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Incentives and Information Quality in Defense Management

J. A. Stockfisch

A Report prepared for

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Rand
SANTA MONICA, CA. 90406

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PREFACE

This report examines the nature of and relationship between the demand for information, study, and analysis, on the one hand, and incentives, on the other, prevailing in present-day U.S. defense management. It was motivated by the belief that the quality of available information, hence the efficiency of Department of Defense management, and ultimately the national security cannot be improved until the relationship between incentives to produce institutional information and its quality is explicitly recognized. The acknowledgment of this relationship suggests further that fundamental realignments in decisionmaking authority and in the roles of the divers actors be seriously examined and reconsidered.

A related study by the same author, *Models, Data, and War: A Critique of the Study of Conventional Forces*, The Rand Corporation, R-1526-PR, March 1975, surveyed the quality of both the data and the standards that seem to prevail in much of the study and analysis produced in the Department of Defense and concluded that the use of quantitative methodologies, specifically operations research, cost-effectiveness calculations, and systems analysis, has led to serious shortcomings. The present report, which was sponsored by the Defense Advanced Research Projects Agency, addresses why the quality is poor. Its conclusions and recommendations are directed at all those involved or interested in improving defense management.

The author was until recently a member of Rand's National Security Research staff.

SUMMARY

Information is needed to manage scarce resources. If powerful groups within an organization compete to control these resources, management can deteriorate into guerrilla warfare. In the defense establishment, the warring factions include elements of Congress and of the Executive branch, including the Office of Management and Budget and the rival military departments.

The battle is fought on the field of planning, budgeting, and programming. Knowledge and information are the ammunition. The planning and study staffs of the rival agencies, as well as sponsored outside study organizations, produce and process the ammunition. The needs of the opposing decisionmakers constitute the *demand* for studies, analysis, and data. Needless to say, the quality of the supply is determined by that demand.

The process by which military forces are designed and weapons procured can be described, if not predicted, by a *political model*. Yet most men adhere to a *rational model* of behavior toward scarce resources. They aspire to be efficient, and in fact are efficient more often than not in the management of their private affairs. But in the public political realm, the dichotomy between the rational and political models of behavior is extreme. The image of the rational model is nevertheless strongly adhered to. The dichotomy creates severe strains that can contribute to an information failure.

A technical development that offers the prospect of changing the relative effectiveness of a weapon can provide a rationale to reallocate resources among combat specialties, military services, and major inputs such as manpower and equipment. It can also impact on command and control arrangements in the field. Yet possible budget and resource reallocations, when they affect two or more specialties, can generate excessively optimistic or pessimistic expectations regarding the change. Since specialized subordinates are the major source of technical and tactical advice for superiors, information concerning the change

conveyed by subordinates to superiors may be biased. At worst, the information can become grossly distorted.

In the post-World War II setting, extensive use has been made of *quantitative methodologies*--particularly military operations research, systems analysis, and cost-effectiveness analysis--to help decisionmaking. These techniques, however, have themselves been caught up in the budgetary warfare and resulting information failure that characterize Defense Department management. Indeed, the practitioners of quantitative methodology may have contributed to that failure. If so, it is somewhat ironic: One of the advantages claimed for formal analysis was that it seemed to offer the prospect of integrating diverse kinds of knowledge and information.

Formal analysis--specifically operations research and cost-effectiveness analysis--views defense resource allocation as a *rational* problem. That is, resource allocation, or a large part of it, is sufficiently well defined to be amenable to analysis, and given sufficient information, it is susceptible to the right solution. The right solution can then be implemented by a management and decisionmaking apparatus that is highly centralized. This management philosophy has given rise to the idea that planning, budgeting, and programming (when the word "programming" encompasses what is traditionally meant by "administration") can and should be integrated.

Defense management is seen alternatively, however, as a political problem entailing reconciliation and compromise among competing viewpoints in the face of much real uncertainty. Technical change is the major--but not the sole--source of this uncertainty. But given the uncertainty, the idea of a rational solution may not, in fact, have much meaning.

The American defense establishment has long relied on centralized management--i.e., detailed management by high authorities through budgetary channels. The attempt to manage a large, complex activity in this way creates perverse incentives for subordinate agencies and distorts the information they produce. Distortions occur because

subelements of the Defense Department tend to present information in a way that will influence budget decisions consistent with their own interests. Quantitative methodology, by using unvalidated combat models programmed with unproven data, has been manipulated to yield widely divergent conclusions possessing superficially equal objectivity.

To put an end to this connection between information distortion and perverse incentives requires changes in budgetary procedures. This report argues that a less centrally managed organization giving military departments larger but constrained aggregations of resources and more freedom to allocate these resources is a critical part of a system that would generate healthy incentives and better information. The report presents a budgeting procedure designed to achieve these effects. It also indicates how the Defense Department might be reorganized to make such a budgeting procedure operational.

ACKNOWLEDGMENTS

Many helpful written comments and criticisms of earlier versions of this report were provided by my Rand colleagues S. T. Hosmer, R. W. Komer, A. E. Nimitz, W. E. Simons, and R. E. Strauch.

Anthony Cordesman of the Office, Assistant Secretary of Defense (Intelligence), and Angeliki Cutchis of the Office, Assistant Secretary of Defense (PA&E), critically reviewed a previous draft and alerted me to problems of both exposition and substance.

Gerald Sullivan of the Defense Advanced Research Projects Agency was instrumental in obtaining the support for this effort. He was patient and encouraging in carrying out his overseeing responsibility and, finally, made useful suggestions to strengthen the arguments developed in this report.

Erma Packman, who edited it, suggested the elimination of many obscure and redundant passages and enhanced the grammar and style of what remained. More versions of this material were typed than I care to recall. However, I do remember Rosalie Fonoroff's cheerful and careful effort.

For ideas and insight the above reviewers share at least some responsibility. The errors, of course, are mine.

CONTENTS

I. INTRODUCTION

The Department of Defense may be regarded, for certain purposes, as a system that acquires, produces, processes, filters, and disseminates divers kinds of information.[1] This information must be integrated to provide useful knowledge for decisionmaking. The evolution of the military general staff system reflects a response to coping with the problem of providing such knowledge.[2] Military staff systems, however, evolved primarily to process information for field commanders conducting operations. In this context, the emphasis was on physical resource accounting and operational planning within the constraints of available manpower, supplies, roads, anticipated enemy forces, weather conditions, and so on. The operational context of

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[1]Some readers might object to the image of the Defense Department as a study and information-processing system, and counter that its primary function is to provide or produce military forces. The counterpoint is correct, but inadequate to sustain the objection. Any organization (or individual) must acquire and process information in order to perform a function or to make a decision. Information and knowledge production and handling absorb much energy and many resources. For a society as a whole, the resources involved are substantial. One study estimated that "knowledge production" absorbed about 30 percent of the U.S. GNP in 1958. See Fritz Machlup, *The Production and Distribution of Knowledge in the United States*, Princeton University Press, Princeton, N.J., 1962, pp. 361-362.

Both the formal and informal structures of an organization can be adequately if not richly described in terms of its internal communications arrangements. Moreover, such organizational concepts as "span of control" or "functional specialization" are meaningful only in terms of ability to acquire, handle, and communicate knowledge. Thus, a business firm, a military establishment, or an entire economy can be fruitfully examined in terms of information costs and handling. For suggestive works along these lines, see Armen A. Alchian and Harold Demsetz, "Production, Information Costs, and Economic Organization," *The American Economic Review*, Vol. 62, No. 5, December 1972; Kenneth J. Arrow, *Information and Economic Behavior*, Harvard University, Cambridge, Mass., Technical Report No. 14, September 1973; and F. A. Hayek, "The Use of Knowledge in Society," *The American Economic Review*, Vol. 35, No. 4, September 1945.

[2]See J. D. Hittle, *The Military Staff: Its History and Development*, The Military Service Publishing Company, Harrisburg, Pa., 1949.

the activity was generally such as to provide fairly rapid feedback regarding the accuracy and relevance of the staff effort.

The staff apparatus was later extended to peacetime military resource allocation, to encompass both administration and budgeting activities.[3] During the present century, armed forces have been obliged to embrace scientists to apply technical expertise to weapons and force planning. One of the consequences of the latter development has been that attempts to model combat and campaigns have become a prominent feature of military management's intellectual effort. Catalysts of this evolution were *operations research*, which emerged from World War II, and its offspring, military *cost-effectiveness analysis*. Admixtures of these two "disciplines" are sometimes referred to as *systems analysis*.[4] Although these activities do not readily lend themselves to precise definitions, they share the common

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[3]Here I refer to the period of the 19th century through the present. This period saw both the rise of parliamentary political systems that constrained the executive and the impact of technological change that produced a split within military organizations between line and technical specialists. One consequence of the increased technical aspects of military affairs was that uncertainties about future military capabilities also increased, thus providing additional channels through which civilians could involve themselves in many details of military administration. Widely diverse institutional mechanisms and behavior patterns, potentially capable of affecting information quality, decisionmaking, and military efficiency, have evolved in various countries.

[4]The term "systems analysis" is often reserved for endeavor the aim of which is to design a "system," such as a management structure or a technical system composed of two or more complicated technologies. Hence there are such derivative terms as "systems engineering" and "systems management." These three concepts can further be construed to suggest something called "social engineering," which can have ideological implications. However, it should be recognized that the word "system" is used in many disciplines and therefore has the potential to suggest diverse meanings. For a brief and penetrating survey emphasizing this point, see Ida R. Hoos, *Systems Analysis in Public Policy: A Critique*, University of California Press, Berkeley, 1972, pp. 15-41.

feature of extensively employing mathematical-statistical models and techniques. But regardless of the finer distinctions (which in certain contexts are both subtle and important) between these applied disciplines, formal studies and analyses are a prominent feature of contemporary military thought.

Many aspects of resource allocation relevant to Defense Department management are analyzed in these studies. Formal models of combat, by means of computer simulations, are often employed to evaluate (and, eventually, to justify) the technical performance characteristics of new weapons. Few of these models, or the behavioral propositions on which they are based, are empirically validated. Further, although large amounts of "data" are manipulated in computer simulations, the empirical foundation, validity, and relevance of most of these numbers are vague. Since there is no generally accepted or independently validated "theory" of war and combat, operational and campaign models have an ad hoc quality. This condition probably cannot be entirely avoided. But it is not an acceptable or satisfactory condition, since the proliferation of combat and campaign models confronts decisionmakers with many, often contradictory findings. Hence, the study process, even though it may produce some useful information, has the potential to produce much misinformation.

Whenever an activity turns out an inferior product for any length of time, the tendency is to blame the apparent source, namely, the producers. When the product is analysis, it may also seem attractive to advocate that the effort be sharply curtailed. But if that is done, a problem remains: Knowledge is necessary for decisionmaking. How is it to be provided, and what would be its quality under some other, but unknown and possibly ill-defined, arrangement?

Although the producers may warrant criticism for some valid reasons (e.g., misleading advertising and thereby overselling the product), it should be recognized that the output would not be produced were it not demanded by consumers. Demanders ultimately determine what is bought in the marketplace.

In the activity of producing knowledge and information, including data and statistics, relevant to decisionmaking in government organizations, the decisionmaker is the analogue to the buyer in the marketplace. But decisionmaking in government is inherently a complex political process. In such a context, the dichotomy between suppliers and demanders is not as clear-cut as it is in most market transactions. Nevertheless, a demand for information, knowledge, and data exists as an aspect of running government resource-using activities. This demand determines the institutional pressures and the *incentives* that govern the behavior of those who produce and supply information. The interaction of demand and production results in something called the *system*. Such a system can induce people to behave in peculiar ways, and the interaction of the demanders and producers can result in a massive *information failure*.

In the context of a structured studies and analysis program, the application of quantitative methodology can be of great help. However, it must have a richer and healthier empirical foundation than it now has. The operations research that emerged during World War II provides an example of a healthy balance between theoretical and empirical activity in the application of quantitative methodology to military affairs.[5] During the postwar period, however, the application of

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[5]For informative accounts of wartime operations research illustrating this point, see Air Ministry, *The Origins and Development of Operational Research in the Royal Air Force*, Her Majesty's Stationery Office, London, 1963; P.M.S. Blackett, *Studies of War: Nuclear and Conventional*, Hill and Wang, New York, 1962; Ellis A. Johnson and David A. Katcher, *Mines against Japan*, Naval Ordnance Laboratory, White Oak, Silver Spring, Md., U.S. Government Printing Office, Washington, D.C., June 1974; and C. H. Waddington, *O.R. in World War 2: Operational Research against the U-Boat*, Elek Science, London, 1973. It might be argued that the strong empirical emphasis of the World War II operations analysis was possible because the ongoing wartime military operations provided the "laboratory" and that such a condition does not prevail in normal peacetime. Therefore, the unfavorable comparison between present and past is unfair. For a reply to this point, it is instructive, in reading the account of the questions addressed, the data gathered, and the hypotheses tested in Waddington's book, to ask: "Could not this same effort have been carried out in peacetime by means of simulated operations and field trials?" The number of times one is compelled to reply yes is striking. This suggests

quantitative methodology got off the track because it became a tool of advocacy.[6] How to get it on the rails again remains something of a challenge. One necessary condition of improvement is more rigorous empirical work, including field experimentation. This shift in emphasis is needed to gain insights into how to construct and test better models, as well as to get better data to feed into models.

However, simply to make more resources available for additional empirical work is not sufficient, because physical testing activities can be influenced by political and budgetary motives. There must also be strong incentives to *demand* hard-nosed analysis and testing. Moreover, these incentives must penetrate all echelons of the Defense Department. However, here the political model of decisionmaking confronts and conflicts with the rational model. The quality of information available for decisionmaking is governed by this conflict through the influence the budgetary struggle has upon *incentives*. What follows addresses this problem.

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that perhaps the most important difference between wartime and peacetime situations with respect to seeking hard information is a matter of incentives.

[6]For an account of how this force became particularly acute in the dialogue between the Systems Analysis Office of the Office, Secretary of Defense, and the Department of the Army during the 1960s, see Lawrence J. Dondero et al., *Methodology for Force Requirements Determination (MEFORD)* (U), Research Analysis Corporation, R-121, May 1971 (Secret).

