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John C. F. Tillson, Project Leader
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Robert Magruder

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PREFACE

This report is the result of research performed under a task order entitled "Structuring a More Deployable and Agile Army" conducted by the Institute of Defense Analyses for the Director, Program Analysis and Evaluation. The initial task was to describe and assess the Army's force management process, using the Total Army Analysis FY2009 (TAA09) as the vehicle for the research. The Army conducted TAA09 in 2000 and 2001 to establish the numbers and types of units in the Army's force structure used as the basis for the Army's Program Objective Memorandum for FY2004. This report assesses the guidance, methodology, and data used by the Army to prepare TAA09. This is a follow-on paper to a previous IDA report on TAA03, IDA Paper P-3189, published in May 1996.

Mr. James Adams, BAHR Incorporated, reviewed a draft of the report and made several helpful comments. Mr. Waldo Freeman of IDA was the technical reviewer of this paper. The Army Staff reviewed the final draft and provided several comments that have been incorporated in the document.

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SUMMARY

The process by which the Army establishes the numbers and types of units it will have is called the Total Army Analysis (TAA). This report focuses on TAA09, which covered the period FY2004 to FY2009 and provided the basis for the Army program and budget for FY2004. TAA09 established the numbers and mix of units in the Army at the end of FY2009. The TAA establishes the basis for all Army activities including resource allocation, personnel management, equipment procurement, and war planning.

The force structure is the essential architecture of the Army. It is the basis for the Army‘s program objective memorandum (POM) and budget submission. The overall process for establishing, maintaining, and sustaining the force structure is force management. Force management is concerned with determining, programming, training, and sustaining the Army’s units. One aspect of force management (the TAA) is prescribing the numbers and types of units (battalions, companies, and detachments) that the Army will have in the future. Another aspect is designing the units and higher-level organizations that will be used to conduct military operations. A third aspect of force management is to program the time-phased unit changes (activations, inactivations, and conversions) needed to transform the current force structure into the future force structure. The force program informs the G1, G3, G4, and G8 of the Army of the resource requirements generated by changes to the approved Army force structure so the Army can take steps to assure the timely availability of resources needed to staff, equip, train, and fund the units and provide the general support needed to sustain them in peace and war.

The TAA consists of the five steps described below. This report focuses on steps one, three, and four.

1. *Force level determination* establishes the number and types of major combat formations (divisions, brigades, and regiments) and other combat units upon which force structure determination is based.

2. *Estimation of Combat Parameters* is accomplished by "fighting" theater combat scenarios in a theater-level simulation to obtain values for battlefield locations, operating tempos, loss rates for people and equipment, and consumption rates for supplies.
3. *Support Unit Determination* establishes the numbers and types of combat support (CS) and combat service support (CSS) units required to sustain the combat units (and themselves) during combat operations or other military operations.
4. *Application of Anticipated constraints* reduces the required troop lists produced by the first three steps into a force structure that fits into the manpower, procurement, and funding constraints established by the Secretary of Defense and Congress.
5. *Conversion to program language* translates the funded troop list into program elements and budget categories for use in preparation of the DoD budget request.

FORCE LEVEL DETERMINATION

Determination of force levels, the initial step in the TAA, consists of establishing the numbers and types of combined arms organizations—divisions, combat brigades, and cavalry regiments—to be in the force structure. This process is guided by several official documents provided by the President and Secretary of Defense. These documents include The National Security Strategy, the Defense Planning Guidance, the Contingency Planning Guidance, the Quadrennial Defense Review (QDR), the National Military Strategy, numerous operational plans, and several other lesser documents. These guidance documents, issued sequentially over the TAA period, are often late, sometimes conflicting, and frequently ambiguous.

For TAA09, the Army used QDR 2001 as the basis for its missions and force levels. The QDR listed the Army's missions in priority but did not specify the force levels for each mission. Table S-1 summarizes the Army's interpretation of the QDR 2001 Guidance and the combat brigades and military personnel required to accomplish each mission.

Table S-1. Summary of the TAA09 Simultaneity Stack

Mission	BCTs & ACRs[a]	Military Personnel[b]	Force Level Guidance	Rationale
Homeland Security	5	92	None	Army Estimates
Deter Aggression	5	89	None	Overseas Support
Critical SSCs	3	25	None	Current Operations
Major Combat Operations	46	643		
Terrorism	*4*	*32*	*None*	*Army Estimate*
Decisive Victory	*26*	*364*	*None*	*TAA07 IPS (+6)*
Defeat the Efforts	*16*	*248*	*None*	*TAA07 IPS (-6)*
Strategic Reserve	7	43	None	Two NG[c] Divisions
Transformation	2	10	None	SBCT[d] Schedule
Generating Force	4	309	None	Workloading
Total	72	1,211		

a BCT – brigade combat teams; ACR – armored cavalry regiments
b Thousands of military manpower authorizations
c NG – National Guard
d SBCT – Stryker BCT

The five columns of this summary are explained as follows:

1. The first column in Table 1 is with two exceptions a faithful replication of the missions assigned by the QDR in order of priority. The second and third missions are aggregated in the QDR under the heading "Deter Aggression Forward in Critical Areas." The first exception is the inclusion under the Major Combat Operations mission of a "Defeat Terrorism" mission that is not mentioned in the QDR. The second exception is a Transformation mission, which is not in the QDR but is part of the overall transformation program approved by the Secretary of Defense.

2. In the second column, force levels for each mission are denoted by the numbers of brigade combat teams (BCTs) and Armored Cavalry Regiments (ACRs) allocated by the Army to each of the missions.[1] The required force structure also provides for four corps headquarters and 17 division headquarters and bases.

1 A brigade combat team (BCT) comprises a brigade headquarters, three infantry or tank battalions, a field artillery battalion, a combat engineer battalion, a support battalion, a reconnaissance company, a signal company, and other combat support elements. An armored cavalry regiment (ACR) is a brigade-sized element.

3. Column three shows the numbers of military personnel authorizations allocated to each mission. In addition, the Deter Aggression mission includes a requirement for 48,000 and the Generating Force, for 309,000 civilian employees.

4. As noted in the fourth column, the OSD gave no explicit guidance on force levels for any of the missions assigned to the Army.

5. The fifth column summarizes the rationale used by the Army to establish requirements for the various missions. Forced to size itself, the Army applied considerable ingenuity for some missions and managed to allocate all of its existing BCTs/ACRs, but in some cases the rationale is less than persuasive. More importantly, the Army's estimated force levels and force packages enter the program-budget review without prior approval from OSD or the Joint Staff and may be subjected to major or marginal cuts during the review process.

The numbers and types of BCTs/ACRs and division bases define the numbers and types of infantry, tank, and reconnaissance battalions based on the doctrinally prescribed composition of divisions, brigades, and regiments. The numbers and types of the other combat units—field artillery, air defense artillery, and combat aviation battalions—are also determined by the existence of corps, divisions, and brigades. That is, the number of field artillery battalions in a division is established by doctrine, and the number of field artillery battalions at the corps level is based on having a fixed number of battalions for each division. The same kind of reasoning is applied to air defense artillery battalions.

The use of existence rules to determine the mix of combat units has two major drawbacks. First, it does not take into account the availability in a theater of operations of fire support and air defense from the Air Force and Navy. Second, it does not take into account the threat and situation in possible major combat operations.[2]

IDA suggests that the number and mix of combat battalions of all kinds be established by means of joint theater-level combat simulations for each prospective theater of operations and be inputs to the TAA rather than outputs of doctrine-based fixed organizations.

IDA also suggests that the Secretary of Defense provide definite guidance on force levels for the Army (and the other Military Services) to use as a basis for its TAA process

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[2] The Army points out that CAA modeling incorporates joint capabilities that offset Army capabilities against specific threats within a situational context and that the force levels modeled in TAA are validated by the combatant commanders, whose staffs review and provide input on the concept of operations modeled for each major combat operation.

prior to the start of the process. Force levels should be based on input from Combatant Commanders, tested and validated in joint analyses, and agreed upon with the Services at the outset of the TAA.

ESTIMATION OF COMBAT PARAMETERS

In this portion of the TAA, the Center for Army Analysis conducts theater-level simulations of the anticipated scenarios to establish the timing of the arrival of units in the theaters, locations of units in the theater, operational tempo, losses of personnel and equipment, and time-phased consumption of supplies. These parameter values are used in the next phase of the process, which establishes the requirement for support units to optimize the output of the combat units. This part of the process was not examined in detail in the IDA study.

SUPPORT UNIT DETERMINATION

The next and crucial phase of the TAA is to establish the numbers and types of support units that are required to support properly the combat units of the force structure. This is accomplished by a model that uses allocation rules to relate workload to unit design capability by time. The allocation rules are expressed in mathematical terms so that the model can calculate the numbers of each type of support unit needed in the theater each day of a simulated campaign. The model calculates both direct support of combat units and support for the support units themselves.

The Army used 1,782 allocation rules that apply to its 28 functional categories of combat and support units. There are three kinds of allocation rules. Manual rules are used to insert into the force requirements unique units, such as the 3rd Infantry Regiment, which provides security for the National Capital Region and serves as a ceremonial unit. For TAA09, there were 135 manual rules. Existence rules state the numbers of units based on the existence of combat units or other support units. Existence rules are used for signal, military police, combat engineer, chemical, and military intelligence that provide combat support to the combat units. Existence rules are also used to establish the number of intermediate headquarters (battalions, brigades, and commands) required to command the subordinate companies and battalions. The rules for headquarters are based on a span of command, generally from two to five or seven subordinate units. For TAA09, there were 1,274 existence rules. Workload rules are used to generate requirements for combat service support units (transportation, maintenance, supply, field services, and personnel

services units) for which the workload and unit capability can be quantified meaningfully. For TAA09, there were 373 workload rules.[3]

The IDA survey of the use of allocation rules finds that in general the rules themselves are logical, but that the underlying consumption rate data for workload rules appears in some cases to be excessive and based on historical data that may no longer be applicable. The Army has developed an Equipment Usage Profile (EUP) methodology that provides greater precision and improved credibility to consumption rate assumptions, but has not adopted it fully to improve the TAA process or other aspects of logistical support.

IDA suggests that the EUP methodology be adopted for all classes of supplies and extended to all logistical planning as well as the entire TAA support unit determination process.

Another problem that appears in the support unit determination part of the TAA is provision of Army Support to Other Services. The Army is required by DoD directives and Combatant Command war plans to provide common support for the Air Force and Navy in a theater of operations. The Army, for example, takes care of all enemy prisoners of war in a theater. The Army also provides chemical support for the Marine Corps. Altogether, the Army is responsible for 12 support functions for other Services. The problem is that the other Services hesitate to specify their needs to the Army as a basis for programming, presumably because they fear their own budgets will be cut. The Army does not like to provide this support, again because it might be cut as excess to Army needs (which it is). It makes good sense to avoid redundant support by having the Army provide certain kinds of support to the Air Force and Marine Corps in theaters of operations, but the Army should not suffer from having to do this.[4] The Army cannot solve this problem by itself.

IDA suggests that the Secretary of Defense designate an official to work with the Combatant Commanders to establish common policies and firm requirements for support arrangements in theaters of operations and assure that these cross-Service requirements are noted as such in the program and budget review process.

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3 In preparation for TAA11, the Army reviewed all of the allocation rules, eliminated some, and modified some. The Army intends to convert some existence rules to workload rules.

4 The Air Force also provides the Army support, such as intra-theater airlift, for which it programs and budgets.

APPLYING MANPOWER AND FUNDING CONSTRAINTS

The product of the first three phases of TAA09 was a list of all units the Army believed are required to carry out the guidance of the Secretary of Defense. The next step is to place the funding and manpower strength constraints on the required force structure. Since the required force structure always exceeds the funded force structure, this part of the process involves making decisions as to what part of the requirement is not funded.

In this phase, the Army compares the required force structure with the current actual force structure by matching the SRCs, or unit types.[5] Units to be funded are allocated to the active Army, National Guard, and Army Reserve in an effort to match the existing force structure to the extent that makes sense. When the current force structure has to be changed to accommodate new unit designs or equipment, a force structure change is entered into the force structure database to schedule a unit conversion, inactivation, or activation. The timing of the force structure action depends on the availability of trained personnel and equipment.

Required units that are not to be funded are listed in Compo 4, which is in effect a list of units that the TAA identifies as needed but the Army cannot afford. The difference between the funded force structure and the required force structure is either a measure of the amount of risk that the Army is willing to accept or an indicator of the Army's need for external support.

External support allows the Army to rely on support from other than their own military units. The Army has always used local hire personnel, contractors, host nation support, and allies to provide support in a theater of operations. Reasonable estimates of available host nation support make it possible to eliminate some military support units and still provide the required amounts of support in a theater of operations. However, procedural rules that limit host nation support offsets to formal treaties have negated this trade-off in recent years. This issue also cannot be solved by the Army alone.

IDA suggests that the theater commanders be required to conduct logistical preparations of their theaters to estimate the amounts and kinds of external support they can count on during potential campaigns. These estimates of external support should be provided to the Army (and the other Services) at the outset of each TAA so that the Army may address support unit requirements in a more realistic manner.

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5 The SRC stands for a Standard Requirements Code, which identifies a specific unit type by TOE number.

GENERAL OBSERVATIONS

The Army has made minor improvements in the TAA process in recent years, but more improvement is needed. Most of the recommendations from the 1996 IDA study were not made. The process is complex and requires a significant investment in time and effort. It is conducted in a hierarchical manner with committees achieving agreement at multiple levels. This approach emphasizes compromise and negotiations, and the results may favor the skills of the participants more than the needs of the Army and the Combatant Commanders. The process has become more complicated and detailed, but it might be better to simplify it and be satisfied with less precise estimates that are roughly right.

Most importantly, the Army builds a force structure almost entirely based on its own doctrine and desires with insufficient consultation with the ultimate users of that force structure—the Combatant Commanders. The Army does consult with the component commanders of the unified commands, but basically, the TAA is an Army process that reflects what the Army believes is best for the Nation.[6]

IDA suggests that the Combatant Commanders responsible for fighting the campaigns play a larger role in the force management process of the Army and presumably of the other Services. The Secretary of Defense should revise the process by which force structures are determined and programs are formulated to assure that the desires and concerns of the Combatant Commanders are considered fully.

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6 The Army points out that CAA applies Combatant Commander plans to the greatest extent possible and provides opportunities for input and review. The Army notes that Combatant Commanders have not argued for less structure than the TAA input provides.

I. INTRODUCTION

The Office of the Secretary of Defense (OSD) asked the Institute for Defense Analyses (IDA) to review the process used to establish the force structure in Total Army Analysis 2009 (TAA09). The purpose of the review was to determine the basis for the Army's requirements stated in TAA09 and the extent to which the Army has modified the process since a previous IDA review conducted in 1996.[1]

Total Army Analysis (TAA) is the name of the process the Army uses to determine the number and types of units (battalions, companies, detachments, and headquarters) it will have. Although the entire process is commonly referred to as a TAA, this is a misnomer, for strictly speaking the TAA itself is but one part of this overall process. In this report, we use the term "TAA" to cover the entire process.

The TAA is a complicated, participatory, hierarchical process that provides the blueprint of the future Army in the form of a troop list of units by component to be funded, formed, and made available for operational missions. The process is complicated—perhaps too complicated—and works in great detail to assemble in coherent form the various forces that impel and constrain the composition of the troop list. The process is participatory in that a large number of Army personnel in the schools, operational units, and many headquarters provide the data and doctrine that are the basis for determining the troop list. The process is hierarchical in that intermediate findings are approved sequentially at several levels of detail from the bottom up and ending ultimately at the desk of the Chief of Staff for final approval. The process is also a lengthy one, taking almost 2 years to complete a full evolution as prescribed by the DoD programming process. Since the process is repeated every other year, there is a good deal of inertia, but marginal improvements, some of them significant, are made each year to improve the fidelity of the process.

Overview of the TAA Process

In the past, the TAA process was applied only to the deployable units of the Operating Force that are available to the Combatant Commanders for military operations. The Army is trying to also apply this method to establish the non-deployable units that make up the Generating Force that fulfills the Title 10 responsibilities of the Army to

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1 John C. F. Tillson et al., *Review of the Army Process for Determining Force Structure Requirements*, IDA Paper P-3189, May 1996.

raise, maintain, and sustain the units of the Expeditionary Army. Most of the emphasis is still on the deployable TOE units, which will be the subject of this brief explanation. In order to explain how the Army goes about this, we shall use TAA09, which established the Army that is proposed in the FY04 POM and Budget.

The TAA process includes five major steps, which proceed more or less in sequence from the initiation of the process until the completion of a program objective memorandum (POM). The Army calls the first three of these the "Requirements Determination Phase," and the last two, the "Resourcing Phase." The Requirements Determination Phase of the TAA process establishes the total number and mix of units needed, in the view of the Army, to conform to the guidance issued by OSD. Requirements are stated in terms of unit types only. Allocation to components is done in the Resourcing Phase. The five steps of the TAA are as follows.

Force Level Determination. In this step, the number and types of major combat formations (divisions, combat brigades, cavalry regiments) the Army is to have are determined based on estimates of forces required to execute the strategy. The "strategy" that assigns missions and priorities to the Army is stated in several OSD and Joint Staff documents, such as the National Security Strategy (NSS), Defense Planning Guidance (DPG), Contingency Planning Guidance (CPG), the Quadrennial Defense Reviews (QDRs) (every 4 years), a National Military Strategy (NMS) prepared by the Joint Staff, operational plans, and numerous other documents that present and expand on various aspects of what the Army needs to make available for use by the Combatant Commanders. The Strategic Plans and Policy Directorate of the Office of the Deputy Chief of Staff, G-3, accomplishes this step.

Estimation of Combat Parameters. This step consists of gaming major combat operations in a theater combat simulation to establish battlefield locations; operating tempos; loss rates for personnel and major end items of equipment; consumption rates for fuel, water, ammunition, and other supplies; and other parameter values that influence the determination of support units. In the past, this was done for all of the major combat formations in accordance with planning scenarios postulated by OSD, but the appearance of missions not involving major combat operations requires assuming the conditions under which these new operations (smaller-scale contingencies, homeland security, deterrence) will be performed. The Center for Army Analysis accomplishes this step.

Support Unit Determination. Establish the numbers and types of support units needed to sustain the operations of the combat organizations. This part of the process uses allocation rules that relate the numbers and types of support units arithmetically to the

numbers and types of major combat organizations. The major combat formations and the combat parameter values from the two previous steps are subject to an algorithm that computes the first-order support units and second-order support units needed to support the first-order support units. The intermediate product of the TAA at the end of this step is a troop list of all TOE units the Army believes are "required" to carry out the strategy and support the major combat formations. The Force Development Directorate of the Office of the Deputy Chief of Staff, G-3, accomplishes this step.

Application of Anticipated Constraints. In this step, requirements are matched with the existing force structure, and the units are stratified into three funded components (1, Active; 2, Army National Guard; 3, Army Reserve) and Compo 4, which is a list of unfunded units. Trade-offs are made to find a best fit within manpower constraints, new item procurement schedules, and budget dollars. A schedule for converting the existing set of units into the desired set of units 7 years later is established to provide a basis for accessing and training personnel and procuring and distributing both old and new equipment items. The result of this step is a list of all funded units and a timetable for converting the existing force into the desired force. The Force Development Directorate of the Office of the Deputy Chief of Staff, G3 accomplishes this step.

Conversion to Program Language. In this final step, the funded troop list and associated personnel and equipment programs are converted into Future Years Defense Program and budget language to provide the basis for the Army's Program Objective Memorandum (POM). The POM itself is converted later into the Army's proposed budget for a particular fiscal year. As fiscal realities are applied and OSD, OMB, and the Congress review the POM and budget, changes are made to the force structure and resources the Army will have. The product of this step is the set of units that the Army is authorized for the budget fiscal year. The Program Analysis and Evaluation Directorate of the Office of the Deputy Chief of Staff, G8, accomplishes this step.

Forces Acting on the TAA Process

The TAA process is an open system, and multiple forces act upon it at several times and locations during its evolution. The major forces that act on the force management process include doctrine, unit designs, OSD guidance, policy and mission guidance, program and budget guidance, budget reviews, and the current force structure. Other forces that act on the TAA include delivery schedules for new equipment, availability of trained personnel, personnel management changes, and organizational alignments.

Doctrine is a description, written and unwritten, that says how the Army fights and operates to accomplish assigned missions. It is a living set of rules that changes constantly but comprises coherent guidance that influences how the commanders, officers, noncommissioned officers, and enlisted personnel behave under a given set of circumstances. Doctrine is required to allow individual soldiers, teams, units, and large organizations to act in accord to achieve common goals. Doctrine may be good or bad, but there is always doctrine. When doctrine is changing, as is the case now owing to transformation efforts, the force structure also changes to reflect a transition from one set of rules to another. Doctrine influences the force management process by providing the foundation for the allocation rules that are applied in the process.

Units are the building blocks of the force structure. One major product of doctrine is the set of units designed to carry out that doctrine. In the Army lexicon, a Standard Requirements Code (SRC) designates a specific type of unit.[2] The design of the squads, platoons, detachments, companies, battalions, and headquarters constrains the possible choices of the force managers when organizations (sets of units) and forces (units associated by a common mission) are considered or determined. Such unit design choices as the number of tanks in a tank company, the number of artillery pieces in a battery, and the amount of maintenance capability to be placed at the battalion level all influence the numbers and types of units selected to comprise a combined arms organization (such as a corps, division, or brigade) and the composition of the troop list. There is a great deal of interaction between the unit designers and force managers as new technology and new doctrine are introduced. Each new unit design requires adjustments in the troop list. One of the problems facing the force managers is the presence in the force structure of different sets of units reflecting different doctrines—the Army of Excellence, Force XXI, the Interim Force, and (soon) the Objective Force. The rate at which the Army can convert older units into new units depends on equipment availability and the extent to which the personnel system can provide personnel trained in the appropriate skills. There is a time lag between the time that a unit is conceived and entered into the force program and when it enters the force structure ready to go.

