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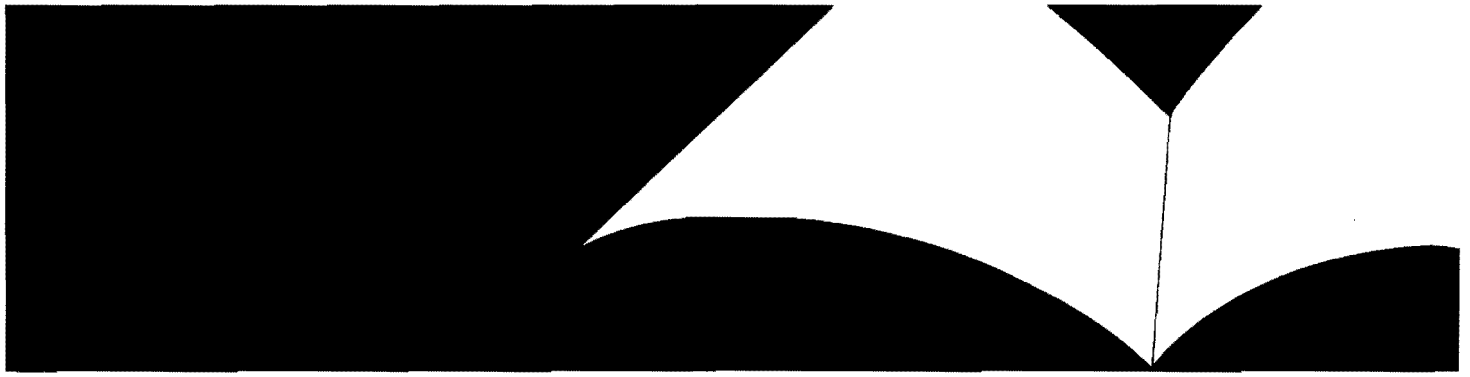

Planning U.S. General Purpose Forces: Army Procurement Issues

December
1976

Congressional Budget Office
Congress of the United States
Washington, D.C.

PLANNING U.S. GENERAL PURPOSE FORCES: ARMY PROCUREMENT ISSUES

The Congress of the United States
Congressional Budget Office

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PREFACE

As the Congress makes decisions on budget targets for the First Concurrent Resolution on the Budget for Fiscal Year 1978, the appropriate size of the defense budget will be one of the most important issues. The military forces which that budget buys can be divided into two parts: the strategic retaliatory forces--intercontinental missiles and bombers and submarine-launched ballistic missiles; and the general purpose forces--all the rest of the Navy, Army, Air Force, and Marine Corps. The general purpose forces account for most of the defense budget, and decisions about their size, location, equipment, and level of readiness determine much of the defense budget. The appropriate character and size of these forces, in turn, is tied to conceptions of how and where they would be used and assessments of the capability of likely adversaries.

The series of Budget Issue Papers of which this is a part is intended to lay out the most important assumptions underlying current planning of the general purpose forces, discuss the match between those assumptions and the current or projected forces, and suggest what might change in defense programs if somewhat different planning assumptions were adopted. The other papers in the series are: Overview, The Navy, The Tactical Air Forces, The Theater Nuclear Forces, and Forces Related to Asia.

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Alice M. Rivlin
Director

December 1976

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SUMMARY

The planning process that determines the size and composition of U.S. general purpose forces is a complex intermingling of military requirements, technological options, and budgetary constraints. Because forces can never meet all possible requirements, some risks must inevitably be accepted. The assessment of the risk inherent in a particular set of forces is based in large part on highly technical analyses and on military judgment. The Department of Defense (DoD) formulates the assumptions underlying the force planning process in accordance with the broad outlines of national strategy determined by the President. The assumptions are made public only in the most general terms. The size and composition or "structure" of the force that ultimately results from the planning process imply a set of inherent military risks. Since a new weapon system usually remains in the arsenal for a long time, decisions made today about the structure of forces will influence the capabilities of forces for some years to come. Similarly, modern weapon systems typically take years to develop; the choices available to the Congress are often extremely limited by the kinds of systems that have been undergoing development. If the Congress is to participate actively in determining the risks to be faced by the United States, it must participate at each step of the process of structuring U.S. forces. This paper is an attempt to clarify the links between the major Army procurement issues now before the Congress and the set of risks associated with the forces implied by alternative procurement decisions.

FORCE PLANNING ASSUMPTIONS

For the most part, the force planning assumptions are quite general and consistent with many force structures. The outlines of the planning assumptions can be inferred from public statements. Some principal points are:

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- General purpose forces are planned primarily for the NATO contingency, although some forces are designed for U.S. commitments elsewhere.

- Although U.S. forces must be ready to meet a surprise attack in Europe, the assumptions that determine their overall size are based on a conflict launched after several weeks of mobilization by the Warsaw Pact.

- All NATO members will participate in a common defense.

- A European conflict will begin as a non-nuclear conflict.

- U.S. forces in NATO will play a primarily defensive role.

- A NATO defense must be a "forward" defense, that is, as close to the potential enemy's border as possible.

- NATO forces must be able to continue fighting after blunting an initial attack.

- No specific conditions for termination of conflict have been established.

Army budget requests are largely based on these assumptions and their implications. Different assumptions would suggest different budget decisions. Three specific Army programs are considered in this light.

CONVERSION OF ARMY INFANTRY DIVISIONS

The Army plans to convert two light infantry divisions into two mechanized infantry divisions by 1981. It is felt that light divisions lack the firepower and the mobility to face Warsaw Pact armies. Since these new divisions would be located in the United States in peacetime, they would be of use in a NATO conflict only if sufficient warning is available for them to be deployed to Europe. Movement of these divisions by sea could take three or four weeks. During a period of increased tensions, deployment of additional troops to Europe could be delayed lest it be seen as a provocative act. If one thinks that surprise attack is the most likely scenario, one would probably choose to procure more tactical aircraft, more airlift capacity, larger stocks of prepositioned equipment and ammunition, or to reconfigure these divisions into special rapidly deployable light infantry, rather than converting them to heavy divisions.

ARMORED COMBAT VEHICLES

The Army plans to increase its inventories of tanks and armored personnel carriers in coming years and to field new varieties of both vehicles. The new tank, the XM1, will be less vulnerable, more maneuverable and have more firepower than the current tank. It will also be more expensive. If only a small NATO force could be deployed to meet an attack, as in the case of a surprise attack, a tank like the XM1 would be of great value. If, on the other hand, defending forces could be reinforced before an attack, a greater number of less expensive tanks might be desirable.

In spite of advances in anti-tank guided missiles, tanks will probably continue to have a place on the modern battlefield, and sooner or later the United States will have to field a new tank. If the need for the XM1 is not pressing, it might be desirable to delay its production to solve some problems of standardizing it with other tanks in NATO.

The Mechanized Infantry Combat Vehicle (MICV) was designed to match the speed, agility, and range of the

XM1. Much more expensive than the present armored personnel carrier, it has been criticized as unduly elaborate, and it is now undergoing redesign. If the XM1 is not procured, the justification for the MICV will be weakened.

ATTACK HELICOPTERS

The present Army attack helicopter, the Cobra/TOW AH-1S, is a highly mobile vehicle capable of destroying enemy armor with anti-tank guided missiles. The Army is developing an Advanced Attack Helicopter (AAH) to perform this same mission. The principal advantage of the AAH over the Cobra is the capacity to launch Hellfire missiles, giving the AAH a "fire and forget" capability: the AAH gunner need not guide his weapons all the way to a target as a Cobra gunner must do. This capability reduces the vulnerability of the helicopter by reducing the amount of time for which the helicopter must expose itself to engage a target. To utilize this capability other friendly forces must designate the target for the AAH. The AAH will also be able to designate its own targets, but this mode of operation greatly reduces its advantage over the much less expensive Cobra.

The mobility of attack helicopters will be very valuable in meeting a surprise attack, but in this situation the availability of designators for the AAH is questionable and the less expensive Cobra may be preferable.

ALTERNATIVE ASSUMPTIONS

Two alternative European scenarios are (1) a surprise attack and short war and (2) a gradually escalating conflict.

The characteristics of the weapons systems outlined above suggest that the Congress might make the following budget decisions in the next few years to shift emphasis toward meeting a surprise attack or fighting a war that will be decided quickly. (Only changes in Army acquisition programs are considered.)

- Approve funds for the development and procurement of the XM1 and MICV, with the intention of placing these weapons with troops in Europe.

- Deny funds for the development of the AAH.

- Accelerate procurement of the Cobra/TOW attack helicopter.

- Deny funds for converting light divisions to heavy divisions.

- Approve funds for improvement and accelerated procurement of anti-tank guided missiles.

If Congress felt more attention should be given to a scenario involving more warning time than is assumed in the standard Defense Department planning case, it might take the following specific actions in coming years:

- Approve funding for conversion of light divisions to heavy divisions.

- Approve funds for further development of the XM1, but deny funds for advance procurement to assure that the tank finally produced offers the best mix of capabilities and standardization with armored units of other NATO countries.

- Deny funds for procurement of the MICV.

- Reduce funding for the procurement of the current attack helicopter, the Cobra/TOW.

- Approve funding for development and procurement of the AAH/Hellfire system.

CHAPTER I INTRODUCTION

To understand the procurement programs and associated budget requests of the U.S. Army, it is necessary to examine the underlying planning assumptions that constitute the basis of the force planning process. The planning process that determines the size and composition of U.S. general purpose forces is a complex intermingling of military requirements, technological options, and budgetary constraints. In theory, general purpose forces are charged with performing whatever military tasks are required by the United States, except waging strategic nuclear war. In practice, no realistic share of national resources devoted to defense spending will provide forces sufficient to meet all potential challenges. Inevitably, the planning process produces a set of forces that is better able to meet some contingencies than others. The risk that circumstances may arise that require a different kind of force must be accepted. Implicit in the choice of a particular set of forces is a particular pattern of risks. As forces change through the acquisition of new weapon systems and the retirement of older ones, through reorganizations, or through changes in doctrine, the accepted risks change.