II. THE QUANTITY AND QUALITY OF MILITARY STUDIES

THE SCOPE AND COST OF STUDIES AND ANALYSIS

What is the cost of Defense Department-supported studies and analysis employing sophisticated techniques? This question was the object of a recent inquiry conducted by the Office, Deputy Secretary of Defense. Table 1 summarizes the main findings in terms of major sponsoring agencies and categories of study.

Table 1

COST OF DEFENSE DEPARTMENT STUDIES AND ANALYSIS IN FY 1974
BY MAJOR CATEGORIES AND SPONSORING ORGANIZATIONS
(Millions of Dollars)

Studies and Analysis Categories	Army	Navy & Marine Corps	Air Force	OSD[a]	Total
Tactical and strategic	21.0	17.0	15.2	9.5	62.7
Systems and equipment	12.1	5.7	.9	4.2	22.9
Science and technology	12.2	6.8	4.9	5.2	29.1
Intelligence	1.4	1.1	1.4	6.5	10.4
Manpower and personnel	4.1	2.9	3.1	1.1	11.2
Logistics	12.1	6.4	4.4	3.7	26.6
Management	7.3	1.4	3.4	1.1	13.2
Total	70.2	41.3	33.3	31.3	176.1

SOURCE: Office, Deputy Secretary of Defense (1975).

[a]Includes activities of Office, Secretary of Defense staff sections, JCS and WSEG, and Defense agencies.

The "studies and analysis" treated in Table 1 are defined in a Department of Defense directive as "typically 'pencil-and-paper' efforts (often computer assisted) designed ... to provide greater understanding of relevant alternative organizations, tactics, doctrines, policies, strategies, procedures, systems or programs.... [They] integrate a

variety of factors, leading to conclusions or recommendations making substantive contributions to planning, programming, and decisionmaking."[1] That this category of studies and analysis pertains to "high-level" decisionmaking is suggested by the intellectual activities that are excluded, for example, (1) contract definition studies related to equipment or missions; (2) system feasibility studies, including the establishment of technical specifications; and (3) field experiments "which investigate a small number of variables associated with an item or system."[2] The 1975 draft revision of the directive specifically notes that "studies and analysis" are "identified by other terms such as systems analysis ..., operations research, threat analysis ..., war game ..., cost benefit analysis, economic analysis."[3]

In a survey of analytical activity conducted during the middle 1960s, Shubik and Brewer identified about 450 "active military models, simulations, and games...."[4] On the basis of cost data obtained from a detailed questionnaire survey directed to a sample of 150, Shubik and Brewer estimated that a total of $130 to $140 million was invested to create the 450 models and games. Since these represented a three- to four-year supply, the authors estimated the annual cost of constructing models and games during that period at between $30 and $40 million.[5] Most of the games identified in the Shubik and Brewer survey were in the "tactical and strategic" and "systems and equipment" categories shown in Table 1. It should be pointed out, however, that the costs given in Table 1 are not all expended on the construction of models. Much of the effort consists of (1) gathering the data that are used as inputs for the models (and other study effort) and (2) subsequent analysis of the outputs of these models.

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[1]Department of Defense Directive 5010.22, October 31, 1968, p. 2. A revision of the directive is forthcoming.

[2]Ibid.

[3]Draft Revision of Department of Defense Directive 5010.22, April 1, 1975, p. 2.

[4]Martin Shubik and Garry D. Brewer, *Models, Simulations, and Games --A Survey*, The Rand Corporation, R-1060-ARPA/RC, May 1972, p. 11.

[5]Ibid., p. 12.

Although the combat model or war game may be regarded as the centerpiece of much of the military studies and analysis, the Defense Department supports other activities utilizing personnel trained in the techniques of rigorous quantitative analysis and requiring funds in addition to the amounts shown in Table 1. We noted above that such activities as contract definition and feasibility studies related to weapons and equipment and to field experiments were excluded from Table 1. The total cost of knowledge production to serve Defense Department needs (excluding intelligence gathering) is difficult to estimate, because there are neither well-defined activity categories nor adequate costing techniques.[6] There is no clear conceptual dividing line between highly technical engineering effort, on the one hand, and much of the less technical staff work that serves the weapon-selection and force-planning process, on the other hand, both of which tie into studies and analysis as officially defined.

For example, consider a contemplated new weapon. The concept might come from a technical establishment or laboratory. There, engineers or technicians often apply the tools of operations and systems analysis, as well as carry out some preliminary system cost analysis. In another segment of a military service, specifically where one can identify user elements, such as at Fort Benning or SAC Headquarters, staff people draw up tentative tables of organization for units that could be equipped with the conceptual weapon. Training and logistics organizations study the proposed system for its manpower and support implications. The divers efforts of these groups begin to reinforce each other, as well as the efforts of groups that are formally charged with conducting studies and analysis. When new systems are under actual engineering development, the developing firms also conduct operational and cost-effectiveness analysis. One major private firm estimated its outlay for this purpose to be around one percent of its development programs. If we apply this one percent factor to the overall

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[6] See Shubik and Brewer, op. cit., passim, for a discussion of these problems as they relate to the modeling side of the activity.

weapon development outlays (total RDT&E, less the amount for basic scientific research) of about $8 billion a year, there is an additional $80 million a year spent on studies and analysis. If this estimated $80 million is added to the $176 million shown in Table 1, a total of $256 million is indicated.

Not all of the categories of study shown in Table 1 can be considered directly related to weapon system analysis, however. For example, much of the work carried out during recent years in the "manpower and personnel" field has been effort to estimate the manpower-supply and supply-price implications of diverse compensation and personnel selection schemes. Similarly, some logistics research has focused on different contracting arrangements. The "science and technology" category undoubtedly contains much highly technical engineering analysis that would apply only indirectly to weapon effectiveness. Yet all these categories of study are intended to serve the broader activity of "force planning," insofar as the findings can eventually or indirectly relate to the effectiveness and costs of either weapons or force structure elements, if not both.

For certain purposes, the Table 1 categories of "tactical and strategic" and "systems and equipment" might be considered the core of this larger study effort insofar as it includes elements that explicitly develop or employ combat and campaign models which, in turn, are used to assess weapon concepts and different force structures. It is here that the techniques of modern operations analysis, including new computational routines, are most directly applied. These data, however, may not adequately cover the diversity of analytical activities performed in a variety of agencies and laboratories subordinate to each of the military departments. Since the fields of systems, operations, and cost-effectiveness analysis are themselves admixtures of diverse intellectual disciplines and since these activities merge with both engineering and force-planning endeavor, there can probably never be an adequate definition (and estimated cost) of military "studies and analysis." Nevertheless, the activity is costly. However, the worth of

valid information and, especially, of well-structured knowledge for decisionmaking is also great.

THE WORTH AND QUALITY OF COMBAT ANALYSIS

What is the worth of the information and knowledge generated by this activity? Our answer to this question is: Not as much as it could be. Indeed, much recent analysis may be worth very little; some of it may even be worthless.[7] This assertion is aimed particularly at combat and campaign modeling of conventional forces, which absorb around 80 percent of the defense budget.

Many combat and campaign models simulate phases of conventional war, from small unit engagements to major campaigns. For a model to provide useful statements to assist decisionmaking, it must yield numerical estimates that describe or predict a system's behavior. These estimates also must generally be related to effectiveness, benefits, or similar concepts of merit. Targets acquired or destroyed, survivability of friendly force elements, and territory captured are examples of such military merit concepts.

To generate these numerical assertions, a model must also employ numerical data as inputs. These latter data treat a set of phenomena different from those treated by the model's output estimates. Specifically, inputs usually express technical and engineering attributes of equipment and munitions, and behavioral characteristics of people who operate the equipment. Detailed models that treat weapon versus weapon --as in the case of a tank-antitank engagement--incorporate much fine-grain detail about the physical performance of that weapon, as measured by such concepts as tightness of shot group, rate of fire, and so on. However, the relevance of increments of weapon technical performance to actual combat utility is at best obscure, if not unknown,

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[7] See J. A. Stockfisch, *Models, Data, and War: A Methodological Critique of the Study of Conventional Forces*, The Rand Corporation, R-1526-PR, March 1975. See also Shubik and Brewer, op. cit., pp. 59-60, who present less sweeping but more pointed criticism that focuses on the level of scientific standards apparent in the modeling side of the activity.

because of inadequate testing to uncover whatever relationships may exist between measures of combat merit and measures of technical performance.

"Aggregative" combat models try to develop insights about large force confrontations in the context of a campaign, usually in a specific geographic setting, such as the NATO Central Front. Here the focus is on the relationship between (1) "force ratios," (2) attrition rates, and (3) movement rates (or territory captured or lost) as a function of either force ratios or attrition rates, or both. The precise specification of force ratios, however, presents a difficult aggregation problem insofar as modern armed forces are composed of different military specialties, including infantry, artillery, armor, and tactical aircraft. This aggregation problem led to the formulation of index numbers. However, these index numbers concealed large elements of subjectiveness and uncertainty.[8] Their use, therefore, detracted from the potential contribution that analytical techniques and the application of scientific inquiry can eventually make to military force planning and weapon system evaluation.

Overall, the quality of military study that employs mathematical-statistical methods is open to methodological criticism on two counts. Models and the critical behavior propositions that they contain are not well verified, and usually not validated at all. The input data used in models often have an obscure or unknown empirical foundation, and the relevance of much data (even when it is valid) to the military effectiveness of systems is unknown. These two shortcomings have a mutually reinforcing consequence. On the one hand, a good or well-structured model may yield unsatisfactory results--and hence may be rejected--due to the faulty data inputs it was obliged to employ. On the other hand, inadequate empirical evidence and operational testing means that there is no mechanism by which to validate or reject competing models. Nor is there an adequate basis upon which to gain insight

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[8]See Stockfisch, op. cit.

on how models might be better structured or improved. Although it may be an exaggeration to assert that military operations research and cost-effectiveness analysis are bankrupt, it is valid to question whether maximum useful knowledge and information are provided for the costs incurred.

QUANTITATIVE METHODOLOGY AND INSTITUTIONAL INFORMATION

It should be emphasized that the problem of information quality as it is affected by organizational behavior is unique neither to the present, nor to military institutions. In a past era, the preparation and writing of military history was the principal method of distilling knowledge from experience. Historical sections become features of modern general staff systems to augment the memoir writing of retired officers. The quality of much of this output led one student to call it the "confusion of history as experience and history as authority..." and to conclude that "the history of warfare is thus dependent on the writer's desire to preserve reputations."[9] In the case of nonmilitary government institutions, the lack of a clear conception of mission or purpose may contribute to the capacity to confuse and obfuscate. What may be unique about the present setting, however, is the extent to which practitioners of quantitative methodologies have become involved in military (and government) information handling.

It should be remembered that military operational and cost-effectiveness analysis were invented by the British in the context of World War II. Features of the British model were quickly adopted by the Americans.[10] In that setting, two healthy conditions prevailed: Resources available for armed services were constrained relative to the enormity and urgency of the enemy threats, and people in the field had strong incentives (including survival in combat) to get the maximum

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[9] Alfred Vagts, *A History of Militarism: Civilian and Military*, revised, The Free Press, New York, 1959, p. 27.

[10] For an account of these developments, see J. A. Stockfisch, *Plowshares into Swords: Managing the American Defense Establishment*, Mason and Lipscomb, New York, 1973, pp. 106-149.

effectiveness from resources. There was a willingness to raise critical questions, to give new ideas a hearing, and to experiment. Although experiments were often crude, especially when they were adjuncts of actual operations, they facilitated discovery of and convergence toward the most efficient production processes.

The post-World War II blending of sophisticated economic analysis and operations research quickly became a tool for high-level decision-making, first, in the subject area of strategic forces. Here, a few and individually costly weapons dominate the force structure. Moreover, each weapon system can have a high political and foreign policy content. Finally, analysis of strategic forces must be overwhelmingly theoretical. The expression "quantitative methodology" in this context has a potential to be misleading because its valid quantitative underpinning is necessarily meager.[11]

When attention is directed to general purpose forces, which absorb around 80 percent of the defense budget, the opportunity to apply fruitfully the techniques of quantitative methodology would seem to be much greater than they were during World War II, if only because time is available to carry out more deliberate and carefully structured field experiments. Changing technology does indeed permit the creation of new production processes in such highly specialized military fields as infantry tactics and tank gunnery. Yet quantitative techniques, including, especially, rigorous field experimentation, have not been systematically applied to achieve these discoveries. The superficial reason is that available resources have been inadequate for field testing of weapons, weapon concepts, tactics, and training technique. But even the meager resources that have been applied to these ends have generally been badly used.

All this may seem puzzling when compared to the World War II achievements of the small number of operations research pioneers, at a

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[11]For a further discussion of these points, see Ralph E. Strauch, *A Critical Assessment of Quantitative Methodology as a Policy Analysis Tool*, The Rand Corporation, P-5282, August 1974, and idem, *Winners and Losers: A Conceptual Barrier in Our Strategic Thinking*, P-4769, June 1972.

time when both measurement instrumentation and analytical techniques were primitive by today's standards. What accounts for the contrast? The answer lies in the incentive elements of the resource-allocation mechanism. These are determined outside the military services, if not outside the Defense Department itself. The fact that the techniques of military systems analysis have become a tool with which we try to achieve detailed management from the highest office has intensified the erosion of incentives.

There has been much discussion of the question of whether too much is being spent on studies and analysis. The answer to this question can be either a qualified yes or a qualified no. If the dominant motivation in producing a formal study or conducting a field experiment is that of advocating and obfuscating, then the answer is yes. To try to prove, by an unvalidated model fed by nonempirical data, that a weapon or system is "cost-effective," when the initial effort may be countered by similar techniques practiced in higher headquarters (and which may be increasingly forthcoming on behalf of Congress), is to prove nothing. The process simply obfuscates.

The answer is a qualified no, if the motivation is to acquire knowledge about military production processes. This includes knowledge that would assist making *detached* judgments about the technical performance features of future systems. But to acquire this kind of knowledge would, at a minimum, call for a major reallocation of talent from model building to empirical endeavors, particularly field experimentation and rigorous readiness evaluation. As the findings of empirical testing came in, the talented model builders would have better insights to enable them to create better models. With respect to studies and analysis, the question of how much is enough seems less pressing than the twin problems of incentives and information quality.