Policy and mission guidance from on high is a major influence in the force management process. The President, Secretary of Defense, staff officers in the Office of

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[2] The SRC is composed of three elements. The first two digits indicate the functional area or branch, the next three digits indicate the unit type, a letter indicates the TOE series, and the last three digits indicate a variation. Thus, SRC 03-375L100 indicates a chemical unit (03), a reconnaissance and decontamination company, the L series of TOEs, and the version in that series.

the Secretary of Defense, and others (including Congress) all tell the Army (and the other Services) what they are supposed to be able to do and often how to do it. Emanating from different sources at different times, the guidance is sometimes contradictory and even confusing. For the TAA09 process, the guidance was particularly difficult to follow, in part because key guidance documents were not completed and other guidance documents arrived late, forcing retroactive adjustments in process steps already taken.

Program and budget guidance is issued by the Secretary of Defense and amplified by the Secretary of the Army to provide the basis for preparing the Army's Program Objective Memorandum (POM), which is the basis for the formulation of the President's Budget Request. The effect of program guidance is to place funding and resource constraints on the troop list. The major constraints are limits on funding and ceilings on military strength by component—Active, National Guard, and Army Reserve. Numerous smaller resource constraints in law or policy further complicate the task of creating a troop list that makes good sense. Since these constraints are applied at different places in the process, they have different effects. Most resource constraints are applied en masse to reduce a required force structure to a resourced force structure.

Budget reviews act on the POM Force to force it into the size and shape approved by the Administration and authorized and funded by Congress. Although most budget adjustments are made on the margin, some of the congressionally mandated changes can be substantial and may require significant adjustment of the troop list.

The current force structure is a major factor in the force management process. In the constrained environment in which the Army operates, a new unit can be activated only by inactivating an old unit, and changes in unit strength and equipment can be made only by trading off spaces and procurement dollars from other units. The future troop list can be created only by making changes (force structure actions) to the current troop list. This is the process of force programming. In effect, the Army faces a zero-sum game in which an increase in one function has to be accompanied by a decrease in another function. The Army applies resource constraints in accordance with senior leader priorties.

Special Characteristics of TAA09

TAA09 has some special characteristics that differentiate it from earlier TAAs and make it somewhat unrepresentative:

- Time available for TAA09 was shorter than the normal process. A TAA is conducted every 2 years, and the normal time for the process is 24 months. TAA09 was done in 15 months.
- A new strategy was announced in early 2001 that changed the force-sizing construct. Previous strategies had focused on having a capability to wage two major wars, with other operations to be accomplished by forces included in those maintained for the two wars. For TAA09, for the first time the Army believed it could maintain, in addition to those for major combat operations, separate forces for smaller-scale contingencies, transformation, and homeland security.
- OSD documents were issued sequentially and did not provide definitive guidance on major combat formations. For TAA09, the National Security Strategy (1999) was out of date. The QDR (September 2001), which was the primary basis for the Army's strategic plan, provided only general guidance. The DPG for FY04 was issued in April 2002, after the TAA09 process was essentially done. The Army in effect was latching onto the latest guidance from on high looking for signs as to what should be done. Also, previous DPGs had specified the divisions, brigades, and cavalry regiments the Army could have. However, neither the QDR nor DPG specified the major combat forces for the Army. For TAA09 (and TAA11) the Army had to compose its own list of combat forces to meet the strategy.

Organization of the Report

The balance of this report is divided into four sections. Section II deals with the part of the process that establishes the numbers and types of major combat formations. Section III deals with the determination of the required numbers and types of support units for the combat units. Section IV discusses how comparing requirements with the current force structure and applying resource constraints create a resource-constrained force structure to serve as the basis for the program and budget. Finally, Section V provides some overall observations on the process.

The report does not address two major parts of the TAA process. We do not address in detail the way in which the Center for Army Analysis establishes the combat parameters by simulating major combat operations. We also do not address the programming or budgeting aspects of the force management process.

In the course of preparing this report, we consulted with numerous Army personnel who invariably were informative and helpful. We listened to several informative briefings. A complete listing of those personnel and briefings is in Appendix A.

II. DETERMINATION OF THE NUMBER AND MIX OF COMBAT UNITS

The TAA process starts upon receipt of a mission or missions to be accomplished. In this case, the missions are sent to the Army from the President (as Commander-in-Chief) and the Secretary of Defense in several guidance documents.

Guidance

The highest level of guidance is promulgated by the President in the National Security Strategy (NSS), which is intended to inform the Government and the Nation of the goals and methods for assuring the security of the United States. This document is supposed to provide the basis upon which the Secretary of Defense issues more specific guidance that shapes the Defense Program and Budget and missions and instructions for the Combatant Commanders. For TAA09, the existing NSS was of little use because it was 3 years old and represented the views of the previous administration.

Within DoD, three major guidance systems provide the Services and the Combatant Commanders direction and guidance they use to prepare their own plans and programs.

The DoD Planning, Programming, and Budgeting System (PPBS) is the process by which OSD guides the preparation of the DoD budget for submission annually to OMB, and then to the Congress. The Defense Planning Guidance sets forth to the Services the strategic concept and the force-structuring construct to be used by the Services to build their forces for the forthcoming budget cycle. OSD also prepares Contingency Planning Guidance, which informs the Combatant Commanders of the operations for which they should plan and the general policies for such plans. As part of the PPBS, the Services prepare their Program Objective Memorandums (POM), which—

after a series of reviews and negotiations—are transformed into the DoD Budget sent to the President for his consideration and revision, then to the Congress for authorization and funding.

The Joint Strategic Planning System (JSPS) is the process by which the Joint Chiefs of Staff and the Combatant Commanders, under the leadership of the Chairman, provide "advice and assistance" to the President and Secretary of Defense on military strategy, critical force capability deficiencies, program recommendations, and budget proposals.[3] The major documents in the JSPS are the National Military Strategy (NMS), the Joint Strategic Capabilities Plan (JSCP), and three documents that comment on the DoD program (Joint Planning Document, Chairman's Program Assessment, and the Chairman's Program Recommendation). Except for the JSCP, which deals with the current force structure, these plans and documents address the future force structure.

The Joint Operational Planning and Execution System (JOPES) is the process by which the Joint Chiefs of Staff and the Combatant Commanders prepare plans to carry out missions assigned to them by the President using currently available forces and resources. JOPES is put into effect by numerous operations plans, concept plans, functional plans, and theater engagement plans. These plans and documents all deal with employing the current force structure.

The Army used elements from all three of these major planning systems to provide the basis for determining its force structure—and specifically for establishing the major combat formations (corps, divisions, brigades, and regiments) to be postulated as the starting point of the TAA09 process. For the Requirements Phase of TAA09, the following guidance documents were considered: Terms of Reference, June 2001; National Military Strategy in draft; Joint Strategic Capabilities Plan, July 2001; the Quadrennial Defense Review, September 2001; Contingency Planning Guidance, April 2002; and both the August 2001 and April 2002 versions of the Defense Planning Guidance.[4] The Army also considered to some extent the 16 operations plans, 43 concept plans, 13 functional plans, and 6 theater engagement plans in effect during the process.[5] These guidance documents appear in sequence and thus affect different parts of the force

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3 CJCSI Instruction, 3100.01A, Joint Strategic Planning System, 1 September 1999.

4 Briefing for the Army Science Board, Total Army Analysis 2009, DAMO-FM, 24 April 2002.

5 Briefing, TAA09 Strategy Discussion, Office Chief of Army Reserve, Office of Strategic Initiatives, 14 February 2002.

management process—possibly with slightly different guidance. Moreover, not all of them were intended or are appropriate to provide a basis for the force management process.

The Army prepares The Army Plan (TAP), which defines the "types and quantities" of above-the-line units in the operating forces. The primary bases for the TAP are the NMS, the DPG, and—when available—a QDR. The Army regards the National Military Strategy as an authoritative document that "describes the strategic environment, develops national military objectives, and describes the military capability required to execute (at prudent risk) the strategy."[6] The TAP is supposed to be based on a DPG that specifies the number and types of divisions, the authorized levels of organization, and an end-fiscal year strength constraint."[7] But the April 2002 DPG did not establish the numbers and types of divisions or the authorized level of organization. It did specify that the Army military end-fiscal year strength would remain constant.

Army planners, faced with a plethora of guidance for TAA09, were able to "pick and choose," but they risked inconsistency when using documents from three systems, each of which is designed for a different function. The National Military Strategy, for example, is not a directive but merely constitutes the advice of the Chairman of the Joint Chiefs of Staff to the Secretary of Defense. Although the instinctive desire of military personnel is to take seriously a military document prepared by military leaders, it is the Secretary's guidance prepared by a predominately civilian staff that provides the authoritative guidance. The Army also consults and relies on the Joint Strategic Capabilities Plan for some direction, but the JSCP is a device for allocating existing forces and has little to say about future forces. The Army also relies to some extent on other current plans in JOPES, but like the JSCP, these have to do with the best use of existing forces rather than the shape of the future force. While it may be useful to consult JSPS and JOPES documents for insights, the Army would be better off to rely on PPBES documents for authoritative guidance.

For TAA09, the major influence on The Army Plan was the QDR for 2001. This document describes the current forces of the Army as a "baseline from which the Department will develop a transformation force for the future."[8] The Army inferred from

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6 US Army War College, "How the Army Runs: A Senior Leader Reference Handbook," 1 April 1999, pp. 5-18 to 5-19.

7 Ibid. Jim Adams comments that the TAA is normally well underway before the TAP is finished, and that the TAP often precedes the DPG.

8 Quadrennial Defense Review (QDR) Report, 30 September 2001, p. 22.

this document the existence of a "Defense Strategy" similar to the National Security Strategy or National Military Strategy. The force structure construct in the QDR says that the Services are to have the capability to do the following in order of priority:[9]

- Defend the United States.
- Deter aggression and coercion forward in critical areas.
- Swiftly defeat aggression in overlapping major conflicts while preserving for the President the option to call for a decisive victory in one of those conflicts, including the possibility of regime change or occupation.
- Conduct a limited number of smaller-scale contingency operations.
- Maintain a strategic reserve to mitigate risk.
- Maintain sufficient force generation capability.

These statements provide the basis for the remainder of the process. For TAA09, as has been noted earlier, OSD did not provide specific guidance on the numbers and types of combat formations (corps, divisions, brigades, and regiments) that the Army would be allowed to have. This lack of specific guidance made it necessary for the Army to formulate the combat formations that it would devote to each of the missions listed above. The results of the Army's deliberations on combat formations are shown in the simultaneity stack that the Army devised to illustrate the content of its force structure.

The Simultaneity Stack

The Simultaneity Stack is a relatively new part of the process. In Cold War days, the Army force structure was designed for a global war with the Soviet Union, and the Army designed its force structure primarily to execute the European Command 4102 Plan, which called for deployment of the bulk of the Army to Europe. The capability to perform other missions, such as what are now called smaller-scale contingencies (SSCs), were assumed to be included in the force structure provided for "the big one." During the 1990s, the basic force-sizing construct called for the capability to wage two "regional wars" simultaneously.[10] This construct also did not provide for SSC forces apart from those needed for the major combat operations. The current strategy leads to a more complex force-sizing construct and requires the Army to plan forces specifically for SSCs.

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9 TAA Briefing. These points were derived from the Quadrennial Defense Review (QDR) Report, 30 September 2001, page 17.

10 The names of these operations changed according to the preferences of the strategists in charge from major regional conflicts, to major theater wars, to major combat operations, but the conflicts remained the same.

After the 911 attacks, Homeland Security became the top priority of DoD, and forces for that mission were also allowed to exist apart from those for SSCs and Major Combat Operations (MCOs). The missions for which the Army had to design its forces became more complicated and some of these forces would be mutually exclusive to the extent that it became necessary to consider explicitly the missions that the Army would have to accomplish simultaneously.

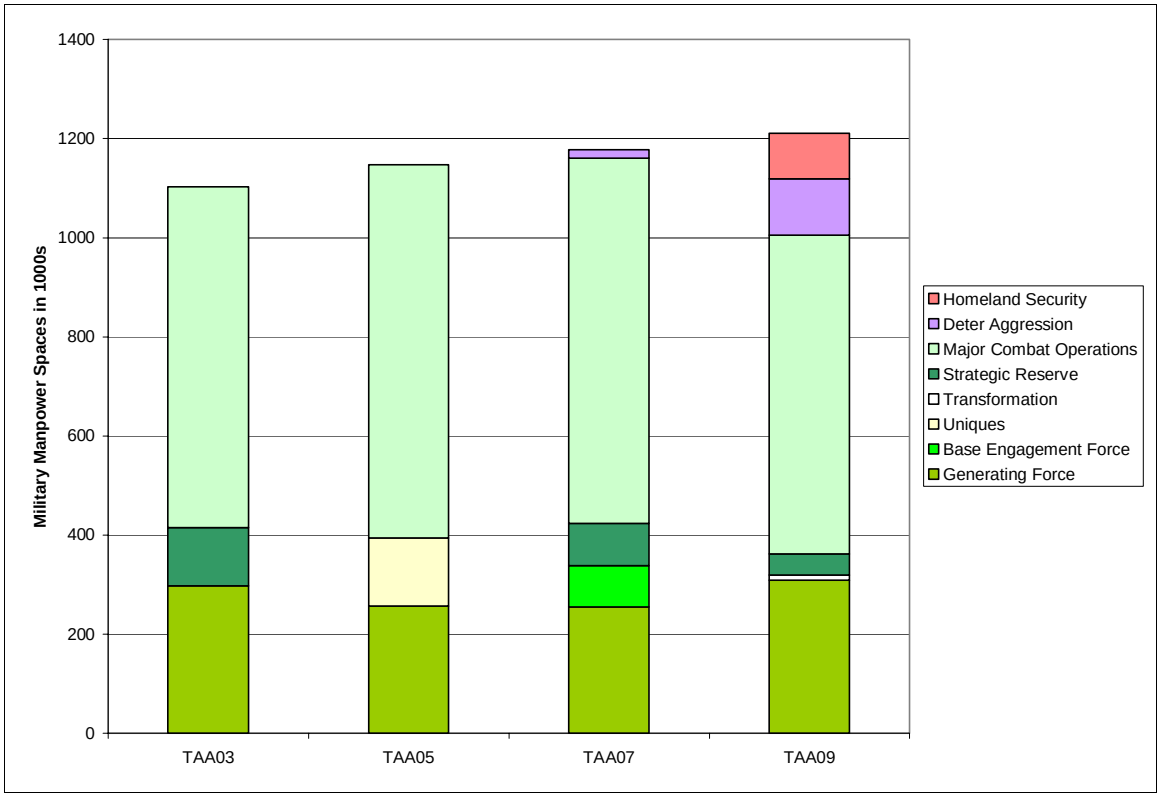

Figure 1. Comparative Simultaneity Stacks

The Simultaneity Stack was first used for TAA07 and continued for TAA09. Figure 1 shows those two stacks and ones for TAA03 and TAA05 that have been created for comparative purposes. The comparison is not exact, for the Army changed the force packages of the Simultaneity Stack as it evolved from TAA03.

- For TAA03, the process addressed only the requirement to wage two near simultaneous theater wars and asserted that 672,000 soldiers would be needed

to do that. The stack shown above was completed by adding 117,000 soldiers in eight National Guard Divisions as a strategic reserve and 309,000 soldiers in the Generating Force.[11]

- For TAA05, the Army made for the first time a distinction between forces for the "war fight" and "uniques," which were requirements other than the war fight. The uniques included support for the unified commands, smaller-scale contingencies, a strategic reserve of six National Guard Divisions, and several ongoing programs, such as counterdrug and counterterrorism. There was also a base generating force of 138,000 military spaces to mobilize, deploy, and train the war fighting units.[12] There was an additional requirement for 115,000 military spaces in TDA units. The sum of these packages was the total requirement of 1,127,000 military spaces.[13]
- For TAA07, the Army continued to refine the Simultaneity Stack by allocating 17,000 military spaces to smaller-scale contingencies and 85,000 spaces to provide a Strategic Reserve, Homeland Defense, and domestic support package that could be dual missioned to meet other needs. A base engagement force of 84,000 spaces was provided to mobilize, deploy, and train the war fighting units.[14] Finally, a base generating force of 255,000 spaces completed the total military manpower requirements of 1,178,000 military manpower spaces.
- For TAA09, the Army provided a force package for each of the missions stated in the guidance. By doing this, the Army completed the transition from a single mission force structure dedicated solely to major conflicts (with all other missions assumed to be lesser included cases) to a set of articulated force packages designed to do several different things at the same time in accordance with the guidance from OSD.

The major elements of the Simultaneity Stack for TAA09 and the military and civilian strengths associated with it are shown in Table 1, below. The six major force packages of the Simultaneity Stack are derived directly from the force-sizing construct in

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11 Tillson et al., IDA Paper P-3189, p. 6.

12 For TAA07 the term "base generating force" was used to denote the general overhead of the Army devoted to Title 10 functions, and the term "base expeditionary force" was applied to assisting the deployment of the war fighting units. For TAA09, both of these packages were consolidated in the "generating force."

13 Information on the stacks for TAA05 is obtained from undated briefing charts provided by DAMO-FM.

14 DAMO-FM briefing slides. There are several versions of the TAA07 stack, each with slightly different data according to the progress of the decision process.

the QDR Report.[15] Most of these force packages have second-order force packages that are addressed separately in the process; these will be explained below.

Table 1. Approved Simultaneity Stack for TAA09
(Personnel in 000s)

Force Package	Military	Civilian	Contractor	Total
Homeland Security	92	1		93
Deter Aggression	114	48	15	177
Major Combat Operations	643			643
Strategic Reserve	43			43
Transformation	10			10
Generating Force	309	228	217	754
Total Requirements	1,211	277	232	1,720

One important consequence of the Simultaneity Stack is that different methods are used for determining the units needed for the various elements of the stack. The general approaches are shown in Table 2. Support units for major combat operations are determined by a process that uses a theater combat simulation (CEM) to determine the conditions of the operations and a logistical support model (FASTALS) to determine the numbers and types of support units required to support the operations. In TAA09, this CEM-FASTALS process was used for two-thirds of the operating forces and one-third of the total force structure. Smaller elements of the stack are configured according to planning documents that produce troop lists called Mission Task Organized Forces (MTOFs) for assumed scenarios.

Table 2. TAA09 Simultaneity Stack Methodology by Force Package

	Combat Units	Support Units
Homeland Security	Homeland Security MTOFs	MTOFs and Current Programs
Deter Aggression	Current Operations/Treaties	Current Operations
Major Combat Operations	TAA07	CEM + FASTALS
Strategic Reserve	Contingencies Beyond Planning	Contingencies Beyond Planning
Transformation	Transformation Program	Transformation Program
Generating Force	n/a	Workload Estimates

[15] Quadrennial Defense Review (QDR) Report, 30 September 2001, pp. 60–65.

Homeland Security

The Homeland Security mission area was DoD's first priority mission for TAA09. However, the program to accomplish that mission had not been formulated, and the guidance on this element was vague. In the absence of definitive guidance, the Army assembled candidate programs categorized into the subelements shown in Table 3. The inclusion of current programs for counterdrug program, missile defense, and information assurance appears to be reasonable. The provision of 8,300 spaces for critical infrastructure protection and 77,800 spaces for managing the consequences of WMD attacks needs to be explained in more detail.

Table 3. Subelements of TAA09 Homeland Security Force Package (Personnel in 000s)

	Personnel	Methodology
Defense of Sovereign Territory		
Critical Infrastructure Protection	8.3	Force Protection Needs (Partial)
Counterdrug Program	0.5	Current Program
Missile Defense	5.8	Current Programs + Some ADA
Information Assurance	1.5	Current Program
WMD Consequence Management	77.8	MTOFS for WMD Attacks

The Army used MTOFs to establish the requirement for managing the consequences of two simultaneous WMD attacks. The Army says that the basis for assuming a requirement to deal with two simultaneous attacks was historical precedent. It will be necessary to learn the composition of these WMD consequence management force packages before an evaluation can be accomplished. This element of Homeland Security provides for 5 brigade combat teams and 20 light infantry battalions for duty in the United States but also capable of deploying to a theater of operations if necessary. The Army has designed but not yet adopted a mobile light infantry brigade for the National Guard to be multipurpose organizations for Homeland Security, SSCs, or Major Combat Operations.

The 8,300 military personnel for critical infrastructure protection is a partial allocation for force protection of Army or DoD installations or other facilities critical for DoD operations. However, this number does not include all of the military personnel that would be needed to provide physical security at military bases, and it can be anticipated that some additional allocation will be made for this mission in a future TAA.

Questions remain about the Army's stated requirements for Homeland Security. This is the first priority mission for DoD, but the absence of more definitive guidance and

qualitative task analysis made it difficult for the Army to establish the number and mix of units required for this mission. The Army did allocate many of the units for this mission to other missions in a dual status.

Deterring Aggression

In order to accomplish the mission of deterring aggression, the Army has designated units to support the unified commands and conduct smaller-scale contingencies in critical regions.

