

technology. The US funded ballistic missile research at low levels in the late 1940's for two reasons: (1) the US strategic posture did not demand a new weapon, and (2) the new weapon was not technically feasible (Perry, p. 1).

The false sense of security was shattered when the Soviets exploded their first atomic weapon in August 1949, years ahead of US predictions. Less than a year later, the North Korean invasion of South Korea exposed the US nuclear arsenal as a paper tiger. Tired of the Korean War and unhappy with US defense policies, President Eisenhower entered office in 1953 promising to resolve the Korean conflict and bring fiscal responsibility to the nation.

2. 1953-1955

The new Chief of Naval Operations, Admiral Arthur Radford, shared the President's views of defense planning and articulated them in the "New Look" speech of 14 December 1953 (Eisenhower, 1963, p. 449). The New Look recognized the US-USSR competition as a long term struggle that had to be reconciled with the nation's material well being. Accordingly, the New Look reallocated money among the five functional accounts in the Department of Defense (nuclear forces, air defense forces, sea forces, etc.) by giving the most support to nuclear forces. Secretary of the Treasury Humphrey applauded this plan as a needed improvement; he had

accused the Truman Administrations of planning for six kinds of wars -- two for each military branch (Hammond, 1962, p. 433).

Consistent with the shift toward relying more on nuclear weapons, Secretary of State John Foster Dulles announced in January 1954 the policy of Massive Retaliation. Dulles argued that committing huge land forces against the Communists demonstrated poor military strategy. Henceforth, he stated, the US would respond to aggression by retaliating instantly "by means and at places of our own choosing." (Dulles, 1954, p. 108)

Two Presidential committees in the mid 1950s provided the impetus for ballistic missile development in the context of the New Look. The first, the Strategic Missiles Evaluating Committee, led by mathematician John Von Neumann, met in November 1953 to reduce development costs of the disparate missile programs. Under the oversight of Special Assistant to the Secretary of the Air Force, Trevor Gardner, the committee reported in February 1954 that ballistic missile programs required reorganization and expansion, since technical feasibility was no longer an obstacle (Perry, p. 12). The committee recognized that the US had allowed itself to fall behind the Soviets in ballistic missile technology. President Eisenhower confirmed this in his memoirs by noting

that in fiscal year 1953, the US allocated less money to long range ballistic missile development than to price support for peanut farmers (1963, p. 456).

The second committee had an even more profound impact on ballistic missile development. President Eisenhower created the Technological Capabilities Panel, led by James Killian, Jr., in July 1954 to evaluate the vulnerability of the US to surprise attacks. The Committee submitted to Eisenhower a report titled "Meeting the Threat of Surprise Attack," known as the Killian Report, in February 1955. The report recommended, inter alia, that:

1. the Air Force ICBM program receive the highest national priority,
2. land- and ship-based IREMs be evaluated as an interim measure until ICBM deployment. (Killian, 1977, p. 76)

In what was to be a harbinger of future reports addressing strategic programs, the Killian Report had a "sense of urgency without pessimism." (Killian, p. 85)

3. 1955-1960

Until 1955, the Navy was apathetic regarding ballistic missile development. It believed that such development would divert resources from more important areas, such as readiness. Additionally, the Navy already had a moderately successful strategic system -- the Regulus cruise missile, introduced in May 1954 (Paolucci, 1970).

Several items came together to steer the Navy back toward ballistic missile development. First, in August 1955,

Admiral Arleigh Burke was appointed as the new Chief of Naval Operations and became a tenacious advocate of sea-based ballistic missiles. Second, the Air Force began eliminating technical obstacles in its Atlas ICBM program, which it started directly after the Von Neumann Report. Finally, in September, the President supported the Killian Report's recommendation "that a 1500 mile ballistic missile system be developed. Both land-basing and sea-basing to be considered (sic)." (SSPO, p. 24)

The Secretary of Defense would not, however, allow the Navy to independently pursue its own IRBM. Consequently, a month later, the Joint Army Navy Ballistic Missile Committee (JANEMC) was established. The Navy inherited the liquid fueled Jupiter IRBM from this merger and, although disappointed in the arrangement, at least saw an opportunity for their own missile. In November 1955, the President placed the Jupiter project on the same high priority as the Air Force Atlas program. (Beard, 1976, p. 198)

On 17 November 1955, the Secretary of the Navy created the Special Projects Office (SPO)² to manage the ship-based aspects of the Jupiter system. Two weeks later, the Navy formally announced that development of a solid-fueled, submarine-launched IRBM (SLBM) was its long

² The Special Projects Office (SPO) later changed its name to Strategic Systems Program Office (SSPO).

term aim. (SSPO, p. 24) By the end of the year, Rear Admiral William Raborn, USN, assumed directorship of the SPO. Under the new Director, the SPO pushed for a unique Navy IRBM; its requirements were too different to permit a common missile with the Army. The Secretary of Defense's Scientific Advisory Committee recommended that the Navy's solid-fueled project "receive top priority, equal to that of" the liquid-fueled Jupiter (SSPO, p. 24). The Secretary of Defense terminated the JANBMC in December 1956 and authorized the Navy to proceed independently on the Polaris project.

The year 1956 also witnessed the publication of Albert Wohlstetter's influential RAND report "Protecting US Power to Strike Back in the 1950s and 1960s." (Kaplan, 1983, p. 121) This study analyzed the vulnerability of the US retaliatory force (SAC bombers and future ICBMs) against the new Soviet fusion weapons. The report evolved from several studies evaluating vulnerability of overseas SAC bases that he produced in 1953-54.

Several events occurred in 1957 which accelerated the Polaris project. First, researchers achieved a significant breakthrough in designing solid fuel rocket motors, which affected both the Minuteman and Polaris programs. Previously, only liquid fueled rockets could develop the thrust to launch a payload out of the atmosphere. Second, the Atomic Energy Commission reported that a small nuclear warhead suitable for Polaris was close at hand. Although

these were the most important technical issues in 1957, Kahn and Wiener (1967) listed four other technologies that the US needed for the Polaris:

1. nuclear propulsion (achieved in January 1955 with USS Nautilus)
2. accurate submarine navigation system
3. small, accurate missile guidance system
4. successful integration of millions of complex, and, largely "untested" parts. (Kahn and Weiner, p. 67)

Third, the Naval Warfare Analysis Group Study 1 (NAVWAG-1) reported in January 1957 that the SLBM was "more invulnerable to surprise attack" than other comparable missiles. NAVWAG-1 concluded that Polaris would make a significant asset to the US deterrent force. (Rosenberg, pp. 161, 191)

Fourth, the Gaither Committee Report "Deterrence and Survival in the Nuclear Age," published in November 1957 praised Polaris. Although known primarily for its recommendations regarding civil defense, the report also recommended acceleration of missile projects, in particular Polaris due to its inherent characteristics of invulnerability (Rosenberg, p. 157).

