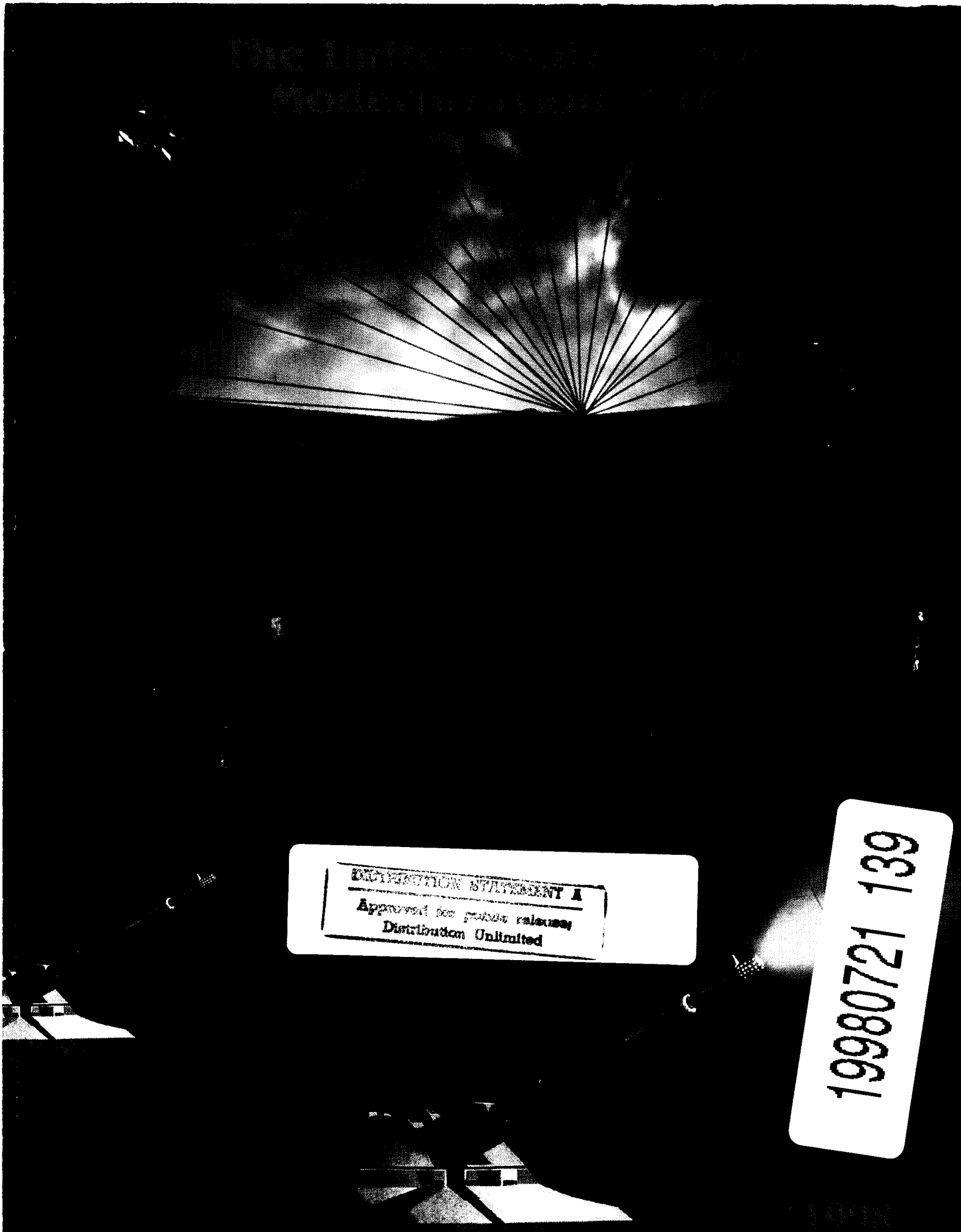


DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

19980721 139

Prepared By:

Office of The Deputy Chief of Staff for Operations and Plans
Attn: DAMO-FDG
400 Army Pentagon
Washington, D.C. 20310-0400

DEPARTMENT OF THE ARMY
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS
400 ARMY PENTAGON
WASHINGTON DC 20310-0400

REPLY TO ATTENTION OF

DAMO-FDV

4 Aug 98

DTIC
Attn: Ms. Patricia Mawby

SUBJECT: 1998 Army Modernization Plan

1. Reference your request for release of the 1998 Army Modernization Plan. The 1998 Army Modernization Plan was published in May 1998 and is released for dissemination, Distribution A.

2. POC is the undersigned, 695-7442.

BRIAN K. MAYS
LTC, GS
Army Mod Plan Coordinator

Post-it® Fax Note 7671	Date	# of pages ▶
To Ms Pat Mawby	From LTC Brian Mays.	
Co./Dept.	Co. DAMO-FDV.	
Phone # 767-8019	Phone # 695-7442	
Fax # 767-8032	Fax # 695-7393	

Printed on Recycled Paper

DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 20310

April 13, 1998

SUBJECT: 1998 Army Modernization Plan

Since the end of the Cold War, the Army has been the Service of choice in responding to the nation's needs. The capabilities and equipment soldiers have today are, in large part, the result of decisions made a decade ago. As the Army prepares now for the 21st century, the decisions we make today will determine the capabilities and equipment of Army XXI.

This presents both an opportunity and a challenge. The Army has developed its operational vision for Army XXI to support the National Military Strategy and Joint Vision 2010 to achieve Full Spectrum Dominance. We are working to make this vision a reality through a process called Force XXI. We have developed the 1998 Modernization Plan to make the best use of scarce resources to equip the Army of the future, while still meeting today's needs. This Modernization Plan details what the Army plans and what we can accomplish with these resources. While we do not accomplish all that we would like, the plan is prudent and sets the course for future change.

This year's Modernization Plan is based on a time-phased investment strategy that takes into consideration the expected geostrategic environment, the expected operational needs, and the technological advances now taking place and on the horizon. The plan focuses the near- and mid-term on enhancing operational capability by achieving Information Dominance. At the same time, it preserves the combat overmatch required to win swiftly with minimum casualties. The Modernization Plan also prepares for the Army After Next by focusing technology development for the far-term payoff of leap-ahead capabilities.

Our vision is clear. Our missions are increasing and expanding. Our capabilities must keep pace. Through modernization, we must ensure that our Army remains the most capable Army in the world; able to shape the international environment to deter potential crises; able to respond to crises that do arise; and able to prepare now to meet the full spectrum of crises expected in the 21st century.

Dennis J. Reimer
General, United States Army
Chief of Staff

Robert M. Walker
Acting Secretary of the Army

DTIC QUALITY INSPECTED 1

Printed on Recycled Paper

THE 1998 UNITED STATES ARMY MODERNIZATION PLAN

Table of Contents

Annex		Page
	Army Modernization Plan	i
A	Force Structure	A-1
B	Soldier Systems	B-1
C	Digitization	C-1
D	CBT Maneuver	D-1
E	Fire Support	E-1
F	Air & Missile Defense	F-1
G	Aviation	G-1
H	NBC	H-1
I	C4	I-1
J	IEW	J-1
K	Tactical Wheeled Vehicles	K-1
L	Logistics	L-1
M	Combat Health Support	M-1
N	Training	N-1
O	Space	O-1
	Glossary	

THE ARMY MODERNIZATION PLAN

> *"I do not know when or where, but we will sometime place soldiers in harm's way, on short notice and ask them to defeat a determined and dangerous foe. When that happens, we should be satisfied that we have done our best to prepare them for the task at hand."*
>
> General Dennis J. Reimer, CSA

Introduction

The Army must be prepared to contribute to the National Military Strategy (NMS) and to do so it must modernize. That need is a constant. No Army, regardless of its prowess in its last war, can presume its weapons, organization, and methods of fighting will automatically be appropriate for the next. That endstate is a potent, capabilities-based force that supports the NMS.

The Army is increasingly being used for the purpose of worldwide deterrence, engagement, and enlargement operations. In the short span of seven years, we have deployed 27 times—an order of magnitude increase over the entire Cold War period. But, despite this increased operational tempo, the Army continues to receive the same percentage of DoD Total Obligation Authority (TOA) as it has received for 40 years, except during Vietnam and Operation Desert Storm.

The Army receives 24% of the DoD TOA and 14% of the total DoD investment accounts. Analysis shows that Army procurement is underfunded annually at approximately $4B. Given the Army's TOA and its requirement to balance near-term readiness with future investment, we developed an investment strategy that determines those programs to modernize, those to recapitalize (upgrade), and those to defer until technology advances provide leap-ahead capability improvements.

The Army believes that digitization of the battlefield provides essential capabilities required by *Joint Vision 2010* to support the NMS, and therefore it is our top priority. This modernization plan lays out how the Army has elected to invest its scarce resources to:

- Field programs that enable information superiority,
- Maintain combat capability overmatch through selective modernization of combat systems,
- Conduct essential research and development and leap-ahead science and technology,
- Recapitalize aging systems with product improvements, and
- Achieve status as a totally integrated force.

Purpose of the Army Modernization Plan

The Army Modernization Plan is a comprehensive, imaginative program of improvement that will guarantee tomorrow's soldiers are equipped and trained for combat with the best tools available. It is an essential demand on the Nation's resources. Military hardware, operational concepts, doctrine, and command initiatives are never absolute and never static. The World War II and Cold War armies required reorganization and restructuring for Vietnam, and the Desert Storm army must be changed if only because other nations and other armies learned lessons in the Persian Gulf also. Their application of modern technology to those lessons will assure that the next battlefield on which we are engaged will be different, perhaps more challenging, certainly an uncertain prospect at the outset.

As we transform the Army to meet future needs, we must strike a balance in our technological efforts between achieving leap-ahead capabilities and finding the best ways to improve existing and soon-to-be-fielded systems. By transforming the Army too quickly, we risk acquiring capabilities that are "overkill" and not needed for the near-term strategic environment. This would be expensive and would create an imbalance in the six imperatives of quality people, training, force mix, doctrine, modern equipment, and leader development. Quick transformation may also result in using technologies not fully matured and that could not retain their long-term relevance. Transforming too slowly risks losing the Army's current position of military dominance. While more affordable, this path seriously risks preparedness for future threats.

In addition to providing a road map to attaining future full-spectrum capabilities, the 1998 Army Modernization Plan:

- Explains the Army's Modernization Strategy,
- Presents a comprehensive and coherent summary of modernization programs,
- Provides an assessment of modernization efforts,
- Identifies significant modernization accomplishments with the resources available and achieved through additional initiatives and efficiencies, and
- Identifies significant modernization shortfalls.

The Army Modernization Plan, together with the Army Science and Technology Master Plan (ASTMP) and the Army Enterprise Strategy (AES) and guided by the modernization strategy, provides the road map for the Army to achieve full-spectrum dominance for Army XXI and position itself for the Army After Next (AAN). The establishment of priorities over time should enable the Army to meet the needs of the National Military Strategy now and in the future. The focused research and development effort should provide for continued improvements required for overmatch as well as development of the next generation capabilities. The ASTMP is the technical companion document to the Army Modernization Plan. The ASTMP describes the highest priority S&T investments to enable *Army Vision 2010* patterns of operation and AAN capabilities. The AES is the single unified vision linking strategy and doctrine to the employment of information technology in military operations. It serves as the enabler for a full spectrum dominant land warfare force for the next century. It integrates Army

doctrine and modernization plans for the evolution of systems to achieve information dominance. The Army Modernization Plan annexes include a section on Essential Research and Development and Leap-Ahead Technology programs that highlight significant efforts important to the respective annexes. Complete descriptions of the Army's 200 Science and Technology Objectives (STOs) as well as Strategic Research Objectives (SROs) are detailed in the ASTMP.

The Need to Modernize

The overarching reason to modernize is to maintain greater combat capability than a potential enemy's. The Army is America's force of decision, ready to conduct missions across the full spectrum of military operations—from promoting regional stability to conducting peacetime operations to fighting and winning major theater wars. The dangers we face today, and consequently the missions we are expected to perform, are more diverse than they were in a bipolar world. To accomplish these missions, the Nation must have an Army able to deter diverse threats and, when necessary, to fight and win.

A Changing Environment

As depicted in Figure 1, in the 1990s the Army's modernization strategy changed to respond to the changing environment. The modernization strategy strived to develop and maintain a balance among five modernization objectives that would provide a full range of capabilities required for Land Force Dominance. This strategy also began to recognize the key role played by information operations on the battlefield. "Win the Information War" became one of the modernization objectives. Major improvements were begun in sensor and information processing capabilities.

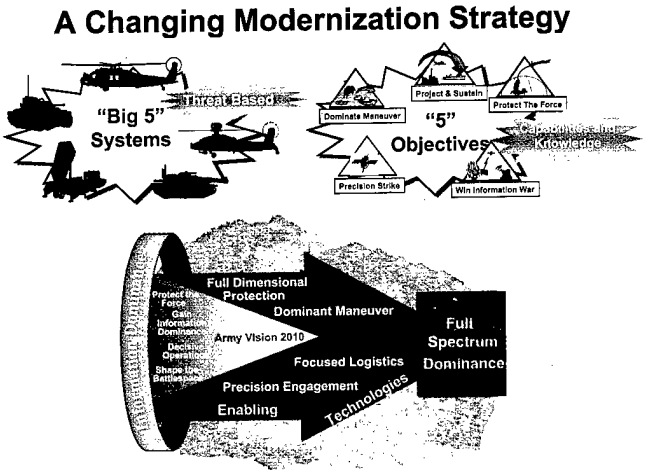


Figure 1

Changes in several conditions and circumstances, and fiscal realities have convinced us that the strategy of maintaining balanced modernization objectives is no longer appropriate to an effort of achieving the full spectrum dominance required for the 21st Century:

- **Changing Geostrategic Environment.** Regional instabilities of the post-Cold War geostrategic environment and the National Military Strategy of Engagement and Enlargement have resulted in increased requirements for land forces across a broad spectrum of crisis activities. The Quadrennial Defense Review (QDR) highlighted the relevance of the Army in the current geostrategic environment. Maintaining peak readiness for key missions by preserving combat force capability and maintaining forces responsive to the missions resulting from the National Military Strategy are top priorities for the Army's modernization programs.

- **New Overarching Visions.** The publication of *Joint Vision 2010* (JV 2010) provided the conceptual template for achieving new levels of effectiveness in joint warfighting. It identifies advanced operational concepts that result in dominance across the entire range of military activities—full spectrum dominance. *Army Vision 2010* (AV 2010) was developed as the blueprint for the Army's performance contribution to these warfighting concepts. The patterns of operation described in *Army Vision 2010* now define the general capabilities required for the Army to meet the needs of the nation in the geostrategic environment of the 21st Century. These patterns serve as a template for Army modernization (refer back to Figure 1).

- **Army Warfighting Experiments.** The lessons learned from a series of Army Warfighting Experiments must be integrated into the modernization and investment plans. As part of its Force XXI process for changing to meet the needs of the 21st Century, the Army has learned lessons about how to integrate new technological advances, particularly in information technologies, to provide enhanced warfighting capabilities. As the Army changes in size, it also is being redesigned to reflect the needs of the new geostrategic environment and to take full advantage of technological advances.

- **Resource Shortfalls.** Over the past decade, however, there has been increased emphasis on the need to rapidly project and maintain overseas presence in order to shape the international environment and respond to a variety of small-scale contingencies and asymmetric threats. Peak readiness for these contingencies requires full funding of training and operations accounts. The Army's Total Obligation Authority has been greatly reduced since the end of the Cold War. As a result of the directed downsizing, the Army made the conscious decision to take care of people, soldiers and civilians, while maintaining current readiness. These priorities came at the expense of modernization funding. Concurrently, the increased OPTEMPO is causing a higher-than-programmed toll on the useful life of Army equipment, thus shortening potential life cycles and further increasing the need for recapitalization. Diversion of modernization funds has resulted in slowing, stretching, or canceling key programs, accepting the inefficiencies of these actions, and deferring the capabilities these systems would provide. Today's modernization and investment strategy emphasizes reducing this migration from procurement accounts and providing procurement stability.

The Army RDA budget has consistently been the smallest in DoD. When supplemental funding for the Gulf War is excluded, FY98 is the 13th consecutive year of declining Army TOA. Over this period, Army TOA declined by nearly 43% (FY85 $106.6B to FY98 $60.4B) (Figure 2).

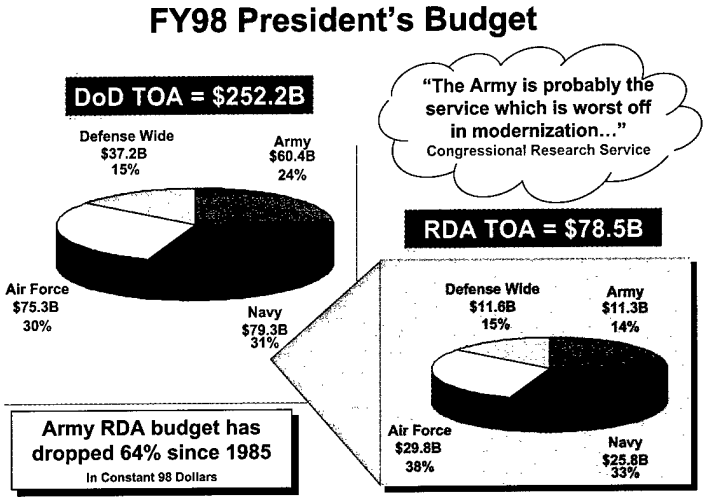


Figure 2

This trend has been most acutely felt in our modernization investment accounts. Today, Army modernization investments account for just 14% of all DoD RDA. With the submission of the FY98 President's Budget, Navy RDA resourcing was approximately double that of Army RDA. Similarly, Air Force RDA resourcing was approximately two and one-half times as much.

Over the past 13 years, Army procurement has declined nearly 73% (FY85 $25.50B to FY98 $6.7B). The FY98 President's Budget totaled $6.7B for Army procurement (Figure 3). In real terms, that was the lowest procurement level for the Army since 1960.

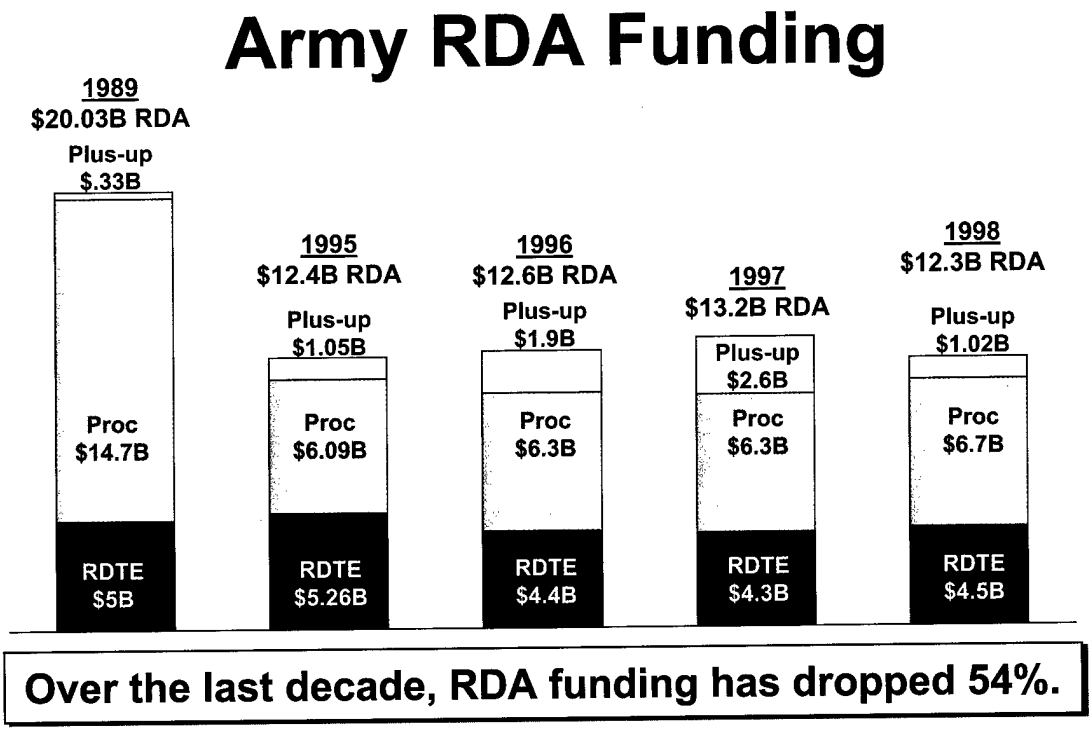


Figure 3

This decline in available funding has caused the Army to maintain procurement programs at minimum sustaining rates rather than more efficient economic rates. Furthermore, with additional funding support from Congress, which totaled $371 million in the FY98 Department of Defense Appropriations Bill, Army procurement funding only keeps pace with inflation. Based on current projections, it appears that FY99 will continue that trend.

In the interim, the Army—with congressional support and leadership—has been doing much to help itself. Through a combination of initiatives, we have acted more efficiently and therefore freed critical funds for higher priorities. The congressionally-mandated 1997 Quadrennial Defense Review was helpful in many respects.

The QDR:

- Focused on the elements of our National Military Strategy—Shape, Respond, Prepare—and recognized the strategic role of land forces across the full spectrum of operations, both now and into the foreseeable future.
- Noted that Army modernization investments are directly linked to the National Military Strategy, especially our ability to "prepare" for the challenges of an uncertain future.
- Validated the Army modernization objectives and programs, and increased funding for digitization and acceleration of the transformation of U.S. Army Reserve and Army National Guard forces to fill critical capability shortfalls in combat support and combat service support forces. These transformations, as well as others associated with Total Army Analysis 2003, are rolled under an initiative called the Army National Guard Division Redesign Study (ADRS). The Secretary of Defense pledged an additional $1 billion for Army digitization and, internally, the Army has more than doubled funding for ADRS from FY98 to FY03.
- Created an opportunity to assess the impact of Army modernization on the Army Reserve Components. This has been an unparalleled success story, with $21.5B in new procurement and cascaded equipment.

Modest personnel reductions in all components (military, civilian, active and reserve) resulting from the QDR have made some additional funding available. However, to balance modernization requirements with resources the Army needs an additional $3-5B per year over the long term, in today's dollars, bringing the total Research, Development and Acquisition (RDA) account to a steady-state $15-16B.

Modernization Strategy – Vision

The Army Modernization Strategy consists of three components - - a vision, goals and investments. As a result of the changes described above, the Army has adopted a modernization vision to guide us into the 21st Century and beyond: Enable *Army Vision 2010* by equipping a capabilities-based Army to achieve full spectrum dominance in conducting prompt and

sustained joint operations while protecting the essential elements of the science and technology and industrial bases (Figure 4).

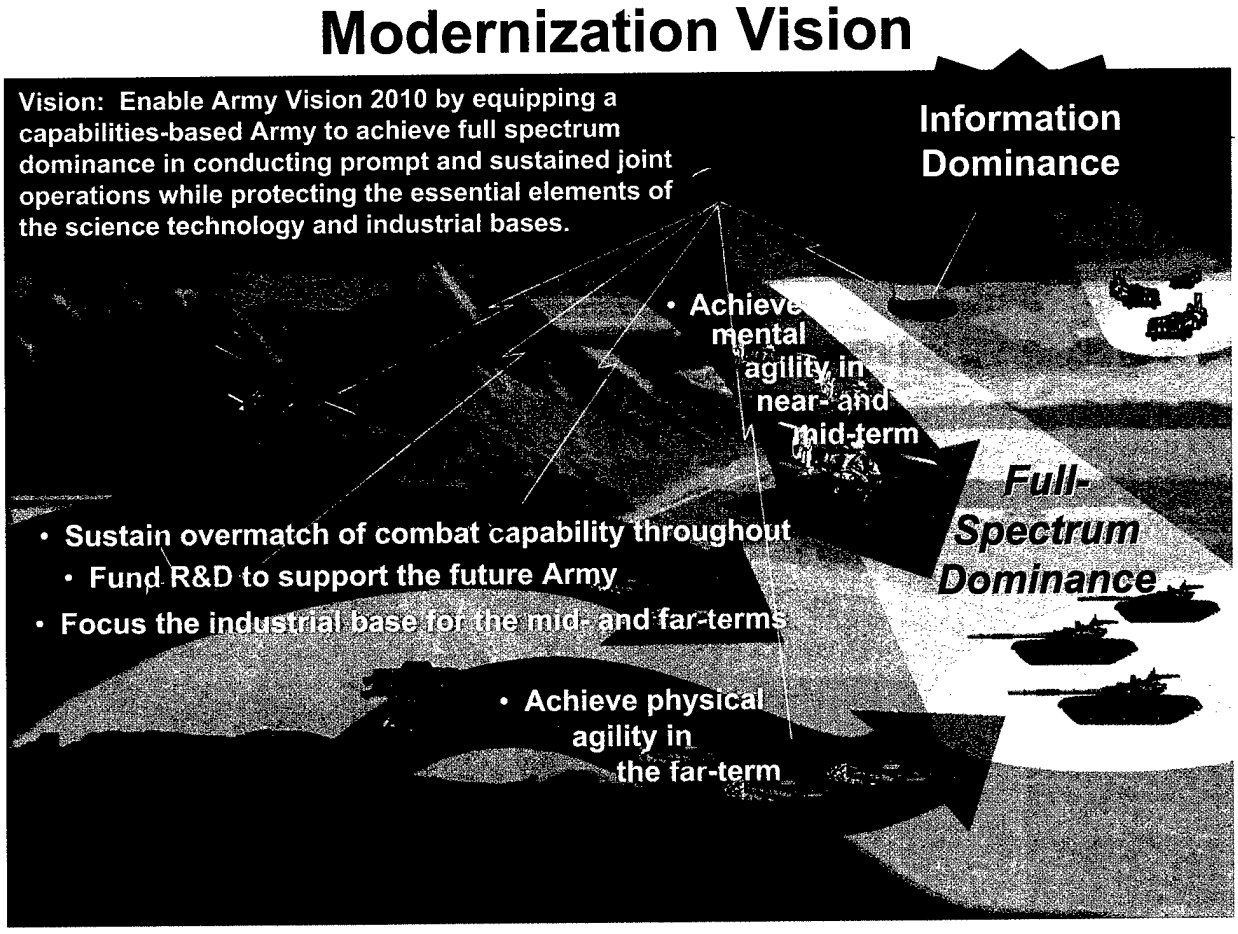


Figure 4

Modernization Strategy – Goals

The modernization strategy is executed by establishing specific goals to be achieved during the next decade. Focusing on achieving information dominance while maintaining combat overmatch will allow us to eventually field a full-spectrum, dominant land warfare force for the next century. The five major goals of Army modernization are:

- Digitize the Army
- Maintain Combat Overmatch
- Sustain Essential Research and Development (R&D) and Focus Science and Technology (S&T) to Leap-Ahead Technology for the Army After Next
- Recapitalize the Force
- Integrate the Active Component (AC) and the Reserve Component (RC)

Using representative systems, modernization goals are depicted in Figure 6. Faced with an uncertain future, but still required to be prepared, the modernization strategy focuses on specific opportunities that provide the Army the best return on investment.

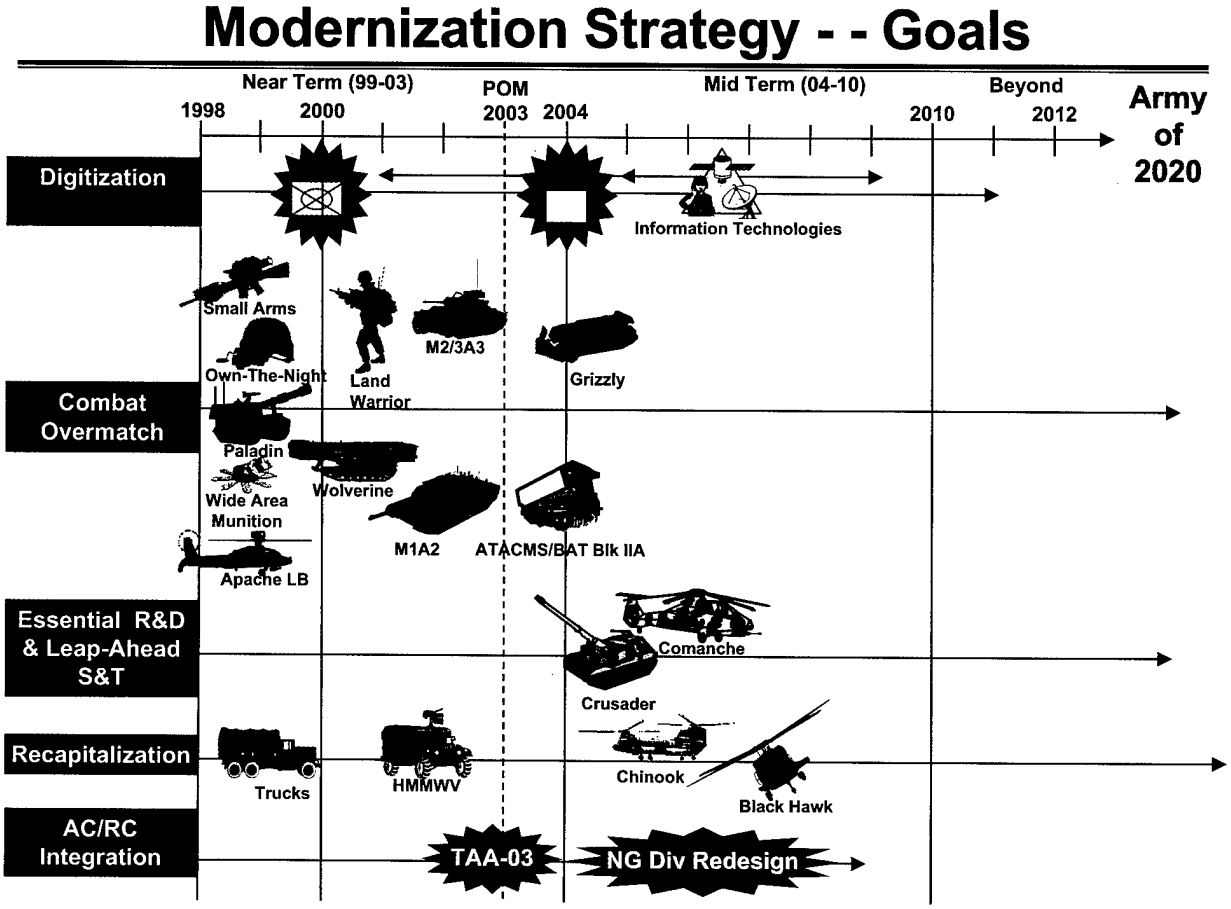


Figure 5

Digitize the Army

Information dominance provides the foundation for full-spectrum dominance. We are learning in the warfighting experiments that secure information technology can create an order of magnitude difference in combat effectiveness. Therefore, the first priority of the modernization strategy is to achieve information dominance in the near-and mid-terms. Information dominance stems from superior information systems and the mindset and training that ensure soldiers are prepared to win on the complex battlefield of the future. It results in a significant operational advantage over any adversary.

Digitization is a component of modernization. It is the means by which we will achieve information dominance. Digitization involves the use of modern communications capabilities and computers to enable commanders, planners, and shooters to rapidly acquire and share information. The resulting improved awareness will revolutionize the conduct and tempo of all phases of combat operations. The cornerstone of this effort is the fielding of a digitized corps by

2004, with an intermediate goal of a digitized division by 2000. Digitization of "echelons above division" organizations is scheduled to be accomplished at a slightly slower pace, depending on the relative position in the deployment sequence associated with the war plans of the theater commanders-in-chief.

The Advanced Field Artillery Tactical Data System (AFATDS), discussed in Annex E (Fire Support), is an example of a system that fits within the information dominance component. It is viable in the near- and mid-terms and provides a common operating picture as part of the Army Tactical Command and Control System. It also provides the command and control necessary for improved fire support coordination and supports the first priority of the modernization strategy to achieve information dominance in the near- and mid-terms.

Maintain Combat Overmatch

The Army currently enjoys overmatch in ground combat operations. However, it is prudent to make improvements to current systems to ensure that combat overmatch is maintained as threat capabilities continue to modernize. Improvement must be tailored to those capabilities that truly provide overmatch against potential adversaries. Doing so requires periodic focused technology insertions to improve combat effectiveness through preplanned product improvements (P3I) programs. This will leverage the technological innovations and maintain much of our industrial base. The Longbow Apache is an example of maintaining overmatch.

The Apache, covered in Annex I (Aviation), currently enjoys overmatch. But as military technology capabilities are proliferated, we must tailor our improvements to the Apache, and to other systems, to prepare for expected adversary capability improvements. Adversarial improvements in signature reduction, survivability, and air defense protection will require corresponding improvements in target acquisition, lethality, and standoff range in order to maintain overmatch.

Overmatch is also maintained through appropriate force structure changes (Annex A). The programmed conversion of up to 12 Army National Guard (ARNG) combat brigades to combat support/combat service support (CS/CSS) units as part of the ARNG Division Redesign Study contributes to that end. As a result of this initiative, the Army's unresourced warfighting requirements (COMPO4) will be reduced while increasing the relevance of ARNG force structure. The conversion of these ARNG combat brigades is scheduled to be completed by 2009.

Sustain Essential Research and Development and Focus Science and Technology on Leap-Ahead Technologies

Deferring the requirement for most next-generation weapons platforms requires investments in funding and focusing the technology and industrial bases to be able to provide the necessary capabilities required to support the future Army. Modernization resources are insufficient to continuously pursue balanced modernization for all required capabilities. Our

strategy maintains overmatch throughout the near- and mid-terms with minimum necessary improvements to most combat platforms. The strategic opportunity provided by a geostrategic environment in which no real competitor is foreseen before 2010 has justified our previous decisions to accept risk by deferring modernization. Deferring modernization, however, leaves a capability gap as current systems approach wearout dates and replacement systems are not yet available for fielding. "Catching up" by fielding incrementally improved systems would be expensive and would field technologies soon-to-be obsolete. To attain the required physically agile systems in the far-term, we must field leap-ahead capability systems to bridge the gap caused by modernization deferrals. This will require lighter, faster, more lethal weapons platforms in addition to the information dominance capabilities achieved in the near-and mid-term, which will then be embedded in these platforms. These systems must provide the ability for the land force commander to utilize his force and forces on the battlefield at the time and place of his choosing. Future weapons platforms will require expanded capabilities to kill threat targets in all weather, on-the-move, day/night, in cluttered environments, and at long ranges with increased probability of destruction out to the extent of the commander's battlespace. Looking this far ahead drastically changes combat vehicle design considerations. The design of lighter, more mobile, more supportable vehicles is an integral part of the focused Research and Development (R&D) strategy. Focused R&D accelerates essential leap-ahead capabilities required for full-spectrum dominance and provides a significant, almost revolutionary, improvement over current capabilities.