Within the process of establishing budgets for general purpose forces, the assessment of risks resulting from the choice of a particular set of forces is often quite informal and rarely explicit. To arrive at a final force structure, many issues must be examined, alternatives specified, and options chosen. Each decision in the process may change the design of forces very little, but together these decisions implicitly determine which risks will be accepted and which minimized. Most of these decisions are based on elaborate analyses, fiscal constraints, technical limitations, and military judgment and do not lend themselves to a systematic consideration of the risks implied at each step of the way. It is impossible to quantify or even to enumerate the risks inherent in a

given posture, but it is possible to discuss how the risks involved in certain events change with changing forces. Because the level of various risks is a major result of the force planning process--being determined by the size and mix of forces--it is of concern to anyone interested in analyzing the defense budget.

The purposes of this paper are: (1) to discuss the view of potential threats that lies behind force planning for the Army, one component of general purpose forces; (2) to examine how the major issues of spending for ground forces now facing Congress are related to this view; and (3) to suggest some alternative spending programs appropriate to other views of the potential threat. This paper is not intended to be a criticism of current planning for ground forces. Rather, it is meant to suggest how one might choose to alter some sections of the defense budget if one held a view of the nature of possible conflicts that is different from the current official view. Any particular force structure based on a particular view of which threats are most likely can be challenged by observers with differing views of likely future events.

This paper does not consider questions of the total size of U.S. ground forces. This topic was treated in an earlier publication of the Congressional Budget Office. 1/

1/ U.S. Army Force Design: Alternatives for Fiscal Years 1977-1981, CBO Staff Working Paper, July 16, 1976.

CHAPTER II FORCE PLANNING ASSUMPTIONS

THE FORCE PLANNING PROCESS

The President and the National Security Council (NSC) set forth the broad U.S. national strategy that is the origin of the force planning process. The Office of the Secretary of Defense (OSD) and the Office of the Joint Chiefs of Staff (OJCS) develop detailed guidance for force planning, based on the NSC strategic policy. Early in the planning cycle, this detailed guidance takes the form of a set of required capabilities for U.S. armed forces. The forces necessary to meet these requirements are considerably beyond what could reasonably be created or supported. As the planning process advances, a consideration of the physical limitations of production leads to a somewhat smaller force, and implicitly some risks are accepted. Fiscal considerations further reduce this desired force, leaving what is called the programmed force. The programmed force provides the basis for the Defense Department (DoD) budget requests. Of course, spending in any one year will change the overall capabilities of forces only slightly, but the accumulated changes in spending can determine the capabilities of U.S. forces for many years.

The present force planning process leaves to the Department of Defense those complex questions of threat assessment, tactics and doctrine, and weapons effectiveness, which are best handled by military judgment. The process also reserves to DoD, however, some of the broader questions about the contingencies to be prepared for and the risks to be accepted. By the time the programmed forces are determined and funding requests are submitted to Congress, many decisions--some detailed and technical, but others quite general--about the nature of the world and what risks are "prudent" have been made.

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The Congress often finds itself in a position only to approve or disapprove the final result of the planning process. The Congress has little opportunity to influence the direction of force planning until a specific budget request is presented. At no time during the planning process are the requirements or the planning guidance made public, except in the most general terms, and the guidance documents themselves are classified. There are, of course, valid reasons for much of this secrecy, but it does have the unfortunate effect of hindering discussion of the major tenets on which force planning is based.

For the most part, the guidance is quite general and is consistent with a wide variety of force postures. Detailed direction for force planning emerges only as specific proposals are advanced, and it is often quite difficult to discern at more detailed levels whether the guidance actually determines which forces are created or the forces proposed determine the details of the guidance.

It is important to distinguish between force planning and operations planning. Planning guidance (and the assumptions on which it is based) is only for the purpose of deciding which forces to procure. Operations planning is broadly consonant with the principal force planning assumptions, but the realities faced by commanders in the field sometimes produce divergent doctrines. For example, in choosing the amount and type of equipment to buy, it might be appropriate to assume that several weeks of warning time will be available to prepare a defense. A commander in NATO, however, must deploy his forces to be ready to meet an attack with no warning and he may desire a somewhat different mix of equipment. Throughout this paper we are dealing with force planning assumptions. Operations plans are important only to the extent that they suggest the procurement of equipment different from that suggested by the force planning assumptions.

MAJOR POINTS OF PLANNING GUIDANCE

Although most of the planning guidance is not public, its basic outlines have been discussed in public or may be inferred from public knowledge. Some of the major points of the planning guidance, particularly those that relate to ground forces, are:

1. General purpose forces are planned primarily for NATO contingencies. It is thought that the most important U.S. interests and the most direct confrontation of the United States and its allies with potentially hostile powers are found in Europe. This is also viewed as among the most demanding contingencies; if U.S. forces can successfully meet a major attack by the Warsaw Pact, then forces will be adequate for other contingencies as well. A NATO conflict could develop out of a lesser confrontation elsewhere (perhaps in the Middle East or North Asia), so U.S. forces must be capable of defending NATO and facing a lesser contingency at the same time. The size of U.S. general purpose forces also reflects commitments to a variety of less demanding missions throughout the world.

2. The enemy that U.S. forces will face in Europe (or in the Middle East) will be highly mobile, heavily armored, and possessed of great firepower. In DoD planning two distinct scenarios are envisioned for a conflict in Europe. The first is an attack by Warsaw Pact forces already deployed near the borders of Western Europe. This attack could be launched with little prior warning and would have to be met and con-

tained by NATO forces already in place. It is usually assumed that no reinforcements from the United States could be deployed in time to participate in the initial defense. The Warsaw Pact would pay a price to achieve surprise since forces stationed in other areas could not be used without giving warning of the impending attack.

The second scenario envisions a full mobilization of Pact forces and the observation of this mobilization by NATO. NATO forces would be reinforced and U.S.-based troops would have to be deployed to Europe quickly enough to counter the Pact buildup of forces. For planning purposes, the Department of Defense projects a warning time of 23 days to accomplish this reinforcement before Pact preparations would be complete. 1/ In either event, U.S. forces would have to face a massive armored attack supported by very heavy concentrations of artillery and anti-aircraft fire.

3. In any case, warning is assumed to be sufficiently clear and timely for NATO defensive plans to be activated. All NATO members 2/ will participate

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1/ Speech by Senator Sam Nunn before the New York Militia Association. Reprinted in the Congressional Record, September 13, 1976, p. S15660.

2/ The participation of France is problematic. France remains a member of NATO, but withdrew its military forces from the NATO command structure;

in a common defense and all NATO-committed forces will be transferred to the NATO command structure. U.S. forces will have access to ports and airfields within NATO countries.

4. Any conflict is presumed to begin and remain (at least for a time) non-nuclear.

5. The role of U.S. forces will be defensive, with offensive operations restricted for the most part to counterattacks. Although NATO forces are not deployed for the offensive, they must retain a high degree of mobility in order quickly to meet an attack anywhere along the NATO front.

6. A NATO defense must be fought as far forward as possible. This means that the time between an attacker's committing an unambiguously hostile act and his engaging defending forces will be short. Against a highly mobile opponent, such a defensive posture may prove a disadvantage. The reasons for adopting a forward defense are in large part political, since the Germans are unwilling to retreat into and fight on German soil unless absolutely necessary.

7. Although the most likely environmental conditions in which U.S. ground forces will have to fight are those

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assumptions made about French participation have not been made public.

of the Central Region of NATO, they must also be capable of operating in other environments, particularly the deserts of the Middle East or mountainous areas of North Asia.

8. Even if an initial Warsaw Pact attack is blunted by forces deployed in Europe, conflict can be expected to continue and reinforcements from the United States will be required.

9. No specific conditions for the termination of conflict have been established. Forces are apparently planned to stop an initial attack and then fight on indefinitely as the resources of the United States are brought into wartime production.

Presumably, further assumptions about the nature of conflicts in which the United States might become involved have been made, but for reasons of classification they have not been revealed. Among these would be the circumstances in which the United States would use tactical nuclear weapons. There are also some assumptions that apparently have not been made, but are, one would imagine, of great importance for designing U.S. forces. Principal among these is a definition of what constitutes a successful defense of Western Europe. Is simply halting Warsaw Pact forces sufficient, or must they be thrown back? Are there areas of NATO Europe which must not be lost? Will it be acceptable to fight major land battles across Western Europe, perhaps destroying much in order to save it, or should a decision be forced at the border with a maximum effort being made there and NATO forces giving up the struggle if this line is breached? There has been little public discussion of these questions, yet they would seem to have profound implications for logistics, strategic transport, reserve component forces, stockpiling of war material, and the structure of military bases in the United

States. Only vague statements about being prepared to fight for six months have emerged. It is possible that uncertainty about these matters heightens the deterrent value of NATO forces, but at least in the public record, the guidance appears incomplete.

The adoption of one set of assumptions does not automatically imply that any other set of contingencies will find U.S. forces powerless. Instead, it means that the military has decided to accept certain risks if some events (thought to be unlikely) occur. For example, because it is thought that if war begins in Europe it will be conventional war and some warning will be available, stocks of prepositioned U.S. equipment in Europe are maintained in large, relatively unprotected depots. This equipment would be extremely vulnerable to either nuclear or conventional surprise attack. One would not expect all equipment to be destroyed by a conventional attack, however, and in a nuclear environment other systems (probably aircraft) might be expected to perform the principal combat missions. Nonetheless, it is true that in order to maintain the capability to deploy troops rapidly to Europe, we have positioned valuable equipment in such a way as to risk serious losses if a successful surprise attack were launched. Given U.S. nuclear power, the possible consequences of a nuclear surprise attack, and the difficulty of destroying large quantities of heavy equipment in a conventional strike, the probability of such an event is thought to be sufficiently low to allow our current posture.

CURRENT U.S. GROUND FORCES

For many years the Army has measured its capabilities against the contingency of a European conflict, and over the years a pattern of Army deployment strongly oriented toward a NATO defense has developed. Of the 16 active divisions now in the Army, four are permanently based in West Germany.