The Army allocates 25,000 manpower spaces and 3 BCTs to conduct future SSCs in critical regions. The size and composition of this force package is based on current deployments to Bosnia (SFOR), Kosovo (KFOR), Kuwait (ODS), and the Sinai (MFOR). While it is reasonable to suppose that the United States will be supporting these kinds of operations in the future, it is not necessarily reasonable to project current forces into that future. Nevertheless, there appears to be no better way available to serve as the basis for this force package. It appears that the QDR does allow the Services to provide forces for SSCs in addition to those intended for major combat operations. Forces in Bosnia, Kosovo, and Sinai are not going to be readily available for major combat operations and do constitute a separate requirement. However, the Kuwait force is in reality a forward deployed element of any force for a major combat operation in the Middle East and is not engaged in a smaller-scale contingency.

The Army includes in this force package a requirement for 2,000 non-unit military spaces to provide a rotation base for the units involved in these SSCs. The justification for this addition to the individuals accounts is not known.

This appears to be a legitimate mission area that ought to be resourced, but the Army could improve both the composition and the justification for the units maintained for the mission. The actual units to be employed on these missions will depend on what is available when the missions start. If the Army continues a 6-month unit rotation policy for these SSCs, the brigade combat teams and support units for them need to be fungible with units maintained for major combat operations.

The Army posits a requirement for 152,000 military, civilian, and contractor spaces to support the unified commands, as shown in Table 4. Similar requirements for Joint Forces Command are listed in the Homeland Security and Generating Forces package. Northern Command was formed subsequent to the development of the TAA09 and was not considered in this package.

Table 4. Manpower Requirements for Unified Command Support (000s of spaces)

Theater	Military	Civilian	Contractor	Total
CENTCOM	0.6	0.3	0.0	0.9
EUCOM	57.2	23.7	11.5	92.4
SOUTHCOM	4.5	1.3	0.4	6.2
PACOM (-)	18.4	11.5	2.0	31.9
CFCOM (Korea)	2.4	10.2	0.8	13.4
SOCOM	6.1	0.0	0.0	6.1
TRANSCOM	0.2	0.5	0.0	0.7
Total	89.4	47.5	14.7	151.6

Each of the allocations for unified command support (what the Army terms "daily requirements") includes three kinds of support:

- Manpower for the Army Service Component Command Headquarters.
- TDA units needed day-to-day as the "generating force" for the unified commands.
- TOE Operating Forces (units) needed by the unified commands to accomplish their assigned missions on a day-to-day basis.

The Army considers some personnel and units located overseas in certain unified command areas of operations to be in support of the deter aggression mission rather than the force generating mission, which is engaged in the Army's Title 10 functions. That is, the requirements for these personnel and units are based on the stated needs of the unified commanders. Included in this form of unified command support are Army personnel assigned to the joint headquarters and activities, to Army major headquarters, and to base operations and other administrative and logistical activities. Most of the TDA support units in this package are located in European Command and Pacific Command (including Korea).

In addition to the TDA support units, the Army dedicates certain TOE units to unified commands in support of their day-to-day missions. This applies primarily to European Command, for whom the Army justifies a corps headquarters, a heavy division, an airborne brigade, and some support units as being required to meet NATO commitments to maintain certain forces in Europe. This is not necessarily binding on specific units. In the case of the heavy division, the Army could deploy a division from Germany to another location and backfill in Germany with mobilized National Guard brigades from the United States.

Major Combat Operations

The Major Combat Operations (MCO) element of the Simultaneity Stack is the largest in terms of military personnel and combat organizations. The Army says that it requires 643,000 military spaces to meet the guidance. QDR2001 and the DPG says that the force sizing construct is to be able to "swiftly defeat aggression in overlapping major conflicts," achieving a decisive victory in one conflict while defeating the efforts of the enemy in the second conflict by blunting the attack and achieving a stalemate. Presumably, when the United States wins quickly in the initial, decisive victory theater, some of the forces employed there will be diverted to the second theater to achieve victory there. The Army adds to this a requirement to defeat terrorism worldwide.

The force package for fighting terrorism consists of an airborne division and the ranger regiment. This force appears to be based on fighting a war similar to the 2001 Afghan Campaign. It would be rapidly deployable and capable of fighting light forces such as those encountered in Afghanistan. This force package is not mentioned specifically in the QDR or DPG guidance.

The force package for a theater in which a decisive victory is to be achieved is based on a war in Korea. For TAA09, the Army used the same forces as were used for that scenario in TAA07, which amounted to 2 corps with 5-1/3 divisions and 8 enhanced separate brigades. The Army added two divisions to these forces that are labeled as for "post-hostilities." Presumably, after the decisive victory has been achieved these divisions would replace two or more other divisions that would be redeployed to the other theater to achieve a victory there.

The force package for a theater in which the initial goal is to defeat the efforts of the enemy to win is based on a Southwest Asia Scenario. The forces deemed to be sufficient to achieve a stalemate in this scenario consist of one corps with 3-1/3 divisions and 5 enhanced separate brigades.

Table 5 shows the major combat organizations and total military strength allocated to the three major force packages of the MCO mission.[16] Table 6 shows the number of military spaces devoted to major combat operations in TAA09 compared with three earlier TAAs.

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[16] Translation of the canonical forces stated in terms of division equivalents and enhanced separate brigades into specific numbers of BCTs and ACRs differs slightly from the Table 5 numbers, which are based on the Army's allocation of these forces.

Table 5. TAA09 Major Combat Operations Force Packages
(Military Personnel Authorizations in 000s)

Force Package	Corps Hq	Division Hq	BCTs	ACRs	Military Strength
Defeat Terrorism		1	4		32
Decisive Victory	2	7	25	1	364
Defeat the Efforts	1	3	15	1	248
Total MCOs	3	11	44	2	643

Details do not add to totals due to rounding.

Table 6. Requirements for Major Combat Operations in Recent TAAs
(Military Personnel Authorizations in 000s)

	Spaces	Guidance
TAA03	688,000	Two near simultaneous major regional wars
TAA05	753.000	Two near simultaneous major regional wars
TAA07	737,000	Fight and win two major theater wars
TAA09	643,000	Two overlapping conflicts; win one fast; stalemate other

Strategic Reserve

According to the Army, neither the QDR nor the other guidance documents addressed or authorized a Strategic Reserve. However, the Army thought it prudent to include a force package for a Strategic Reserve. The content of the Army's proposed Strategic Reserve is shown in Table 7. According to the Army, this Strategic Reserve is a list of "units initially uncommitted."

The Strategic Reserve as constituted in TAA09 is not a balanced force, and its utility is severely limited. The Army describes the Strategic Reserve as consisting of two divisions with echelons above division support for one, but that is not the case. As constituted the TAA09 Strategic Reserve is substantially undersupported to be able to conduct independent operations as, say, a corps, or even to be committed as a reinforcing element for an existing corps or joint task force. Other kinds of support units would have to be reallocated from other assignments to permit this two-division force to be committed to combat or even non-combat operations. It could serve as a pool from which BCTs and other support units could be sent to augment other forces, and this may be the use intended by the Army.

Table 7. TAA09 Strategic Reserve

	Spaces (000)
Combat	27.9
2 Division Headquarters	
7 Brigade Combat Teams	
Combat Support	6.7
2 Field Artillery Brigades	
2 Engineer Brigades	
2 Chemical Companies	
1 Civil Affairs Battalion	
Combat Service Support	8.6
3 Corps Support Battalion HHCs	
2 Water Battalions	
2 POL Battalions	
2 Finance Battalions	
1 Maintenance Company	
20 Truck Companies	

In recent years, there has been little serious discussion of a strategic reserve of land combat power to hedge against wrong estimates of what it would take to execute our strategy of rapid decisive combat, wars that last longer than the planning guidance stipulates, the occurrence of conflicts that we have not predicted, or the imminent rise of a peer competitor or even a near peer competitor.[17] The *raison d'etre* of a strategic reserve is to have some extra combat power available if our planning assumptions turn out to be wrong and something unanticipated happens. In a very real sense, the Strategic Reserve is the President's force—the final capability available to take advantage of an unexpected opportunity or face up to an unexpected danger.

Transformation

The Army addresses Transformation in a straightforward manner. The Army wants to set aside from the ready elements of the operating force, those units that will at any one time be transforming from the legacy force to the Interim or Objective Force TOEs. These forces would be in the process of conversion and would not be available for

[17] It is worth noting that the Navy has a de facto strategic reserve in the form of ships in overhaul, and the Air Force has a de facto strategic reserve in the form of operational support aircraft and training aircraft.

deployment while they are receiving new equipment and being trained. This is a steady state requirement until the transformation is complete. The Army places 9,500 military personnel spaces in this force package, including a division headquarters, two brigades, and a partial division base. The Army resourced 100% of this requirement in the process—the only element to be resourced fully.

Allowing units undergoing equipment conversion or overhaul to be excused from readiness requirements is consistent with the practice in the Navy and Air Force. This appears to be reasonable element in the Simultaneity Stack.

TAA09 does take into account the results of at least part of the Transformation program. The troop list for the end of FY2009 includes five Interim Brigade Combat Teams (now called Stryker Brigade Combat Teams).

Generating Force

Although the Army claims that the TAA09 addressed the Generating Force, there was little evidence of this in the briefings we received. No notable developments were presented.

As mentioned earlier, that part of the Generating Force that is used to operate installations and provide services for Army forces stationed in Europe and Korea was moved from the Generating Force to the Deter element of the stack. These personnel—mostly civilian employees—were moved from the CONUS Generating Force to a new category for Europe. In effect, the Army seeks to differentiate the cost of stationing troops and dependents in Europe from the general Title 10 costs of raising, training, and maintaining the Army as a whole to an active element of the QDR Defense Strategy. In a sense, this would reclassify these resources to a more useful form of overhead rather than just general overhead. It would also shift the onus of justifying these resources from the Service to the Combatant Commander responsible for the theater.

The Generating Force in TAA09 has remained at about the same required strength as in earlier programs despite the transfer of about 60,000 spaces (mostly civilians and contractors) to the Deter Aggression force package. This brings up the question of whether the Generating Force has expanded or not. The Army has expanded the scope and size of the Generating Force somewhat by adding some TOE units to support training centers in peacetime and wartime. These units include the 11th Cavalry Regiment at the National Training Center, three National Guard brigade combat teams, and two National Guard divisions that would support the training centers during mobilization but would be

available for other duties thereafter. However, the overall impact of the shift of theater support units and personnel in Europe and the Pacific Theater is not made clear.

Army National Guard Division Redesign Study

The Army National Guard Division Redesign Study (ADRS) is a program to convert Guard combat units into CS/CSS units.[18] The program was initiated in 1996 and originally called for converting 12 combat brigades into support units over a period of several years. In its current version, the program calls for conversion of 10 combat brigades. The ADRS is programmed to be halfway accomplished by FY07 and to be completed by FY11. Table 8 shows the combat organizations of the Army National Guard under the current program. ADRS is being conducted offline and separately from the TAA09 process. However, support units being formed in the National Guard are being selected from the Army's Compo 4 troop list to assure that they meet valid requirements.

Table 8. Army National Guard Combat Brigades under the ADRS

	FY03	FY07	FY11
Enhanced Separate Brigades	15	15	8
Divisional Brigades	24	19	22
Separate Brigades	3	2	2
Total Brigade Combat Teams	42	36	32

The genesis of the Army National Guard Division Redesign Study was an action taken in the mid-1990s to address combat support and combat service support shortfalls at echelons above division. In the early 1990s, the Army was downsized from a Cold War structure of 18 active and 10 National Guard divisions to a Base Force structure of 12 active and 8 National Guard divisions. The active Army was later reduced to 10 divisions. Cold War force structure requirements called for all active and Guard divisions to have enough CS and CSS units to sustain them in major combat operations. However, post-Cold War downsizing imposed substantial reductions in active, Guard, and Reserve military personnel strength, so that it was not possible to provide support units for all of the divisions. The 10 active divisions were included in the war plans, but the 8 National Guard divisions were not. With OSD and JCS agreement, the Army inactivated the

[18] Briefing, LTC Bob Nelson, DAMO-SSW, 23 July 2002.

CS/CSS support units that were intended to support the 8 National Guard divisions.[19] This means that from the time of the Base Force until the present, the Army has had insufficient support units to sustain all of its combat forces in prolonged combat. The ADRS is intended to remedy part of the shortfall of support units, but it will not be completed until FY2011 and even then may not result in a balanced force structure.

The way that the program was initiated and is being carried out results in some unusual configurations for divisions. In what is apparently an effort to preserve division flags, heritage, and general officer positions, the Army has agreed to bundle combat support and combat service support into faux multifunctional "brigades" to be included in multifunctional divisions. One such division would have two light infantry brigades, a heavy brigade, and two support brigades. This cumbersome command arrangement incurs excessive overhead and would require reorganization before employment. The "support brigades" do not fit into the Army's doctrine for organizing the army-in-the-field, and many of the support units would have to be reassigned to doctrinally based organizations before being deployed for an operational mission.

The ADRS confirms that the Army has insufficient CS/CSS units to support all of its combat formations in sustained military operations. The Army does not make clear exactly which of its combat formations are fully supported for military operations and which are not. It appears that the Active component combat units are fully supported, the National Guard enhanced separate brigades may be fully supported, and all or some of the National Guard divisions are either partially supported or unsupported. This situation appears to be the result of circumstance rather than a coherent plan for matching combat units and support units.

When it is completed, the ADRS conversions will alleviate the shortage of support units, but it is not clear whether the Army will at that time have a balanced force structure. In the meantime, the Army is looking for ways to employ combat divisions that do not require them to have a set of supporting units. TAA09 uses two unsupported National Guard divisions to replace active divisions in a theater during the post-hostilities phase.

Another way to get along without a full set of support units is to reconfigure some National Guard divisions for a Homeland Security role, relying on external support to sustain their domestic operations. The Army has developed for the Army National Guard a new mobile light brigade of about 3,500 soldiers with three infantry battalions and some

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[19] Jim Adams, comments on draft, September 2002. Adams also notes that the QDR1997 told the Army to balance its force structure.

support units. The new mobile light brigade is more robust than current light or air assault infantry brigades. It will also have a full brigade base with units tailored to the mobile mission. The brigade will be 100% mobile on wheeled vehicles. These brigades may be dual-missioned for homeland security duties or in the second (defeat the effort) major combat operation.

It would be useful for the Army to describe the extent to which the force packages of the Simultaneity Stack are balanced between combat and CS/CSS units.

Total Army Requirements TAA09

The Simultaneity Stack as it appears in TAA09 is an excellent device for showing the Army's assigned missions and the resources the Army believes are needed to accomplish those missions. Some improvements could be made in the internal composition of the force packages themselves, but displaying the intended uses of Army resources is a good idea. While most of the discussion in this report has been about military manpower, the Army also considers civilian employees and contract employees in its estimates of requirements. For contractors, the Army uses the metric of contract employee equivalents to provide a comparable figure with civil service employees. The sum of the Simultaneity Stack force packages is the total requirement asserted by the Army in TAA09.

Table 9 shows the military and civilian manpower spaces the Army believes are required to follow the OSD guidance for FY2011. To put these figures in perspective, the Army says that it requires 1,211,000 military personnel, but the known limits on military personnel are 1,035,000 (480,000 active, 350,000 Guard, and 205,000 Reserve). This means that the Army says it needs 176,000 more military personnel to meet the guidance than it will be able to have. The Army says it has a requirement for 277,000 civilian employees, but the FY2001 to FY2009 budgets support a civilian strength of about 223,000 on the average.

Table 9. Total Army Manpower Requirements TAA09
(Personnel Authorizations in 000s)

Element	Military	Civilian	Contract	Total
Homeland Security	92	1		93
Deterring Aggression				
CC Requirements	89	48	15	152
Critical SSCs (+ rotation)	25			25
Major Combat Operations				
Defeat Terrorism	31			31
Decisive Victory	364			364
Defeat Efforts	248			248
Strategic Reserve	43			43
Transformation	10			10
Generating Force	309	228	217	754
Total Army	1,211	277	232	1,720

Table 10 shows the major combat formations (above-the-line units) included in the Simultaneity Stack for TAA09.

Table 10. TAA09 Major Combat Formations

Stack Element	Corps Hqs	Division Hqs	Brigade Cbt Tms	Cav Regts	SF Groups
Homeland Security*			5		
Unified Command Support	1	1	5		3
Critical SSCs		2	3		
MCO – Defeat Terrorism		1	4		1
MCO – Decisive Victory	2	7	25	1	2
MCO – Defeat the Efforts	1	3	15	1	2
Strategic Reserve		2	7		
Transformation		1	2		
Generating Force			4		
Total Army	4	17	70	2	8

* Also 20 Light Infantry Battalions

The combat formations shown in Table 10 provide the basis for establishing the number and mix of support units the Army needs to sustain them in combat. They are in inputs to the theater-level combat simulation that provides combat parameters for major combat operations, and they are the major elements of forces for other missions.

The combat formations derived from this part of the TAA process do not appear to be based on a qualitative joint assessment by the Combatant Commanders of their needs

for combat units. The Army does consult the Combatant Commanders, mostly but not entirely through the Army component commanders for each unified command. We could not determine, however, whether joint war gaming or other joint analyses were used to determine an optimum mix of combat units to accomplish assigned missions against a specific threat.

It is important for the combat unit inputs to be valid, because in the rest of the TAA process the Army spends an enormous amount of energy and delves in meticulous detail to assure that the combat formations are properly supported. Combat units are the start point for the rest of the TAA process and are treated as a "given" from this point. It would be prudent for OSD to devote some effort to assure that the proposed inventory of combat units is adequate and appropriate to the needs of the Combatant Commanders before the remainder of the proposed force structure is fleshed out.

III. ESTABLISHING THE NUMBER AND MIX OF SUPPORT UNITS

One of the desirable characteristics of a force structure is "balance." This term means that the combat units that provide the combat power of a force are accompanied by the appropriate number and mix of support units to maximize the combat power of the combat units. On the one hand, combat units that are excessively supported are inefficient because support units take up spaces that could be filled with more combat units. On the other hand, combat units that are inadequately supported are risky because they can deliver less than their design level of combat power and can affect mission accomplishment adversely. It is necessary but insufficient merely to provide the necessary support; it is also necessary to assure that the support is available when the combat units need it. Determining what constitutes a time-phased balanced force is a crucial but difficult aspect of the force management process.

The army-in-the field is a system of systems. Each subsystem provides a distinct output in terms of combat power, supplies, or services. In designing the force structure, the Army tries to optimize both the output of each subsystem and the contribution each subsystem makes to the overall system. This is not easy. The primary method the Army used to determine the numbers and types of support units needed is to "fight" the combat units in a theater-level combat simulation that provides estimates of certain parameters that in turn provide the basis for the application of allocation rules in another model. For missions that do not involve major combat, the Army uses MTOFs as the basis for estimating the numbers and types of support units for a wide range of operations. Finally,

the Army estimates the numbers and types of units to carry out its wartime executive agent responsibilities to provide joint theaterwide support.

Application of Allocation Rules

The Army uses allocation rules to establish the required number of support units to be in the force structure. [20] As discussed above, the combat units and combined arms formations (brigades, divisions, and corps) are given. The allocation rules are used to provide a first estimation of the numbers and types of combat support and combat service support units needs, according to doctrine, to maximize the deliverable combat power of those combined arms formations. The process is so complex and the interactions among the system so numerous that the Army used a computer algorithm called FASTALS to perform this part of the process. This means that the rules have to be expressed numerically. As the Army says,

> An allocation rule is a machine readable statement of a unit's capability, mission and/or doctrinal employment. Normally it is an arithmetic statement that incorporates the appropriate planning factors.

Currently, 1,782 allocation rules are in use. The Army uses three general kinds of allocation rules: manual, existence, and workload.[21] For the purposes of operations in the field, the Army and force structure design, the Army regards itself as being composed of 28 subsystems, called branches or special sets. The first two digits of the SRC designate each subsystem. Table 11 shows the breakout of these 28 subsystems by the numbers and kinds of allocation rules used.

Manual Rules

Manual rules are based on guidance from the Office of the Secretary of Defense, other offline policy, and in TAA09 for combat units from the Simultaneity Stack. These requirements are manually entered into the models used to compute support unit requirements. Modeling support at the Center for Army Analysis (CAA) in support of the TAA process has historically been oriented to the echelons above division, and the start point was the manual input of all combat units as a given.

Although not shown in Table 11, all armor, cavalry, or recon (SRC 17) and most infantry (SRC 7) units are entered manually. The three infantry unit allocation rules

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20 Howard Keller, TAA11 Allocation Rule Review, 15 May 2002 (Allocation Briefing).

21 A fourth kind of allocation rule based on theater requirements is no longer used.

shown in the table are for the 3rd Infantry Regiment, the Ranger Regiment, and 11th Armored Cavalry Regiment that provides the Opposing Force (OPFOR) at the National Training Center.[22]

According to the Table 11, requirements for Air Defense Artillery (SRC 44) units are established by 14 manual rules and are inputs to the TAA process. Examination of these rules, however, reveals that they are in reality based on the existence of major army formations rather than results of analysis or combat modeling.

TAA09 allocation rules for air defense were as follows: one battalion per division; one battery per armored cavalry regiment and separate brigade; one command headquarters and headquarters company per active theater; one brigade headquarters and headquarters company per active theater; one brigade headquarters and headquarters company per corps; two SHORAD battalions per EAC brigade; three SHORAD battalions per corps brigade; and Patriot Missile Battalions based partly on brigade headquarters and partly on threat analysis of major combat operations.[23] Application of these rules for TAA09 resulted in the required force structure shown in Table 12.

The Air Defense requirements are mostly determined by the doctrinally based existence rules of so many battalions per higher headquarters. This procedure develops a requirement for air defense units that may have little to do with the threat for which these units are required. It would be preferable to determine Army air defense requirements (and the air defense requirements of the other services) by means of a joint analysis of the threat and situation in each of the possible combat theaters and scenarios.