III. INFORMATION IN THE ORGANIZATIONAL CONTEXT

THE PROBLEM OF ORGANIZATIONAL INFORMATION

Any large hierarchical organization is composed of specialist subgroups that must carry out their tasks in a coordinated way. Achieving coordination is the job of the organization's *management*. The performance of this managerial function requires the transmission of information in two directions: First, the management must specify the organization's goals and develop a program designating the tasks that each of the specialized groups is to carry out. Then, relevant details of this program must be transmitted downward to subordinate agencies. Second, to formulate a program, the managers must have information about the capabilities of the subordinate agencies, including the resources at the latter's disposal. Information about *operations*, therefore, must be transmitted upward through the hierarchy.

What is the nature of this two-way transmission of information? A key aspect is the knowledge on the part of the subordinates that the information they transmit will be used by superiors to formulate programs and goals by which the subordinates will subsequently be evaluated and rewarded. The information will also be used to allocate resources to subordinates. How will this knowledge affect the information transmitted?

The answer to this question is not simple. A general answer is that the quality of information that subordinates convey to superiors is a function of *incentives*. If benefits and rewards, penalties and punishments are related to the information conveyed, then the information itself may not be entirely objective. Although falsification is not necessarily a feature of the organizational information problem, this possibility should not be ruled out. Subordinates may conceal information about their capability so as to receive less demanding assignments, achieve given assignments and quotas with less effort, or exceed assignments should there be exceptional reward for doing so.

Superiors, in turn, understand, if not expect, this kind of subordinate behavior and employ various means to counter it. One technique is to propose goals that cannot possibly be met, to induce subordinates to try harder. This technique, however, can backfire when an agency perceives that the stated plan is not feasible. Another management approach is to intensify inspection and auditing procedures and to participate to a greater extent in the detailed decisionmaking previously made at the lower levels. But, the increased centralized management can encounter, if not generate, a more severe information problem. As inspectors and auditors try to penetrate more deeply into the operating agencies, the operators can respond by manipulating the more detailed information. The original problem that motivated the increased scrutiny not only remains unsolved, but also it becomes increasingly pervasive.

Two conditions sustain and facilitate the kind of subordinate behavior that creates the information problem. First, the activities for which a subordinate is responsible can possess inherent uncertainties. Equipment can break down; individual workers can become ill; weather or other external, uncontrollable conditions can change in an unfavorable way; resources or support may not be forthcoming as scheduled from colleagues or other departments. In the case of armed forces, an opponent can turn out to be stronger or more determined than anticipated. Given such uncertainties, it is prudent to assume that they might operate adversely with respect to any future program. In many instances, to try to convey to superiors adequate information about these uncertainties is either impossible, or would require such vast amounts of information--to be transmitted and acted upon as the situation developed--as to be impracticable. Moreover, even if the mass of data could be efficiently transmitted, stored, and retrieved (a capability that may be feasible with modern data processing systems), it would still be of limited use for superior decisionmakers in the absence of models or aggregation concepts adequate to utilize or integrate the details. But even if this aggregation or analytical problem could be

coped with, a second condition would remain to afflict the organizational information process.

The second condition responsible for the information failure is the human tendency to be self-serving. Insofar as individuals seek to maximize personal utility or satisfaction, that objective is achieved either by obtaining a larger reward or payoff for a given amount of effort or by obtaining a given reward for a minimum expenditure of effort. In an organizational context, a subordinate can achieve either goal with a higher probability to the extent that he has more resources at his disposal. Hence, an individual has the incentive to conceal information about excessive resources under his control, or about exceptional capabilities of some of those resources--including his own capability.

The description of behavior as "self-serving" should not be construed to have a pejorative connotation. Nor should it imply that people are not guided by higher motives. Whatever a person's ends--selfish or noble--he must have resources to attain them. To get resources impels all to behave in roughly the same way. In the private sector, one has to offer something in exchange for what one gets in a market transaction. In the government sector, political authorities responsible to taxpayers must, first, approve a request for funds, resources, or goods and, second, bear responsibility for imposing taxes to provide these. When operating control over resources is obtained, the utility or satisfaction of a recipient is enhanced. For the government official, this means "serving the public interest." He also enjoys power, the esteem of peers and subordinates, job security, and other benefits, including the satisfaction derived from carrying out his mission. "Self-serving" conveys this complex of motivations; it is neutral with respect to any set of deeper ethical or moral concepts.

Given a self-serving motive on the part of subordinates to acquire and control resources, the information transmitted in a large organization has a peculiar quality. It can contain some objective knowledge. But intertwined with it can be large amounts of misinformation which

may take a variety of forms. Because information must flow upward through the hierarchy, it is often edited and aggregated to avoid inundating the higher echelons with excessive detail. Given the need to aggregate, there is opportunity to adjust or modify the material. Often, changes are justified on the ground that those at the higher level may not adequately appreciate aspects of local conditions affecting the production of the raw data and that they would consequently draw incorrect conclusions from unadjusted aggregations. However, information so adjusted can frequently become misinformation. Cost-effectiveness studies and computer simulations of combat--given the often unvalidated models frequently using unproven data--are currently a major source of misinformation in the defense establishment.

Intertwined with valid data and large amounts of pseudodata are substantial information gaps. This condition exists in part because organizations are often unwilling to undertake a quest for information that might reveal adverse findings with respect to a favored program or activity. Conversely, positive fallouts of a favored program are frequently touted by specialist groups to justify budgets with a zeal exceeded only by that of an adversary force opposed to attempts to measure those benefits. It has been observed, for example, that "the academic technostructure is more powerful than that of Detroit, and not necessarily better motivated; moreover, its British members have recognized that measurement of their output would reduce that power, and resist it accordingly."[1]

Given the ill-defined admixture that can characterize the organizational information confronting decisionmakers, what is the meaning of *management, command, authority, power*, and so on? Indeed, what is the meaning of *decisionmaking*? One answer is that organizations are nevertheless managed to some degree. But just how effectively is a subject that spans all aspects of organizational behavior and resource-allocation mechanisms. Meanwhile, a case can be made that much of the

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[1]Brian J. Loosby, Review of *The Corporate Society* (edited by R. Marris), *The Economic Journal*, Vol. 85, June 1975, p. 426.

standard nomenclature, theory, and discussion employed in treating organizations verges on becoming conceptually unravelled to the extent that an organizational information problem prevails.[2]

The problem of organizational knowledge might be regarded as pathological. A dramatic information (or intelligence) failure--of which the Pearl Harbor disaster is considered an example[3]--can lend plausibility to the pathology hypothesis. Although numerous incidents can be recounted to suggest that information failures have a pathological dimension,[4] emphasis upon the pathological can be misleading if the conclusion is drawn that information failures are exceptional rather than frequent.[5] But the perspective of pathological information failure overlooks a possibly more pervasive kind of information problem--that centering around the countless decisions that go on daily with respect to resource allocation and production processes.

INFORMATION, RESOURCE-ALLOCATION MECHANISMS, AND PRODUCTION: INCENTIVE ASPECTS OF THE PROBLEM

The question can be raised, given strong incentives to control resources by means of information transmission, how is it that organizations can work at all? Moreover, how can a system composed of a large

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[2]However, this problem has come to occupy the increasing attention of many scholars, some of whom have unlimbered heavy mathematical artillery to treat it. See, for example, G. M. Heal, *The Theory of Economic Planning*, American Elsevier Publishing Co., Inc., New York, 1973; E. Malinvaud, "Decentralized Procedures for Planning," in *Activity Analysis in the Theory of Growth and Planning*, E. Malinvaud and M.O.L. Bacharach (eds.), St. Martin's Press, New York, 1967; Jacob Marschak and Roy Radner, *Economic Theory of Teams*, Yale University Press, New Haven, 1972; Theodore Groves, "Incentives in Teams," *Econometrica*, Vol. 41, No. 4, July 1973, pp. 617-631.

[3]Roberta Wohlstetter, *Pearl Harbor: Warning and Decision*, Stanford University Press, Stanford, 1962.

[4]See Harold L. Wilensky, *Organizational Intelligence: Knowledge and Policy in Government and Industry*, Basic Books, Inc., New York/London, 1967, passim.

[5]That they may be infrequent, however, is not to diminish their importance--particularly where the subject is foreign affairs and the associated use of military force. Therefore, detailed dissection of momentous events is a worthwhile intellectual activity. For a recent

number of organizations function as a *social resource-allocation mechanism*?[6] Some insight into these two questions is provided by the point that this problem is merely one aspect of the pervasive social dilemma: If I steal when everyone else is honest, I can gain at the expense of others. If everyone steals, then everyone loses, since much energy is diverted to antisocial activity and ways to deter it. In an organizational-political context, there are strong incentives to bend and manipulate information, because my exaggeration when compared with your candor can, in many instances, elicit a superior's pleasure toward me and displeasure toward you. The method to cope with this kind of problem is to design institutional devices that create appropriate incentive systems to deter people from the antisocial behavior.

With respect to a society's resource-allocation mechanism, one way to cope simultaneously with critical aspects of the interrelated information and incentive problem is by means of a combined system of free markets and private property rights. Ongoing market transactions simultaneously provide *objective* information on prices to buyers and on consumers' preferences to producers. The consumer does not normally concern himself with knowledge about a producer's internal or production processes; nor is he interested in the producer's costs. What does concern him is the quality of the end products, and he learns about this by experience or by word of mouth.

Producers are motivated to cater to buyers' demands to achieve sales, or dollars. Producers are further motivated to economize on the use of resources necessary to produce their outputs and to combine diverse resources in an optimal way, so as to obtain maximum profit (a residual) from their dollar sales. When producers compete for consumers' dollars, the most efficient ones either survive or tend to capture an increasing share of the market and drive out inefficient producers; or, the domination of a market by inefficient producers tempts

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pathbreaking effort, see Graham T. Allison, *Essence of Decision: Explaining the Cuban Missile Crisis*, Little, Brown, and Co., Boston, 1971.

[6]We borrow this expression from Leonid Hurwicz, "The Design of Mechanisms for Resource Allocation," in *The American Economic Review*, Vol. 63, No. 2, May 1973, pp. 1-30.

outsiders to enter. Producers, moreover, have a strong profit (and survival) incentive to minimize shirking on the part of their workers and to induce them (by firing and hiring) to take care of valuable equipment and inventory. A sufficient condition for this kind of profit- (or residual-) maximizing system is the social institution of well-defined and *strong* private property rights.[7] The right to keep at least some part of the residual (after taxes), when profits are functionally related to production performance and efficiency, makes the incentive to economize operational.[8] Although large elements of "gaming" that distorts information can be uncovered in any private firm--as between, say, workers, foremen, and shop managers and the sales, engineering, and other specialized divisions--its adverse social impact upon efficient resource use appears to be kept within limits by the twin forces of competition and greed on the part of both private-earnings maximizers and purchasing-power maximizers. When markets are sufficiently articulated, communication and information transmission between buyers and sellers need only be confined to quoting prices and placing orders. Neither party to a transaction need know anything more about the other's business. That is, the seller can be unconcerned about how the buyer may use the purchased product; the buyer need not bother about technology, production conditions, and so on. The use of knowledge and, especially, its transmission is thereby economized.

When we turn to the government sector, what is the manager's analog to the businessman's maximizing a residual? One general answer

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[7]The emphasis on *strong* private property rights is important and has a number of subtle aspects. Essentially, the concept is one that fosters healthy incentives for decisionmakers to manage carefully by linking their prospects for rewards and punishments (or losses) to their performance. For a further discussion, see Eric G. Furubotun and Svetozar Pojovich, "Property Rights in Economic Theory: A Survey of Recent Literature," *Journal of Economic Literature*, Vol. 10, December 1972, pp. 1137-1162, and especially pp. 1138-1140.

[8]The right to capture a residual also provides wherewithal to owners to design and sustain incentive schemes like profit sharing, sales commissions, and so on.

is that the government administrator strives to maximize his budget since he is denied the opportunity to capture profits.[9] In the context of government operations, however, the incentive to achieve efficiency can be greatly attenuated; typically, it is negative. The reason that the incentive is often negative is that if a bureau head suggests an economizing scheme, his political masters are likely to cut his budget (perhaps thanking him, or even giving him a citation). However, any proposed economizing scheme possesses an element of chance: Reduced resources could result in lowered output. But even when resources are cut, the bureau head is nevertheless expected to carry out the assigned mission. So the game is not very attractive.

The ability and opportunity of a government bureau head to try to maximize his budget is critically dependent upon uncertainties about his *production process*.[10] If the activity is one about which the "buyers" (that is, the members of the community and their elected officials) have a clear idea about the outputs they want and if the production process is fairly simple and transparent, the head of an agency may have limited opportunity to try to maximize his budget. For example, imagine a community where there is a consensus that trash should be picked up twice a week. It is likely to be simple to determine how

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[9] William A. Niskanen, Jr., *Bureaucracy and Representative Government*, Aldine Atherton, Chicago, 1971.

[10] The term "production process," as used here, incorporates but is not exclusively confined to the concept of a "production function" as it is used in economic literature. It is generally implicit in production- and resource-allocation models that both the concept of a production function is well defined and the useful services forthcoming from resource inputs--e.g., labor, machinery, and so on--are maximized as a result of good management and strong incentives. The latter assumption is appropriate in the context that has characterized the private sectors of most Western societies. When that assumption is not appropriate, the concept of a production function alone may not be adequate to capture all the critical aspects of production efficiency. Incentives must also be explicitly treated. I use the term "production process" in this broader sense.

many trucks and men are necessary to make the necessary pickups. The head of the sanitation department will be able to employ such techniques as time-and-motion studies to uncover shirking, and so on. Or, the activity could be contracted out to private operators, by means of a periodic and competitive bidding process. In the latter case, neither the head of a city's sanitation department nor the city manager and council need know anything about the mechanics and management of the trash removal business. For all practical purposes, they can function--on behalf of their taxpayer-clients--like a hard-nosed private consumer. Should the operation be municipally undertaken, officials may compare its operations with similar ones in comparable cities. Information about relationships between inputs and outputs is therefore accessible by a variety of techniques. The opportunity for the bureau head to obfuscate his production process as a means of obtaining larger budgets is constrained. Moreover, since the buyers can resort to an alternative way of getting the service, i.e., contracting, the incentive for the bureau head either to obfuscate or to be slipshod in his management is diminished.

