

**STRATEGY
RESEARCH
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**TECHNOLOGY AND U.S. ARMY RESERVE FORCE STRUCTURE
IN THE ARMY AFTER NEXT**

BY

**LIEUTENANT COLONEL PAUL M. BRADY
United States Army Reserve**

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LIEUTENANT COLONEL PAUL M. BRADY
UNITED STATES ARMY RESERVE

COLONEL MICHAEL A. PEARSON
Project Advisor

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U.S. Army War College
CARLISLE BARRACKS, PENNSYLVANIA 17013

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ABSTRACT

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The United States Army has entered a period of rapid technological development that will dramatically change the conduct of war in the future. As the Army progresses through Force XXI to the Army After Next, technology will be the driving factor in changing how we fight. Technology will also enable changes in the way we support ground forces in the future and these changes will perpetuate adjustments in force structure dedicated to support operations. The U.S. Army Reserve, as a principle provider of Combat Support and Combat Service Support at corps level and above, must be prepared to adapt its force structure in order to maintain competencies relevant to the force in the Army After Next.

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INTRODUCTION

The United States Army has entered a period of rapid technological development that will dramatically change the conduct of war in the future. The proliferation of knowledge combined with ongoing research and development in both the Department of Defense and the civilian sector has created concepts and products with exceptional potential for military application. During the next ten years the Army must analyze the impact of evolving technologies in light of future geopolitical and national security implications, Army roles and missions in the National Military Strategy, and continuing budgetary restraints. As the Army charts the course from Force XXI to the Army After Next, technology will be the driving factor in changing how we fight. Technology will also enable changes in the way we support ground forces in the future, and these changes will perpetuate adjustments to force structure dedicated to support operations. The Army Reserve, as a primary force provider of Combat Support (CS) and Combat Service Support (CSS) at corps level and above, must be prepared to adapt its force structure in order to maintain competencies relevant to the force in the Army After Next.

This study will examine probable changes to the force structure of the Army Reserve in light of potentially dramatic changes in the nature of future warfare. The central thesis is

that the characteristics of the Army After Next, shaped by security concerns and enabled by technological changes to military art, will require less force structure dedicated to the theater level support currently provided, in large part, by the Army Reserve. At the same time, other requirements in the area of information warfare are well suited for placement in the Reserve components and offer logical roles to expand Army Reserve structure in support of a probable future National Military Strategy.

The paper will be divided into three parts followed by a conclusion. Part One will describe the current status of the Army Reserve and discuss force structure at corps and echelons above corps as projected out to 2005 by the Total Army Analysis 2005 (TAA-05). Part Two will explore characteristics of the Army After Next based on indicators of the future security environment and projected changes in military art enabled by technology. These characteristics will be tied to relevant aspects of force structure in the Army Reserve at corps and echelons above corps. Part Three will provide examples of how evolving technology can affect manpower requirements for CS and CSS in the Army Reserve as the Army proceeds down the path to the Army after Next outlined in Part Two. The conclusion will provide recommendations for consideration in long range planning for the Army Reserve.

PART ONE: ARMY RESERVE FORCE STRUCTURE

BACKGROUND

In recent years the Army Reserve has undergone dynamic change in organization and force structure. The U.S. Army Reserve Command (USARC) was established in 1991 to command all U.S. Army Reserve units located in the Continental United States except those under the Special Operations Command. The Chief of the Army Reserve, dual hatted as the USARC commander, immediately streamlined the subordinate command structure by eliminating ten major Army Reserve headquarters, and organizing the remaining ten headquarters, by area, to coincide with the ten Federal Emergency Management Agency (FEMA) regions. Also, he reorganized the Army Reserve Training Divisions to support institutional training under the Total Army School System (TASS) and wartime training exercises for Reserve Component CS and CSS units.

Along with these organizational changes, the Army Reserve downsized in conjunction with the Department of Defense and Army force reduction efforts during the same period. The Army Reserve reduced structure first by transferring or inactivating combat arms units in accordance with the 1993 Army offsite agreement. Then the leadership conducted a critical review of each remaining unit and either inactivated or reorganized units that were not relevant to the National Military Strategy. Between 1989 and

1997 the Army Reserve downsized from 319,000 to 215,000, and will reach the Quadrennial Defense Review (QDR) recommended end strength of 201,000 by Fiscal Year 2002.¹

The core competencies of the Army Reserve fall almost completely in the area of combat support (CS) and combat service support (CSS). Placing support structure in a Reserve component makes sense from the standpoint of reducing costs during peacetime, when the needs are less, while maintaining capability through mobilization in the event of a major conflict or other lesser contingencies. With a declining defense budget, the Army will continue to place a deep reliance on the Army Reserve for CS and CSS in the future. The leadership of the Army Reserve must continue looking ahead to anticipate changes in future CS and CSS needs in order to keep the force relevant and ready.