In addition, three brigades, each from a different U.S.-based division, are also stationed in West Germany. 3/

All the divisions stationed in Europe are so-called heavy divisions, as are the U.S.-based divisions that contribute brigades to Europe. The designation "heavy division" is applied to armored and to mechanized divisions. These divisions contain exclusively armored or mechanized maneuver batallions, each kind of division having both kinds of battalions but in differing mixes. 4/ An armored battalion is composed primarily of tanks, and a mechanized infantry battalion is composed of riflemen with sufficient armored personnel carriers to transport all riflemen in the battalion. Heavy divisions are stationed in Europe because most Warsaw Pact divisions are also heavy 5/ (in Pact countries they are called tank and motorized rifle divisions), and it is felt that heavy divisions can best counter these forces.

3/ The division is the principal unit of Army operational command. A U.S. division is made up of approximately 16,000 men divided into three brigades and various support elements. A brigade is further divided into battalions, usually three or four to a brigade. At full strength a division usually consists of ten or eleven battalions, although this number can be tailored to meet the requirements of a specific operation. Among the support elements attached to a division are such things as headquarters, communications units, medical units, and artillery. For more information on the organization of Army units, see U.S. Army Force Design: Alternatives for Fiscal Years 1977-1981, Congressional Budget Office Staff Working Paper, July 16, 1976.

4/ The distinction between mechanized and armored divisions is vanishing. In theory, an armored division now has six armored battalions and five mechanized, while in a mechanized division, these proportions are reversed.

5/ The Soviet Union maintains seven airborne divisions. All other Warsaw Pact divisions are armored or motorized.

In addition to the units stationed in Europe the United States maintains active forces for rapid movement to Europe in the event of a crisis. The units assigned to this mission are the remaining elements of the three heavy divisions which already maintain brigades in Europe, one detached armored cavalry regiment, and associated support elements. To speed the movement of these units, their equipment is already in Europe. 6/

Thus seven active divisions--all heavy--are maintained for early use in a NATO contingency. Seven other divisions remain in the continental United States for use in a variety of missions, including NATO contingencies. Of these, two are heavy, three are light infantry, one is airborne, and one is air assault. 7/ The two remaining active Army divisions are both light infantry, designated for Pacific contingencies and stationed in Hawaii and Korea, respectively. U.S. ground forces are completed by three active Marine divisions, one Marine reserve division (all light infantry) and eight Army reserve component divisions (three heavy and five light).

6/ This equipment is stockpiled through the POMCUS (Prepositioned Material Configured in Unit Sets) program. At present, all the required equipment is not available because POMCUS stocks were depleted in resupplying Israel after the October 1973 war. Three programs maintain the readiness of these units to deploy quickly: REFORGER includes one division, the armored cavalry regiment, and many support units; the 2 PLUS 10 program includes the remaining two divisions plus a number of support units; and MRLOGEUR provides further support units to open and maintain lines of communication and supply.

7/ A light infantry division consists primarily of riflemen who operate without armored vehicles, although sometimes a tank battalion is included. The airborne division is very light infantry and is designed to be transported anywhere in the world rapidly and delivered into combat by air transport or parachute. The air assault division is composed of light infantry who operate with the extensive aid of helicopters.

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CHANGES IN U.S. ARMY FORCES

Since the end of U.S. involvement in Southeast Asia, the Army and DoD have increasingly turned their attention to the Warsaw Pact threat. This has coincided with a growing perception on the part of DoD that Warsaw Pact, particularly Soviet, capabilities in Europe are growing. DoD points to improved Soviet aircraft, one new tank in operation and another expected soon, rapidly growing anti-tank forces, improved artillery, and an upgraded logistics system. Critics respond that while Soviet hardware may be improving, many of the Pact units in Europe are still far from ready for combat (some may be similar in readiness to our National Guard) and could not be made so without alerting NATO and allowing defenses to be strengthened. There is no easy answer to the question of actual Soviet capabilities in Europe, but it is against a backdrop of a threat perceived to be increasing that the Army plans its forces for the coming years.

Plans are also formulated in the light of repeated criticism of NATO. The United States, of course, is only one member of NATO, and U.S. forces have immediate responsibility for only a portion of the NATO front. Strengthening American forces will accomplish little if allied forces are not also strengthened. Some critics argue that the Warsaw Pact would never be so foolish as to launch an attack on the U.S. sectors when easier avenues are present in other sectors, and these critics see no point in unilaterally upgrading U.S. forces.

Others argue that NATO does not possess the political organization or cohesion to respond quickly to a threat and that until better arrangements are made for assuring political unity, military improvements will be useless. Finally, the argument is made that even in the best of circumstances, NATO as presently structured will fail militarily. A surprise attack, it is said, will find the various national forces maldeployed and lacking the coordination required for a successful defense. If initial attacks should somehow be successfully contained, it may prove impossible to mobilize large numbers of troops to

counter continually reinforced Soviet forces. In the United States, those who hold this view point to the dismantling of the Selective Service System, the questionable readiness of reserve units, and the policy of replacing individual soldiers rather than entire units to fill gaps created by combat losses. They argue that buying new weapons will achieve little without a major reorganization of NATO's military structure.

Although these pressing concerns are beyond the scope of this paper, they are raised to give some indication of how ground force planning fits into a wider scheme of defense planning. For the remainder of this paper we adopt the view that present arrangements are sufficient for a NATO defense if the right forces can be supplied for this defense. This allows us to focus our attention on some specific items of Army spending and to examine how these items relate to various assumptions about the kind of war that may be fought in Europe.

Proposed spending for ground forces, particularly for the Army, reflects the general guidance outlined above and seems to represent a subtle shift in emphasis for Army capabilities. Almost all proposed spending for new weapons by the Army is for the development and procurement of weapon systems designed to meet a sophisticated, high-intensity, highly mobile threat. New tanks have been proposed that are better able to withstand hits by anti-tank guided missiles. Newly proposed helicopters are to be armed primarily with anti-armor weapons. The mobility and firepower of some light infantry divisions are to be increased by converting them to mechanized infantry divisions. These proposals imply a shift at the margin of U.S. capabilities towards being able to confront forces like those of the Warsaw Pact and away from being able to undertake military actions against less heavily armed opponents. Because of the lead times involved in procuring new weapons systems and the long lives of the systems themselves, this shift in emphasis will remain for some time. Behind this change in emphasis lies a perception of growing Warsaw Pact capabilities and an implicit foreign policy judgment that ground forces are less likely to

be called on to fight outside Europe or the Middle East. Improved relations with the Soviet Union notwithstanding, the Army has embarked on major programs of procuring new weapons. Since these weapons must be able to survive and operate in the intense combat environment of Europe, they are inevitably more expensive than those that would be needed in less demanding environments outside of Europe.

Further insight into the kind of war for which the Army is preparing can be gained through an examination of some specific spending proposals presented by the Army for the coming fiscal years.

The Army will request funds for fiscal year 1978 to begin the conversion of two U.S.-based infantry divisions into two mechanized infantry divisions. 1/ Current Defense Department programming calls for these conversions to be completed by fiscal year 1981. When both are complete, the Army will have five light divisions: three infantry, one airborne, and one air assault. The airborne division, the air assault division, and one of the remaining infantry divisions are in the continental United States. The other two infantry divisions are in Korea and Hawaii, respectively.

The principal costs of these conversions will be for the acquisition of the required armored vehicles (tanks and armored personnel carriers) and for the conversion of all artillery organic to the divisions to self-propelled varieties. The major constraint on the timing of these conversions is the rate at which new armored vehicles can be produced. Changes in the manpower required for the conversions are minimal and are not a major concern. Some additional military construction will be required to provide basing for the converted divisions; also, their operating expenses will increase. Table 1 presents Army estimates of the major costs of these division conversions. Total one-time expenditures for major items is about $455 million in fiscal year 1977 dollars.

1/ Although the divisions involved have not yet been officially identified, the choices are quite constrained. There are only three light infantry divisions in the continental United States at present: the 24th Infantry Division at Ft. Stewart, Georgia; the 9th Infantry Division at Ft. Lewis, Washington; and the 7th Infantry Division at Ft. Ord, California. The Army Times of June 14, 1976, p. 43, reported that the two final choices will be the 24th and the 9th Divisions.

Table 1. Major Items of Expenditure for Division Conversion, in Millions of Fiscal Year 1977 Dollars

Items	Quantity a/	Unit Costs	Total Cost
Equipment			
Tanks (M60A3)	328	.627	206
APC (M113A1)	518	.075	39
Self-Propelled Artillery: 8"	16	.496	8
155mm	92	.463	43
Construction			109
Estimated War Reserve Stocks b/			24
One-Time Additional Operating Costs			26
Total			455
Recurring Additional Operating Costs			29

Source: U.S. Army figures.

a/ Included in these figures are extra units for maintenance purposes (the "maintenance float"). For example, six tank battalions require 6 X 54 = 324 tanks. The four additional tanks are the maintenance float.

b/ These stocks are meant to replace combat losses, but are not calculated by the Army for each division. The stocks required depend heavily on when a division is expected to arrive in the theater of conflict. For this estimate a rule of thumb of 8 percent of total equipment costs was used.

In addition to these conversions of active units, three National Guard infantry battalions 2/ are also scheduled for conversion. Estimates of the total costs of these National Guard conversions are not available, but the cost for tanks and armored personnel carriers (APCs) alone should be about $42 million in fiscal year 1977 dollars, if they are converted to two mechanized infantry battalions and one tank battalion.

RATIONALE FOR CONVERSION

The rationale for converting these units is that light infantry may not have the firepower and tactical mobility to meet an attack by Warsaw Pact forces. All Warsaw Pact forces (with the exception of Soviet airborne divisions) are motorized, and Soviet military doctrine emphasizes the importance of a high rate of advance on the offensive. Gaps in defensive positions are to be exploited whenever possible and the defenders bypassed so that the advance will not be slowed. When it is necessary to attack defensive positions directly, Soviet doctrine calls for massive concentrations of artillery fire to prepare the way for successive waves of armor to break through in blitzkrieg operations. To stop the advance of enemy forces in Europe, NATO forces will require great mobility to position themselves astride the enemy routes of advance and must be capable of surviving the great firepower of Pact forces. It is widely felt that light infantry will not be able to perform these functions. If Europe is thought to be the battlefield where U.S. forces are most likely to be enagaged, then some light infantry units must be "heavied up."