When either the outputs or technology of a resource-using activity are uncertain, the relationship between a bureau head and his political masters becomes more complex. Uncertainty may center around differences in viewpoint regarding the relative weights that might be attached to each of an activity's multiple outputs. For example, is a school system's function that of (1) preparing students for higher education, (2) vocational training, (3) social conditioning, (4) keeping adolescents off the street, or (5) something else? Or is it some combination of these; and, if so, what is the relative importance assigned to each of them? Since citizen consumers may have divergent views on these matters, the bureau head is in the position of trying to cater to each of them. To be effective, he must often participate in the formation of coalitions representing the diverse citizen interests. When effective, he is able to obtain larger budgets.

Technical change operates to affect in an uncertain way the qualities of an activity's various outputs. It also injects elements of uncertainty into the production process itself. The effect of technical change decreases the ability of outside monitors to assess an operation's efficiency. This problem is greatly compounded if the process of technical change also offers a *prospect* of changing the quality of outputs in a way that is desirable to one or more of the diverse interest groups that may comprise the consuming public.

The problem posed by technical change as a potential source of obscuring the nature of a production process is not insurmountable, even in the government sector. To cope with it, however, institutional mechanisms must exist, or be designed, to create appropriate incentives for specialists to economize on the use of resources. In some instances, such incentives may be difficult to devise for reasons *intrinsic* to a given production process. Under some circumstances, there may be fundamental *political* reasons for the difficulty. Although the intrinsic and political reasons are intertwined, it is helpful for clear understanding to separate them.

Coping with technical uncertainty[11] is a common event in the private sector. In its fundamental workings, the process is essentially experimental. That is, a more adventurous, innovative, and self-confident management or entrepreneur may, first, undertake careful studies of either the market prospects for a new product, or the cost-saving potential of a process innovation. Second, he may next institute a new production technique in a small-scale pilot plant; or, he may promote and test limited batches of a new product in selected markets to ascertain consumer acceptability and how to design a larger sales strategy. These efforts (including a pilot plant) may be characterized as a *field trial* or *experiment*. Their purpose is to buy

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[11] By "coping with technical uncertainty" I mean discovering and trying to exploit any opportunity to put new scientific or engineering knowledge to practical use, either to produce and promote a new product, or to produce an existing product with fewer scarce physical inputs, or some combination of both. It entails more than a technical invention or natural discovery.

information at a modest cost. The resulting information serves either, or both, of two functions. It enables the innovator to modify his subsequent program in ways that will enhance its success. It provides signals of whether the program should be terminated to cut its total loss. In the latter instance, a failure will be recorded by the accountants--but a minor one insofar as a major financial disaster will have been avoided.

This quest for information that characterizes the private-sector innovative process is energized by an uncomplicated motive to make profits and to avoid catastrophic losses. For this reason, the focus of its participants can be confined to coping with the intrinsic uncertainties centering around the innovation's technology or consumer acceptability. The information search is detached and objective, since failure or inefficiency will prove costly to the participants. To be sure, even in a moderately sized firm, an innovation can upset the relative status of two or more of the firm's specialist subgroups, and this possibility can inject an element of political behavior into their respective information searches and evaluations. But the political motivation can be mitigated if each of the competing managers has a stake in the larger organization's financial performance. Share ownership and stock option schemes are devices that serve this end.

In the government sector, politics can dominate the resource-allocation mechanism, because bureau heads have much less incentive to economize on resource use. If the intrinsic uncertainties of a production process are such that citizens, or their politically chosen review instruments, cannot easily observe and monitor production, a setting exists in which a bureau head operates under weak control mechanisms. His incentive to economize, or to prod his subordinates to economize, is weakened.

Such a situation may lead to a wide variety of outcomes. In some instances a bureau may nevertheless continue to be efficient simply because of dedication on the part of its leaders and members. Or, it may be highly efficient in some phases of its operations, but lax in others. A circumstance contributing to this condition is that the uncertainty

affecting the bureau's production process can generate skepticism on the part of some political officials as to whether the bureau's budget level is justified. Some budget cut may seem justified to these outsiders. In such a case, the bureau head has an incentive to search for officials, including legislators, who may be kindly disposed toward the bureau. Activities in which such officials have a keen interest may be vigorously and efficiently carried out, while other activities, receiving little management attention, are carried out inefficiently.

Efficient management in government can be further thwarted by political patronage. Bureau heads may feel constrained to manage resources in such a way as to enhance support from legislators, or to soften potential criticism from legislators who might otherwise critically question certain phases of a larger program. Some legislators may actively seek for their constituents the benefits that accrue from government spending. Others may use their power to induce a bureau head to tilt programs toward a policy objective that is felt to be in the best general interest. Thus the management of the organization finds it difficult to develop a sharp focus about its objective, in part because it has many masters. It must scramble to obtain or retain its budget. The budget it does receive must often be justified and advocated in terms of numerous line-item accounts, each of which may be subject to detailed scrutiny.

The requirement for justification confounds the information problem by creating pressure to marshal information that will justify each line-item expenditure. The latter kind of justification, however, is not an end itself. Rather, it is a means that must be employed to justify the aggregate budget. Consequently, it should not be surprising that the production and processing of information is also affected by the objective of budget advocacy.

SUMMARY

"The proper integration of information and incentive aspects of resource allocation is perhaps the major unsolved problem in the theory

of mechanism design."[12] There is uncertainty about physical nature, including the capacity of workers and equipment to render useful services. In an institutional or organizational setting, both prudent and self-serving individual behavior often creates incentives to retain secrets about capability to produce. Information must then be elicited--including that which can be obtained by measuring performance itself--through incentive systems determined by contractual arrangements.[13]

When the focus is narrowed to public resource-using instruments, which do not measure output performance in terms of monetary profit and loss and do not provide unambiguous rewards for maximizing a residual, both individual and organizational incentives tend to be poorly defined. Organizational goals can be achieved only if resources are obtained. The incentive to obtain resources can, in some contexts,

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[12]Hurwicz, "The Design of Mechanisms for Resource Allocation," op. cit., p. 27.

[13]It should be emphasized that the efficiency loss due to faulty incentives is of a major magnitude that is not adequately encompassed in resource-allocation models focusing on optimization, *given* well-defined production functions and factor services. For an illumination of the point in the context of developing countries (where, often, the property-right structure and incentive systems are deficient), see Peter Kilby, "Organization and Productivity in Backward Economies," *Quarterly Journal of Economics*, Vol. 76, No. 2, May 1962, pp. 303-310; and Harvey Leibenstein, "Allocative Efficiency vs. 'X-Efficiency,'" *The American Economic Review*, Vol. 56, No. 3, June 1966, pp. 392-415.

For examples treating comparable government or nonprofit versus private activities where the production processes are well defined, see Roger Ahlbrandt, *Municipal Fire Protection Services: Comparison of Alternative Organizational Forms*, Sage Publications, Inc., Beverly Hills, California, 1973; David G. Davies, "The Efficiency of Public versus Private Firms: The Case of Australia's Two Airlines, *Journal of Law and Economics*, Vol. 14, April 1974; Louis DeAlessi, "An Economic Analysis of Government Ownership and Regulation: Theory and the Evidence from the Electric Power Industry," *Public Choice*, Vol. 19, Fall 1974; Alfred Nichols, "Stock versus Mutual Savings and Loan Associations: Some Evidence in Differences of Behavior," *The American Economic Review*, Vol. 57, May 1967.

attenuate ability to carry out the organization's ill-defined goal, including a detached quest for knowledge on how to achieve those goals. Attainment of knowledge about ways to save resources used may not be vigorously pursued, and in some instances this effort can even be strongly resisted. Hence, knowledge available to outsiders will be imperfect for reasons in addition to the uncertainty inherent in nature or technology. In some instances, the organization's goal may itself be unfeasible. When the possible cause is the inability to discover the best production process, or the inability to establish an incentive system that energizes bureaucrats and public officials in the "right" way, concern with classical allocative efficiency--the primary focus of the contemporary blending of economic and operational analysis, that is, cost-effectiveness analysis--may be short of the mark. Rather, a reallocation of effort toward finding ways to converge on the best production processes, and the creation of stronger incentives for public officials to try to find them, may be warranted. Although the problem described in this section is pervasive in the public sector (including socialized activities in certain settings), what follows narrows the focus to resource allocation relevant to armed forces management.

IV. A DEFENSE ESTABLISHMENT AS A RESOURCE-ALLOCATION MECHANISM

Because it is difficult to resolve the organizational information problem, the resource-allocation mechanism is, itself, not as well defined as one would like. Yet the concept of a resource-allocation mechanism may be a useful one to apply to the problems that confront defense decisionmakers at this time. In this section, I shall try to structure the concept as it pertains to peacetime military management. The purpose is to set the stage for the next section, which undertakes an assessment of recent practices and offers an example of how the problem of information, incentives, and resource allocation might be improved.

Two major, interrelated arguments characterize the discussion that follows. The first distinguishes between the rational and the political models of decisionmaking, because the failure heretofore to recognize that there are, in fact, two quite different models has imposed a strain on defense management. The second emphasizes the interdependence of incentives and information, because information cannot be improved without first improving the incentives. Then, with better information, there can be realistic hope that management can be improved.

THE ELEMENTS AND STRUCTURE OF A MANAGEMENT SYSTEM

A hierarchical organization permits the division of specialist groups so as to enable the head of each group to manage and allocate resources.[1] Each leader brings to bear his technical expertise, or

[1]Hierarchical organizations also permit reasonable spans of control among large numbers of single elements--e.g., battalions and divisions. However, it should be recognized that even the smallest organization usually consists of different specialists, whose diversity impacts on the effective span of control. For example, a modern rifle squad can consist of riflemen, automatic weapons specialists (or a machinegun crew), grenadiers, an antitank weaponeer, and a scout, or varying mixes of these. The larger the number of specialists in the

knowledge relevant to a special technology. This knowledge also enables him to search for and assess people best suited to the specialty. Furthermore, the various subordinate heads must cooperate with each other, that is, transactions must take place between them. These are lateral transactions. Heads must also obtain resources to expend in pursuit of their tasks. These expenditures must be authorized and constrained in some way. This allocation process also involves transactions requiring negotiations. The authorizations are determined by superiors. These transactions are vertical. Both kinds of transactions are costly in time and energy.

The elements of management constitute an interrelated set of specifications, procedures, and rules designed to control the transactions and to minimize their cost. What is the nature and structure of the elements that constitute these interrelationships?

First, let us identify the elements.

The Decisionmaking Hierarchy

Hierarchy in an organization arises from the need to coordinate the activities of divers specialties. The coordinating task increases in complexity as the scale of the total activity increases. The complexity arises from critical interdependencies. For example, the headquarters of a conglomerate corporation consisting of a number of heterogeneous operating divisions may make decisions allocating major capital expenditures, determine new plant locations, or decide on new product lines. It may also determine product prices.[2]

The pricing of products by headquarters may be necessary when the products closely complement or compete with similar products produced

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microorganization, the more severe the leader's span-of-control problem. That is, the span of control must be narrowed. For a given size of macroorganization, narrowing the span of control requires deepening the hierarchy. Hence span of control and the depth of hierarchy are highly interdependent.

[2]In this and the immediately following discussion, examples from nonmilitary situations are used because of their neutrality with respect to controversial issues that have long pervaded military circles. The military reader, however, can with little difficulty substitute analogous military examples.

by the same or another organization. For example, a firm like General Motors needs to assure that the price of Chevrolets, in an effort to compete with Ford, does not decrease overall corporate profits by an adverse impact on the sales of Pontiacs. Similarly, in the case of a company with separate operating divisions that produce film and cameras, it may be appropriate to deny the camera division freedom to maximize its profits (and hence freedom to set its prices and outputs) because lower camera prices and greater camera production (and hence lower profits to the camera division) may stimulate camera and film sales and enhance overall corporate profits. Where these relationships between products do not exist, the individual operating divisions can be left free to do their own pricing on the ground that they are closer to their customers (and competitors) and hence have better knowledge of "what the traffic will bear" than do managers and staff in a remote headquarters.

The product-pricing example provides one basis upon which to evaluate the merits of centralized versus decentralized management. In the case where the products of the different operating divisions are close substitutes or complements, there is a compelling reason for price setting on the part of the main office. The merits of centralized versus decentralized decisionmaking with regard to the pricing function are irrelevant in such a situation. Where operating divisions put out products that are not closely related in consumption, it is possible to permit autonomy in pricing. Division managers need only be instructed to maximize the profits of their respective divisions. (Bonus or other incentive schemes can strengthen this guideline.) If there are no "external effects" between the operating divisions of the corporation, the individual profit centers can be allowed maximum freedom. The management of the larger corporation can be characterized as decentralized.

Even in a setting that would be congenial to decentralized pricing, a case may nevertheless exist for centralizing the function. Perhaps the technicalities of production are so demanding that division managers must be chosen for their technical expertise. Finding

people who are equally adept at deciding pricing and related marketing policy may be difficult, or too costly. In this case, marketing experts would tend to be found at the headquarters and engineers in the operating divisions.

Decision Thresholds

The decision threshold is the arrangement specified between levels of a hierarchy with regard to a given function, normally, the amount of resources at stake. For example, a branch bank manager may make loans up to a specified amount; an application for a larger loan is referred to the district headquarters, and so on. In the capital budgeting function, the lowest organization in a hierarchy may have freedom to make outlays up to a specified amount, with successively higher thresholds for higher echelons. In capital budgeting, thresholds may be specified in terms of a given single expenditure or a given budget, or both. For example, a plant manager may be allowed $10,000 for the year to acquire small tools or machines, or to make structural improvements as he sees fit, but need the approval of his superior for any single expenditure of $1000 or more. In the product pricing area, a division may be permitted to raise or lower its prices by amounts not to exceed a specified percentage.

Decision Guidelines

Operations and decisions of lower organizational elements (within the specified threshold or division of labor) may be subjected to guidelines specified by the higher headquarters. These guidelines may either be rigorously specified or "rules of thumb." In a general way, they reflect aspects of the organization's policy. In military organizations, the word "doctrine" captures this concept. The concept describes how business is to be conducted. Guidelines are often "enforced" by an auditing or inspecting procedure, and usually they are intertwined with the thresholds. For example, a branch bank manager may operate under a threshold permitting him to make personal loans up to $1000. However, he may also be required to adhere to guidelines specifying

that the borrower have a monthly income of at least the amount of the loan, assets double the amount of the loan, or other characteristics described by the phrase "credit rating." Deviation from guidelines may necessitate referring the "special case" to the higher headquarters.