THE ARMY RESERVE IN FORCE XXI

A primary mission of the Army Reserve in Force XXI will be the management of mobilization and deployment support assets that enable the Army to project power into any theater of war. Force structure dedicated to this mission includes CONUS Replacement Centers, Deployment Support Brigades, Transportation Terminal units, Garrison Support units, and Power Projection Platforms. These units are resourced and have been utilized for recent contingency operations. Their role will continue to grow as

greater reliance is placed on power projection capabilities in Force XXI.

Type Units	COMPO1 Regular Army		COMPO 2 Army Guard		COMPO 3 Army Reserve		COMPO 4
	Req	Auth	Req	Auth	Req	Auth	Req
Aviation	8643	9784	12094	12422	2035	1873	2426
Chemical	1921	1498	1862	1849	6058	5744	11267
Engineer	10620	9800	26395	31063	20745	20027	3263
Artillery	9775	9682	27194	28692	0	0	1305
Infantry	0	0	0	2779	0	0	0
Medical	11643	7452	4430	4826	17786	17692	198
Ammunition	3876	3874	1010	997	4075	4075	1012
Field Service	4298	4184	7958	7975	14196	11184	12941
Signal	12497	15568	11105	10383	3354	3755	2395
Personnel	5156	5956	2031	3814	4620	6245	0
Finance	2080	2098	1157	1183	971	969	0
Chaplain	0	0	0	0	70	70	0
Armor	0	0	0	575	0	0	0
Military Police	12061	12304	11372	13168	9316	8918	181
Military History	3	3	0	14	48	48	0
Judge Advocate	0	0	0	0	965	1465	116
Special Forces	4677	7270	0	3462	0	0	42
PSYOP	908	1129	0	0	1648	2605	0
Military Intel	7394	6113	816	2877	1725	2710	384
Civil Affairs	131	208	0	0	5139	4954	0
Supply	2525	2528	1255	1263	9966	7981	4052
Maintenance	8254	8258	18561	18527	7483	7435	2329
Air Defense	8362	7085	5646	5803	0	0	4082
Public Affairs	108	78	612	560	700	695	0
Army HQ Support	1976	1653	475	617	123	252	0
Corps HQ Support	1326	1317	425	500	213	213	0
Transportation	11892	11423	23416	23464	20715	20303	23365
Multi Func. Log	5594	6581	0	2240	3558	3728	0
Lt Infantry HQ	0	65	0	0	0	0	0
Total	135720	135911	157814	179053	135509	132941	69358

Table 1. Total Army MTOE, Corps and Echelons above Corps.

Source: Total Army Analysis - 05 (TAA-05)

Most of the Army Reserve force structure will be comprised of Modified Table of Organization and Equipment (MTOE) units at corps and echelons above corps. Table 1 provides a consolidated listing of corps and echelons above corps type units as projected by the Army out to 2005. All three Army components are shown along with the COMPO 4 reflecting required but not resourced structure.

In Force XXI, the Army Reserve will comprise 32 percent of the total required structure and 30 percent of the resourced structure at corps level and echelons above corps. More importantly, the Army Reserve will hold from 45 percent up to 98 percent of the available required and/or resourced structure in key support units such as chemical, medical, ammunition supply, field service, psychological operations, civil affairs, and general supply. In addition, significant structure

Type Unit	Required Structure	Percent of Total Army	Resourced Structure	Percent of Total Army
Chemical	6058	62%	5744	63%
Engineer	20745	36%	20027	33%
Medical	17786	53%	17692	76%
Ammunition	4075	45%	4075	46%
Field Service	14196	54%	11184	48%
Personnel	4620	39%	6245	39%
Military Police	9316	28%	8918	26%
PSYOP	1648	64%	2605	70%
Civil Affairs	5139	98%	4954	96%
Supply	9966	73%	7981	68%
Maintenance	7483	22%	7435	22%
Transportation	20715	37%	20303	37%

Table 2. Core Competencies of the Army Reserve

in manpower, though not in percentages of the force, will reside in engineer, personnel, military police, and maintenance units. All of these types of units will constitute the major core competencies of the Army Reserve at this level in Force XXI. The manpower percentages in the Total Army of these core competencies are shown in Table 2.

Moving from Force XXI to the Army After Next, the CS and CSS focus of the Army Reserve will probably not change. What may change is the concentration of manpower and, hence, force structure dedicated to various support operations particularly at corps level and above. A projection of the characteristics of warfare in 2025 provides a starting point for determining where force structure adjustments should be made in the Army Reserve to maintain relevance in the Army After Next.