Some objections to converting light divisions to heavy divisions have been raised. In peacetime the units with newly improved capabilities and their equipment will remain in the United States rather

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2/ These battalions make up the 256th Infantry Brigade of the Louisiana National Guard. See Army Times, June 14, 1976, p. 43.

than being deployed to Europe, and so will not be available to participate in the initial battle. Deploying these units to Europe before the outbreak of hostilities involves more than just time. The movement of troops to a potential theater of conflict can be a highly provocative act in a time of increased tensions. For the United States to risk such provocation, conflict may have to be clearly imminent. It is not far-fetched to imagine the movement of these newly capable forces delayed significantly because of fear that their deployment may precipitate an attack. In any event, new heavy divisions will not be among the first units deployed to Europe in a crisis. The three divisions with equipment already positioned in Europe (as part of the REFORGER and 2 PLUS 10 programs) will be given top priority. If a European conflict began with little or no warning, converted units would improve NATO capabilities only if the initial attacks were contained and the conflict continued long enough for them to be deployed. Many observers view a surprise attack as the greatest threat to NATO; these conversions do nothing to counter this threat directly, although they may enhance the deterrent value of NATO forces by increasing NATO capabilities in the event that a surprise attack does not defeat NATO forces quickly.

The commitment of additional heavy divisions to the early stages of conflict is hindered by the difficulty of transporting a heavy division. Among present U.S. aircraft, only the C-5 is capable of carrying tanks or self-propelled artillery, and only one main battle tank at a time may be carried. A mechanized infantry division would normally include about 250 tanks. Since there are only 77 C-5s now, more than three round trips for each of these aircraft would be required to move just the tanks of a heavy division to Europe. Other equipment could go with the tanks or in smaller aircraft, but the volume and weight of equipment to be airlifted is still substantial. Although it is possible for the converted divisions to be moved by air, it is more likely that sealift will be used to deploy them to Europe. The problem is compounded if one of the converted divisions is stationed at Ft. Lewis, Washington or Ft. Ord, California, thus requiring transport across the

United States before embarkation. Even without transcontinental shipping, sealifted troops would require a minimum of three weeks to be deployed. 3/

It appears that the decision to "heavy up" infantry divisions reflects an implicit assumption that a potential war in Europe will not be decided quickly, but that it will continue long enough for these additional heavy divisions to be needed. The resources required to convert these infantry units might alternatively be used to bolster NATO defenses during the initial phases of the conflict. That they are not implies a willingness at the margin to accept current risks of losing the first battle in order to improve capabilities in the event of a long war.

ALTERNATIVES

There are three major alternatives to current plans for infantry conversions. The first is simply to retain the divisions in question as light infantry, perhaps improving their anti-armor capabilities by including in these divisions more anti-tank missiles or attack helicopters. While light infantry divisions would presumably be less effective than a mechanized division, they could be transported by air more quickly, thus entering the battle zone sooner. The Army has argued that although it takes longer to deploy an entire mechanized division, its firepower is sufficiently superior to that of a light division to justify conversion. Studies are underway within the Army to determine the feasibility of an increased anti-tank capability for rapidly deploying units such as the 82nd Airborne and the 101st Air Assault Divisions.

3/ See Donald H. Rumsfeld, Report to the Congress on the FY 1977 Budget and its Implications for the FY 1978 Authorization Request and the FY 1977 - 1981 Defense Programs (January 27, 1976), p. 18.

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The second alternative is to station the converted divisions in Europe. The costs and political difficulties involved in such a choice, however, are severe enough to foreclose this option for the immediate future.

The third alternative is to station only the equipment of the converted divisions in Europe in order to reduce the time required for their deployment. This option would ultimately require larger purchases of new armor so that equipment would be available in the United States for training purposes as well as in Europe for use in a crisis. The difficulty of procuring even as much armor as is required for the conversions suggests that this may not be a practical near-term option. There is also some question about how easily troops and equipment may be "married up" after conflict has broken out. Nonetheless, prepositioning of equipment may well be the only means of bringing more firepower to bear in the early stages of conflict without a major restructuring of U.S. units and their NATO commitments. Other measures are possible--a greatly enhanced airlift capacity and increased procurement of tactical aircraft are the most often mentioned--but they are expensive and their effectiveness has been questioned.

Presumably, if one felt that the very early stages of the war would be decisive and that U.S. forces should be geared more for this phase of conflict, one would oppose these division conversions. A number of reasons lead some to think that a war in Europe might be quickly decided. Warsaw Pact intentions might be quite limited, seeking to grab a small amount of territory for political advantage or simply to destroy some NATO military capability perceived as threatening in a crisis. Other observers feel that NATO's ability to withstand a major Warsaw Pact offensive is questionable. If, in fact, defenders were quickly overrun, converted divisions based in the United States would be of little help. Alternatively, the view is expressed that a major NATO-Warsaw Pact conflict would arise only in the gravest of situations and that, in such circumstances, the use of nuclear weapons, especially on the part of whichever side found itself at a conventional disadvan-

tage, cannot be ruled out. Once nuclear war begins, the argument goes, it will have to be settled quickly, with one side surrendering or the warfare becoming global. In neither case would extra heavy divisions be of use. Finally, some observers (particularly in Europe) feel that it is in NATO's interest to concentrate its efforts on the first battle. If this battle is not decisively won by Western Europe, they fear a long, drawn-out conflict will have to be fought on European soil. The destructiveness of modern war is such that the question is raised whether freedom from Soviet domination would be worth the destruction of much of Northern Europe.

All of this is not to suggest that converting light divisions to heavy divisions is necessarily an incorrect choice. It is merely to point out that the choice implies certain views about the world and the nature of possible conflicts. Some responsible observers hold differing views and would choose different paths.

CHAPTER IV ARMORED COMBAT VEHICLES

In the past three years the Army has perceived the need to increase dramatically the numbers and capabilities of its armored combat vehicles. Of the many types of armored vehicles, tanks and armored personnel carriers (APCs) have received the most attention, because they are the primary combat vehicles for modern warfare and because new models of both vehicles are under development.

In January, 1976 Secretary of Defense Rumsfeld announced that the combined Army and Marine Corps inventory objective for tanks had been raised from 10,300 to 14,400 and that the objective for APCs had risen from 16,500 to 21,400. 1/ These increased objectives were based on a reexamination of armor requirements in light of the lessons learned from the October, 1973 Middle East war and the decision that two infantry divisions should be converted to mechanized divisions by fiscal year 1981. The Army needs additional vehicles not only to reach these higher objectives, but even to meet the original objectives. U.S. tank production was slow for several years, 2/ and U.S. inventories were depleted in order to replace Israeli losses after the 1973 war. At the end of 1975 the Army had on hand only 39 percent of its objective inventory for tanks and 51 percent of the objective for APCs. 3/

1/ Rumsfeld, Report to the Congress on the FY 1977 Budget and its Implications for the FY 1978 Authorization Request and the FY 1977 - 1981 Defense Programs.

2/ In 1973, production was only about 30 tanks per month; the rate is much higher now. See the statement of Martin R. Hoffmann, Secretary of the Army, before the Senate Armed Services Committee, Hearings on S. 2965, Part 2, 94-2, 1976, p. 614.

3/ Ibid., p. 613.

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To meet these objectives, the Army procurement program calls for the continued production of the present M60 series of tanks into 1980, and for the beginning of production of the new XM1 tank in late 1979. (This schedule is now open to question because of recent decisions requiring redesign of some components of the XM1.) In addition, older model M48 tanks are to be fitted with new engines and armament to fill short-term deficiencies in tank inventories. 4/ Tank inventory objectives are expected to be achieved by 1982. The current APC, the M113A1, will continue in production, and contracts are expected to be awarded in October, 1977 for production of an improved Mechanized Infantry Combat Vehicle (MICV).

THE XM1 PROGRAM

The development program for a new main battle tank, the XM1, is currently attracting much attention. The final design for the XM1 was supposed to have been chosen in July, 1976, but the decision was postponed and the participants in the design competition (Chrysler and General Motors) were instructed to redesign some features of their proposed tanks to achieve greater standardization with the new main battle tank being produced by the Federal Republic of Germany. The Germans have also agreed to modify some components of their tank to achieve this goal.

The principal changes in the design of the American tanks are the incorporation of a turbine rather than a diesel engine and the modification of the turret to accommodate either a 120mm main gun or the 105mm gun originally planned. 5/ The turbine

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4/ For more detailed information on the timing of these programs, see Martin R. Hoffmann's statement, Ibid., p. 614.

5/ Since the 120mm gun will not be ready for procurement as early as the XM1s, the current plan calls for early models of the XM1 to be equipped with the 105mm gun now used in M60 series tanks, with larger weapons being installed as they become available.

engine was chosen because, according to the Department of Defense, it offers greater potential for future development. Ostensibly the decision to use a larger gun was based on the perceived need for larger caliber tank rounds to defeat Soviet armor in coming years. The Army had previously argued that the 105mm gun with improved ammunition would be adequate to defeat known and expected Soviet armor, and there has been speculation that agreement on the larger gun, highly favored by the Germans, was a concession necessary to reach agreement with the Germans on other points of standardization. 6/ It has been widely reported that the redesign decision was made by the Secretary of Defense in the face of Army opposition.

The original plan was for the German tank, the Leopard II (AV), to be tested along with the U.S. tanks, with the United States purchasing whichever tank proved superior. The agreement to standardize certain key systems on American and German tanks has been widely interpreted as an agreement for each country to produce its own tank, although DoD has repeatedly stressed that the United States would choose the Leopard if it proves superior to U.S. designs. Emphasis would presumably be placed on making major items of supply interchangeable, particularly ammunition, fuel, and replacement tracks.