Recapitalize the Force

To guard against fleet obsolescence and the high costs associated with maintaining aging equipment, funding and planning are necessary to ensure a viable recapitalization program. Today's equipment must be replaced or refitted to ensure that it is safe to operate, provides the soldier with reliable systems to go to war, and does not require excessive time and money to maintain. Recapitalization of worn or dated equipment maintains its usability and effectiveness. Current production and fielding rates of many Army systems do not meet the levels required to prevent fleet aging from becoming a chronic problem. Rising fleet ages prevent soldiers from operating with the most current and capable combat systems, and Operating and Support (O&S) costs to maintain aging fleets drain precious dollars from procurement accounts. Recapitalization can be achieved through replacement, extended service programs (ESP), preplanned product improvements (P3I), depot rebuild, or technology insertion. The Tactical Wheeled Vehicle (TWV) programs, discussed in Annex K, provide an excellent recapitalization example. Most TWV systems are replacing fleets that are well overage and expensive to maintain. The recapitalization includes a mixture of new vehicles and refurbishment programs that extend useful life as well as reduce operating costs. This often neglected but critically important area of modernization must have a steady flow of resources to prevent capability gaps.

Integrate the Active Component and the Reserve Components

The Army will continue to modernize the Reserve Component along a timeline that ensures that the Total Force remains interoperable and compatible. The Reserve Component today is at an historical high point in modernization. From FY92 through FY98, over $21.5B of

new or relevant and serviceable equipment was provided to the Army's Reserve Component. This was achieved through a combination of procurement programs and equipment cascading from other forces. Examples include:

- All ARNG tank battalions are modernized from M60A3 to M1/M1A1 Abrams tanks,
- Ten ARNG battalions are now fielded with MLRS, Paladin Howitzers are replacing aging M109A1-A5s in the artillery,
- 15 enhanced brigades have been pure fleeted with M2/M3 Bradley Fighting Vehicles,
- Nine Apache battalions are fully operational (7 ARNG and 2 USAR);
- 12 ARNG and three USAR Aviation battalions have been modernized with UH-60 Black Hawk helicopters and
- Five Heavy Equipment Transport (HET) and five Heavy Materiel Supply companies in USAR have been pure fleeted with HETS.

As the Army transforms itself to a smaller, CONUS-based, power projection Army, it will rely on the Reserve Component more than ever before. Active Component/Reserve Component (AC/RC) integration is the integration of the Total Army. By analyzing the roles and missions of the Active and Reserve Components, a force mix to meet the National Military Strategy and the National Security Strategy can be achieved. During Total Army Analysis 2003, a major force structure initiative was approved to reduce the COMPO4 (required but unresourced) requirement necessary to support the Defense Planning Guidance (DPG) illustrative planning scenario by converting ARNG combat structure to combat support/combat service support structure.

Other Requirements

Finally, the modernization investment strategy will need to fund selected **other requirements**, such as unforeseen safety modifications, to conduct fundamental operations to properly field, equip, sustain, and train the force. The procurement of 500 additional outload rail cars for positioning at selected locations to enhance force projection is an example of key contributions to this investment category.

Modernization Strategy - - Investments

To achieve this vision, the Army has decided upon a strategy that prioritizes investments over time. The strategy reflects the linkage to every required pattern of operation. The requirements are based on well articulated Joint and Army visions. These visions provide the operational concepts and patterns of operation that define the capabilities needed. The strategy links the capabilities of the visions to the systems that provide those capabilities. Modernization programs can now be considered and assessed not only in terms of the patterns of operation that they support, but also in terms of their investment categories (Figure 6).

Investments Are Linked to Required Capabilities . . .

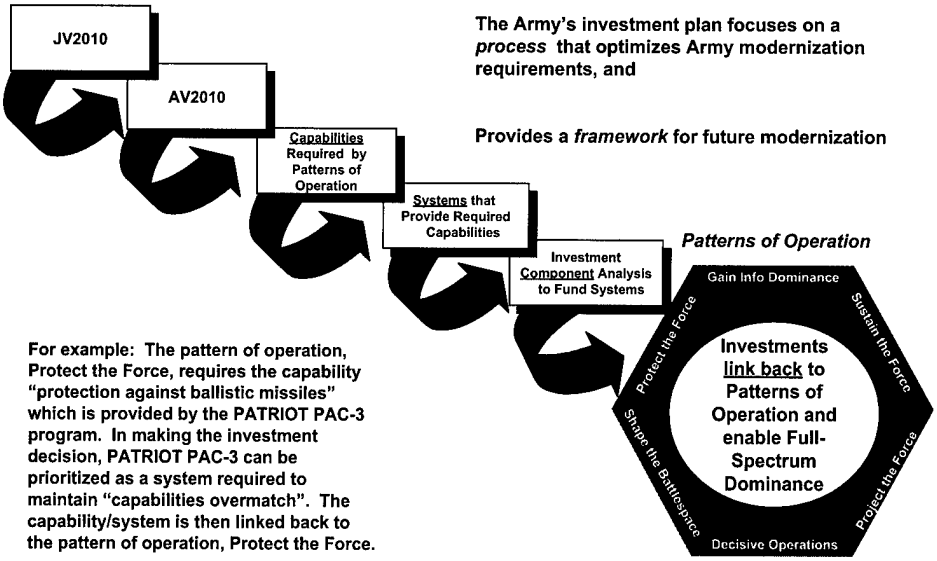


Figure 6

The strategy being implemented to meet these requirements prioritizes investments over time. Investment priorities subtly shift in the near-, mid-, and far-terms to synchronize modernization activities.

Modernization Strategy Requires Transition Phase Investments

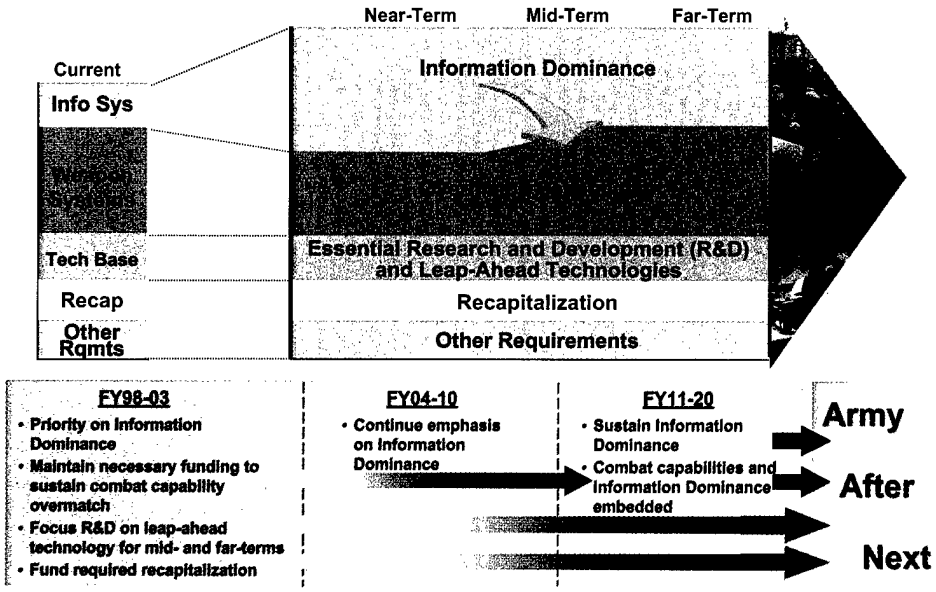


Figure 7

Investments: Near-Term (FY98-03)

The emphasis in the near-term is information dominance. Near-term priorities are:

- Those systems which enable information dominance, particularly those that contribute to the Army goal of fully equipping a digitized division by 2000 and a digitized corps by 2004,
- To provide the minimum funding necessary to maintain the current degree of capability overmatch,
- To provide funding for S&T efforts to develop technologies that guard against an uncertain future in all AV 2010 patterns of operation and,
- To recapitalize essential aging systems to extend their life and increase their capabilities.

Investments: Mid-Term (FY04-10)

The mid-term goal is to achieve information dominance and begin to attain the physical agility needed to achieve full-spectrum dominance. Mid-term priorities are:

- Continued emphasis on systems that provide information dominance capabilities. As these programs mature and are fielded, the focus will shift to ensure the established modernization tempo provides for embedding information dominance systems throughout the force in the far-term.
- Continue to fund required overmatch capabilities.
- To focus basic research and early applied research to enable AAN forces to achieve full-spectrum dominance.
- To recapitalize aging systems. The Army must continue to reduce the age of its fleet and recapitalize through technology insertions, new systems acquisitions, and aged systems retirement.

Investments: Far-Term (FY11-20)

The far-term goal is full-spectrum dominance. The Army will have synchronized and executed the modernization of planned and required capabilities to ensure a force that embodies *Joint Vision 2010* and *Army Vision 2010* operational capabilities. Far-term priorities are:

- Those systems which support full-spectrum capabilities. They will have overmatch and information dominance capabilities embedded. This will provide the necessary physical agility for tomorrow's battlefield.
- Sustaining information dominance capability.
- Provide stable funding of S&T that focuses applied research and advanced technology development on AAN required capabilities.
- Continued recapitalization of the force.

Modernization priorities are synchronized over time to support Army patterns of operation, enhancing the required operational concepts described in *Army Vision 2010.*

Assessment by Patterns of Operation

Army Vision 2010 affirms that land component operations "will be fully integrated with those of joint, multinational, and non-governmental partners. Recent experience reminds us that Army operations have never been and will never be independent. From initial mission receipt through deployment, operations, and transition to follow-on operations, Army elements will execute their responsibilities through a deliberate set of patterns of operation. These patterns are not phases, nor are they sequential. They serve to focus the many tasks armies have always performed in war and other military operations." These patterns are: *Gain Information Dominance, Project the Force, Protect the Force, Shape the Battlespace, Decisive Operations,* and *Sustain the Force.* By extension, Army modernization initiatives converge to support these patterns of operation.

Gain Information Dominance

Gaining information dominance through digitizing the Army is the near- and mid-term Army modernization priority. Information operations, conducted to gain information dominance, are essential to all patterns of operation. They consist of offensive and defensive efforts to create a disparity between what is known (and can be shared with other friendly forces) about the battlespace and operations within it and what the enemy knows.

The capabilities required through the far-term include seamless, secure communications at all levels. Supplying the warfighter with key decision-making information in a timely manner is at the center of information dominance. The Warfighter Information Network (WIN) is an evolving integrated C4 network comprised of commercially based, advanced technology information and communications systems. Current capability shortfalls in data capacity, security, and network management restrict our ability to satisfy information requirements, but the emphasis on digitizing the Army should eliminate this problem as upgraded C4 systems are fielded. However, synchronization of information and communications systems is critical, and requires a comprehensive Command, Control, Communications, and Computers/Information Technology (C4/IT) investment strategy that balances technology investments. The initial C4/IT strategy, published in May 1997, was a significant initial step and focuses on capabilities rather than individual systems. Information systems must be procured and fielded in concert with the communications systems designed to support them. Failure to synchronize results in sub-optimal performance of all parts of the architecture. In addition, interoperability must be maintained. Open cooperation with other services and our allies is essential so architectures and standards can be adhered to. Finally, as fielding leading-edge equipment to all forces at one time is infeasible, minimum essential compatibility with last generation equipment is required so baseline interoperability is maintained within the Total Force.

We must have continuous real-time Intelligence Preparation of the Battlefield (IPB). The Army is fielding a robust sensor capability, as well as investing in the downlinks required to

obtain timely information from joint and national intelligence assets. Unmanned Aerial Vehicle (UAVs) and other airborne sensors enable commanders to see their battlespace, provide targeting information, and protect their forces through early warning of enemy intentions. The modernization plan includes sensors such as the Outrider Tactical Unmanned Aerial Vehicle (TUAV) that provide reconnaissance, surveillance, target acquisition, and battle damage assessment. In addition, intelligence fusion systems such as the All Source Analysis System (ASAS) provide commanders with relevant intelligence needed to understand enemy deployments, capabilities, vulnerabilities and potential courses of action. Low acquisition rates for IEW systems are a concern, but in the far-term the Army should have the capabilities required given current program stability.

We must have the ability to disrupt enemy information operations as well as protect and conceal friendly information operations. The Ground Based Common Sensor (GBCS) is an example of a system that provides signals intelligence and an electronic attack capability. It will be fielded in a wheeled variant for the light divisions and a tracked variant for heavy divisions.

In the digitized force, machine-to-machine data transfer will become the norm. Unfortunately, today's communications "pipes" were built to carry voice and low rate data and are insufficient to handle the increased volume of traffic. For the most part, the technology is available now to modernize communications. There are numerous other systems discussed in each annex that support gaining information dominance. Each has a unique warfighting role and all are important to the overall effort. While there are a number of competing requirements to balance, gaining information dominance is the first priority for the Army in the near- and mid-terms.

Project the Force

The Army has changed from being predominately forward deployed to a CONUS-based power projection force. Augmented with critical equipment pre-positioned where the need is most likely, air and naval components of the joint force will commence transport of a tailorable, modular Army within hours of the decision to deploy. In the future, this force will be equipped with lighter, more durable, multipurpose warfighting systems, thus reducing the amount of lift required, as well as the size and complexity of the logistics "tail" needed to sustain the force.

The Army considers the C-17 a key power projection system. It can transport outsized/oversized equipment directly from the CONUS to anywhere in the world, access short runways, operate in austere environments with minimum materiel handling equipment, and conduct strategic brigade airdrops of paratroopers and equipment. Department of Defense analysis estimates that the C-17 can operate in as many as four times the number of airfields as the C-5. A total of 120 C-17 aircraft will be procured by 2003. This program is considered a cooperative success between the Army and the Air Force.

The Army also supports Navy programming for additional Roll-On/Roll-Off ships and the Navy initiative that looks at new, high-speed sealift capabilities. Historically, 90% of Army

equipment and sustainment stocks are deployed by sea. The 19th and final Large, Medium-Speed Roll-On/Roll-Off ship is scheduled for delivery in FY01.

Logistics-Over-the-Shore operations ensure the Army can conduct operations over unimproved shorelines, through restricted access ports, or through improved ports. Equipment required to conduct Logistics-Over-The-Shore operations include vessels to transport cargo from the strategic sealift ship to the beach, pier, or shore, and other utility craft such as floating cranes, tugs, and Roll-On/Roll-Off discharge facilities. The Logistics-Over-the-Shore equipment currently funded in the near-term includes three floating cranes, eight small tugs, three logistics support vessels, three containerized maintenance facilities, and causeway systems. The causeway systems include the floating causeway, causeway ferry, and Roll-On/Roll-Off discharge facilities. Modernization initiatives to make warfighting systems lighter will provide even greater efficiency in the far-term.

Protect the Force

A proliferation of potential enemy missile systems and weapons of mass destruction (WMD), coupled with competing priorities for limited modernization resources, result in some risk in this area. To protect the force, the Army will rely on a technically advanced, operationally simple network of multicomponent intelligence sources capable of detecting and locating forces, active and passive obstacles, in-flight aircraft, ballistic and cruise missiles and their launch sites, chemical and biological agents, and other still-developing threats.

Missile system technologies to defeat both air-to-surface and surface-to-surface systems are key requirements to protect the force. From initial entry through redeployment, air and missile defense (AMD) systems support this requirement. PATRIOT PAC-3 and the Theater High Altitude Area Air Defense System (THAAD), covered in Annex F, are among the AMD modernization initiatives in this area.

The PAC-3 incorporates upgrades to the radar set, engagement control station, and launchers with the new design, high velocity hit-to-kill PAC-3 missile. PAC-3 capabilities will more than double the current defended area on the ground against Theater Ballistic Missiles (TBMs), kill TBMs with twice the range of the Gulf War threat, and increase missile accuracy and lethality to effectively intercept and destroy TBMs/cruise missiles with WMD warheads and aircraft threats. Current funding supports procurement of 1,200 missiles, enough for five of the ten PAC-3 battalions. The THAAD is currently in development. When fielded in 2006, it will provide wide-area protection against medium- and short-range ballistic missiles. It will provide the objective two-tiered defense of CINC critical assets in theater in the mid-term.

Manned and unmanned platforms will contribute to the weave of sensor and weapons capabilities so that the reach of full dimensional protection can extend far beyond the horizon. Sensors will provide refined information to even more elements at lower echelons. The Airborne Reconnaissance-Low (ARL) and its far-term follow-on system, the Aerial Common Sensor (ACS) are examples of modernization programs to meet this required capability. The ARL provides communications intelligence, live imagery information, and Moving Target Indicator

(MTI)/Synthetic Aperture Radar (SAR) imagery for tactical commanders. The final ARL will be fielded in FY00, with upgrades to existing aircraft extending through the near-term. The ACS will employ leap-ahead technology to combine the functions of the ACS and the Guardrail Common Sensor (GRCS) in the far-term. By FY12, a total of five systems will be fielded: one system per corps, and one system for the Echelon Above Corps (EAC) Military Intelligence (MI) Brigade. These systems, and others, are discussed in Annex J, Intelligence and Electronic Warfare.

Modernization of personal armor, chemical and biological protection ensembles, and medical modernization initiatives contribute to protecting the force. Modular Body Armor provides "bullet stopping" protection for dismounted soldiers and Marines at a reduced weight compared to current systems. The Joint Service Lightweight Integrated Suit Technology (JSLIST) provides the soldier with chemical survivability, minimizing the physiological and psychological burdens associated with wearing current protective clothing. In the future, vaccines to provide soldiers a protective immune response against biological agents are a required capability. Leap-ahead medical research into multi-agent vaccines for biological threat agents is ongoing. However, medical evacuation capabilities lag. Current ground combat evacuation capability is based on obsolete M577 and M113 Vietnam-era platforms. Air evacuation is conducted in UH-1s and older UH-60s. Modernization to the UH-60Q is funded, but not until the far-term.

Shape the Battlespace

Shaping the battlespace sets the conditions for success—it is directly linked with decisive operations. Together they allow the force to overcome the enemy's center of gravity and result in the total takedown of an opponent. For land forces, shaping the battlespace is far more than just precision strike which, as a lone function, is nothing more than 21st Century attrition warfare. Shaping the battlespace is the unambiguous synchronized application of all combat multipliers with the scheme of maneuver to overwhelm the enemy. Technologies required include Artificial Intelligence (AI) algorithms to support Intelligence Preparation of the Battlefield (IPB), sensor-to-shooter links, and brilliant munitions.

The JSTARS Ground System Module/Common Ground Station is a modernization program that contributes to shaping the battlespace. It provides a dynamic link between sensors and shooters. It receives, processes, manipulates and disseminates data from the airborne JSTARS radar, unmanned aerial vehicles, and other tactical, theater, and national systems for targeting, situational development, and battle management. Ninety-eight Common Ground Stations are scheduled for procurement.

The Army Tactical Missile System (ATACMS) Block IIA program combines the extended range of the missile (300 km) with the Brilliant Anti-Tank (BAT) munition, resulting in the ability to effectively engage moving armor formations. Coupled with sensors such as JSTARS, it will have a significant battlefield effect. This capability is not expected until the mid-term.

Decisive Operations

Decisive operations force the enemy to accede to our will. In combat operations, decisive operations are defined in terms of victories in campaigns, battles, or engagements. In other military operations, decisive operations are defined in terms of accomplishing the military objectives (free elections in Haiti or the absence of war in Bosnia are examples). Modern technologies will exploit situational understanding to enable tailored, still undefined combat organizations to task organize quickly and fight dispersed. Fused inputs from manned and unmanned sensors (including satellites) will provide battlefield situational awareness to distances well beyond the horizon, enabling the synchronization of weapons equipped with significantly advanced avionics, weaponry, vehicle mobility, stealth, survivability, and communications technology. The Army currently has an overmatch capability in most weapons systems, such as the Abrams, Bradley, Apache, MLRS and PATRIOT, as well as other tremendously effective weapons systems. However, modernization cannot be deferred if overmatch is to be maintained indefinitely.

Other countries are developing weapons systems that equal and, in some cases, exceed the capabilities of weapons we currently field. The M109A6 Paladin is a good example. Currently there are several howitzers developed by other nations that exceed Paladin capabilities in range and rate of fire, such as the British AS 90, the German PzH 2000, the Russian 2S19, and the Chinese Noricum GNK155, and could potentially end up in the arsenals of non-allied nations. The Crusader is the leap-ahead howitzer that allows the Army to regain and maintain overmatch in cannon artillery. It has the world's first fully automated reload system, firing 15 rounds in the time a Paladin crew can fire four. Other incorporated technology advances ensure this howitzer will be the key heavy, close-fire support system well into the mid 21st Century and the Army After Next.

Our capability to dominate maneuver and achieve decisive operations also depends on air operations. The RAH-66 Comanche and the Longbow Apache are rotary wing modernization systems, and are discussed in Annex I.

In the near- to mid-term, the Army's ability to conduct decisive operations is adequate, but there is risk if programs that maintain or regain overmatch are not continued. In the far-term, current tanks, air defense artillery, infantry fighting vehicles, and other combat systems reach their Refit, Replace, Retire (R3) points with no follow-on systems available, and other nations' advances match our weapons performance.

Sustain the Force

For the Army, focused logistics will fuse information, logistics, and transportation technologies to deliver the right support at the right place on the battlefield at the right time. Technology will be a great enabler of focused logistics. Smaller fighting elements with easily maintainable equipment, made of more durable materials which share repair-part commonality with other equipment, will significantly reduce the logistics "tail" required to sustain the force. Precision weapons and fuel-efficient systems will reduce logistics demand volume. Advanced

business solutions for inventory control, materiel management and distribution, transportation and warehousing, and automatic cross-leveling and rerouting will greatly expand current Army Total Asset Visibility. Every pattern of operation depends on focused logistics, yet focused logistics can also stand alone in situations such as humanitarian missions.

The current objective of a distribution-based logistics system is to move away from extensive (and expensive) stockage to a velocity managed, customer-friendly system. Modernization initiatives aim to provide visibility (Total Asset Visibility, communications, situational awareness), capacity (throughput per day), and control (centralized distribution management). The measure of success is time, whether it is supply (time of need to receipt by the user) or maintenance (breakdown to repaired system available for use). Digitization is the key, with the goal to reduce the time it takes to satisfy the user. The Combat Service Support Control System is part of the Army Tactical Command and Control System (ATCCS). This system replaces an unstructured, slow, labor-intensive manual system unresponsive to present day battlefield Command and Control (C2) requirements. Automatic connectivity between the system and consumption sensors eliminates the need for manual input from logistical, medical, financial, and personnel systems. Integrated, automated decision-making capabilities replace manual information management tools.

Tactical Wheeled Vehicle (TWV) modernization, to include recapitalization of the fleet, also contributes to the "sustain the force" pattern of operation. Significant progress has been made in lowering average fleet age of tactical wheeled vehicles. Although approximately 25% of the fleet is currently overaged, it is a much improved picture from several years ago. Even so, most TWV funding appears in the outyears of the POM.

The Army Modernization Plan Annexes

Patterns of operation provide the framework used within each of the Modernization Plan annexes to describe system contributions to the enhanced operational concepts, resulting in a few changes to the content and structure of this year's Army Modernization Plan. Previously, the Army's efforts at enhancing the capabilities of the individual soldier, the Army's greatest resource, have been included in Combat Maneuver. This year, a new annex has been added (Annex B) which highlights these Soldier Systems programs. Another annex has been added (Annex C) to highlight the Army's Digitization program, a central piece of the modernization strategy. Theater Missile Defense (TMD) and National Missile Defense (NMD) have been integrated into the Air and Missile Defense annex (Annex F) simply to prevent duplication. TMD is still viewed as the integrated efforts of each of the TMD elements: Active Defense, Passive Defense, Attack Operations, and BM/C4I. Special Operations Forces (SOF) modernization has again been integrated into each of the annexes that are providing equipment for SOF, and the Training annex (Annex N) again reflects the overall Army training modernization, as opposed to reviewing training modernization status in each of the annexes.

The Army Modernization Plan provides focus to assess the capabilities available to achieve full-spectrum dominance as part of the joint team in 2010. Within each annex, there is an assessment—**RED, AMBER, GREEN**—of that mission area's modernization programs and

their contributions to achieving full-spectrum dominance and the capabilities required to execute the operational concepts of *Joint Vision 2010*. Each mission area is constrained to the available and programmed resources, and is responsive to the external factors of the changing threat, technology breakthroughs or delays, funding levels, and personnel/force structure assets. Capabilities are assessed and shortfalls and deviations from the modernization strategy are identified.

- **RED** means no capability exists, or the capability is insufficient to defeat the expected threat.
- **AMBER** indicates that a limited capability and quantity exists to support achieving the capability. The wide range of possibilities in this assessment area requires that the limitations be defined in more detail on a case by case basis to determine if the limitations are minor or approaching no capability.
- **GREEN** means adequate capability and quantity exist.

These ratings are based on the anticipated required 21st Century capabilities and the current resourcing status of programs necessary to meet capability goals. Systems are rated in the **Near-Term** (FY98-03), **Mid-Term** (FY04-10), and **Far-Term** (FY11-20).

Force Structure. Annex A summarizes the structure of the force. Force Structure decisions are critical to Army capabilities as it evolves to Army XXI and beyond to the Army After Next. Redesign of divisions and corps is discussed in this annex, as well as Reserve Component force structure changes and changes to the Institutional/TDA structure. What is clear, however, is that without realization of current modernization objectives it will be difficult, if not impossible, to transform the Army from an industrial age configuration to an information age force.

Soldier Systems. Soldier Systems are discussed in Annex B. Efforts to modernize soldier systems in the Army's combat branches are well underway. Modernization of combat support and combat service support elements are lagging because existing resources are currently applied against those units most likely to be in direct contact with the enemy. Systems for the Contingency and Rapid Response forces (Force Packages (FPs) I and II) are generally AMBER, while soldier systems to equip FPs III and IV are **RED**.

Digitization. Army Digitization is discussed in Annex C. Digitization of the 4th Infantry Division by FY00 and the entire III Corps by FY04 is an Army priority and is the method by which we will achieve information dominance in the mid-term. Overall, Digitization is **AMBER**.

Combat Maneuver. Combat Maneuver forces are aggregated as the subject for Annex D. Mounted and dismounted forces (heavy and light units) provide the Nation with the required options for conducting future military operations. They are inherently tailorable, lethal, and versatile, and are the centerpiece of military action, providing decisive victory by dominating the battlespace. The Abrams tank and Bradley Infantry Fighting Vehicle will

continue to provide overmatch into the far-term given planned upgrades, but work must start now on follow-on systems to avoid a capability gap. For light forces, improvements in night vision equipment and Land Warrior dismounted soldier system programs are discussed. Technology improvements for III Generation FLIR are an important addition to Combat Maneuver capabilities into the far-term. Army engineer forces (included in Annex D) support Army XXI operations across the entire spectrum of conflict and throughout the battlespace. Engineer units maintain the mobility of the maneuver force with road and bridge equipment and through mine breaching operations. They impede the movement of enemy forces through countermobility missions. Topographic information and products, produced by Army engineers, provide accurate and timely terrain data, as well as hard copy and electronic situational updates of unit locations and dispositions. Introduction of the Grizzly Engineer Breaching Vehicle and Wolverine Assault Bridge are long-overdue additions to heavy force operations.

Fire Support. Field artillery forces occupy three major roles in the warfight under the heading of indirect Fire Support (Annex E). Together these three roles (close support, counterfire, and interdiction) provide maneuver forces the capability to employ decisive fires simultaneously throughout the depth of the battlespace. Crusader is the number one fire support priority. This system is required to regain cannon artillery overmatch. It is the technology carrier for all other heavy combat vehicles into the far-term, and is the Army's first fully digitized weapons system. First Unit Equipped is scheduled for FY05. The ATACMS program is another fire support modernization priority. Extending the range through a series of block improvements and incorporating brilliant munitions into the ATACMS missile provide significant capability to the Army to shape the battlefield and engage in decisive operations. Modernizing the light forces is also a priority. The Lightweight 155 howitzer, a joint Army/Marine program, provides a replacement for the aging M198. Fire Support modernization is currently **AMBER**.

Air and Missile Defense (AMD). Annex F supports the modern force by providing active defense against air and missile attack. Procurement of new systems, such as THAAD, and modifications to existing systems (Bradley Linebacker, PATRIOT PAC-3, etc.) and consideration of and experimentation with emerging technology are incorporated in the AMD plan. While funding constraints preclude the timely fulfillment of the overall AMD plan, significant portions are being implemented. Unfortunately, key systems such as Bradley Linebacker and MEADS are underfunded or unfunded, requiring reliance on other services and allied capabilities to accomplish full-spectrum dominance and protect key theater assets.

National Missile Defense (NMD) continues as a technology readiness program to reduce the risk of responding to a quickly developing NMD threat. Theater Missile Defense (TMD) combines the active defense of air defense forces with the remaining elements of an integrated Theater Missile Defense: passive defense, attack operations, and the necessary Battle Management/Command, Control, Communications, and Intelligence (C4I) required to successfully accomplish this demanding battlefield mission. Overall, modernization in this area is rated **AMBER**.

Aviation. The inherent versatility of Army Aviation (Annex G) enhances the efficiency and effectiveness of virtually all combat functions (maneuver, intelligence, fire support, battle command, mobility and survivability, air defense, and logistics). Army aviation provides an extension of combat power throughout the battlespace. Aviation forces bring to the fight reconnaissance, security, real-time battlefield intelligence, force protection, attack helicopter operations (including deep attack), air assaults, combat support, and special operations capabilities.

Among the factors driving aviation modernization are the deficiency in reconnaissance/ security, the requirement to maintain overmatch capability, current digitization efforts, and advancing airframe age of selected systems. The RAH-66 Comanche is the aviation response to current deficiencies in reconnaissance/security operations, and eventually too as a possible candidate to replace the Apache. The Longbow Apache program combines extended range targeting and adverse weather target acquisition with a fire and forget RF HELLFIRE missile. It will maintain the Apache's position as the world's premier attack helicopter. Utility and MEDEVAC mission areas require attention, as they are primarily equipped with Vietnam-era legacy systems such as the UH-1; and the UH-60, first fielded in 1978 as the UH-60A, approaches 30 years old in the mid-term. Aviation modernization is assessed as **AMBER**.

Nuclear, Biological, and Chemical (NBC). Protection of the force against WMD is addressed in Annex H. Arms control efforts cannot guarantee the absence of weapons of mass destruction (WMD) on future battlefields. The NBC mission area has three components: NBC defense, smoke and obscurants, and Flame/Incendiary and Nonlethal (FINL) munitions. The NBC modernization strategy focuses on developing multifunctional, multi-Service, easy to use and maintain, lightweight equipment to improve force survivability and to mitigate mission degradation caused by the very equipment protecting the force. Overall, NBC is rated **AMBER**.

The need for a strong NBC program is indisputable. Nations with limited military capability often pursue NBC weapons programs to shift the balance of power. Significant and measurable progress has been made in NBC defense modernization. Advances in detection equipment for radiation, chemical, or biological contamination have resulted in several new systems. Individual and collective protection systems, such as the Joint Service Lightweight Integrated Suit Technology (JSLIST) and the Advanced Integrated Collective Protection System (AICPS) are funded, but not in the immediately required quantities. There is a great deal of essential science and technology work in the NBC arena, which should bear significant dividends in preparing the Army for future potential conflicts. Even with the OSD plus-up, our ability to meet the two Major Theater War (MTW) requirement is lacking.

Command, Control, Communications, and Computers (C4). Modern armies coordinate their actions through an architecture of Command, Control, Communications, and Computers, described in Annex I, and Intelligence and Electronic Warfare (IEW) systems described in Annex J. They are the foundation of the Army's digitization efforts. The Warfighter Information Network is key to this area. Future investments in WIN will equip the warfighter with information networks required for information dominance in the near- and mid-terms, but current funding shortfalls may limit our ability to transform to a totally digitized force. To achieve information dominance, the C4 community must provide the means to share

information among warfighters and supporters at all levels of warfare. C4 modernization, into the far term, is **AMBER**.

Intelligence and Electronic Warfare (IEW). IEW systems (Annex J) are critical to winning the information war and disseminating intelligence in real time to tactical commanders as a part of information operations. The gathering, processing, and dissemination of information must be synchronized with the operational concept and battle plan to ensure the commander's requirements are met. We cannot achieve information dominance without the IEW capabilities required. In the near-term, critical intelligence shortfalls at lower echelons are being addressed with the joint Tactical Unmanned Aerial Vehicle (TUAV) program and the extension of the ASAS Remote Workstations to brigade and battalion level. These programs are integral to the successful implementation of a fully digitized division in FY00 and corps by FY04. During the mid-term, accurate sensors, enhanced communications, and faster processing capabilities that will ensure timely targeting information to the shooter come on line. The ability to maintain success into the far-term depends on technology insertion efforts to keep pace with rapid changes in the environment. Overall, IEW rates **AMBER** until the mid-term, changing to **GREEN**.

Tactical Wheeled Vehicles (Annex K) support the warfighter by providing transportation for ammunition and fuel and sustainment supplies, and unit mobility. Rapid force projection, extended communications lines, and the likelihood of operating without an existing logistical infrastructure, place unique demands on the Army's transportation capability. Tactical Wheeled Vehicles are fundamental to the support of every mission the Army undertakes. Recapitalization of the fleet is a continuing effort, as the cost to maintain and operate overage Tactical Wheeled Vehicles is prohibitive. Significant improvements have been made in Tactical Wheeled Vehicle outyear funding, which will, if made available, approach the level of modernization required. If it does not, however, the current average fleet age will continue to rise. Tactical Wheeled Vehicle modernization is rated **AMBER**.

Logistics. The foundation of Army Logistics (Annex L) modernization rests on projecting the force, sustaining the force, and providing core support to the force at all levels. In addition to support of Army combat units, Army logistics assets support other services, multinational forces, and during relief operations provide support directly to civilian populations. Airlift and sealift programs are approaching required numbers, and Logistics-Over-The-Shore equipment for cargo discharge are also in final stages of procurement. However, maintenance test equipment, war reserve and training ammunition, and petroleum distribution systems still lag behind requirements. The Combat Service Support Control System, enabling logisticians to effectively and efficiently manage resources in support of digitized battlefield operations, should complete fielding by FY08. Overall, logistics modernization is rated **AMBER**.