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22 Message, Howard Keller, 14 August 2002.

23 Message, G3, 30 October 2002, w/SRC Master File for ADA units attached. The Army used for TAA09 the same allocation rules that were applied for TAA07.

Table 11. Allocation Rules for TAA09

SRC Series	Branch/Function	Manual	Existence	Workload	Total
Combat					
01	Aviation	0	41	0	41
06	Field Artillery	0	13	0	13
07	Infantry	3	0	0	3
44	Air Defense	14	0	0	14
Special Operations Forces					
31	Special Forces	0	7	0	7
33	Psychological Operations	0	10	0	10
41	Civil Affairs	1	26	0	27
Combat Support					
03	Chemical	0	49	0	49
05	Engineer	0	101	0	101
11	Signal	0	65	0	65
19	Military Police	0	99	42	141
30	Military Intelligence	0	11	0	11
34	Military Intelligence	0	11	0	11
Combat Service Support					
08	Medical	0	84	48	132
09	Ammunition Supply	1	125	21	147
10	Quartermaster	1	103	27	131
42	Quartermaster Supply	28	42	20	90
43	Maintenance	5	66	36	107
44	Transportation	63	212	135	410
Personnel Service Support					
12	Adjutant General	4	35	15	54
14	Finance	0	43	20	63
16	Chaplain	0	4	0	4
20	Military History	0	4	0	4
27	Judge Advocate	0	36	9	45
45	Public Affairs	0	11	0	11
Major Headquarters					
51	Theater Headquarters	3	4	0	7
52	Corps Headquarters	4	19	0	23
63	Logistics Headquarters	8	53	0	61
Total Army Rules		135	1,274	373	1,782

Table 12. Air Defense Artillery Force Structure TAA09

	Active	Guard	Total
Divisional Battalions	10	8	18
ACR Batteries	6	1	7
Command HHC	1	1	2
Brigade HHC	5	1	6
SHORAD Battalions	0	9	9
Patriot Battalions	10	2	12

Existence Rules

Existence rules are based on doctrine. The term "existence rule" is a misnomer, for most of these are workload related, albeit indirectly in many cases. In order to be capable of being inputted to the TAA process conducted by the Center for Army Analysis, these rules have to be in the form of an arithmetic relationship with a combat unit. This means that doctrine has to be converted into a numerical expression that fits into the FASTALS model. While the numbers are expressed in terms of a linear relationship with another unit, the rules are much more complex and concrete than the name implies. The existence rules are created for each functional area (or system) by the proponent combat developments center and school.

There are basically three sources for existence rules.

- The most prevalent source is the Basis of Allocation prescribed in Section I of the TOE (paragraph 4). These rules are usually very specific, such as "One per Theater Army or Joint Theater of Operations." These rules indicate the intent of the unit designers.
- The second most prevalent source is the capabilities statement found in Section I of the TOE (paragraph 3). For example: "Commands, controls and technically supervises three to seven battalions and their assigned/attached units."
- The least used existence rule source is based on "Off-line calculations, other decisions, other documents." For examples: the addition of a second Field Artillery Brigade, of three battalions, for each division based on a recent Army Science Board proposal. This example will be discussed later in this paper.

This section of the report provides four case studies of the use of existence rules to establish the required force structure. The four cases are intermediate headquarters, corps headquarters, field artillery brigades, and chemical units. Each of these illustrates a slightly different application.

Intermediate Headquarters

One of the simplest kinds of existence rule is that used to establish the number of battalion and brigade headquarters needed to provide proper command and control for the companies and detachments that do the work.[24] The basis for these rules is the span of control. In effect, this rule is based on the existence of subordinate units. A span of control of three to seven subordinate units translates into an existence rule that says that there would be 0.199 battalion headquarters per company or 0.199 brigade headquarters per battalion headquarters. In some cases, the number of subordinate units is limited to five, and in all cases it takes three subordinate units to generate a headquarters. The rule is applied incrementally, as shown in Table 13.

Table 13. Application of an Existence Rule for Headquarters

Subordinate Units	1	2	3	4	5	6	7	8	9	10	11	12	13
Hq Generated	0.199	0.398	0.597	0.796	0.995	1.194	1.393	1.592	1.791	1.990	2.189	2.388	2.587
Hq Required	0	0	1	1	1	1	1	2	2	2	2	2	3

This existence rule is straightforward and reasonable. It could be adjusted to provide a broader span of control, and doing so would decrease slightly the number of intermediate headquarters required for a particular set of companies and detachments. Doing this, however, depends on judgments as to what constitutes adequate command and control and not the existence rule *per se*.

Corps Headquarters

The IDA study of the TAA03 process noted that a corps headquarters carried with it about 31,000 military spaces in other units that were placed in the force structure by existence rules based on a corps headquarters. According to the Army's existence rules, each corps rated an aviation brigade, an artillery brigade, a signal brigade, military police brigade, military intelligence brigade, air defense brigade, and transportation brigade. About 20,000 of these spaces were for the aforementioned elements, and another 11,000

[24] Howard Keller, TAA-11 Allocation Rule Review, 15 May 2002.

were for support units to support them. The "cost" of a corps headquarters because of this situation changed an issue about adequate command and control into an issue about excessive support.

A corps is the highest echelon combined arms organization envisioned by the Army. In World War II, a field army was both a tactical and administrative organization composed of several corps and a full array of combat support and combat service support units. The corps was a tactical headquarters whose composition changed often as the mission and situation changed. In the later days of the Cold War, the field army echelon was eliminated, and the corps became both a tactical and administrative organization. Thus, an army corps does carry with it responsibility for the full panoply of combat support and combat service support. To perform this function adequately, the corps commander needs to have, in addition to the fairly small staff in the corps headquarters itself, subordinate commanders to provide specialized services. Responsibility for provision of combat service support will be vested in a multifunctional corps support command headquarters commanded by a brigadier general. Responsibility for provision of communications for the corps will be vested in a signal brigade headquarters commanded by a colonel. Responsibility for coordination of all engineer activities in the corps will be vested in an engineer brigade headquarters commanded by a colonel. Similar brigade-level headquarters will be needed for other functions, including chemical, military police, military intelligence, civil affairs, and personnel services. The point is that a corps is a large organization that provides a full range of functional support and requires a command structure to allow it to do so. This suggests a way to modify the existence rules to make a corps command structure more affordable while justifying the working elements on the basis of the situation.

It would be possible for the Army to change the existence rules dependent on a corps headquarters so that only the subordinate command headquarters would automatically accompany a corps headquarters.[25] The companies and battalions that do the actual work could be justified on the basis of other existence rules and workload rules. This approach would preserve the command structure for the corps but leave the mix of the other units in the corps base dependent on the scenario and the mission. Doing this would reduce the "cost" of a corps headquarters to about 3,000 spaces—all in brigade-level headquarters and headquarters companies.

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[25] Jim Adams, meeting on the TAA process, 27 June 2002.

Reducing the cost of a corps would make it easier to have enough of them to command the Army's divisions and brigades effectively. The rule of thumb is that a corps can command 6 to 15 brigade combat teams (organized into 2 to 5 divisions).[26] An Army of about 70 brigade combat teams (with 18 division headquarters) would need at least 4 corps headquarters for command and control and 4 corps bases for orderly provision of support. The Army plans to use 2 of the corps for the decisive victory conflict and 1 for the defeat the efforts conflict. The fourth corps and a base could be used to command the remaining brigade combat teams, including the brigade combat teams held for SSCs and as a strategic reserve.[27]

Field Artillery Brigades and Battalions

During TAA03, the Army adopted a new existence rule that added a second field artillery brigade and three field artillery battalions in support of each Active component division. The effect of this new rule was to add to the force structure requirement for TAA03, 10 field artillery brigade headquarters, 27 field artillery battalions, and about 15,000 military manpower spaces for the field artillery units, plus a comparable number of spaces for additional support units. This rule has remained in effect for TAA05, TAA07, and for TAA09. The Army says it is reviewing the amount of field artillery support to be provided and may adjust this rule for TAA11.

The 1996 IDA study noted the new existence rule and questioned the analytical basis for such a far-reaching action.[28] There is reason to believe that the rule was based on the experience of senior officers during Operation Desert Storm. The primary basis for doubling field artillery support for active divisions was an Army Science Board (ASB) study that "interviewed a number of senior Army generals and reviewed the results of an analysis conducted by the TRADOC Analysis Center." The IDA study comments that the TRADOC analysis "appears to anticipate high casualty rates among Army forces, especially among Army artillery units [which are] significantly higher than historical data would suggest is reasonable."[29] Although IDA recommended that further analysis of this decision was warranted, the Army has not done so.

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26 A separate brigade requires the same amount of attention by the corps commander as a division.

27 Jim Adams, October 1999 Panel Memo.

28 Tillson et al., IDA Paper P-3189, 1996, p. 24.

29 Ibid.

We have reviewed this rule and conclude that there are several possible weaknesses in its application:

- Artillery battalions can be added without having to add artillery brigade headquarters as well. One field artillery brigade headquarters has a span of control of from 3 to 7 battalions, and 3 more battalions, if needed, could have been added to the existing brigade headquarters.
- The increase in the number of battalions was accompanied by a decrease in the number of howitzers (from 24 to 18) and MLRS launchers (from 27 to 16) in each battalion. This had the effect of increasing overhead in battalion staffs and support elements more than firing capability.
- The decision did not consider adequately the increased firepower available for counterbattery fires against Soviet artillery because of the multiple launch rocket system (MLRS). The lethality of the Army's field artillery was increased significantly by the introduction of the MLRS, and it is likely that additional artillery to face foes considerably less formidable than the Soviets was simply not needed.
- The numbers and types of field artillery units to be included in the force structure should be based on joint modeling and testing of mixes of infantry, tank, reconnaissance, and other forms of fire support available to a joint force commander, including Air Force and Navy close air support.

We believe that field artillery units should not be allocated on the basis of the existence of divisions, brigades, or other combat elements. Field artillery is not a support element in the same sense as supply units or engineer units. Field artillery is an important contributor to the lethality and combat power of the force structure and should be input to the combat models in the same manner as infantry, tank, and reconnaissance units and formations.[30] Detailed discussion of field artillery requirements is in Annex B.

Chemical Units

Chemical units provide combat support to the army-in-the-field. Combat support units provide services that assist the combat forces in command and control (signal, military intelligence, some aviation) and maneuver (engineer, military police, chemical). These existence rules are based on a doctrine that establishes the kinds and proportions of these services needed to maximize the ability of the combat forces to accomplish assigned

[30] The same reasoning applies to Air Defense Units, whose numbers and mix depend on the enemy threat and other capabilities in the joint forces for theater air defense.

missions. Although they are termed "existence rules," they are based on workload—but workload that is dependent on the perceived needs of other units.

Chemical units provide three kinds of services to the combat units and the included support units:

- They detect and warn of the presence of chemical, radiological, or biological agents on the battlefield so that soldiers can take protective measures and commanders can adjust operations for the constraints of a contaminated battlefield.
- They decontaminate military equipment rendered unusable by persistent chemical or biological agents or radiation so that operations can proceed.
- They provide haze (smoke screens) using chemical obscurants to conceal the maneuver of combat forces.

Chemical companies include a decontamination (decon) capability, a reconnaissance (recon) capability, a smoke capability, or a combination. Divisional companies are designed to provide decon and smoke. Companies to be assigned to airports and seaports are designed to provide recon and decon. All chemical units have a capability for detection and warning, and some units are dedicated to the reconnaissance mission. Chemical staff augmentation teams are assigned to theater and intermediate headquarters to advise commanders on defensive measures and response to chemical, radiation, or biological attacks.

To provide these services, chemical units are established on the basis of the number of divisions, the number of corps, the number of ports in the theater of operations, and the size of a theater of operations. Table 14 shows the chemical units required for TAA09 and the distribution of those units among the components. Note that only about 60% of the requirement for chemical units (as measured by manpower spaces) is resourced. Additional detail on Chemical allocation rules and units in TAA09 is in Annex B.

Table 14. Chemical Unit Laydown for TAA09

	Active	Guard	Reserve	Resourced	Compo 4	Prepo*	Required
Units	67	61	74	202	87	5	294
Spaces	4,049	5,525	6,459	16,034	10,034	876	26,943

* Prepo stands for prepositioned equipment sets and is Component 6 in the Army's system.

Existence rules are based on workload, but the amount and kind of work to be done is estimated based on inferred demands created by other units—primarily by the combat units that provide the entire output of a force. Existence rules apply mostly to units that provide service. For units whose workload is determined by amounts and rates of movement of goods, a different kind of rule is applied.

Workload Rules

Workload Rules are used to establish requirements for units whose principal work is to receive, transport, and distribute goods—supplies. They are based on capabilities statements in Section I of TOEs and compared with FASTALS generated demands for the various classes of supplies.

One task that must be done in planning for military operations is to forecast the amounts of supplies of the various kinds that have to be provided in the theater of operations on a time-phased schedule. These forecasts determine not only the supplies to be provided but also the numbers and kinds of combat service support units needed to process, move, and distribute the supplies to the using units when they are needed. Table 15 shows the classes of supply, the kinds of supplies in each class, and three kinds of workloads that determine the amount and kinds of supplies and the timing for the arrival of these supplies in theater.

The first kind of workload is that imposed by the existence of the forces. The simplest example of this is Class I, which provides food for the troops. The amount of food to be made available is a function of the number of calories to be provided, the nutritional mix of food to provide the calories, and the number of troops to be fed in each time period of the operations. The unknown factor in calculating the requirement for food is the number of troops to be fed at each point in time after the operation starts, and this schedule has to be obtained from the FASTALS model based on the time-phased force deployment data in the war scenario for each theater.[31] The basic parameters for the other classes of supplies that depend on our own forces are noted in Table 15.

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[31] CAA uses its own Transportation Model to approximate the flow of units in the theater.

Table 15. Factors That Influence Demand for Supplies in a Theater of Operations

Class of Supply	Kinds of Supplies	Function of Own Operations	Function of Theater Policies	Function of Interaction w/Enemy
I	Subsistence	Personnel Strength	Feeding Plan	
II	Field Gear	Personnel Strength	Uniform Policy	OPTEMPO
III Bulk	Fuel	Number & Mix of engines	Vehicle Use Policy	Daily Usage Factor
III Packaged	Lubricants	Number & Mix of Equipment	Maintenance Policy	Daily Usage Factor
IV Barrier	Wire & Sandbags	Number of units	Force Protection Policy	OPTEMO
IV Construction	Lumber Etc.	Personnel Strength	Construction Standards	OPTEMPO
V	Munitions	Number & Mix of Weapons	Fire Support Rules of Engagement	Rate of Fire
VI	Soldier Items	Personnel Strength	Theater Policy	
VII	End Items	Equipment in Units	Recovery Policy	Loses of Items
VIII	Medical	Personnel Strength	Evacuation Policy	Personnel Casualties
IX	Repair Parts	Number & Mix of Equipment	Evacuation Policy	OPTEMPO

The second kind of workload is that imposed or modified by our own policies. For food, the policy as to what kind of food to be served influences the workload for Class I. Using or not using Class A rations (fresh food) determines how much refrigeration has to be provided, which in turn influences electrical demand, which influences fuel consumption for generators. Perhaps the most important policy decisions have to do with theater construction standards, theater casualty evacuation policy, and theater equipment evacuation policy. Construction standards determine in effect the standard of living for the troops, and the more comfortably they live, the more it costs in terms of construction materials and construction capability (units or contractors). Generally, as time wears on, theaters start out in austere mode and escalate to more comfortable facilities, at least in the rear areas. Patient evacuation policy establishes the estimated length of treatment beyond which the patient will be evacuated to the United States for treatment in a fixed hospital.

The shorter the patient evacuation policy, the fewer medical units are required in the theater. Similarly, the equipment evacuation policy sets the time of repairs that would cause an item to be taken back to the United States instead of being repaired in the theater. The shorter the evacuation policy, the fewer maintenance units and repair parts that have to be in the theater. Policy plays a big role in logistical planning, but its influence often is not recognized.

The third kind of workload is that imposed by the interaction of enemy and friendly forces in combat. These are essentially unknowable in advance with a high degree of confidence. Yet, the values for these parameters are the leading reasons for providing particular amounts of fuel, ammunition, repair parts, and replacements and the major reason for large numbers of logistical units. Combat consumption factors may be divined from historical experience, the opinions of experts, or the results of detailed analyses. For the TAA, they are outputs of the CEM—a theater combat simulation that "predicts" their values precisely for various locations on the battlefield, various combat postures, and various time periods.

CAA uses consumption planning factors as the basis for workload allocation rules. Consumption rates for each class of supply are provided by CASCOM for each SRC. These are expressed in pounds per day or gallons per day per unit. Theater demand for each day of the anticipated campaign is calculated by multiplying the consumption factor by the numbers of each type of SRC in the theater during that period. This process establishes the amount of each class of supply that has be delivered to the theater and distributed within the theater each day of the campaign. When the daily amounts of the supplies are compared with the rated daily capabilities of the supply, and transportation units are compared, the numbers and types of these units needed to receive, store, distribute, and issue these supplies is calculated to provide a basis for the force number and deployment priorities for that theater and that postulated campaign.[32]

The IDA review of 1996 found that the Army was using consumption planning factors that 1) were based on outdated historical data, 2) tended to be constants for all conditions, and 3) (most importantly) generated very high requirements for combat service support units. In the intervening 6 years, the Army has made some progress in adopting better ways to estimate these consumption factors. However, there is still much progress to be made in this area. The Army took note of this problem and during August

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[32] Interview, Jeff Hall, CAA, 16 October 2002.

2002 conducted a review of all of the 1,728 allocation rules. While there is no sure way to predict the nature of a future conflict, it is possible at least to use planning factors that appear to be reasonable.

Demand for supplies varies greatly across the classes of supply. The greatest demands in terms of weight are for bulk fuel and water, each of which comprises over 40% of the total weight of supplies consumed. The next greatest demand is for engineer construction and barrier materials, followed by food and ammunition. Table 16 shows the weight of supplies in short tons that the Army estimates would be consumed in the course of waging two major combat operations as required by the strategy. These estimates are for consumption only during the two campaigns and do not include supplies that would be retained in theater stocks or the weight of the unit equipment and personnel to be deployed. The point of the table, in which several classes have been consolidated, is to demonstrate the major importance of fuel and water in driving requirements for combat support units to obtain these liquid supplies, store them, and distribute them to using units.

Table 16. Estimated Consumption of Supplies for Major Combat Operations (Weight in Thousands of Short Tons)

Class of Supply	Weight	% of Total
III Bulk Fuel	5,346	44
Water	5,011	41
IV Engineer	456	4
I Subsistence	371	3
V Ammunition	344	3
All Other	586	5

Water Supply Units. Water is essential for people and equipment. It is a unique commodity because the supply problem is distribution within the theater instead of bringing it to the theater. In temperate climates, there are adequate sources of water, so the task is obtaining water from natural sources, purifying it, and distributing it to users. In arid climates, water is harder to find naturally, although there is ground water that can be accessed by drilling wells. In Saudi Arabia during Operation Desert Storm, water was obtained from existing wells and from desalinization of saline water. In some cases bottled water may have to be brought into the theater. As noted above, the demand for water is the second highest for any commodity and exceeds by almost a factor of 2.85 the demand for all commodities other than bulk fuel.

Water is needed for drinking, personal hygiene (including showers), medical care, mortuary operations, engineer operations, vehicles, and in the event of chemical attacks, decontamination of vehicles. Water planning factors are estimated for hot moist, hot arid, temperate, and cold climates. In moist and temperate climates, some of the demand for water can be met by nonpotable (untreated) water, but in arid climates all water has to be potable because untreated saline water corrodes engines and equipment.

Table 17 shows the planning factors for water used in TAA09. Potable water is needed for human consumption, field feeding, medical treatment, and vehicle operation. In non-arid climates, water for showers and laundry, mortuary operations, engineer operations, and aircraft maintenance does not have to be purified. Water consumption has been reduced significantly by the fielding of the new Laundry Advanced System (LADS) that replaces the current M-85 laundry unit. The LADS laundry unit reduces the planning factor by about 6½ gallons per day per person. The theater planning factors shown do not include water for chemical decontamination, which will add significantly to the demand for water. In all climates, chemical decontamination will require additional water, in the amount of 30 gallons per person and from 200 to 500 gallons per vehicle to be decontaminated

Table 17. Planning Factors for Water
(Gallons per Person per Day)

Sustaining Factors	Arid	Tropical	Temperate	Cold
Potable w/M85	18.66	8.75	7.25	7.75
Potable w/LADS	12.41	8.75	7.25	7.75
Total w/M85	20.53	19.34	17.69	18.24
Total w/LADS	13.65	13.09	11.44	11.99

Water supply units purify water, store water, distribute water through pipelines, and issue water to users. Water is purified at water supply points and stored in 50,000-gallon collapsible tanks. Bulk water is distributed from the water supply points through pipelines available in the tactical water distribution system (TWDS) sets or in rubberized bags called SMFTs loaded on flatbed trailers hooked up to tractor-trailers in cargo truck companies. Most units carry water for their own use in organic water tank trucks or trailers. Table 18 shows the Water Supply Units required in TAA09.

Table 18. Water Supply Units for TAA09

Unit	Active	Guard	Reserve	Funded	Compo 4	Required
Water Supply Bn HHD	1	11	9	21	0	21
Water Supply Co	1	7	11	19	3	22
Purification Det 30K	1	10	4	15	4	19
Purification Team	3	20	7	30	5	35
TWDS Team	0	2	5	7	0	7
Arid Augmentation Tm	0	5	0	5	0	5
Laboratory Team	0	2	0	2	0	2
Total Units	6	57	36	99	12	111

In addition to the water supply units shown in Table 18, each division has a water purification team in the direct support supply company of the division support command. This team has the capability to operate five water supply points in the division area of operations, store 60,000 gallons, and purify and issue 120,000 gallons of potable water per day.