In November, 1976 the Army announced that Chrysler had been awarded a contract to complete development of the redesigned tank. The effects of the redesign on the timing and cost of the XM1 program are still uncertain. The Army announced in July, 1976 that the changes in design would delay the XM1 program by no more than four months and increase costs by no more than 15 percent. On September 20, 1976, however, Gen. Walter Kerwin, Vice Chief of Staff of the Army, testified that the redesign could delay the program as much as two years and add $900 million to its cost,

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6/ Some of the areas of standardization are the adoption by the Germans of a U.S. fire control system and the equipping of tanks of both countries with a common (as yet unspecified) track.

about 18 percent of the original cost. 7/ Originally the program called for 3,312 tanks to be produced by 1989, at a total cost of $4.5 billion.

The XM1 offers several improvements over the current tank, the M60A1. The XM1 will be less vulnerable to enemy fire because of its lower silhouette, its storage of ammunition outside the crew compartment, and because of its new type of arrayed armor that provides greatly improved protection against high-explosive and shaped-charge munitions, the type carried by modern anti-tank guided missiles. The XM1 will be more maneuverable, with higher speed and more agility than the M60 series tanks and will be able to fire accurately while in motion. The improved main gun and a more advanced fire control system will allow the XM1 to fire more quickly and at longer ranges.

There seems little question that, if built, the XM1 will provide a significant improvement in U.S. armor capabilities. Discussion revolves around justifying the expense of a tank as sophisticated as the XM1. The unit cost of an XM1 is expected to be at least $1,000,000 8/ in constant fiscal year 1977 dollars. This figure reflects the costs of the XM1 prior to the redesign decision; if costs are increased by 15 percent, the unit cost would rise to $1,150,000. By comparison, the unit cost of the current production M60A1 is about $490,000 and the cost of the improved

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7/ Aerospace Daily, September 21, 1976.

8/ This cost is based on an assumed buy of 3,312 tanks and includes all research and development funding in fiscal year 1978 and beyond. The figure of about $1.4 million per tank, derived by dividing the total program cost of $4.5 billion by the number of tanks to be procured, is not relevant here because it includes both development costs and an estimate of inflation in the years of the program. Figures are CBO estimates.

model of the M60 series, the M60A3, is around $630,000. 9/ While the XM1 is undoubtedly more capable than either of these, its higher cost means that for given resources fewer tanks can be bought.

RATIONALE

The rationale for developing and procuring a tank like the XM1 is tied closely to the prevailing view of what a war in Europe might be like. U.S. armored units can expect to be outnumbered by Warsaw Pact armor, not only because in the early phases of a conflict Pact forces will have more armor available than NATO forces, but also because Pact forces will be able to concentrate for an attack, achieving a further local advantage over the NATO defenders. Because they will be outnumbered, the defenders will have to move constantly, firing from concealed positions and spending little time in the open. To offset an opponent's numerical advantage in tanks, U.S. tanks will have to be superior in performance. The XM1's agility, low profile, and ability to shoot on the move meet this requirement. The improved range and accuracy of the XM1 gun and fire control system will, therefore, be important assets in tank duels. Because replacement tanks will take time to arrive from the United States, it is important that tanks stationed in Europe are capable of continuing to fight, and the improved protection afforded by the XM1's advanced armor is of special value in a European scenario. Finally, the fastest-growing threat to tanks is expected to be the small, relatively cheap anti-tank guided missile, and it is against the shaped-charge warheads of these missiles that the XM1's new armor gives the greatest increase in protection over the armor of the M60 tanks.

As with the rationale for heavy divisions, however, a different set of assumptions about a possible conflict may weaken the case for procuring

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9/ Figures assume the same tank and equipment as in the fiscal year 1977 budget.

the XM1. Although the XM1's armor, its most important advantage over present tanks, could not be incorporated in the M60-series tanks, other improvements found in the XM1, particularly the fire control system and perhaps greater agility, can be expected to be incorporated into future models of the M60 series. Major improvements are alrady planned for the M60A3, which will enter the force in 1977; older M60A1s will be converted to the A3 configuration. It is unlikely that the 120mm gun can ever be mounted on an M60, but until very recently, the Army has argued that the 105mm gun of the present tank would be adequate for even the XM1.

A tank with the XM1's improved capabilities would be of greatest value if U.S. forces were called upon to fight when badly outnumbered and hastily organized for defense. When only a relatively small number of troops are available, it would be important for them to have the best weapons possible. This is the situation NATO would face in a case of surprise attack. If, on the other hand, sufficient warning time is available for troops to be deployed to Europe from the United States, the value of the XM1 might be lessened. In this case mobility, agility, and firepower would still be important, but since more forces could be deployed to meet an attack, it might be desirable to provide as many tanks as these forces could employ. This suggests that the monies spent producing the XM1 might be better spent providing a larger number of less expensive M60 tanks to convert light divisions to heav- divisions and to enlarge the war reserve stocks available to replace battle losses.

The XM1's new armor gives the greatest increase in protection against anti-tank guided missiles. The best ammunition for defeating the new armor is usually thought to be the high kinetic energy rounds fired by tank guns. While the arrayed armor presumably offers some increased protection against high kinetic energy rounds, no major improvements in this respect have been claimed. Thus it seems that the improvements offered by the XM1 armor will be most important when U.S. forces are exposed to fire from anti-tank missiles. This will occur if U.S. armored

forces must operate without adequate artillery and infantry support to suppress enemy anti-tank operations. In a hastily organized defense, this support might be lacking and the XM1 would prove extremely valuable. In a prepared defense, however, there would presumably be time to deploy supporting units and to coordinate their operations. If sufficient warning time is available to prepare a defense, resources might be better allocated to the provision of more support (particularly artillery) rather than to the procurement of the XM1. U.S. tanks would also be expected to face anti-tank missiles if U.S. forces took the offensive, having to expose themselves to advance on enemy positions. The XM1 would be desirable if major counteroffensive operations are thought likely.

It seems, then, that the XM1 is most easily justified if it is assumed that U.S. forces will have to fight a running, improvising kind of defense or that they will be engaging in counterattacks. If, on the other hand, the assumption is that U.S. forces will have the time to prepare a well organized defense and that counterattacks would be limited, a larger number of guns of less expensive M60s would be more desirable.

OPTIONS

The options open to the Congress with regard to the XM1 are unfortunately quite constrained. If a new tank is to be acquired in the next few years, there is no real alternative to a tank like the XM1. The German Leopard II (AV) is sometimes suggested as an alternative, but it has most of the characteristics of the XM1. Indeed, this version of the Leopard was produced specifically to meet the U.S. requirements for the XM1. Estimates of the cost of the Leopard vary widely, but it is usually thought to be in the same (perhaps slightly higher) price range as the XM1. There has been some discussion about the development of a lightweight, highly mobile tank, but no design concept for such a tank exists. (Research is being conducted toward the development of a lightweight, liquid-propellant tank gun.) There seems little hope of developing any new tank in the near

future. It is worth noting that the XM1 development program was begun in 1972, and the tank will not reach production before 1979.

While cancelling the XM1 program would apparently mean that no new tank could be fielded for six or seven years, the Congress could choose to slow the pace of the XM1 program. The potential attractiveness of this option (besides saving a relatively small amount of money in the near term) arises from charges to the effect that the decision to standardize some components of the XM1 with those of the German tank have required ad hoc redesign that may degrade the effectiveness of the whole system. An analysis of these charges is beyond the scope of this paper, but a delay would allow a more careful examination of the effects of redesign on the tank's performance. The XM1 was originally designed as an integrated system, and some have argued that changes in a few components will require redesign of others as well. Of course, any delay in the XM1 program will result in a delay in modernizing U.S. armored forces. If one believes that the kind of war we will face in Europe demands a tank like the XM1 as it is now planned, one would presumably be opposed to any delay.

THE FUTURE OF TANKS

A further closely related question is whether the United States should embark on a major effort to build larger inventories of tanks of any sort. Considerable debate has focused on whether or not tanks have a place on the battlefield of the future. Because XM1 production will not begin until at least 1979 and the final programmed units will not be delivered until 1989, the tanks of the XM1 generation are expected to remain in the force for a long time. Recent advances in the technology of precision-guided munitions (PGMs) have made point targets such as tanks much more vulnerable than they have been in the past, and the question has been raised whether the tank may soon be obsolete, perhaps even before we have finished buying the XM1.

The armor of the XM1 was developed to counter the new anti-tank guided missiles, the most rapidly growing threat to tanks.

Although the XM1 will not be perfectly safe from such munitions, it can operate successfully in the face of this threat according to the Army. The other side of this coin is that although we have no evidence yet that the Soviet Union has developed armor similar to that of the XM1, the state of the Soviet metallurgic art is such that improved armor must be expected in the next few years. With the advent of this new armor, our own ATGMs may become less effective. The best munitions for defeating improved armor appear to be high kinetic energy cannon rounds, munitions best delivered by tank guns. Thus, as armor improves on both sides, the tank might be expected to become more valuable both because it is less vulnerable and because it will be required as a tank killer.

On the other hand, there is a growing threat to point targets such as tanks from precision-guided weapons delivered by air or by long-range artillery. The United States already has a precision-guided air-to-ground weapon in the Maverick and is developing a Cannon Launched Guided Projectile (CLGP), a laser-directed round fired from current 155mm artillery. There is no evidence that the Soviet Union yet has weapons of this type, but they must be expected within the lifetime of the XM1. These types of weapons can carry much larger warheads than can the present generation of ATGMs, and no reasonable amount of armor could provide protection against a direct hit by one of these warheads. A growing number of such weapons would reduce the value of tanks in the coming years.

Although the technological trends do not clearly favor one side or the other in this controversy, there seems to be a general consensus that some tanks will always be required for certain missions. Tanks are essential for spearheading attacks, providing mobile direct firepower, exploiting penetrations of enemy positions, and providing the shock value required for a successful attack. But tanks also have limitations.