The Soviets also influenced the missile program. In August 1957, they announced the launch of a ballistic missile that had "covered a huge distance in a brief time." (Frankel, 1957) However, the biggest boost to the Polaris program was from the Soviet launch of Sputnik in 4 October and 3 November 1957. The Soviet success stunned Americans, including many

in the government who had believed the Soviets were technically backward. The Sputnik threw the nation into a frenzy; ham radio operators listened to the satellite's beeping, musicians wrote songs about it, and people watched the Sputnik travel across the sky with binoculars (ABC, 1987).

Two months after the Sputnik launches, the SPO and Bureau of Ships recommended to the CNO a proposal for speeding the timetable under "national emergency" conditions (SSPO, p. 26). The SPO, already an elite, high-pressure organization, performed under near-wartime conditions. Its military staff personnel wore uniforms instead of civilian clothes in Washington, D.C., its civil service staff worked a "standard" 5 1/2 day work week, and Rear Admiral Raborn spoke at pep rallies at defense plants (Sapolsky, pp. 44-45). After Sputnik, Polaris never suffered from funding problems. In late 1957, Raborn told a Congressional hearing: "I received more than a fair share of what I needed to do the job." (Senate, 1959, p. 101)

In June 1959, the Navy launched the first Polaris submarine, USS George Washington, at Groton, Connecticut. Consistent with the emergency nature of the Polaris program after 1957, the Navy had cut an existing new construction attack submarine, the USS Scorpion, in half and inserted a 130 foot missile section. In 1960, the USS George Washington successfully launched two Polaris test missiles off Cape

Canaveral, Florida. Almost exactly five years after the creation of the SPO, the USS George Washington began its first two month patrol as part of the US retaliatory force.

4. 1960-1965

The Polaris program's high point in the late 1950's passed clearly behind as the 1960 Presidential election faded away. The missile gap which had become the major strategic issue of the campaign turned out to be a myth. On 6 May 1962 at the Kwajalein Atoll in the Pacific, the Polaris proved its system reliability in the ultimate test ever performed in the nuclear age by being the first US nuclear-armed ballistic missile to be launched and detonated. Finally, the Polaris began to receive the close scrutiny that it was excused from during its heyday in the late 1950s.

C. NUCLEAR STRATEGY

1. Deterrence

The relevant question this study seeks to answer regarding the Polaris is this: what pushed its development? Did national interest as expressed through military strategy drive the Polaris? Or did the technological imperative? Or did something more complex?

The concept of submarine launched ballistic missiles arose out of several strategic considerations of the post World War II era. First, deterrence was already a generally accepted principle. Bernard Brodie wrote in 1946 in his

seminal book The Absolute Weapon that the primary function of military force in the nuclear age was to deter war; "it can have almost no other useful purpose." (p. 76) Secretary of Defense Forrestal reinforced the notion that deterrence was accepted in government. In 1948 he noted that "the chief deterrent to war, is the threat of immediate retaliation with the atomic bomb." (Millis, 1959, p. 538)

Second, an obsession with surprise attack shaped the overall strategy of deterrence. Brodie wrote as early as 1946 that nuclear weapons tilted the "scales overwhelmingly in favor of surprise attack." (pp. 22-23) Wohlstetter's vulnerability studies quantified the problems of prevention of surprise attack during the mid 1950s. Admiral Burke testified before the Senate that Polaris would enhance the US retaliatory posture because of its invulnerability (Senate, 1960, p. 292). Moreover, the NAVWAG-1 and Gaither Reports were animated by a fear of surprise attack.

Lastly, Massive Retaliation was an asymmetrical strategy that directly influenced the composition of US military forces (Haley, 1985, p. 55). The national mindset was opposed to any more land wars against Soviet or Soviet-backed aggression, such as the Korean Conflict, hence almost any form of nuclear weaponry received abundant financial resources.

Deterrence, vulnerability, and massive retaliation defined the strategic environment of the mid 1950s. However,

two other points influenced strategic weapons procurement. First, policy makers began to appreciate the subtleties of counterforce and countervalue attacks. This created a need to locate strategic forces away from population centers (Armacost, 1969, p. 106). Second, problems with overseas base rights began to appear (Senate, 1959, p. 75).

The Congress and the Department of Defense authorized the Polaris Program because it satisfied all these requirements. The Senate Armed Services Committee wrote that the ballistic missiles had a single purpose: to deter by threat of retaliation (Senate, 1959, p. 75). The Polaris solved the problem of political control over bases by its sea basing plan. Brodie wrote that it solved the vulnerability issue by being both hardened (unlike SAC bombers) and dispersed (1959, p. 218). Furthermore, a submarine's inherent undetectability while submerged immediately rendered it superior to a surface ship. The Polaris also solved the problem of absorbing counterforce attacks.

Intelligence assessments of the threat played no small role in Polaris development. But it was already incorporated into the overall strategy outlined above. By the time Sputnik ignited the nation's fears, the CNO's requirement for a solid fueled submarine launched ballistic missile was eight months old. The optimum Polaris missile "envelope" and FBM submarine "envelope" were similarly already established (SSPO, p. 25).

The Killian Report integrated the Soviet threat and technological opportunity. Although its original charter was to analyze US vulnerability to a bolt-from-the-blue attack, committee members also sought to redirect military research toward development programs based on the threat. The Killian report, while emphasizing national interest insofar as recognizing the threat, did not formulate strategy. Killian wrote later that the goal was not to pursue the capability for mutual assured destruction, but rather to achieve and remain at an offensive advantage (1977, pp. 74-75).

The fact that massive retaliation came under attack during Polaris's crucial years in 1957-1959 does not upset the premise that massive retaliation as a strategic concept helped shape the requirement for it. The most eloquent critique of the Dulles doctrine was that it recognized only all-out war and all-out peace (Kissinger, 1957, p. 11). But this hardly breaks the link between national interest, military strategy, and Polaris.

2. Targeting

In the field of nuclear strategy, one cannot consider deterrence apart from targeting doctrine. The interaction between Polaris and targeting, thus, needs to be explored.

