THE NEW APPROACH TO MANAGEMENT IN THE U.S. DEFENSE DEPARTMENT*†

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Mr. Chairman, Ladies and Gentlemen:

I am delighted to have this opportunity to visit Toronto and join with you in this joint meeting of the Canadian Operational Research Society (CORS) and The Institute of Management Sciences (TIMS). As many of you may know, I have for many years been keenly interested in the development of operations research, particularly its application to defense problems. Now I find myself as Comptroller of the U. S. Defense Department, busily engaged in trying to build a bridge between financial management and military planning to facilitate the application of operations research or systems analysis to military problems.

Traditionally, in the U.S. Defense Department, financial management and military planning had been treated as independent activities: the first, falling within the province of the Comptroller; and the second, within the province of the Joint Chiefs of Staff and the planning organizations of the Military Departments. Planning was done in terms of military forces and major weapons systems, projected over a period of five to ten years. Budgeting was done in terms of functional categories—Military Personnel, Operation and Maintenance, Procurement, etc.—and projected only one year ahead.

Consequently, military planning and budgeting were on completely different wave lengths. Military plans were prepared without regard to resource constraints, and as General Maxwell Taylor so vividly portrayed in his book, "The Uncertain Trumpet," the costs of these plans were always far in excess of the budgets the Administration was willing to request from the Congress.

Furthermore, they were more a pasting together of unilateral Service plans than unified Department of Defense plans. To a great extent the order of priority of forces, weapons systems, and activities was left to the Military Services. It was not surprising, therefore, that serious imbalances developed in the over-all plan. For example, the amount of airlift furnished by the Air Force for the strategic deployment of Army forces was never adequate in terms of the deployment objectives. Tactical air support was far short of what was required by the

* Received June 1962.

† Featured address at the joint meeting of The Institute of Management Sciences and the Canadian Operational Research Society, Toronto, Canada, May 3, 1962.

Army ground forces. And combat stocks of munitions and equipment were seriously unbalanced as among the four Military Services.

The gap between military planning and budgeting left the Secretary of Defense with no alternative but to cut back military programs each year in the course of his budget review. Decisions on forces and major weapon systems had to be made without adequate information as to their future cost implications or their cost-effectiveness relationships in terms of the missions they were designed to perform.

The functional arrangement of the budget, while still very useful in the management of certain classes of Defense activities, does not focus on the key decision-making area which is of principal concern to top management in the Defense Department, namely, the sound choice of major weapon systems in relation to military tasks and missions. It does not produce the data in the form needed to relate directly the cost of weapon systems to their military effectiveness; and because its time horizon is generally limited to only one year, it does not disclose the full time-phased costs of proposed programs.

It was, therefore, clear to us that the existing financial management system would have to be reoriented and restructured.

First, a link had to be forged between military planning and budgeting. As I wrote a year before taking office: "The job of economizing, which some would delegate to budgeteers and comptrollers, cannot be distinguished from the whole task of making military decisions."

Second, the forces and weapons systems had to be grouped in relation to their principal military missions—the way in which major decisions have to be made. For this purpose we developed a standardized list of program elements, that is, combinations of men, equipment, and installations, whose effectiveness could be related to our national security objectives. Examples are B-52 wings, missile battalions, and combatant ships—together with all their equipment, men, installations, supplies and support required to make them effective military forces. These program elements were organized into large related groups, and finally into major programs related to major military missions. For example, the major program, "Strategic Retaliatory Forces," is divided into aircraft forces, land-based missile forces, sea-based missile forces, etc. Within the aircraft forces are the B-52's, B-58's, and B-47's. Within the land-based missile forces are the ATLAS, TITAN, and MINUTEMAN.

Other major military programs—Continental Air and Missile Defense Forces, General Purpose Forces, Airlift and Sealift Forces, Reserve and National Guard Forces—were similarly organized. All of the Department's research and development projects not directly associated with elements of other major military programs were placed in a separate program. Finally, all other activities not readily allocable to missions, forces, or weapon systems were grouped together in a program labeled General Support.

Third, resource and dollar costs had to be tied directly to the forces and weapons systems so that the financial implications of the decisions made could be predicted with some degree of accuracy.