Their strategic deployment is slow. They cannot operate in some types of terrain: dense forests, rugged mountains, marshes, etc. They are noisy, difficult to conceal, and require extensive logistics support.

Armored weapons are ideally suited to the Soviet style of battle. Soviet doctrine emphasizes the offensive; defenses must be penetrated and attackers must have armored protection since they must expose themselves to enemy fire in order to advance. The tank is a valuable defensive weapon also, since it can destroy other tanks while providing defenders with protection from artillery and small arms fire. But other weapons can also be used on the defensive, particularly anti-tank missiles. Part of the overwhelming numerical superiority of Soviet tanks over those of NATO can be attributed to the Soviet stress on the offensive.

The decision by the United States to increase significantly its tank inventories relative to other weapons systems seems to imply a view of war in Europe as mobile, continuing for long enough for the weight of armored forces not already in place to be felt, and not favoring a static defense. Presumably if one were concerned with the possibility of a quickly decided war or one beginning without much warning, one would favor a posture that would place more weapons in the field more quickly. This might be accomplished by positioning additional tanks in Europe, either with troops or as prepositioned equipment for rapidly deploying units. Alternatively, it could be done by concentrating procurement on less effective, but more rapidly deployable weapons, such as ATGMs, helicopters, or infantry.

With regard to the overall size of the U.S. tank force, Congressional options are also constrained. The rate of procurement of M60-series tanks cannot be increased because plants are operating at capacity now. (This capacity is presently growing and will

reach a peak of about 120 tanks per month by January, 1978. 10/ By the end of the fiscal year 1977 funded delivery period, the Army will have approximately 10,000 prime tanks, or 72 percent of its requirement. 11/ Production of M60s could be slowed. This might happen either because the Congress views tanks as becoming less important in future years or because no war in Europe appears imminent and the Congress finds it desirable to wait and procure the more effective XM1 tanks. The major alternative to larger tank forces in the near term would be the procurement of other weapons capable of engaging Warsaw Pact armored units. The most likely candidates for this role would be infantry units more heavily armed with anti-tank missiles like TOW or Dragon or attack helicopters armed with anti-tank weapons. Another possibility would be the procurement of additional tactical aircraft, like the A-10, with anti-armor capabilities.

COMBINED ARMS CONCEPT AND THE MICV

The 1973 Middle East war confirmed the belief that no single type of weapon could survive on the modern battlefield without the support of other weapons. For example, tanks can be successfully attacked by infantry armed with ATGMs unless the tanks are in turn accompanied by infantry to find and suppress concealed enemy infantry units. Similarly, infantry units can be effective against tanks if artillery fire can strip the protective infantry from around tanks and force tank crews to close their hatches, thus losing some ability to detect threatening forces. This mutual support is known as the combined arms concept, and in the name of this concept the Army

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10/ See statement of Martin R. Hoffmann before the Senate Committee on Armed Services, op. cit., p. 614.

11. See statement of Harold L. Brownman, Assistant Secretary of the Army for Installations and Logistics, before the Senate Committee on Armed Services, Hearings on S. 2965, Part 5, 94-2, 1976, p. 2742.

is developing a new Mechanized Infantry Combat Vehicle (MICV).

To be fully effective, the XM1 must be accompanied by infantry. The present armored personnel carrier (the M113A1) was seen as incapable of providing transport and protection for accompanying infantry, and the MICV was designed to have the speed, agility, and range of operations to keep pace with the XM1. The MICV is designed with gun ports to allow the infantrymen being transported to fight without dismounting from the vehicle and exposing themselves to enemy fire. The M113A1 carried only a machine gun; the MICV mounts both a machine gun and a 20mm cannon. The cost of the MICV will be much greater than that of the M113A1. The best estimate at present is that the unit cost of an MICV is about $217,000 12/ in constant fiscal year 1977 dollars; the cost of an M113A1 is about $75,000. Current programming calls for production contracts for the MICV to be awarded in fiscal year 1978. The M113A1 will continue in production, and the resulting force of armored personnel carriers will represent a high-low mix of the two vehicles.

The MICV has been criticized both for its high cost and for its design. It has been argued that the MICV was designed as a vehicle approaching a light tank, and as a result its cost is quite high. It is also argued that infantry will not be able effectively to suppress enemy ATGM fire without dismounting and thus the ability of riflemen to fight from inside

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12/ Based on a buy of 2,410 units to include non-sunk RDT&E (research, development, test and evaluation) costs (fiscal year 1978 and beyond) and procurement. This is the escalated unit program acquisition cost as it appears in the the Defense Department's Selected Acquisition Reports of September 30, 1976. The cost excludes the cost of armament, communications equipment, and development vehicles. The MICV program is now undergoing extensive redirection that impacts on vehicle configuration, program cost, procurement quantity, and development and procurement schedule. The unit cost is subject to large change.

the MICV will be of minimal value. Indeed, the MICV itself will become a target for ATGMs. The entire MICV program is currently undergoing reevaluation, and the final design is not yet fixed. It is clear, however, that the MICV is to be a companion vehicle for the XM1 and the justification for building the MICV would be weakened if the XM1 is not procured.

Most of the budget implications of alternative armored forces will not be seen in fiscal year 1978. The Army program presented with the fiscal year 1977 budget requests $213 million for development of and advanced procurement for the XM1 in fiscal year 1978, but full production will not begin until fiscal year 1979 at the earliest. Only 55 MICVs were to be bought in fiscal year 1978, at a cost of $38 million, but redesign of this vehicle is now underway and these numbers may change. The major expenditures for armored vehicles will be related to purchasing older systems. Procurement and modification of M60-series tanks is programmed to require $555 million; modification of M48-series tanks, $81 million; and procurement of M113A1 armored personnel carriers, $78 million. 13/

13/ Rumsfeld, Defense Posture Statement, FY 1977, p. 139.

CHAPTER V ATTACK HELICOPTERS

In recent years the Army has placed a great deal of emphasis on developing a concept for using helicopters on the modern battlefield. The role of the helicopter in prior years, most notably in Vietnam, was similar to the close air support mission of fixed-wing aircraft, providing highly mobile fire support, for ground forces, usually with rocket or machine gun fire. In this role helicopters operated like fixed-wing aircraft, ranging beyond the positions of ground forces and striking the flanks and rear of enemy positions. European contingencies, however, require a different concept. Warsaw Pact forces are expected to have extensive air defense capabilities, and an aircraft flying as low and as slowly as a helicopter would have little chance of surviving if detected by enemy forces. To counter this threat, the Army has developed the concept of an attack helicopter armed with anti-tank weapons that provides a highly mobile force for scouting, protection of flanks, and direct attack of enemy armor units. In this new role, the helicopter has become truly a ground weapon. Operating very close to the ground, masked by terrain features and vegetation, helicopters will expose themselves only long enough to fire and guide their weapons to their targets. Because helicopters are highly vulnerable to even small arms fire, they must operate among friendly forces and rely on the relatively long range of their weapons to engage enemy forces and remain safe themselves.

ATTACK HELICOPTERS, CURRENT AND PLANNED

The current attack helicopter, the Cobra/TOW AH-1S, is armed with TOW 1/ missiles; its unit procurement cost in fiscal year 1977 was $1.48 million. 2/ The

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1/ Tube-launched, optically-tracked, wire-guided.

2/ The fiscal year 1977 buy was 82 helicopters. (Ammunition not treated as part of cost.)

fiscal year 1978 request is expected to seek funding for 83 of these helicopters.

Also under development is an Advanced Attack Helicopter (AAH). It will operate in much the same way as the Cobra/TOW, but will have enhanced performance characteristics and will carry the new Hellfire anti-tank missile. The cost of an AAH is expected to be almost three times that of a Cobra, around $4.2 million in fiscal year 1977 dollars. 3/

The principal rationale for the development of the AAH is that its design will permit greater survivability because the helicopter will have to expose itself for a shorter period of time in order to engage a target. The present attack helicopter, the Cobra/TOW, remains masked by terrain features as it moves to within range of a target. It must then expose itself long enough for the gunner to sight the target, release his missile, and guide the missile throughout its flight. The whole process can usually be accomplished in less than thirty seconds, but during that time the helicopter is highly vulnerable. The AAH will carry a new anti-tank missile, the Hellfire, that, instead of requiring guidance by the gunner, will automatically home on a target designated for it by a laser beam operated by other friendly forces--other helicopters, ground forces in the vicinity of the target, etc. The gunner in the AAH will never have to see his target. All that is required is that a direct line of sight be established between the missile and the target before the missile is released. Once the missile is released, the helicopter may immediately take cover again; the missile will automatically reach its target as long as the laser designator can be kept on the target. This ability to "fire and forget" can reduce significantly the exposure of the helicopter and increase its rate of fire since it can release missiles in rapid succession without waiting for each to reach its target. The AAH will also be able to designate its own targets, but operating in this mode it

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3/ Based on a buy of 536 units. Includes research and development costs not already spent (fiscal year 1978 and beyond) and procurement.

has little advantage over the Cobra/TOW, since the gunner must identify his target, designate it with a laser, and maintain a laser on the target throughout the flight of the missile. To utilize the Hellfire missile, the AAH is required; the Cobra does not have the payload capacity to carry the heavier Hellfire nor are its avionics sufficiently sophisticated to operate the Hellfire.

THE ROLE OF ATTACK HELICOPTERS

The advantage of the AAH/Hellfire system over the Cobra/TOW system will be greatest in situations where helicopters are operating with the main body of ground forces, facing a highly mechanized opponent who possesses heavy concentrations of anti-aircraft weapons and sophisticated radars. In this environment the dangers of exposure will be the greatest and the likelihood that other forces can designate targets for the AAH will be the highest. For other missions, particularly scouting and protecting the flanks of ground forces, the helicopter will more often be called upon to operate on its own and thus may have to designate its own targets, giving up much of its increased capacity.