Procedures for Enforcement and Adjudication: The Question of Burden of Proof

The three elements described above--the decisionmaking hierarchy, decision thresholds, and decision guidelines--may be regarded as an organization's internal legal system governing the contracts that member divisions can make with each other or with outsiders. They also encompass the *property rights*, or the claims and obligations, which the various participants have with respect to each other. But no legal system can be explicitly specified in all its detail, and individuals must be able to exercise discretion. To the extent that orders and instructions must be transmitted, however, the rules can facilitate considerable economy in the internal flow of messages.

The exercise of discretion raises problems about the interpretation of the rules and the precise content of the property rights. Rule enforcement and adjudication of property rights are called for. A subtle part of the operative features of any management system derives from (1) the vigor with which various rules are enforced and (2) the manner in which the burden of proof by which judgments of rule violation (or bending) are established.

Subtleties arise because specified rules and procedures have two vital but somewhat conflicting functions. On the one hand, they can have high information content. For example, if I know the rules and procedures and know also that a colleague strictly adheres to them, then I am able to predict a great deal about that colleague's behavior. Here is the knowledge content. The need for messages and information transmission is economized. On the other hand, if we are all casual about a rule, each of us is less constrained to exercise discretion and more inclined to take advantage, perhaps, of knowledge about specific conditions. The colleague's behavior is less predictable in that

situation, and I would then be prudent to communicate with him. But communication can be costly and occasionally can create misunderstanding or even confusion.

The problems posed by this tradeoff are usually handled pragmatically. Some rules are seldom broken; if they are broken, the burden of proof justifying the violation is upon the "defendant," or subordinate. Other rules need not be adhered to at all times, and the burden of proof that harm was done is on the "prosecutor," or superior.[3]

An organization's *management structure* is the set of interrelationships of these four elements. Such interrelationships, which can vary widely among organizations, are influenced by, among other things, the quality of the personnel. For example, low decision thresholds and tight guidelines would accompany low-quality subordinate heads. The opposite situation might be found where leaders are intensively screened, technically expert, and strongly motivated. The officers of a fighting military organization might be strongly motivated to be their brothers' keepers. In such a case they can be permitted much scope for individual initiative.

Since these four elements can exist in a wide range of combinations in a given management structure, there is also much scope to design incentive systems, including incentives to acquire and convey information. What implications does any specific combination have for the efficiency of a resource-allocation mechanism and its information system in the management of a military establishment? To address this question requires some perspectives on the kinds of major resource-allocation decisions that must be made.

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[3] In the context of military field operations, similar problems arise with respect to the degree to which orders are obeyed. When admonished by the Kaiser after an operation in the Prussian-Austrian war, an officer responded that he was simply obeying orders. The Kaiser purportedly replied: "But His Majesty made you an officer because he believed you would know when to *disobey* orders.

RESOURCE-ALLOCATION DECISIONS IN PEACETIME ARMED FORCES MANAGEMENT

For a defense establishment, resource allocation in peacetime[4] may be viewed as involving five sets of major decisions:

1. Determining the total defense budget
2. Allocating resources among military services
3. Allocating resources among specialized combat functions
4. Specifying the combat readiness of the force structure
5. Selecting performance characteristics of new weapons to be developed and procured

These are not intended to represent airtight, mutually exclusive categories, but rather to provide a template that can be related to the structural elements of the management system discussed in the previous section. The comparison will enable us to try to identify the critical incentive features that impact upon information and administration.

Bearing in mind the dichotomy between the *political* and *rational* models of defense decisionmaking, we may describe the five categories of resource-allocation decisions as follows. The rational model assumes that each kind of decision is susceptible to rigorous analysis. Further, it must implicitly assume that the analysis is served with adequate empirical data. The approach to decisionmaking, then, can proceed from, first, some perception of the military *threat* and, second, an assessment of the effectiveness of one's own combat elements relative

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[4] We emphasize the peacetime setting. In time of a major war, a military department can display a high degree of efficiency in striving to maximize its outputs, in terms of fighting capability, from its available resources, as the War Department did in World War II. In this setting, of course, it operates under a resource (although not necessarily a dollar) constraint. Confrontation of a formidable enemy provides the appropriate incentive. For a vivid account of this behavior in the context of a *noncentrally* managed structure, see Kent Roberts Greenfield, Robert R. Palmer, and Bell I. Wiley, *United States Army in World War II: The Army Ground Forces: The Organization of Ground Combat Troops*, Department of the Army, Historical Division, Washington, D.C., 1947.

to that threat in such a way as to estimate the numbers of force elements required to deal with it. The total cost of these force elements generates estimates of the total budget.

This same analytical process also suggests how the total budget should be allocated among the major combat elements, including strategic forces, conventional land and air forces, and conventional naval forces. Estimates of the opponents' ability to mobilize and deploy forces (an aspect of threat assessment) indicate further the appropriate combat readiness of one's own forces. Determination of how the total budget should be allocated among the major military services emerges as a by-product of this rational model. Thus, force planning (and budgeting) is simply a problem of roughly matching the other side's numbers, while taking account of geographic and terrain constraints.

This approach to defense decisionmaking might have been workable in the past. Prior to World War II, simple force metrics common to the major European countries--divisions or capital ships, for example--could be used. One country's land-force divisions did not differ significantly in structure or cost from another's, and what differences there were could be accounted for by terrain or relative resource endowments. At the same time, technology was relatively simple. Technical change did not have the potential it seems to have today to upset the relative power status.[5] Although technical improvements were

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[5]This statement is contestable on two counts. First, many of the technical changes available in the past did cause anxieties for force planners. However, it is difficult to find historical examples of the possession of a "technologically superior" weapon(s) by one side being the basis for winning a war. (We rule out of this consideration colonial-type operations where Western troops encountered men armed with spears, or similar antiquated weapons.)

Given lack of clear empirical evidence that a superior technology is decisive in war (or even major battles), a question can be raised about the prevailing view that we must strive to attain "qualitative superiority" in weapons by means of research and development spending so as to counter the "large numbers" possessed by our major opponent. (We waive the awkward question of precisely what is meant by "qualitative superiority.") If the tradeoff is numbers of fighting elements

fielded--the machinegun, the *Dreadnaught* class of capital ships, and even aircraft and the tank--these could be procured quickly by all parties, if only in limited numbers to find out whether an opponent's acquisition of a new weapon might afford the means to upset the military status quo.

These conditions, in combination, afforded fairly transparent indicators of relative military capabilities that were understandable to both professional military men and thoughtful civilian policymakers. Although domestic politics and patronage considerations were an aspect of military management in all countries, the main features of the production process could be sufficiently transparent to all parties so as to make the rational model of resource allocation fairly operational.

Since World War II, the United States has employed two major approaches in the allocation of its defense budgets. Prior to the 1960s, each military service was constrained in terms of total dollars and manpower, but each had a large degree of freedom to decide what the most important military threat was and how to meet it. This setting may have produced a tendency for a service to place an undue proportion of its resources in some areas and to give less attention to others. Some observers believed that the resulting imbalances in the overall force structure may not have been intended by the civilian leaders, or perhaps may not have been perceived by them in time to redress any imbalance that could occur.

These problems had their roots in the rivalry among the three services with regard to military roles and missions in the setting of major budgetary swings between the two major force components: strategic and conventional. A new weapon concept could often seem to affect a prospect to reduce or expand the traditional role of a particular service. Each service hastened to develop weapons that would either maintain its role or obtain for it a share of a rival service's

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(infantry, tanks, combat aircraft) versus high-cost weapons, which incidentally require large numbers of service troops to maintain, the historical evidence is not very assuring that opting for the ill-defined high quality (i.e., high unit cost) is a good bet.

role. This behavior was not all bad: It led to some worthwhile developments, as illustrated by the Polaris system. However, it also produced a tendency to support crash development programs and haste to procure a newly developed system so as to get it into the force structure. Hard-nosed operational testing of new weapon concepts was difficult, if not impossible, to get under these incentives.

The attempt to control unilateral service behavior centering around the roles and missions rivalry was a major innovation of the 1960s. A major mechanism for control was the newly developing cost-effectiveness analysis. In the dialogue between the Office of the Secretary of Defense and the military services, however, *neither cost nor effectiveness was held constant by the Secretary and OSD*. That is, some programs were cut back on cost considerations, others on the basis of effectiveness. In some instances, certain programs--or even details of them--were increased as a result of active prodding by the civilian leadership. Notable examples of these were the Army's aviation and the strategic airlift programs. In this fashion, rather fine-grained decisions on the force structure, as well as equipment procurements, came to be determined in the Office of the Secretary of Defense. Increased centralization of decisionmaking occurred insofar as decision thresholds available to the services were lowered. A further important, and apparently not well-perceived, consequence of the managerial changes was that policy regarding the burden of proof with respect to an allocation decision became ambiguous. With an emphasis on cost effectiveness (and its analytical engine) as a tool of highly centralized decisionmaking, this ambiguity was to have profound information consequences.

The military services were cast in the role of advocates of the new weapon development programs. In this environment, information about weapon effectiveness could not help but become politicized. The more fine-grained were the decisions made by high political officials, the greater was the incentive for detailed information to acquire a political potential and coloration.[6] To the extent that analytical

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[6]This involvement also weakened the ability of high officials to acknowledge error in decisions in which they had been involved.

models became a way to assimilate much diverse data--particularly that relating to the impact of technical change on weapon and force element effectiveness--they also became weapons in the battle of budgetary advocacy and counteradvocacy. Finally, the data inputs to models themselves became the ultimate weapon to control the information-production process. Certain data were manipulated. More important, failure to generate data, including failure to test by experimental or other empirical effort models upon which cost-effectiveness analyses were based, became an even more powerful way to influence the information-production process. Why undertake a program of experimentation, or field testing, which offered some probability of showing that a favored weapon (or doctrinal) concept had flaws? If future dollar or manpower budgets were at stake as a result of such findings, the incentive for rigorous operational testing was clearly negative. (Even technical testing was affected.) Under these circumstances, little or no empirically valid information was considered preferable to the possibly contraindicative results of testing.

SUMMARY

Whatever effect a rapidly advancing technology might have upon the production of military capability, it appears to have increased the political content of the U.S. military establishment's peacetime information-production process. A changing technology, of course, expands one branch of man's knowledge. For that knowledge to improve human conditions--by way of enhancing efficient resource use--it must be coupled with the knowledge of how to apply technology to *operational* problems. When such application entails risks of reallocating resources among organizations, the incentive of those organizations to produce operational knowledge is weakened. Knowledge production and processing become increasingly politicized, and the use of quantitative methodology itself becomes a political activity.

One way to try to cope with the consequences of political behavior that contributes to inefficient resource use is to increase centralized

management. That is, high officials make more fine-grained decisions. Modern management techniques--based on quantitative methodology and a more powerful data-processing and communication technology--appeared to offer promise of facilitating such a managerial philosophy. Yet a case can be made that extreme central management can be overwhelmed by subordinate agencies that control the information-production process. Moreover, as a result of the contest, information quality is itself a casualty.

The organizational information-production process presents a major challenge with respect to all aspects of public administration, especially the *implementation* phase of public policy. Policy goals themselves can be misspecified insofar as the means or resources available are inefficiently used. Misspecification of policy goals can occur because information available to policymakers is degraded. This degradation results from the behavior of specialists who respond to incentives created by policymaking officials. The specialists themselves, however, must labor with poor information. Goals which may be feasible, given the resources made available, may still not be achievable due to operating inefficiencies. Thus the attenuation of information quality afflicts a management system with respect to both goal specification and the attainment of ends that would otherwise be feasible.

V. WHAT TO DO ABOUT THE PROBLEM OF INCENTIVES

WEAPONS DEVELOPMENT AS A FOCAL POINT OF U.S. BUDGETARY POLITICS

A prominent feature of the U.S. system has been the casting of its divers military specialists as advocates relative to each other and to the highest civilian political authorities, with the latter doling out both funds and manpower authorizations. In the context of rapid technical change combined with the purposeful development of new weapons, much of this advocacy focused on the specification of the performance characteristics of new weapons that could become the objects of major development programs. As objects of subsequent procurement programs, the new weapons are viewed in terms of their capacity to enhance or preserve service roles or combat-branch missions.

With each development cycle of a system, unit system cost increases. Claims of enhanced effectiveness also increase. In this context, fine-grained models of combat are used to justify the claim that the more costly system is "cost-effective." When repeated over several development cycles for a given weapon class and extended to many different kinds of weapons, the overall cost of a larger aggregation of force increases. Yet when questions are raised regarding the ability of the aggregate force to cope with an opponent's large numbers, the estimates of friendly capability acquire a more somber coloration. In this context, aggregative models of combat and campaigns are used to buttress arguments for larger forces.

The decision process is characterized by low decision thresholds and tight decision guidelines, with the burden of proof generally on military advocates. Funds for new weapon developments are authorized by high civilian authority. Because new programs may have important subsequent effects on procurements, which in turn justify force structure elements, the weapon system evaluation process--which begins with the specification of performance characteristics that new weapons should have--acquires its high political content. One inevitable

consequence is that information production relevant to weapon development and even tactics formulation becomes politicized to an extreme degree. Another consequence is that the military specialists in the various combat branches do not have strong incentives to strive for maximum combat effectiveness from a given amount of resources, because the resources available to them are not fixed. Rather, the amount that might be available in the future is, in part, dependent on success in advocating a development and associated procurement program. Hence, the information search in the specific functional area is also affected.

It is well known that the approach to *efficiency* entails either (1) achieving a given output for the least cost, or (2) attaining maximum output for a given outlay, but not both. Actually, either approach is applied ad hoc, and at a minimum, each requires a great deal of information. But most of the information must be produced by the military and technical specialists. When senior decisionmakers, shifting from one weapon decision to another, at the same time shift their objective from minimizing costs to maximizing effectiveness, or vice versa, they create an incentive to bias the information system toward either heading off budget cuts that apparent cost savings might sustain, or advocating new weapon developments that will buttress future procurement programs. Thus, the information search is not motivated primarily to achieve efficient resource use. Rather, it comes to serve a political process that is intertwined with an attempt to manage centrally the large system.