The water supply function is undergoing a change in organization designed to reduce the number of small units (teams and detachments) and consolidate water support into dedicated water support units organized in modules to provide direct and area support for units in the field. When the new concept is in full effect, the number of water units will be reduced from over 100 to about 28, with a savings of about 500 military spaces. Additional detail on water supply, including a discussion of allocation rules, is in Annex C.

Equipment Usage Profiles

Over the past 6 years, the Army G-4 and the Combined Arms Support Command (CASCOM) developed the Equipment Usage Profile (EUP) methodology to provide improved estimates of consumption rates for supplies.[33] The Army G-3, G-4, and CASCOM continue to refine EUP with the goal of applying it to all classes of supply. For TAA-09, EUP was approved only for Class III bulk fuel supplies.

[33] It is quite possible that the Army's development of the Equipment Usage Profile was in response to 1996 IDA review of the TAA process.

The basic method of estimating demand for consumable supplies in a theater is a function of four factors:

- *Force mix*: the numbers and types of units in the theater is derived from the operational plans for the theater and the CEM theater combat simulation operated by CAA.
- *Equipment Mix*: The numbers and types of equipment in each type of unit is a property of the unit design for each SRC.
- *Consumption rate*: The rate at which an item of equipment consumes supplies is an engineering property of each item of equipment.
- *Usage Rate*: The OPTEMPO of each unit that determines the extent to which the unit and the items of equipment in the unit are used. is determined by the conditions of the operation.

Thus, predicted consumption of any class of supply by an SRC is the aggregate product of the number and types of consumers in the unit; the OPTEMPO of the unit in terms of rate of usage per day for specific conditions; and the amount consumed per day, hour, or mile for each condition. These estimates are then aggregated for each SRC type scheduled to be in the theater that day to achieve an estimate of total theater consumption for that day. The time-phased estimate of demand for supplies is used as the basis for a time-phased deployment to the theater of appropriate numbers and types of support units to receive, store, distribute, and issue the supplies as they are needed to support combat operations.

The EUP methodology seeks to replace the current static usage rate estimates with more realistic usage rate estimates that allow for variations in operating tempo on the battlefield. That is, EUP seeks to replace average data derived from historical experience with a set of rates that allows for a more precise, and perhaps more realistic, accommodation to the dynamics of military operations. Equipment usage profiles are "numbers or sets of numbers describing equipment usage over time, expressed in hours of operation, distance traveled, or rounds fired per time period (normally one day)." Their virtue, compared with the previous set of usage factors, is that they recognize that usage varies in the theater according to what a unit is doing. The particular operational phase or tactical posture for a unit is defined by the CEM, and the appropriate OPTEMPO usage factors are entered into tables and used to calculate consumption rates.

The present application of EUP to Class III Bulk fuel illustrates the method. The daily consumption rate for a particular item of equipment is a function of the fuel consumption of the engine per hour or mile of operation and the hours or miles the engine

will be operated each day. The first factor is a property of the engine. The second factor is a variable depending on what the engine or vehicle will be doing that day as part of the combat operation. Thus, the key element of the EUP methodology is predicting OPTEMPO.

The method used currently for estimating fuel consumption relies on usage rates called "Strip Profiles" that are documented in Supply Bulletin 710-2. These strip profiles specify a fixed number of hours per day or kilometers per day that a general type of equipment (such as generators) is assumed to be used or driven during each day of an operation. That number is the usage rate used in the calculation of fuel consumption. Using the strip profile usage rates, the daily fuel consumption for an armored division in Korea is estimated to be about 480,000 gallons per day.

In the EUP, different usage rates are to be established for specific combat situations defined in terms of presence in theater, location on the battlefield, phase of the operation, and tactical posture. This approach recognizes that the major fuel-consuming systems will not be operated in the same way for each unit each day of a military operation. Table 19 shows the current EUP matrix for five tactical postures and four operational phases. One of these matrices is prepared for each theater. When realistic data are entered into the matrices, the representation of OPTEMPO is both more realistic and more precise.

Table 19. EUP Matrix Format

	Operational Phase			
Posture	Denial	Buildup	Counter-Offensive	Exploitation
Attack				
Defend				
Delay				
Static				
Reserve				

For TAA09, CASCOM provided for each theater a phase-posture matrix for each type of equipment that consumes fuel, such as vehicles and generators. However, the data in the matrices was provided in full phase and posture detail for only two vehicles—the M1A2 tank and the Bradley Fighting Vehicle. For all other vehicles and equipment, only differences in the phase data were provided and each posture was assigned the same value for each phase.

For the M1A2 tank, for example, this approach estimates the number of hours each day that an M1A2 tank spends idling, moves on roads, or moves cross-country for each posture and each phase. Fuel consumption rates for M1A2 tanks vary greatly according to what the tank is doing. The tank uses less fuel while idling, more for road movement, and a lot more for cross-country movement.[34] When the EUP methodology is used for the tanks and fighting vehicles of the same division in the deny posture and attack phase of the campaign, the daily consumption of a heavy division in Korea is estimated to be about 325,000 gallons—about 150,000 gallons per day less than the estimate derived using the static strip profile method.[35]

When the EUP methodology was applied to Class III bulk fuel consumption by tanks and Bradley fighting vehicles, the result was a significant reduction in the fuel requirements and a greater than 20% reduction in the POL supply force structure required above division level. In this example, more precise delineation of the activity of the division reduced requirements. That may not always be the case, and for some equipment items, the requirement may increase.

Application of EUP to other combat systems and to other vehicles in the army-in-the-field, such as those for artillery, aviation, and engineer units, can be expected to provide improved estimates of fuel consumption and lead to further reductions in the units required to distribute fuel. Applying EUP to other classes of supply should do the same for the fidelity of the overall TAA process.

Army Support to Other Services

A persistent problem for the Army is providing support to other services in response to the assignment by the Secretary of Defense and Combatant Commanders of wartime executive agent responsibilities. Some of these assignments are made by DoD Directive and apply to the entire department; others are made in operations plans promulgated by theater commanders. Table 20 shows a list of the services and supplies that the Army is responsible for providing to other Services and DoD elements.[36] Each of

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34 The M1A2 tank presently has to be idling while not moving in order to assure that the black boxes are fully operative when it is time to move out. The adoption of an auxiliary generator for this model will obviate the necessity to idle when not in action.

35 Ed Howell, CASCOM Briefing, 7 August 2002.

36 Source is Army G4 and DA Memo 10-1, 15 January 1997. The Army calls this Army Support to Other Services (ASOS). In addition to these wartime theater assignments, the Army is also responsible for numerous other Executive Agent responsibilities listed in DA Memo 10-1.

these assigned responsibilities requires the Army to obtain and provide resources for the benefit of other DoD components, and some require the Army to maintain and deploy additional support units to a theater of operations.

The Army has three problems in providing the capabilities to support the other Services as assigned by the Secretary of Defense.

- The Air Force and the Marine Corps do not provide the Army their requirements for the various forms of support. This may be because they fear that their own force structure will be cut to "pay for" the extra support that the Army must maintain for them. This situation became so bad that in TAA05 the Army simply omitted any units to support the other services.
- Combatant Commanders place requirements on the Army for their respective theaters that are not DoD-wide and that require the Army to make extraordinary provisions for their respective theaters.
- The Army is forced to justify and defend support units that are not necessarily needed to support Army forces but are needed to carry out the wartime executive agent responsibilities. This sometimes leads to reductions in certain types of support units on the ground that they are excess to Army needs—which may be true but not pertinent to the Army's joint theaterwide responsibilities.

This situation may lead to inadequate support in an operation. The Air Force and Marine Corps may assume they will receive support that the Army cannot provide without shorting their own forces. Some of the units that are involved in theaterwide joint support are low priority. These include mortuary services, postal services, and customs inspection. If insufficient numbers of these types of units are available to provide a service for the entire theater on a joint basis, combat power of the force may not be reduced appreciably, but there will be adverse consequences somewhere in the system of systems. Other Army joint theater responsibilities, such as aerial supply equipment, may have more serious repercussions if there are too few of these units to support combat operations.

Table 20. Army Wartime Executive Agent Responsibilities

Responsibility	Authority	Remarks
Single Manager Conventional Ammo	DODD 5160.5	
Operation of Common User Ports	PACOM OPLAN CENTCOM OPLAN	
Common User Land Transportation	PACOM OPLAN CENTCOM OPLAN	
Inland Logistics Support	PACOM OPLAN	USMC only
Overland POL Distribution Support	DODD 4140.25	
	PACOM OPLAN CENTCOM OPLAN	
Intermodal Container Management	DODD 4500.09	
Theater Logistics Manager	CENTCOM OPLAN	
Land Based Water Resources	DODD 4705.01	
Military Troop Construction	DODD 4270.05	Europe & Middle East
Military Troop Construction	DODD 1315.06	Air Force only
Enemy Prisoners of War & Detainees	DODD 2310.01	
Military Postal Service	DODD 4525.06	
Customs Inspection	DODD 4030.49	
Blood Supply	DODD 6000.12	Air Force only
Medical Logistics Manager	Joint Pub 4092	
	PACOM OPLAN	
Veterinary Services	DEPSECDEF Memo 1980	
	CENTCOM OPLAN	
Mortuary Services	DODD 1300.22	
Chemical Protective Clothing and Equipment	CENTCOM OPLAN	
Air Drop Equipment Systems	CENTCOM OPLAN	

The Army alone cannot resolve this problem. It is up to the Combatant Commanders to recognize and respond to the wartime executive agency assignments as appropriate to their respective theaters and adjudicate among claimants to establish what units the Army ought to have to provide joint theaterwide support in their respective areas of operations. The Office of the Secretary of Defense ought to recognize the validity of these WEAR requirements in the program and budget reviews. The purpose of WEAR is to eliminate duplication and waste that could ensue if each service sought to provide all of the various kinds of support within their own structures. It would not make sense for each service to provide mortuary services units when the Army can specialize in this function and do it for all. Similarly, it does not make sense for each Service to have an intertheater airlift capability when the Air force can do that for all.

The Office of the Secretary of Defense has taken notice of this problem and has recently issued DoD Directive 5100.99 to provide policy guidance on WEAR.[37] This directive confirms the assignments of executive agency responsibilities, and establishes rules for the identification of requirements and the identification of such requirements in the PPBES. In particular, the Chairman is directed to communicate executive agent assignments to the Combatant Commanders, who are supposed to assist in establishing firm requirements for the agents to use in their force management processes and program formulation.

Mission Task Organized Forces

A few years ago, faced with the necessity to justify forces for smaller-scale contingencies, the Joint Staff conducted a massive game called Dynamic Commitment in which numerous possible scenarios were considered in detail. This was really a planning exercise, and the scenarios were converted into contingency plans that resulted in, among other things, troops lists of the forces that would be required to accomplish the missions. These troop lists were called "Mission Task Organized Forces," or MTOFs. The Army used MTOFs in TAA09 to establish the requirements for Homeland Security and to a lesser extent, smaller-scale contingencies.

The use of contingency plans to establish requirements is essentially circular because contingency plans by definition use available, existing units. Thus, individually, the MTOFs are not much help in the force structure design process. It is possible, however, that as a group, the MTOFs can be useful for establishing a need for unit types that might otherwise be omitted from the TAA troop list. Doctrine for major combat operations relies on large numbers of units of many different types, so that relationships within and among the various supporting systems are defined on a grand scale. Smaller-scale operations, on the other hand, are by definition small and often take place in difficult areas of operations. They are often focused on operations other than combat, so that the doctrine devised for large-scale combat in two or three canonical scenarios does not apply exactly. Elaboration of the MTOF effort to provide for more exploration and analysis of alternatives could make this method of establishing force packages more useful.

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[37] DoD Directive 5100.88, Wartime Executive Agency Responsibilities, 3 September 2002. Courtesy of Gina Meiners, OSD.

IV. RESOURCING OF REQUIREMENTS

Once the requirements are established, the Army has to close the gap between the troop list that it wants and a troop list that it can have. This is done in the resourcing phase of the force structure design process by recognizing three major constraints: 1) the inertia of the existing force structure, 2) the organization of the Army into full-time and part-time personnel, and 3) the limits of the funds, personnel, and equipment that can be available to the Army in a particular time frame.

Matching the Required Troop List to the Current Troop List

The first step in the resourcing phase is to match the required troop list with the programmed troop list. The products of this computer-matching process are units that match a requirement, units that exist but are not required, and SRCs that are required but do not exist. Since the TAA is an incremental process, most of the units that are in the programmed force structure already exist. The job of the force programmers in the Army is to propose and obtain approval for force structure actions that will bring the programmed force into congruence with the required force structure as much as possible within the constraints. There are three basic kinds of force structure actions: activation, inactivation, and conversion. Before activating a new unit or converting a unit into a different TOE series or different SRC, the force programmers are obliged to make certain that the trained and experienced personnel and the necessary equipment for the new or converted unit will be available at the effective date of the force structure action.

One result of the matching process is to provide a first cut on the assignment of SRCs to the various components. Most of the units will remain in their current components unless there is compelling reason to convert a unit from the Active component to a Reserve component or vice versa. National Guard and, to a lesser extent, Army Reserve units are stationed in areas that can support their recruiting needs adequately. In addition, it is difficult in many cases simply to move a Reserve component unit to another locality, and as a result these units are often converted from one SRC to another with the same home station. The major decision is whether a unit is to be funded or assigned to Compo 4 as an unfunded requirement. This decision is based on the manpower spaces allocated to each branch or functional area and the results of negotiations among the branches as the constraints are applied.

External Support in a Theater of Operations

External Support in general consists of goods and services obtained from sources other than military units and DoD systems. In a theater of operations, external support is provided by allied military forces, allied governments (including the host nation or nations), local contractors, US contractors, third country contractors, local purchase, and local hire. Literally, external support is obtained from the theater of operations itself using resources and supplies external to the Army's own theater support system. The use of external support can reduce the number of military personnel and military units required in a theater of operations to provide the logistical and personnel support for the deployed military forces. This is a much broader concept than Host Nation Support, which allows only for supplies and services the delivery of which has been agreed to between the United States and the Host Nation in a formal treaty or international agreement. The definition of Host Nation Support is so narrow and the standards so high that the Army has not been able to reduce its stated requirements for military support units by deciding to rely on it.

In our previous work, we pointed out the value of taking external support into consideration during the force management process.[38] Nothing has been done in the past 6 years to do this. In the interim, however, reliance on external support has increased in practice for the smaller-scale operations in Bosnia and Kosovo, and such support was used extensively in the Afghanistan Campaign as well. Policy regarding external support has not kept up with practice in the areas of force management and program development.

Planning and providing for external support in theaters of operations is properly the business of the Combatant Commanders. The Combatant Commanders have the duty to know a lot about the potential areas of operation in their respective theaters and to be able to take advantage of locally available resources to supplement those provided by DoD. The Services do not have the ability to consider the joint support required for the conduct of campaigns. When the Combatant Commanders simply turn to their Service Component Commanders to do the logistical planning, the Service Component Commands follow the lead of the Services rather than the lead of the Combatant Commanders and take a narrow view of external support. Even though the Service Component Command staffs will do some of the work involved in making an estimate of the logistical support required for war plans, the unified command joint staffs ought to put it all together and add the policy and content to external support.

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[38] John C.F. Tillson et al., IDA Paper, P-3189, May 1996.

External support should be considered at the outset of the force management process, not at the tail end. The present system considers external support in the resourcing phase after the requirements for military support units have been established. This has the effect of discouraging reliance on external support. Despite the common knowledge that external support has been used in past wars and will be used in future wars, those responsible to provide support are reluctant to reduce their force structures on that basis. The official reason that backs up this reluctance offers official sanction for not counting external support in the planning phase—while turning to it automatically and instinctively when the operation starts. This modus operandi, of course, means that use of external support will be impromptu, hasty, expensive, and chancy. It would be far better to devise a method that would provide for reasonable reliance on external support in the planning phase of the PPBES.

One way to do this would be for the Army and OSD to agree on the echelon at which external support will be applied. Below that echelon, military units would provide all support. Above that echelon, support would be provided by a mix of military units and external support, with the edge given to external support. This would simplify the process of force management and promote a reasonable inclusion of external support into the operational planning process.

The Secretary of Defense should make the Combatant Commanders responsible for provision of external support. At the outset of the planning process, the Combatant Commanders should be required to conduct a logistical preparation of the battlefield. This would involve understanding of the non-DoD assets that could be used to sustain the operations of the US and its allies. This process would go far beyond the limits imposed by the official definitions of Host Nation Support and take a holistic view of what could be obtained and put to use by local, third country, and US contractors and allied governments. In doing this the Combatant Commanders would obtain a good understanding of resources that would not be available in sufficient amounts and then make provision for bringing them into the theater.

Compo 4

When the Army compares its requirements with its resources (as limited by multiple constraints), one of the ways it disposes of the imbalance is to assign units to Compo 4. Originally, Component 4 was intended to list "unmanned" units for which a full equipment set was available and which could be activated and placed into operation rapidly upon mobilization. (The archetypical unmanned unit was a military history

detachment with two soldiers, a jeep and a typewriter.) For the past 20 years or so, Compo 4 has been a repository of units for which the Army has neither personnel nor equipment. It has become a "wish list" of units that would be nice to have but are not important enough to fund. Its sole virtue is that it provides a menu of units from which to pick when there is a budget windfall—but of course that never works out for the conditions causing a budget windfall seldom relate to past force structures. The Army says that the size and composition of Compo 4 describe the risk that the Secretary of Defense accepts by not funding the full requirement.

Casual acceptance of a shortfall from "requirements" casts serious doubt on the validity of the requirements. If a requirement is valid, it should be resourced. If it is not resourced, the doctrine and rules used to formulate the requirements are suspect. For the Chemical Function (SRC 03), TAA09 came up with a requirement for 26,000 military manpower spaces for 294 chemical units to provide the level of chemical warning and defense, decontamination, and obscurant capability needed to support the army-in-the-field adequately in accordance with the DPG and Army doctrine. However, the Army chose to resource only 202 of the required chemical units with about 60% of the required spaces, leaving the army-in-the-field 40% short of what it would take to do the job the Army itself says is necessary. (In this case, the Army chose not to provide "adequate" decontamination capability.) It is evident that the Army does not believe its own stated requirements.

If the intent of the force management process is to produce a balanced force that maximizes combat power under a variety of scenarios, the use of Comp 4 as a sort of overflow bin flirts with failure. Under the sequential committee process the Army uses to reconcile different claimants, the votes go to the groups with the biggest clout and most clearly perceived needs. This process occurs first during the requirements phase and a second time during the resourcing phase. During the requirements phase, impasses may be resolved by tacit agreements to add a "requirement" knowing that there is little chance of it being resourced.[39] This allows the leadership to avoid making difficult decisions about what is really required. During the resourcing phase, the losers may take solace that their unmet requirements are at least being kept in the game on a waiting list. When the required and resourced troop list meets the real Army that exists, another set of

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[39] Jim Adams points out that this was done in one instance during the later part of the Cold War to place large numbers of transportation units into Compo 4 on the basis of a planning assumption that was soon rejected.

compromises have to be negotiated. It is unlikely that an Army so designed could have enough of the right kinds of support units to be balanced in any real sense.

An example of the pitfalls of Compo 4 is afforded by a recent Army study on the impact of relying more on precision munitions and less on non-precision munitions (mostly artillery shells).[40] By means of sophisticated analysis, the study group found that increased use of precision munitions could maintain the same level of lethality and deliver the same or more combat power at a lower total systems cost and a reduced logistics burden. The study found that a requirement for 10,000 support spaces (about 2% of the total) could be eliminated by the greater use of precision munitions. The savings would include 36 ammunition platoons, four truck companies, and two hospitals (because of fewer friendly casualties). However, these "savings" could not be realized because the number of funded ammunition supply platoons and other units of these types were so far below the number required that "there is no savings in the current or planned force structure." The authorized support structure was found to be insufficient for either the base case using non-precision munitions or the improved case using precision munitions. Not only does this finding offer no incentive for making more use of precision munitions, it reveals that the Army does not plan to provide sufficient support to make efficient use of its fire support systems. As the study said: "Are the reductions real? The answer lies in whether the units that are unnecessary are real units. If they were never resourced, then eliminating them saves nothing in peacetime. If the two MTW scenario emerges, then the units saved amounts (sic) to so many less contactors hired and/or troops recruited or allies relied upon to perform that workload."[41]

Current use of Compo 4 contributes to the continuation of a discontinuity between what is needed and what can be afforded. To characterize the difference as "risk" trivializes the possible impact of what could occur when the full requirement is needed for combat. What would be the impact, for example, in a battle involving chemical warfare of insufficient decontamination capability to permit full use of our own armored vehicles and trucks?

The program constraints that will impact the Army are well known prior to the start of the force management process. If these constraints were considered at the outset of the process instead of the end, the preferred force structure might be considerably

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40 Unclassified Draft Final Report and Briefing, "Precision Munitions and Logistics Study," as of 7 February 2000.

41 Ibid., p. 18.

different from that produced by the relatively unconstrained TAA requirements phase. The Army should consider abolishing Compo 4 and change the way it approaches force management. Instead of subtracting unfunded units from a doctrinally based troop list of requirements, it could conduct the process so that the trade-offs and tough decisions are done in the early stages.[42] This kind of process could produce a force balanced better between combat (output) and support (input) than does the current process.