During most of the 1950s, the Strategic Air Command's targeting set included three major options:

Bravo: blunt the Soviet attack by destroying their nuclear forces

Romeo: retard movement of Soviet forces by attacking other military targets in Eastern Europe
Delta: disarm Soviets by damaging their war industries.
(Rosenberg, p. 133)

Admiral Burke tried to develop alternate strategies in July 1958 with his proposal for "finite deterrence." Burke believed Polaris could slow down the arms race by its low political visibility and concluded that only a small Polaris force was needed for deterrence. (Rosenberg, p. 164)

In November 1958, the National Security Council's Net Evaluation Subcommittee began to shift toward this view; it recommended that targeting emphasize urban-industrial targets for cost efficiency reasons. Rosenberg wrote that Eisenhower was sympathetic to this approach since he favored a minimum force level approach to defense planning. Also, the President was displeased with SAC's expanding target list and its inevitable link to increasing force requirements. (p. 163)

Burke refined his finite deterrence in September 1959. He argued that it would be foolish to target empty Soviet missile and bomber bases; instead, the US should target cities and command centers. Eisenhower did not adopt Burke's viewpoint and in 1960 stated the US would use SLBMs for air defense suppression. (Rosenberg, p. 171)

During the same period, RAND analysts were arguing a "no cities" targeting policy (Kaplan, 1983, p. 204). Robert McNamara adopted "no cities" targeting as an integral part of his war-fighting and damage limitation strategy in his Ann

Arbor speech (McNamara, 1962). McNamara changed this policy once again in 1964-65; his new concept of Assured Destruction was based on a systems analysis approach to allocating resources and did not address the technological capabilities or limitations of the US strategic force.

United States targeting policy had a seesaw existence from 1957-1965. But the events do not suggest that Polaris critically influenced targeting. Two forces appear to explain the targeting shift during this period. First, Rosenberg stated that the Navy and Army were trying to break the "lucrative link" between the target list and expanding SAC force requirements (p. 162). In short, it was becoming financially infeasible to maintain a counterforce policy. This dilemma turned up again when McNamara dropped a damage limitation strategy in favor of assured destruction, in response to economic forces. Second, political forces played a huge role. The Kennedy Administration took office on a platform criticizing massive retaliation. McNamara's shift to "no cities" reflected in part his idealistic desire to show the Soviets good faith, in return for them not targeting US cities.

A feedback loop probably exists in the strategy-technology relationship. The Polaris technology provided the impetus for creation of a Reserve Force. But the literature does not provide evidence to support a common myth that

Polaris' inherent inaccuracy drove countervalue targeting, the declaratory strategy of the 1965-1974 era.

It appears that the only role technology played was as a vehicle to implement policy decisions. The US had neglected ballistic missile technology in favor of manned bombers until the Von Neumann Report. Therefore the US reallocated resources into ballistic missile technology to correct this deficiency and support the national policy. Moreover, this situation supports Schmooker's (cited in Sapolsky, p. 236) contention that money determines the direction of technology. Military labs (such as the Army's Redstone Arsenal under Braun) performed most of the missile research until the Von Neumann Report bred the Atlas program. Even then, contractors on the Polaris program took no financial risk in the research and development (Sapolsky, p. 82).

D. CASE STUDY CONCLUSION

The Polaris program holds a very unique place in US weapons development history. The project, along with its sister ballistic missile programs, and the Manhattan Project mobilized the technical resources of the nation toward a common goal. The Polaris missile, especially, acquired a mystique of its own: "It was not just another missile that

was being built; it was, rather, the missile that was going to stop the Russian threat to the US mainland." (Sapolsky, p. 159)

Admiral Raborn's vision carried over to the Polaris contractors; eight of the largest published a sleek hardcover book full of human interest stories and photographs of the industry's Polaris efforts. Hughes Aircraft became so caught up in the project's national importance that its female workers wore red, white, and blue Polaris blouses (Adventures). Additionally, a popular book, Polaris!, was published at the height of the program (Barr, 1960).

Quite clearly, strategy, not technology, drove the Polaris program. Sapolsky wrote the most forceful statement than can be made regarding a possible technological imperative; the Polaris benefitted from an "unusual convergence between technological opportunities and a consensus on national needs." (p. 241) Not all technically advanced US weapons systems were likely to experience such a unique convergence. Polaris's follow-on missile, the MIRVed Poseidon, suffered much political trauma in its development. The next chapter will look at the possibility of a technological imperative in the development of the Tomahawk.

IV. THE TOMAHAWK: A CASE STUDY

"SLCM: A Weapon in Search of a Mission"

-Farrell, 1981, p. 105

"[SLCM]: A Weapon in Search of a Mission"

-Huisken, 1981, p. 28

A. INTRODUCTION

The two quotations above suggest that the Tomahawk cruise missile is ripe for evaluation as a test of technological imperative hypotheses. The authors suggest that the Tomahawk program evolved without a clear-cut mission. On the surface, this suggestion appears to justify the claims that strategic weapons systems emerge from the "military-industrial complex" without well-founded strategic rationales. This case study reaches the opposite conclusion -- that the US strategic cruise missile (SCM) program developed from sound strategic considerations and ultimately produced a worthwhile strategic weapon: the air-launched cruise missile (ALCM). That the Tomahawk sea-launched cruise missile (SLCM) remains without an apparent role is not an egregious example of technology run rampant, but rather of glacial doctrinal adaptation.

None of the three reasons that endorsed the Polaris as a useful case study apply in the Tomahawk situation. Unlike Polaris, the Tomahawk SLCM is not strictly a strategic weapon. It presently has three variants: nuclear land attack (TLAM/N), conventional land attack (TLAM/C), and

anti-ship missile (TASM). Second, the Tomahawk development chronology is not narrow in scope; it begins in 1972 as a strategic cruise missile, proceeds to a 1977 split into the strategic ALCM and theater SLCM, and continues today with its third version, the GLCM. Third, it did not command as high a level of technical resources as the Polaris. Indeed, one of the SLCM's primary attributes is its cost-effectiveness.

B. CHRONOLOGY

1. 1946-1962

While the modern history of cruise missiles began with the same German rocket scientists of the ballistic missile program, it would be incomplete without mention of Elmer A. Sperry, cofounder of Sperry Gyroscope Company. The principles of gyros permitted unmanned flight. In September 1916, a US Navy Lieutenant witnessed and reported a test flight of an unmanned aircraft; however, the military had no immediate interest. (Werrell, p. 7)

The military potential of unmanned aircraft became apparent with the V-1 during World War II. Similarly, the desperate Japanese kamikaze attacks showed the usefulness of guided bombs. US Navy experience with the V-1 led to the Regulus I strategic cruise missile. The Regulus I carried a 3.8 megaton warhead 250 miles and operated from 1955-1964. During its day, the Navy considered it a moderately successful strategic missile and even constructed a nuclear powered guided missile submarine, USS Halibut (SSGN-587), to

launch it. Several diesel submarines specifically designed for Regulus I were also commissioned.

The Navy's success with the subsonic Regulus I led to development of a supersonic Regulus II. At the same time, the Director of the CNO's Long Range Objectives Group attempted to fill a forecasted shortcoming in retaliatory capability in the 1961-1963 period. While emphasizing the obvious solution of increasing the rate of Polaris SSBN production, he advanced the idea of developing a 1200 mile unmanned, all-weather cruise missile. He believed that a modified Regulus II could attain a 2000 mile range with accuracy sufficient for the existing urban targeting policy. (DON, 1958) Ultimately, high cost and greater promise of Polaris forced cancellation of Regulus II in late 1958.