Fourth, forces, programs, and their costs had to be projected over a period of years so that their future, as well as present, cost implications could be appreciated. A five-year period for programs and costs was selected, as short enough to ensure reasonably accurate estimates and long enough to provide a good approximation of the full cost. Because of the equipment leadtimes involved, military forces in place had to be projected three years further or over a period of eight years.

Fifth, dollar costs had to be broken down into three categories—research and development, initial investment and annual operating. It costs as much to operate a B-52 wing for five years as it does to procure the aircraft for that wing, and it costs more to operate an infantry division for *one* year than it costs to equip it initially. Also, it is essential to know the cost of developing a new capability in contrast to the cost of introducing it into the forces, since we may wish to limit our immediate commitment solely to development. The NIKE-ZEUS and the B-70 bomber are two cases in point.

Finally, since we will continue to budget and the Congress will continue to appropriate funds in terms of budget categories and appropriations—a "torque converter" had to be provided to enable a ready translation of programs into budget categories and vice versa.

The initial work on the formulation and review of programs was completed last year when our military forces were projected through fiscal year 1970 and our major military programs, resources and costs were projected through fiscal year 1967. The work had to be done under a great deal of pressure. The first half of the year was devoted to the review and adjustment of the previous Administration's 1962 budget, and it was not until July, with the Berlin crisis threatening, that we were able to turn our full effort to programming. And, by September, we had to start the preparation of the annual budget which had to be transmitted to the Congress early in January.

This year, the basic program is in being. Procedures have been developed to effect program changes on a year-round basis. As new programs are approved they will be incorporated into the projections. Similarly, where requirements change and currently approved programs are no longer needed, they will be deleted from the projections. And when it is decided to advance a program element from research and development to production and deployment, it will be transferred from the R & D program to the appropriate mission program, i.e., Strategic Retaliatory Forces, General Purpose Forces, etc.

In May or June of each year, we plan to ask the Military Departments to submit their proposals for an additional annual increment to the projected forces and programs. Thus, approved forces and programs, projected at least five years into the future, will always be available to serve as a basis for the preparation of the annual budget in the fall of each year.

Sometime late in September or early in October the Military Departments will be requested to submit their budget estimates for the next fiscal year, prepared on the basis of the approved forces and programs. These estimates will be reviewed by the Secretary and his staff during October and November

so that the final estimates may be submitted to the President by early December.

The exact number of missiles, aircraft, tanks, guns, etc., to be funded in the next annual budget will be determined in this budget review. Detailed shopping lists, production schedules, leadtimes, activity rates, personnel grade structures, prices, status of funding and all the many other facets involved in the preparation of the annual Defense budget will, as in the past, be scrutinized in this review.

Thus, we now have a single, integrated planning-programming-budgeting process entailing (1) the planning and review of requirements, (2) the formulation and review of programs extending several years into the future, and (3) the development of the annual budget estimates.

This new procedure should:

(1) Provide for more orderly, continuous program review in contrast to the hectic program-budget review crammed into just a few months of the year, which had been the practice in the past;

(2) Disclose the full financial implications of program decisions;

(3) Keep future military planning roughly in balance with probable resources and dollar availabilities—thereby minimizing the number of false starts and reducing the number of marginal and excessive support programs; and

(4) Promote unified, balanced *over-all* Defense programs in place of *unilaterally* balanced Army, Navy, and Air Force programs.

The new programming procedure should also greatly facilitate the application of operations research or systems analysis to Defense problems, by relating resources and dollars to forces and weapons organized by missions. Of course, we can do much more along this line in some programs than in others. The Strategic Retaliatory Forces, for example, are more amenable to quantitative analysis than the General Purpose Forces and, indeed, have already benefited from much study by operations researchers in the past.

As you know, the major mission of those forces is to deter war by their ability to destroy the enemy's war-making capacities. With the kinds of weapons available to us, this task presents a problem of reasonably finite dimensions, which are measurable in terms of the number and type of targets or aiming points which must be destroyed and the number and types of weapon delivery systems required to do the job under various sets of conditions.