PART TWO: CHARACTERISTICS OF WARFARE IN 2025

FUTURE SECURITY ENVIRONMENT

Many authors have speculated about what the world will be like in 2025. The descriptions range from very optimistic views as expressed by Peter Schwartz and Peter Layden in "The Long Boom"² to predictions of chaos and dysfunction throughout the world. History has taught us over and over that a single event or discovery, such as the use of the first atomic bomb or the

discovery of microchip technology, can drastically alter the course of things that follow. Not knowing what the future holds is the most difficult part of projecting the security environment twenty to thirty years from now. The best the Army can do is consider a range of security systems based on plausible future scenarios and, as noted Professor of Military Studies Steven Metz states, "...continue to debate and analyze the implications of each so that it is prepared once the future system does begin to take shape."³ When this happens, requirements for the Army After Next in terms of size, structure, doctrine, and equipment will become evident.

Although the precise security environment of 2025 cannot be predicted, interpolation of current trends into the future provides a starting point for planning the Army After Next. The National Defense Panel looked out to this timeframe in their study of defense issues and provided a few security concerns that will probably affect the Army After Next. The panel believed the proliferation of weapons of mass destruction would continue to be a primary security concern, especially with the availability of these weapons to conventionally weak states or other nonstate entities that may use them for terrorism. The panel also felt that forward presence or access to key regions may be limited for political reasons or because bases and ports will be vulnerable to attack, particularly by weapons of mass destruction. Maintaining information superiority and protecting our ability to

operate and support military actions from surface to space was an area the panel believed to be crucial to future military success. The panel also speculated that military operations in cities would become increasingly more likely due to continuing urbanization around the world.⁴

These findings indicate several capabilities required in the Army After Next. First, future Army forces must be able to detect, protect, and defend against weapons of mass destruction used by an adversary during military operations or in a terrorist situation. Second, the Army must have superior power projection capability and may have to travel longer distances over land, after deployment, to reach a future theater of war. Third, information operations or information warfare, both offensive and defensive, will become one of the most important elements of future warfare. And last, urban operations will call for Special Forces type capabilities, destructive weapon systems that are highly accurate in order to minimize both collateral damage and noncombatant injury or death, and civil-military capabilities to follow urban combat operations.

To gain a clearer picture of the nature of the future U.S. Army, or the nature of the Armed Forces of other countries, allies and adversaries, Steven Metz offers some general "currents of change."⁵ First, Metz describes an increasing heterogeneity of armed forces around the world as some countries pursue new technologies while others remain tied to old. Also, he states

that heterogeneity increases as countries expand the traditional functions of security beyond warfighting to include economic and environmental concerns and then configure their military to protect these interests. Second, he identifies a diminishing connection between size and capability of an armed force. Metz believes a smaller, advanced military can be more effective than a larger force if it is well-organized, trained, and led. The third current of change discussed by Metz is the blurring of military and civilian aspects of security. He identifies the increased role of information in military operations combined with the strong correlation between corporate and military information security technology as evidence. He also posits that functions performed by armed forces and police could eventually be the same.⁶

Assuming the U.S. will strive to stay on the leading edge of technology, several characteristics of the Army After Next may emerge from the currents of change described by Metz. The Army will be smaller, more lethal, and possibly without peer in ally or adversary as heterogeneity increases. Coalition efforts may be more difficult with the interoperability problems and, if a peer threat emerges, a "technology race" similar to the arms race of the Cold War era could ensue. Technology will steer organization and doctrine and it will allow the Army to respond to security issues beyond traditional warfighting. If military and civilian aspects of security blur in the future as Metz

projects, the Army After Next could have some significantly new roles and missions.

The National Defense Panel findings and Metz's currents of change indicate that the Army After Next will be significantly different, by necessity, than today's force. As the Panel concluded, "While many of today's legacy systems will play a role in deterring and responding to threats to U.S. interests, we believe that the current and planned structure, doctrine, and strategy - that is to say, our current security arrangements - will not be adequate to meeting the challenges of the future."⁷ Accepting that future security concerns will shape the Army of 2025, the next question becomes how the concept of military art will change and how this will impact the Army After Next.