The Air Force also worked with cruise missiles in the 1950s. In addition to its well-known ballistic recommendations, the Von Neumann Strategic Missiles Evaluation Committee reported in 1954 that the Air Force Snark and Navaho missiles had serious deficiencies (Werrell, p. 93). The Snark relied on a complex celestial navigation system that the Committee objected to. It recommended, inter alia, that the Air Force use cruise missiles in a decoy mode to assist long range bombers in penetrating Soviet air defenses. The Air Force ballistic missile program also supplanted cruise missile efforts and forced cancellation of Snark in 1961.

2. 1962-1972

The October 1962 Cuban Missile Crisis introduced the US Navy to a relatively new threat: short range, surface-to-surface missiles fired from patrol boats. The Soviets had outfitted the Cuban Navy with 25 mile SS-N-2 Styx missiles aboard Osa class gunboats. By this time the Navy had gained considerable experience in surface-to-air missiles, but relied on carrier aircraft for battlegroup protection against tactical surface-to-surface cruise missiles.

The lack of a tactical anti-ship cruise missile was a manageable problem since the Navy possessed overwhelming carrier airpower in the mid-1962. Nevertheless, Captain (later Admiral) Worth Bagley, and Captain (later Admiral) Elmo Zumwalt, proposed to Secretary of the Navy Paul Nitze a major research and development program in 1966 for anti-ship cruise missiles. Nitze's approval laid the foundation for official Navy support of long range cruise missiles. (Art and Ockenden, 1981, p. 381)

The 1967 Arab-Israeli war provided the most important impetus to the fledgling US Navy cruise missile program. The Egyptian sinking of the Israeli destroyer Eilat with a SS-N-2 shifted the US effort from one of study to one of action. Indeed the incident "jolted" the West ("Navy," 1972, p. 60). In 1968 the Navy set up the Anti-ship Missile Defense Office. This led to a Defense Select Acquisition Review Council (DSARC) decision in November 1970 to approve

development of the Harpoon, a 60 mile anti-ship tactical missile (Huisken, p. 29). Since the Harpoon would not become available until the mid-1970s, the Navy also began the Interim Surface-to-Surface Missile (ISSM) as an interim measure (Jane's, 1972, p. 46).

The years 1970-71 marked several milestones in the development of cruise missiles. First, Elmo Zumwalt became CNO and immediately began pushing for a long range cruise missile. Zumwalt's memoirs illustrated his intense feelings:

"To my mind the Navy's dropping in the 1950s of a promising program for a cruise missile called 'Regulus' was the single worst decision about weapons made during my years of service." (Zumwalt, 1976, p. 81)

Second, the Center for Naval Analyses issued a study that evaluated the contribution such a missile would make to strategic forces. It concluded that an underwater launched cruise missile was feasible. (Werrell, p. 151) Third, the Harpoon Project Office set up a separate program element called "Cruise Missiles (Advanced)" (ACM) to "consider the follow-on technological cruise missile developments beyond Harpoon." (Canfield and Kellett, p. 39) Lastly, the CNO established the Submarine-Launched Anti-Ship Interim Missile Ad Hoc Panel to develop Harpoon as a rapid way to achieve a long range SLCM capability (Levine, 1977, p. 127).

This period also witnessed the confluence of several other trends. United States forces in Vietnam achieved outstanding success with Remotely Piloted Vehicles (RPV).

The Ryan Firebee RPV had an especially low loss rate, even when employed in heavily defended areas. Additionally, the Air Force desired a new decoy to replace the Quail of the 1960s. The Congress, however, favored a dual mission for any new decoy, that of decoy and long range attack missile. Subsequently the Air Force began the Subsonic Cruise Armed Decoy (SCAD) program. Crucial to this program was the development of an efficient turbofan engine for long range.

In April 1971, the Navy proposed a new class of guided missile nuclear submarines to carry a proposed 300-500 mile cruise missile. The project earned the acronym STAWS for Submarine Tactical Antiship Weapons System and gained considerable support from Admiral Rickover. Therefore, at the time of the May 1972 SALT agreements, the Navy possessed two cruise missile programs: the Harpoon tactical anti-ship missile and the ACM long range anti-ship missile. At that time, the SCM was only an element within conceptual studies overseen by the Secretary of Defense's Systems and Analysis Section. (Werrell, p. 151)

Secretary of Defense Laird and the Joint Chiefs of Staff were not as sanguine about the SALT I Interim Agreement and the ABM Agreement as the rest of the country. They conditioned their support of the agreements on a series of assurances. Among these was an increase in spending for modernizing strategic forces. (DOD, 1973, p. 22) Laird

immediately appeared before Congress to ask for additional funding to the Fiscal Year 1973 Military Procurement Authorization.

Laird proposed additional funding for the Trident system, B-1 bomber, and the submarine launched cruise missile (Senate, 1972, p. 4194). Since the strategic SLCM had been essentially a conceptual study, these hearings represented its first major airing before the Congress. Specifically, the Secretary of Defense requested funding to give the first ten Polaris SSBNs an SCM capability. This deployment mode seemed logical since the SALT Interim Agreement had limited SSBNs and would have forced decommissioning of older Polaris SSBNs as the new Trident SSBNs began sea trials.

With Laird's backing and the enthusiastic support of the Defense Director of Research and Engineering, John Foster, the SCM progressed smartly. In November 1972 the Navy cancelled the ACM and STAWS programs in favor of a SLCM with both tactical and strategic variants. Laird's vision had focused on a strategic SLCM based on a Center for Naval Analyses study; the Navy's only active long range SLCM program was a tactical anti-ship version (ACM) managed through the Harpoon Project Office. The new SLCM program was directed to use existing technology, such as the SCAD turbofan engine. (Werrell, p. 153)

3. 1972-1977

Congress received its first official presentation on the post-SALT SLCM program during the Fiscal Year 1974 Military Procurement Authorization hearings in spring 1973. Captain (later Rear Admiral) Walter Locke, USN, the SLCM Program Manager, stated that his objective was:

"to develop a submarine launched very long range, low altitude, relatively invulnerable, cruise missile resulting in a credible deterrent and a more diversified mix of United States Strategic Forces." (Senate, 1973, p. 2630)

He argued that the US lagged behind the Soviets in deployment of cruise missiles and buttressed his contention with a slide showing SS-N-3 Shaddock coverage of the East Coast as far inland as Pittsburgh and Atlanta.

Locke presented four launch options at these hearings:

1. vertical launch out of converted SSBNs, such as the oldest 10 of the Polaris/Poseidon series;
2. horizontal launch from standard, 21 inch, SSN torpedo tubes;
3. horizontal launch from standard, 21 inch, SSBN torpedo tubes;
4. vertical launch from a new design SSN (derived from the STAWS concept). (Senate, 1973, p. 2635)

Option one represented the original Laird proposal. Admiral Zumwalt favored option two and Admiral Rickover favored option four, since it involved a new submarine design. As part of the acquisition process, the DSARC would choose one of the four options.