Combat Health Support (Annex M) is a capability required to Protect the Force and Sustain the Force. Medical support to the soldier provides the basis to conserve the fighting strength and thus assist the Army in achieving its warfighting goals. Combat Health Support modernization is rated AMBER. There are critical shortfalls in patient evacuation vehicles, both

ground and air, that contribute to this rating. The current air evacuation vehicles are a mixture of Vietnam-era UH-1s and older UH-60s. Procurement of the UH-60Q is funded, but not until the far-term. Ground evacuation is still conducted in M113s and M577s, which are incapable of keeping up with maneuver forces equipped with M1s and Bradleys. Moreover, their armored protection is inadequate. The Armored Medical Treatment Vehicle (AMTV) is designed to meet this shortfall, but it is not funded in the POM. The Medical Communications for Combat Casualty Care (MC4) is an umbrella system that encompasses all current and future medical information systems and databases, communications, and digitized medical diagnostic monitoring and treatment systems. It will link the medical system to the digitized battlefield. Limited procurement is scheduled to begin in FY99.

Training. Good training (Annex N) creates soldier confidence, increases morale and esprit, and allows leaders to master command and control functions for operations at all echelons. The Army needs a mixture of simulations and live field exercises for both individual and unit training proficiency. The Army's Combat Training Center (CTC) program is the centerpiece of the Army's collective training effort. Instrumentation upgrades to the Joint Readiness Training Center for light forces, the National Training Center for heavy forces, and the Combat Maneuver Training Center in Germany are ongoing, but partially funded. Embedded systems and Conduct of Fire Trainers (COFT) for weapons systems are also an important part of the overall training modernization program. Great strides have been made in training simulations, which translate into more efficient use of training dollars. Training is rated **AMBER**.

Space. The Army's use of space-based systems and capabilities (Annex O) is increasingly important to the conduct of all phases of land warfare, including achieving information dominance. In the near-term, full-spectrum operations are limited in the Global Positioning System (GPS) and the Military Satellite Communications (MILSATCOM) programs. Global Positioning Systems allow for navigation over unfamiliar or featureless terrain. Communications extend ground force capabilities to allow for efficient command, control, and sustainment of split-based and highly mobile forces. From disaster relief, humanitarian, and security assistance roles to combat operations, decisive victory and full-spectrum operations depend on space capabilities and products. Modernization of space systems improves in the mid-term, but increasing requirements and aging SATCOM systems in the far-term bring the assessment back to **AMBER**.

Modernization of Special Operations Forces (SOF) equipment is unique. Attaining special operations objectives often means using specialized training and equipment to deliver people, equipment, and weapons with surgical precision; locating high value, strategic, movable targets; and delivering firepower more accurately with less collateral damage and injury to civilian populations. Modernization of SOF, however, also includes equipment common to other force elements of the Army. Throughout this Army Modernization Plan, discussion in the annexes will point out where SOF capabilities are significantly impacted by Army equipment modernization.

Conclusion

The modernization strategy upon which the *1998 Army Modernization Plan* is based strives to maintain the technological advantage that has served the Army so well in recent conflicts—to maintain the capability to win swiftly with minimum casualties. The strategy also recognizes that, although readiness requirements have already deferred previously planned modernization, there is a near-term opportunity to focus a greater portion of the modernization efforts on systems which provide the broad capabilities required for information dominance. At the same time, the modernization program must be synchronized to maintain combat overmatch capabilities, recapitalize equipment no longer mission capable or too expensive to operate, and prepare for the future by focusing Research and Development efforts on fielding leap-ahead capabilities to position the Army to meet the warfighting needs of the Army After Next.

There are many factors, such as the Defense Reform Initiative, affecting the Army's ability to carry out the modernization plan. The framework established by the modernization strategy is intended to provide a means to optimize modernization planning while responding to these varied factors and maintaining a strategic flexibility to respond to the Nation's needs in an unstable, unpredictable strategic environment.

The Army has done its best to balance near and future readiness. The absolute demands of increasing requirements for land forces to support the National Military Strategy have mortgaged modernization. The Army has increased its efforts to streamline the procurement process, establish initiatives, and achieve other efficiencies in order to generate savings for more modernization. Still, there are limited areas for discretion in what the Army can accomplish. These initiatives can only provide a portion of the required resources. In the last published Modernization Plan, our assessment was AMBER headed to RED. While the Army has since received an infusion of dollars to the RDA accounts, it applies mainly to the POM out-years. We have included that infusion in the current planning and it helps in attaining our modernization goals. Historically, however, out-year dollars are decremented as we move closer to them. As stated at the beginning, a steady-state requirement of approximately $15.5B (in FY98 dollars) is necessary to pursue required modernization over the long-term. **The Army's collective modernization assessment remains AMBER. Without this infusion of resources, Army capabilities will decline to a RED status before the end of the mid-term.**

ANNEX A: FORCE STRUCTURE

SECTION 1: INTRODUCTION

Force Structure Overview

The U.S. Army continues to structure its forces to provide the Nation with a full spectrum of land force capability as it transitions the force into the 21st Century consistent with *Joint Vision 2010*. The Quadrennial Defense Review (QDR) validated the Army's existing operating (combat/TOE) force structure while recognizing the opportunity to effect some reductions in both the operating and the generating (Institutional/TDA) forces and in both the Active and Reserve Components. The principles which have emerged from other ongoing initiatives, which will guide the Army's force structure changes in the program years are:

- Maintain balance while implementing directed reductions
- Continue to shape the future force
- Leverage the capabilities of the Reserve Components

The Army's reduction in endstrength will be balanced with complementary force structure reductions. The challenge is to retain the Army's capability to execute the National Military Strategy (NMS) while reducing both force structure and endstrength. Additionally, the Army must maintain its ability to meet its Title 10 responsibilities (Figure A-1).

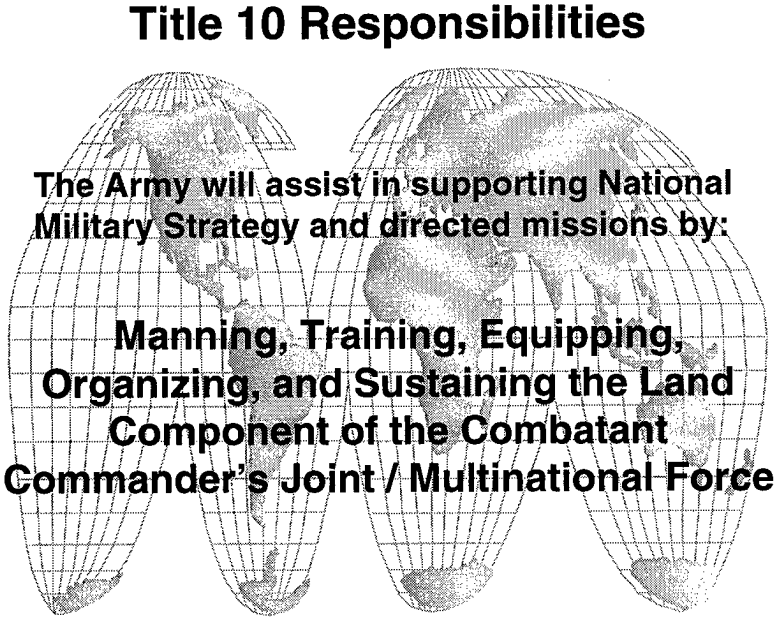


Figure A-1

The Army's ability to support the NMS remains central to the Army's force structure requirements. Concurrently, we must continue to plan and execute initiatives to shape the Army for the 21st Century. Force XXI will enable the Army to redesign the Army's operating forces by

leveraging information technology to achieve full spectrum dominance. The Institutional Army Redesign is an ongoing effort to reengineer the Army's Generating Forces (Figure A-3).

In order to maximize the contribution of the Total Army, we must leverage the full capabilities of the Reserve Components. The Army's goal is a totally integrated force that is sized and shaped to meet the Army's commitment to the NMS. The QDR report concluded that the need for a large strategic reserve has declined. Given today's strategic environment, elements of the Army's strategic reserve forces can be reduced and transitioned into capabilities that have greater utility across the entire spectrum.

Active Component (AC)

The QDR validated the Army's existing operating force structure. The AC will maintain a four corps, ten division structure consisting of four light divisions (two light infantry, one air assault, and one airborne), and six heavy divisions. Each division will consist of three AC combat brigades. Two armored Cavalry regiments (one light and one heavy) will be retained. These forces will be complemented by a Ranger Regiment and five Special Forces Groups. These forces are referred to as active Operating Forces (Figure A-2).

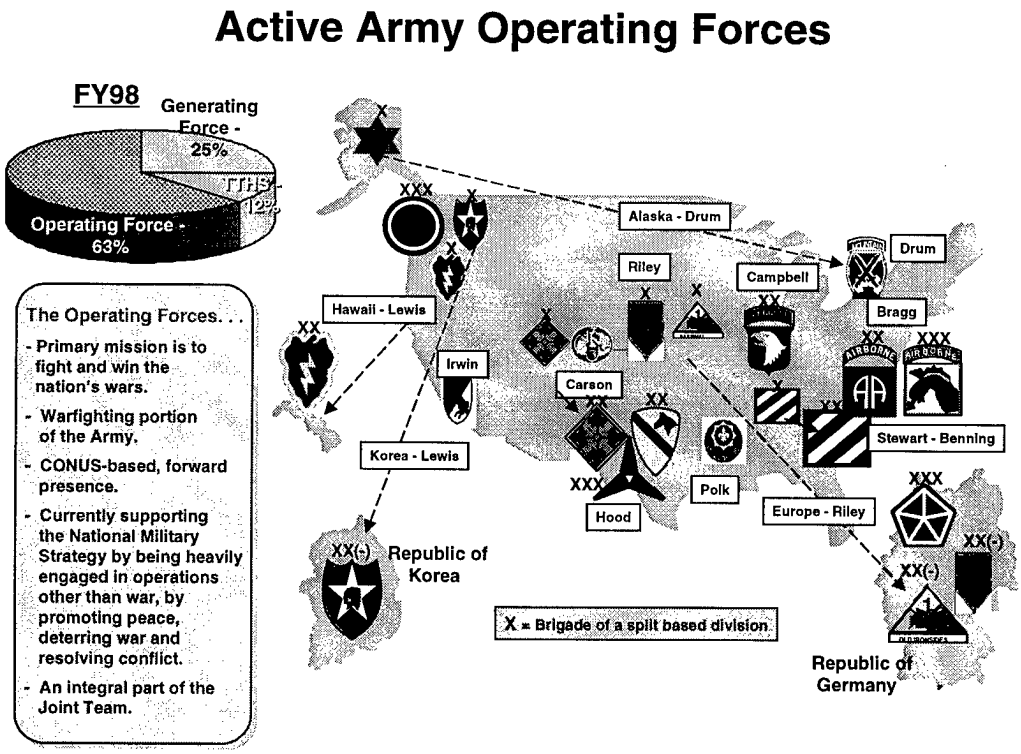


Figure A-2

AC force structure reductions, resulting from the QDR, will be executed in coordination with planned endstrength reductions. These reductions will bring active Army endstrength to 485K in FY98 and to 480K by the end of FY99, thereby achieving directed drawdown objectives for the AC.

Active Component Infrastructure

In addition to the Operating Forces, the active Army also consists of Generating Forces that provide the minimum infrastructure necessary for training, projecting, and sustaining the Total Army force structure in peace and war (Figure A-3). Current reengineering efforts and initiatives continue to produce a more efficient institutional infrastructure, while providing quality mission support to our operational forces at home and abroad.

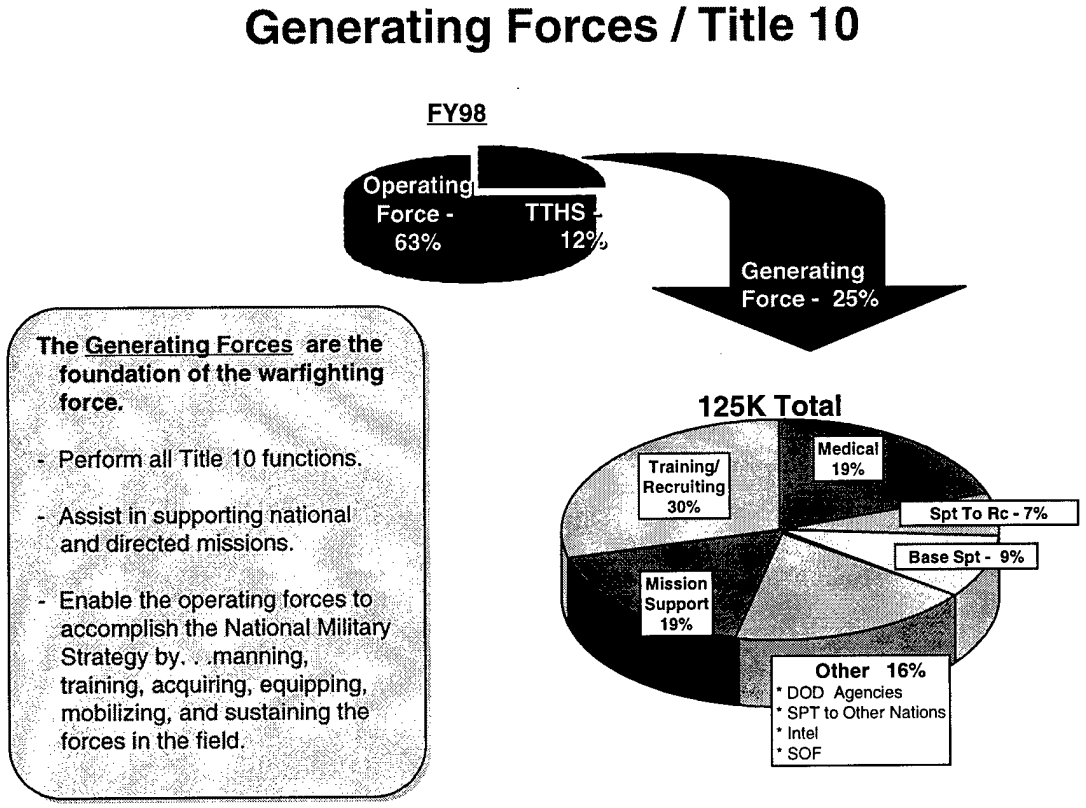


Figure A-3

Force Structure and the Force XXI Campaign Plan

The end of the Cold War has seen the Army shift its intellectual and physical focus from a predominately forward deployed force to a CONUS-based force projection Army. Eight AC divisions, one corps, and associated support units have been inactivated since the end of the Cold War. While the size of the Army has been substantially reduced, the tempo of current operations remains high. The imperative for a smaller, better, high tempo Army is to increase its capabilities through modernization.

The Army's senior leadership is convinced that Force XXI is the right course of action to successfully develop the structure of America's land force of the future. Warfare will change radically during the 21st Century, and America's Army must focus on staying ahead and capitalizing on those changes. The Force XXI Campaign Plan (Figure A-4) is the concept that the Army will use to manage and exploit anticipated revolutionary changes in technology. A

balanced, stable force structure offers flexibility and focus during modernization efforts throughout the transition period and provides a stable launching platform for transition to Army XXI.

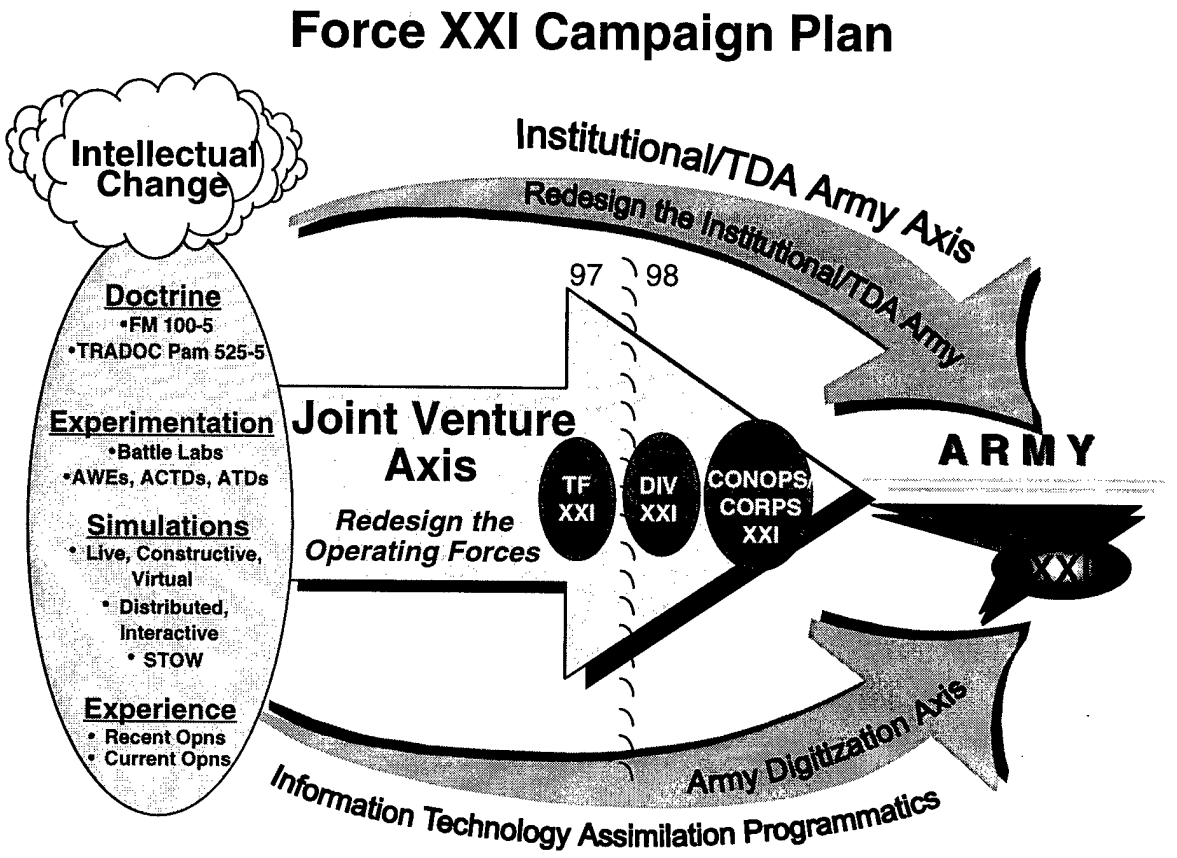


Figure A-4

Force XXI will bring about a transformation of the entire Army, from the way it defines requirements, to the way it acquires material from the industrial base, how it conducts its Title 10 functions, and how it organizes, trains, and fights. This force, first and fundamentally, will be designed around information. While Force XXI will exploit other modern technologies to the fullest extent possible, information systems will drive the Army's quantum leap in effectiveness. These systems will tie organizations together with an unprecedented level of shared situational awareness, precision, and speed in order to create high levels of synergy—both on and off the battlefield.

Army XXI is moving from a threat-based to a capabilities-based Army. It will be more lethal, mobile, and survivable. It will be information dominant, modular, and tailorable, enabling an efficient response to a variety of contingencies and challenges around the world. Army XXI will also enhance the Army's ability to orient forces by linking command and control, communications, and intelligence means. These enhanced capabilities resulting from the application of superior information and digital technology will certainly influence the doctrine and design of the future force.

The Army of the 21st Century must also adapt to constraints caused by shrinking budgets and reductions in manpower. Army XXI must harness current and emerging technologies which offer quantum advances in operational capabilities for land forces. Those technologies will enable the Army of the future to project greater combat power with current force structure levels.

The future Army must provide superior land forces in support of joint operations. This mission will be accomplished primarily by projecting power from CONUS with the appropriate lethality, capability, and versatility to respond to a wide variety of missions and contingencies.

We have already begun planning and preparing for anticipated challenges during development of the future force. The Army's redesign efforts concentrate on capturing efficiencies in all areas, particularly training and logistical support. These critical initiatives are highlighted in each axis of the Force XXI Campaign Plan.

Joint Venture Axis

The main effort of the Force XXI Campaign Plan is the Joint Venture Axis. This axis is focused on the redesign of the Army's operational forces. The Joint Venture Axis is a concerted effort between the Army's major commands and the Army staff. The Commander, United States Army Training and Doctrine Command (TRADOC), has responsibility for overseeing and coordinating this effort. The initial focus of the Joint Venture Axis is the redesign of the Army division.

The Joint Venture Campaign's Experimental Axis (Figure A-5) uses a linked, interactive series of Advanced Warfighting Experiments (AWEs), Advanced Technology Demonstrations (ATDs), and Advanced Concept Technology Demonstrations (ACTDs) to provide verifiable insight for critical decisions about future Army force structure. These advanced experiments will provide the critical analysis that will be the cornerstone for developing future organizations, equipment, training, and doctrine. The primary goal of the Experimental Axis is to prompt interim and final force design decisions.

Joint Venture Campaign

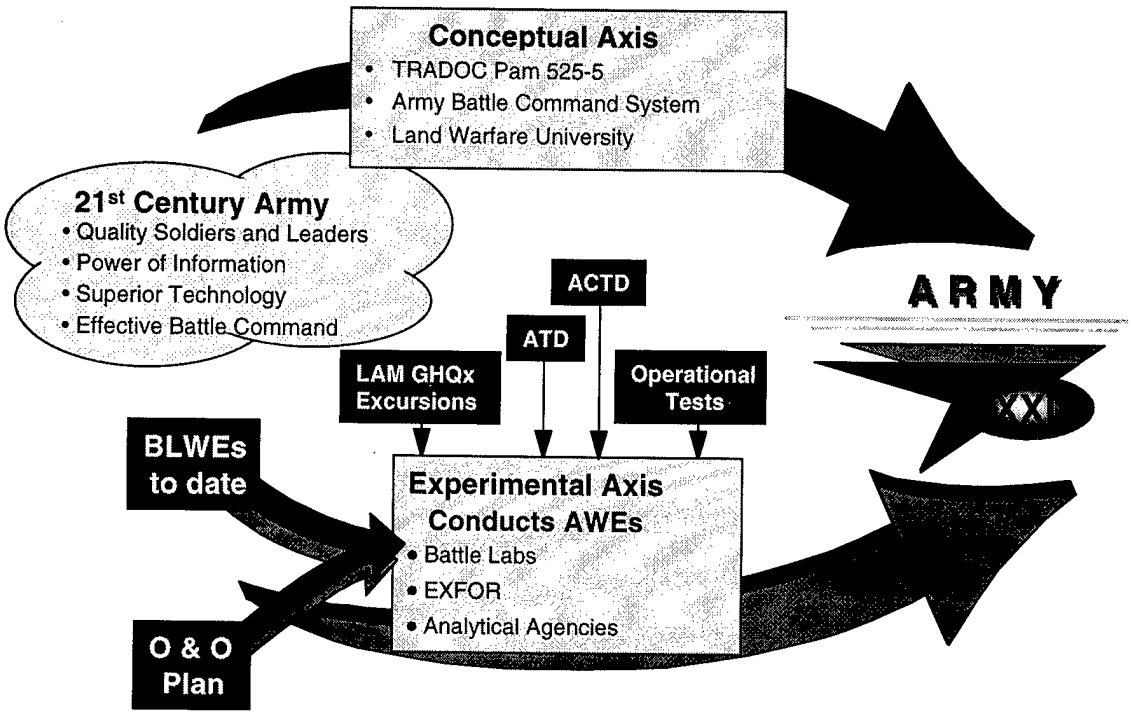


Figure A-5

Institutional/TDA Redesign Axis

Another vital axis supporting the Force XXI Campaign Plan is the Institutional/Table of Distribution and Allowances (TDA) Redesign Axis. This axis is a critical element of the top-to-bottom, front-to-rear reengineering studies process. The Institutional/TDA Redesign Axis is spearheaded by the Army's Vice Chief of Staff, with the mission to reengineer and redesign the Institutional Army by the year 2000 to perform Service Title 10 functions to support redesigned Army warfighting organizations more effectively and efficiently.

The Institutional Axis is a three-phased operation (Figure A-6). In Phase I the baseline TDA organization was established from which the Army will evolve into the 21st Century. In Phase II, the baseline will undergo an interim transition to a revised organization to better posture for Army XXI. Phase III will commence with the objective of the final Institutional/TDA organizational design completed by the year 2000. An emerging vision of that ultimate design has been captured in draft DA Pamphlet 100-xx, "Force XXI Institutional Army Redesign."

Institutional Army Redesign Axis

Campaign Plan

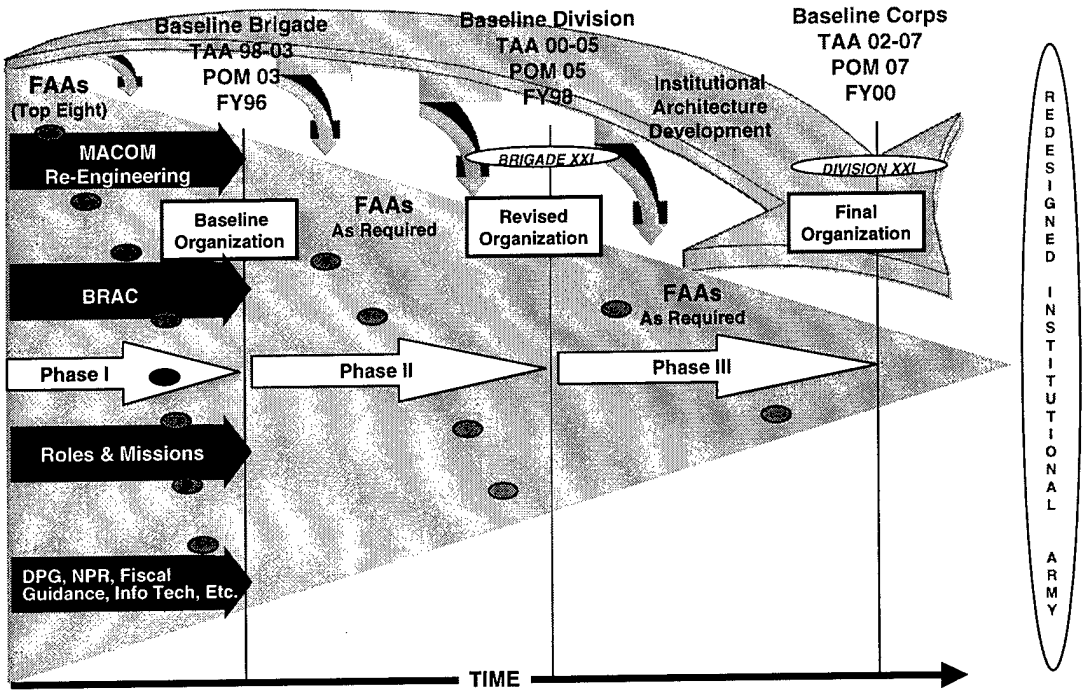


Figure A-6

The Institutional/TDA Redesign Axis incorporates studies pertaining to specific Title 10 functions. Reengineering changes resulting from the first phase, conducted from January 1995 to June 1996, were submitted in POM 99-03. Some of the more significant results of Phase I include: (1) redesignating Information Systems Command (ISC) to Army Signal Command, a subordinate worldwide operational command of U.S. Forces Command (FORSCOM); (2) subordinating U.S. Army Recruiting Command (USAREC) and Military Enlistment Processing Command (MEPCOM) to TRADOC; and (3) reducing Headquarters Department of the Army (HQDA), its Field Operating Agencies (FOAs) and Staff Support Activities (SSAs) by approximately 44%.

Phase II (Figure A-7) of the plan addresses those Title 10 functions not examined in Phase I in order to establish an interim design for the Institutional/TDA force. This phase began in March 1996 and is scheduled for completion in time for results to be entered into POM 00-05. Those specific functions examined in Phase II include:

- Installation Management. Alternatives for providing services on installations and the organizational structure for managing installations were investigated.

- Law Enforcement. The entire process, both operational and institutional, was reviewed. Institutional dimensions of the process were investigated including confinement facilities and installation provost marshal organizations. The latter included consideration of conversion to a TOE design.

- Health Care. Operational and institutional health care organizations were reviewed together with a view toward merging the two organizations into one common process and organization capable of supporting all those entitled to health care.

- Intelligence. A seamless intelligence architecture, from maneuver unit to national agency, is being assessed with proposed alternative organizations that offer a product/customer focus while acknowledging the Army's role in the global intelligence community.

- Support of Organizational Training. Expanding on the Phase I assessment of individual training, in Phase II the Institutional Axis assessed the Army's processes for synthesizing individuals into organizations capable of meeting training standards and performing doctrinal tasks required by the combatant commands.

- Finance. A vision was developed for simplifying the Army's financial/resource management processes and achieving more efficiency in operations. Related initiatives serve as a blueprint to enhance Army financial management operations into the 21st Century.

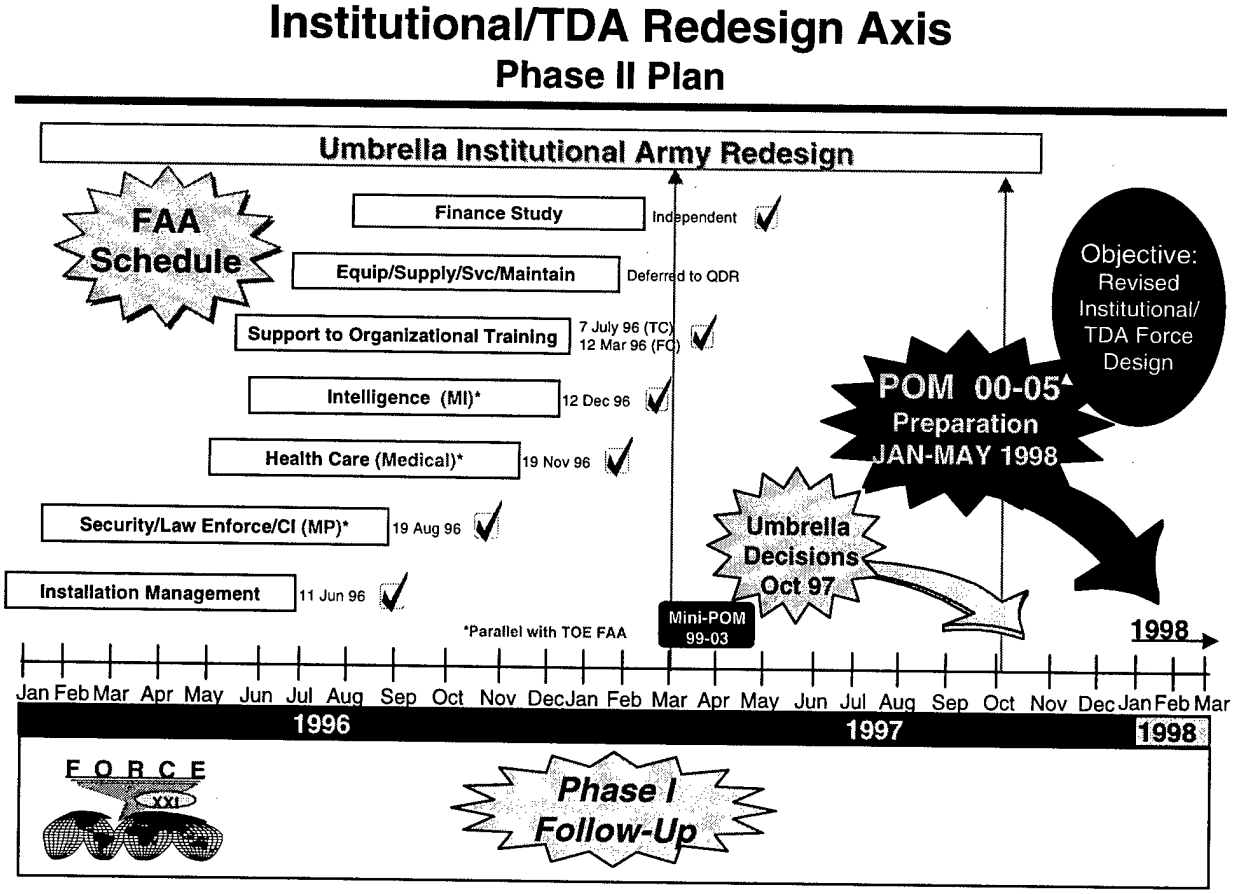


Figure A-7

Phase II culminates with a decision briefing to the Vice Chief of Staff and Assistant Secretary of the Army for Manpower and Reserve Affairs. Proposals emanating from the functional assessments will be recommended for programming in POM 00-05. The objective of this phase, a revised Institutional/TDA force, will then posture the axis for its third and final phase. Phase III will result in the organization of the TDA force for Army XXI and will be entered into POM 02-07. Throughout the campaign, the Institutional Axis continues to embrace the National Performance Review principles of *cutting unnecessary spending, serving customers, empowering employees, and fostering excellence.*

Army Digitization Axis

The third and final axis of the Force XXI Campaign is the Army Digitization Axis. The digitization plan involves four thrusts and represents our greatest challenge for Force XXI (Figure A-8).