MILITARY ART IN THE ARMY AFTER NEXT

The 1997 Annual Report on The Army After Next Project to the Chief of Staff of the Army provides an excellent analysis of military art and science in 2025. The project leaders used a series of futuristic war games conducted at Fort Leavenworth and Carlisle Barracks to frame strategic and operational issues of an offensive major theater war in the future. Two key elements of military art surfaced during the war games: knowledge and speed. The report states, "Mating superior knowledge with speed of movement can provide the means to frustrate the defender's

ability to acquire and mass fires and thus allow an attacker to cross the deadly zone intact to accomplish an operationally decisive maneuver."⁸

Knowledge is power and, in essence, will be an enabler of speed on the battlefield in 2025. Knowledge dominance will come from a complex network of ground, air, and space based systems that provide both intelligence and command and control communications. The report describes this "surface to space continuum" as "The New High Ground"⁹ that "...will provide an *unblinking eye* capable of constant surveillance over the battlespace and will connect the combat force with its distant support and sustainment base."¹⁰ Protection of information systems will be paramount. Redundant systems, as well as a capability to sustain operational tempo with degraded systems, will be an imperative. The emphasis on information systems at the operational level, combined with the strategic information security concerns outlined above, solidifies the need for a broad and robust information warfare capability, both offensive and defensive, in the future.

Knowledge dominance will allow leaders to make decisions and act with the speed necessary to decisively overcome an opposing force even if postured in defense. Speed begins at the strategic level, with deployment before an enemy can set, and follows through to the operational and tactical levels on the battlefield. To cross the deadly zone intact, an operational-

move from its continental U.S. home base into combat in just a few days while being supported by a radically streamlined logistical tail.¹¹ *Just-in-time* and *just-what's-needed* logistics, supplied by support units operating in remote locations outside the theater, will further enhance the speed of the tactical force.¹²

Precision maneuver will be another characteristic feature of battlefield dynamics enabled by knowledge dominance. One of the Leavenworth games demonstrated "...that superior knowledge permits a commander to apply each discrete part of his force in a single simultaneous act of overwhelming fire and maneuver."¹³ The Winter War Game at Carlisle Barracks indicated that sequenced operations at theater level should be fluid to the point that firepower and maneuver meld into a single culminating action aimed at ending the campaign quickly.¹⁴

Military art and science in 2025, as proposed by the Army After Next Project, will rely heavily on technology to achieve the speed and knowledge necessary for success on the battlefield. Movement to a knowledge-based Army will be through exploitation of information technology. This cognitive agility will combine with emerging technologies in other areas and allow rapid, swift, and lethal movement across the battlefield. The future fighting force will need to be complemented by an equally efficient support structure from unit through theater level. Some general

implications about this support structure, and hence the future of the Army Reserve, can be surmised from the analysis of military art in 2025 combined with future national security projections outlined above.

IMPLICATIONS FOR THE ARMY RESERVE

Many of the current core support roles of the Army Reserve will continue and possibly expand in the Army After Next. A primarily CONUS based active force indicates the Army Reserve force structure dedicated to power projection capability will remain viable and, perhaps, take on more responsibility in the deployment of active forces as well as reserve component forces. The concern for proliferation of Weapons of Mass Destruction dictates a continuing dependence on Army Reserve chemical units. Psychological operations, an important part of current doctrine in defeating the enemy's will to fight, can be equally effective in future warfare, especially with the increased likelihood of Special Forces type warfare in an urban environment. Also, civil affairs units will be necessary for the anticipated need to conduct civil-military operations following urban combat operations or as a key player in the police type actions predicted by Metz.

Army Reserve Military Police assets are concentrated in Prisoner of War type units that will continue to be relevant in

Major Theater War. If Metz's currents of change and theory of heterogeneity hold true, the U.S. will fight enemies that have not modernized their force and depend on size for combat power rather than advanced technology. These situations may yield a high number of POWs that must be managed in order to sustain the pace of the battle.

The projected speed and rapid culmination of future operations will affect force structure of some types of units. Engineer preparation of the battlefield and other construction support may be overcome by the speed of the battle. Engineer units, though still extremely relevant to critical aspects of the warfight, may not be needed at the manpower levels structured in TAA-05. Medical structure, likewise, may not be required at currently projected levels since there will be fewer and better protected soldiers fighting a war of relatively short duration. Combat losses are predicted to be up to 80 percent lower on the Army After Next battlefield.¹⁵

The characteristics of the Army After Next fighting force will affect force structure in all the remaining types of units listed in Table 2. A small, lethal, highly mobile combat force capable of striking over great distances with highly coordinated fire and maneuver will require an equally streamlined and agile support chain from unit through theater level. A smaller force will require fewer supplies to sustain it and this, alone, has force structure implications for the Army Reserve. The speed and

wide dispersion of such a force will make current supply procedures ineffective on the future battlefield. The reduced forward presence of forces, vulnerability of entry ports and bases to weapons of mass destruction, and a desire to minimize the in-theater logistical tail indicate a continuing refinement of Force XXI doctrinal concepts for sustainment operations.