In June 1973, Malcolm R. Currie testified before the Senate Armed Services Committee on the occasion of his

nomination to replace John Foster, who had retired. While Currie supported the SCM like his predecessor, he stated it should not be associated just with submarines. In his eyes the ultimate goal was to produce a strategic cruise missile "with the question of specific roles and launch platforms -- land, sea, or air -- left open until the technology is demonstrated." (Senate, 1973a, p. 14)

In June and July 1973, Henry Kissinger twice wrote to Deputy Secretary of Defense (DSOD) William P. Clements, Jr. on the usefulness of the SCM for negotiating leverage in the continuing SALT negotiations. At the same time, Clements cancelled the SCAD program for cost-effectiveness reasons and started up the ALCM program. The DSOD directed that the Navy and Air Force cooperate in developing technology. Specifically, the Air Force would share its efficient turbofan engine from the SCAD program and the Navy would contribute its terrain contour matching (TERCOM) guidance. (Werrell, p. 154) This method of guidance compared a radar altimeter picture of the terrain with a map stored on an onboard computer.

The period 1973 to 1977 represented the period of greatest cooperation between the two programs. During this period the strategic cruise missile matured within the Navy. Its acronym, SLCM, shifted from meaning submarine-launched to sea-launched cruise missile, in order to accommodate surface ships. Also in 1975, the Navy bestowed the name

Tomahawk on the SLCM. The Air Force did not assign a name to its ALCM program.

In November 1974, the final operational requirements were released; these requirements called for a torpedo tube-sized missile with strategic and tactical variants. Three months later, Currie proposed a new rationale for the SLCM. He argued that a SLCM's slow flight time made it useful for an unambiguous response in a crisis situation, compared to a ballistic missile which could spook an adversary. Also SLCMs could serve as part of the invulnerable reserve force. (Huisken, p. 42)

However, the Navy began to emphasize that it held a requirement for a conventional SLCM (TLAM/C) for power projection roles. The SLCM land attack mission underwent a shift from strategic nuclear to theater nuclear and conventional. (Huisken, p. 45-48) Ultimately, of course, the strategic cruise missile role went to the ALCM.

4. 1977-1987

The January 1977 DSARC meeting marked one of the most significant milestones in the cruise missile chronology. Deputy Secretary of Defense Clements' decision memorandum from this meeting produced several recommendations. (Werrell, p. 171) First, it proposed shifting both the SLCM and ALCM program into full scale engineering development. This step represented a significant increase in commitment due to the requirement for large increases in funding (DOD, 1968, p.

149). Second, DSARC recommended the establishment of a joint development office, with the Navy as lead manager. This became the Joint Cruise Missile Project Office (JCMPO) under Rear Admiral Locke. Third, the new JCMPO was directed to concentrate on a long range, 1500 mile ALCM. The previous design contained the original SCAD constraints. Fourth, DSARC gave greater priority to the TLAM/N version, relative to the TLAM/C and TASM. Lastly, DSARC also moved TASM into full scale engineering development. Overall, Clements desired a program that had little performance risk and maximum sharing of components between the two systems (Concrow, et al, 1982, p. 6).

President Carter confirmed the Air Force's greatest fears by cancelling the B-1 bomber and extending B-52 life with ALCMs on 30 June 1977 (Werrell, p. 177). This action reinforced the ALCM as the nation's strategic cruise missile and further shifted the TLAM/N to a lesser role. Also the Carter Administration postponed the TLAM/N development scheme aboard SSNs (Sorrels, p. 2). This led the Government Accounting Office to observe that "OSD seems reluctant to produce and deploy the nuclear land attack SLCM." (GAO, 1980, p. 67)

The late 1970s marked a period of considerable GAO interest in the SLCM. On 26 January 1977 it released a critical report titled, "Confusion and Uncertainty as to the Need for and Use of Air Launched and Tomahawk Cruise Missile

Programs." (GAO, 1977) This report recommended that the Secretary of Defense relate the requirement to mission needs, "in particular the Navy requirements for nuclear cruise missiles...." (GAO, 1977a) In 1978 a skeptical GAO reported that the future of the cruise missile "will be determined more by the outcome of the SALT discussion than by military need." (GAO, 1978, p. 76)

The Reagan Administration reversed the B-1 decision and continued the SLCM program. Today, the first squadron of ALCM equipped B-1 bombers exists. The first SSN equipped with a vertical launch capability, USS CHICAGO (SSN-721), was commissioned in 1986. The TLAM/N still remains as a theater weapon with a vague role. The TLAM/C has received attention for its possible use in the Persian Gulf ("New Duties," 1987, p. 7C).

C. DEVELOPMENT RATIONALES

1. Nuclear strategy

As with Polaris, this case study seeks to answer the question: "What drove the Tomahawk procurement decision -- innovative technology or national strategy?" The previous section reviewed the important events of Tomahawk development, particularly during the crucial 1972-1977 time frame. This section will begin with nuclear strategy from 1965, when it left off in the Polaris case study, and

continue to the beginning of the Carter Administration. The strategy will then be related to the procurement decision.

McNamara devoted much time to seeking an answer to one of the perplexing dilemmas of the nuclear era: how much is enough? He discovered that his early damage limitation advocacy resulted in more requests for nuclear forces in order to manage an expanding Soviet target list. He then applied a systems analysis approach to this question. He determined that on a graph of effectiveness versus equivalent megatonnage (EMT), the curve became flatter at 400 EMT. This later translated into destruction of 30 percent of the population and 76 percent of industry (Enthoven and Smith, 1971, p. 207). He turned this concept of force sizing into an approach to nuclear strategy called Assured Destruction (AD).

Under the prevailing sentiment of the time, AD evolved into mutual assured destruction (MAD). McNamara believed that AD was a fundamental truth in the nuclear age, equally apparent to both the US and USSR. Hence, each power was to maintain only that amount of strategic force necessary to obtain the assured destruction of the other. Any notion of strategic superiority was explicitly denied. It must be noted, however, that the Soviets never accepted the mutuality of assured destruction. While eschewing superiority, McNamara did not object to modernization; his Fiscal Year 1969-73 defense program included funds for "advanced ICBM

technology." (DOD, 1968, p. 71) Also the Poseidon and Minuteman III MIRV programs began during his tenure.