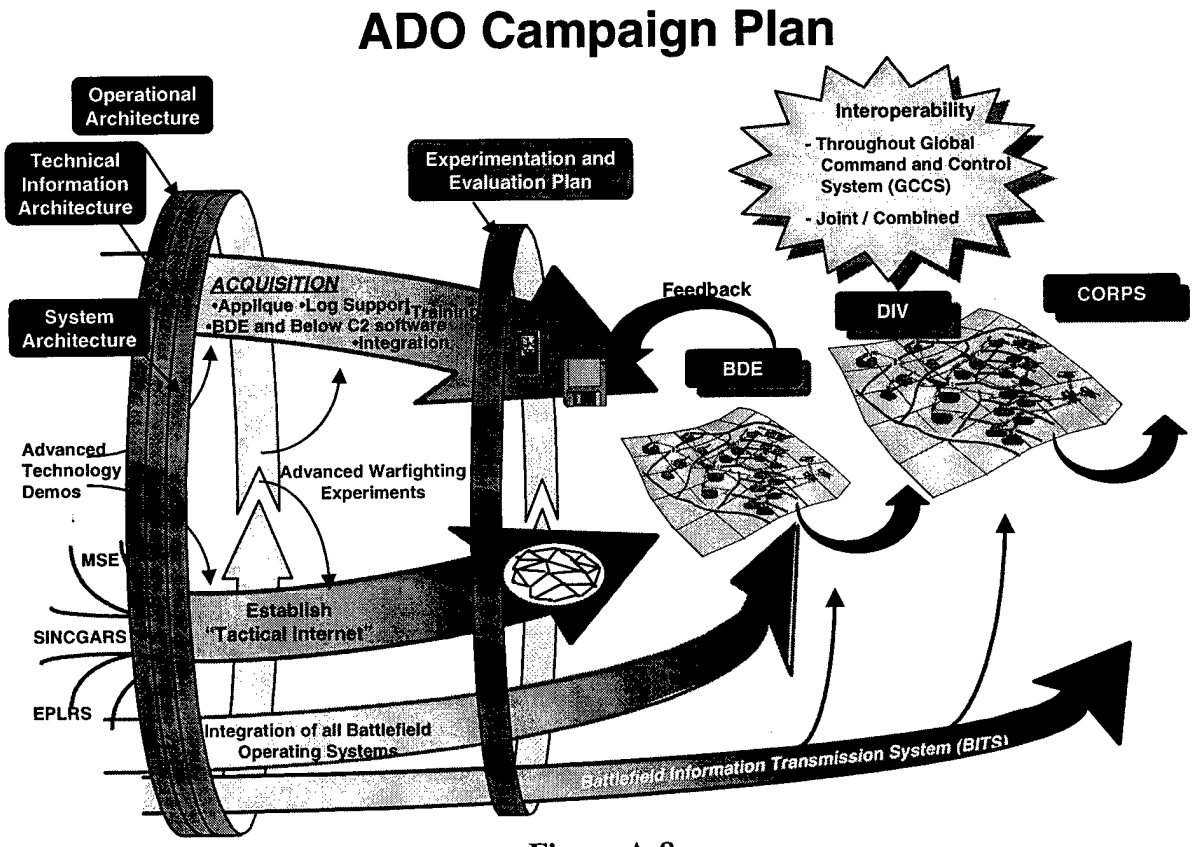


Figure A-8

The top thrust, or arrow, involves the acquisition of strap-on, or applique, hardware and software systems that will allow us to experiment with digitization and field an initial capability while we work toward the Battlefield Information Transmission System (BITS).

The second arrow represents efforts to establish a Tactical Internet that links current tactical communications hardware systems (MSE, SINCGARS, EPLRS).

The next step, represented by the third arrow, is to integrate various software programs for each of the Battlefield Operating Systems (BOSs). Our current series of software systems were developed without consideration for interoperability outside a specified BOS. We need to modify the software to allow them to exchange information.

The bottom arrow represents the long-term solution to digital communications; it is the BITS, which will be a family of future digital radios capable of handling long-term digital communications requirements.

All four thrusts will be focused by efforts to develop common operational, technical information, and architectures for future systems that are interoperable with the joint community's evolving Global Command and Control System.

Force XXI Time Line

The Army's Force XXI Campaign Plan is designed to transform the Army from its current industrial age configuration into an information age force. The Force XXI schedule (Figure A-9) is proceeding on schedule, but projected efficiencies and effectiveness will be jeopardized without the realization of proposed modernization initiatives and total commitment to funding key enablers. It is imperative that proper testing and implementation of the Force XXI concept continues on schedule if the Army is to benefit from efficiencies in the form of force structure savings.

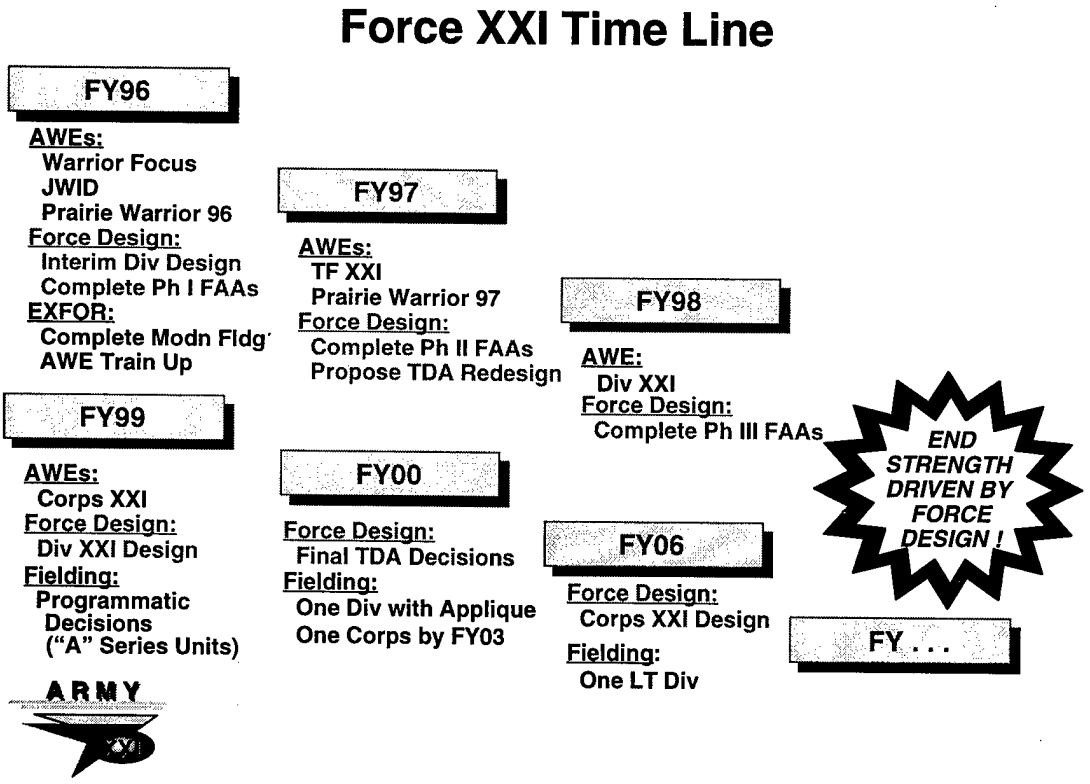


Figure A-9

Reserve Component (RC)

The RC force structure will continue to transition during the POM years. The RC will achieve its QDR objective of 45K reduction in force structure by the end of FY02. The initial 20K will be achieved by the end of FY00 and has been apportioned to the Army National Guard (ARNG) for 17K and the U.S. Army Reserve (USAR) for 3K. The remaining 25K reductions will be completed by FY02 and determined by the Army Staff in coordination with the National Guard Bureau (NGB), representatives of the Adjutants General, and the Office of the Chief of Army Reserve (OCAR). The specific reductions will be integrated into Total Army Analysis 2007 (TAA-07).

The ARNG will program for 15 Enhanced Brigades as part of the Total Army's warfighting capability. To transition ARNG force structure effectively for increased utility across the spectrum of conflict, the ARNG will continue to execute the programmed ARNG Division Redesign Study (ADRS) which converts up to 12 ARNG maneuver brigades to combat support (CS)/combat service support (CSS) forces required to support the Army's warfighting requirements. Redesign conversions will be accelerated as funds become available. The ARNG will achieve QDR force structure and endstrength reductions as adjudicated during the June 1997 AC/RC offsite conference. Those reductions call for ARNG force structure and endstrengths to be reduced in parallel. ARNG force structure and endstrength will be reduced 17K NLT FY00 in increments to be decided by the Army Senior Leadership. These reductions will bring ARNG endstrength to 350K by the end of FY00. Further endstrength reductions to be achieved by FY02 have yet to be determined.

The USAR will continue to implement QDR force structure and endstrength reductions consistent with the outcome of the AC/RC offsite conference. The USAR will reduce endstrength to 205K by the end of FY00. As with ARNG reductions, USAR endstrength reductions by FY02 have yet to be determined.

Decisions resulting from Total Army Analysis 2003 (TAA-03) reduced the longstanding CS and CSS force structure shortfalls, required to support the NMS, from 124.8K to 58.4K. Subsequently, the ADRS examined alternatives to convert existing low-priority combat units into support forces. The ADRS further reduced CS and CSS shortfalls from 58.4K to 15.7K when the Secretary of the Army approved the study on 23 May 1996. The impact of the ADRS will further enhance the integration of RC force structure and better position the Army for success with ongoing modernization efforts.

Multi-Component Units

In an era of increasing missions and constrained budgets, the Army is seeking innovative ways to maximize its available resources. The formation and documentation of multi-component units is one such initiative. Multi-component units are Modified Tables of Organization and Equipment (MTOE) organizations which utilize AC and RC personnel, equipment, and funding to leverage the resources and expertise from the Total Army.

During Total Army Analysis 2005 (TAA-05), the Army decided to form eleven units which will be fully documented as integrated multi-component units. This process will enable the Army to address the many legal, administrative, and procedural issues involved in the formation of these units.

In addition to those units selected for single documentation, TAA-05 made several recommendations for the formation of multi-component units. These units would continue to operate with organizational documents from their respective components. By leveraging the capabilities from each of the components, multi-component units will enable the Total Army to reduce AC force structure while converting existing RC force structure to more relevant functions.

Integrated Divisions

To make the ARNG combat structure more relevant to the warfight, the Army is establishing two AC/ARNG Integrated Divisions. The initial phase of this process will put three ARNG Enhanced Brigades under command of an AC/ARNG division headquarters. This alignment should improve training readiness for early deploying ARNG combat elements, facilitate more rapid deployment of these brigades, and enhance post mobilization preparation for war. This phase lays the foundation of the future transition of these forces to fully structured, integrated warfighting divisions. The Commanding General, U.S. Army Forces Command will lead the process with active participation from the Army Deputy Chief of Staff for Operations and Plans, the National Guard Bureau, and the Adjutants General.

The Army will continue to take full advantage of the soldiers, equipment, and resourcing of the Active and Reserve Components to field the most modern, lethal land combat force in the world.

Department of the Army Civilian Personnel

Department of the Army Civilians (DAC) are major contributors to the Army's overall mission. Civilians comprise approximately 18% of the Total Army and occupy vital support positions in all Army operations. More importantly, civilians provide stability and institutional knowledge regardless of the organizational level to which they are assigned, from senior management to administrative support. This is particularly true in the area of depot level maintenance, supply, acquisition, training, medical care, research and development, and facilities operations. The civilian work force is the cornerstone of the Army's CONUS-based, Power Projection Strategy.

The overall tempo of Army operational deployments and mission requirements is ever increasing, yet the civilian work force continues to decline. As a result of the QDR, Army civilian endstrength continues to fall—a total of 186K from FY89 to the end of FY03, or 46% since FY89. Civilian downsizing reflects reductions in funding, force levels, mission support requirements, and outsourcing and privatization initiatives.

The current program reduces civilian endstrength to 217K by FY03. These reductions are related to CONUS-based outsourcing and privatization efficiencies in base support operations, reshaping of Army Materiel Command, and military technician reductions consistent with RC force structure reductions. Additional savings are anticipated based on results of ongoing and programmed studies. Military technician reductions are notional and contingent on compliance with the Defense Authorization Act of 1997 and the OMNIBUS Consolidated Appropriation for FY97.

Strategic Force Packaging

Strategic Force Packaging groups the Army's units into force packages based on the "first to fight" principle, ensuring that programs and resources are consistent with objectives of the NMS and the requirements articulated in the Defense Planning Guidance.

The Strategic Force Package affect the development of the Department of the Army Master Priority List (DAMPL), Army Acquisition Objectives (AAO), modernization plans, and other planning and programming activities within the Army. The force packaging concept assigns major combat units, CS/CSS units, prepositioned equipment sets, and war reserve stocks to Force Package I, II, III, or IV. Three factors are considered for unit force packaging: their designation as an early deployer for crisis response, urgency of their need in stated CINC requirements for operations other than crisis response, and their ability to contribute to the full range of operations specified in the NMS.

CS and CSS units are the linchpins of successful operations. The Contingency Force Support Packages (FSP) are designated FSP 1 and FSP 2 and contain designated CS/CSS units capable of supporting full spectrum operations during a crisis.

Force Package I: Contingency Response Forces. Contingency Response Forces, together with required support and command and control, provide the supported CINC with rapidly deployable forces capable of conducting full spectrum operations. Balanced forces with a mix of capabilities permit tailoring and deployment to any theater. Contingency Response Forces possess a forcible entry capability, include supporting SOF, are initially sustained by predominately AC CS/CSS units for 30 days, and can be reinforced or augmented with additional AC and RC units as necessary to meet regionally unique requirements. The Army's goal is to deploy a Contingency Response Force of up to three divisions (one light and two heavy) from CONUS in 30 days.

Force Package II: Rapid Regional Responses Forces. These forces are designed to reinforce or augment Contingency Responses Forces and are comprised primarily of forward-stationed forces and forces deployed temporarily from CONUS on an intermittent or recurring basis. The Army's goal is to deploy designated forces from FP1 and FP2 (five divisions with associated CS/CSS) in 75 days.

Force Package III: Reinforcing Response Forces. These forces are designed to provide the National Command Authority with a reinforcing capability for a Major Theater War (MTW),

or a portion of the primary force, in the event that a second MTW or other crisis erupts. Reinforcing Response Forces are comprised of AC forces and the ARNG enhanced brigades. The enhanced brigades are expected to reinforce, augment, backfill, and/or provide rotational forces to AC formations.

Force Package IV: Strategic Reserve Forces. These forces are required to train, equip, and sustain the current force, including the capability to conduct domestic missions and to meet the requirements for the expansion, reconstitution, and/or regeneration of the force through all phases of mobilization.

SECTION 2: CONCLUSION

> "We must find the best ways to organize, train, and equip our forces to exploit our competitive advantages—quality people and advanced technology."
> General Dennis J. Reimer, Chief of Staff, U.S. Army

The Army's primary mission remains fighting and winning the Nation's wars, and its most demanding requirement is outlined in the NMS: *winning* **two Major Theater Wars (MTWs) in close succession, one followed almost immediately by another.** The Army is also confronted with other similarly dangerous challenges, such as Smaller-Scale Contingency (SSC) operations and responding to asymmetric threats.

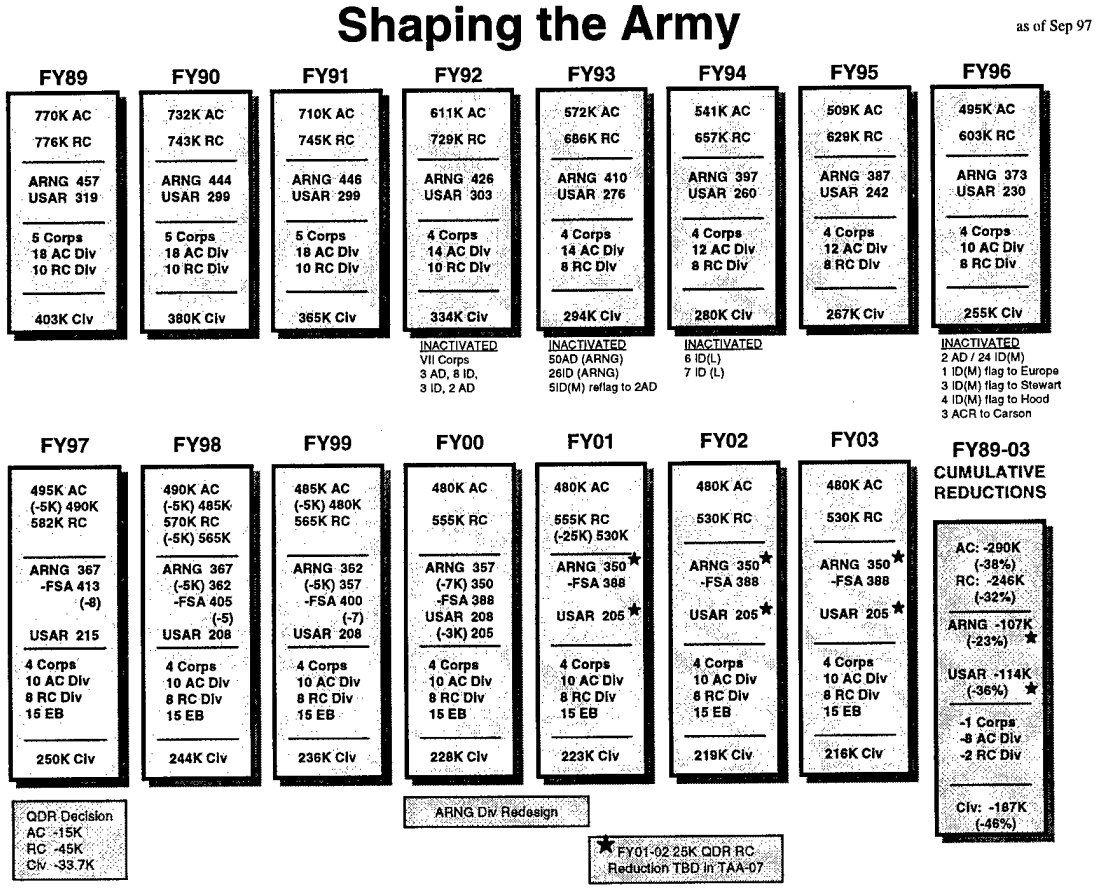


Figure A-10

Today's Army is meeting the challenge of its most significant force structure changes since the end of World War II. It has been transformed from a forward-deployed Cold War Army to a globally engaged land force. The power projection Army is designed to execute the NMS through **peacetime engagement** that shapes the environment, **deterrence** and **conflict prevention**, and the use of **rapid deployments to respond to crises** while maintaining the ability to **achieve quick, decisive victories** with minimal casualties. The current and programmed force structure allows America's Army to successfully conduct prompt and

sustained operations on land, and provide a wide variety of operational capabilities applicable across the continuum of peace and war (Figure A-11).

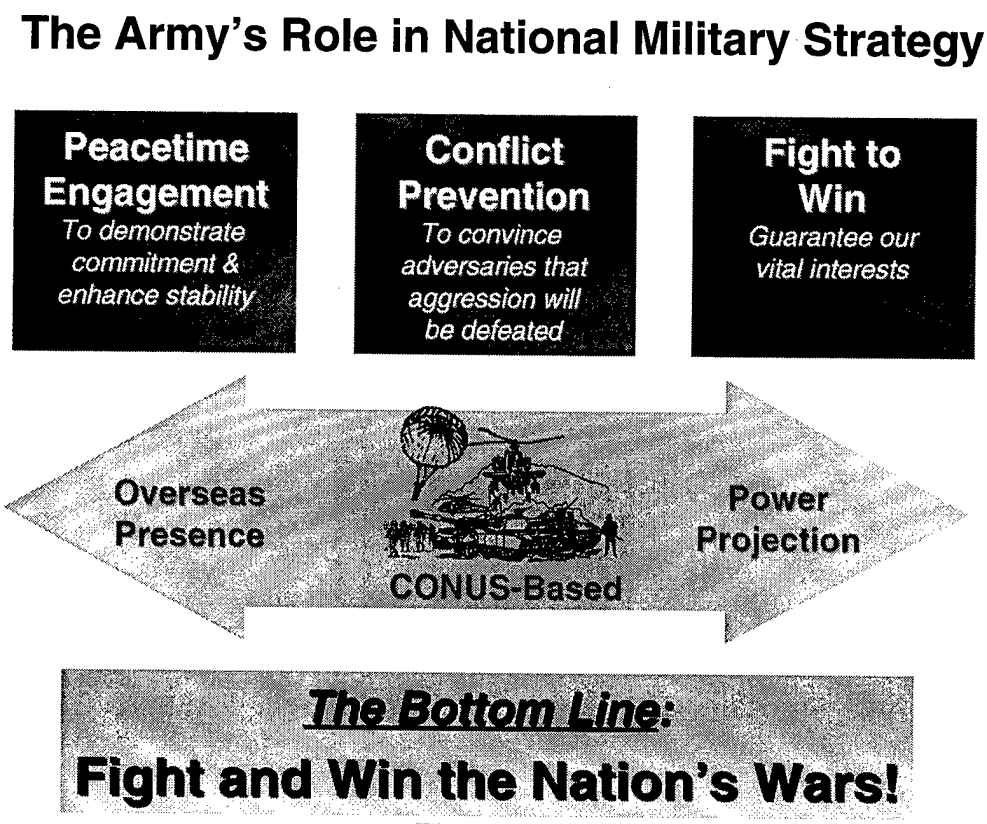


Figure A-11

The U.S. Army force structure will continue to evolve and be designed to best support the NMS and meet the Army's Title 10 responsibilities, while posturing for the challenges of the 21st Century. The Army is developing the means and the process to achieve future success but, without the procurement of superior technology and modernized systems that success will be jeopardized. The current force structure must have a robust, fully funded modernization program to mitigate risk to our smaller force. It is imperative that America's land force remains trained, ready, and equipped to defend our national interests during the 21st Century.

ANNEX B: SOLDIER SYSTEMS

SECTION 1: INTRODUCTION

> *"But we can never forget that the ultimate technology and the ultimate weapon for the U.S. Army will always be the individual soldier."*
> General Dennis J. Reimer, Chief of Staff, U.S. Army

Overview

A highly trained and properly equipped soldier is a crucial and integral component of the successful employment of all Army systems. The soldier is, in fact, a unique weapons system platform. The soldier of 1998 and beyond must be capable of performing a full range of operations supporting many different missions around the world, including peacetime engagements, deterrence, and conflict prevention, while maintaining a core competency to provide land power dominance at any level of conflict.

Today, Army soldiers are not fully prepared to meet all the field conditions they are expected to face. Technological advances have allowed the Army to achieve superior overmatch with most major weapons systems. However, with current equipment our soldiers can only hope for technological parity with their opponent in a close and brutal fight. Chemical agents, antipersonnel devices, kinetic and directed energy weapons, harsh environmental factors, as well as burdens of soldier load and physiological effects, threaten the safety, lives, and effectiveness of our Army's soldiers. In addition, soldiers will increasingly face sensors and sighting systems that make survivability more difficult. Thus, modernizing and fielding effective and efficient soldier systems to the Army continues to be a major challenge and a pressing requirement. It follows that the soldier's, and hence the Army's, overall mission success will rely upon soldier systems receiving sufficient resources to develop and field the equipment and clothing necessary to meet tomorrow's battlefield demands.

Soldier systems are a family of integrated systems for the individual soldier that consists of everything that is worn, carried, or consumed for individual use in a tactical environment. The over 110 soldier system programs focus on the individual mounted and dismounted soldier and the aviator crewman in combat, combat support, and combat services support roles. The soldier system is analogous to any other major weapons systems platform in that it has numerous component parts that must work in harmony to be effective. Yet, the soldier system is uniquely different from all other major weapons systems in two significant respects. First the soldier system frame is human; its loss is not measurable in dollars. Second, the soldier is the common element for all Army major weapons system platforms. The operation of every major Army system is affected by the quality of the soldier systems and the synergy created by the ability of soldiers to interface effectively and efficiently with his or her equipment and systems. With the soldier as the common element for all of the Army's major weapon platforms, it is both logical and imperative that soldier systems remain a key component of the Army Modernization Plan. This annex addresses the Army's planned modernization of soldier equipment. *Army Vision*

2010 is the blueprint for the Army's contribution to the enhanced operational concepts of *Joint Vision 2010*. This annex describes soldier systems' planned modernization efforts to achieve these required capabilities. This plan will lead the Army to *Army Vision 2010* in the mid-term, and will set the stage for the soldier of the future in the Army After Next in the far-term.

Soldier Warfighting Concept

> *"The gun, the missile, the ship, the plane, the spaceship is no better than the Man who operates it."*
>
> Hanson W. Baldwin, Military Historian, Author, *Battles Lost and Won*

The soldier of today enters combat with a 75- to 125-pound load and power capability for 12 to 24 hours of sustained operations before re-supply (mission, enemy, terrain and troops—time-dependent). A multi-layered component approach affords some environmental and chemical protection, as well as protection from airburst munitions to head and torso and direct fire munitions, but with a heavy weight penalty. Paper maps, a compass, and a stand-alone Global Positioning System (GPS) unit serve as the navigational aids, and the soldier relies on his own vision, hand signals, and his voice to provide situational awareness. Currently, the weapon is the M16A2 rifle with a line-of-sight scoped out to 600 meters in daylight (and only 300 meters or less at night). Today's soldier does not possess overmatch in the close, brutal fight, nor is the soldier prepared for the 21st Century battlefield.

Soldier systems contribute to the five significant capabilities needed by every soldier to attain overmatch of the enemy. In turn, as shown in Figure B-1, the soldier capabilities can be linked directly to the Army patterns of operation. When soldiers with overmatch in these five capabilities are placed in elements of squad or above, these units form the foundation for successful employment of the Army patterns of operation. Without individual soldier overmatch capability provided by soldier systems modernization, the synergistic effect of an Army unit's pattern of operation will be weak or fail. These soldier capabilities, linked with comprehensive training and mission rehearsal, empower the individual soldier to shape his battlespace.

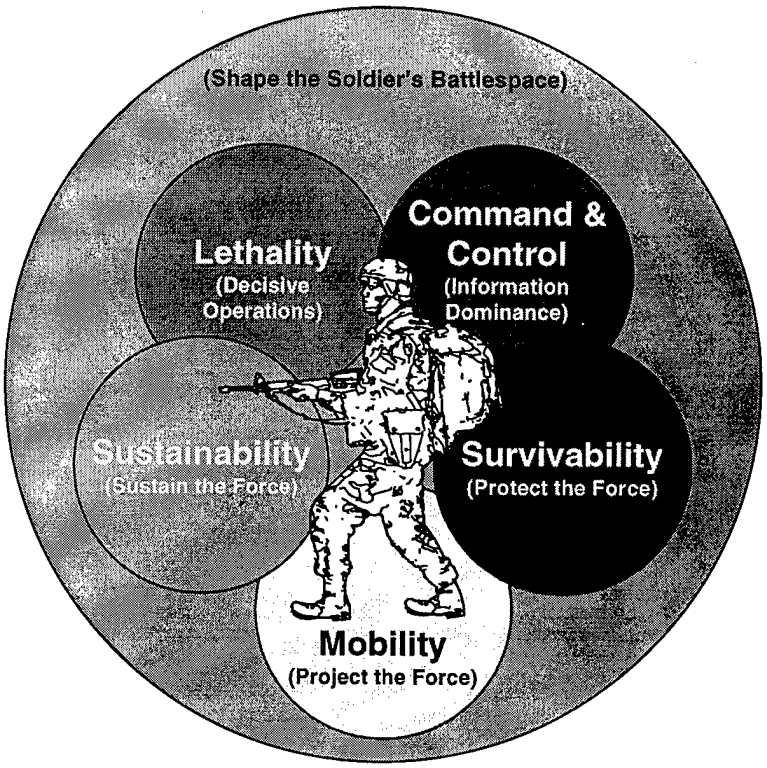


Figure B-1

Near-Term and Future Capabilities Required

This Army soldier modernization strategy provides for integrated soldier systems to enhance the soldier's capabilities in the near-term. Science and technology followed by technology insertion will equip the future soldier with the capabilities essential for full spectrum dominance.

	Near-Term Capability Requirement	Future Capability Requirement
Decisive Operations	• Modular Weapons Systems • Thermal Weapon Sight • Non-Lethal Munitions	• Objective Individual Combat Weapon • Target Acquisition and Hand-off • Selectable Lethality
Protect the Force	• Slightly Reduced Weight • Reduced Heat Stress • Modular Protective Systems • Combat Identification	• Dramatically Reduced Weight • Advanced Physiological Monitoring • Fully Integrated Protection • Fully Integrated Combat Identification
Information Dominance	• Linkage to Digital Battlefield • Real-Time Data	• Mobile Internet • Battlefield Asset Data Link • Sensor Fusion
Project the Force	• Integrated GPS/Digital Map • Exact Airdrop Insertion • Reduced Bulkiness	• Route Selection • Individual/Group Transporter • In-stride Mine Avoidance
Sustain the Force	• 12-Hour Battery • Battery Commonality	• 7-Day Sustained Operations • Improved/Lighter Power Sources

Figure B-2

Challenges Ahead

The paradigm of the Army poised to meet the demands of the Cold War has been replaced by the scenario of equipping for two Major Theater Wars (MTWs) and contingency operations. In actuality, the Army is responding to many contingencies on a continuing basis, as well as continued preparation for two MTWs. The Army has responded, in a time of a dramatically smaller forces, by shuffling units between force packages and by relying heavily upon low-priority units to augment overtaxed, high-priority units. This causes a constant challenge to keep all units equipped with modernized clothing and equipment, in turn resulting in disruptions to the fielding plan and unbudgeted equipment shortfalls. This dynamic fielding environment leads to an overall absence of modernized equipment and clothing in many deploying units and dramatically impairs mission effectiveness. This impact has become apparent in training and battle rehearsal exercises at Army training centers and in discussions with commanders and soldiers in the field.

Major technical challenges include weight reduction, power sources, power management and, most importantly, systems integration. These directly affect the soldier's mental agility. For

example, the technologies exist, or are emerging, that can enable conveying vast amounts of information to the soldier. Determining the right balance of needed information at the right time is a complex challenge. Soldiers must have instantaneous access to information that is relevant to their missions, the ability to process that information and to communicate voice and data up and down the chain, and to use the information effectively to achieve the mission. Providing this information while reducing soldier load requirements continues to be an essential challenge (e.g., power sources). Materiel solutions to the requirements, identified in Figure B-3, will greatly increase the potential capabilities of the soldier, but this increased capability will be at a cost. The weight of soldier equipment, despite the emphasis on lightweight materials, greatly exceeds what the soldier can carry and still operate effectively.

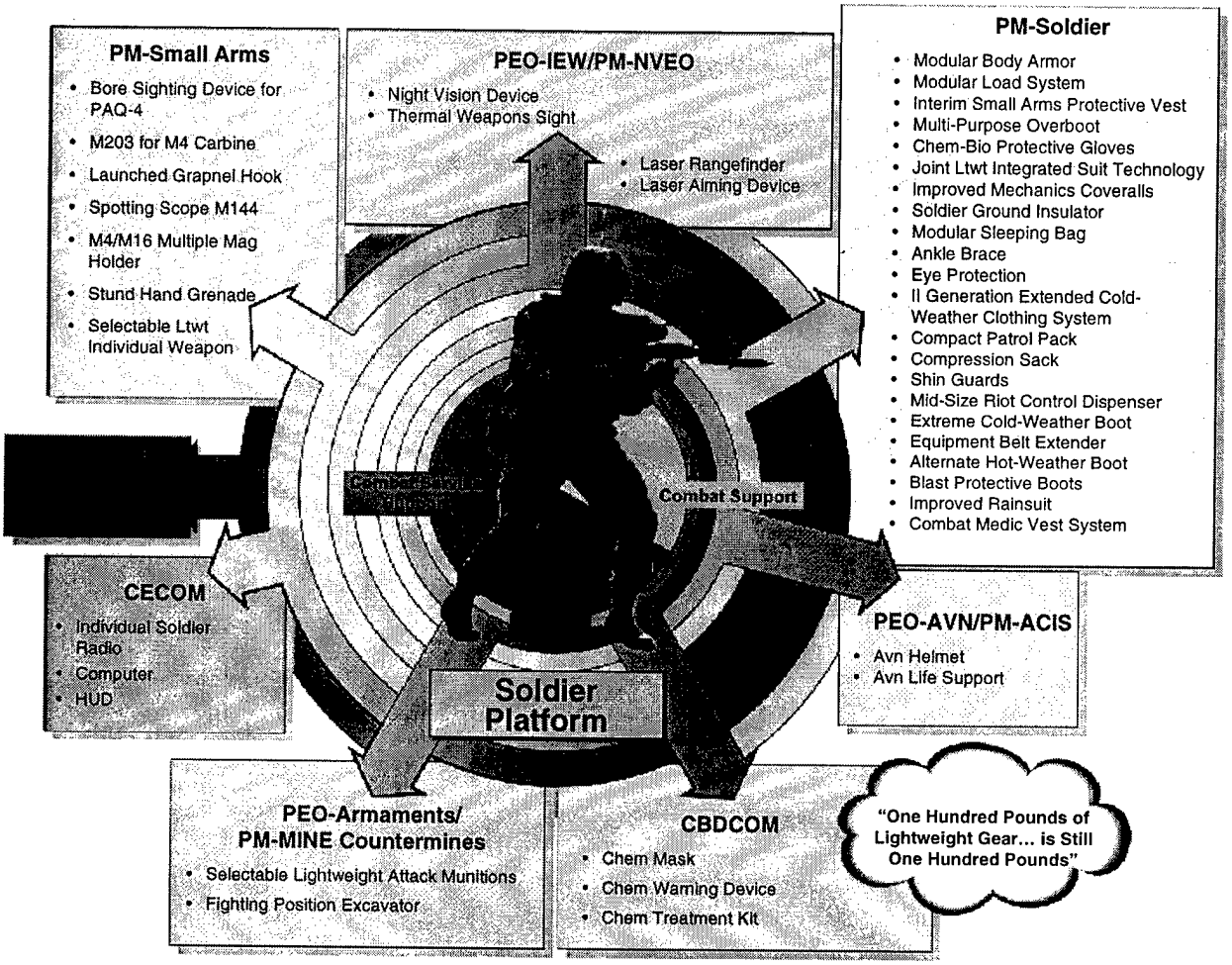


Figure B-3

The soldier system integration challenge focuses on mission-tailorable equipment, integrated systems, and subsystems that will enhance combat, combat support, and combat services soldier capabilities while restricting load to what can reasonably be carried and operated effectively. In addition, integrated soldier systems of the future will include the capability for embedded training, mission rehearsal, and soldier capabilities testing and evaluation. Physical agility requires successful resolution of these integration challenges.

Summary

The Army leadership is committed to modernizing all soldiers. The Army's soldier modernization strategy is focused on improving soldier capabilities through the application of human and systems engineering, realizing technological benefits, advancing interoperability, employing a technology insertion strategy, and putting equipment rapidly into the field. A clear need exists to enhance the combat effectiveness and protection of the individual soldier for any mission and all environments. Improvements in soldier capabilities are the essential cornerstone to move the Army toward realization of the digitized battlefield and for the Army After Next (Figure B-4). Soldier modernization, as described in the remainder of this annex, delivers new technology, as well as leveraging technology from other services and nations, to improve the warfighting capabilities of the individual soldier. With the soldier as the critical link to success in the patterns of operation, enhancing soldier combat effectiveness through improvements in warfighting capabilities is imperative to future mission success.