Army After Next planners look to advanced technologies as enablers in achieving a drastically reduced Army After Next in-theater support tail. These advanced technologies can impact on the Army Reserve force structure in three ways: (1) by reducing support requirements necessary to sustain the fighting force as in the case of greater fuel efficiency and more accurate and lethal weapons systems; (2) by increasing efficiency in operations such as supply, maintenance, and personnel; and (3) by opening new potential roles for the Army Reserve particularly in areas like information warfare on the battlefield or as it relates to defense of the homeland in preparation for and during periods of conflict.

PART THREE: TECHNOLOGY AND ARMY RESERVE FORCE

STRUCTURE

TECHNOLOGY THAT REDUCES REQUIREMENTS

Fuel comprises about 70 percent of the logistics burden, in terms of weight and volume, in supporting a fielded Army.¹⁶ Movement, storage and delivery to battlefield users require an entire self-supporting infrastructure, much of which is provided by the Army Reserve. These factors make fuel efficiency technology one of the most critical targets for research and development in creating a highly mobile force and reducing the logistical footprint within the theater of operations.

A recent Army After Next Task Group studied fuel efficiency and proposed two primary approaches that they believed to be practical by the 2025 timeframe: (1) cut energy requirements 50 percent by doubling propulsion efficiency, and (2) reduce platform weight to cut propulsion requirements in half.¹⁷ The aggregate would reduce fuel requirements by up to 75 percent. The Task Group believed these goals would be achievable based on promising technologies currently under research. Improved propulsion and power technologies include advanced turbine cycles, advanced diesel cycles, hybrid drive technologies, waverotor designs and improved power transmission

configurations.¹⁸ Primary weight-reducing technologies include the use of increased structural complexity and advanced composite materials in the design and manufacturing of wheeled and armored vehicles, and the development of tiltrotor systems for Army aircraft. Other potential weight-reducing technology for armored vehicles includes active protection systems to minimize the armor plating and lighter alternatives to conventional track systems.¹⁹

More progressive technologies may be possible on the battlefield by 2025 whereby fossil fuels would be replaced by electricity, solar power, advanced fuel cell technologies, and synthetic liquid fuels produced on site using simple materials.²⁰ Fuel cell technology, in particular, has attracted a high level of interest recently with the development of a fuel processor that extracts hydrogen from gasoline or other fuels to produce electricity from a pollution-free fuel cell.²¹ Also, the possibility always exists for a future breakthrough technology that could render the need for fuel or power resupply nonexistent.

With fuel comprising 70 percent of the weight and volume of logistical stockpiles, a 75 percent reduction in fossil fuel consumption, without considering other technologies, could equate to a potential 52.5 percent reduction in the total logistics footprint theater wide. The favorable consequences of increased fuel efficiency should perpetuate equal changes in the force

structure. These changes would begin reducing force structure around 2010 and continue through 2030 when older less efficient equipment will be phased out of the inventory. The Fiscal Year 2005 Total Army requirements at corps and echelons above corps for fuel storage and delivery reflects structured manpower requirements of over 37,000 with less than 34,000 resourced. The Army Guard and Army Reserve provide 51 percent and 41 percent, respectively, of the fuel storage and resupply capability projected in the Fiscal Year 2005 force structure. Both components have petroleum supply units and POL truck companies with the Army Reserve structure also including petroleum pipeline and terminal operations units. An eventual 75 percent reduction in fuel requirements could reduce structured manning requirements by a corresponding 75 percent, or almost 28,000. Maintaining a similar mix of manning levels between components would reduce Army Reserve force structure from over 15,000 to about 3,700. Considering evolution to a smaller Army After Next Force with correspondingly fewer fuel consuming vehicles, the reduction in force structure will be even greater.

Weapons technology provides another key area for research and development to enhance mobility and lethality while reducing logistical support needs. Next to fuel, ammunition comprises the largest logistical burden in terms of weight and volume. Force structure at corps and echelons above corps in TAA-05 has structured manpower requirements dedicated to ammunition handling

of almost 9,000 with 45 percent of those in the Army Reserve. Medium truck companies augment ammunition transport capability in a theater of operations with up to an additional 4,000 structured positions in the Army Reserve alone. From a logistical standpoint, the goal by 2025 will be to maintain or increase combat power with significantly fewer resources in terms of combat manpower, weapons systems, and support structure. This will be accomplished in three basic ways in the Army After Next: (1) precision strike, (2) improved propellants and explosives, and (3) advanced systems to control and coordinate fires.