With its rejection of superiority and satisfaction with the existing nuclear relationship, the AD strategy would not have provided the impetus for strategic cruise missile development. From the standpoint of "Assured destruction," competing for advantages in the nuclear arms race was hopeless. The 400 EMT force size was to be divided among a triad with only periodic modernization. Betts wrote that the strategic cruise missile was neutral with respect to AD. That is to say, the SCM had no effect on AD and AD provided no rationale for the SCM's procurement. (Betts, p. 11)

The Nixon Administration held a different set of core beliefs regarding nuclear strategy and the US-USSR relationship. Two elements of its national security strategy played a role in cruise missile development: advancement of the strategy of "sufficiency" and a commitment to arms control negotiations. That arms control could have such an irrevocable link with strategic force procurement was illustrated by Nixon:

"Putting an end to the arms race meant working out tradeoffs with the Soviets, and I wanted us to have the most bargaining chips from the outset in order to get the best deal." (Nixon, 1978, p. 414)

Two important elements distinguished Nixon's policy of strategic sufficiency from the strategies of previous administrations. (DOD, 1971, p. 15) First, strategic force

procurement decisions would be "based on specific criteria," instead of the arbitrary 400 EMT yardstick. Second, the strategy contained "a reemphasis on maintaining and using our technological superiority." Most importantly, strategic sufficiency represented a shift away from AD; it called for adequate "war-fighting capability...both in limited nuclear and conventional options." (DOD, 1971, p. 17)

Strategic sufficiency had direct implications in strategic force planning -- both in force levels and force composition. Specifically, the strategy had four objectives:

1. adequate US second strike capability;
2. no first strike incentive for the USSR in a crisis;
3. equal destructive capability between the US and USSR;
4. modest damage limitation capability for the US, with the Safeguard ABM system. (DOD, 1972, p. 65)

Laird emphasized that US force planning required flexibility so that alternatives were available to the President, depending on the level of aggression. Furthermore diversity was a key item:

"We are examining new concepts for future strategic offensive forces, keyed to an approach that diversifies U.S. programs if additional capabilities are needed in the future." (DOD, 1972, p. 67)

Implicit in strategic sufficiency was a recognition of the huge Soviet buildup of strategic weapons. Members of the US Blue Ribbon Defense Panel reported in 1970 that the US-USSR balance was undergoing a radical shift. By highlighting the growing Soviet first-strike capability, the

report provided one of the first indications that the Soviets did not adhere to the MAD concept. Additionally, the Panel warned of a threat to US technical superiority which could produce a "disastrous technical surprise." (Blue Ribbon Panel, 1970, p. x) The Nixon Administration supported this warning, as illustrated in Laird's 1972 Annual Report:

"The continued Soviet strategic offensive force buildup, with its long term implications, convinced us that we need to undertake a major new strategic initiative." (DOD, 1972, p. 69)

Also the Nixon Administration entered office with a commitment to strategic arms control. The SALT agreements were seen as a way to obtain stability in nuclear competition. Richard Nixon and Henry Kissinger had a vision of a new relationship between the US and USSR. Kissinger wrote that "...we also needed SALT if we were ever to explore the possibilities of peaceful coexistence." (Kissinger, 1979, p. 1245)

The SALT I Interim Agreement froze the strategic delivery vehicles and launchers of the US and USSR, but at a lower level for the US. Additionally, it allowed the Soviet Union heavy ICBMS but prohibited the US from producing any, even though the US had none. This seeming imbalance (and others) were considered warranted by US technical superiority and possession of strategic bombers; it was justified under the name "offsetting asymmetries."

The SALT I agreements served to codify nuclear parity between the US and USSR. As such, these agreements illustrated the dominant strategic nuclear trend of the early 1970s; the Soviets had quickly caught up with the US from the depths of the Cuban missile crisis and were on the verge of shifting the nuclear balance against the US. The U.S. Blue Ribbon Panel and the Secretary of Defense certainly recognized this trend. Kissinger was in the unlikely position of championing a strategic arms agreement while endorsing a US strategic buildup: "We needed the agreement if we wanted to catch up in offensive weapons." (emphasis added)(Kissinger, 1979, p. 1245)

The evidence suggests that the twin strategies of strategic sufficiency and arms control provided the rationale for developing the Tomahawk. Recognition of the deteriorating strategic trend vis a vis the Soviets, emphasis on technical superiority, and rejection of McNamara's AD in favor of the more flexible strategic sufficiency occurred before Laird chose to initiate Tomahawk development. Strategic sufficiency encouraged the development of strategic weapons with the attributes of diversity and technological superiority. The SLCM in its original role fulfilled this need.

In Laird's view, the SALT I agreements were achieved only because the US had successfully pursued Safeguard, Poseidon, and Minuteman III (Senate, 1972, p. 4194).

Therefore, US nuclear forces had to be bolstered for the next round of SALT negotiations, with increased funding for Trident, B-1, and the SLCM. Laird's testimony was explicit in this matter; the US needed "hedges for the future.... This is no time for complacency." (Senate, 1972, p. 4195)

Laird provided several other specific rationales for the cruise missile. First, the SLCM would provide a comparable capability to the nuclear-capable, 250 mile SS-N-3, deployed aboard Soviet guided missile submarines. Second, the submarine basing mode would add significant survivability to US retaliatory forces. Third, the cruise missile's low flying characteristics would stress Soviet air defenses. (Senate, 1972, p. 4244) Moreover, Laird had to actively solicit inputs from the Joint Chiefs for a modernization plan; his own in-house technical group, the Defense Advanced Research Project Agency (DARPA), did not manage the early SCM projects, SCAD and ACM. The fact that the Navy's interest lay more in the long range Harpoon anti-ship missile successor (ACM) lends weight to the judgement that no existing "techno-bureaucracy" pushed the strategic cruise missile.

The shifts in declaratory targeting philosophy and policy during the Nixon Administration appear to have played no role in the SCM development decisions. While the MAD concept underwent a significant assault during the early 1970s, it was not until 1974 that a significant change in

targeting policy was openly promulgated. Secretary of Defense James Schlesinger announced that the US would shift to a menu of selective options instead of massive nuclear strikes (Schlesinger, 1974).

Even without directly targeting cities, the previous options, involving extensive collateral damage to cities and industry, could have given the Soviets the wrong signal and invited retaliatory strikes on US cities. The new strategy would give the President more flexibility. However, Schlesinger was more concerned with ICM accuracy and retargetability; Huisken reported that Schlesinger was neutral toward the SCM (Huisken, p. 40). Malcolm Currie appeared to have tried to fit the SLCM into the Schlesinger strategy, but as the chronology showed, achieved no success (Huisken, p. 43).

2. Technological Issues

This analysis would be incomplete without examining the problem in reverse and addressing technological issues. The SCM represents for many a classic example of technological imperative. Of the four major cruise missile studies, three -- Betts, Sorrel, and Werrell -- concluded technological determinism played a role. Huisken, however, devoted an entire chapter to "Technological Momentum" and concluded none existed.

One of the issues concerned whether the SCM was a first or second generation weapon. Nihart (1972) and

Pfaltzgraff and Davis (1977) evaluated it as a second generation weapon. Tinajero (1976), Tsipis (1975), and Thee (1986) argued the cruise missile was a revolutionary breakthrough. Tsipis and Werrell were particularly impressed by electronic miniaturization and guidance improvements.