Improvement of defense management to achieve greater efficiency does not seem feasible unless the quality of information can somehow be improved. But such an improvement seems impossible unless those who are most knowledgeable about specialized military combat roles have strong incentives to engage in detached study of their respective specialties. Yet if dollars or other aggregate resources are at stake, the quest for knowledge is apt to be less than wholly critical or detached. The only practical way to alter these perverse budgetary incentives is, simultaneously, to change the management structure and to

sever or attenuate wherever possible the extremely close relationships that now exist between aggregate dollar funding (and manpower authorization), on the one hand, and specific weapon development and acquisition programs, on the other hand. If such changes were to be made, military services and combat branches would then have less incentive to develop and acquire weapons so as to get dollars and more incentive to use available resources to acquire fighting capability.

AN ALTERNATIVE MANAGEMENT PHILOSOPHY: LESS CENTRALIZED MANAGEMENT

The Elements of the Proposed Management System

It was suggested above, first, that the elements of a management structure consist of:

- The organization's decisionmaking hierarchy
- A set of decision thresholds
- A set of decision guidelines
- Procedures governing the burden of proof

Second, it was noted that, in peacetime, five kinds of major military resource-allocation decisions are made:

- Determining the total defense budget
- Allocating resources among military services
- Allocating resources among specialized combat and support functions
- Specifying the combat readiness and deployment of units
- Selecting performance characteristics of new weapons to be developed and procured

Third, it was further pointed out that efficiency in resource use entails either of two mutually exclusive approaches:

- o Attaining a given objective at minimum cost
- o Attaining a maximum capability with given resources

These three dimensions of management can be related as follows.

Certain kinds of decisions can or should only be made centrally, or by the highest authority--i.e., on the basis of a consensus of the Legislative branch and the highest civilian officials in the Executive branch. Setting the total defense budget and allocating it among the statutory military departments are clearly decisions of this kind. Budget allocation among the major mission functions--such as strategic versus conventional forces, and with respect to what kinds of conventional forces (e.g., naval, land, and tactical air forces)--are also matters of highest policy content. Similarly, the specification of force readiness--as reflected, for example, by an allocation between active force and reserve units, or for overseas deployment, mobilization capability, and so on--must be coherent among major mission functions and consistent with broad foreign and domestic policy objectives.

The selection of specific weapons (or the performance characteristics of weapons to be developed) are only in rare instances a matter of major and direct policy content. Such instances most frequently arise with strategic forces, as illustrated by the ABM, MIRV, and so on. If the majority of weapon development and acquisition programs are, however, individually devoid of high-level policy content, how might that fact be exploited to move toward a less centrally managed system and to minimize the politics currently inherent in the information-production processes?

What follows is advanced to illustrate a *principle* that serves the end of averting excessively high-level detailed management through budgetary channels. The examples should not be viewed as particular models or blueprints for reform. Indeed, institutional and managerial relationships (particularly military ones) are susceptible to considerable variation and, therefore, experimentation. Different management and associated incentive schemes could be instituted in two or more services, or even major functional areas, and compared over time, to

determine which ones work best. Indeed, such experimentation is desirable, if not necessary, to identify unanticipated side effects that are almost certain to arise. Rigorous field testing of diverse incentive systems and the information quality they generate is just as sorely needed as is the testing of weapon and tactical concepts. Hard thinking on how such experiments might be designed is the first order of business. The following proposal, therefore, should be viewed merely as a means to stimulate thought and debate on this important subject.

The Case of Land Forces

Because of their heterogeneous combat and equipment elements, land forces present the most serious challenges to central and detailed control. What follows is an illustrative model of a constrained budget approach to land forces management.

First, let it be decided how many Army[1] divisions there are to be, in both active and reserve status. Next, assume that a division force has the same characteristics that it now has:

Division Force Strength	50,000 men
Equipment Investment per Man	$20,000

The $20,000 investment per man is essentially the Table of Equipment (TOE) allowance. The total investment per division, then, will be one billion dollars.[2] If it is decided to have 24 divisions (active and reserve), the investment for the entire force will be $24 billion. If it is also established that the equipment has an average weighted life of ten years, an annual budget of $2.4 billion will be needed.[3] This allowance will be budgeted to the Army as long as the 24-division

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[1]The same approach can be applied to the ground elements of the Marine Corps.

[2]The numbers used in this discussion are either rough approximations or illustrative.

[3]The dollar amount, however, should be adjusted by a factor that reflects changes in the general price level.

force objective remained in effect. It is explicit that none of these resources may be allocated to, say, the strategic mission to develop an ABM. If the Army then decides to acquire a new and more costly helicopter, it will have to give up something in return. Conversely, if it develops more efficient ways of maintaining its trucks so that the average life can be extended from, say, five years to six years, the resulting cost savings can be used instead to buy some of the more costly helicopters. This system provides the presently absent strong incentive to eliminate marginal or redundant items. Specifically, there would be an incentive to raise questions and *acquire information* about which items are redundant. The same skepticism would also extend to costly, incremental technical performance features of proposed new systems.

The intended philosophy of this approach is that the *total dollars received for equipment is independent of the specific items procured.* Hence, the decision to buy or not to buy a particular item will not affect the materiel dollar budget. Under the present system, claims may be made for a newly developed item or a contemplated development program because it provides a rationale or justification for dollar funding. Support of such claims by rigorous tests, often possible by field experimentation, is seldom attempted.[4] Under the suggested new approach, a service would find that its own best interests were served by thorough operational testing. And in such a setting, the service would be more likely to acquire equipment to achieve effectiveness than to obtain dollars.

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[4]In recent years, there has apparently been an increased emphasis on operational testing as a result of its advocacy by the Blue Ribbon Defense Panel of 1969-1970. Unfortunately, the main thrust of the activity has been either to implement a so-called fly-before-you-buy weapons procurement policy, or to ascertain how many of certain currently produced weapons should be procured. Moreover, many of the previously established testing activities have simply acquired the adjective "operational." Thus far, there has been little emphasis on using field experimentation to test either analytic models or prevailing judgments, and such testing is necessary if the weapons acquisition process is to be brought under control.

The example thus far has discussed tradeoff opportunities only in terms of materiel, but other possibilities also exist. For example, the Army is currently moving toward a force of sixteen active divisions from the previously authorized thirteen divisions, within an aggregate manpower constraint. The approach advocated here would permit tradeoffs among funding or "input" categories. For example, with a division-force threshold of 50,000 men, innovative ways might be found to perform some of the support functions (perhaps by employing less complicated or more reliable systems). The manpower cost savings could be employed in other ways--say, to provide more battalions of tanks or infantry, or to acquire some preferred new system. Similar trades should be permitted on the spare-parts inventory.

To allow greater latitude to tradeoffs among major funding and input categories, however, presents a potential problem that impacts upon force readiness and ability to sustain combat operations should the need arise. Bureaucratic incentives could cause a service to have a larger number of units at a low state of combat readiness, as contrasted with a small number of units at a high state of readiness. There could be weak incentives to acquire reserves of war consumables, in favor of allocating resources to more visible combat units (which justify command slots). Hence, the country could have a great mobilization potential, to be available in a year or two, but meager immediate fighting capability. Needless to say, choices like these are pregnant with foreign policy content. The timely availability of combat capability, as indicated by unit-readiness criteria, must therefore be specified centrally and by civilian authorities.[5] Appropriate budget

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[5]This subject, of course, has many dimensions: the role of reserves, mobilization planning, consistency among divers combat and service elements (e.g., land, tactical air, and strategic lift), foreign basing, arrangements with possible allies, and finally, criteria by which readiness of combat units may itself be specified and measured. It is our contention that readiness criteria have been unduly specified in terms of such input concepts as percentage of authorized troops or materiel present in the unit. As an alternative, emphasis should be placed on measures that are closer to military output, such

allowances governing unit readiness and war-consumable allowances, of course, must be made by those authorities.[6]

Applicability to Conventional Air and Naval Forces

How might a management philosophy that places less emphasis upon fine-grained advocacy by specialists be implemented for conventional air and naval forces? A general answer is: Provide the military departments stable aggregate budgets for each of their major mission categories; do not require that a budget be justified in detail. Examples of relevant mission categories follow.

Air Force:	Tactical Air
	Continental Air Defense
	Strategic and Tactical Airlift
Navy:	Sea-based Tactical Air
	Antisubmarine Warfare
	Amphibious Lift

For operating elements comprising these mission forces, varying degrees of readiness would have to be specified and appropriate cost allowances made. Readiness-evaluation tests--preferably conducted by units selected on a random, unannounced basis--should be conducted to insure that (1) producers do not sacrifice effectiveness for visible tactical units and (2) the readiness of these components roughly corresponds to that specified for ground forces and deployment plans.

A more aggregated budgeting scheme for tactical air forces (both Air Force and Navy) might therefore be based on the following kinds of criteria:

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as how quickly and well can a unit deploy and perform simulated missions. Apart from giving troops and crews desirable exercise and training, readiness-evaluation exercises keyed to appropriate output measures would also provide much valuable information about equipment and manning requirements, and about the management skills of individual commanders. But, again, strong incentives to generate this kind of information are lacking under the present budgeting and planning system.

[6]For a more detailed example of such a budgeting system applicable to land forces, see Appendix.

	Per Unit Aircraft
Annual procurement allowance	$ 533,000
Annual operating cost for each readiness category	
Category 1 (24 hours)	1,500,000
Category 2 (10 days)	1,000,000
Category 3 (20 days)	800,000

The $533,000 annual procurement allowance per aircraft is based on a procurement, fly-away cost of $8 million per aircraft and an average life of 15 years.[7] The different categories for annual operating cost reflect varying degrees of required combat readiness. For example, Category 1 means that a unit is able to fight, or to deploy to a combat situation, within, say, 24 hours. It may thus possess roughly 100 active personnel per aircraft, including 2.5 crews per aircraft, and is funded to sustain 250 hours per year of peacetime flying for each aircraft. As part of its readiness qualification, such a unit must be able--given 24 hours' notice--to meet such tests as the following:

1. Deploy from the U.S. to an overseas (or carrier) base.
2. Fly 20 sorties per aircraft within seven days after that deployment. Maintain one sortie per day per aircraft thereafter.
3. Achieve specified scores in target acquisition, identification, and bombing or weapon accuracy against simulated enemy target systems, in a context--where appropriate--of cooperation with friendly ground force elements.

Units assigned lesser degrees of readiness may either be expected to meet less demanding performance measures, or be given longer warning periods for meeting given performance requirements. These longer periods might be utilized to call up reservists who are assigned to those lower priority units or to engage in intensive training prior to the actual testing.

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[7] This estimate, of course, could be more precisely articulated between, say, a high-performance, all-weather system like the F-15, on the one hand, and a special-purpose, more austere system like the A-10 or F-16, on the other hand.

Such a system of readiness evaluation would allow much scope for incentive schemes to reward units that exceed specified performance standards, in the form of spot promotions for commanders, extra leave for the troops, and even unit and individual cash bonuses.[8] Similarly, units that managed to pass their readiness tests with an established record of having saved some of their annual expense allowances could be given bonuses. These latter provisions would resemble the profit sharing encountered in the private sector.

In establishing readiness standards, civilian policy authorities will have to estimate and specify performance qualities (with appropriate advice from military and other specialists) and separately provide the funding for wartime consumption allowances. These would include expendable munitions, spare parts, fuel, and allowances for major equipment attrition.

Given parameters like the $533,000 annual procurement allowance per aircraft and the specified annual operating costs, a service could then make the following "contract" with the Government. If the service initially has 2000 aircraft, it would receive, say, about $3.1 billion a year (assuming that the force has an average of Category 2 readiness). Should it find ways to economize on some of its inputs--and there is a rich variety of ways to achieve such economies--while still meeting its readiness standards, it should be free to acquire more capability--perhaps more aircraft, or equipment modifications, or some combinations of these. Or, it may wish to acquire auxiliary capability, such as air base defense. Certain aspects of this enhanced capability might properly be the object of negotiation between policymakers, or specified in the contract.

A basic condition of the proposed management philosophy, however, must be that the political masters not respond to an efficiency proposal in the following way: "Fine. You have discovered how to support

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[8]For an account of how one organization employed performance evaluation and incentive systems, see Strategic Air Command, *The Development of Strategic Air Command, 1946-1973*, Headquarters Strategic Air Command, Offutt Air Force Base, Neb., September 19, 1974.

an aircraft with only 60 people instead of 100. Hence, we can now have as much capability for an annual cost per aircraft of $1.2 million as we have had up to now for $1.5 million." Implicit in this kind of response is the idea of operating efficiently by achieving a given capability for the least cost. In theory the idea is impeccable. But it can be operational only if all parties in the budgetary dialogue have complete and perfect information about the production process. Unfortunately, no one has that kind of information. When there is a high probability that political decisionmakers will respond to efficiency proposals as cost minimizers, the effect on the producer-operators, who are the primary producers of the relevant information, is devastating. The incentive to pursue economy and efficiency is overridden by the incentive to prevent budgetary cuts. And this latter incentive causes the information failure.

The General Philosophy of Management: Summary

The general management philosophy implicit in the above examples is twofold:

First, the military departments and their respective functional combat specialties should have maximum opportunity and incentive to obtain as much combat capability as possible from specified aggregates of resources available to them. To achieve this aim, they must have the opportunity to make tradeoffs among the diverse, highly specific resources presently identified as budgetary line-items. But if they are to make these tradeoffs, they must be permitted to find ways to economize on the use of at least some of those specific inputs. They must also be allowed to spend those savings in other ways that contribute to combat effectiveness. All this is simply another way of saying that military specialists should have freedom to allocate (and reallocate) resources. This means that decision guidelines and thresholds must be considerably relaxed. It means also that high civilian authorities should not place a demanding burden of proof on the military departments with respect to sets of reallocations that might be undertaken. This

is also an argument for much less detailed decisionmaking through budgetary channels on the part of Congress, the Office of Management and Budget, and the Office of the Secretary of Defense.

Second, the military departments, and their respective combat specialists, must nevertheless operate under resource and other broad policy constraints. These must be laid down centrally, by the highest civilian authorities. To assure that broad national security objectives are served within the aggregate resource constraints, the civilian authorities must block out the aggregate resource allocation in terms of major missions and statutory military departments. Moreover, they must specify the kinds and degrees of combat readiness and sustainability in ways that are consistent with broad national security objectives and that provide the desired level of time-phased capability, coordinated among the various combat specialties, including land, air, naval, and strategic deployment forces.