Current doctrine calls for attack helicopters always to be accompanied by lighter, smaller, and less expensive scout helicopters that can act as designators, but there will seldom be as many scout helicopters as attack helicopters in a formation and scouts may not be able to designate targets for all the attack helicopters. Scout helicopters also operate with Cobras, but their role with the present helicopter is only to identify targets; scouts need not remain exposed to designate targets. Without supporting ground forces nearby, then, either the AAH will have to operate on its own or two helicopters--one scout and one attack--will be required to accomplish an attack mission.

Some questions have been raised concerning the use of helicopters in the first of these roles. A complex net of communications linking designators and helicopters is required to operate a "fire and

forget" system. Designators must tell helicopters when a target is appropriately marked and roughly where the target is. The helicopter must then respond quickly so as not to endanger the designator, who might be observed and attacked by enemy forces. 4/ Such coordination may be very difficult to achieve in the midst of a battle, and helicopters may be forced to operate on their own.

It may also be that the advantages of the Hellfire missile can be had without deploying it aboard an expensive airborne platform. The Hellfire has been successfully test fired in an indirect fire mode. That is, a target has been designated and the missile fired in the general direction of a target without a line of sight first being established between the missile and the target. During the flight the missile acquires its target and homes on it. Such a capability would allow the Hellfire to be mounted on a relatively cheap, well protected vehicle like an armored personnel carrier rather than on an expensive and vulnerable platform like a helicopter. The APC would not have the mobility of a helicopter, but this might not be such a disadvantage if the main function of the Hellfire is thought to be adding to the fire of ground units already in place. The missions for which the APC would be inadequate--scouting and protecting flanks and the rear--are those in which the AAH offers the least advantage over the Cobra.

ALTERNATIVES AND OPTIONS

Beyond questions of how appropriate the design of the AAH may be, the Congress must decide the

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4/ Laser-sensing equipment is already available in experimental forms. Some British tanks, for example, have been outfitted with devices which automatically release smoke when the tank is illuminated by a laser. The smoke blocks the view of the designator, and if the tank takes rapid evasive action, the laser-guided weapon will miss its mark.

number of attack helicopters of any variety that the Army should procure. There are several concepts of how an attack helicopter might be used. In Vietnam, helicopter gunships provided highly mobile firepower for light infantry units operating against lightly armed opponents. The current generation of attack helicopters reflects the deemphasis of this kind of capability and stresses meeting heavily armored, mechanized units. While the Cobra and the AAH each have machine gun armaments and can carry rocket launchers, their primary mission in the NATO scenario seems to be that of tank killers. But in the NATO environment there are other weapon systems for killing tanks that are much cheaper and less vulnerable, principally tanks and ground-deployed anti-tank missiles. The advantage of helicopters, of course, is that they are much more tactically mobile than either alternative anti-tank system. Helicopters can be carried by more types of transport aircraft than can tanks, although more time is required to rig helicopters for shipment and to prepare them for flight upon arrival. Thus, if aircraft capacity is the major constraint in deployment to Europe, helicopters may offer some advantage over tanks. To justify the procurement of large numbers of helicopters (particularly at a time when tank inventories are being expanded), one must envision missions for the helicopters for which these advantages are important. The most likely requirement for the specific capabilties of an attack helicopter would be in the case of a surprise attack, when their mobility is necessary to meet enemy armor thrusts. In this situation, however, sufficient ground support may not be avail able to justify the AAH, and the cheaper Cobra might prove the more cost-effective system.

It is not clear exactly how the Army intends to utilize the tactical mobility of the attack helicopter. Attack helicopters are now deployed in two organizational structures: in an air cavalry brigade stationed in the United States and with Army divisions and armored cavalry regiments in the United States and in Europe. The one air cavalry brigade is incomplete, having only one of the two attack helicopter battalions that are supposed to make up its full complement. Currently, new helicopters are going to fill division

structures in Europe, not to round out the cavalry brigade. This gives the impression that it is in the divisional structure that the Army finds the most pressing need for the helicopter. The Army does not appear to have clearly spelled out its doctrine for the control of attack helicopters yet, and a better understanding of this doctrine would be an aid to the Congress in determining the value of further spending in this area.

The time required to develop new weapon systems and the long lifetimes of older systems make it impossible for major changes in the total force posture to be made quickly. Decisions to build and deploy certain weapon systems and not others imply not radical shifts of doctrine, but a gradual drift of emphasis. To take part in decisions about the ultimate structure of forces, the Congress must be involved in making these incremental decisions that eventually determine the capabilities of U.S. forces.

As we have tried to demonstrate in the preceding discussions, Army programs for the procurement of major items seem justified under particular assumptions about the nature of conflicts in which U.S. forces might be engaged. In different circumstances, however, other procurement programs might lead to a more desirable force structure. As an example of how different assumptions about a possible conflict lead to different budget decisions, two scenarios, differing somewhat from the standard Defense Department planning cases (as outlined in Chapter II), are presented. The major differences between these scenarios and the standard case lie in the amount of warning time available and the length of the war. Both focus on a conflict in Western Europe.

SURPRISE ATTACK AND SHORT WAR

Throughout their existence NATO forces have been criticized as being ill-prepared to meet a sudden, massive attack by the Warsaw Pact. The problems of coordinating a joint defense--maintaining troops of one nation in the territory of other nations, meshing the operations of unstandardized forces, communicating in a variety of languages, and requiring

approval from various governments before joint operations can begin--suggest that NATO will always be vulnerable to surprise attack. To achieve surprise, Warsaw Pact forces would have to forego the more readily visible preparations for an offensive. In particular, it would be difficult to mobilize or deploy additional troops, to move supplies forward, or to redeploy aircraft. Without these preparations, an attack would be smaller and less well supported than if full mobilization were possible. These penalties, however, may be accepted in order to capitalize on a perceived NATO vulnerability to a sudden attack.

Launching a surprise attack might be particularly tempting to Soviet leaders if only limited goals were sought. In such a case, the penalties of less than full mobilization would be minimal. The Soviet intent might be to launch an attack suddenly and end the conflict quickly, before NATO forces could be engaged. Various scenarios have postulated limited territorial thrusts or preemptive attacks on the part of the Warsaw Pact. Either of these could lead to a conflict that would last only a short time, perhaps no more than two weeks. The political gains arising from a successful fait accompli would be significant for the Warsaw Pact; NATO would be forced either to capitulate, renew the fight in friendly territory, or resort to nuclear war.

In the event of either a surprise attack or a very short war in Europe, there would be a premium on highly capable, highly mobile forces already deployed in Europe and on forces stationed in the United States which could be rapidly moved to Europe. All forces would require the ability to operate independently and in an atmosphere of chaotic communications, disrupted command structures, and minimal information. Stationing more U.S. troops in Europe would, of course, be the best hedge against surprise attacks, but the political and financial difficulties inherent in doing so would probably preclude this course. The next best choice would be to preposition more equipment in Europe and to be ready rapidly to deploy the troops to use this equipment. As pointed out above, this choice would require the purchase of additional equipment for training purposes. In

the case of a true surprise attack (as opposed to one with minimal warning), prepositioned material would be vulnerable to attack before it could be used. The most likely alternative for the near future is to make U.S. forces in Europe as capable and as mobile as possible and to design forces in the United States to be rapidly deployed to Europe.

Defending forces would be required to move quickly to block enemy advances and would probably have to fight in hastily prepared positions. Greatly outnumbered, they would most likely have to give ground, trading space for the time required to establish more substantial defensive positions and to receive reinforcements. This flexible, active defense would favor vehicles with the agility, protection, and firepower of the XM1 and its accompanying MICV. Because of their speed and anti-tank capabilities, attack helicopters would also play an important role in meeting the initial assault, perhaps because few other weapons would be in a position to do so. The requirement that the helicopters often operate without extensive support from ground forces and without close coordination with ground commanders suggests that helicopters might have to operate on their own much of the time, finding and designating their own targets. In these circumstances, the AAH would not offer much of an advantage over the present Cobra, and the much higher cost of the AAH would limit the total number of aircraft available for deployment.

In hedging against a surprise-attack or short-war scenario, additional heavy divisions in the United States would be of little value. These units would be more useful if they were kept as light infantry, with higher densities of anti-tank guided missiles and perhaps reinforced by attack helicopters. The intention would be to structure these units so that they could be airlifted to Europe rather than going by sea.

The most attractive hedges against a surprise attack might not even involve changes in ground forces. The enhancement of airlift capabilities would make it possible to deploy U.S.-based forces to

Europe more rapidly and thus place more forces in a position to fight during the most critical stages of the conflict. Similarly, tactical aircraft can be more rapidly deployed and can range over wider areas than can any ground forces and thus may be more capable of meeting attacks on short notice.

If strengthening NATO's ability to fight a short war with little warning is seen as the most pressing need, the Congress might make the following budget decisions regarding spending for ground forces:

- Approve funds for development and procurement of the XM1 and MICV with the intention of positioning these new weapons in Europe.

- Deny funds for development of the AAH.

- Accelerate procurement of the Cobra/TOW attack helicopter.

- Deny funds for converting light divisions to heavy divisions.

- Approve funds for improvement and accelerated procurement of anti-tank guided mssiles.

GRADUALLY ESCALATING CONFLICT

At the other extreme from a surprise attack is a conflict in Europe that erupts after a lengthy period of rising tensions. A conflict of this sort might grow out of a confrontation between the United States and the Soviet Union in some other area of the world, for example, the Middle East. Presumably, the probability of violence breaking out in Europe would

be sufficiently great to alert leaders early enough for NATO to activate its command structures, to establish advantageous defensive positions, and for troops from the United States to reinforce the forces in Europe. Perhaps U.S. forces in excess of the seven divisions with initial commitments to NATO would be deployed. Those who see this type of scenario as plausible usually maintain that only the most extreme provocation would prompt the Soviet Union to choose as dangerous a course of action as a major attack on Western Europe. Under these circumstances, it is unlikely that the Soviet attack would halt short of a complete victory, and thus war might be expected to last for a relatively long time, perhaps four weeks or more.