Werrell's chronology of systems development seems to contradict his own conclusion. He conceded that the TERCOM guidance system was patented in 1958 by E Systems. Fourteen years passed, however, until TERCOM received the necessary strategic attention. The Navy did not devote funds to it until Laird pushed the SCM, since the Harpoon and its long range anti-ship successor did not use it. After the 1972 SCM decision, three years of development, sparked by Laird's strategic rationale, were followed before the Navy conducted a TERCOM competitive flyoff between E Systems and McDonnell Douglas. (Werrell. p. 155) Ironically, McDonnell Douglas used many off-the-shelf components in its design and beat E Systems, TERCOM's original developer, for the SCM contract. The computer to store the maps of predetermined target areas was one of the few new components. (Robinson, 1973, p. 13)

Huisken provided the most incisive analysis of why the fuel efficient turbofan engine did not reflect a revolutionary breakthrough (p. 166). Aircraft designers of the 1950s searched for more powerful turbojet engines for supersonic flight. This preoccupation precluded them from extensive research into fuel efficient turbofan engines.

Levine (1977) added that the turbofan engine was developed around the late 1950s and received major improvements in the mid-1960s (p. 124). Evidently, the turbofan required a pressing military need before it gained extensive engineering development.

Probably the most accurate characterization of cruise missile technology development would be to say that it grew out of inchoate programs. Betts wrote that cruise missile technology grew out of "uncoordinated evolution of technological innovation rather than a deliberate effort or an epochal breakthrough." (p. 4) Nevertheless, this sort of evolutionary development does not support the technological imperative argument. After all, the TERCOM and turbofan technologies were not conceptually matched until 1973 -- after Laird's post-SALT request (Levine, p. 140). Until that time, the turbofan SCAD was just a long range decoy and the SLCM was just a long-range version of the turbojet Harpoon equipped with terrain guidance of existing technology.

D. CASE STUDY CONCLUSION

The case study has demonstrated that strategic rationales decisively influenced the development of the strategic cruise missile. The Nixon Administration attempted to redress a worsening strategic balance and lay the groundwork for a strong position in future SALT negotiations. Kissinger

(1982) wrote later, "We never believed detente would ease our defense burden." (p. 998)

While prevalent in the literature, the technological imperative hypothesis have been shown to be false. The issue is ultimately one of evolutionary versus revolutionary development. Clearly, the CNO would never offer the Secretary of Defense an infeasible idea for a weapons system. Nevertheless, the two most important cruise missile technologies, guidance and propulsion, existed before 1972. Only a strategic push was needed to develop them. Sapolsky's statement in the Polaris case study that a convergence of technological opportunity and strategic need existed seems also to apply for the SCM (Sapolsky, 1972, p. 241).

The case study primarily addressed the origins of the Tomahawk and, therefore, ignored current doctrinal issues. As the quotes at the beginning of the case study indicate, the SLCM still has no official designated missions ten years after its introduction. But the chronology indicates that the Navy has had a long interest in an anti-ship cruise missile (TASM) and a recent interest in a conventional land attack cruise missile (TLAM/C). The latter two versions have been integrated into the Navy's force structure and doctrine.

More precisely, the current criticism should be leveled at the TLAM/N. It presently has no official strategic role, at least not in the public domain. Its stated theater

role is murky, since the control of attack submarines presents difficult command problems between the National Command Authority and the Unified CINCs. Unlike Air Force GLCMs and Army Pershings, Navy TLAM/N equipped SSNs constantly change position and have additional crucial missions, such as ASW or aircraft carrier protection. But this is a doctrinal problem, not a strategic problem, since the fundamental purpose of a strategic cruise missile is to support US national strategy, as exemplified by the ALCM. One cannot blame the TLAM/N's current travails on technological imperative hypotheses.

Secretary of Defense Laird's original strategic cruise missile proposal underwent several changes. The original SSBN proposal was dropped because the weapon conversion and reactor plant overhaul and refueling would not have been cost effective. The succeeding SSN option did not survive as a launch platform vis a vis the Air Force B-1 and B-52 for two reasons. (Huisken, p. 128) First, only bombers could deploy cruise missiles in large enough quantities. The Air Force has equipped 98 B-52Gs with up to 20 ALCMs apiece (DOD, 1987, p. 209). This quantity is much higher than 90 first line SSNs each carrying, at most, two to four TLAM/Ns, due the necessity to stock an SSN's torpedo room with torpedoes for self-defense and ASW. Second, the strategic mission could not be reconciled with the SSN's ASW mission. An SSN's ASW role may require it to operate in an area which is

not suitable for a TLAM/N launch; also command and control problems are complex.

The Tomahawk showed the complex relationship between national strategy and technology. The case study also illustrated a weapons procurement determinant not found in the Polaris study: arms control. While the case study vindicated defenders of the rational school of strategic weapons procurement, it portrayed a process far more complex than the interests-strategy-weapons model.

V. DOES TECHNOLOGY DRIVE STRATEGY?

"Americans pride themselves on their skill in organizing yet this skill has yet to be applied to security, which is the foremost business of any nation."

-Possony and Pournelle, 1970, p. 91

A. ANALYSIS OF CASE STUDIES

James Kurth (1971) wrote that a "thicket of theories" has developed to explain rationales for US weapons purchases (p. 373). Among these are the strategic rationale, the technological rationale, and the bureaucratic rationale (the latter was not evaluated in this study). The two case studies have shown that the strategic rationale applied for the Polaris and Tomahawk development and acquisition process. While this conclusion vindicates the national level policymakers, what can be said for the other strategic planning decision-models? In other words, can critics charge that the military services are producing weapons before they have a need for them?

Figure 4 depicted where the US Navy fits into the weapons capability decision process. Prior to Polaris, Navy strategy certainly did not call for an intercontinental ballistic missile. Two Presidential Commissions, the Von Neumann and the Killian, provided the genesis for a Navy ballistic missile capability, not an internal Navy-generated mission need. Similarly, the Office of the Secretary of Defense originated the need for the Tomahawk SLCM.

In an earlier era, critics turned the technological imperative critique on its head. Strategists charged that the Army was slow to integrate the "new" tank into its doctrine. The Navy was slow to see the value of "new" aircraft carriers; its 7 December 1941 fleet was weighted heavily toward obsolete battleships. In these cases military services had a mission, but had not integrated weapons based on the new technology into it.

In effect, critics of US weapons procurement tend to play both ends against the middle. If the services are slow to fit an existing weapon into a newly emerging need, such as the tank, they receive criticism. If they are quick to integrate a newly emerging weapon into an existing need, such as the SLCM, they again receive criticism. In the latter case, critics write that a technological imperative exists and that technology is driving strategy.