The ability to destroy targets with a higher percentage of first round hits has a trickle down effect on every aspect of Army After Next operations. Fewer weapons systems and less ammunition will be required to provide a given level of combat power. In turn, less manpower will be required to maintain and sustain that given level of combat power. Army After Next analysts state that, to a large degree, the technology required to meet the future vision of munitions delivery already exists.²² An Armor officer recently capsulized this theory in an analysis published by Armor magazine of how a digital tank platoon, in the defense, can destroy an attacking motorized rifle battalion with less than a basic load of Smart, Targeted Activated, Fire and Forget (STAFF) ammunition.²³

Improved propellants and explosives go hand in hand with improved accuracy of delivery systems to reduce battlefield

logistics. Improved performance of energetic materials will lead to smaller, lighter munitions that can be stowed in larger numbers on the delivery platform. Researchers theorize that through improved design, materials, and new high explosive formulations the mass of a current anti-armor HEAT round could be reduced by 50 percent with most of the savings attributable to the high explosive.²⁴ Some experts suggest that the performance of energetic materials, based on volume, could increase up to ten-fold by the Army After Next.²⁵

The third factor in reducing logistical requirements for ammunition embraces a capability to coordinate fires so that each target is engaged efficiently by the most appropriate and available weapon system(s). This capability depends on the integration of sensor systems, battlefield information technology, and command and control systems that currently does not exist. As stated in the Army After Next Winter Wargame report, "It should be possible to establish a cooperative, distributed communications and sensor information sharing network for Army (and joint) precision strike, similar to the Cooperative Engagement Capability (CEC) used for naval ship defense."²⁶ The benefit from a logistical standpoint stems from eliminating redundant target allocation and engagement that wastes ammunition.

In addition to advancements in weapons systems and ammunition, new concepts of ammunition resupply may further

reduce ammunition handling manpower requirements. Army After Next analysts expect ammunition resupply to be modular in design by 2025. Ammunition would pass through the resupply system in honeycomb-type containers and be transferred, robotically, directly to the gun thereby eliminating all intermediate handling.²⁷ Given the reduced weight, volume, and number of rounds necessary to arm the force, the anticipated speed of the battle, and the need to minimize logistical footprint, resupply of ammunition by aerial means, manned or unmanned, may be both desirable and necessary.

Advanced technology in weapons systems and ammunition, like fuel efficiency technology, will reduce force structure requirements devoted to ammunition storage and delivery. The degree of reduction is difficult to calculate. Ammunition does not have a set relationship between weight and volume like fuel. Also the dimension of quantity can play a role in manpower required to store and deliver ammunition. But anticipated reductions in all three dimensions, combined with new delivery methods, indicate the plausible elimination of nearly all ground transport capability for ammunition at corps and echelons above corps.

TECHNOLOGY THAT INCREASES OPERATIONAL EFFICIENCY

Army combat operations require a significant amount of manpower dedicated to support operations in supply, maintenance,

and personnel. Unlike fuel and ammunition, where technology will reduce resupply needs for each vehicle or each weapon system, technology will not change the sustainment needs for each soldier or each piece of equipment. Force structure requirements in these areas will naturally go down in proportion to the smaller size of the Army After Next fighting force, but information and communications technologies will provide efficiencies that allow more dynamic reductions.

Force XXI operations lay the groundwork for Army After Next supply operations. "Split-based operations, total asset visibility, telemetry to allow anticipation of requirements, containerization, automation, and assured communications will provide flexible, prompt, and efficient sustainment on future battlefields."²⁸ These capabilities will be enabled initially by integration of CSS automation systems into the Army Battle Command System.²⁹ Next generation systems are expected to have automated planning capability, decision support tools, and the capacity to interact with logistics systems of other services.³⁰

In addition to efficiencies gained by information systems, new delivery methods will likely replace the manpower intensive systems of today. The Marine Corps is currently exploring Advanced Precision Airborne Delivery Systems (APADS) to deliver equipment and supplies to field units. APADS consist of parafoil or semi-rigid wing delivery platforms dropped from high altitudes and guided by on-board Global Positioning System (GPS) technology

to within 100 meters of a specified ground location.³¹

Researchers project that by 2025, APADS like pods containing critical supplies will be launched from low orbiting space based cargo drones - literally a "depot in the sky."³²

With the kind of technology projected by the Army After Next timeframe, necessary force structure for in-theater ground based supply operations will be a fraction of current requirements. Digitized automation and advanced communication capability will allow supply operations to be conducted from remote locations with *just in time* and *just what's needed* efficiency. This efficiency will reduce manpower requirements while complementing the speed and agility of Army After Next fighting force.

Maintenance operations in the Army After Next will be more efficient for two reasons. First, the vehicles, weapon systems, and components will be more dependable through "ultra reliability" engineering. Secondly, diagnosis and repair time will be reduced by 50 percent and diagnosis accuracy will be increased to 99 percent.³³ Vehicular operators and weapon system crews will avert many failures with on board prognostics and sensors, and maintenance personnel will have miniature computers to diagnose and repair equipment onsite.³⁴ Increased dependability and improved diagnostics are predicted to reduce the number of repair parts in the system by 40 percent offering a second order effect of reducing requirements for a major class of

supply.³⁵ Keeping equipment and weapons systems in operational condition in order to sustain the pace of future battle will be the driving force to improve maintenance technology. A side benefit will be the reduction in force structure necessary to man the maintenance units of the Army After Next.