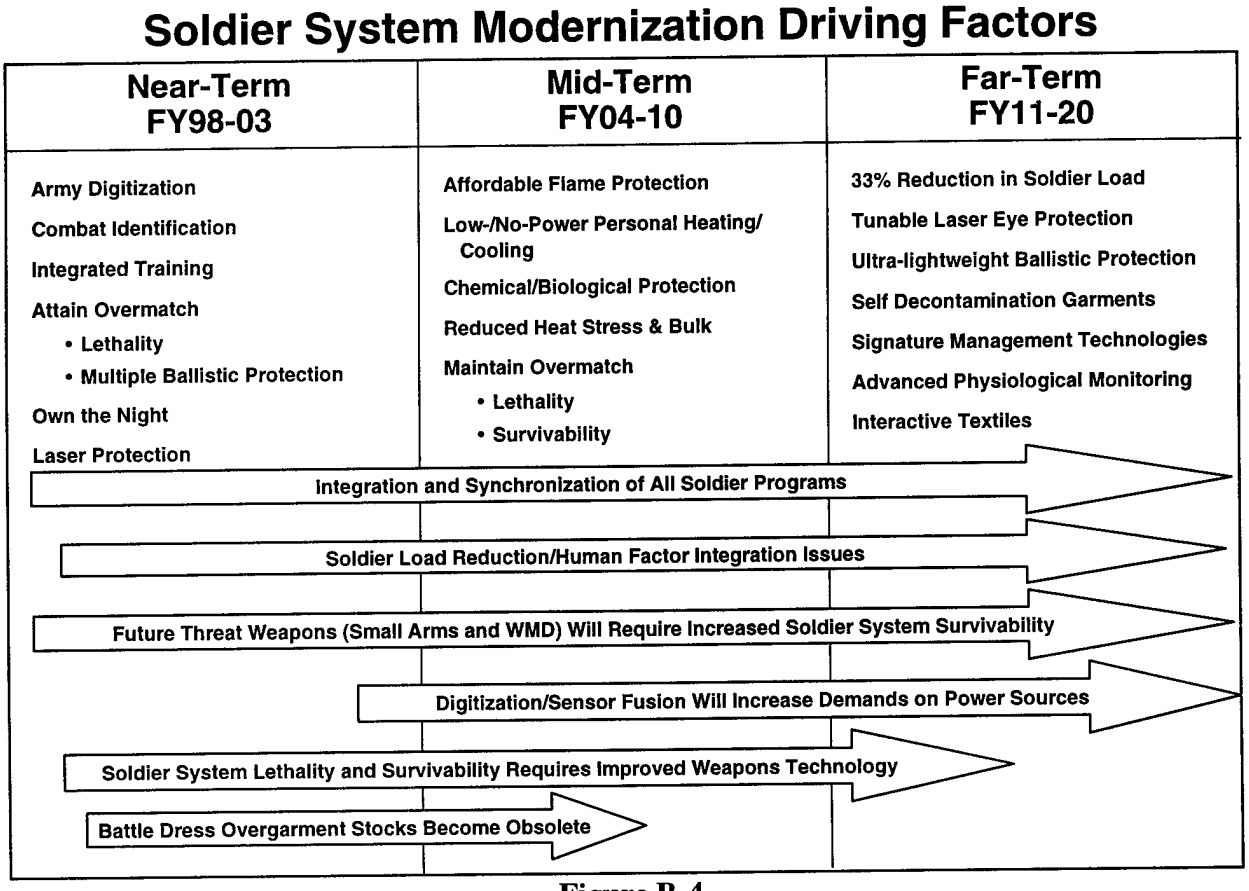


Figure B-4

SECTION 2: CURRENT PROGRAM ASSESSMENT

> *"The security challenges of a largely bipolar world have been replaced with more ambiguous and, in some cases, equally dangerous problems."*
>
> General John M. Shalikashvili

Overview

The Army's new force projection strategy requires the deployment of tailored Continental United States (CONUS)-based contingency forces comprised of elements from all Force Packages to fulfill contingency missions across a broad spectrum of conflict. The Army's current soldier systems modernization funding and fielding plans only support a small portion of the Army's force projection strategy. This section provides an overview and an assessment of our warfighting capabilities from the standpoint of where we are today and how our modernization strategy will fulfill the Army's requirement in the mid- and far-terms.

Good progress is being made in the Science and Technology (S&T) and the Engineering and Manufacturing (EMD) phases of the life cycle of soldier systems. Efforts must increase in order to resolve the significant technology challenges that arise as the nature of the soldier's battlespace evolves. The Army's current soldier modernization lacks sufficient centralized funding and fielding (CFF) and sustainment resources to meet the fielding demands of today's environment. Until sufficient resources are devoted to fielding modernized clothing and equipment to all units and full fielding occurs within three years, many of the capability assessments will reflect **RED** or **AMBER.**

Soldier Systems Modernization Strategy

The cornerstone to a successful soldier systems modernization strategy is the need to synchronize the modernization of soldier systems and capabilities with the rest of the Army. Utilization of technology carriers such as the Warrior programs and Army digitization will help synchronize system fielding to maneuver forces. Figure B-5 illustrates soldier systems programs and their relationship to the components of the Army Investment Strategy and the *Army Vision 2010* patterns of operation. Many programs cover more than one investment component but are categorized based on their primary contribution. Although Land Warrior's primary contribution is to soldier lethality and providing overmatch capability, it will also make a significant contribution to information dominance.

Invest Comp

Patterns of Operation	Information Dominance	Overmatch	Essential S&T Leap-ahead	Recapitalization	Contributing Capabilities	Infrastructure
Information Dominance		Land Warrior Air Warrior Mounted Warrior	Force XXI Land Warrior			
Shape the Battlespace						
Decisive Operations		SPEAR	MOUT ACTD OICW			
Project the Force		MLS	Airdrop Technologies			
Protect the Force		MBA SEP, CIE JSLIST	Soldier Systems Technology for AAN		Advanced Bomb Suit	Firefighters Integrated Suit STEPO
Sustain the Force		Army War Reserves			Combat Medic Vest	
Other Missions						
Maintain Readiness						

Figure B-5

The soldier systems modernization strategy integrates, packages, and provides synergistic improvements to systems that increase the individual soldier's combat capabilities on the battlefield and make direct contributions to all Army patterns of operation. These systems are also structured to recognize the need to fulfill varied and tailored requirements in a modular fashion for each "type" of soldier found on the battlefield. This process is accomplished through the use of one of three soldier system development paths: the Soldier Enhancement Program (SEP), the Clothing and Individual Equipment (CIE) program, or the Soldier Warrior Programs (represented by Land Warrior, Mounted Warrior, Air Warrior, Joint Service Lightweight Integrated Suit Technology (JSLIST), and Special Operations Forces Personal Equipment Advanced Requirements (SPEAR) programs).

The SEP (Marines participate through the Marine Enhancement Program–MEP) requires minimal Research, Development, Test, and Evaluation (RDTE) effort and shortens the developmental phase of the life cycle process through the use of commercial off-the-shelf (COTS) items. Representative SEP program items are depicted in Figure B-6.

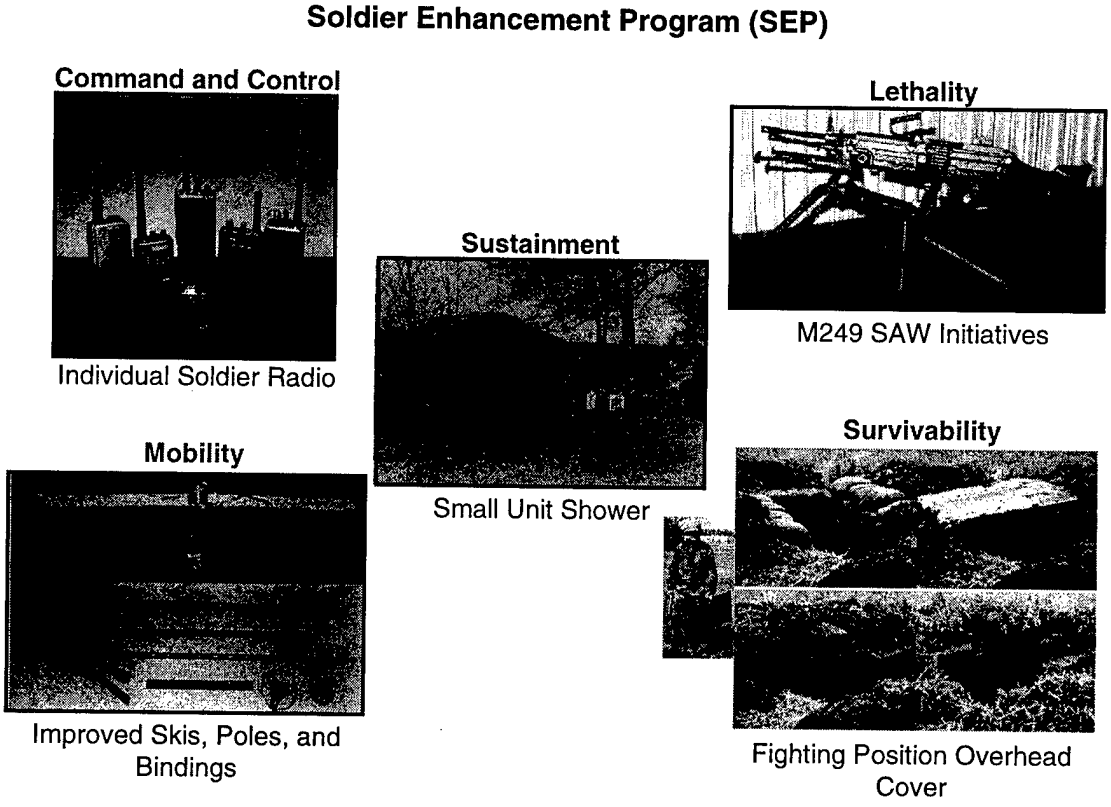


Figure B-6

The CIE program encompasses all combat, life support, ballistic, and environmental protection items worn or carried by the soldiers for individual use (that have not already been addressed under the SEP program). The CIE program also includes non-tactical clothing and individual equipment, including dress uniforms. Representative CIE items are depicted in Figure B-7.

Soldier systems flagship programs provide the soldier with a decisive winning edge on the battlefield. The use of technology demonstrators has become a major vehicle for transitioning promising technologies into the systems of tomorrow. As a result of Army Science and Technology (S&T) efforts, high-payoff technology capabilities are being pursued through tailored, modernized strategies in the Warrior programs to field equipment as fast as technology allows. Land Warrior is a result of past Advanced Technology Demonstration (ATD)

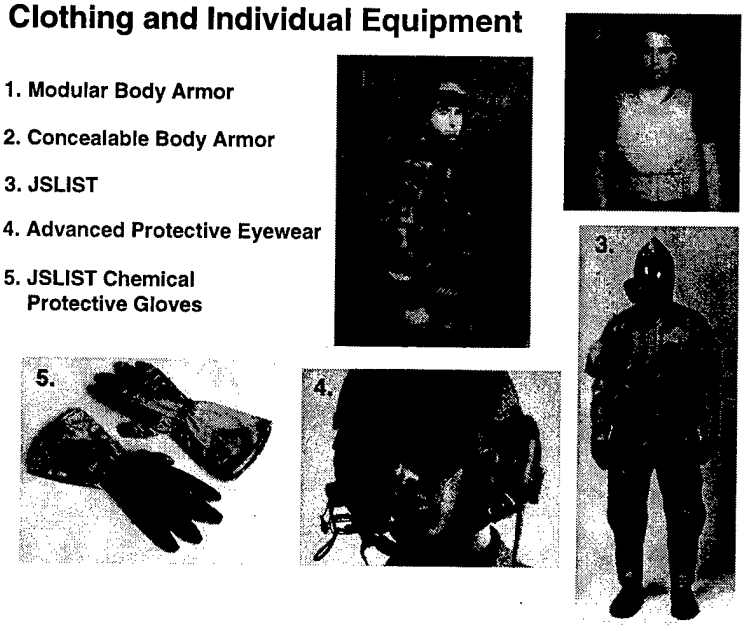


Figure B-7

efforts and will field an integrated soldier fighting system by FY00 and should fully outfit Force Packages 1 and 2 by FY11. Figure B-8 depicts the Land Warrior system components and major thrusts.

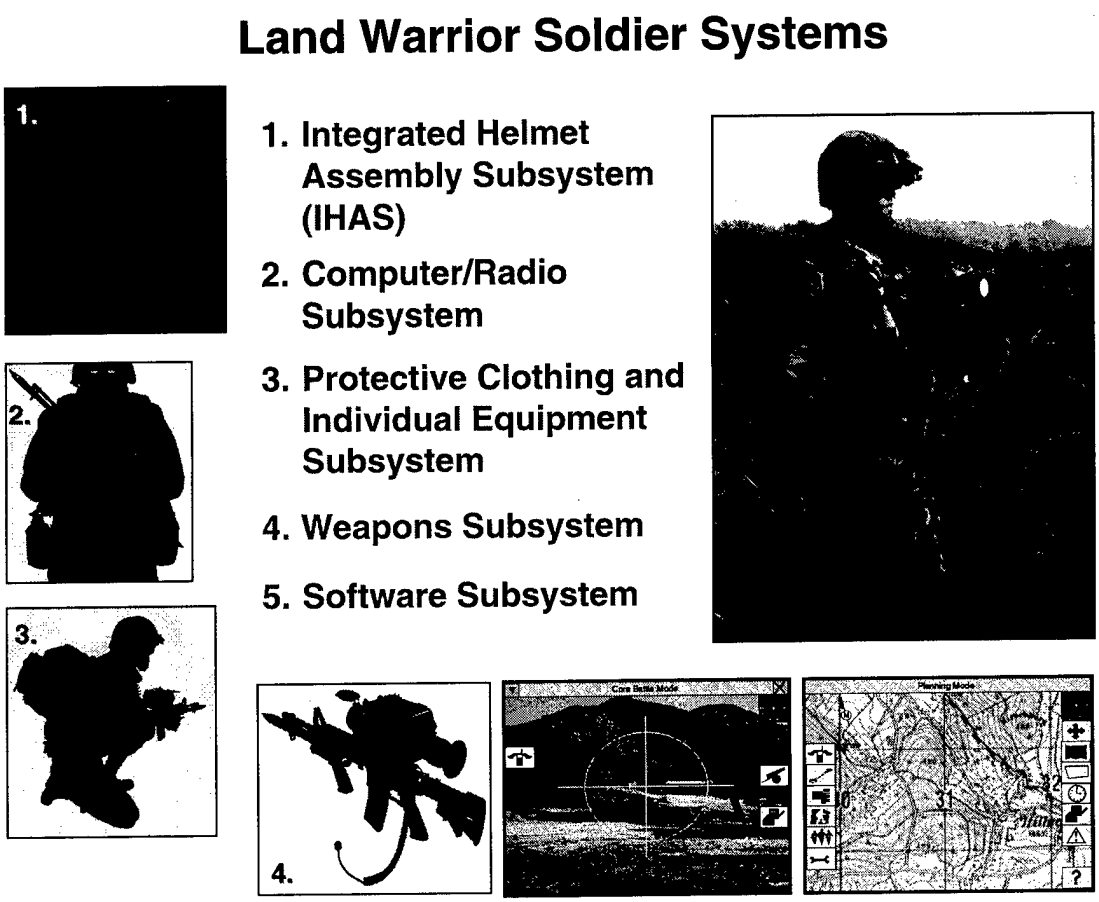


Figure B-8

Army emphasis on acquisition reform has provided a welcomed focus on streamlining the front end of the life cycle process (Milestone 0 to Milestone 3), decreasing the time to turn requirements into items ready to field. However, the developmental process is useless unless the developed capabilities can be placed in the hands of soldiers. Initial fielding and subsequent sustainment of organizational clothing and equipment has consistently lagged due to shortfalls in funding and outdated fielding policies. During FY97 the Army began efforts to increase the focus on the procurement and fielding aspects of soldier systems. These efforts will continue and, in fact, must accelerate.

Central Funding and Fielding (CFF) is the procurement mechanism that acquires and fields life-support and mission-enhancing equipment to individual soldiers. Formerly, such items were made available for purchase at installation level using Operations and Maintenance Account (OMA) funding. With the rising demands on installation OMA, the Army has been procuring selected items and free-issuing them to high-priority units. This has been the mechanism used to field items developed by the SEP program and the Organizational Clothing and Individual Equipment RDTE (OCIE) process. The intent is to field these items within a

three-year period after RDTE is complete. Once initial fielding under the CFF program is complete, the sustainment process begins. Sustainment and replenishment of CFF items are funded at the installation level.

The Training and Doctrine Command (TRADOC) has identified over 80 items for development and procurement since the SEP program's inception in 1991. Unfortunately, there are insufficient CFF resources to "pure fleet" many items throughout the force. Although the problem faced in previous years of having the CFF dollars reallocated to other Army priorities seems to be on the mend, there are still insufficient funds to procure all of the CFF items required throughout the force. The impact has been that higher priority units have received a larger number of CFF items than lower priority units. Moreover, the goal of fielding systems within three years usually is not met. A specific example of the impact of this consistent under-funding is the deployment of the modular sleeping bag system. Initial deployment was started in FY95, but fielding of FP 1 and FP 2 alone will not be completed until after 2000. Replacement and sustainment at installation level of expensive OCIE items are also problematic because of the high expense associated with replacing many of the CFF procured items.

Sustainment of soldier systems is also becoming a greater challenge. The operational tempo (OPTEMPO) of the late 1990s, utilizing a dramatically smaller soldier force, is accelerating replacement requirements for equipment and systems. Due to the high technology demands generated by these factors, many of the modernized equipment items are more costly. With the increased turnover of items, as well as increased costs, commanders must decide whether to use their scarce OMA funding to replace old, worn-out equipment with expensive, modernized equipment or to conduct training to maintain proficiency.

The Army War Reserve (AWR) program provides the Army the ability to project a CONUS-based force quickly and to sustain those forces for extended periods of time. The AWR program provides for the development of requirements, stockage, management, planning, and execution of clothing, textiles, and other soldier system commodities in support of contingency operations involving the projection and sustainment of Army forces. Army War Reserve funding prevents the Army from achieving a 100% fill of the AWR requirements. Although deficiencies have been identified, no new mobilization funds have been received for over five years. This may result in the depletion of Army War Reserve sustainment stock before the industrial base is ready to provide full support during a conflict.

Information Dominance Capability Assessment

Information dominance will influence the individual soldier's ability to initiate decisive operations on the small unit/individual level by providing the soldier critical situational awareness of his battlespace. The decisions the soldier can make, based on his assessment of information received via command and control tools, directly influence his lethality, survivability, mobility and sustainability. Further, information dominance affords the individual soldier increased survivability through better understanding of both enemy and friendly elements on the battlefield as well as increased mobility through integrated GPS.

Information Dominance Capability Assessment

Soldier Programs	Systems Funded	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
Land Warrior	34,000	AMBER	AMBER	AMBER

Figure B-9

Land Warrior is the Army's revolutionary program to develop and field a totally integrated soldier fighting system by the year 2000. Originally focused on soldier lethality and command and control, program focus has expanded to include soldier mobility, survivability, mission rehearsal, and sustainment. The addition of these requirements and the HQDA direction for a First Unit Equipped (FUE) of FY00 has resulted in an aggressive program schedule with limited RDTE funding and little room to accommodate any major problems which could surface. This causes the program to be rated **AMBER** in the near-term (Figure B-9). The slow fielding rate of Land Warrior due to overall insufficient funding through the Extended Planning Period (EPP) causes Land Warrior to remain **AMBER** for the mid- and far-terms.

Overmatch Capability Assessment

Overmatch Capability Assessment

Soldier Programs	Systems Funded	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
Land Warrior	34,000	AMBER	AMBER	AMBER
Modular Load System	36,000	AMBER	AMBER	AMBER
Modular Body Armor	36,000	AMBER	AMBER	AMBER
JSLIST	1,345,000	AMBER	AMBER	AMBER
CIE/SEP (Basket Program)	N/A	AMBER	AMBER	AMBER

Figure B-10

The Warrior programs, along with PM-Small Arms and PM-Night Vision Soldier Enhancement Program initiatives such as the long-range sniper rifle, modular weapon system rail adapter, the monocular night vision device, and the selectable lightweight attack munitions, will provide the individual soldier with lethality overmatch in both the mid- and far-terms. However, until Force Package 3 receives Land Warrior, it will remain **AMBER** throughout the rated period (Figure B-10).

Modular Load System. Great strides have been made at lightening the load and integrating ballistic protection with load carriage systems. The Modular Load System will increase mobility, reduce heat stress, and be compatible with Modular Body Armor (MBA) and other CIE. It includes fighting load carrier, patrol pack, rucksack, butt pack, and pockets/pouches. Affordability issues make the Modular Load System **AMBER** throughout the rated period. The soldier will also continue to pay mobility and sustainment penalties in equipment weight and bulkiness to secure ballistic protection. This may change as technology advances provide the soldier with less bulky and lighter weight ballistic protection.

The **Integrated Modular Body Armor (MBA)** system will provide "bullet-stopping" protection for dismounted soldiers and Marines against fragmentation, fleschettes, and small arms rounds (7.62x54, 5.56 Green Tip) at a reduced weight compared to current systems. However, until all units receive this soldier survivability equipment, MBA is rated **AMBER** through the far-term.

Joint Service Lightweight Integrated Suit Technology (JSLIST). JSLIST can provide the soldier with an overmatch capability for chemical survivability. The consolidated efforts of four services will develop the next generation suits for chemical/biological (CB) protection. JSLIST allows soldiers, sailors, airmen, and marines to perform operations for 24 hours in a chemical environment after 45 days of wear. The suit is launderable, with improved comfort and less weight, bulk, and heat stress for improved mission mobility and sustainment. Since JSLIST currently has a one million suit shortfall ($250M), all suits currently planned for procurement will be placed in contingency stocks as opposed to being issued directly to soldiers. This will place readiness and training shortfalls on affected units. This affordability issue makes the JSLIST rating **AMBER** throughout the POM.

The **Soldier Enhancement Program (SEP)** and **Clothing and Individual Equipment (CIE)** programs suffer the same affordability issues as the above mentioned programs and are rated **AMBER** throughout the rated period. A sampling of the over 110 SEP and CIE programs that help create soldier systems overmatch are as follows:

Fighting Position Overhead Cover will provide basic overhead protection for a two-soldier fighting position from airburst, indirect fire, and small arms weapons. It will reduce setup time compared to the Class IV lumber/plywood system. It will also be easier to transport and store.

Concealable Body Armor. Concealable body armor provides ballistic protection against handgun and small arms rounds for users in missions where concealable armor is needed, e.g., protective services and force protection. There are two levels of protection—a specific soft system for handgun protection and upgrade plates for small arms like the AK-47. It features improved protection, fit, concealability, and reduced soft vest weight. It provides standardized, concealable protection for military and other government users.

Equipment Belt Extender. This provides the soldier with a four-inch extension for equipment belt adjustment without removing and relocating equipment. It also provides rapid

fighting load adjustment when donning and doffing cold weather and Nuclear, Biological, and Chemical (NBC) garments and body armor.

Machine Gun Assault Bag. This provides the soldier with a bag to support 500 rounds of linked machine gun ammunition. It reduces soldier load by eliminating the requirement to carry ammunition cans, increases response time by having ammunition in a ready-to-fire configuration, and keeps ammunition clean.

Knee and Elbow Pads. Pads reduce injury to soldiers by providing increased protection for knees and elbows. They extend the life of soldier uniforms and reduce lost duty time due to injury.

Advanced Protective Eyewear System (APES). This system provides the combat vehicle crewmen with an improved goggle, providing eye protection from sun, wind, dust fragmentation, and laser threats.

Essential Research and Development and Leap-Ahead Technology

Essential R&D for Soldier Systems

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• MOUT ACTD • Force XXI Land Warrior (Includes Integrated Sight) • Personnel Airdrop • Ballistic Protection for Improved Individual Survivability	• Future Warrior Technologies	• Nanoscience SRO • Compact Power SRO • Enhanced Soldier Performance SRO

Further information may be obtained in the Army Science and Technology Master Plan, Chapter III.I (Soldier Systems).

Figure B-11

NEAR-TERM (FY98-03)

Military Operations in Urban Terrain (MOUT) Advanced Concept Technology Demonstration (ACTD). The MOUT ACTD is a joint Army/Marine Corps program that encompasses a breadth of technologies including an advanced soldier system, advanced individual precision weapons, combat identification, counter-sniper non-lethal weapons, advanced sensors, situational awareness, and personal protection. The core capability that will be generated via the ACTD is the linkage of a series of advanced systems/components into a MOUT "system of systems" whereby the components are interfaced, integrated, or linked in an architecture to ensure their effective interoperability and functionality in the challenging MOUT environment.

Force XXI Land Warrior technology insertion program will ensure the future battlefield dominance of dismounted infantry. Advanced technologies in microelectronics, weaponry, and protection will be systematically applied to individual soldiers, Marines, and special operators of current and future warrior systems to augment their operational capabilities to achieve maximum synergy between human and equipment performance.

Force XXI Land Warrior is rated **AMBER** for lethality in the near-term. The rating switches to **GREEN** in the mid-term and beyond as technologies enhance individual, crew, and personal combat weapons effectiveness with such systems as the Objective Individual Combat Weapon (OICW). This system will provide the soldier with the capability to attack fortified, non-line-of-sight targets and targets that have gone to ground. In addition, Force XXI Land Warrior is rated **AMBER** for command and control in the near-term, but becomes **GREEN** as personal communications devices become available. The personal communications device for the soldier will provide the next generation Land Warrior radio technology by adapting commercial cellular technology to support the needs of the dismounted soldier and to satisfy the joint service requirements for dismounted warfighter communications. Helmet-mounted display research will reduce power drain; increase luminance, chromaticity, and uniformity; improve high-speed refresh rates; enhance contrast; reduce cost; and increase display life.

Soldier systems S&T programs involving soldier mobility include personnel airdrop technologies that will provide the means of delivering personnel and supplies with greater accuracy, safety, and precision, resulting in greatly reduced personnel airdrop injury rates and increased survivability of delivery aircraft. Also, precision drop will reduce drop zone size requirements to support rapid force entry tactics, resulting in a faster consolidation of force and allowing just-in-time resupply of rapidly moving forces. Advanced airdrop technologies will provide improved performance and enhanced safety of current personnel parachute capabilities. Advanced airfoil and parachute designs will provide gliding personnel parachute concepts and increases in jump altitude, as well as soft landing capabilities to augment personnel parachute performance. Sustainment technologies include lighter weight batteries; a fuel cell powered battery charger; and low-cost, pseudo-rechargeable, environmentally benign batteries for use in training and low-rate applications. In addition, advanced subsistence technologies will provide ration systems that sustain and support highly mobile, forward-deployed troops, and provide enhanced performance capabilities including improved target acquisition, enhanced cognitive skills and decision making (particularly under stressful battlefield conditions), extended mission endurance, and increased alertness. Improved food packaging will protect and prevent ration components from physical, chemical, or microbiological deterioration in extreme conditions.

Advanced Personnel Airdrop Technologies Demonstration. This will demonstrate technologies to provide improved performance characteristics and enhanced safety of existing personnel parachute capabilities. Utilizing advanced airfoil and parachute designs, it will demonstrate a gliding personnel parachute with a 20% increase in maximum jump altitude and a 25% increase in glide ratio when compared to the current Army state-of-the-art MC-4 parachute. By the end of FY99, a non-parachute soft landing capability will be demonstrated which will

reduce descent rates to values below 16 feet per second, utilizing "pneumatic muscle" technologies.

Ballistic Protection for Improved Individual Sustainability. The intent of this program is to develop advances in materials technology that increase the protection and performance of armor systems for the individual warfighter. Specifically, the goal is to integrate and transition improved technologies (at least 20% reduced weight for small arms protection) to development and/or as technology insertions to modify existing individual protective systems. It will demonstrate/insert protective materials technology that will provide a reduction in casualties at 35% less system weight than the 1996 individual countermine protective systems. The program will demonstrate an improved material system prototype for second generation multiple ballistic threat protection with a 25% decrease in weight (or an increase in protection or a combination, depending on user input).

MID-TERM (FY04-10)

Future Warrior Technologies. This program demonstrates the integration and supportability of technology insertions into the Land Warrior, Air Warrior, and Crew Warrior systems. The technology insertions will further enhance the various platforms in the areas of improved miniaturization, improved power management, improved Command, Control, Communications, Computers, and Intelligence (C4I) integration, low observables, improved mobility and improved vision systems. The target goal of 20% reduction in unit production cost while providing the increased capabilities will be assessed during this demonstration. All systems will be designed for maximum commonality to reduce the overall logistics burden and unit costs. The program will exploit emerging commercial technology trends to ensure the final products, the upgraded Warrior systems, are technologically superior to any potential adversary.

Soldier systems technology for the Army After Next has the goal of reducing the Land Warrior load to 50 pounds and will provide fully integrated protection against a full spectrum of threats while reducing bulk, logistics, and weight. In addition, goals for AAN include dramatically increasing lethality with target acquisition which will automatically acquire and hand over targets to appropriate supporting weapons in all conditions, day/night and through obscurants. Finally, situational understanding will include a full time link to all available battlefield assets, automatically selected for unit, position, and mission. In addition, the soldier will be capable of seven days' sustained operations without re-supply.

FAR-TERM (FY11-20)

The **Nanoscience Strategic Research Objective (SRO)** will enable the development of extremely lightweight sensors and Command, Control, Communications, and Computers (C4) technologies for the future soldier. The **Compact Power SRO** will develop technologies that increase the soldier's power capacity while decreasing the weight burden. The emerging **Enhanced Soldier Performance SRO** is focusing on technologies to improve soldier combat performance, including nutritional, physiological, and cognitive engineering interventions.

Research and development programs involving soldier survivability include textile and composite-based material systems, design concepts for individual ballistic protection, chemical biological protection (to include selectively permeable membranes and/or enhanced adsorbent components), countermeasures to sensors, multi-functional materials (to include environmental and flame/thermal protection), warrior performance and endurance enhancements (to include microclimate conditioning), laser eye protection (to include agile laser protection), and integration of soldier systems modular components. These efforts will provide the technology basis for upgrading soldier survivability in the Warrior systems.

Contributing Capabilities and Infrastructure

Efforts to modernize the soldiers in the Army's combat branches are well underway with a combination of the efforts of the Warrior, Special Operations Forces Personal Equipment Requirements (SPEAR), CIE, and SEP programs; the results will impact only a small portion of the total active force. Modernization of the combat support and combat service support soldier elements are lagging since modernization requirements for these essential members, who contribute much to the total force, are yet to be determined. Current efforts are underway to determine requirements for combat medics and how spin-offs from the Warrior programs can improve field medical capabilities. In addition, efforts to meet requirements of firefighters, Explosive Ordnance Disposal (EOD), military police and chemical decontamination personnel are currently ongoing with some of the following examples:

The Firefighter Integrated Suit—Combat (FIS-C), an ensemble that provides the Army firefighter both chemical agent and fire protection, will be developed. It enables firefighters to conduct fire and rescue operations in a chemical warfare environment—no current capability.

The Advanced Bomb Suit (Figure B-12) will provide protection from Unexploded Ordinances (UXO) and Improvised Explosive Devices (IED) fragmentation, blast, and overpressure. A modular design configuration will meet the specific needs of various users. It reduces weight (roughly 12% using new lightweight materials), improves protection, and combines service requirements.



Improved Toxicological Agent Protective Ensemble (ITAP)



Advanced Bomb Suit (ABS)



Self-Contained Toxic Environmental Protective Outfit (STEPO)

Figure B-12

The Self-Contained Toxic Environmental Protective Outfit (STEPO), an encapsulated ensemble which will provide four hours' protection against chemical/biological agents, toxic industrial chemicals, missile fuels, POL, and flame, will be developed. It will reduce heat stress and provide increased protection for prolonged operations.

The Improved Toxicological Agent Protective Ensemble (ITAP) will provide protection for short-term entry, lifesaving, and routine depot toxic chemical agent stockpile operations. It improves on the M3 TAP suit capabilities and fills the gap between the STEPO and Level C clothing.

The Combat Medic Vest System provides efficient organization of medical equipment to enhance the treatment of casualties and to reduce the medic's load burden. The vest and pack system will allow medics hands-free capability and easy access to most frequently used supplies when treating injuries in the field. A one-size-fits-all vest carries 40% and pack carries 60% of supply items and equipment.

Overall Assessment

In summary, today's Army is the best-fed, best-led, best-equipped, and best-trained fighting force in the world, but it still lacks the capabilities required for its soldiers to ensure combat overmatch, minimize casualties, and fully meet the vision of Army XXI. For the Army to maintain its decisive edge, it must ensure that its ultimate weapon, the individual soldier, is sufficiently equipped to meet the challenges of the next century.

Progress is being made in the S&T and EMD phases in the modernization of soldier systems. Support for these efforts must continue in order to achieve a decisive edge in the more challenging battlespace of tomorrow. However, not all the soldiers of our Army are issued the force multiplying clothing and equipment that has been developed to meet the formidable conditions of today's battlefield. The severity of budget constraints repeatedly causes disjointed and tiered fielding of modern systems. Fielding programs intended to achieve synergy among new systems are staggered over as many as six years in various divisional fighting forces, creating have and have-not units. This reduces soldier effectiveness and undermines morale. The difficulty of getting newly approved clothing and equipment into the hands of the soldier in a reasonable time-frame results in the current assessment for production and fielding as **AMBER** for Force Packages 1 and 2 and **RED** for Force Packages 3 and 4. In addition to problems inherent to initially fielding an item, the cost of technology in presently fielded soldier systems makes it extremely difficult for commanders to purchase soldier equipment items out of O&M funding. Therefore, the rating for the sustainment phase is **RED**. A significantly increased investment must be made to procure and field soldier systems, providing the soldier a force multiplier to offset a steep decline in soldiers in the field and a dramatic increase in OPTEMPO. Failure to do so increases the vulnerability of the soldier we deploy.

SECTION 3: CONCLUSION

The soldier of the 21st Century must be physically tough, intelligent, and well trained. Regardless of advances in technology, the combat soldier's mission remains to close with and destroy an enemy by means of fire and maneuver. Close combat forces must capitalize on advances in technology to allow increased lethality and survivability of the individual soldier. A key and vital aspect of our National Military Strategy is "troops on the ground." Whether the mission is deterrence, peacekeeping, humanitarian relief, or conflicts short of war, it cannot be accomplished without the commitment of ground troops. A theater naval task force and an air wing were unable to stop the genocide in Bosnia—the soldier on the ground with a rifle in his hands made the difference.