The way to ease this dilemma is for the defense studies community to standardize its terminology. A previous section asserted the need to differentiate between national security interest and national interest. The present discussion indicates that strategy and doctrine need to be clarified. Unlike the Soviet Union, the US has imprecise meanings for these terms (Evangelista, 1984, p. 601). This paper has demonstrated that military strategy belongs in the realm of national level leadership (except probably in time of war). Doctrine, however, is task- or service-specific. The Navy,

for example, has ASW doctrine, the Marine Corps has amphibious doctrine, the Army/Air Force team has AirLand Battle doctrine. As Holley (1986) stated, doctrine is a "mode of approach" based on experience for accomplishing missions.

Therefore students of national security affairs should not levy a general criticism that services are not ready to fully integrate new weapons into their operational plans and doctrines. In the case of the Tomahawk SLCM, the Navy should not be criticized for still working out a doctrine for it. As VADM Metcalf (1987) stated, the job of the current generation of naval officers is to determine the most effective manner of employing forces provided to them by the senior generation. That is to say, experience is necessary to fully integrate a new weapon.

This discussion points to some necessary modifications to Figures 4 and 5. Clearly, military strategy may influence capabilities before a service doctrine is developed for it. Also a feedback loop must exist between new capabilities and service doctrine. However, the case studies have shown that new capabilities, i.e. new technologies, the focus of this paper, have not influenced military strategy. Therefore, a feedback loop from capabilities back up to

military strategy (or national interest) is not required or desired. Figure 4 is thus resubmitted as Figure 8 (modification of Figure 5 is similar):

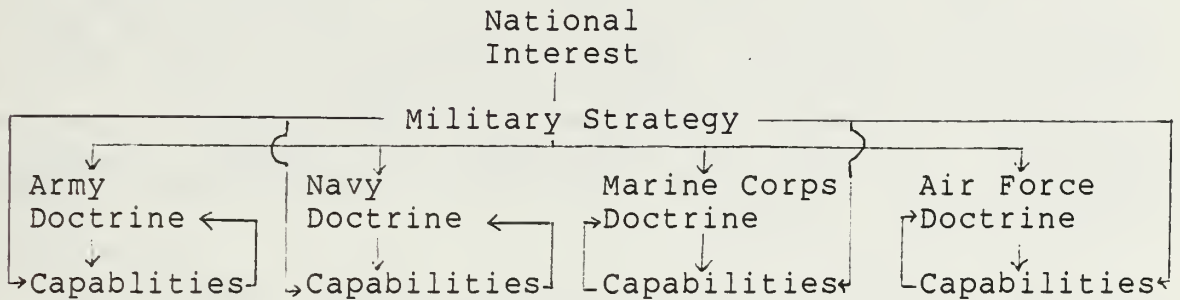


Fig. 8 Modified Service-based Decision-making Model

B. CONCLUSION

This study began by showing that national security affairs are rooted in a process called strategic planning. A three element sequence of interest-strategy-capabilities was identified as the core of the process. Various models for strategic planning decisionmaking indicated that interests are the necessary first step.

"Interests" are a shorthand notation for national security interests or national interests. Scholarship regarding "national interest" in the field of international relations is largely dormant. Strategic studies scholars have noted that military strategy is broadening into national and grand strategy, which includes assessments of the national interest.

The vagueness of the national interest concept allowed it to fall into the morass of "ends and means." It was shown

that humanities, such as metaphysics, provided the basic means for determining national interests. Social sciences, such as international relations, military science, and business administration provided the ends. John Locke's natural rights philosophy and St. Thomas Aquinas' Just War criteria were cited in Chapter II as political and theological theories that established the enduring values for the US national interest.

A new paradigm for the national interest based on the Constitution was established in Figure 7. The paradigm divided national interest into political and moral components, and assigned the term "national interest" to the political element. Since self-preservation is a moral obligation of states, the term "national security interests" was assigned to the moral component; the Declaration of Independence, the Constitution, and Lincoln's Gettysburg Address provided its foundation.

The new model for national interest found certitude, but also a messy political process, in the Constitution. In the realm of national security planning, democracies are clearly inferior to dictatorships because the latter have the advantages of secrecy, coercion, and a minimum of debate before action (DeTocqueville, p. 234). Yet the Constitution provides a mechanism for determining the national interest that is satisfactory for US strategic planners and provides democratic legitimacy for the policies.

This second part of this study showed that the technological imperative hypothesis detracts from the ideal strategic planning process. This argument suggests that the advancement of weapons technology represents an immutable process that man is helpless to stop. Therefore, glamorous new technologies compel government policymakers to buy new weapons, regardless of whether the stated military strategy requires it.

The Polaris SLBM and Tomahawk SLCM systems were selected in order to determine if the technological imperative influenced their development. It was found for Polaris that the US military strategy of deterrence through massive retaliation, in concert with the threat posed by Soviet missile advances, led directly to the initial Polaris procurement decision. Only then did government policymakers allocate resources to develop the necessary propulsion, guidance, and warhead technologies. This sequence fit the ideal standard in traditional strategic planning: interest-strategy-capabilities. The technological imperative played no role.

The Nixon Administration replacement of Assured Destruction strategy with Strategic Sufficiency, combined with its inclination toward arms control, led directly to the initial Tomahawk procurement decision. The Tomahawk case was complicated by the fact that the eventual strategic weapon was an ALCM, rather than the original SLCM. The Navy is now

attempting to fit the SLCM into its doctrine and is receiving unjustified criticism for having to do so.

Each case study disproved the technological imperative hypothesis. It appeared that technological opportunity and strategic need converged in each case. Furthermore, the national interest, as defined in this paper, supported the strategies which influenced the two weapons purchases. The national interest paradigm of Figure 7 allowed elected officials to change the direction of national policy, as when the Nixon Administration shifted nuclear strategy from that articulated during the Kennedy and Johnson Administrations.

The case studies also shed new light on the interaction between strategy and technology. From a larger standpoint, the national interest paradigm and technological imperative hypothesis illustrated the components and linkages of the strategic planning process. As a policy-relevant study (Gray, 1982, p. 2), it will hopefully raise questions for those charged with procurement of strategic weapons. Additionally, since this paper chose a route between a macro and micro approach, it is hoped that it may contribute to middle range theory on defense procurement and open areas for further research, such as the relationship of the public interest to national security interests and national interests. An investigation of how or if a given weapon system supports military strategy over its design lifetime, rather than just in the initial procurement phase, would also

prove valuable. Developing a more rigorous model of strategy, doctrine, and tactics, similar to Soviet efforts, would prove challenging but very beneficial to the field of strategic planning.

The quote at the beginning of this chapter suggests that Americans do not practice efficient planning in national security. Although planning has never been the strong suit of a democracy, even a marginal planning capability still tends to receive strident criticism. This is unfortunate, for as political commentator Charley Reese said: "...people fall out of love with life ... [because] they demand perfection and that isn't in the contract." (1981, p. 161)

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