Let me sketch out for you a rather simplified version of our approach to this problem.

Obviously, the first step in such an analysis is to determine the number, types, and locations of the aiming points in the target system.

The second step is to determine the numbers and explosive yields of weapons which must be delivered on the aiming points to ensure the destruction or substantial destruction of the target system.

The third step involves a determination of the size and character of the forces best suited to deliver these weapons, taking into account such factors as:

1. The number and weight of warheads that each type of vehicle can deliver.
2. The ability of each type of vehicle to penetrate enemy defenses.
3. The degree of accuracy that can be expected of each system, i.e., the CEP.

4. The degree of reliability of each system, i.e., the proportion of the ready operational inventory that we can count on getting off successfully within the prescribed time.

5. The resources required by each system, translated into full dollar costs.

Since we must be prepared for a first-strike by the enemy, allowances must also be made in our calculations for the losses which our own forces would suffer from the initial enemy attack. This, in turn, introduces a number of additional factors into our calculations:

1. The size, weight, and effectiveness of a possible enemy attack—based on estimates of the size and character of the enemy's long-range strategic offensive forces and the warhead yields, reliability and accuracy of their weapon systems.

2. The degree of vulnerability of our own strategic weapon systems to such an attack.

I am sure you all recognize that each of these crucial factors involves various degrees of uncertainty. But these uncertainties are not completely unmanageable. By postulating various sets of assumptions, ranging from optimistic to pessimistic, it is possible to introduce into our calculations reasonable allowances for them. For example, we can use in our analysis both the higher and lower limits of the range of estimates of enemy ICBM's and long-range bombers. We can assign to these forces a range of capabilities as to warhead yield, accuracy and reliability.

With respect to our own forces, we can establish, within reasonable limits, the degree of reliability, accuracy, and vulnerability of each type of offensive weapon system and its ability to penetrate the enemy defenses under various modes of operation. Obviously, the last factor also involves an estimate of the size and character of the enemy's defenses.

Utilizing fully the work already done in this area, we ran through a rather large number of calculations testing out a wide variety of possible forces against the assumed target system at different points in time through the end of fiscal year 1967. The results were used, together with other inputs from other parts of the Defense Department, to assist the Secretary in reaching a decision on the size and character of the Strategic Retaliatory Forces required, now, and over the next five or six years—to assure that we have at all times the capability to destroy any nation which might attack us, even after we have absorbed the first blow.

The determination of the size and character of the Airlift/Sealift Forces presents a somewhat different problem. In contrast to the Strategic Retaliatory Forces, the requirements for Sealift and Airlift Forces, and particularly Airlift, do not lend themselves easily to purely quantitative analysis.

First, there is an almost infinite variety of circumstances, political as well as military, which could call for forces of various sizes and kinds, ranging from a simple show of force to large, heavily equipped combat forces.

Second, we may be confronted by more than one aggression at the same time and in different parts of the world.

Third, there is always some uncertainty even though remote as to the use of overseas bases for staging our airlift fleet.

But there are a number of important trade-offs on which analyses and calculations can throw much light.

First, the requirement to move forces from the continental United States could be reduced by stationing larger numbers of men and/or quantities of equipment overseas.

Second, both men and equipment can be moved by sea as well as by air.

Third, the quantity of airlift and sealift available in the civilian economy for emergency use is also amenable to increase through government action.

Recognizing these variables, the Military Departments have developed a series of plans for deployments to meet limited war contingencies. In analyzing these plans, we adopted a "building block" approach; that is, we asked such questions as: What does it take to move the men, equipment and supplies of one infantry division 10,000 miles in thirty days?

With building blocks like this in hand, we were then able to estimate roughly the requirements imposed by the need for more divisions or air squadrons, for a faster deployment, for areas in more or less distant parts of the world, and for multiple crises. Using these parameters, we ran through a number of calculations to determine the most economical way of meeting the requirement, taking as variables (1) airlift versus sealift, (2) central reserves versus forward deployments, (3) prepositioning versus supply from the continental United States, (4) reliance on civilian air and sealift versus government-owned air and sealift, and (5) the choice of vehicles, both aircraft and ships, taking into account their availability from production during the period being programmed.