The overall rating for soldier systems is depicted in Figure B-13. Soldier system information dominance is rated **RED** in the near-term for soldier systems modernization until (1) Warrior systems establish an Initial Operational Capability (IOC) in a light division (FYO4) and (2) the light forces digitized architecture is established. Soldier systems overmatch takes into consideration all five soldier capabilities and receives a **RED** rating in both the near- and mid-terms due to lack of soldier survivability capability in individual body armor and NBC protection. In addition, overmatch is also reduced by lack of soldier mobility caused by excessive body armor weight and power sources requiring excessive use of batteries. Good progress is being made in soldier system S&T. Support for these efforts must continue in order to achieve a decisive edge in the more challenging battlespace of tomorrow. While there are technology challenges to be met and overcome, this area is rated overall **GREEN**. Until requirements are defined for soldiers in the areas of combat service and combat service support contributing capabilities will be rated **AMBER** in the near- and mid-terms. This rating will change to **GREEN** in the far-term as these requirements become more defined and "spin-off" technologies become available from the Warrior programs.

Overall Assessment

Invest. Cat	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
Info Dominance	RED	AMBER	AMBER
Overmatch	RED	RED	AMBER
Essential R&D	GREEN	GREEN	GREEN
Contributing Capabilities	AMBER	AMBER	GREEN

Figure B-13

Soldier systems modernization priorities are to develop and field integrated systems that increase the soldier's situational awareness, lethality, efficiency of power sources, and survivability; reduce load weight; and further reduce the adverse impact of his environment

(weather and NBC). This will be done through further definition of suits of clothing and equipment that form logical, integrated soldier systems, using the Land Warrior as a point of reference. The combat engineer, the field medic, the firefighter, the EOD technician, and the chemical decontamination technician, to name a few, have unique equipment requirements over and above those of the individual soldier. Additionally, centralized funds to field modernized equipment must be robust enough to fulfill the Army's current commitment to field to Force Packages 1 and 2 in a reduced time. It must also then be extended to reach through Force Package 3 in order to meet the "contingency" response requirements consistently levied on those units.

POM FY99-03

	DOES:	DOES *NOT*:
Land Warrior	• Begin fielding to force • Provide systems to 4th ID	• Provide force IOC • Provide light force digitization
Modular Body Armor	• Provide "bullet-stopping" survivability to soldiers	• Protect all soldiers in high-priority units
Modular Load System	• Provide better mobility to soldiers	• Provide better mobility to all soldiers in high-priority units
Central Funding & Fielding	• Provide rapid initial fielding of clothing and equipment	• Field to lower-priority units
JSLIST	• Provide initial contingency stock	• Protect Total Force

Figure B-14

No American soldier should be sent into harm's way without the proper equipment. The Army leadership is committed to providing soldiers with the best equipment the Army has to offer. Resource requirements in both soldier modernization RDTE and procurement will receive greater management emphasis than in previous years to ensure a positive turnaround in the area of soldier modernization. In this way, the Army will continue to ensure that "Soldiers Are Our Credentials."

"Soldiers Are Our Credentials!"



Figure B-15

ANNEX C: BATTLEFIELD DIGITIZATION

SECTION 1: INTRODUCTION

Overview

The Army digitization effort is a vital part of the larger Army process for meeting the challenges of the 21st Century. Tomorrow's Army—Army XXI—will emanate from the reconceptualization and redesign of the force at all echelons, from the foxhole to the sustaining base. Assimilation of information and information technologies will be crucial to the success of the redesign effort.

Army modernization is facing formidable challenges, and technology offers significant operational advantages. When technological breakthroughs occur, the Army must capitalize on them and distribute the advantages across the force. Horizontal Technology Integration (HTI) is a key component of the Army Modernization Strategy, oriented on system upgrades that capitalize on new technology insertion, as well as the development of new system platforms. It applies emerging technologies commonly across multiple systems to improve the warfighting capability of the total force. It simultaneously integrates and fields such technologies into different weapons systems and support platforms that fight together, providing exponential improvements to the force. "Pushing" Army emerging technologies across the range of systems also enhances interoperability. This affords economies of scale by capitalizing on opportunities to modernize where opportunities may not have been considered earlier. Battlefield digitization is one of the horizontal technology initiatives. It is a key element in support of the Army's concept for information dominance.

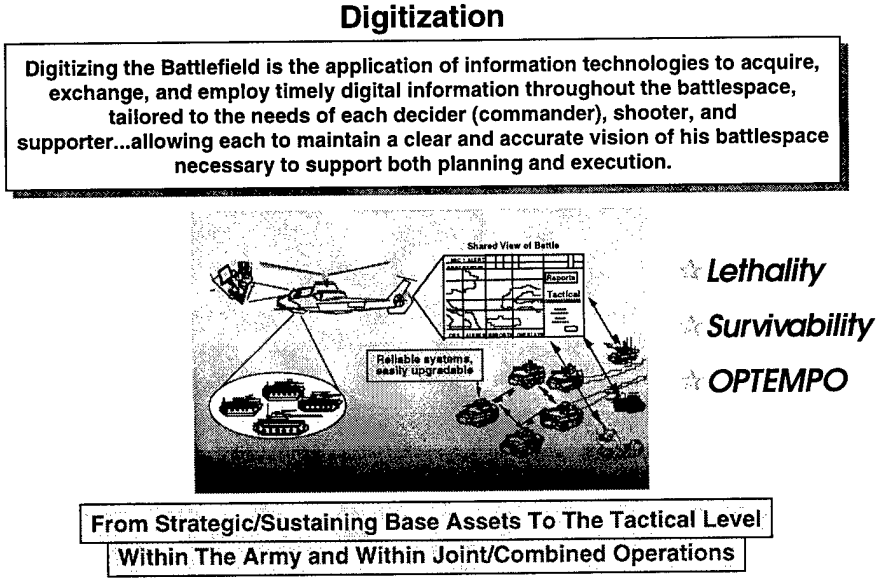


Figure C-1

Digitization is the application of information technologies to acquire, exchange, and employ timely information throughout the battlespace. This information is tailored to the needs of each decision maker (commander), shooter, and supporter allowing each to maintain a clear and accurate picture of the battlespace necessary to support both planning and execution phases of military operations. Digitization allows the warfighter to communicate vital battlefield information instantly and reliably, rather than through slow and less reliable voice radio channels and even slower liaison efforts. Digitization is a force multiplier providing a cost-effective means of enhancing combat power. It provides a significant increase in the ability of commanders and leaders at all levels to quickly synchronize forces, direct and indirect fires; and to rapidly make decisions to increase operational tempo. It provides timely and accurate information on friendly locations, reducing the potential for fratricide. Digitization achieves shared situational awareness, which provides a clear and accurate **common picture of battlespace** to commanders at all levels (Figure C-2).

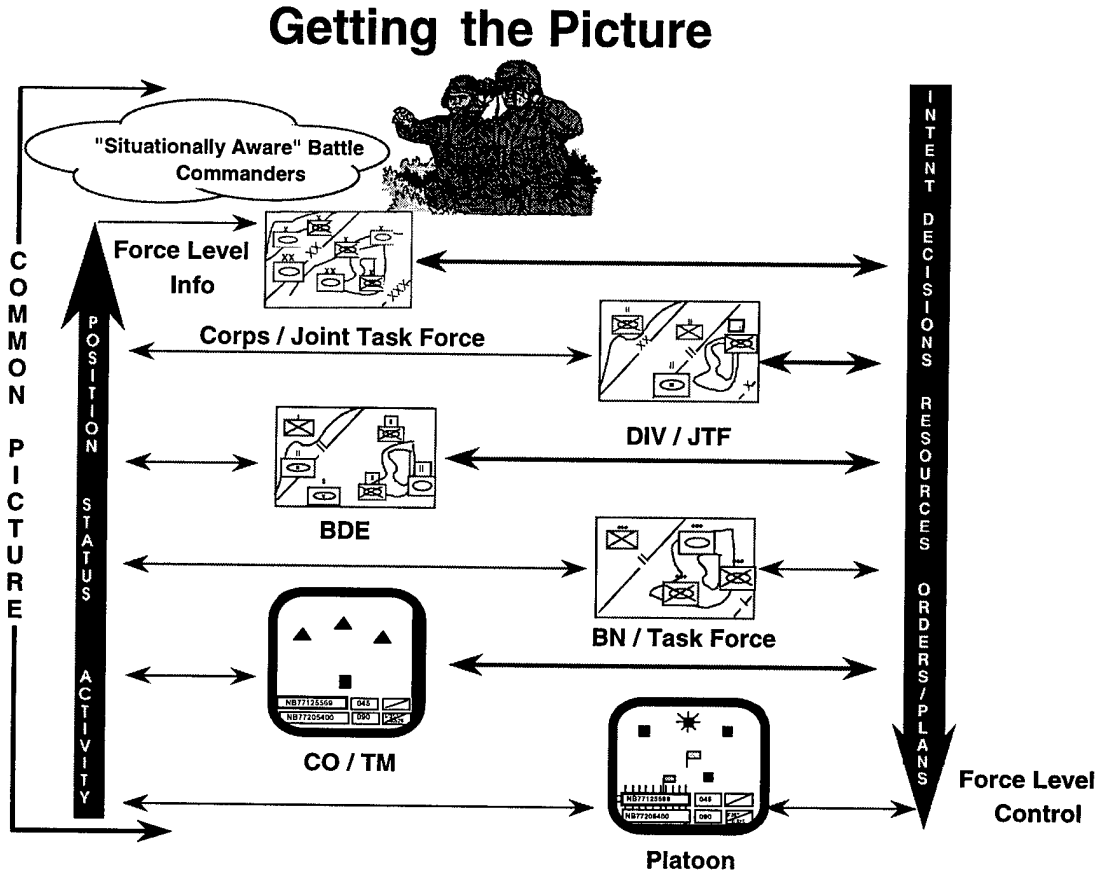


Figure C-2

The digitization program integrates numerous existing command and control capabilities enabling the sharing of critical battlefield information in near-real-time, which previously was not readily accessible. In addition, it is posturing to integrate emerging communications and command and control technologies for the future by leveraging significant advances in information technologies from the civilian sector (e.g., portable laptop computers, Internet

technology, direct broadcast TV). Digitization includes the acquisition of fully digitized platforms (those with already built in or "embedded" digital capability) and provides add-on digital capabilities (through applique sets) to critical systems that do not have embedded digital capabilities. Digitization provides a fully integrated command and control capability from the strategic level to the platform level, and will link with joint and multinational capabilities. The driving factors for battlefield digitization modernization are shown in Figure C-3.

Battlefield Digitization Modernization Driving Factors

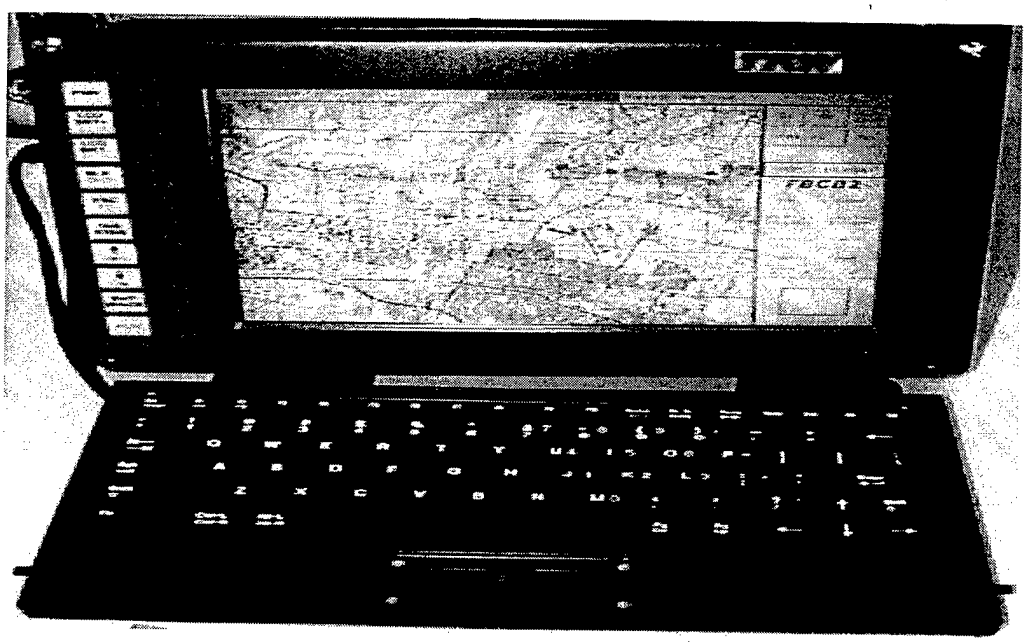
Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• Digitized division by FY00 • Digitized corps by FY04 • Mature and field FBCB2 and Tactical Internet • Develop network management solutions • Fully integrate Army Battle Command Systems • Mature and field Land Warrior • Integrate CSS STAMIS systems under ICS3 program • Integrate embedded battle command software into key armor, infantry, fire support and aviation platforms • Begin development of Joint Tactical Radio	• Continued fielding of digital capabilities. • Integration of future WIN technologies • Begin replacement of SINCGARS and EPLRS with Joint Tactical Radio • Complete integration of STAMIS under ICS3 • Integrate new digital technologies (voice activation, crewman helmet, etc.)	• Continue improving Force XXI Information Dominance through technology insertion • S&T development of Battlefield Digitization technologies to support Army After Next and Joint Vision XXI

- Assess, develop and integrate security solutions
- Refine comprehensive technical, system and operational architectures
- Ensure affordability/supportability of "packaged fieldings" (it is a system of systems)
- Develop Information Dominance doctrine, tactics, techniques and procedures
- Develop joint and combined arms training and simulation requirements
- Continue efforts to attain joint and combined Interoperability

Figure C-3

The Army Battle Command System (ABCS) is the integration of these digital command and control systems found at all echelons: from the ground force commander at the theater to the individual soldier or weapons platform. ABCS is the integration of automation systems and communications capabilities, which link strategic and tactical headquarters. It is interoperable with joint and multinational command and control systems at higher echelons and is vertically and horizontally integrated at the tactical and operational levels. ABCS has three major components: Army Global Command and Control System (AGCCS), Army Tactical Command and Control System (ATCCS) and the Force XXI Battle Command, Brigade and Below (FBCB2) system.

The digitization effort at the brigade and below levels of command is called Force XXI Battle Command, Brigade and Below (FBCB2). The four key components for digitization at brigade and below are the applique (essentially an add-on computer with software and installation kit), the software modules that will be integrated into the command and control systems on embedded platforms, the Tactical Internet (TI), and interfaces with the existing Army Tactical Command and Control System (ATCCS). The applique with its associated software is being developed to provide situational awareness and digital command and control capability to existing Army platforms not already digitally equipped. Prototypes of this system were evaluated during the Task Force XXI Advanced Warfighting Experiment conducted at the National Training Center in March 1997. Modifications to the applique hardware and software, the TI and the ATCCS systems are currently being made based on lessons learned from the experiment and will be further assessed during subsequent evaluation opportunities.

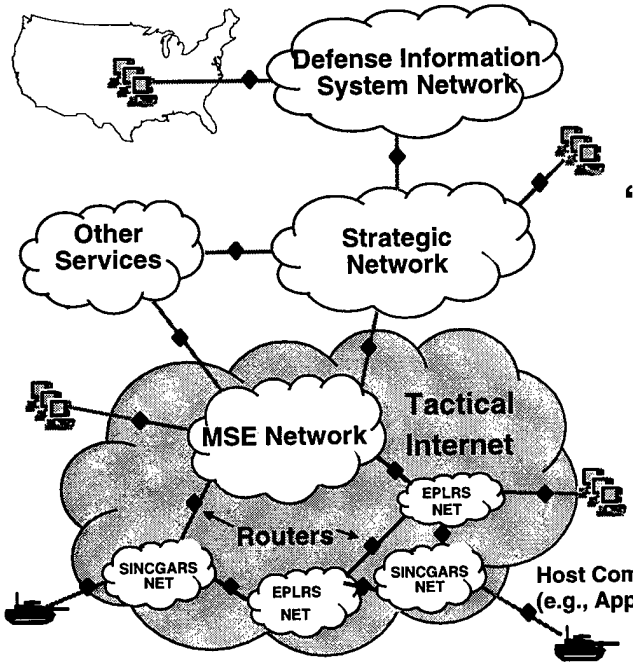


Prototype Applique

Figure C-4

The Tactical Internet provides the communications backbone for the digital effort, and currently comprises existing combat net radios (SINCGARS, EPLRS) and mobile subscriber equipment. Given the large amount of both digital and voice traffic experienced during the Task Force XXI exercise, it became necessary to readdress the capability of the existing radios to handle the volume of traffic expected during future operations. A parallel development effort is underway for both the applique and TI, to provide the necessary capability to pass the amount of digital information required and expected. The TI effort includes the development of new radios with increased data and voice capabilities, the addition of routers and servers, improved network management capabilities, security improvements, and accommodations for interfaces with the evolving ATCCS systems.

Tactical Internet



"Tactical"

- Data communications infrastructure at corps and below
- Gateways to strategic levels

"Internet"

- Uses the "Internet Protocol" (IP) suite for seamless communications
- Uses de facto commercial network standards/products
- Dynamically routes data to hosts
- Facilitates technology insertion

Figure C-5

The remaining component of the digitization effort involves the interfaces between the existing ATCCS systems. This aspect of interoperability is software intensive and requires innovative solutions to complex issues. Each of the five subsystems of the ATCCS program—Maneuver Control System (MCS), Advanced Field Artillery Tactical Data System (AFATDS), All Source Analysis System (ASAS), Forward Area Air Defense Command and Control (FAAD C2), and Combat Service Support Control System (CSSCS)—plays a critical role in providing the commander vital information needed to plan and execute combat missions within the assigned battlespace. Ongoing efforts are focused on ensuring these previously developed systems are interoperable, resulting in a single, coherent system binding the combined arms Battlefield Operating Systems.

SECTION 2: CURRENT PROGRAM ASSESSMENT

Overview

This section provides an overview and assessment of the Army's strategy to digitize the force from the standpoint of where we are near-term, and how our modernization strategy fulfills our objective requirements in the mid- to far-terms. Digitization, since it cuts across the entire force, plays a part in all the critical areas of information dominance, overmatch program systems, essential research and development and leap-ahead technologies, and recapitalization. The pieces that make up battlefield digitization can be found in each of the supporting annexes to this document. Therefore, this section will concentrate on how the Army plans on providing those individual capabilities throughout the force.

DIGITIZATION OF THE FORCE

The Army's current fielding plan to digitize the force is based on the availability of resources and sufficient funds to complete the effort by FY10. The overall fielding effort involves fielding a "packaged digital capability" to our field commanders. Each package will consist of a brigade set of digital components, including weapons systems, allowing for rapid dissemination of critical information throughout the battle area. The fielding plan will be adjusted over time to accommodate fluctuations in resources necessary to complete the plan.

The Army plans to "equip" the first digitized division by the end of FY00 and the first digitized corps in FY04. The first digitized division will be equipped with a mix of legacy and early design "digital" systems. Many of these systems exist in the force today or are already planned to be fielded to the unit as part of the normal modernization process. The systems that comprise a digital division are categorized as priorities 1 and 2. The priority one systems are the "must haves" if the potential of digitization is to be realized. A majority of these systems are the Army's core command, control, communications, and computers systems that make up the Army Battle Command System (ABCS). For a division to be considered "digitized," it must be equipped with these systems. Those items that fall into the priority 2 category are critical if the Army is to capitalize on the increased information provided through digital communications. It is these systems that will allow the commander to take advantage of the information, by synchronizing forces resulting in significant improvements in lethality, survivability and operational tempo.

Digitized Division Essential Systems List

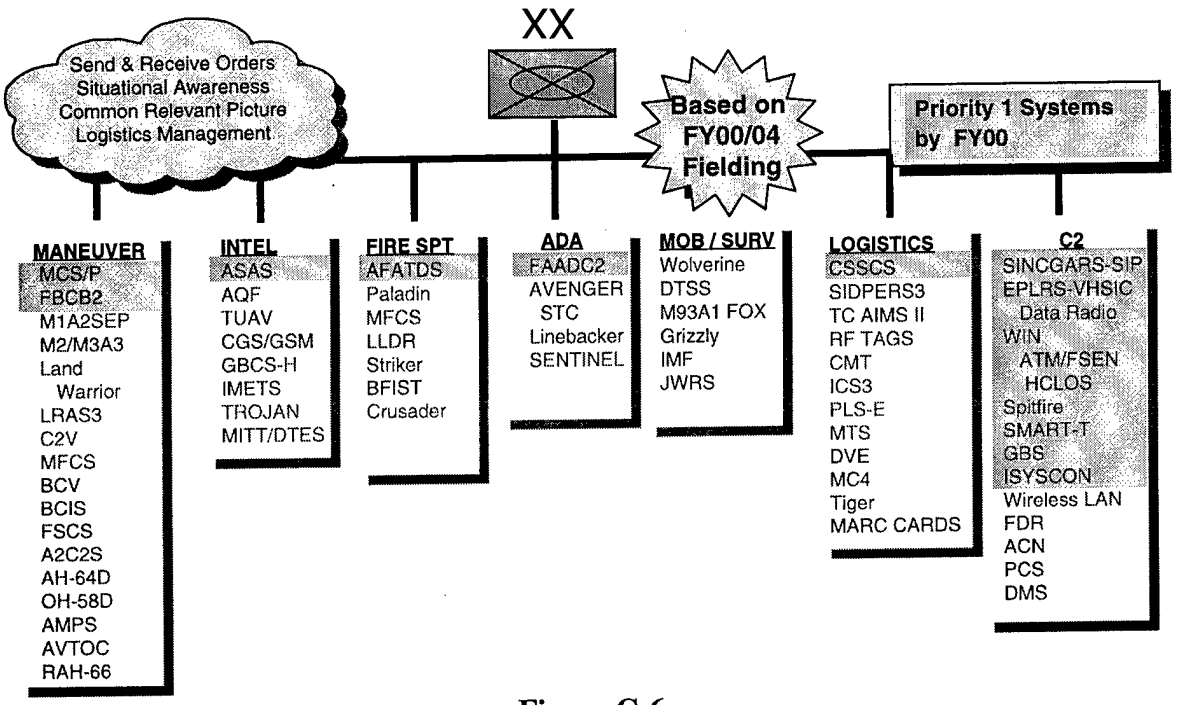
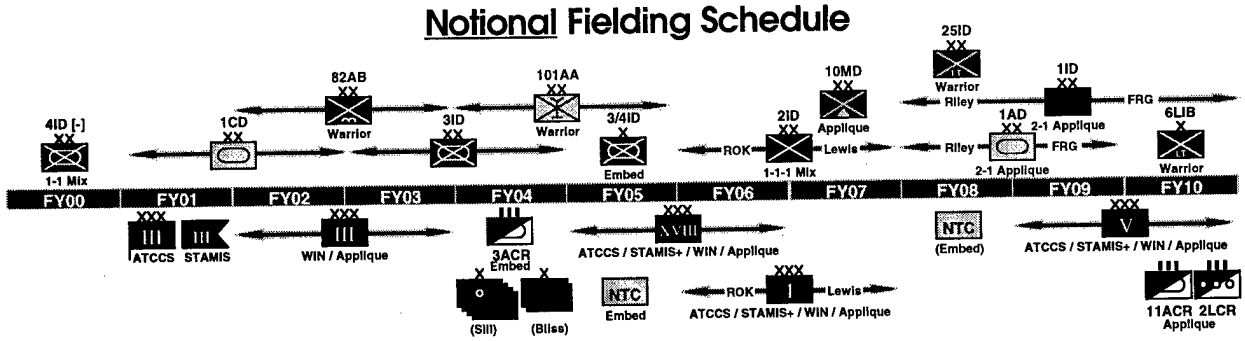


Figure C-6

In the near- to mid-terms, the Army has three main objectives: to digitize one division by FY00, a second division by FY02, and the corps by FY04. The specific elements of the corps will be determined through additional experimentation and the availability of resources. Beyond this initial plan, the Army has laid out a tentative schedule for the remaining force as shown in Figure C-6. Related issues are still being developed and will be incorporated in The Army Plan (TAP), as appropriate, for digitization of the Light Forces and Reserve and National Guard elements.

Digitizing Army XXI

Notional Fielding Schedule



Fields First Digitized Corps (FDC) by End of FY04;

Figure C-7

NEAR- TO MID-TERM FIELDING CAPABILITY ASSESSMENT

The first division to be digitized is the Army's 4th Infantry Division located at Fort Hood, Texas. All the priority 1 systems will be fielded. However, fiscal constraints prohibit full digitization through weapons platforms with embedded battle command such as the M1A2 SEP tank, M2A3 Bradley and AH-64D Apache helicopter. Therefore, the first digitized division will be a combination of embedded and appliqued weapons and support platforms.

The second division, the 1st Cavalry Division, will be the first division to have all priority 1 and available priority 2 systems fielded. The Army is adjusting individual system fielding schedules so that a packaged fielding can be accomplished. In the past, systems were fielded individually; this idea of "packaged" fieldings is new and, in the future, will provide our divisions with the most capable information technologies and the most lethal weapons to act on that information.

Following the digitization of the divisions, the Army will proceed with ensuring that the corps elements that support these two divisions are also modernized with the same information technologies to support effective command and control of the force. Included in this plan are the Army Prepositioned Stocks, digital equipment for the Army's training centers and the training base.

Fielding to the remainder of the force will be dependent on availability of funding as we move past FY04. To make this assessment (Figure C-8), digitization is subdivided into four components: communications systems, command and control systems, weapons platforms with embedded command and control, and other platforms (both weapons and support vehicles) with appliqued command and control.

Digitization Capabilities Program Assessment

Digitization Component	Near-Term FY 98-03	Mid-Term FY 04-10	Far-Term FY 11-20	Remarks
Communications	GREEN	AMBER	AMBER	Procurement of new/additional radios for Tactical Internet
Command & Control	AMBER	AMBER	AMBER	Procurement of additional ATCCS & WIN components
Embedded Weapons Platforms (M1A2 SEP, AH-64D)	AMBER	GREEN	GREEN	Realign existing fielding plans; Aviation integration
Other platforms (HMMWVs, trucks)	GREEN	GREEN	GREEN	

Figure C-8

Lack of sufficient communications and command and control capabilities is the primary deficiency in the ability of the Army to obtain information dominance and overmatch once the first corps is digitized (FY04 and beyond). Existing tactical radio programs will not structured to provide the necessary numbers of radios required to outfit the remaining force structure. In addition, development of new high-capacity radios and communications devices, needed to provide seamless connections from the sustaining base out to the battlefield, could be hampered by fluctuations in science and technology funding lines. The same deficiency exists with our command and control systems. The recent Advanced Warfighting Experiments have shown the value of having the capability of these systems at lower echelons to provide commanders a common picture of the battlefield. This is a radical change in the way the Army fights. The new requirement for interoperability and common architectures has these programs performing significant engineering and software design changes to meet the demands of the future digital battlefield.

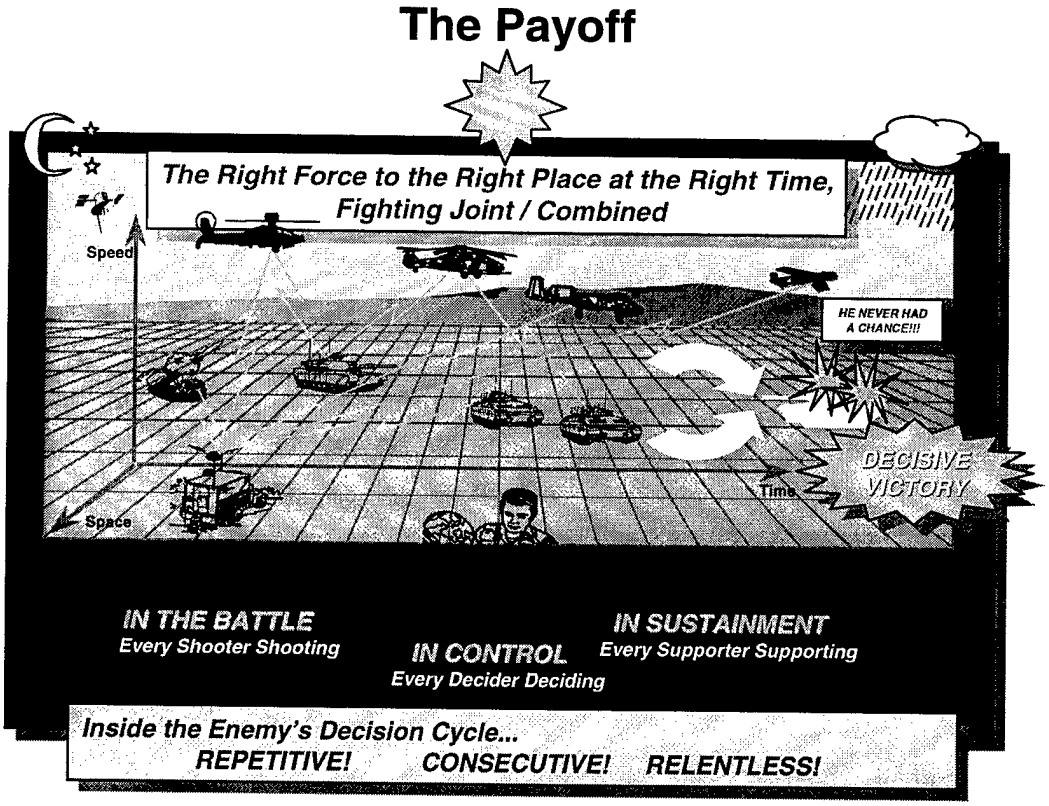
To continue the evolutionary growth in capability beyond FY10, the Army must maintain industry involvement in development and acquisition of advanced Information Technology (IT) devices. When, and if, the technologies emerge, the Army must be able to identify those with the potential for incorporation into the inventory and then have the resources available to acquire them. **Failure to do both could result in downgrading the Communications assessment to RED.**

The weapons and support platforms on the battlefield are adequate to meet the modernization vision for Army XXI and the digital battlefield. To support the concept of packaged fieldings, the Army is currently reassessing the distribution of these various priority 2 systems, but no additional equipment is anticipated. The **AMBER** rating for embedded weapons platforms in the near-term is due to the current challenge associated with integrating embedded digital platforms into the digital battlefield.

SECTION 3: CONCLUSION

The future for Army digitization has been mapped out along a path to achieve a modernized, Army XXI-capable force. This plan lays out a realistic course of improvements that supports the National Military Strategy, Army XXI, and Army Vision 2010. It squarely places the Army on the road to Army After Next. Given current fiscal constraints, the impact of this strategy results in an overall **AMBER** assessment for digitization.

The challenges for the near-term are many: systems integration, security, network management, software and hardware engineering, and training development. The payoff to be realized in the mid-and far-terms is enormous. Digitization provides a common picture of the battlespace in near-real-time, promotes shared situational awareness among Battlefield Operating Systems, and allows the commander the ability to more effectively and decisively concentrate battlefield combat power. Additionally, digitization provides for the high speed exchange of data; rapid correlation, fusion and display of intelligence data to commanders at all levels; and near-real-time exchange of targeting data from sensor to shooter. This results in a 21st Century force operating with unprecedented speed with significantly enhanced capabilities in terms of survivability and lethality.



Total Synchronization Through Digitization

Figure C-9

The backbone of digitization is communications. Communications represents the single greatest deficiency in battlefield digitization. The Tactical Internet of today uses legacy radio systems that are being upgraded to meet the increased need to move data on the battlefield. To meet the demand of a digital Army, these radios are required in numbers that were never planned for by our analog Army. The ability to digitize and modernize beyond the first corps on the timelines desired requires adjustments to correct this deficiency.

If communications is the backbone of digitization, the heart is the command and control systems that turn data from across the battlefield into information that can be used by the commander. These systems were originally designed to support operations at higher echelons along vertical chains of command. With the advent of technologies that can now support the sharing of that information horizontally, the Army has recognized their value at lower levels. The original modernization plans cannot meet the increased demand for these systems.

The Army is in the process of re-evaluating the current fielding plans for our priority 2 embedded weapons platforms and other support vehicles. This re-evaluation concentrates on their distribution across the force to better support the "packaged" fielding of digitized divisions.

The digitization strategy outlined here will ensure our soldiers and leaders have a command and control capability that will serve as a combat multiplier across the full range of military operations. Digitization, as a total system of systems package, offers the Army the increase in lethality and survivability required for a force projection force. Digitization creates a synergy across the modernization spectrum. Its ability to increase force effectiveness is inextricably linked to other programs. Reduced procurement rates and deferred programs will limit efforts to improve force efficiencies and reduce costs.

ANNEX D: COMBAT MANEUVER

SECTION 1: INTRODUCTION

> *"You can fly over a land forever; you may bomb it, atomize it, pulverize it, and wipe it clean of life, but if you desire to defend it, protect it, and keep it for civilization you must do this on the ground, the way the Roman Legions did, by putting your young men into the mud."*
>
> T.R. Fehrenbach, *This Kind of War*

Overview

The Army is the Nation's strategic land combat force for power projection and sustained combat operations. Land operations, conducted by a joint or multinational force, will be the decisive means to achieve desired strategic end states. Combat maneuver units, specifically heavy forces, light forces, and engineer forces, comprise the backbone of America's strategic land combat force. Twenty-first Century warfare will require combat maneuver units that are rapidly deployable, lethal, survivable, and capable of sustained operations throughout the full spectrum of conflict. *Army Vision 2010* is the blueprint for the Army's contributions to the enhanced operational concepts of *Joint Vision 2010*. This annex describes Combat Maneuver's planned modernization efforts to achieve these required capabilities. Discussions address how the combat maneuver force modernization supports the *Army Vision 2010* patterns of operation: Information Dominance, Shape the Battlespace, Decisive Operations, Project the Force, Protect the Force, and Sustain the Force.

Modernization appraisals are provided after each system with a short subjective rationale for the assessment. Generally the program is rated on its contribution to achieve the required capabilities for the stated pattern of operation. The ratings are based on current funding streams for that program and the amount of technological risk in development to achieve the capability. A **GREEN** rating indicates that adequate capability and quantity exists to achieve the operational capability. An **AMBER** rating shows a limited capability or quantity exists to achieve the capability. A **RED** rating indicates that the required operational capability does not exist, or capability is insufficient to defeat the threat or provide the required support.