In this case, additional heavy divisions would be of great value, since there would presumably be time for them to arrive in Europe and take part in the conflict. Because more troops could be in place to meet an attack, it is likely that the extra firepower of more numerous, less expensive M60 tanks, particularly if equipped with improved fire control systems as planned for the M60A3, would be an advantage in the defensive phases of the battle. Under any circumstances, of course, the superior armor protection of the XM1 would be an advantage, and its improved mobility would be important in counteroffensive operations. Most observers seem to agree that eventually the United States should field a new tank something like the XM1; the major question seems to be how soon the tank is required. The need for a new tank of this sort is probably not as pressing in this case as in the standard case. If this contingency were emphasized, the Army might be able to delay somewhat the procurement of the XM1 in order to achieve greater standardization with other NATO forces. Such a delay might be attractive to the Army as well as to the Congress because of current fears that too quick a redesign of the XM1 to achieve greater standardization would jeopardize the entire program by inflating costs and/or degrading performance. (It should be stressed that the Army has not suggested such a delay.) If the XM1 program is delayed, there would be no reason to proceed at once with the procurement of the MICV.

Attack helicopters might be of less importance in this scenario than in a surprise attack, but the capabilities of the AAH might represent a particularly valuable improvement in this relatively well organized and highly integrated defense.

Summarizing, if the Congress felt that the most pressing concern were to increase the ability of U.S. forces to fight a long war after clear and timely warning, it might take the following specific actions with regard to Army acquisition programs:

- Approve funds for conversion of light divisions to heavy divisions.

- Approve funds for further development of the XM1, but deny funds for advance procurement to assure that the tank finally produced offers the best mix of capabilities and standardization with armored units of other NATO countries.

- Deny funds for procurement of the MICV.

- Reduce funding for the procurement of the current attack helicopter, the Cobra/TOW.

- Approve funds for development and procurement of the AAH/Hellfire system.

CONCLUSION

Current Army programs appear to represent a compromise between the two extreme cases outlined above. As such, they have the advantage of providing a degree of protection against the entire spectrum of contingencies. They have the disadvantage of attempting to do a little bit of everything without specializing capabilities for either extreme. This has the effect of increasing costs as multiple weapon systems are developed to meet a wide variety of situations.

The standard planning assumptions used by the Defense Department may well represent the optimal set of force structuring criteria. Indeed, a great deal of thought has been given to their formulation. Other sets of assumptions are possible, however, and are perhaps as plausible as the standard set. The set of options available to the Congress is quite limited because of the past history of weapons development; the Congress would find it difficult to appropriate funds for a weapon system for which no workable concept has yet been developed. Within the set of available options, however, alternative sets of assumptions do suggest different budget decisions.

The alternative assumptions suggested here are intended to serve as examples and are by no means exhaustive. Further modifications in the standard planning assumptions could be made regarding the use of nuclear weapons, the participation of allies, the locale of a likely conflict, and so on. Informed budget decisions can be made only with an understanding of what assumptions lie behind force planning, and even if the Congress ultimately accepts the assumptions of the Defense Department, more explicit discussion of these assumptions will aid debate over defense spending.

APPENDIX

APPENDIX A BUDGET IMPLICATIONS OF ALTERNATIVE FORCE STRUCTURES

Although it is impossible to derive precise estimates of the costs of the alternative force structures suggested in Chapter VI, it is possible to indicate the magnitude of funding involved. The following two tables summarize the two alternative force postures and give estimates of how much the costs of the alternatives differ from currently programmed spending. A positive figure indicates that the alternative costs more than the current program; a negative figure indicates that the alternative costs less. These figures are based on hypothetical cuts or increases in various programs and should be considered as illustrative, not definitive. The costs given here are for acquisition only. Operating costs have not been included.

Table A-1. Surprise Attack and Short War Force, by Fiscal Year, in Millions of Fiscal Year 1977 Dollars

Budget Action	Change in Funding from Planned Acquisition	
	1978	1979 - 1989
Approve XM1	0	0
Approve MICV	0	0
Helicopter Programs:		
--Deny funds for AAH	(-110)	(-2,100)
--Approve more AH-1S Cobras[a/]	(+50)	(+540)
Net	-60	-1,560
Deny funds for division conversions[b/]	-227	-227
Approve more ATGM[c/]	+90	+672

a/ Assumes increased buy in fiscal year 1978 by 50 percent over program and sustaining this level of procurement to buy sufficient extra Cobras to replace the 536 programmed AAHs on a one-for-one basis.

b/ Assumes half the cost of conversions in fiscal year 1978. Estimated increase in yearly operating costs of $29 million not included.

c/ Assumes increasing fiscal year 1978 funding by 50 percent and maintaining this rate through fiscal year 1981.

Table A-2. Gradually Escalating Conflict Force Structure, by Fiscal Year, in Millions of Fiscal Year 1977 Dollars

Budget Action	Change in Funding from Planned Acquisition	
	1978	1979 - 1989
Approve division conversions	0	0
Continue development, but no advance procurement for XM1	?[a]	?[b]
Postpone procurement of MICV	-40	?[b]
Reduce procurement of AH-1S Cobra[c]	-60	-100
Approve AAH	0	0

a/ This would probably imply cancelling most funds for prototype procurement in fiscal year 1978. The cost of prototypes is not available.

b/ Figures impossible to estimate pending outcome of possible redesign decisions.

c/ Assumes reducing fiscal year 1978 procurement by 50 percent and cancelling all remaining production.

GLOSSARY

AAH: Advanced Attack Helicopter. New U.S. attack helicopter now under development. Will carry the Hellfire ATGM.

Air Assault Division: A light infantry division designed to use helicopters for battlefield maneuvers.

Airborne Division: A light infantry division configured to be transported anywhere in the world rapidly and delivered into combat by air transport or by parachute.

AH-1S: The current U.S. Army attack helicopter. Called the Cobra, it can be armed with machine guns, rocket launchers, or TOW anti-tank guided missiles.

APC: Armored Personnel Carrier. A lightly armored, tracked combat vehicle for transporting riflemen on the battlefield. The current U.S. APC is the M113A1.

Armored Division: A heavy division composed of tank battalions, mechanized infantry battalions, and numerous supporting elements. Tank battalions are composed of 54 tanks plus command vehicles. Mechanized infantry battalions are made up of 54 APCs and the infantrymen they transport plus command vehicles. An armored division usually has six tank battalions and five mechanized infantry battalions.

Arrayed Armor: New armor developed for the XM1 and other tanks of its generation. Details on the armor are closely held, but it is known that it is made up of various materials forming an armor "array." Also called Chobham armor.

ATGM: Anti-Tank Guided Missile. A missile designed to destroy tanks. Uses a shaped-charge, high-explosive warhead and is guided to the target either by the gunner who fires the missile or by other friendly forces who mark the target by illuminating it with a laser.

Attack Helicopter: Small, two-seater helicopter armed with machine guns, rocket launchers, or ATGMs. These helicopters will be used principally for destroying enemy armored vehicles.

Cobra: Popular name for the AH-1S attack helicopter.

Deploy: To array troops for battle.

Designator: The person or equipment used to mark a target for PGMs. Usually this involves illuminating the target with a laser.

Dragon: The U.S. Army medium ATGM. Carried and fired by one man, the missile is guided throughout its flight to its target by a wire connecting the missile to the gunner's sight.

Fire Control System: In a tank, the equipment by which the main gun is aimed. Included are range finders, ballistic computers, and sights.

Heavy Division: An armored or a mechanized infantry division, so called because of the equipment associated with the division.

Hellfire: The new ATGM under development for use on the AAH. It will home on a target illuminated by a laser designator.

Kinetic Energy Round: A round fired at great speed from the main gun of a tank. It has no explosive charge and relies on its speed (kinetic energy) to damage its target. Principally for use against armored vehicles.

Light Division: An infantry, airborne, or air assault division, so called because of the equipment associated with the division.

M48: Oldest main battle tank in U.S. Army use. All M48s are being modified to the M48A5 configuration to make them comparable to M60-series tanks.

M60: Current U.S. main battle tank. Now in three versions: M60A1, M60A2 (missile firing), and M60A3 (improved version of M60A1). After 1977 only the M60A3 version will be produced, and all M60A1s will be converted to this configuration.

M113A1: Current U.S. Army armored personnel carrier.

MICV: Mechanized Infantry Combat Vehicle. New U.S. armored personnel carrier now under development.

Mechanized Infantry Division: Same as an armored division in U.S. forces (see Armored Division), except mechanized division has six mechanized infantry battalions and five tank battalions.

Mobilization: The process of making ready for conflict: marshaling supplies, deploying troops, calling up reserves, etc.

Motorized Division: In Warsaw Pact armies, similar to a U.S. mechanized infantry division, but somewhat smaller.

NATO: North Atlantic Treaty Organization. Mutual defense organization of the United States, Canada, and Western European nations.

PGM: Precision Guided Munitions. Munitions that are guided to their specific targets, usually by homing on a target illuminated by laser or radar or by direction from the gunner launching them. Included are ATGMs, "smart" bombs, and cannon-launched guided projectiles.

Self-Propelled Artillery: Artillery mounted on tracked chassis and capable of moving under its own power.

Shaped Charge: High explosive charge carried by ATGMs and rounds from tank main guns. The force of the explosion is focused in one spot to intensify its effect.

Shock Value: The characteristic (often ascribed to tanks) of producing incapacitating fear or panic among opposing forces.

Tactical Nuclear Weapons: Nuclear weapons not part of central strategic forces. These weapons are usually thought of as being delivered by artillery rounds, tactical aircraft, or missiles with ranges under 400 miles.

Tank Division: In Warsaw Pact armies, similar to U.S. armored divisions, but smaller.

TOW: Tube-launched, Optically-tracked, Wire-guided missile. The U.S. Army heavy ATGM. Mounted on a tripod or on a vehicle, the TOW is guided throughout its flight to its target by a wire connecting the missile to the gunner's sight. TOW is carried by the AH-1S Cobra.

Warsaw Pact: The mutual defense organization consisting of the Soviet Union and the Eastern European nations.

XM1: New U.S. main battle tank, now under development.

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