Given readiness criteria based on simulations of deployments, combat drills, and exercises, civilian authorities (including their staff instruments) become, in effect, the consumers who periodically test the quality of the goods (or outputs) produced by the military specialists. Correspondingly, they need to be less concerned with trying to infer something about output quality by minute examination of the proposed inputs during budgetary deliberations.

Again, it is emphasized that the examples given above are intended to illustrate a management philosophy. That philosophy is predicated on less effort by political authorities to manage in detail through budget channels, but simultaneously greater attention to the major defense and foreign policy aspects of Defense Department management. Achieving the right kind of balance between more and less centralized management is a delicate matter. Other approaches than that suggested by the above examples should also be conceived and evaluated.

VI. SOME OBJECTIONS TO DECENTRALIZED MANAGEMENT

A number of objections and criticisms can be raised about the management philosophy proposed in this report. Let us consider some of them in ascending order of cogency, bearing in mind, however, that the immediate problem is the improvement of information quality. In the face of this kind of problem, it is often tempting to strive to achieve some ideal solution. However, *the practical solution to the information problem is to obtain some degree of improvement by creating healthier incentives*. In such a context, one should avoid letting the best be the enemy of the good.

1. Military Specialists Lack Competence

Support for the view that military specialists lack competence can be generated by citing many staff studies, past mistakes, the "Colonel Blimp" image, and examples of poor management. We reject the assertion.

Listing of past mistakes to support the case of incompetence on the part of military professionals is superficial criticism when it is unclear whether the larger system in which the professionals were operating was one that sustained healthy or perverse incentives. The poor quality of the studies produced by military specialists--as we have tried to show--may more accurately be a reflection of the incentive system.

2. Civilian Control of the Military Requires Detailed Management by High Civilian Officials

The above argument implies that giving military agencies more discretion in resource allocation means attenuating civilian control. This argument, however, can distort what it is we should want from "civilian control of the military." At a minimum, it must surely mean at least two things: First, the likelihood of a military takeover of the government must be virtually zero. Second, the major policymaking governing military affairs, including the initiation and strategy of

military operations, must be determined by constituted civilian policymakers. A further aspect of "control" in public administration is that officials be accountable for the funds and resources for which they are responsible managers.

It is not clear how the control of administration through high-level budgetary channels contributed to protecting the Republic from either military coups or illegitimate military ventures. Other institutional arrangements and deeper social forces serve these ends. Perhaps the most effective device for keeping the military in check is the fostering of diverse organizations so that no single one has an exclusive administrative monopoly over the military components--namely, ground troops, and infantry in particular--that are potentially the most important in carrying out an attempted takeover. Thus the United States, with a sizable Marine Corps, in addition to an Army with a substantial reserve component, has a healthy arrangement.[1]

The suggestion to permit specialists more freedom to make resource allocations in no way eliminates the requirement of accountability. Subordinate officials can and should be obligated to account for their expenditures. The spirit and goals of a less centrally managed system, however, are achieved only when senior officials abstain from using

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[1]Many observers who have been critical of the recent transition to an all-volunteer armed force argue that a "citizen army" based on some form of conscription best serves the objective of keeping the military under control. The implication of possible military takeover is also often present when the word "mercenary" is employed pejoratively in the context of military manpower procurement. This latter image appears mainly derived from a casual reading of history. In early modern times, and during the Thirty Years' Wars in particular, there were many instances of surly troops turning on their employers. Surly they were, and in all cases it was because the employers failed to meet the payroll. Otherwise, professional troops were most scrupulous in honoring their contracts. For an extensive discussion of this point and a general account of an efficiently managed military system (when the payroll was met), see Fritz Redlich, *The German Military Enterpriser and His Work Force: A Study in European Economic and Social History*, Vol. 1, Fritz Steiner Verlag, Wiesbaden, 1964.

such accounting channels to try to influence the detailed decisionmaking. Attempted detailed control through budget (and auditing) channels has profound effects on subordinates in determining both their incentives and the information they produce. To overlook these subtle and important forces in extolling the idea of civilian control of the military neither serves that end, nor provides perspective on how to nurture it.

3. Congress Likes to Exercise Detailed Control over Spending

The general rationale for the assertion that Congress wants to control spending is a "pork barrel" model of representative government. Much empirical evidence can be marshaled to support the assertion. Two observations are pertinent regarding its effects and future impact. First, the extent to which congressional elements are inclined to exert control over the details of military administration through budgetary channels has varied considerably in the past. The items that compose construction have always elicited keen congressional scrutiny, probably because new construction can signal possible relocation of activity which, in turn, has implications for payrolls in local areas. Second, in other spending categories, House and Senate appropriations subcommittees have each exhibited different behavior patterns. During the 1950s, the House subcommittee concerned itself with much detail, whereas the Senate focused on the broad policy and force structure implications of major budget items.[2]

Although patronage is a motivation in these relationships, congressional scrutiny of budgets is also sustained by other concerns. One is to determine or to make more explicit the policy intent of the Administration when the latter is not believed to be entirely candid. Another is to affect policy itself by budgetary means.[3] The important

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[2]For an account of this behavior pattern during the late 1940s and 1950s, see Samuel P. Huntington, *The Soldier and the State*, Harvard University Press, Cambridge, Mass., 1959, pp. 400-426.

[3]Huntington, ibid., argued that this end was the main impact of the Congress on budgetary process from the end of World War II to the

point suggested by past congressional behavior is that it has been pluralistic and fluid; it is especially fluid at present in the twin settings of (1) deep concern on the part of some congressional elements about the efficiency of Defense Department administration and (2) the desire to make operational its recently instituted budgetary reform measures. Indeed, Congress might even be willing to exert less detailed control if the information presented to it were less focused toward advocacy, and thus more credible.

4. Major Budget-Allocation Questions Remain Unresolved

The final and major objection can be illustrated by the following (and similar) criticisms. The decentralized management philosophy does not answer the fundamental question of how much is enough with respect to the total defense budget. Further, it does not get at lower orders of the same question, specifically, how much should be allocated to strategic versus conventional forces, how can we be sure that the Army, for example, will acquire the optimum mix of infantry, armor, artillery, and so on. A related objection can be posed by the following question: If the alternative management scheme worked, and if greater fighting efficiency were really obtained, would we not have more military capability than is needed?

One reply to this line of criticism is to recall the injunction about not letting the best be the enemy of the good. But more to the point, it can be asserted that the current system does not really

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sixties. Moreover, its effect--relative to attempted economizing on the part of political administrations--was to provide both larger and more diverse military budgets and programs than would otherwise have been the case. This behavior, in Huntington's view, was to the good insofar as it provided more national security. Moreover, it is consistent with the idea that Congress and the Executive branch *share* policymaking responsibility. There is nothing in Huntington's view on the policy-making role of the Congress that is incompatible with my argument that the policy-making budget process should be modified so as to give military managers stronger incentives to be efficient by way of better information production.

address these questions either, the pretense that it does notwithstanding. Indeed, gross inefficiencies due to a probable information failure should itself give pause to adhering to any such misplaced belief. More fundamentally, we need to acknowledge explicitly that with regard to the question of how much is enough, or its major variants, no one really knows and probably no one ever will know. Furthermore, it can even be argued that no one has to know with much precision, given the fact that luck and uncertainty have always played a disproportionately large role in war. These are matters of broad and rough judgment with respect to fiscal economics, in general, and to the day-to-day conduct of foreign policy insofar as the latter impacts on the fundamental question of war and peace. They are the questions that the highest officials must ponder; may they ponder them wisely. (It might be noted that were they to spend less time fretting about the procurement of bullets and typewriters, they might be better able to deal with these questions.) Indeed, a strong argument can be made that the current management system, to the extent that it relies on a comprehensive planning and budgeting system that derives superficial underpinning from extensive intellectual advocacy, gives an *illusion* of providing precise answers to the broad issues of defense policy. Because these issues often pose unanswerable questions, however, the attempted answers, when advanced with great precision as deduced from assertions about weapon effectiveness, are only illusions. Any confidence put in those answers is severely misplaced.

In the meantime, how can management of the military resource-using activities best serve the fundamental national defense and foreign policy interests? The answer would seem to be: By providing the most effective fighting capability for the resources expended. One important by-product of this philosophy, if it is successful, will be lower combat losses to achieve a given objective by actual military operations. The most effective fighting capability for the resources expended can be achieved only at low levels of aggregation--that is, in the communities of the various combat specialties (e.g., infantry, armor, and

tactical air--on the basis of the weapons selected, the tactics evolved, and how personnel are selected and trained. Since each of these communities must necessarily operate under constrained budgets, each should have the maximum motivation to attain the most combat effectiveness from whatever resources happen to be made available to it. However, if the aggregate resources made available to, say, the Army's armor and infantry communities, or to the tactical air forces of the Air Force and the Navy, cause--in the context of yearly budgetary adversary relations--distortion of the information produced by those specialists, then the detached and critical search for information itself is adversely affected. Hence the information available to policymakers for making broader allocation and force structure decisions is distorted. What basis is there to assume that any such allocation made at these higher levels of government is "best"?

One reply is that, in the final analysis, such decisions as the mix of land- and sea-based tactical air, ground versus air forces, and so on, are capable of being made only on the basis of the roughest sort of judgment. Hence, budgeting and broad national security planning are, in fact, quite separate activities from those of detailed programming and administration. Moreover, it can be further argued that it has always been separate, despite formal attempts to link programming and administration to planning and budgeting. Thus if the link is really absent, explicit recognition of the point may permit much scope to improve administration and programming by changing the incentive system.

VII. ORGANIZING A LESS CENTRALLY MANAGED SYSTEM

The present Defense Department organization has evolved to implement a management system in which senior officials make many detailed decisions through budgetary channels. It is ill-suited to an approach that would give lower organizational elements more responsibility and autonomy. Particularly ill-suited is the organization of the Office, Secretary of Defense (OSD). It has over the past two decades acquired too much power to control too many details of military administration. Thus a reorganization of the Defense Department is necessary to permit the creation of a new incentive system.

The Figure on page 60 presents a Defense Department reorganization scheme consistent with that objective. It is intended to relieve the Office, Secretary of Defense, of excessive, detailed management so that it will be able to concentrate on major policy, strategy, and aggregate budgeting questions. The row of boxes immediately under the box labeled "Office of the Secretary of Defense" depicts the kinds of staff sections that would assist the Secretary (and the President) in carrying out this mission.

It should be emphasized that the primary responsibility of the Office, Secretary of Defense, is to formulate the budgets, plans, and programs that constitute the President's *proposed* program, which in turn is subjected to Congressional scrutiny, modification, approval, and authorization through its appropriations. OSD also has the responsibility to overwatch the statutory military departments and the field commands to assure that the policies and programs intended by the Presidential and Congressional action are carried out. This oversight function, however, must be handled with restraint lest the superior authority ends up involving itself in too much administrative detail, to the detriment of performing its primary function of formulating major policy and programs. Organizational blueprints (like this Figure) are therefore silent on these delicate and subtle elements of management and institutional design. At best, a new organizational blueprint

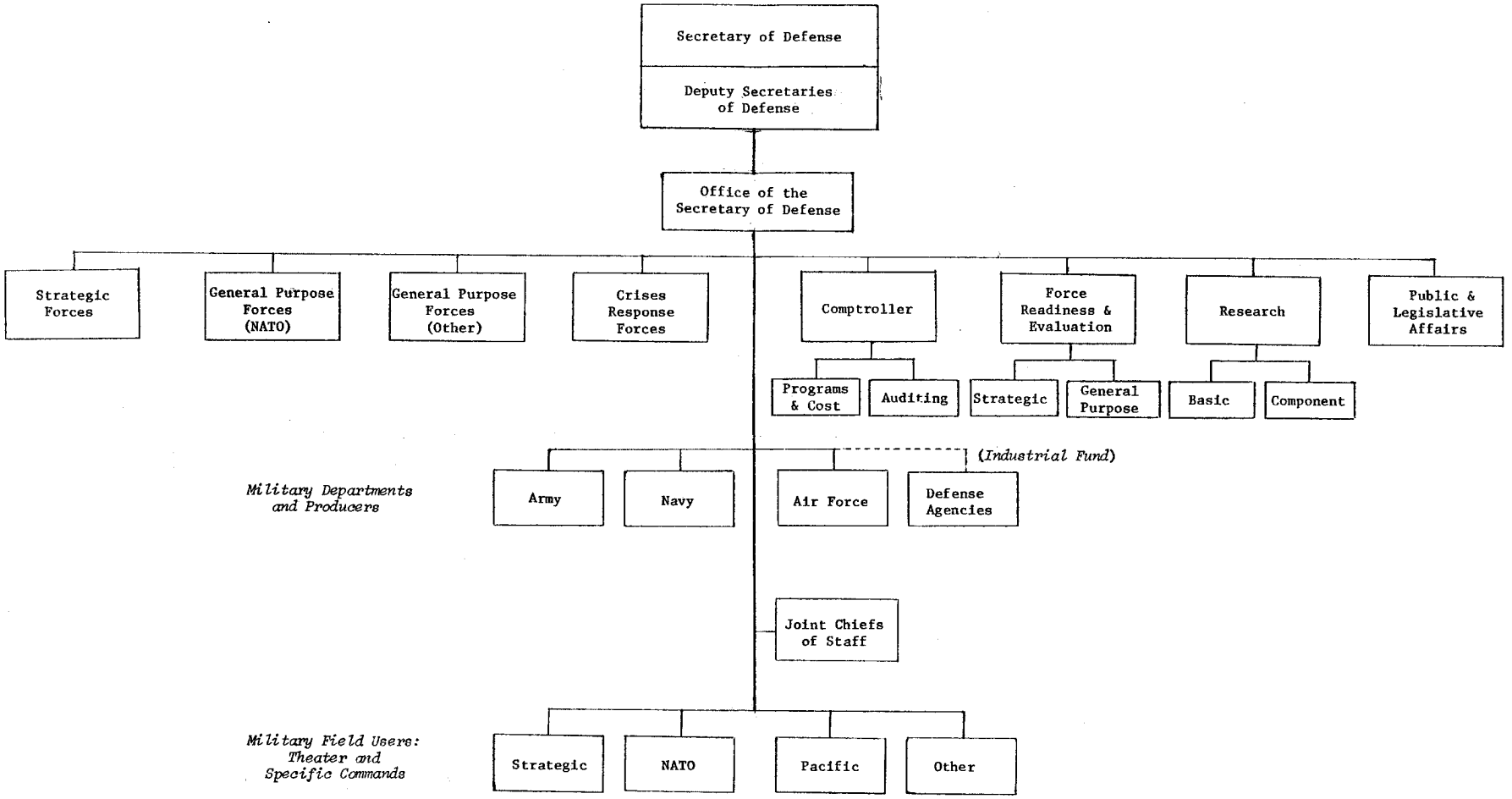

Fig.--Proposed reorganization of the Department of Defense

can only facilitate attainment of management goals. With this caveat in mind, let us elaborate on the organization proposed in the Figure.