V. OBSERVATIONS

1. *The Army is making an effort to improve the force management process.*

The Army is trying to improve the force management process. Some of the changes appear to be in direct response to the 1996 PA&E Review conducted by IDA. Other changes are internally generated. However, progress has been slow.

Although the 1996 IDA review pointed out serious problems with outmoded and inappropriate allocation rules, the Army made little progress in the intervening 6 years. Allocation rules for TAA09 were, with a few exceptions, based on the same consumption data as were used in TAA03. The Army knows this. As noted earlier, all of the 1,728 allocation rules were reviewed this year, and some changes were being made in support of TAA11. The problem of predicting combat consumption rates remains to be solved. The Army needs at least to use combat parameters and consumption rates that appear to be reasonable.

The Equipment Usage Profile (EUP) methodology appears to be quite useful as the basis for generating more precise requirements for combat service support units. However, the adoption of the full EUP methodology has been slow and laborious. This methodology was created in response to the 1996 IDA review of the TAA03 process. In the intervening 6 years, it has been adopted fully for only two vehicles—the M1A2 tank and the Bradley Fighting Vehicle. The G4 of the Army is the proponent and advocate for EUP, and the G3 of the Army is the putative user of the methodology in the TAA process. Each agency professes to favor wider use of EUP, and it is not clear why this approach has not been used more widely.

When all combat systems are subjected to more realistic combat usage factors in EUP, there can be a more accurate estimate of Class III consumption. Applying the EUP

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[42] Achieving balance within constraints would require an iterative process in which adjustments are made incrementally.

methodology to other classes of supply with large consumption rates will improve the credibility of the part of the TAA process that generates requirements for all CSS units.

The Army is also moving to update the models used by the Center for Army Analysis in the TAA process. Both the CEM and FASTALS models were introduced about 30 years ago and although they have been modified over the years, they are obsolete. CAA intends to use both the CEM and the Joint Theater Combat Model (JTCM) developed by RAND Corporation in TAA11 preparatory to doing away with the CEM altogether. The JWARS theater combat simulation is being considered for use in the long term. FORGE is an improved version of FASTALS that will be PC-based (FASTALS runs on a mainframe computer). FORGE will have improved interfaces to allow manipulation of data and real terrain instead of the virtual terrain in the FASTALS. In addition, CAA will develop a better data management system to assist in keeping track of the voluminous data generated by the TAA process.[43]

2. *The process is very complicated.*

The force management process is a very complicated affair, with numerous new documents and subprocesses, each generating new acronyms. This is partly because the system has grown by accretion, with new things plastered on top of the old ways. There does not appear to be a single oversight group with both knowledge and authority capable of simplifying the process—or at least explaining it better.[44] The complexity also occurs in part because of the constant change of personnel involved in the process. New people lacking understanding of the process simply invented new ways instead of learning the old ways and adapting them to new circumstances. The Army realizes this and has taken two actions to achieve a partial remedy. The Army Force Management School at Fort Belvoir, Virginia, teaches action officers and general officers the fundamentals of the business. The Army has established a career field so that officers have repetitive tours in the staff agencies doing this work. In addition to these efforts, it would be useful for the Army to review the process and delete many of the acronyms, systems, and databases that have only marginal value. Simplification of the process would also make it easier for the Army to explain to outsiders what it is doing—something that appears currently to be somewhat deficient.

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43 Interview, Jeff Hall, Center for Army Analysis, 16 October 2002.

44 The authors of this report are all former Army officers with experience in the force management process. It is not an overstatement to say that we were each at times overwhelmed by the complexity of what we were trying to understand.

3. *The drive to improve precision may or may not improve the validity of the resulting force structure.*

The two major problems in designing the Army's force structure are to determine just how much combat power will be needed to fight and win current and future wars and just how much support needs to be provided to maximize the output of the combat units. To resolve the second problem, the Army is trying to develop new methods of establishing consumption rates for supplies and demands for services that rely on detailed descriptions of future combat. The approach is to devolve the problem into smaller problems that depend on great detail for resolution. This approach is facilitated by available computing power. The new detailed approach is better than previous approaches based primarily on historical data aggregated into rough rules of thumb. The new approach has the virtue of identifying factors that are obvious and not in dispute, and making clear the dependence of consumption estimates on combat-related factors whose values cannot be decided upon until an event actually happens. The new process is more precise, but it might not be more accurate. Important factors are determined in the TAA by a large theater-level simulation, whose results are dependent on values, relationships, and algorithms that are themselves suspect when examined critically.

The results obtained by this means may be inaccurate in the sense that they will be invalid when a war occurs. Such uncertainty is normally hedged by using safety factors that increase the probability that there will be enough support when the event occurs. In the Department of Defense on a tight budget, the relationship is reversed, and when a shortage of resources appears likely because of unrelated constraints, the practice is to eschew the safety factor approach and instead increase the allowable risk of failure.

It might be better to acknowledge the inherent uncertainties of results that are based on predictions of combat operations and avoid so much detail in favor of ground rules that are roughly right and provide a robust capability to do many things reasonably well under a wide variety of possible future circumstances.

4. *The Army is forced to justify units and resources that are demanded and used for the benefit of the other Military Services.*

The Army is assigned responsibility to provide in a theater of operations a wide variety of services and goods for the benefit of the other Services. This makes good sense by making it unnecessary for each Service to maintain a full line of each type of support. Having one Service, for example, responsible for enemy prisoner of war operations or mortuary services minimizes duplication of effort and achieves economies of scale. However, the way that this policy is handled in practice requires the Army to justify resources held for the benefit of the other Services, often without the cooperation of those other Services. In the budget game, this places the Army at a disadvantage, and as a result the Army is often not resourced properly to support other Services in a theater to the detriment of the conduct of campaigns.

5. *The Combatant Commanders, who are the ultimate users of the Army's deployable force structure, have insufficient influence on the process.*

The Army alone cannot resolve some of the perennial problems of the TAA process. Such issues as reliance on external support in a theater and wartime executive agency responsibilities in a theater of operations have to be resolved by the responsible Combatant Commanders. The Defense Reorganization Act of 1986 means, among other things, that the Army is a provider of units to Combatant Commanders, who conduct all of the military operations. Since this is so, the Combatant Commanders ought to have a large voice in the types and numbers of units in the pool from which they can obtain combat and support capabilities. The Army does provide for the Combatant Commanders to review and provide input to the concepts of operations modeled for each of the major combat operations, but this is inadequate, and the role of the Combatant Commanders in the process should be increased to the point that the Army is responding to their concepts of operations. At present, the Combatant Commanders have insufficient influence over the units and resources they will have to accomplish assigned missions.

The Army would benefit by more active interaction with the unified commands in the TAA process. This would be particularly valuable for estimating combat units needed to accomplish particular missions, for addressing external support, and for assuring that the capabilities and support of other services can be considered by the Army.

6. *Despite some rhetoric about "capabilities-based planning" there is no evidence that this method has been applied to the Army force management process.*

The net effect of the TAA process is to preclude capabilities-based planning. Each combat formation, each support unit, each soldier, and each dollar has to be justified on the basis of what it can contribute to a set of imaginary scenarios that are highly unlikely to occur. The detail is so great that the sum of the parts often is less than it could be.

Capability-based planning would allow—indeed require—the Army to create and maintain a certain amount and mix of general (not generic) capabilities that the Secretary of Defense could allocate to the Combatant Commanders as necessary and appropriate to deal with present and future events. This can be done without reference to specific speculative scenarios. The emphasis would be on striving to be roughly right rather than taking a chance on being exactly wrong.

7. *The guidance provided to the Army does not provide a very useful basis for force management.*

For TAA09, the Army estimated the combat units needed to carry out the missions stated in the QDR and DPG. A force package was created for each mission, and the total of the personnel and units in the force packages was the Army's requirement. Not surprisingly, the total requirement resembled in great measure the existing Army. The changes were minor in the TAA itself, and the major modifications were decided outside the TAA in separate, parallel actions for Transformation and National Guard Division Redesign, respectively. At the same, time OSD was lamenting the fact that the Army appeared unable to respond to guidance to become more deployable strategically and more agile tactically. Since the Army tries to follow the guidance faithfully, if the results are unsatisfactory, the fault may lie in the guidance itself.

Major combat formations--corps, divisions, and brigades--ought to be specified in the guidance based on joint analyses, games, and consultation with the Combatant Commanders. If the Secretary of Defense decided at the outset of each program cycle the major forces and the projected personnel and funding constraints, this would provide better results in terms of fleshing out the support required to sustain the combat forces in situations envisioned by the Secretary. This would provide a sound basis for achieving economies and allow some stability between major program cycles that could improve the readiness of the forces.

If the Secretary of Defense wants a more agile and deployable Army, he has only to issue an order to the Army to this effect. The Army is responsive to the objectives of the Secretary of Defense and would welcome guidance accompanied by funding authority. The present transformation from the current force structure to an agile, lethal Objective Force could occur sooner if programming and procurement schedules also were transformed to make that happen.

The TAA process is an agglomeration of past practices that produced a satisfactory product for the pre-Goldwater-Nichols command arrangements and new ideas that are relevant for the current situation. The process does not fit well into the new DoD joint command arrangements that are emerging as the Goldwater-Nichols goals are being realized. OSD and the Joint Staff need to participate more in the Army's force management process at the beginning and while it is ongoing and not simply wait for opportunities to criticize the product and make marginal adjustments in the PPBES. Like other legacy systems in DoD, the Total Army Analysis needs to be reconfigured for modern times, but the Army alone cannot accomplish that.

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Appendix A
SOURCES

Appendix A
SOURCES

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Appendix A
SOURCES

The Institute of Defense Analyses received excellent cooperation from the Department of the Army, Office of the Deputy Chief of Staff for Operations and Plans, G3, in the preparation of this report. LTC Paul Hilton, DAMO-FM, Mr. Ed Blesi, DALO-XX, and Mr. Howard Keller, DAMO-FM, were particularly helpful in obtaining data and setting up briefings while pursuing a demanding schedule to get their own work done. Mr. Jeff Hall, Chief of the TAA Division, Center for Army Analysis, was very helpful on two separate occasions. Colonel (Retired) Jim Adams reviewed a draft of the report and provided numerous perceptive and helpful comments.

INTERVIEWS

Colonel Morris M. Young, Chief, Force Management Division, DAMO-FMF (to 7/02)

Colonel Gerald O'Keefe, Chief, Force Management Division, DAMO-FMF, (after 7/02)

LTC Paul Hilton, Chief, Programs Team, Force Management Division, DAMO-FMF

LTC Kevin Givens, Programs Team, Force Management Division, DAMO-FMF

Major Lydia Combs, Chemical Integrator, Headquarters US Army Forces Command

Mr. Howard W. Keller, Jr., CALIBRE Systems, Inc, (DAMO-FMF Programs Team)

Mr. Edward Blesi, G4 Department of the Army

Mr. Ed Howell, Combined Arms Support Command

Mr. Larry Francis, DAMO-FMF

Mr. Jeff Hall, Center for Army Analysis, 25 February 2002 and 16 October 2002.

Mr. James Adams, CEO of Bahr, Incorporated, 27 June 2002

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Appendix B
FIELD ARTILLERY UNITS TAA09

Appendix B
FIELD ARTILLERY UNITS TAA09

FIGURES

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Appendix B
FIELD ARTILLERY UNITS TAA09

The adoption in TAA03 of an existence rule that called for two field artillery brigades, each comprising three field artillery battalions, in support of each Active component division increased the required Army force structure by about 30,000 military spaces—15,000 in field artillery units and another 15,000 in support units. Because of the weight of the ammunition, field artillery units are the largest driver of ammunition supply units and a significant driver of cargo truck units. About 90% of the ammunition required in a theater of operations consists of artillery shells. Thus, the adoption of this existence rule had a significant effect on the Army's force structure requirements.

The timing of the increase in field artillery support suggests that it was a direct result of the experience of some senior commanders in the Persian Gulf War who felt that they could have used more artillery than was available in Southwest Asia for that conflict. The primary basis for doubling field artillery support for active divisions was an Army Science Board study that "interviewed a number of senior Army generals and reviewed the results of an analysis conducted by the TRADOC Analysis Center."[1] The analysis and the decision for the additional field artillery battalions failed, however, to take into account a major transformation in field artillery support that was already well under way in the early-1990s. This was the advent of the multiple launch rocket system (MLRS) as a major general support artillery weapon.

BACKGROUND

Just before the Cold War ended in 1989, the field artillery community was in the midst of a transformation from the M110A3 8-inch howitzer to the MLRS. At that time there was one corps artillery brigade of three battalions in support of each army division, and MLRS was just beginning to come into the inventory.

War games and analysis showed that the use of the MLRS as a counterfire weapon system in concert with Firefinder radars provided the US for the first time a capability to

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1 John Tillson et al., Review of the Army Process for Determining Force Structure Requirements, IDA Paper P-3189, May 1966, p. 24.

defend Europe against a massive Soviet attack without the use of nuclear weapons. One analysis was based on a major war game of the main US defensive effort in the Fulda Gap approach to Frankfurt. The General Defense Plan for this area called for the 3rd Armored Division, with operational control of the 11th Armored Cavalry Regiment (-) in the covering force, to defend in this sector starting at the Germany border. The 72nd Field Artillery Brigade reinforced the 3d Armored Division Artillery with seven battalions—one 155mm howitzer, three 8-inch howitzer, one MLRS, and two Lance missile units. The two Lance battalions were retained in general support of the V Corps and had no effect on the outcome of the conventional battle. The threat was two Soviet Armies attacking West Germany at Fulda in depth, with both the 1st and 2nd echelon army's artillery battalions in support of the 1st echelon divisions. Although the Soviet capability to locate US artillery at that time was not effective, the Soviet attackers had a definite edge over the US defenders in terms of artillery fires. At the conclusion of the exercise, about 90% of the Soviet artillery and about 50% of the US artillery had been destroyed, but the 3rd Armored Division, although very weakened, had held its ground. The reason that the US forces did so well in that game was because of the introduction of Firefinder radars and MLRS, and their dedication to the counterfire role.[2]

The Firefinder phased array radars greatly increased the US capability for counterbattery fires to destroy Soviet artillery units. These radars located enemy artillery targets electronically and transmitted accurate target location data to US firing units even before the enemy rounds impacted. The radars were very hard for the enemy to locate because of the way they operated in the search and detect mode. During exercises at that time, even US intelligence assets were unable to locate these radars very accurately. The Firefinder radar locates artillery and mortars with accuracies that improve with more observations, ranging from an error of about 35 meters to about 10 meters as the enemy continues to fire. In favorable circumstances, an electronic fire request from Firefinder to a US firing unit could arrive before the enemy's initial rounds have impacted.

The availability of MLRS was key to the effectiveness of US counterbattery fires. The standard response for counterfire missions by MLRS was one launcher load of 12 rockets fired in salvo mode One launcher load of rockets fired at an enemy self-propelled artillery target located by Firefinder radars could be expected to destroy over 50% of the enemy materiel and cause over 50% of the personnel to be immediate casualties—causing

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2 Colonel (retired) Robert Magruder, the primary author of this annex, was 3rd Armored Division Artillery Commander at the time of this war game.

the enemy artillery unit to be ineffective. The same effects would require three battalion volleys of 8-inch howitzers and five battalion volleys by 155 mm howitzers. The single salvo MLRS response would likely impact on the enemy artillery unit before they could move to another location. An MLRS battalion of 18 launchers has the capability of firing at 18 individual targets every 30 to 60 minutes. This firepower would have been highly effective against Soviet artillery.

By 1990, each 8-inch howitzer battalion in a heavy division was replaced by one MLRS battery, which was the equivalent in firepower and lethality against area targets. One 8-inch howitzer battalion with 24 howitzers and around 500 personnel was replaced by one MLRS battery with 9 launchers and around 100 personnel. This was an equal capability trade-off for area and counter battery fires.

Following Desert Storm/Desert Shield (DS/DS), which took place just 1 year later, the Army replaced all 8-inch howitzer battalions with MLRS battalions—providing roughly a threefold increase in lethality. Since the MLRS has a 3-person crew versus a 9-person crew for an 8-inch howitzer, some manpower spaces were saved, but this saving was offset by the additional logistical support needed to deliver the larger tonnages of rockets required for the MLRS. Currently, there are five MLRS battalions supporting each heavy division.

While the initial fielding of the MLRS was still taking place, the Army decided to add a second Field Artillery Brigade and three field artillery battalions in support of each active division. When the rule was applied, the "additional brigades" each had one 155 mm battalion and two MLRS battalions. This meant that there would be in the corps artillery six battalions (two 155 mm howitzer, four MLRS) for each division in a corps plus three battalions for general support of the corps. Thus, a Cold War corps of three divisions was allocated nine battalions organized into three brigades. A post-Cold War corps of 3 divisions would have 21 battalions organized into 7 brigades.

The effect of the increase in battalions was diminished somewhat by the simultaneous reorganization of cannon batteries from 8 to 6 howitzers and MLRS batteries from 9 to 6 launchers. Thus, although artillery units were added, the slimmer battery structure meant that a lot of the increase in personnel would be in redundant battalion headquarters staff and battalion support elements.

The two brigades per division allocation rule added three additional battalion headquarters and a brigade headquarters for each division. The additional brigade headquarters was not needed, for the applicable force structure allocation rule is that one

brigade headquarters can command and control between 3 and 7 field artillery battalions.[3] As noted above, the change from 8 gun batteries to 6 gun batteries added unnecessary battalion headquarters. When it was completed, this change placed about 12,000 more soldiers into headquarters.[4]

Subsequently, a second MLRS battery was added to each division artillery to create a divisional MLRS battalion of two MLRS batteries, each with 9 launchers, a target acquisition battery, and a chemical company.

When the Army replaced all 8-inch battalions with MLRS battalions, the effectiveness and lethality of artillery supporting the heavy divisions tripled.[5] When a second field artillery brigade containing another two MLRS battalions was added to the force structure, the lethality and effectiveness of field artillery was again increased substantially.

The current field artillery force structure and organization were designed to fight a major conventional war against Soviet and allied armies that featured strong artillery forces with cannons that outranged our own cannons. In that Cold War conflict, counterbattery fires would be of great importance to the US and NATO forces defending Europe. At the end of the Cold War, the Army found itself with the beginnings of an artillery force that, with the full deployment of the MLRS, was more than a match for Soviet artillery. The end of the Cold War, however, meant that countering the threat of massed Soviet Artillery was no longer the main role for US artillery.

ARMY FIELD ARTILLERY BATTALIONS FY88–FY02

As described above, the field artillery was in the midst of a massive transformation when the Cold War ended. Figure B-1 shows the numbers of field Artillery battalions in the total Army (Active, Guard, Reserve components) from the end of FY1988 to the end

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3 DAMO-FM, TAA-11 Allocation Rule Review, briefing dated 15 May 2002.

4 OSD, Achieving a Transformation in Fire Support, Report to Congress on Indirect-Fire Systems, June 2002, p. 48 (OSD Report).

5 From a basis of effects and lethality of area fires and ability to service targets, the MLRS battery is about equivalent to the 8-inch Battalion. One SPLL of MLRS can fire 12 rockets containing 7,728 ICM bomblets in 1 minute and reload in 15 to 30 minutes. The more accurate 8-inch battalion (3x6) firing two volleys in about 3 minutes delivers about 6.480 ICM bomblets and does not need to reload ammunition. In 1 hour, 1 MLRS battery could service about 12 such targets and the 8" battalion could service about the same number. This 1-hour scenario would represent about a third of the firing for a given day of combat.

of FY2002.[6] In this chart, both towed and self-propelled 155 mm howitzers are combined. The number of "mixed" battalions includes 155 mm/8-inch battalions that were in National Guard divisions for a short period and 8-inch/MLRS battalions that were and interim solution during conversion from 8-inch to MLRS. The mixed battalions were few in number and do not affect the trends shown.

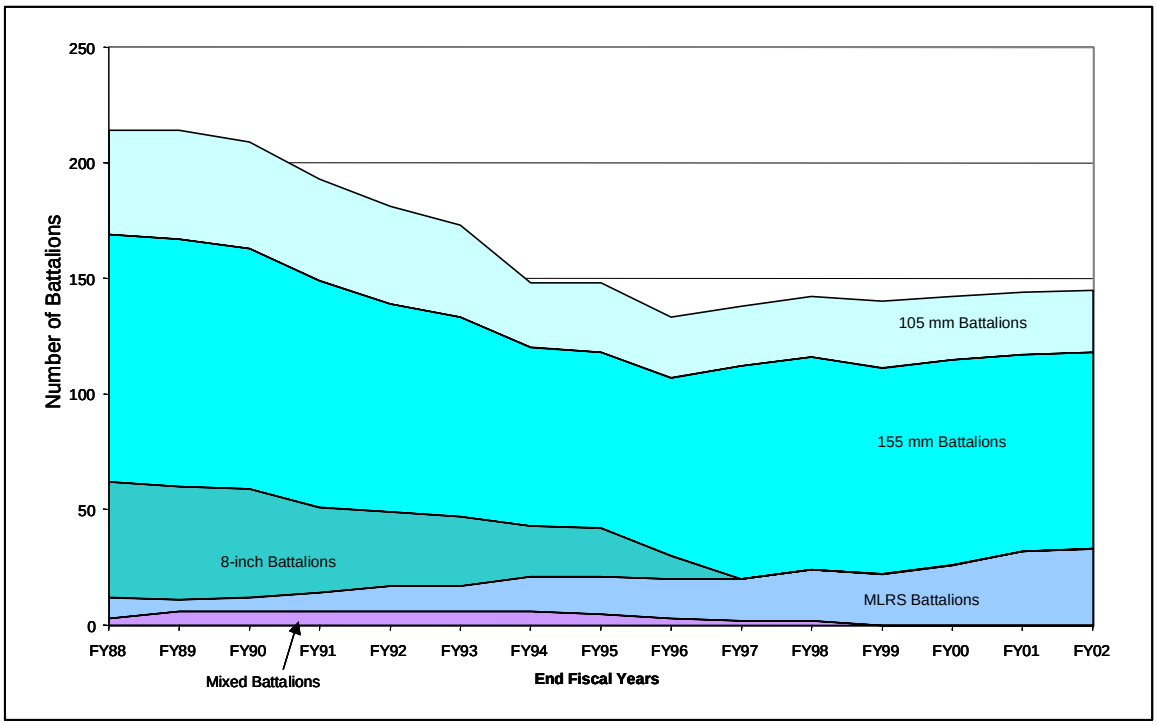

Figure B-1. Army Field Artillery Battalions FY1989—FY2002

The chart shows the planned replacement of 8-inch battalions by MLRS battalions and the reduction in the number of battalions after the end of the Cold War. The increase in battalions that occurred about FY1996 is the result of the two brigades per division allocation rule that in effect reversed the steady decrease in the number of battalions that occurred from FY89 to FY96. Starting in FY1996, the number of 155 mm battalions increased slightly and the number of MLRS battalions increased at a greater rate.