Personnel support operations currently demand relatively high manpower levels at corps and echelons above corps. Although pay and personnel systems were among the first to be automated, data storage limitations have caused the Army to create separate database applications to accomplish individual functions or processes. These applications improved the speed and accuracy of a given process, but the level of manpower needed to operate multiple systems voided any significant increase in efficiency through automation from a force structure standpoint.

By 2025, tremendous advancements in information technology will allow downward adjustments in force structure dedicated to personnel operations. Data storage capacity will increase ten fold and be complemented by microprocessors that are 200 times faster than current processors.³⁶ New methods of building databases will eliminate the redundancy of multi-system approaches and enhance the ability to maintain all military records and personnel actions on an individual soldier in one consolidated system. Perhaps a megasystem that includes records of all military personnel from all services and all components will be possible by 2025. The efficiency of a joint personnel

system, capable of capturing the unique requirements of each Service, has immeasurable potential to reduce force structure in all the Services.

Advanced technology will offer other efficiencies in the area of personnel operations. Identification cards with a queriable read-write chip will hold more than one gigabyte of soldier data allowing records to be read anywhere, anytime on pocket size computers.³⁷ Advanced communications technology will allow record updates and personnel actions to be accomplished from remote locations. Commander counseling, Chaplain or legal assistance, and even calls home may be accomplished via two-way video communications.³⁸ Postal operations will probably become an anachronism replaced by generation after next electronic mail. These changes, combined with the advanced data system technology outlined above, indicate personnel operations of the Army After Next will be highly efficient and less manpower intensive than Force XXI.

The degree that Army After Next technology will reduce force structure in the Army Reserve at corps and echelons above corps cannot be precisely determined. The yet undetermined smaller size of the fighting force will produce a corresponding, across the board, decrease of support structure in all areas listed in Table 1. Technology will then allow additional reductions, as in the examples described above, that support the demands of future warfare discussed in Part Two. Ironically, much of the

technology that will provide manpower savings and enable the Army to meet strategic, operational, and tactical demands of 2025 will require dedicated structure to protect that technology. This new structure will most likely be built under the relatively new concept of information warfare.

INFORMATION WARFARE: A NEW ROLE FOR THE ARMY RESERVE

The Institute for the Advanced Study of Information Warfare (IASIW) defines information warfare as "...the offensive and defensive use of information and information systems to exploit, corrupt, or destroy, an adversary's information and information systems, while protecting one's own."³⁹ Information warfare adds a new dimension to warfighting that will force the defense establishment and policy makers to rethink how to wage war. National security consultant Bruce Berkowitz compares the information revolution to the development of the concept of strategic bombing. Just as the invention of the airplane eventually led to a new and dominant doctrine of strategic bombing, information technology will gradually evolve into new theory and doctrine for warfighting in the Information Age.⁴⁰

The Defense Department recognizes the need to develop information operations capability. Recently announced Pentagon intentions to establish an information operations post at the deputy assistant secretary level within the Office of the

Secretary of Defense speaks to this. Also, the Joint Staff has circulated a draft of Joint Publication 3-13 (JP 3-13), Joint Doctrine for Information Operations.

The draft of JP 3-13 contains several indicators for Army Reserve involvement in information warfare. The draft states that information operations will cover all three levels of war, but most will be conducted at the operational level to achieve or support theater objectives.⁴¹ Further, the draft discusses information operations as an "...integration of many capabilities and related activities." The major information operations capabilities to be integrated include psychological operations (PSYOP), operation security (OPSEC), military deception, electronic warfare (EW), physical destruction, and computer network attack. Related activities include civil affairs and public affairs.⁴² Since 70 percent of PSYOP, 96 percent of civil affairs, and 52 percent of public affairs resourced structure for theater level support is in the Army Reserve, involvement in information operations is automatic.

In addition to the connection between proposed joint doctrine and capabilities already in Army Reserve force structure, there are other good reasons for the Army to delegate a prominent role in information warfare to the Army Reserve. Information operations, particularly as they pertain to security, are ongoing during peace. In periods of conflict or war the requirements increase exponentially. Missions that fall into

this category are well placed in the Reserve component to maintain a needed wartime capability while minimizing cost during peacetime. In addition to cost savings, the Army may be able to capitalize on the talent available in the civilian sector by recruiting individuals involved in corporate information operations. Metz writes:

"There is less distinction between civilian information technology and military technology than in other arenas. The skills needed by a future "information warrior" will not be fundamentally different from those in charge of corporate information security."⁴³

In addition, many potential "information warriors" in the corporate world may be prior service members who already have military credentials.