Capabilities Contributing to *Army Vision 2010* Patterns of Operation

HEAVY FORCES

The heavy force is a combined arms team that dominates the maneuver battle through rapid maneuver and lethal fires. Tanks and infantry fighting vehicles are the centerpiece of the heavy force combined arms team; other integral components include fire support; aviation, reconnaissance and mobility/survivability systems. Collectively, heavy forces physically and psychologically destroy the enemy throughout the battlespace by the use of shock, firepower, and mobility.

Heavy forces provide staying power to any operation and the decisive edge in ground combat. As a result, heavy maneuver forces lead the Army in implementing the digital architecture required to support *Army Vision 2010.*

LIGHT FORCES

Light forces are combat, combat support, and combat service support units that participate in and support non-mechanized and non-special military operations. Light forces (including airborne, air assault, Rangers, and Special Forces) are the principal quick reaction, early entry and lead force in forced entry operations. They are the Army's most versatile and flexible force, especially in close terrain, built-up areas, and periods of limited visibility. Light force missions include the entire spectrum of operations from humanitarian assistance through full combat.

ENGINEER FORCES

Engineer forces support *Army Vision 2010* by providing mobility, survivability, and sustainment missions throughout the battlespace. Engineer forces (including combat, construction, and topographic units) support both heavy and light forces in all missions from smaller scale contingencies to major theater wars. They provide the technology needed for both information and terrain dominance. Their presence during all operation phases, from early entry to post hostilities, greatly enhances the capabilities of the total force.

How Combat Maneuver Modernization Aligns With the Army Modernization Strategy

Consistent with the Army's modernization strategy, combat maneuver modernization will focus resources in the near-term on achieving information dominance while preserving our overmatch capabilities. This means that our near-term objective is incorporating digital architecture into our main platforms, including the soldier (Annex B, Soldier Systems). The fielding of the M1A2 SEP, A3 BFV, and Land Warrior to the First Digitized Division (FDD) in FY00 is a critical milestone. Concurrent with this near-term effort, continued investment in and integration of overmatch technologies is essential. To this end, the ongoing "Own the Night" (OTN) initiative provides state-of-the-art night fighting capability and will provide a decisive advantage during the close fight. Additionally, the ongoing replacement of the Dragon anti-tank system with the Javelin anti-tank system will provide dismounted soldiers the ability to defeat current and projected threat armor out to 2500 meters.

With the shift of investment emphasis in the mid-term to overmatch capabilities, combat maneuver will invest heavily in the next generation heavy anti-tank weapons, the Follow-On To TOW (FOTT), Grizzly, and Wolverine. Ground maneuver modernization will include critical product improvements required to sustain battlefield overmatch and invest in essential leap-ahead technology with focus on technology carriers such as the future scout vehicle for the Army After Next.

Challenges Ahead

HEAVY FORCES

A smaller heavy force faced with a wider range of missions places a premium on training and readiness, as well as a robust and coordinated modernization effort. A smaller heavy force will become even more reliant on the Reserve Component to prosecute an extended conflict, requiring a vigorous and sustained equipment cascading strategy to modernize the reserve forces. The cascading strategy will become even more critical as the Army pursues its digitization vision and common operating environment that will rely on accurate situational awareness.

Challenges to the warfighting capabilities of the maneuver force center on its ability to ensure quick, decisive victory with minimum casualties and loss of materiel. The heavy force must enhance its capabilities to be lethal, operationally/strategically deployable, agile, tailorable, sustainable, and survivable as part of a joint or multinational force in any military operation. Key to the warfight is the mobility enhancements that the Grizzly and Wolverine will provide to the maneuver forces. To ensure that our heavy forces maintain the decisive edge in combat overmatch, we must leverage technology using technology carriers such as II Generation FLIR and Digitization in four critical areas:

Target Acquisition/Target Identification will improve most weather, day/night target acquisition and target identification and probability of hit capabilities at greater ranges. This allows for optimizing the synchronization of supporting fires.

Situational Awareness will provide commanders the capability to acquire, analyze, and apply critical information to integrate, synchronize, and focus battlefield operating systems to their maximum potential.

Lethality leverages situational awareness and target hand-off within the combined arms task force, while improving probability of kill through fire control and munitions improvements.

Survivability optimizes system and soldier survivability through use of new materials, safety enhancements, leadership training, battlefield combat identification, and improved countermeasures.

LIGHT FORCES

While our heavy forces enjoy a margin of technological superiority in most areas over the remainder of the world's ground forces, the same cannot be stated universally about our light force capability. Given that future short-notice deployments will be spearheaded by light forces, it is imperative that they possess the capability to win swiftly and decisively with minimal casualties. Light forces are on the threshold of establishing dominance in the areas of decisive operations and protecting the force. Achieving dominant capability through systems modernization for light forces is depicted in Figure D-1.

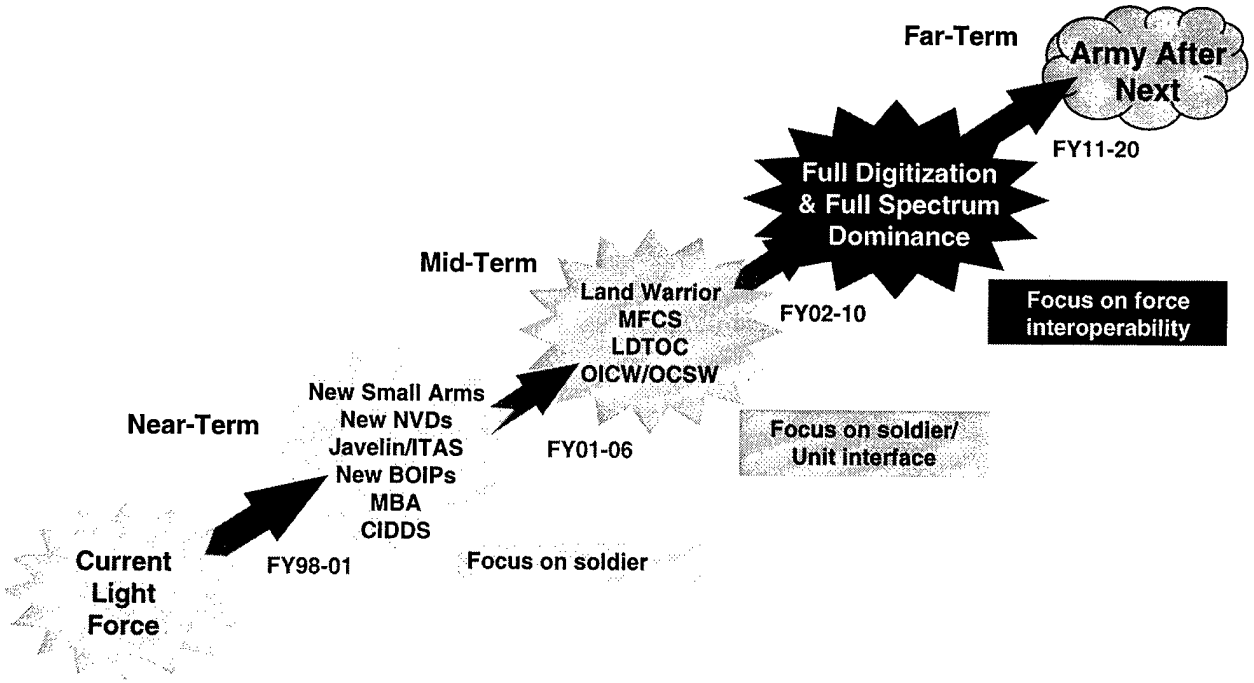


Figure D-1

Conduct Decisive Operations. Over recent years, the Army has invested heavily in the latest night vision equipment and the technology required to integrate that equipment with old and new weapons systems. As a result, light forces are on the leading edge of truly "owning the night." New Basis of Issue Plans (BOIP) provide both third generation passive night vision and infrared aiming lights capabilities to all soldiers in the infantry platoon and fifteen thermal sights in each platoon. Through this proliferation of technology, light forces will significantly improve their lethality overmatch and survivability in the close fight. Coupled with improvements in small arms, ammunition, and the Javelin anti-tank system, the light force soldier will be significantly better equipped than potential adversaries.

Protect the Force. The near-term fielding of Modular Body Armor (MBA) and other protective equipment will greatly enhance the protection level of soldiers. With the fielding of Combat Identification for Dismounted Soldiers (CIDDS), the risk of fratricide will diminish.

Gain Information Dominance. In the near-term, the fielding of the Mortar Fire Control System (MFCS) will greatly enhance the timeliness and accuracy of mortar fire for maneuver battalion commanders. Fielding Land Warrior will represent a pivotal milestone in the advancement of the capabilities of individual combat soldiers. Land Warrior is the Army's revolutionary program to develop and field a totally integrated soldier fighting system by the year 2000. That program and other initiatives focused on the soldier as a system are addressed in greater detail in Annex B.

With the fielding of the **Light Digital Tactical Operations Center** (LDTOC), light forces will have digital connectivity from the individual soldier to the battalion commander. (See Annex E, Fire Support for LDTOC.)

ENGINEER AND MINE WARFARE

Engineer forces and systems support the operational concepts of *Army Vision 2010* across the entire battlespace. Engineers employ a wide range of equipment to accomplish the many tasks related to this broad support requirement. The challenges ahead are:

Peacetime Engagement. The Army must increase capabilities to perform engineer missions in nation assistance, infrastructure development, facilities management, and disaster relief operations.

Conflict Prevention. The Army increase capabilities to engage in countermine, demolition, survivability support, barrier construction, and other build-up missions to demonstrate the resolve and will of U.S. forces.

Combat Support. The engineer force must increase capabilities to perform in war. Freedom of maneuver remains vulnerable to asymmetric threats (mines and obstacles). Engineers maintain the mobility of the maneuver force throughout the depth of the battlefield with the Grizzly (the heavy breacher), Wolverine (Heavy Assault Bridge-HAB), the Heavy Dry Support Bridge (HDSB), the Improved Ribbon Bridge (IRB), stand-off mine detection and breaching systems. Engineers apply countermobility throughout the depth of the battlefield through the use of scatterable mine systems such as Volcano, the Modular Pack Mine System (MOPMS), and the HORNET (Wide Area Munitions-WAM). During early entry operations, engineers perform terrain reconnaissance, construct/repair seaports and airfields, support logistics-over-the-shore operations, construct/repair/rehabilitate strategic and operational airfields, construct/repair/maintain roads, and construct infrastructure facilities—all to allow joint forces to perform continuous operations after rapidly deploying to an area of operations. The average age of the engineer equipment fleet continues to grow and remains a source of great concern to the Army.

Topographic Support. The engineer force must increase topographic support across the operational spectrum. Engineers support force projection/early entry operations and all Command, Control, Communications, Computers, and Intelligence (C4I) systems by maintaining the digital terrain database, performing terrain visualization and analysis through observation, presentation of digital terrain data, and exploitation of multi-spectral imagery. They also provide unique terrain information products for maneuver units. Rapid technological advances affecting this field will continue to present operational challenges to stay relevant and to maintain inter-operability.

Summary

As the backbone of America's strategic land combat force, ground maneuver forces must achieve and retain information dominance and decisive operations on the battlefield while enhancing our capability to perform a myriad of peacetime missions (Figure D-2). The systems described in the remainder of this annex are critical to sustainment of our dominance in the land fight.

Ground Maneuver Modernization Driving Factors

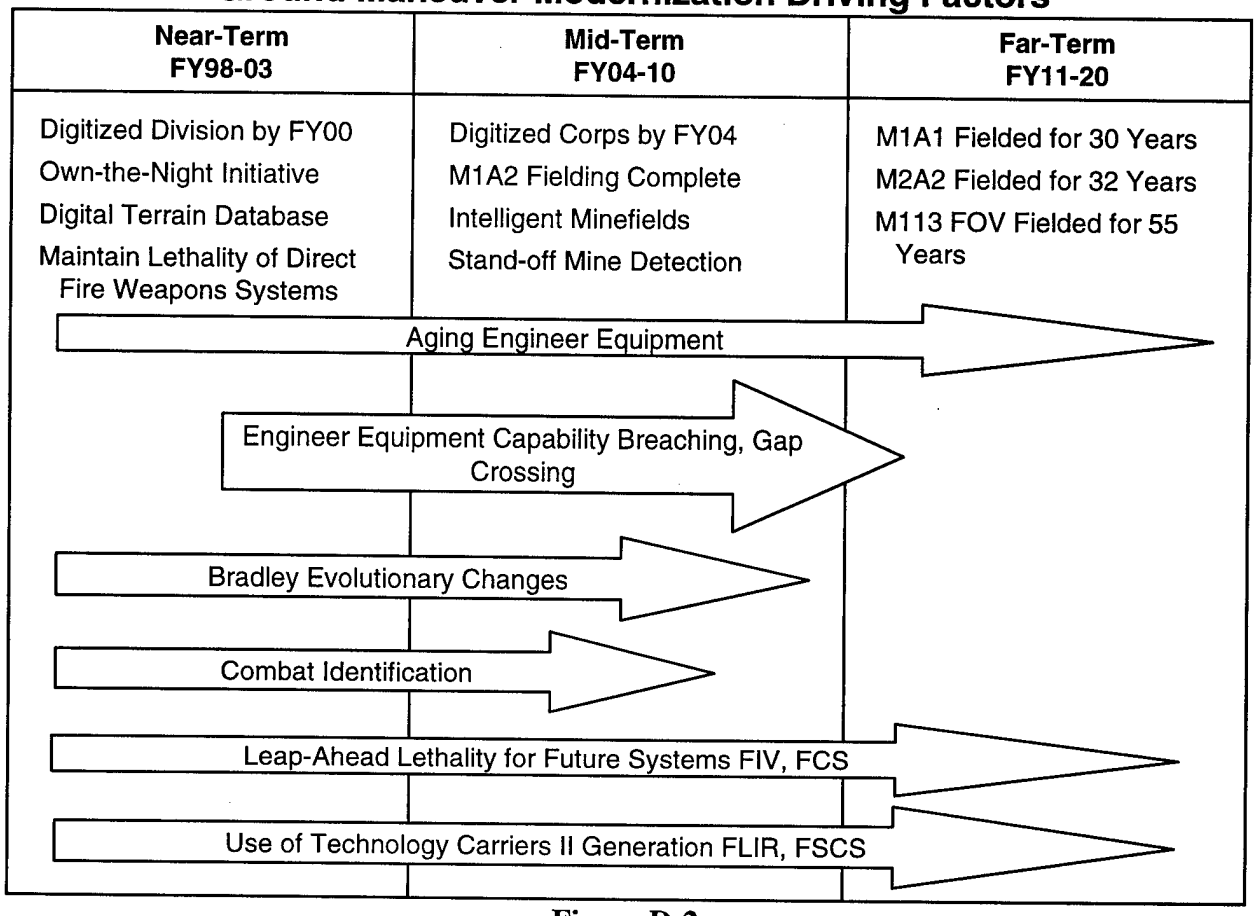


Figure D-2

SECTION 2: CURRENT PROGRAM ASSESSMENT

Overview

Development and procurement of modern combat maneuver systems continues to proceed at a slow rate. The state of ground force modernization is best characterized by the affordability decisions to fund other high priority Army bills. Modernization of equipment used by light forces and individual soldiers continues with the soldier system modernization programs. Engineer systems have not received the priority required to maintain parallel modernization.

A key objective is to better synchronize the modernization of our systems and capabilities. Utilization of technology carriers such as II Generation Forward Looking Infrared (FLIR) Sensor, Combat ID, and Digitization will help synchronize system fielding to maneuver forces. Figure D-3 illustrates all the ground maneuver systems and their relationship to the components of the Army investment strategy and the *Army Vision 2010* patterns of operation. Many programs cover more than one investment component, but are categorized based on their primary contribution.

Investment Components

Patterns of Operation	Information Dominance	Overmatch	Essential R&D and Leap-Ahead	Recapitalization	Contributing Capabilities	Infrastructure
Information Dominance	LRAS3, **ASTAMIDS, HORNET PIP1, CIRCE, DTSS, RAPTOR**	*Land Warrior*	FSCS			
Shape the Battlespace		HORNET	*LOSAT, FOTT EFOGM,* Tank Extended, Range Munitions		**Volcano**	
Decisive Operations		Grizzly, Wolverine TMAS, M2A3, IMBC, M1A2, M1A2SEP, *Small Arms, MIPM, Javelin*	FIV	M113, M1A1 (AIM), M2A2ODS		
Project the Force	CIDDS		*Soldier System Technology for Army After Next*			
Protect the Force		ACE	*OBJ FAM Weapons*		**GSTAMIDS, HSTAMIDS**	
Sustain the Force		M88A2 (IRV) HDSB				
Other Missions				**Eng SPT Equip (ESE), Eng Construction Equip.**		**Fire Trucks (TOE)**
Maintain Readiness						
	Heavy Forces		*Light Forces*		**Engineer Forces**	

Figure D-3

Information Dominance

Combat Maneuver—Information Dominance Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Heavy Forces							
LRAS3		Note 1	20	**GREEN**	**GREEN**	**GREEN**	
Light Forces							
CIDDS	9,200	9,200		**GREEN**	**GREEN**	**GREEN**	
LVRS	2,732	1,375		**AMBER**	**AMBER**	**AMBER**	FUE 98/50% Rqmt
LW	34,000	34,000		**AMBER**	**AMBER**	**AMBER**	See Annex N
Engineer Forces							
ASTAMIDS	97	Note 1		**RED**	**AMBER**	**AMBER**	Partial Fill AC
CIRCE		Note 1		**AMBER**	**AMBER**	**AMBER**	Procurement
DTSS	193	59	05	**AMBER**	**AMBER**	**AMBER**	R&D Funding
RAPTOR		Note 1		**AMBER**	**AMBER**	**AMBER**	Tech Risk

Note: 1. Not determined

Figure D-4

HEAVY FORCES

Long-Range Advanced Scout Surveillance System (LRAS3). LRAS3 is a mounted and man portable, day/night, adverse weather observation and target acquisition device that utilizes II GEN FLIR (global replace). It will allow scouts to acquire and identify enemy equipment and positions while remaining outside sensor and direct fire engagement ranges. LRAS3 will have a 50-70% target acquisition enhancement over current/modified systems. LRAS3 is a partial solution to long standing deficiencies for HMMWV equipped scouts. Procurement is set to begin in FY00 with a First Unit Equipped (FUE) in FY00. Future division design and scout platoon analysis will determine the APO and BOIP. Through the far-term, LRAS3 is **GREEN.**

LIGHT FORCES

Combat Identification for Dismounted Soldiers (CIDDS). CIDDs is a lightweight integrated laser aiming light, Combat ID and, MILES-capable device that uses an eye-safe laser interrogator and a radio frequency transponder to provide the dismounted soldier with positive identification of other friendly soldiers. It is fully Land Warrior compatible. **GREEN.**

Lightweight Video Reconnaissance System (LVRS). LVRS provides reconnaissance soldiers with the ability to send still picture video (day or night images) in near-real-time over the SINCGARS radio. Product improvement initiatives on weight, size, and power reduction are underway. Fielding is to begin in FY98 to selected units in Force Packages (FPs) 1-3. Due to the need for product improvements that will not occur until FY99-00, the system is rated **AMBER.**

Land Warrior (LW). LW will integrate the dismounted warfighter into the Army's digitized battlefield network. It will include the clothing and equipment needed to enhance the soldier's lethality, survivability, mobility, and sustainment, and provide situational awareness and target acquisition. The systems/components that make up LW include an integrated individual soldier computer/radio, enhancements to protective clothing and individual equipment, integrated headgear with helmet-mounted display and image intensifier, and modular weapons system with thermal weapons sight, infrared aiming light, laser rangefinder, digital compass, video camera, and close combat optics. Real-time, soldier-to-soldier situational awareness will provide information dominance in the close fight. Land Warrior is rated **AMBER** because current funding will dictate an extended fielding schedule. (See Annex B, Soldier Systems.)

ENGINEER FORCES

Airborne Stand-off Minefield Detection System (ASTAMIDS). As a component of the countermine system, ASTAMIDS provides a new capability for future maneuver warfare: the means to detect and record mined areas well forward of friendly troops, thereby supporting planning and execution of deep maneuver. ASTAMIDS will be fielded to intelligence and/or aviation units at division and corps levels. The AAO is currently planned at 97 systems. Technology challenges and a planned procurement for FY04 are the bases of a near-term rating of **RED.** The mid- and far-term ratings are **AMBER** due to low procurement rates and a partial fill of the active force.

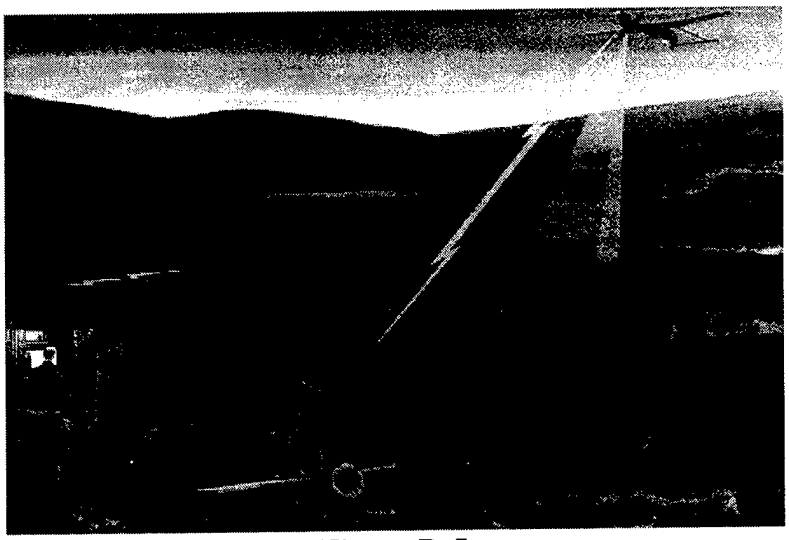


Figure D-5

Countermobility Remote Control System (CIRCE). CIRCE provides a universal remote control capability for HORNET-PIP munitions and for remotely initiating demolitions. CIRCE used in conjunction with the HORNET PIP will provide the commander with a truly "dynamic" obstacle. The commander will be able to remotely turn the munitions on and off and on again. The capability will enable him to have total freedom of maneuver and the ability to recover the munitions. This program is linked to HORNET procurement, thereby limiting the operational capability. **AMBER**.

Digital Topographic Support System (DTSS). Introduction of the DTSS to topographic engineer units in the near-term will improve their ability to produce and disseminate rapid terrain analysis products to include maps in support of force projection operations. Subsequent introduction of the Topographic Imagery Integration Prototype (TIIP) will provide a

theater-level digital database generation capability where none now exists. TIIP will be particularly useful in the timely production of Digital Terrain Elevation Data (DTED) for early entry forces and forces engaged in a rapidly expanding area of operation. The DTSS Operational Requirements Document is being revised to reflect a new requirement. The Task Force and Division XXI Advanced Warfighting Experiments determined that the system should be fielded down to brigade level to ensure that all Army Battle Command System systems are given adequate topographic support. No funding exists in the current POM to provide these additional quantities; however, current R&D funding and limited procurement funding through the mid-term and a partial fielding to high priority units in the far-term provides an assessment of **AMBER.**

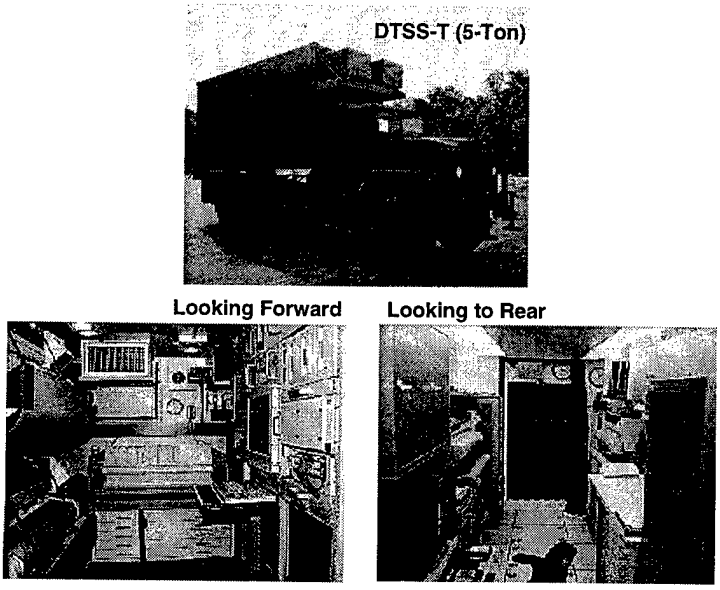


Figure D-6

Intelligent Combat Outpost (RAPTOR). The RAPTOR is the Army's mine concept that will be the focal point of the future mine strategy. RAPTOR integrates information age technologies with smart wide area anti-tank munitions (HORNET-PIP) to provide the warfighting commander the ability to remotely command, control, communicate, and collect combat information from smart munitions, advanced sensors and communications gateways. This concept, which has been a proven winner at the Task Force XXI and Division XXI Advanced Warfighting Experiments, is a revolutionary tool for the maneuver commander. Through this system the commander can now decide, detect, deliver and assess the threat as never before. He can dominate the battlespace by integrating focused fires with intelligent and dynamic obstacles to maximize the lethality of the entire force. Due to some technological risk, RAPTOR is rated **AMBER** through the far-term.

Overmatch

Combat Maneuver-Overmatch Program Assessment-Heavy Forces

System	# System Required	# System Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
M1A2	627	627		GREEN	GREEN	GREEN	
M1A2 SEP	1,150	1,150		AMBER	AMBER	GREEN	Note 1
TMAS				AMBER	AMBER	AMBER	Limited Funding
M2/3A3	1,602	1,602		AMBER	AMBER	AMBER	Low Fielding
M88A2	953	616		AMBER	AMBER	AMBER	Low Production
FOTT				GREEN	GREEN	GREEN	

Note: 1. Includes M1A2 numbers.

Figure D-7

HEAVY FORCES

Abrams Main Battle Tank (M1A2). The M1A2 is an integral component of the Army's implementation of *Army Vision 2010* and provides critical lethality and survivability advantages not present on the M1A1. Significant system improvements to provide overmatch and dominate decisive operations include: Commander's Independent Thermal Viewer (CITV), Position Navigation System (POS/NAV), Improved Armor, Improved Commander's Weapon Station, an embedded BIT/FIT capability, and the Intervehicular Information System (IVIS). The M1A2 Abrams is the Army's first digitized ground combat maneuver system, and is positioned for significant capability improvements commensurate with Army progress towards total battlefield digitization. The program is **GREEN**.

Abrams System Enhancement Program (SEP). The System Enhancement Program will integrate the M1A2 Abrams tank into the common operating environment of the future digitized battlefield. The M1A2SEP will enhance information dominance of mounted maneuver forces by replacing IVIS with new Army Common Operating Environment (ACOE) compatible digitization command and control software and hardware. SEP will integrate II Generation FLIR at both the Gunners Primary Sight and Commanders Independent Thermal Viewer, thermal management (environmental cooling/thermal touch reduction), power management (Under Armor Auxiliary Power Unit), and a more robust processing system for significant added lethality. M1A2SEP will field to the First Digitized Division (FDD) in FY00, with the First Digitized Corps (FDC) completed by FY04. The minimal objective is to field the six heavy divisions with one brigade and the division cavalry squadron with the M1A2SEP. The other two brigades of each division will be equipped with the M1A1 with digital appliques. Additionally, M1A2SEPs will equip the 3rd Armored Cavalry Regiment. To ensure sufficient numbers of M1A2SEPs, the initial M1A2 fleet goes through a retrofit to SEP configuration. M1A2SEP fielding is projected for completion by FY09. Due to the length of time to complete fielding, the SEP program only provides a limited operational capability to meet the required capability through the mid-term. **AMBER.** In the far-term the program is **GREEN.**

Main Battle Tank -- Near-Term (FY97-03) Planned Programs



	M1A2 System Enhancement	M1A1 Improvements	Future Combat System
Info Dominance	• Upgraded tactical displays • Digital maps/EPLRS • SINCGARS SIP and INC • Integrated GPS/Pos-Nav • Army standard C4I architecture • Embedded Battle Command	• Integrated Appliqué • PLGR Integration	
Sustain Overmatch	• CITV & GPS II Gen FLIR • Eyesafe laser rangefinder • Armor upgrade • Improved fire control processor • M829E3 kenetic energy round • Under armor auxiliary power unit • Thermal management system	• External auxiliary power unit • M829E3 kenetic energy round • AIM XXI sustainment program • Armor Upgrade	
Under Consideration	• Drivers viewer enhancement	• Drivers viewer enhancement • Eyesafe laser rangefinder	
Tech Base	• Integrated Defense System • Improved Armor • Automatic target acquistion, identification, & tracking • Tank Extended Range Munition	• Integrated Defense System • Improved Armor • II Gen FLIR • Tank Extended Range Munition	• New prime power source • EM or ETC gun • Embedded detection, hit, penetration, & kill avoidance • Enhanced target detection, acquisition, identification, & tracking

Figure D-9

Tank Main Armament System (TMAS). TMAS is a comprehensive program for the fielding of tank ammunition and gun systems in order to support the continued lethality of the U.S. tank fleet. The TMAS kinetic energy lethality program, the only Army program of its kind, is critical to sustaining the ability to continue to overmatch any threat on the battlefield. The M829E3 Armored Piercing Fin Stabilized Discarding Sabot-Tracer (APFSDS-T) is designed to defeat explosive reactive armor, and is the primary focus of development. This round will mitigate risk in the mid-term, providing sustained lethality overmatch without requiring an increase in tank cannon size. Future TMAS efforts will include the development of the Tank Extended Range Munition (TERM) for use on Abrams tanks and the Future Combat System. This round will possess increased probability of hit and kill at extended ranges for both direct fire and non-line-of-sight engagement capability. Due to limited funding through the far-term for procurement of the M829E3, TMAS is rated **AMBER.**

Bradley Fighting Vehicle Upgrade (M2/3A3). The Bradley Fighting Vehicle is designed to protect and transport infantry to the critical points on the battlefield; to provide direct fire support for the infantry; to fix, suppress, and kill light armor; and, if required, to kill tanks. Since production in 1981, the Bradley has gone through several evolutionary changes. The M2A2 ODS and M2/3A3 will be the infantry carriers for the active divisions in the near- and mid-term future. The M2/3A3 will be the infantry's transitional platform from Force XXI to the *Army Vision 2010.* As a part of the Army's long-term plans to maintain the viability of the

Bradley into the 21st Century, new requirements have been addressed through a series of product improvement packages as shown in Figure D-10. The M2/3A3 Bradley upgrade maintains task force compatibility with the M1A2 Abrams and achieves technology overmatch on the digitized battlefield. In addition, the A3 will gain significant lethality through a II Generation FLIR, a commander's independent FLIR, and a ballistic fire control system. The FUE will be in FY00 and is one of the critical pieces of equipment for the FDD. The A3 is one of the Army's first digitized ground combat systems. Due to the length of time required to complete fielding and the associated risk to power projection, this program is rated **AMBER**.

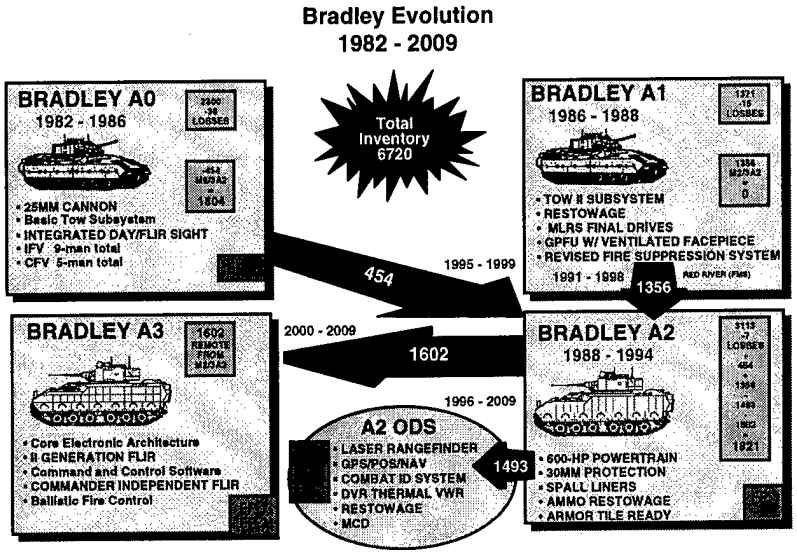


Figure D-10

HERCULES Recovery Vehicle M88A2. The HERCULES is a 70-ton vehicle capable of recovering an Abrams-series tank. HERCULES also has the capability to lift 35 tons. Replacement of the current M88 recovery vehicles will provide significant battlefield flexibility, eliminating the need to utilize two M88s to safely tow an Abrams tank. The current AAO of 629 vehicles fields to the high-priority units and the training base. Fielding the HERCULES will mitigate a long-standing safety issue associated with safe recovery and towing of Abrams tanks. FUE began in 3QFY97. The HERCULES is rated **AMBER** through the far-term due to a low production rate and required traction improvements.