The total number of field artillery battalions reached a low point of 133 in FY1996 and increased more or less steadily after that to 145 in FY2002. The initial increment of the increase was fifteen 155 mm howitzer battalions in from FY1996 to FY1997. After that, 155 mm battalions were traded off for MLRS battalions to achieve the 145-battalion structure at the end of FY2002.

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6 John R. Brinkerhoff, Army Combat Potential FY1962-FY2000, IDA Document D-2498, January 2001.

The consequence of the simultaneous introduction of the MLRS and the increase in battalions supporting the active heavy divisions is shown in Figure B-2. In this chart a weighted value index shows the relative lethality of the field artillery structure over time. This weighting scheme is designed to show the relative lethality (value) of the various weapons compared with the 155 mm howitzer for counterbattery fires. In this chart, the 155 mm battalions are assigned a value of 1.0. The 105 mm battalions are assigned a value of 0.5, the 8-inch battalions a value of 2.0, and the MLRS battalions a value of 7.0. The aggregate weighted value score is a rough descriptor of the lethality of the field artillery force structure.

According to this procedure, the Army's field artillery capability is greater now than during the final years of the Cold War, owing primarily to the advent of the much more effective MLRS.

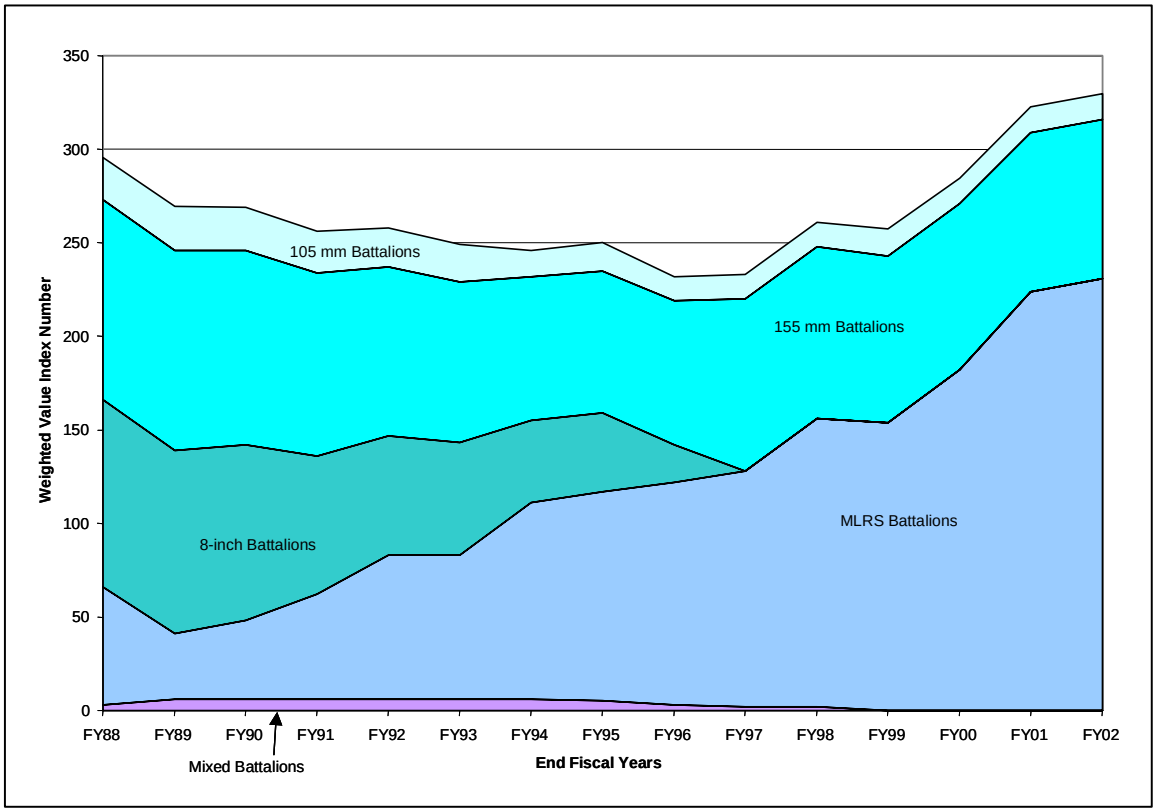

Figure B-2. Weighted Value Index of Field Artillery Battalions FY1989—FY2002

A major problem with this analysis is that the weighting of the MLRS compared with the 155 mm howitzer is based primarily on counterbattery mission, for which the MLRS is very effective. However, the MLRS currently is not as well suited for close

support as howitzers because the rockets are not accurate enough. To be used as a close support weapon in close proximity of friendly troops, the MLRS would need a more precisely guided rocket.

It would appear that the allocation rule that doubled the artillery battalions in support of the active divisions was not needed to rescue the field artillery force from oblivion. Far from it, the Army had already made provision to increase the capability of the force, while at the same time reducing the number of headquarters and personnel in field artillery units. In that sense, the new field artillery allocation rule was unnecessary. The cost of the new rule was lowered because the weapons were already in the inventory, but the Army did have to devote extra personnel to these units and to the additional units placed into the force structure to support them. But the relative size or capability of the field artillery force structure is not the relevant measure, which is how much is needed to fight America's future wars.

HOW MUCH ARTILLERY IS ENOUGH?

The numbers and types of field artillery support needed to support air land combat depend on the nature and availability of targets and the needs of the maneuver formations for close-in supporting fires. When considering the size and nature of the field artillery force in today's Army, it is useful to consider four major factors.

- Targets for artillery will not be as plentiful in the future as was anticipated during the Cold War. The Army does not presently face a threat that contains the armored forces or artillery units that characterized the Soviet and Warsaw Pact armies. There will be fewer targets, and many of these will be engaged better by precision weapons than area fires.
- Field artillery units deliver fires over a large area and are seldom out of action. The first of division and corps artillery battalions can be massed as necessary, and the artillery battalions of divisions in reserve can be used in certain circumstances to support the committed divisions by responding to requests for support against targets within their range.
- Field Artillery is being used less in warfare. Rounds fired per tube per day have decreased successively for wars after World War I. Reasons for this reduction include greater munitions lethality and accuracy, greater maneuver mobility and lethality, greater command and control of field artillery units through technology advances, and advances in joint fire support systems.[7]

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7 OSD Report, p. 38.

- Future operations will be conducted in a joint environment in which fire support from the Air Force and Navy will be de facto part of the Army's fire support system. This has been true to a limited extent in the past, but in the future it will become routine.

Merely addressing the field artillery allocation rules presents a distorted view of the artillery support available to the Army's maneuver forces. The second brigade allocation rule was applied only to the 10 active divisions, leaving the 8 National Guard divisions and 17 separate brigades without any corps artillery support. In that sense, the second brigade provides somewhat unintentionally the original doctrinal support of one 3-battalion brigade for each division and a little left over for the separate brigades.

The total number of brigade combat teams—both divisional and separate—is 70 at the end of FY2002. The total number of field artillery battalions for that fiscal year is 145. There are on average about two field artillery battalions per maneuver brigade—counting the battalions organic to or in direct support of each brigade. That means that 75 artillery battalions are available at the corps level to allocate in support of tactical maneuver. When considered in this manner, the total number of artillery battalions does not appear to be excessive.

It appears that the Army, by arranging for excessive support for its active brigade combat teams and insufficient support for its Guard brigade combat teams, has inadvertently achieved about the right amount of support for the Total Army.

Two other considerations, however, affect the size and composition of the field artillery force structure—logistics and precisions munitions.

Precision Munitions

Future artillery precision ammunition developments will reduce the numbers of 155 mm and MLRS rounds needed to kill targets. With due allowance for spatial coverage, these new rounds will also permit reductions in the field artillery force structure and the support units needed to supply the rounds.[8] Table B-1 shows some pertinent data on the new precision munitions for artillery.

8 OSD Report, p. 43.

Table B-1. Costs of Current and Future Capabilities to Kill a Typical Area Target

Type Round	Procurement Cost/Round $	No. Rounds per Target	Cost of Rounds Used ($000)	Weight of Rounds Used (lb)	Cost of Ground Delivery ($000)[a]	Total Cost of Target Attack ($000)
MLRS	16,000	12	192.0	12,000	72.0	264.0
Excalibur[b]	22,750[c]	3	68.3	5,000	2.7	71.0
GMLRS[d]	63,000	1	63.0	1,000	6.0	69.0

a OSD Report, p. 45.

b Ibid., p. 45. Excalibur 155 mm round is expected to be fielded with a circular probable error of 10 meters at 14 km to 40 km range by 2006.

c Ibid., p. 45. Cost of round is $22,000 with the cost of the fuse ($250) and powder ($500) included.

d Guided MLRS round is expected to be fielded with a circular probable error of 17 meters at 14 to 70 km range by 2006. The number of bomblets will still be DPICM, but the number will decrease from 644 to 404 to allow space for the guidance package. Other munitions suites will also be available to GMLRS.

The target for the data in Table B-1 is a self-propelled artillery battery. The target is assumed to be located by Firefinder radars with a target location error of 35 meters and a range of 20 km. The attack is to achieve at least 50% damage to personnel and material.

The 155 mm Excalibur precision round is projected to deliver DPICM bomblets with a 10-meter CPE out to 40 km. The attack on the artillery target as described above can be achieved with 3 rounds. Excalibur is expected to be available in the 2006 timeframe.[9]

The Guided MLRS (GMLRS) is a rocket whose weight is comparable to that of the current MLRS rocket, but it can achieve more than twice the range. The GMLRS contains 404 DPICM bomblets, half of which will hit within 17 meters of its aim point.[10] In conjunction with Firefinder radars, a single rocket can effectively destroy an enemy self-propelled artillery battery. GMLRS is expected to be available in 2006.

Each MLRS launcher is capable of being targeted on a separate target electronically and capable of reloading and being able to shoot another mission in a matter of minutes depending on travel if needed to get re-supplied. With GMLRS rockets, up to 12 targets can be fired at (and destroyed) without reloading.

9 OSD Report, pp. 35, 45, 49.

10 OSD Report, p. 35.

A target located with a reasonable target location error (TLE) can be killed if in range of field artillery howitzers or rockets. With GMLRS, one launcher load of 12 rockets can destroy 12 battery- or company-sized targets.

Once these or other precision munitions are available after 2006, the field artillery force structure can be adjusted to provide the necessary fire support for the Army.

Logistics

Field Artillery demands a lot of logistical support in the form of ammunition supply companies and cargo truck companies, as well as port facilities and perhaps railway cars.

In calculating the logistics support required for forward deployed units and soldiers, DoD indicates that approximately one soldier in a support unit (such as truck company, maintenance company, personnel support unit, medical unit, or command and control unit) is needed for every two soldiers forward deployed in a combat division.[11] This may be a very conservative estimate for MLRS supporting units that must carry large tonnages of ammunition.

MLRS is a major consumer of ammunition by weight. The MLRS rocket weighs about 1,000 pounds and contains 644 dual-purpose improved conventional munitions (DPICM) bomblets. In a typical day of combat, one MLRS battery firing five SPLL loads of rockets will fire more weight of ammunition in a day than a 155 mm cannon battalion or three maneuver brigades. An MLRS battalion could fire more than 1 million pounds of ammunition per day in combat with only five missions per launcher per day. Five battalions of MLRS will consume close to 75% of the weight or all Class V supplies to a heavy division in a given day of combat, with cannon artillery at about 20% of the consumption. This is based on an estimate of workload and target distribution.[12]

The impact of guided weapons on the logistics footprint will be significant to say the least. In the above case, one rocket or 3 howitzer rounds of precision munitions provide a level of effectiveness comparable to that of 12 current MLRS rockets for this particular target. And it does this for almost $200,000 less when considering the cost of procurement and delivery to the battlefield.

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11 Ibid., p. 43.

12 Some TAA07 data from CAA shows cannon ammunition weight exceeding MLRS weight. This finding may result from underutilization of the MLRS units.

Should the transport of this ammunition go from overland to long-distance air-delivery, the transportation cost increases from $6/lb to $50/lb.[13] Delivering Excalibur by air now becomes a feasible alternative. A recently published Army war scenario shows that Excalibur accounts for 30% of all indirect fire (counterfire) kills.[14]

The discussion above indicates that the Army's reconsideration of the two field artillery brigades per active division allocation rule is timely. Artillery battalions are not support units in the sense that Engineer or supply units are. Artillery contributes lethality to the combined arms team, and the number and mix of artillery units ought to be derived from joint analysis and war games conducted to determine the combat units of the Army. For the TAA, artillery units ought to be inputs rather than derived from existence rules.

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13 OSD Report, p. 45.

14 US Army Field Artillery Center, Alternative Indirect Fire Study, Draft Version 1.5 (June 2002), p. 30.

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Appendix C
CHEMICAL UNITS TAA09

Appendix C
CHEMICAL UNITS TAA09

TABLES

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Appendix C
CHEMICAL UNITS TAA09

Chemical Corps units do three things: 1) detect and warn of chemical and biological attacks, 2) decontaminate military equipment rendered unusable by persistent chemical or biological agents, and 3) provide haze (smoke screens) using chemical obscurants to conceal the maneuver of combat forces.

In recent years the Chemical Corps has restructured its units from single-function companies (smoke or decon or recon) to multifunctional units in which there is a mix of different kinds of platoons. This provides a more flexible way to deliver these services.

- All chemical units provide a capability to detect and report chemical, radiological, and biological agents, but some units are dedicated to this role.
- Reconnaissance units with a dedicated chemical and radiation detection capability are provided to cover the corps rear area, airports, and seaports.
- Biological detection units are designed specifically to detect, presumptively identify, and report the presence of aerosolized biological warfare agents on an area coverage basis.
- At division level, the emphasis is on smoke and decontamination. Heavy divisions, the airborne division, the air assault division, and armored cavalry regiments have an organic multifunctional company. Light infantry divisions have no organic chemical company.
- Corps units provide additional smoke and decontamination capability to back up the division units.
- Additional decontamination capability is placed at the theater army level.
- A full array of chemical units is provided to support each Marine Expeditionary Force (MEF) in the theater.
- Battalion headquarters command from two to seven subordinate companies.
- Brigade headquarters command from three to five subordinate battalions and provide chemical staff officer capability at corps, MEF, and theater army headquarters.
- Chemical staff augmentation teams provide a chemical special staff officer capability for advising commanders of major support organizations on chemical matters.

- Chemical commanders and staffs at all levels advise their supported units on defensive measures, operate an area-based chemical and biological warning system, and supervise the response to warning of chemical or biological attacks.

UNIT CAPABILITIES

Each chemical unit has a rated capability that is stated in the establishment document (TOE). Table C-1 shows the design capabilities of the most important chemical units. These quantitative outputs are expressed in allocation rules.

Table C-1. Design Capabilities of Selected Chemical Companies

	Recon	Decon (Thorough)	Smoke
Recon/Decon Co	Yes	8 to 10 vehicles/hour	
Heavy Division Co	Yes	8 to 10 vehicles/hour	0.2 to 1.1 km haze
Decon Co		40 to 60 vehicles/hour	
Recon Co	Yes		
Mechanized Smoke Co			2.4 to 4.8 km haze
Smoke/Decon Co		32 vehicles/hour	4 km haze
Biological Detection Co	*		

* Biological Detection Companies provide 35 teams equipped with critical node arrays that detect and presumptively identify biological warfare agents. They do not perform "recon" in the same sense as the other units. They are mobile but must be stationary to perform their mission. Source: Major (P) Lydia Combs, 22 November 2002.

ALLOCATION RULES FOR CHEMICAL UNITS

The following allocation rules are a somewhat simplified version of the allocation rules used for TAA09. These rules, like other allocation rules, are under review. In the following list, the rules are organized according to the unit upon which the rule is keyed.

<u>Units Organic to Divisions and Cavalry Regiments:</u>

Each cavalry regiment has a smoke/recon/decon company

Each heavy division has a smoke/decon company

Each airborne and air assault division has a smoke/decon company

Units Assigned to Corps or in support of a MEF:

1 chemical brigade headquarters

2 recon companies

1 biological detection company

6 smoke/decon companies

1 chemical battalion headquarters for 2 to 5 companies

Additional units assigned to a corps on the basis of one per division assigned to the corps:

1 smoke/decon company

1 mechanized smoke company

1 biological detection company

Units assigned to Theater Army:

1 chemical brigade headquarters

1 Recon company

1 biological detection company

4 smoke/decon companies

1 smoke/decon company per APOD and SPOD

1 recon/decon company per SPOD

1 decon company per APOD, SPOD, and Airfield

1 chemical battalion headquarters for 2 to 7 companies

1 staff augmentation team per major headquarters and area support group

On this basis a corps with three divisions (one heavy, one airborne, and one light) and an ACR would have the following chemical units:

2 divisional chemical companies

1 chemical brigade headquarters

3 chemical battalion headquarters

3 Biological detection companies

1 Recon/decon company

2 Recon companies

10 Smoke/Decon companies

2 Mechanized smoke companies

This corps would have the capability to provide a detection and warning system for radiation, chemical agents, and biological agents that would cover the entire corps area, process 350 vehicles per hour for thorough decontamination, and provide a single haze or several hazes with an aggregate width of about 50 kilometers. The first capability is necessary to provide the troops timely warning of chemical attacks so they may don their chemical protective clothing. The second capability would determine the time it would take for the corps to recover from a chemical attack and resume full-scale operations. The third capability would affect the capability of corps elements to conduct river crossings, flank attacks, and deep penetrations. Presumably, the mix and numbers of chemical units that result from the allocation rules provide sufficient capability to support the operations of the corps. In that sense, these units are required.

OTHER REQUIREMENTS

In addition to the units required to support the army-in-the-field, three other requirements affect the chemical force structure.

Special Forces Support. Each Special Forces group has an organic recon team.

Homeland Security Support. The Army postulates a requirement for 54 additional chemical companies in support of homeland security.

3 Chemical brigade headquarters

8 Chemical battalion headquarters

21 Recon/decon companies

10 Biological Detection companies

12 Decon companies

Technical Escort Unit. The Technical Escort Unit (TEU), which supports and secures the movement of chemicals and other sensitive materials and provides technical support for responses to accidents and attacks, has been converted to a TOE battalion. The original TAA009 laydown proposed that the TEU be increased in strength and broken down to achieve greater flexibility in employment into the following 27 units:[1]

5 Company Headquarters

10 Joint response Teams

5 National Capital Region Response Teams

7 Remediation Response Teams

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[1] The proposed reorganization of the TEU may not occur.

TAA09 CHEMICAL UNIT LAYDOWN

On the basis of these allocation rules, the Army requirement for Chemical Corps units in TAA09 was for 294 units with almost 27,000 military manpower spaces. After matching the required units with existing units, considering manpower and equipment constraints, and negotiating with other branches, the Army decided to fund 202 units with an aggregate military strength of 16,000 spaces. The distribution of the requirement among the components is shown in Table C-2. The other category of non-funded units is for units for which equipment is prestocked but the units are not staffed.

Table C-2. Chemical Unit Laydown for TAA09

	Active	Guard	Reserve	Resourced	Compo 4	Other	Required
Units	67	61	74	202	87	5	294
Spaces	4,049	5,525	6,459	16,034	10,034	876	26,943

About 40% of the requirements are placed in Compo 4. The Compo 4 list includes the following units:

1 Chemical Brigade Headquarters

8 Chemical Battalion Headquarters

1 Smoke Company

4 Recon/Decon Companies

6 Biological Detection Companies

14 Smoke/Decon Companies

42 Decon Companies

Table C-3 shows the laydown of chemical units by component and compares the requirement for TAA09 with the requirement for TAA07.

Table C-3. Chemical Units by Component TAA09 (and requirement for TAA07)

	AC	NG	AR	Funded	Compo4	Prepo	TAA09	TAA07
Abn/AA Co	2			2			2	2
Heavy Div	3	7		10		3	13	10
ACR Heavy	1	1		2			2	2
ACR Light	1			1			1	1
Brigade Hqs	1	3	5	9	1		10	8
Battalion Hqs	3	11	11	25	8		33	26
Decon Co	4	2		6	42		48	0
Recon Co	1	2	5	8	1		9	9
ACR Light (Port)	1	23		24	4		28	9
Mx Smoke Co	2		4	6	1		7	6
Recon/Decon Co	5			5	4		9	3
Smoke/Decon Co	5	6	25	36	18	2	56	98
Bio Det Co	2	4	11	17	6		23	12
Special Forces Tm	2	2	3	7			7	7
Staff Teams	3		10	13	2		15	20
Tech Escort Tms	27			27			27	0
CBRN-RRT	4			4			4	0
Total Units	67	61	74	202	87	5	294	238

The chemical force structure for TAA09 was determined based mostly on the allocation rules that were used for TAA07. However, there were three significant changes:

- The Technical Escort Unit was converted from a TDA organization into a modular TOE organization that can be employed in teams for multiple missions.
- A total of 56 units were added to perform the Homeland Security mission.
- About 50 smoke/decon companies were converted into straight decon companies. However, most of these decon companies were placed into Compo 4.