Drawing from the corporate workforce to build this capability for the Army will have the additional national security benefit of increasing awareness of this threat to commercial enterprises. Information warfare can stretch from the battlefield up to the strategic level and will not be limited to military targets. Civilian information systems, so important in the infrastructure of developed nations of the world, will inevitably be prime targets of future war. Army Reserve information operators can serve as a bridge to cooperation between the Department of Defense and industry in defending against information attacks.

The National Defense Panel acknowledged information attacks on U.S. information and economic infrastructures as a threat to

national survival second only to weapons of mass destruction (WMD).⁴⁴ In the discussion of Homeland Defense, the panel specifically recommended the National Guard and Army Reserve train local authorities for the possibility of a WMD attack and be prepared to assist if one should occur.⁴⁵ The panel did not make a recommendation like this for information attacks, but the logic of establishing a similar program with Reserve component assistance makes sense from both a national security and a budgetary standpoint.

With the projected capabilities of and reliance on information technology, offensive and defensive information warfare will be essential elements of all Army After Next operations. Force structure dedicated to information warfare will undoubtedly grow relative to the increase in technological capabilities and vulnerabilities during the first quarter of the 21st century. Most of that growth will be on the technical side of information warfare. The Army Reserve already plays a large role by virtue of its current force structure. Increasing Army Reserve force structure in the areas of OPSEC, EW, and computer network attack would complement current roles and provide an economical way to develop a robust information warfare capability for the Army After Next.

CONCLUSION

The force structure of the Army Reserve reflected in TAA-05 will undergo significant changes by the Army After Next. In many cases, manpower will be replaced by efficiencies in systems and processes. The pursuit of increased efficiency will be driven by factors deemed critical to success on the battlefield in the geopolitical and national security environment of 2025 and will be enabled by technological advancements over the next 25 years.

Advanced technology will reduce manpower necessary to achieve a specified level of combat power in the fighting force, which, in turn, will reduce support structure. Also, advanced technology will either reduce support requirements, as with fuel efficiency, or improve manpower efficiency in missions allocated to the Army Reserve at corps and echelons above corps. The objective of minimizing the logistical footprint in a Major Theater War will serve as a primary stimulus for continued Research and Development in CS and CSS related technologies.

The increasing reliance on technology will create a growing demand for defensive and offensive information warfare. The Defense Department's development of information warfare is virtually in its infant stages even though significant need and threat already exists. Each Service must adapt policy, doctrine, organization, and force structure as information capabilities emerge. For the Army, the Army Reserve provides a logical and

economical medium for organizational and force structure changes in the area of information warfare. Additionally, opportunities exist to capitalize on qualified individuals from the civilian sector and to increase awareness and preparation for asymmetrical commercial information attacks by a future adversary.

Force structure changes in the Army Reserve resulting from technological advancements will be protracted over the period leading into the Army After Next timeframe, but long range planning should begin now. First of all, the Army Reserve's recent review of units in terms of relevance to the National Military Strategy should continue. The effect of future technologies on the mission and processes of each unit must be used as a trigger for projecting changes in CS and CSS force structure. Additionally, these force structure changes need to be phased with current equipment wear out to prevent failures in supporting the fighting force and to avoid waste of scarce budgetary resources.

Secondly, Army Reserve recruiting and training should begin shaping the force to meet the phased changes in structure that will occur during transition to the Army After Next. Skills that will be reduced or no longer needed must be identified in time to adjust recruiting efforts. Some risk in manpower levels should be accepted for these occupational specialties in order to reduce the cost of transition.

Finally, core competencies in information warfare should be

developed in the Army Reserve. Specifically, these competencies should include missions related to: (1) expanding offensive and defensive information warfare at the operational level; (2) protecting information systems used for CS and CSS theater support operations; and (3) preparing for and responding to commercial and domestic information attacks. The Army needs to develop organization and structure for information operations. Once this is established, the Army Reserve can begin shifting force structure, perhaps from other areas where less manpower will be needed in the future. To meet the immediate needs of information warfare, the Army Reserve should recruit individuals that have developed hard skills in information technologies in the civil sector, particularly those with prior military status. To support the transition, the Army should adopt policies to recognize civilian based qualifications in information technology.

The Army Reserve must stay on top of new technologies and constantly reevaluate the impact on CS and CSS force structure. Long range planning is critical, particularly with the resource limitations anticipated in the future. Flexibility and creativity will enhance the planning and transition process. Above all, the Army Reserve must continue to focus force structure on mission and strive to maintain its current level of relevance into the Army After Next.

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³⁴ Ibid.

³⁵ Ibid.

³⁶ Ibid., 11.

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