An example of an operations analysis problem of a somewhat lower order involves the choice of a tactical fighter for the support of the Army ground forces over the next few years. Two principal contenders were involved in this choice after some earlier eliminations—the Air Force F-105 and the Navy F4H. The cost-effectiveness of both of these aircraft was examined in various missions—air superiority, interdiction, and close support. I believe most of you are familiar with the elements of such an analysis. The results were of great assistance to the Secretary in making his selection—in this case, the F4H.

In this connection, we discovered that the proper choice of nonnuclear ordnance is even more important to military effectiveness for conventional war than the choice between these two aircraft. We found that with a proper choice of conventional munitions, the military effectiveness of both aircraft could be greatly increased for limited war operations.

I believe it is fair to say that our analysis of this problem will make a real contribution to the efficient strengthening of our capabilities for limited and conventional war.

I am sure it will come as no surprise to this group that the widening application of operations research to the defense problem has led to the allegation in some quarters that competent military judgment is being displaced by computers. This is a little hard for me to take, since I have been warning against infatuation

with computers for years, to the point of being considered a maverick in operations research circles. If I may be forgiven a personal reference, I would like to quote a paragraph from page 120 of "The Economics of Defense in the Nuclear Age" [1]:

"It cannot be stated too frequently or emphasized enough that economic choice is *a way of looking at problems* and does not necessarily depend upon the use of any analytic aids or computational devices. Some analytic aids (mathematical models) and computing machinery are quite likely to be useful in analyzing complex military problems, but there are many military problems in which they have not proved particularly useful where, nevertheless, it is rewarding to array the alternatives and think through their implications in terms of objectives and costs. Where mathematical models and computations are useful, they are in no sense alternatives to or rivals of good intuitive judgment; they supplement and complement it. Judgment is always of critical importance in designing the analysis, choosing the alternatives to be compared, and selecting the criterion. Except where there is a completely satisfactory one-dimensional measurable objective (a rare circumstance), judgment must supplement the quantitative analysis before a choice can be recommended."

Nevertheless with all such qualifications, the role of OR is very great. Indeed, as I said elsewhere in the same book:

"The role of systematic quantitative analysis in military decisions is potentially much more important than in the private sector of the economy. . . . There is almost never anyone who has an intuitive grasp of all the fields of knowledge that are relevant. . . . In some special cases we may be able to assemble a group of 'experts,' each of whom has a good intuitive grasp of the factors relevant for answering one of [the] subquestions, and after discussion emerge with a fairly unequivocal answer. But in general, and especially where, as is usually the case, the choice is not between two but among many, systematic quantitative analysis will help—or prove essential. . . . There is . . . an alternative process for achieving efficiency in private business—competition and natural selection. . . . In government this alternative does not exist. Efficient techniques and policies have to be selected consciously; and wherever the relevant factors are diverse and complex, as they frequently are, unaided intuition is incapable of weighing them and making an efficient decision."

I have observed nothing in the sixteen months I have spent in the Pentagon to change this opinion. Arbitrary budget ceilings should be avoided and so should arbitrary military requirements. The military effectiveness of any given weapon system cannot logically be evaluated standing alone, but must be considered in relation to the cost—and in a world in which resources are limited, the alternative uses to which the available resources could be put.

Furthermore, a proposed new weapon system may be unique in that it combines in one system a number of different military capabilities. But we may find that the same capabilities exist in the forces already planned, even if in several different individual weapon systems. In such cases, the cost of doing the job with the proposed new weapon system must be compared with the cost of doing the job with more of those already programmed.

Obviously, there is an area of intuitive judgment involved in such considerations, but we want to give that area of judgment as much quantitative support as we can. What we need in requirement studies is less assertion and

more analysis, fewer adjectives and adverbs and more nouns and verbs, and, indeed, fewer words and more numbers.

Here is where operations research can make its great contribution to a stronger and more efficient free world defense.

Reference

1. Hitch, Charles J. and Roland N. McKean, *The Economics of Defense in the Nuclear Age*, Harvard University Press, 1960.