COMMENTS ON CHEMICAL UNITS

The most striking feature of the Chemical unit laydown for TAA09 is that, while the requirements appear to be both reasonable and firmly based on doctrinal and practical needs, only 60% of them were resourced. The unresourced units match somewhat to the

list of units required for Homeland Security, but there appears to be no direct connection. About two-thirds of the required decontamination capability was not funded, making it clear that this function is not considered very important in the Army's overall chemical defense strategy.

Given the confusion in the Army and DoD about what forces to allocate to the Homeland Defense Mission, the requirements in TAA09 for Homeland Security may be soft. However, it would have been prudent to fund at least some chemical units for this top priority mission, given the lead-time of seven years available to buy the equipment and train the personnel for the units.

Given the known threat of chemical and/or biological attacks in Southwest Asia or Northeast Asia, it would appear prudent to fund all of these requirements and perhaps more. The requirements do not provide chemical support for civilian employees and contractor employees, nor do they provide protection for allies that may be fighting on our flanks. If the chemical and biological threats are as great as has been stated publicly, it would make sense to assure that our major combat operations do not fail because we provided too little chemical and biological defense capability.

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Appendix D
WATER SUPPLY UNITS TAA09

Appendix D
WATER SUPPLY UNITS TAA09

TABLES

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Annex D
WATER SUPPLY UNITS TAA09

Water is an indispensable commodity for military operations. It also creates a very large demand for logistical support in a theater of operations—second only by weight to Class III bulk fuel in that respect. To sustain the major combat operations used as the basis for force management in TAA09, Class III bulk fuel accounts for 44% and water 41% of the weight of supplies estimated to be consumed in theaters of operations.[1] Meeting the demand for water establishes requirements for water supply units and also contributes significantly to the requirement for cargo truck companies that carry water as well as other classes of supplies.[2]

The Army has given considerable attention to the water supply function in recent years. The large requirements generated for water supply units and cargo truck companies to haul water in TAA07 caused the Army to commission in 1999 a study by the Logistics Management Institute (LMI). This study concluded that the requirement for water supply units in TAA07 was too high. While the Army took issue with the LMI study findings on technical grounds, it also initiated a thorough revision of the way that the Army produced and distributed water in a theater of operations. The Combined Arms Support Command (CASCOM) set about revising water planning factors, the concept of water supply operations, equipment for supply and use of water, and the design of water supply units.

DEMAND FOR WATER

Two basic kinds of water are to be supplied. Potable water has to be purified in order to be fit for human consumption. Nonpotable water that is simply taken into the system and distributed without purification may be used in humid climates for applications that do not involve humans. In arid climates, all water for military use has to be potable to prevent contamination of water supply equipment, laundry units, and vehicles by salts dissolved in unpurified water. The amount of storage and distribution

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1 Center for Army Analyses briefing.

2 Much of the content of this annex is based on a draft annex written by DAMO-FM, 3 November 2002.

capacity is determined by demand for both potable and nonpotable water; the demand for water purification capacity is determined by demand only for potable water.

Table D-1 summarizes the planning factors for water used in TAA09. A complete table of water planning factors used in TAA09 is presented at the end of this annex.

Table D-1. Water Consumption Planning Factors (gallons per person per day)

	Temperate Climate	Arid Climate
Potable Water	7.25	12.41
Nonpotable Water	3.46	0
10% Loss Factor	0.73	1.24
Total Water Demand	11.44	13.65

The elements of water supply demand per soldier in a theater of operations are as follows:

- Universal unit level consumption includes potable water for drinking, personal hygiene, field feeding, heat injury treatment, and vehicle operation. This planning factor is about 8 gallons per person per day in an arid climate or 6 in a temperate climate. It is permissible to provide for a period of up to 10 days a minimum amount of potable water to be used only for drinking, field feeding, and personal hygiene (no showers). This minimum factor is 5 gallons per person per day in an arid climate or 4 gallons in a temperate climate.
- Water for medical treatment must be potable in all climates.
- Water for Central Hygiene (based on two showers per week and 15 pounds of laundry per week), Mortuary Affairs, Engineer Operations, and Aircraft maintenance may be nonpotable in all but arid climates.
- A 10 percent loss allowance (4% evaporation and 6% spillage and waste) is added.

The planning factors differ for units in different areas of the theater. The sustaining factor in temperate climates is about 6 gallons of potable water per day for personnel in divisions and just over 7 gallons per day for personnel at echelons above division. Presumably, the troops in the higher echelons will have more opportunities for showers and laundry services than those in closer contact with the enemy.

Chemical decontamination in the aftermath of a chemical attack requires additional water, all of which may be nonpotable except in an arid climate. Decontamination of one person or a small equipment item requires 28.8 gallons. Hasty decontamination of a vehicle requires 150 to 200 gallons, and deliberate decontamination 450 to 500 gallons.

The Army was able to reduce the water consumption planning factors significantly by fielding the Laundry Advanced System (LADS) that replaced the older M-85 laundry unit. Operation of one LADS unit requires only 500 gallons per day compared with 24,000 gallons per day required by one M-85 unit. The LADS was approved in 1997 and procurement of 146 of these units was approved. About two-thirds of these units have been issued to water supply units and the remainder will be issued in 2003. The LADS cuts water demand by about 6 or 7 gallons per person per day.[3]

The Army has also taken action to reduce the theater stockage levels for water. For TAA09, the Army planned a theater reserve stockage level for water of 5 days for arid climates and 4 days for humid climates. For TAA11, the theater reserve stockage level was reduced to 2 days of supply for arid climates and 1 day of supply for humid climates.

Although the water consumption planning factors have been reduced, the demand is still quite large. The demand factors are applied only to the support of military personnel in the theater of operations, including Air Force and Marine Corps personnel. There is no requirement to provide water for civilian employees or civilian contractors or local civilian personnel in the theater of operations.

WATER SUPPLY OPERATIONS

In humid climates, water will be purified at the sources inland (rivers, lakes, wells) and distributed locally by water supply elements embedded in composite direct support supply companies assigned to division support commands and corps support commands. There is a difference at the division level between the Army of Excellence (AOE) organization and the Force XXI (FXXI) organization. Each AOE division has an organic water supply team of 27 personnel in the DS supply company of the Main Support Battalion of the Division Support Command. This water supply detachment has the capability to produce 120,000 gallons of potable water per day and operate up to five water supply points to issue water to using units. The FXXI divisions have no organic water supply capability and depend on water purification sets and water supply points

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3 LADS Fact Sheet, DAMO-FM, 10 December 2002.

established in the division area by corps support command units. Water at echelons above corps will be provided by dedicated water supply units or by contractors.

In arid climates, the assumption is that water will be purified at the coasts and hauled to distribution points inland. The water supply elements of the DS supply companies will distribute water brought to them from purification sites. The water supply units will purify brackish water at the coasts, establish dry water points inland, and provide service to bases, headquarters, and hospitals. Transportation truck companies will haul the water from the coastal water supply points and distribute it to inland water supply points. Local sources and contractors will be used to supplement the water supply units.

WATER SUPPLY UNITS

Water supply units perform four functions: purify water, store water, distribute water through pipelines, and issue water to users. Units are allocated based on the demands for the temperate climate, with augmentation teams added for operations in arid climates.

The Army is converting from the L-series TOEs created as part of the Army of Excellence to the F series TOEs of the Force XXI design. The AOE units were used in TAA09, and the FXXI units will be used in TAA11.

The basic AOE unit for water supply operations in the corps and theater army areas is the Water Supply Company (SRC 10468L). This unit has strength of 4 officers, 1 warrant officer, and 138 enlisted personnel. It is organized into two water supply platoons. It can purify 200,000 gallons of water per day, store 1,600,000 gallons of water, and operate eight direct support (DS) water issue points. When augmented by two tactical water distribution systems (TWDS) detachments, each with 20 miles of pipeline, it can distribute 1,200,000 gallons of water per day.

In the FXXI design, the basic structure is a set of modular platoons that can be assigned to water purification and distribution company headquarters according to the tactical situation. There will be two basic types of platoons—water purification platoons and storage and distribution platoons. Most of the separate detachments and teams will be eliminated. The TWDS teams will be retained for use in support of facilities that benefit from a local area water distribution system.

WATER SUPPLY ALLOCATION RULES

In order to derive mathematical allocation rules for water supply units, the liquid measure in gallons is converted to weight in short tons for both the demand and the units.

The total theater demand on a given day is computed from the planning factors using the number of personnel scheduled to be present that day in each of the virtual areas of the battlefield established in the CEM. The workload for the FASTALS model is expressed in thousands of short tons.

The capability of each water supply unit is rated in short tons of capability per day. The FASTALS model performs the calculations of comparing the demand in each battlefield area each day with the rated capacity of the water supply units and determines the numbers of units needed to meet the demand.

For example, the new water purification platoon (SRC 10567FC00) is designed to purify 180,000 gallons of water per day from a fresh water source or 120,000 gallons per day from a brackish water source in an arid climate. When this is converted to weight, each water purification platoon can purify 747 short tons per day [180,000 gallons times 8.3 pounds per gallon all divided by 2,000 pounds per ton]. Therefore, for each 1,000 tons of demand, FASTALS establishes a requirement for 1.339 water purification platoons.

The weight of water to be transported in the theater is one of several elements that are aggregated to establish the requirements for cargo truck companies. Water is transported in large rubberized bags on flatbed trailers, which are also used to transport containers with other kinds of supplies and equipment. While some water can be distributed using pipelines, most of it is carried on these flatbed trailers. The requirement for both water supply units and cargo truck companies is increased by the Army's assumption that all water for an arid climate theater will be purified at the ports and transported to inland water supply points for local distribution.

The force structure is derived from this kind of allocation rule by considering the numbers of water unit types in each area of the theater and comparing their design level outputs with the demand (workload) in these areas. The program calculates the total capacity in each area to support the projected population in each theater and translates that into discrete units. When all of the demands have been met, the result is the required numbers and types of water supply units to meet the Army's estimate of the water to be supplied to military forces engaged in major combat operations and other military operations.

WATER SUPPLY FORCE STRUCTURE

The Army's water supply force structure is based on Army needs and support for other Service elements in a theater as well as enemy prisoners of war in the custody of the Army. Based on that demand, the Army in TAA09 stated a requirement for the force structure shown in Table D-2.

Table D-2. Water Supply Units in TAA09

Unit	SRC	Active	Guard	Reserve	Funded	Compo 4	Compo 9*	Total
Water Supply Bn HHD	10466L	1	11	8	20	0	0	20
Water Supply Co	10468L	1	6	10	17	0	3	20
Purification Det 30K	10469L	3	9	4	16	0	4	20
Purification Team	10570LC	2	19	7	28	0	0	28
TWDS Team	10570LG	0	2	5	7	0	0	7
Div Aug Wtr Spt Team	10570FA	1	0	0	1	1	5	7
Arid Aug Teams	42507L	0	4	0	4	1	0	5
Total Water Units		8	51	34	**93**	2	12	**107**
Water Teams in DS Supply Companies		10	9	24	43	0	7	50
Total Water Function		18	60	58	**136**	2	19	**157**

* Compo 9 is External Support

By multiplying the authorized strengths of each of the water supply units by the numbers of each unit in each component, it is possible to calculate the total number of military personnel authorizations to staff the units. Table D-3 shows the results of this calculation.

Table D-3. Military Manpower Authorizations for TAA09 Water Units

	Active	Guard	Reserve	Total
Water Units	375	2,108	2,044	4,527
Water Teams in DS Supply Companies	270	243	648	1,161
Total Water Function	645	2,351	2,692	5,688

Under the FXXI concept, the number of water units will be reduced significantly. The TAA09 requirement included 20 companies and 102 detachments and teams that are either separate or part of DS supply companies. The TAA11 structure will consist entirely of new production and distribution companies, each with a nominal mix of two purification platoons and two storage and distribution platoons. The platoons may be detached and attached to other CSS headquarters to provide a tailored water supply system

for a particular area of operations. Assuming a force structure of 28 production and distribution companies, the simplified structure will provide a savings of about 500 spaces. Both force structures include 7 TWDS.

COMMENTS ON WATER SUPPLY

The Army has taken aggressive action to improve the efficiency of its water supply operations. The demand has been reduced, units have been redesigned for more efficiency, and the concept of operations has been refined to be more flexible in application. However, there are some points of concern.

The assumption that *all* water for an arid climate theater has to be purified at coastal locations and transported inland is very important to the generation of requirements for water supply and truck companies. It creates a large demand for transportation resources. It is possible, however, that even in arid climates, some water may be provided from inland sources, such as wells. This was the case for the Persian Gulf War. The theater commanders could clarify and refine this assumption.

Water supply is a function for which external support can be very useful. Except for unpopulated areas in a theater, water is required for indigenous people and local commercial activities. Even in arid climates, potable water is available from local wells and purification plants. Some of the output of these existing facilities can be used to augment or offset some of the requirements for military water purification capacity. During the Persian Gulf War, the Army relied heavily on Saudi desalinization plants and local commercial water transportation assets.

The Army has made a gesture toward reliance on external support in its water supply force structure for TAA09. Comparison of the force structure in Table D-2 with the ARSTRUC suggests, however, that the Army has simply moved some units from Comp 4 to Compo 9 (External Support). The full extent to which the Army can rely on external support for water supply is not well understood. Theater commanders could conduct a survey of the water situation in their respective theaters and either confirm or modify the operational assumptions about locally available water supply resources.

The TAA process for establishing the number and mix of CSS units is straightforward. Water supply provides a good example of the application of workload-based allocation rules, but it is not typical. It is likely that each of the classes of supply has features that make them unique when figuring out how to match demand to capability in a way that makes sense.

Table D-4. Water Consumption Planning Factors Related to Military Personnel in Force Structure (Gallons Per Person Per Day)

FUNCTION	HOT				TEMPERATE		COLD	
	TROPICAL		ARID					
	Sustaining	Minimum	Sustaining	Minimum	Sustaining	Minimum	Sustaining	Minimum
	Potable Water Only							
Universal Unit Level Consumption[1]	**7.51**	**4.76**	**7.71**	**4.96**	**6.01**	**3.26**	**6.51**	**3.76**
Level I and II Medical Treatment	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**
* Central Hygiene, Shower and Laundry[2] (w/M-85)	*8.30*	*0*	**8.30**	**0**	*8.30*	*0*	*8.30*	*0*
* Central Hygiene, Shower and Laundry[2] (w/LADS)	*2.05*	*0*	**2.05**	**0**	*2.05*	*0*	*2.05*	*0*
Level III and IV Medical Treatment	**1.20**	**1.20**	**1.20**	**1.20**	**1.20**	**1.20**	**1.20**	**1.20**
*Mortuary Affairs Operations	*0.01*	*0.01*	**0.01**	**0.01**	*0.01*	*0.01*	*0.01*	*0.01*
*Engineer Operations	*1.20*	*0*	**1.20**	**0**	*1.20*	*0*	*1.20*	*0*
*Aircraft Maintenance Operations	*0.20*	*0.20*	**0.20**	**0.20**	*0.20*	*0.20*	*0.20*	*0.20*
Potable Water Planning Factor (w/M-85)	**8.75**	**6.00**	**18.66**	**6.41**	**7.25**	**4.50**	**7.75**	**5.00**
Potable Water Planning Factor (w/LADS)	**8.75**	**6.00**	**12.41**	**6.41**	**7.25**	**4.50**	**7.75**	**5.00**
*Nonpotable Water Planning Factor (w/M-85)	*9.71*	*0.21*	0.00	0.00	*9.71*	*0.21*	*9.71*	*0.21*
*Nonpotable Water Planning Factor (w/LADS)	*3.46*	*0.21*	0.00	0.00	*3.46*	*0.21*	*3.46*	*0.21*
10% Loss Factor w/M-85	**0.88**	**0.60**	**1.87**	**0.64**	**0.73**	**0.45**	**0.78**	**0.50**
10% Loss Factor w/LADS	**0.88**	**0.60**	**1.24**	**0.64**	**0.73**	**0.45**	**0.78**	**0.50**
Total Theater w/M-85 (Potable & Nonpotable)	**19.34**	**6.81**	**20.53**	**7.05**	**17.69**	**5.16**	**18.24**	**5.71**
Total Theater w/LADS (Potable & Nonpotable)	**13.09**	**6.81**	**13.65**	**7.05**	**11.44**	**5.16**	**11.99**	**5.71**

Source:

[1] Includes Gal/Pers/Day and/or per capita requirements for drinking, personal hygiene, field feeding, heat injury treatment, and vehicle maintenance

[2] Based on a central hygiene standard of 2 showers and 15 pounds of laundry per soldier per week

* = *NonPotable Requirement*

Appendix E
ACRONYMS

Appendix E
ACRONYMS

ACR	Armored Cavalry Regiment
ADA	Air Defense Artillery
ADRS	Army Division Redesign Study
AOE	Army of Excellence
APOD	Aerial Port of Debarkation
ARSTRUC	Army Structure Message
ASB	Army Science Board
ASOS	Army Support to Other Services
BCT	Brigade Combat Teams
CAA	Center for Army Analysis
CASCOM	Combined Arms Support Command
CEM	Concepts Evaluation Model
CENTCOM	Central Command
CONUS	Continental United States
CPG	Contingency Planning Guidance
CS	Combat Support
CSS	Combat Service Support
DoD	Department of Defense
DoDD	Department of Defense Directive
DPG	Defense Planning Guidance
DPICM	Dual-Purpose Improved Conventional Munitions
DS	Direct Support
DS/DS	Desert Storm/Desert Shield

EAC	Echelons Above Corps
EUP	Equipment Usage Profile
FASTALS	Force Analysis Simulation of Theater Administrative and Logistical Support
FM	Field Manual
FORGE	Force Generator
FXXI	Force XXI
FY	Fiscal Year
GMLRS	Guided MLRS
ICM	Improved Conventional Munitions
IDA	Institute for Defense Analyses
JCS	Joint Chiefs of Staff
JOPES	Joint Operational Planning and Execution System
JP	Joint Publication
JSCP	Joint Strategic Capabilities Plan
JSPS	Joint Strategic Planning System
JTCM	Joint Theater Combat Model
KFOR	Kosovo Force (NATO Implementation Force)
LADS	Laundry Advanced System
LMI	Logistics Management Institute
MCO	Major Combat Operation
MEF	Marine Expeditionary Force
MLRS	Multiple Launch Rocket System
MTOF	Mission Task Organized Force
MTW	Major Theater War
NATO	North Atlantic Treaty Organization
NG	National Guard
NMS	National Military Strategy

NSS	National Security Strategy
OMB	Office of Management and Budget
OPFOR	Opposing Force
OPLAN	Operational Plan
OPTEMPO	Operational Tempo
OSD	Office of the Secretary of Defense
PACOM	Pacific Command
POL	Petroleum, Oil, and Lubricants
POM	Program Objective Memorandum
PPBES	Planning, Programming, Budgeting, and Execution System
PPBS	Planning, Programming, and Budgeting System
QDR	Quadrennial Defense Review
SBCT	Stryker Brigade Combat Team
SFOR	Stabilization Force in Bosnia, NATO-led
SHORAD	Short-Range Air Defense
SPOD	Sea Port of Debarkation
SRC	Standard Requirements Code
SSC	Smaller-Scale Contingency
TAA	Total Army Analysis
TAA03	Total Army Analysis 2003
TAA05	Total Army Analysis 2005
TAA07	Total Army Analysis 2007
TAA08	Total Army Analysis 2008
TAA09	Total Army Analysis 2009
TAA11	Total Army Analysis 2011
TAP	The Army Plan
TDA	Table of Distribution and Allowance
TEU	Technical Escort Unit

TLE	Target Location Error
TOE	Table of Organization and Equipment
TRADOC	Training and Doctrine Command
TWDS	Tactical Water Distribution System
US	United States
WEAR	Wartime Executive Agent Responsibilities
WMD	Weapons of Mass Destruction

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13. SUPPLEMENTARY NOTES

14. ABSTRACT

This report examines critically the process by which the Army establishes the force structure it will use as the basis for its program submission and budget. This report focuses on the Total Army Analysis 2009, which provided the basis for the Program and Budget for FY2003. This is a follow-on effort to an earlier IDA study that focused on TAA03, and part of the project was to determine what the Army had done in response to previous observations. The report is organized into five parts. Part One provides an overview of the TAA process, explains the forces acting on that process, and notes the special features of TAA09. Part Two discusses how the Army established for TAA09 the number and mix of combat units. This discussion explains the allocation of required units among multiple missions and the way that the Army establishes the combat units it believes are required to carry out the strategy. Part Three explains how the Army determined the numbers and mix of combat support and combat service support units needed for the combat units. This part includes a discussion of allocation rules that provide a means to estimate support units based on estimated theater consumption of supplies. Part Four examines the actions taken to reconcile the required list of units with anticipated manpower and funding constraints. Part Five provides observations on the nature and validity of the TAA process as revealed in the report.

15. SUBJECT TERMS

Army, doctrine, force management, force levels, force structure, manpower, military personnel, civilian personnel, Future Years Defense Program (FYDP).

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