The Office, Secretary of Defense, should be primarily a policy-formulation and budgeting organization. Overall defense allocations could focus on specific foreign-policy and associated military missions. The first four boxes on the left indicate such missions and their respective forces: strategic, and the three major applications of general purpose forces. These staff sections would assess requirements and formulate plans to derive aggregate budget estimates to support programs primarily keyed to each major mission. On the basis of their suggestions, the Secretary would make gross budgetary recommendations to the President, and ultimately to the Congress, as to how the defense budget should be allocated among major missions and the military departments.

The Comptroller, OSD, would prepare and compile the cost information about the different force and program elements, including the cost of varying degrees of unit readiness. It would also perform a financial auditing function to assure that the military departments spend their respective allocations for the force elements intended by the official program budget that is eventually approved and authorized by Congress.

The Force Evaluation and Readiness staff section would perform the inspection (inspector general) and auditing function, focusing on operational efficiency and readiness. It would have to develop meaningful readiness criteria and proxy measures of operational effectiveness that could be recorded in drills, exercises, field trials, and operational tests. Both policymakers and the managers of the military departments should be able to look to this activity and the measures it generates for insight into output performance and management efficiency.

The OSD Research staff section represents a basic change in the present Research and Development establishment. To put it bluntly, the objective would be to break up what many observers have called the "R&D cartel." The OSD-directed research function should concentrate solely on basic research and component development. The director

should be given the responsibility for improving the state of scientific and technical knowledge and developing new basic components (for example, turbine blades, power drives, shaped charges, materials, and so on) that may eventually have military application. *It must avoid becoming involved in the development and design of new weapons that may eventually be procured.* The latter activity is to be the preserve of the respective military departments which, in turn, will deal with the private sector weapons suppliers.

The statutory military departments are the institutional producers of military forces. They would carry out the myriad administrative and programming decisions to train troops, acquire and maintain materiel and so on, which would eventually lead to the production of battalions, squadrons, and ships that can fight. Although these institutions are producers of military units in this broad sense, their managers and officer corps are composed of both technical and user specialists. Society must be able to rely on these user specialists to employ and blend both technical and operational knowledge in ways that will provide efficient field forces. Most of these same specialists, of course, would also command the units assigned to specific and theater commands, as indicated in the bottom row of the Figure.

Accordingly, it is argued that these departments, which have the responsibility of producing military forces, should also have as much leeway as possible to carry out that responsibility, including maximum flexibility to evolve new weapon concepts, to test prototypes that may be offered by industry (both domestic and foreign), and to deal with private designers, developers, and producers at arm's length. But managers of military departments can perform these roles in a hard-nosed, detached way only if they operate under a budget constraint and subject to a minimum (or preferably an absence) of political pressure. Political pressure currently emanates from both political officials and the Research and Development community (through the latter's official apparatus), which tends to equate weapon effectiveness with technical sophistication or high technical performance. Only if the fundamental workings of this arrangement is changed will the military

professionals have maximum freedom to concentrate on their specific mission, that is, producing efficient military forces. It is for these reasons that the scientific-technical community should be constrained to producing new knowledge and, at most, components that imaginative designers might draw upon to provide better weapons.

The category labeled "Defense Agencies" in the Figure would include such organizations as the Defense Supply Agency and Defense Communications Agency. These organizations arose out of attempts to carry out a highly centralized management philosophy. Whether any has provided real cost savings, or simply added another headquarters to the hierarchy, is an open question. These are prime candidates for abolishment to reduce the number of government agencies. However, our recommendation is to require them to operate under a rigorous industrial fund arrangement, wherein the military departments are customers who nevertheless remain free to purchase from other sources the services supplied by these agencies.

The Figure retains the existing arrangement of unified and specific commands, which have operational control over forces assigned to them. Precisely what part they might play in any decentralized resource management and budgeting scheme should be the subject of further thinking. It has been advocated that these commands be given budget allocations to exert the role of consumers, or demanders, relative to the military departments. This idea is certainly consistent with that of a less centrally managed system and the view that the field commanders, who have the ultimate operating responsibilities, may have the best knowledge of and insight into allocating resources to carry out their missions. A counterargument to this view is that theater commanders have enough to do with operational planning, maintaining force readiness, training, and so on. These pros and cons, however, should perhaps be considered on a case-by-case basis, with promising schemes perhaps being tried experimentally.

The Figure also shows the Joint Chiefs of Staff. The role of this organization has been the subject of much debate over the years, primarily because it became the major focal point of struggle and

disagreement between military leaders and secretaries of Defense regarding budgets, service roles and missions, and strategy. The individual service chiefs have been placed in an extremely difficult position for which the committee arrangement that is the essence of the Joint Chiefs of Staff is responsible. Collectively, the Chiefs' recommendations on budgets and future force objectives are consistently greater than the political process can ever provide. Hence, the Secretary of Defense, the President, and the Congress consistently reject their advice.[1] On touchy roles and missions issues, the Chiefs tend to compromise and avoid hard choices, with the result that important issues are submerged and seldom resolved. Yet with virtually every budget cycle, the Chiefs are induced to testify that the President's budget and force plan is optimal. Here they are cast in the role of members of the administration's "team," and are thereby obliged to carry a political burden. To require dedicated professionals to play these conflicting roles does neither them nor the country a service. Moreover, it tends to politicize critical segments of the officer corps. For these reasons, a case can be made that the institution of the Joint Chiefs of Staff be abolished.

It should be remembered, however, that the Joint Chiefs of Staff emerged from the World War II experience. That experience proved the need for a corporate body that could deal directly with the highest civilian officials on matters of broad strategy, especially to work up contingency and deployment plans consistent with the respective capabilities of the military services. There was also a need to reconcile

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[1]Moreover, by selectively reducing individual items recommended by the Chiefs, the Secretary of Defense ends up making detailed decisions. For items which he does not change, he can argue to Congress that he "accepts" the Chiefs' recommendations. Much of the art of preparing the Secretary's (and the administration's) budget involves this selection process, the objective of which is to lure (or dragoon) the Chiefs into supporting the proposed budget. However, Congressmen understand this game, as do members of the military departments, who succeed in conveying their preferences to Congressional supporters. Here the pork barrel model of public administration becomes operative.

the often conflicting demands of the different theater commanders and to maintain a central message and command post. These operational needs are as valid today as they were during World War II. The existing institution still performs these functions, and for this reason it should be retained. But the formal role it has acquired in peacetime budgeting deliberations should be greatly attenuated, if not eliminated. Bear in mind that the Chiefs, individually, have legal access to both the Secretary of Defense and the President, and nothing in this proposed reorganization scheme implies changing that relationship.

Appendix

AN ILLUSTRATIVE CONTRACTUAL AND BUDGETING ARRANGEMENT BETWEEN THE ARMY AND THE GOVERNMENT

The proposals advanced in the text for some decentralization of the management land forces are terse. Details not treated there can raise additional troublesome questions. What follows is a somewhat more specific design for a less centrally managed system.

Table A-1 lists policy guidelines, which are specified by civilian authorities, as well as illustrative baseline cost and manpower factors, which are assumed for purpose of discussion. (More realistic estimates of the magnitude of these factors would require further study and perhaps negotiation between the Army and civilian authorities.)

The policy guidelines in Table A-1 assume that 24 "division forces" are the desired objective and that it has been decided to allocate these units between active and reserve status and between overseas and U.S. deployment as shown in the table. It has been further specified that a portion of an active division force can consist of selected reserve units--e.g., such service support as medical sections and ordinance repair companies, or even such combat support as corps artillery battalions. Similarly, selected units of the hypothetical overseas force can be rotated back to the United States; hence 20 percent of these troop units are shown to be located in the United States.

Given the broad policy and deployment guidelines as shown in Table A-1, the total troop strength would be as follows:

Active Army		800,000
Including:		
Overhead Troops	160,000	
Division Force Troops	640,000	
Of which:		
Overseas	200,000	
U.S.	600,000	
Reserves		560,000
Including:		
Division Forces	300,000	
Backup for Active Divisions .	160,000	
Fillers and Replacements	100,000	
Total		1,360,000

Table A-1

ILLUSTRATIVE POLICY GUIDELINES AND RESOURCE PARAMETERS FOR ARMY BUDGETING AND MANAGEMENT

1. Policy Guidelines (all items specified by civilian authorities)	
Division Forces	24
Active	16
Reserve (including National Guard)	8
In Continental United States (Active)	10
Overseas (Active)	6
Readiness (number of divisions)	
5 days	7
15 days	7
30 days	10
Combat Consumption (division months)	50
Portion of Active Division Force Manpower in Reserve Status	10 percent
Portion of Overseas Division Forces in Continental United States	20 percent
2. Cost Parameters	
Men per Division Force	50,000
Weighted Average Annual Pay and Allowances per Man	
On Active Duty in the United States	$15,000
On Active Duty Overseas	$20,000
In Reserve	$5,000
3. Materiel Costs	
Equipment Investment per Division Force	$1 billion
Average Weighted Life of Equipment	10 years
Annual Procurement Allowance for 24 Divisions	$2.4 billion
Cost of Combat Consumption per Division Month	$50 million
Total Procurement for Combat Consumption for 50 Division Months (excluding procurement from production during contingency period)	$2.5 billion
Annual Cost of Peacetime Training Ammunition	
Active	$25 million
Reserve	$5 million
4. Other	
Annual Operation and Maintenance Cost per Division	
Active	$50 million
Reserve	$10 million
Overhead Troops	160,000 men
Annual Operation and Maintenance Cost of Overhead Establishment	$2 billion

The "division force," the principal metric employed in this example, is ill-defined in many of its finer details. It has no precise composition because it is necessarily a coarse planning concept that reflects myriad tactical, administrative, and logistic considerations, the details of which are uncertain with respect to any future operation. In a rough way, its magnitude mirrors the fact that, although field armies consist primarily of divisions, they also possess separate combat units, such as armored cavalry regiments and artillery battalions assigned to corps, plus numerous service supporting units that operate the communications zone in a combat theater.

The relevance of the division-force metric is that, given a deployment or operation in a combat theater, there will be such administrative and tactical units as divisions and regiments, such tactical units as corps, plus a variety of combat and service support units; some of the latter are variously and temporarily assigned to divisions or corps or providing support and securing the rear area. Divide this overall conglomeration of manpower by the number of divisions in a theater of operations (usually an independent regiment or brigade is reckoned as one-third of a division), and we get the division force, which roughly comes out to between 40,000 and 50,000 military personnel. Although the metric is rough, it can be useful for aggregative purposes, including budgeting.

The important materiel cost items in Table A-1 are (1) equipment cost, or initial investment, per division force, or per man, (2) the annual outlay for training ammunition, and the expenditure for materiel (particularly ammunition) necessary to sustain combat operations. On the basis of these and other estimates shown in Table A-1, and the specified policy objectives, an annual baseline peacetime Army budget could be derived.

Given a baseline budget like that shown in Table A-2, a contract could be drawn up between the Government and the Army. The task of the Army planners and managers could be simple: Have units ready to deploy and fight in accordance with the specified readiness criteria. Within

Table A-2

HYPOTHETICAL ANNUAL BASELINE PEACETIME BUDGET
FOR ARMY LAND FORCES, BASED ON POLICY GUIDELINES
AND COST PARAMETERS IN TABLE A-1

Item	Cost (in $ million)	
Material		
Procurement of Equipment for Divisions	$2,400	
Procurement of Equipment for Overhead Troops	320[a]	
Peacetime Ammunition Requirements for		
16 Divisions @ $25 million	400	
8 Divisions @ $ 5 million	40	
Total Materiel Procurement		3,160
Personnel		
Overseas: 200,000 Troops @ $20,000 Each	4,000	
Active, U.S.: 160,000 Overhead Troops and 440,000 Division Troops @ $15,000 Each	9,000	
Reserves (including National Guard): 560,000 Troops	2,800	
Total Military Personnel		15,800
Operation and Maintenance		
Overhead Establishment	2,000	
Divisions		
16 Divisions @ $50 million	800	
8 Divisions @ $ 5 million	40	
Total Operation and Maintenance		2,840
Total Expenditures		$21,800

[a]Factored at same rate per man as for division force troops.

those constraints, proceed to redesign the force, select weapons, develop new training and tactics, or make other changes and spending reallocations that will improve fighting capability relative to the designated threats. As part of the readiness inspection and evaluation program, units will be selected randomly to be tested in ability to perform simulated combat deployment and combat exercises, or to participate in field trials. These tests will be the basis for judging the status of, and improvements in, fighting proficiency.

It is explicit that if any of the policy objectives are revised, the Army will obtain a budget adjustment in accordance with the revision and the major cost parameters. For example, if it is decided that there should be one additional active division force, in the United States, the Army would be allocated:

$ 1 billion	for initial procurement[1]
25 million	for annual ammunition costs
600 million	for active troop pay
50 million	for reserve troop pay
50 million	for operation and maintenance

When a new division force is added or an old one deactivated, or when the force or other policy parameters are otherwise revised, it is obvious that the policymakers have made a judgment and evaluation. When the force or its overall readiness is reduced, they have explicitly taken the responsibility for the action. The budgetary adjustment reflects the explicit decision. This approach would contrast with occasions in the past when budget cuts have been made, often crudely and on numerous line items, while it was simultaneously claimed that no loss of combat capability had occurred. In some instances, there may have been a reduction of some waste. But in others, no one really knew, particularly in the absence of any vigorous system of combat effectiveness evaluation.

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[1] If a reduction is specified, the equipment of the eliminated unit would be available as an offset for the annual procurement allowance applicable to the remainder of the force.

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