Follow-On To TOW (FOTT). The FOTT is the next generation heavy anti-tank missile system. It is fire and forget with maximum range well beyond the tank main gun. It will replace the TOW in both heavy and light forces. The proposed system design will make the FOTT compatible with ITAS/IBAS and the current family of launchers. The FOTT will have a modular design to enhance shelf-life extensions and allow the missile to counter future threats. The program began in FY96 with a goal of First Unit Equipped by FY06. **GREEN.**



Figure D-11

LIGHT FORCES

Night Vision Goggles (AN/PVS-7B/7D). The AN/PVS-7B/7D NVG permits soldiers to effectively fight and move at night. This head-helmet-mounted night vision goggle (Figure D-12) uses one advanced third generation image intensification helmet-mounted tube, allowing detection and targeting (along with the AN/PAQ-4C Aiming Light), of man-sized targets from 150-180 meters under minimal starlight. This equipment provides a critical edge in combat for light, airborne, air assault, Ranger, and Special Forces units. **GREEN**

Combat Maneuver—Overmatch Program Assessment—Light Forces

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
AN/PVS-7B/7D	385,000	195,000		GREEN	GREEN	GREEN	
MNVD	43,500	43,500		GREEN	GREEN	GREEN	FUE 98
DVE	23,046	3,137		AMBER	AMBER	AMBER	Funding
ITAS	1,165	1,165		GREEN	GREEN	GREEN	
M16A2	846,028	746,373		GREEN	GREEN	GREEN	
M16A4	Note 1			AMBER	AMBER	AMBER	Limited Procure
M4	119,942	105,462		GREEN	GREEN	GREEN	
MWS	Note 1			AMBER	AMBER	AMBER	Funding
M240 SAW	75,443	71,870		GREEN	GREEN	GREEN	
MK19-3	20,751	20,751		GREEN	GREEN	GREEN	
M240B	11,095	8,226		GREEN	GREEN	GREEN	
Javelin	26,600	25,900		GREEN	GREEN	GREEN	Note 2
MIPM/SRAW	58,000	Note 2		AMBER	AMBER	AMBER	FUE 02
TWS	60,449	22,869		GREEN	GREEN	GREEN	
MELIOS	19,546	9,109		AMBER	AMBER	AMBER	Battery Development
AN/PAQ-4C	39,627	38,600		GREEN	GREEN	GREEN	
AN/PEQ-2A	15,625	12,020		GREEN	GREEN	GREEN	
AN/PVS-4PIP	10,000	3,440		AMBER	AMBER	AMBER	
SNS	2,600	2,600		GREEN	GREEN	GREEN	
(E)TLOS	249	249		AMBER	AMBER	AMBER	Technology Risk
MFCS	1,027	932		AMBER	AMBER	AMBER	Funding

Notes:
1. Required Systems not determined
2. Required numbers are missiles, and procurement objective still TBD

Figure D-12

Monocular Night Vision Device (MNVD). A Soldier Enhancement Program (SEP) initiative, the MNVD, an one-eyed NVG, permits combat leaders and other selected personnel to have one advanced third generation multipurpose night vision device. The MNVD mounts in the same way as the NVG and also functions as a night vision accessory to the Close Combat Optic. The Army is funded to resource procurement for special forces, Rangers, light, Airborne, air assault, and mechanized dismounts in AC units. Fielding began in 1QFY98. **GREEN.**

Driver's Vision Enhancer (DVE) (AN/VAS-5). DVE provides second generation thermal driving capability for combat and tactical-wheeled vehicles to include the BFV, Abrams tank, M113A3 family, HMMWV, PLS, and HEMTT. First Unit Equipped was during 1QFY97. The Army has resourced the DVE for the M58 smoke vehicle, the Bradley A2ODS and the Bradley A3. DVE is rated **AMBER** due to limited procurement funding.

Improved Target Acquisition System (ITAS). The ITAS upgrades the TOW heavy ant-tank weapons system now in light force units. ITAS improves target detection, acquisition, fire control, and recognition range. ITAS has II Generation FLIR, direct view optics, laser rangefinder, autoboresight, BIT/BITE, and embedded training. ITAS begins fielding in 1998 to the 82nd Airborne Division and is funded for light forces in the Total Army. **GREEN.**



Figure D-13

Small Arms. The Army will modernize much of its small arms inventory in the upcoming years. A new medium machine gun, the M240B, entered the inventory during FY97. The M4 and M16 modular weapons systems will enter the inventory during FY98 and make small arms platforms integrated fighting systems with the quick and secure attachments of day and night optics, aiming lights, and other accessories allowing quick tailoring for mission requirements. On the horizon, the objective family of small arms weapons will provide the Army with true combat overmatch capability in the small arms arena.

M16A2 Rifle. The M16A2 rifle is a 5.56mm, lightweight, air-cooled, gas-operated, magazine-fed, selective-rate, low recoil rifle capable of delivering accurate lethal fire at ranges up to 550 meters. An improved version of the M16A1, the M16A2 incorporates improvements to the receiver, barrel, trigger group, stock, and grip that increase overall effectiveness. Improved accuracy is achieved by using heavier NATO-standard ammunition and incorporating an improved muzzle compensator, three-round burst control, and heavier barrel. In 1996, the Army awarded a five-year contract for M16A2s. Through the POM, the Army procures 86% of its requirement. **GREEN.**

M16A4 Rifle. The M16A4 is an upgrade on the M16A2 which incorporates an upper receiver rail assembly under a removable carrying handle. The rail assembly allows for the quick and secure attachment of day and night optics. With the attachment of the M5 rail adapter system (RAS) the M16A4 becomes a modular weapons system. The Army is currently funded to provide the M16A4 to light and mechanized infantries, armored cavalry, and select combat engineer units. **AMBER.**

M4 Carbine. The M4 carbine is a more compact version of the M16A2 rifle with a collapsible stock. It provides the individual soldier operating in close quarters the capability to engage targets at extended range with accurate and lethal fire. The M4 shares approximately 80% of its parts with the M16A2 rifle. It will replace all .45 caliber sub-machine guns (M3), and partially replaces .45 caliber pistols, 9mm pistols, M16A1 and A2 rifles carried by unit leaders, crew-served gunners, vehicle crewmen, and radio operators. Through the POM the Army procures 90% of its requirement. **GREEN.**

Modular Weapons Systems (MWS). The MWS is a system of accessory rails that replace the current handguards/heatshields on the M16A4 rifle and the M4 carbine. The system

will permit the quick, no-tools attachment of aiming lights, close combat optics, powered optics, I2 devices, thermals, grenade launchers, and other ancillary equipment. The concept is to allow unit commanders the ability to tailor their unit's weapons for specific missions and reconfigure without the need for re-zeroing except when necessary. Funding is available to support Army procurement through high priority units requirements. **AMBER.**

M249 Squad Automatic Weapon (SAW). The M249 is a 5.56mm, lightweight, air-cooled, gas-operated, belt-fed, one-man portable automatic weapon capable of delivering a large volume of effective fire at ranges up to 800 meters. The basis of issue is one per soldier designated to fire in the automatic rifle role in all types of units. As a light machine gun, it is scheduled to replace the M60 7.62mm medium machine gun in certain units. In 1996, the Army awarded a three-year contract for M249s. Through the POM, the Army procures 95% of its requirement. **GREEN.**

MK19-3 40mm Grenade Machine Gun (GMG). A 40mm, self-powered, air-cooled, belt-fed, blowback operated weapon, the MK19-3 is designed to deliver accurate, intense, and decisive firepower against point targets at ranges out to 1,600 meters and area targets at ranges out to 2,200 meters. It replaces selected M2 .50 caliber heavy machine guns in selected units and will be the primary suppressive weapon for combat support and combat service support units. In 1997, the Army awarded a three-year contract for MK19-3s. Through the POM, the Army procures 95% of its requirement. **GREEN.**

M240B Medium Machine Gun. The M240B addresses the problem of reduced performance in the aging M60 medium machine gun fleet. The M240B is an extremely reliable, ground-mounted, gas-operated 7.62mm machine gun that fires NATO-standard ammunition from the open bolt to a maximum effective range of 1,100 meters. In addition to improvements in reliability, the weapon will be modified to accept modular accessories such as day optics, night vision devices, laser aiming lights, flashlights, and training devices. The M240B is intended to replace ground-mounted M60 machine guns in infantry, armor, and selected combat engineer units. In 1997, the Army awarded a contract for procurement of M240B medium machine guns. Through the POM, this satisfies 72% of the Army requirement. **GREEN.**

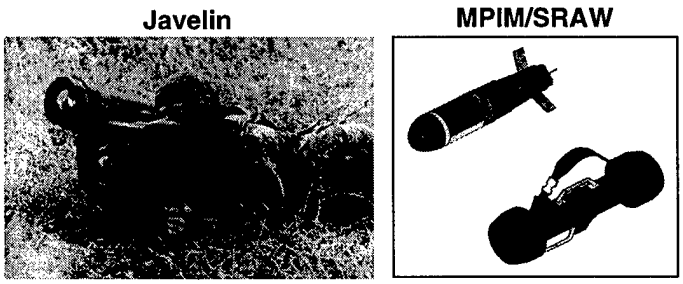


Figure D-14

Javelin. Javelin, a joint Army/USMC program, is a man portable, medium antitank weapon that replaces the obsolete Dragon. The Javelin has an integrated day/night (thermal) sight; a range exceeding 2,500 meters; a lock-on before launch, fire and forget capability that can

be selected for direct or top attack; and can be fired from enclosures. The Javelin is the number one anti-tank priority for light forces. The Javelin began fielding in 3QFY96 and is currently fully resourced through high-priority units, with a Javelin training package for the remainder of the force. **GREEN.**

Multipurpose Individual Munition (MPIM)/Short-Range Anti-tank Weapon (SRAW). The MPIM/SRAW, a joint Army/USMC program, is a light, disposable, multipurpose weapon that replaces both the AT4 and BDM and is capable of defeating personnel in bunkers, behind masonry and brick walls, and in light armored vehicles. The MPIM/SRAW has an effective range of 500 meters against masonry structures and 300 meters against earth-timber bunkers. It is safely fired from enclosures and can be used by all soldiers without the need for a dedicated gunner. This is a joint program that uses a launch and flight module developed in the USMC SRAW program and uses the Army-developed MPIM warhead module. Research and development occurs in FY96-99 with the First Unit Equipped in FY02. **AMBER** in the near- through far-terms.

Thermal Weapon Sight (TWS)/(AN/PAS-13). The TWS is a family (light, medium and heavy variants) of lightweight, compact, battery-operated, second generation, thermal imaging devices that begins fielding and full production in FY98. The TWS will mount on the M16 rifle, M4 carbine, M249 squad machine gun, M60 and M240B medium machine guns, the .50 caliber heavy machine gun, and the MK-19 40mm machine gun. An integrated laser rangefinder and compass/vertical angle measurement device is planned for technology insertion in FY99. The planned procurement extends out to FY08, but will only be fielded to fill critical requirements. **GREEN.**



Figure D-15

Mini Eye-safe Laser Infrared Observation Set (MELIOS). The MELIOS, a lightweight, eye-safe, handheld, battery-powered, laser rangefinder, accurately measures ranges to 10,000 meters. The Army has funded 7,363 MELIOS, a quantity which fields MELIOS to critical requirements in the AC and seven National Guard EBs. An integrated Compass/Vertical Angle Measurement upgrade kit is funded for all devices. It still requires a non-rechargeable, go-to-war battery which makes this system **AMBER** through the far-term.

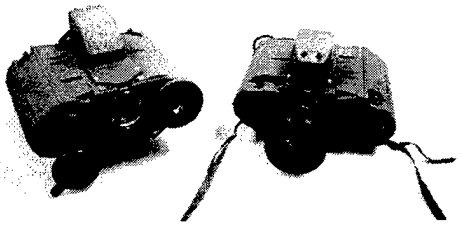


Figure D-16



Figure D-17

AN/PAQ-4C Infrared Laser. A 5.8-ounce eye-safe laser target designator for small arms target acquisition. It is visible only with image intensification devices (i.e., NVGs and MNVD) and when boresighted to a weapon, allows the soldier at night to fire accurately to a

range of approximately 300 meters. Additional fielding of 17,000 devices in FY98 will fully equip the AC and half of the enhanced brigades. **GREEN.**

AN/PEQ-2A Infrared Laser. A 7.2-ounce dual laser similar to the AN/PEQ-4C in function. The PEQ-2A has two lasers with a maximum effective range of several thousand meters. One laser functions in an IR floodlight illumination capacity, which increases the effectiveness of the soldiers' image intensification devices. The AN/PEQ-2A will be issued to machine gunners and selected infantry leaders. Fielding begins in FY98. **GREEN.**

AN/PVS-4 Product Improvement Program (PIP). Provides soldiers with small arms not equipped with TWS with a third generation image intensification tube and a rail grabber to allow mounting on the new family of small arms (M16A4/M4/M240B MMG and M249 SAW). Funding will resource only a portion of the 82nd Airborne Division. **AMBER.**

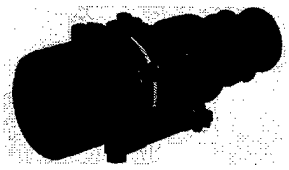


Figure D-18

Sniper Day/Night Sight (SNS). The SNS provides the sniper the capability to fire the M24 Sniper Weapon System (SWS) accurately to a range of 600 meters at night and 800 meters during the day. An advanced third generation image intensification tube mounts to the existing M24 rail. The Army is funded for 100% of requirements and will field SNS to all M24 SWS beginning in FY98. **GREEN.**

(Enhanced) Target Location Observation System [(E)TLOS]. (E)TLOS provides counter-sniper capability to the infantry squad. An eye-safe IR illuminating laser provides retro-reflection from enemy optics. (E)TLOS GPS, laser rangefinder, and compass/vertical angle measurements provide digital target acquisition of targets at 3-5kms. (E)TLOS is Land Warrior capable for data export and has a unit weight under five pounds. Fielding is to begin in FY99-00. Due to technology risk with the development of this system, this program is **AMBER**.

Mortar Fire Control System (MFCS). MFCS is an automated fire control system that seamlessly integrates mortar platoons into the current and future fire support command and control architecture. MFCS provides an onboard fire control system that includes fire control that maximizes lethality (CEP is reduced from 230 meters to 60 meters) and increases survivability by allowing "shoot and scoot" capabilities similar to Paladin. Additionally, MFCS hosts Force XXI Battle Command Brigade and Below (FBCB2). The MFCS provides increased capabilities to both heavy and light forces. MFCS is a Force XXI Warfighting Rapid Acquisition Program (WRAP). WRAP funding accelerates the fielding of this system by two years. FUE is scheduled for 3QFY00. MFCS will be fielded to Active Component mortar platoons. The MFCS program is insufficiently funded through the far-term to provide the required operational capability. **AMBER.**

ENGINEER FORCES

Combat Maneuver—Overmatch Program Assessment—Engineer Forces

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
HORNET (WAM)				RED	AMBER	AMBER	Procurement
Grizzly	906	366		AMBER	AMBER	AMBER	Low Production
Wolverine		Note 1		AMBER	AMBER	AMBER	Low Fielding
HDSB	123	74		AMBER	AMBER	AMBER	Procurement
ACE		482	07	AMBER	AMBER	AMBER	Procurement

Note: 1. Required for Wolverine are 928 launchers with 465 funded and 1,013 bridges with 989 funded.

Figure D-19

HORNET [Wide Area Munition (WAM)]. The HORNET is the foundation of future obstacle warfare. The initial hand-emplaced HORNET has a stand-off detection and engagement capability to attack targets out to 100 meters with a top-attack munition. Its 100-meter range covers the same frontage as 150-200 conventional anti-tank mines. HORNET will be the base dynamic obstacle system technology, reached through the HORNET product improvement program (with turn-on, turn-off capability) and Deep Attack HORNET deliverable by rocket, missile, or fixed wing aircraft. Limited procurement in the near-term to meet the operational capability causes a **RED** rating; and 28% fill of the AAO of 40,000 systems for the 1st digitized division, corps, and high-priority units makes this system **AMBER** through the far-term. See Annex L, Logistics, for Wide Area Munition information.

Grizzly Breaching Vehicle. The Grizzly will provide an in-stride, under-armor breaching capability for heavy divisions. The Grizzly is based on an M1 chassis and power unit and will have the same cross-country mobility, component commonality (75+%), and situational awareness capability as the M1A2 and M2A3 force it supports. The current Army Acquisition Objective (AAO) is more than 900 with 311 systems required for the Active Force. FUE will be in FY04; through the far-term more than 300 systems will be procured for the high-priority units and propositioned unit sets. **AMBER** because of slow production rates.

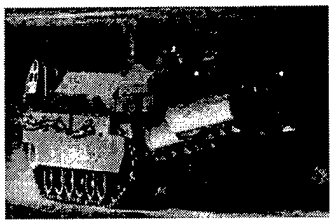


Figure D-20

Wolverine Heavy Assault Bridge (HAB). The Wolverine will provide a Class 70 assault crossing capability over 24 meter gaps. This system will replace the Armored Vehicle Launched Bridge (AVLB), a Class 60, 18-meter assault gap-crossing system. The Wolverine is based on the M1A2 SEP chassis and will have the same mobility, component commonality (90+%) and situational awareness capability as the M1A2 and M2A3 force it supports. The current AAO is over 900 with 332 required for the Active Force. FUE will be in FY00. More than 300 systems are fielded through FY11. The system is rated **AMBER** through the far-term primarily due to low rates of fielding to meet the operational capability.



Figure D-21

Heavy Dry Support Bridge (HDSB)-Forward Tactical Area LOC Bridge. The HDSB will provide the maneuver force a forward area heavy crossing bridge capable of crossing Class 96 wheeled traffic (heavy equipment transporter with an M1A2 tank) over 40 meter gaps. This bridge will be installed in less than 90 minutes by less than 14 men. It will replace the Medium Girder Bridge (MGB) which takes several hours to install by an engineer platoon. FUE for this bridge will be in 1QFY02, limiting our gap crossing capability. **AMBER** through the far-term.

M9 Armored Combat Earthmover (ACE). The ACE is the primary earthmover in mechanized combat engineer battalions. Currently there are 482 systems on hand, filling 28% of the total Army requirement, with less than 70% of the Active Force fielded. Rated **AMBER** in the near-term. No major procurement for an improved ACE is planned until FY07; this, added to the existing ACE numbers (which will have reached their R3 point), completes fielding to the Active Force and begins fielding to other units by FY11. The new fielding will begin with the highest priority units in the force, which will allow cascading to other non-ACE equipped units. Considering aging equipment among original ACEs, the assessment through the far-term continues as **AMBER**.

Essential Research and Development and Leap-Ahead Technologies

Research and development efforts to modernize combat maneuver systems for *Army Vision 2010* and Army After Next focus on:

- Maintaining lethality of direct fire systems in the near-term
- Extending the battlespace of maneuver systems
- Seeking leap-ahead lethality for future systems
- Improving survivability of mounted and dismounted forces
- Improving tactical and strategic mobility
- Improving effectiveness and survivability of early entry forces
- Reducing countermobility effects of mines
- Developing non-lethal weapons

To achieve the Army's vision for *Army Vision 2010* and the even more challenging vision for the Army After Next, successful development and transitioning of advanced technologies to systems will be essential. A major challenge will be to provide technologies for affordable systems that have higher strategic and tactical mobility (e.g., smaller, lighter, and more agile ground systems with reduced logistics burden), yet retain, or possess, even greater combat capabilities. The AAN concepts are still evolving, but one can see certain themes. For the U.S. Army to be a true power projection force with greater flexibility and responsiveness, ground combat systems need to be smaller and lighter, both for intertheater and intratheater transportation. Development and analyses of competing concepts, identification of technical

barriers, and establishing technology programs to address them, helping the user refine requirements, and addressing affordability early in the development process are activities that are appropriate for the R&D base. The most notable Advanced Technology Demonstrations (ATD), technology demonstrations (TD), and R&D investment programs are summarized below.

Essential R&D for Combat Maneuver

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• LOSAT ACTD • EFOG-M ATD (RFPI ACTD) • Direct Fire Lethality ATD • Extended Range Munition • Future Scout and Cavalry System ATD • Multi-Function Stories Sensor Suite ATD (MFS3) • Objective Family of Small Arms • Vehicular Mounted Mine Detector ATD	• Future Combat System TD • Future Infantry Vehicle TD	• Full Spectrum Active Protection • Mobile Wireless Communication (SRO) • Biomimetics (SRO)

Further information may be obtained in the Army Science and Technology Master Plan, Chapter III.G (Mounted Forces), III.H (Close Combat Light), and II.M (Engineer and Mine Warfare)

Figure D-22

Near-Term (FY98-03)

Line-of-Sight Antitank (LOSAT). The LOSAT is a direct fire kinetic energy missile fired from a heavy HMMWV platform using the Improved Bradley Acquisition System II Generation FLIR sight. It provides overmatching lethality against current and future armor threats and provides for automatic multiple target tracking and engagement. LOSAT can be airdropped or airlanded from Air Force cargo aircraft, CH-47s, and UHLO Black Hawks in support of early entry contingency/light forces.

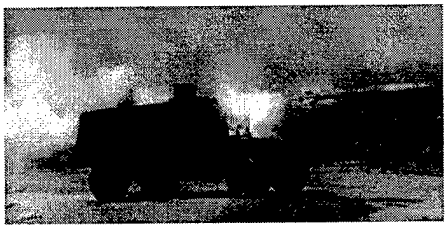


Figure D-23

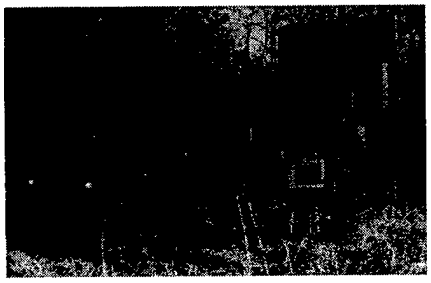


Figure D-24

Enhanced Fiber Optic Guided Missile (EFOG-M). The EFOGM is a digitized non-line-of-sight antitank system capable of defeating high-value targets under day/night, poor weather conditions, out to 15kms fired from a heavy HMMWV chassis. Resourced for participation in the RFPI ACTD FY98, EFOGM will also undergo an extended user evaluation in FY99-00 resulting in the fielding of 12 fire units, three platoon command vehicles, and 256 operational missiles to the XVIII Airborne Corps.

Direct Fire Lethality (DFL) ATD. This ATD will demonstrate technologies to enhance the direct fire, hit and kill capabilities of the Abrams tank and other armored vehicles. The approach is to provide a quantum leap in performance with little or no weight or volume burden on the vehicle. Emphasis will be placed on defeat of explosive reactive armor appliques with precursors for Kinetic Energy (KE) and weapon stabilization of turret and main gun. DFL ATD began in FY96 and will be completed in FY01.

Extended Range Munition (ERM). This program will demonstrate advanced munition technologies to provide tanks with both line-of-sight, and long-range, non-line-of-sight anti-armor capabilities against high-value targets equipped with explosively reactive armor (ERA) and/or active protection systems (APS). The program responds to a user requirement to extend the battlespace of main battle tanks to eight or ten kilometers.

Future Scout and Cavalry System (FSCS) ATD. FSCS ATD will demonstrate the advanced technologies—e.g., sensors, survivability, communications, mobility, and lethality—required to develop the Army's first dedicated scout/reconnaissance vehicle. Plans call for a robust, competitive demonstration while omitting the traditional demonstration and validation phases as a time and cost saving measure. The demonstration will be conducted competitively under a cooperative program with the United Kingdom. The ATD is scheduled to start in FY98 and is to be completed in FY02.

Multi-Function Staring Sensor Suite (MFS3). This program supplies the advanced sensor technology development to improve the effectiveness and survivability of the combat vehicle. This ATD will demonstrate a compact, affordable suite of advanced integrated sensors to increase long-range noncooperative target identification, reduce time lines, increase detection probabilities of low-signature targets, and detect mortar/sniper fire location. The suite will include staring infrared arrays, multifunction laser and acoustic arrays. This ATD started in FY98 and is scheduled to be completed in FY01.

Objective Family of Small Arms (OFSA). The OFSA is a technology-based program managed by the Joint Service Small Arms Program to develop leap-ahead small arms systems that will provide the soldier significantly increased lethality and overmatch on the battlefield. The Objective Individual Combat Weapon (OICW) provides the soldier the ability to detect, acquire, engage, and defeat personnel targets out to ranges of 1,000 meters. It combines the firepower of 20mm controlled (set to specific range) air bursting munitions with 5.56mm kinetic energy projectiles. The system includes a full solution, computer integrated fire control (day/night-powered optics, laser rangefinder, combat ID, environmental sensors, and adjusted aim point display) that will improve probability of hit 300-500% over the standard M16. The OICW is the future infantryman's weapon and is expected to begin fielding in FY06. The Objective Crew Served Weapon (OCSW) represents the next generation crew served weapons system identified to replace existing CAL .50 and MK 19 weapons systems. The OCSW leverages technologies developed for OICW. It fires 25mm air bursting and anti-armor munitions with an effective range of 2,000 meters.

Vehicular Mounted Mine Detector ATD. This ATD demonstrates the mounted capability to detect metallic and nonmetallic mines conventionally or remotely emplaced. The system uses ground-penetrating radar, forward-looking radar, infrared, sensor fusion, and automatic target recognition. Teleoperation capability will be demonstrated. Two multisensor suites for mounted, close-in and stand-off detection of minefields, individual mines, and unexploded ordnance are planned. This ATD began in FY96 and ends in FY98.

Mid-Term (FY04-10)

Future Combat System (FCS). The Future Combat System (FCS) responds to a requirement for a new close combat system that is a leap-ahead in lethality, survivability, and sustainability. A key element of FCS is the ability of this system to perform expanded battlefield roles in the close heavy battlespace while significantly reducing the logistical support required for deployment and sustainment of such a system. This need for an expanded battlefield role resulted in a change from a Future Main Battle Tank (FMBT) concept to FCS. FCS concept development is focused on candidate armament technologies which are the main design drives for FCS. Also being explored in S&T are alternative power sources and approaches to provide a platform capable of maximum output with minimum logistical demands. Advanced survivability measures will be integrated into the FCS. First Unit Equipped (FUE) is desired for FY15.

Future Infantry Vehicle (FIV). The strategically deployable FIV will provide full dimensional protection and transport for its crew and an 11-man Land Warrior infantry squad to any point on the battlefield. The FIV will dominate maneuver and provide fires at extended ranges with increased survivability. The FIV and variants are anticipated to replace the Bradley family of vehicles and the aging M113 family of vehicles as general transport and medical evacuation vehicles. The FIV needs to begin fielding no later than 2012 to meet projected operational requirements and anticipated threat.

Far-Term (FY11-20)

Full Spectrum Active Protection System (FSAPS). The objective of this program is to develop technologies to provide hemispherical protection for combat vehicles against high-velocity, large-caliber kinetic energy penetrators, as well as slower moving anti-armor guided missiles. Efforts funded by the Defense Advanced Research Projects Agency and the Army have examined ways to defeat threats such as handheld high-explosive antitank weapons and anti-tank guided missiles. The much more demanding task of defeating faster moving long rod penetrators is the goal of long-term efforts. If successful, the active protection approach can make combat vehicles far lighter than they would be if they had to rely on ballistic armor only for comparable levels of protection.

Strategic Research Objectives (SRO). The Mobile Wireless Communications SRO will support the development of highly efficient bandwidth utilization techniques, with terrain and environment independent communications to enable integrated, precision maneuver. Biomimetics research focuses on advanced survivability methodologies based on design principles derived from natural systems, for example, spider-silk.

Recapitalization

Combat Maneuver—Recapitalization Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Heavy Forces							
M1A1 AIM	1,535	0		**RED**	**RED**	**RED**	Funding / Note 1
M2/3A2 ODS	1,573	1,573	16	**AMBER**	**AMBER**	**AMBER**	Procurement
M113 UPGD	19,213	1,370		**AMBER**	**AMBER**	**AMBER**	Funding / Note 1
Engineer Forces							
ESE		Note 2		**AMBER**	**AMBER**	**AMBER**	Procurement
IRB				**AMBER**	**AMBER**	**AMBER**	Procurement
CONST. EQ		Note 2		**RED**	**AMBER**	**AMBER**	Procurement

Notes:
1. Upgrade program to currently fielded systems at their R3 point.
2. Consists of multiple systems.

Figure D-25

HEAVY FORCES

Abrams Integrated Management (AIM) XXI. The AIM program is the armor community's high-payoff program to ensure the M1A1's viability. By the year 2015, the initial production version of the M1A1 will have been in the field for 30 years. AIM XXI will provide benefits of life-cycle cost reduction, increased readiness, enhanced configuration control, fleet modernization, industrial base sustainment, and opportunity to insert warfighting capabilities while the tank is disassembled. AIM XXI is currently funded to conduct a Proof of Principle (PoP) using 17 M1A1s from the NTC. Both government and industry facilities will be used to execute complete disassembly and rebuild of subassemblies, both hull and turret, and finish with a complete system check. The PoP effort began in 4QFY96 and ended in 1QFY98 with a final report from AMSAA. Not funded—**RED**.

Bradley Fighting Vehicle Upgrade (M2/3A2 ODS). Following the Gulf War, an improvement program was initiated to address Bradley deficiencies discovered during that conflict. This program resulted in the Operation Desert Storm (ODS) retrofit with "off-the-shelf equipment" and will result in 1,573 existing M2/M3 Bradleys being retrofitted between FY96 and FY00. The ODS Program was initiated as an expedited, nondevelopment program for near-term improvements. ODS improvements include an eye-safe Laser RangeFinder (LRF) with super-elevation for the 25mm cannon; Global Positioning System (GPS) with digital compass; a Driver's Viewer Enhancement (DVE) restowage; and mounting for the Battlefield Combat Identification System (BCIS). M2/3A2 ODS is rated **AMBER** through the far-term due to procurement quantity.

M113 Family of Vehicles (FOV) Upgrade Program. The Reliability Improvement Selected Equipment (RISE) program was designed to improve the mobility and survivability of the M113 family of vehicles. Improvements include a 275-horsepower engine and an upgraded transmission, externally heavy fuel tanks, and an improved steering system. The Army intends to apply a RISE power upgrade to select vehicles in high priority units. Included in the RISE upgrade program are the M1059 smoke carriers, M1064 mortar carriers, M1068 command posts, and the Opposing Force (OPFOR) Surrogate Vehicle (OSV)— the replacement for the Sheridan Fleet at Combat Training Centers. The total Army requirement for M113A3 family in all units is 19,213. Due to reduced annual funding which results in an extended fielding timeline the M113A3 is **AMBER.**

ENGINEER FORCES

Engineer Support Equipment (ESE). ESE includes many items of equipment which support the total force; floodlight sets, rubber assault boats, diving equipment, prime power generation equipment, and well drilling equipment are all included under ESE. ESE is primarily low-density and unique equipment that is procured using an under $2 million line which has been largely underfunded in recent POMs. Most of the ESE in the field are beyond their R3 points and current procurement programs are beginning to address this deficiency. ESE is rated **AMBER** in the near-term. Numerous recapitalization efforts in FY04 are required to continue this recovery, particularly in the areas of diving equipment, well drilling, and surveying instruments. It is rated **AMBER** in both mid- and far-terms since these procurements will only fill high-priority units.

Improved Ribbon Bridge (IRB)-Float Bridge. The IRB will replace the current ribbon bridge found in engineer assault float bridge companies. This bridge will provide a greater degree of flotation, allowing crossings in faster currents, as well as increased survivability against small arms fire and small artillery fragments. The bridge will also have stronger ramp sections to support access/egress across higher riverbanks. Current systems are **AMBER** due to limitations on crossing ability. This system remains **AMBER** through the far-term despite fielding to most of the Active Force.

Construction Equipment. Construction equipment provides Army forces with a wide range of capabilities, from force projection, to survivability construction, to sustainment engineering. Missions include road and runway construction/repair, to fighting positions and protective berms/structures, to bridges and temporary shelter construction. Although several systems are being fielded, construction equipment is over age and therefore **RED** in the near-term. Construction equipment is projected to be procured for high-priority Active and Reserve units only. **AMBER** through the far-term.

Contributing Capabilities

ENGINEER FORCES

Combat Maneuver—Contributing Capabilities Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Engineer Forces							
Volcano				GREEN	GREEN	GREEN	
GSTAMIDS	645			AMBER	GREEN	GREEN	Procurement
HSTAMIDS	16,000			RED	AMBER	GREEN	Capability

Figure D-26

Volcano. This is the state-of-the-art tactical mine system for Army forces today, providing scatterable, rapidly emplaced minefields. Ground Volcano dispensers will be fielded through the entire force by FY99. Air Volcano dispensers (employed on UH-60 helicopters) began fielding in FY96 and will be complete through most units by FY98. Shortfalls exist in reload capabilities due to reduced procurement of Class V, increasing risk during early entry/force projection and extended operations. Due to an anti-personnel landmine use moratorium in 1999, Volcano canisters will be produced with six anti-tank mines rather than the former combination of five anti-tank mines and one anti-personnel mine. See Annex L for Volcano ammunition information. **GREEN.**

Interim Vehicle Mounted Mine Detector (IVMMD)/Ground Stand-off Mine Detection System (GSTAMIDS). The IVMMD is an interim capability until GSTAMIDS is fielded. GSTAMIDS will detect metallic and nonmetallic-metallic mines both on and off routes. Both systems have the capability to mark and record detected mines. The IVMMD will be placed in storage for contingency operations in FY98-99 until needed for military operations. **AMBER** in the near-term, **GREEN** in the mid-term. Procurement of the objective GSTAMIDS will begin in FY02, maintaining the assessment as **GREEN** by FY11.

Handheld Stand-off Mine Detection System (HSTAMIDS). HSTAMIDS provides dismounted soldiers a multispectral means to detect mines. This system will rely on a combination of technologies to detect metallic and nonmetallic-metallic mines on and below ground surface. HSTAMIDS will replace the AN/PSS-12 mine detectors. AAO is over 16,000 sets. Procurement will begin in FY01; this causes our nonmetallic-metallic detection assessment to be **RED** through the near-term, rising to **AMBER** through the mid-term, and to **GREEN** by the close of the far-term.

Infrastructure

Combat Maneuver—Infrastructure Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Engineer Forces							
Fire Truck	182	132	15	**AMBER**	**AMBER**	**AMBER**	Procurement

Figure D-27

Firetrucks (TOE). Tactical firetruck procurement will begin in FY99 to upgrade the Army's existing fleet. Trucks will be improved to a 1000-gallon capacity and will feature off-road capabilities to better support Army airfield operational requirements. AAO is 182 while APO is 132; procurement will continue through FY08. **AMBER.**

SECTION 3: CONCLUSION

Ground maneuver of the future must be able to project lethal and survivable combat power anywhere in the world. We must continue to modernize the total suite of combat maneuver systems, i.e., heavy forces, light forces and engineers to achieve a totally integrated and interoperable force. Overall, our combat maneuver systems are rated **AMBER** through the far-term; however, they are at further risk if projected funding is not realized. Additional budget constraints can cause disjointed, tiered fielding of modernized systems rather than complete suites of modernized equipment to integral units and organizations. The inability to field to integral units forces soldiers to be proficient on multiple generations of similar equipment. It also requires units to retain extensive repair parts, tools and test sets to accommodate the wide variety of equipment.

The heavy ground maneuver force systems such as the Abrams tank, Bradley Infantry Fighting Vehicle, and Grizzly will continue to be the cornerstone systems for future heavy warfare. Combined with LRAS3, Crusader, Comanche, and Apache Longbow, heavy forces will retain land dominance and give the American soldier unsurpassed lethality. Upgrades to the Abrams and Bradley systems are critical to sustain the capability to overmatch potential adversaries and avoid the risks of parity. The introductions of the Grizzly breaching vehicle and the Wolverine assault bridge to heavy force operations are long overdue.

Light forces must also capitalize on advances in technology to allow increased lethality and survivability of the individual soldier. Soldier systems are an integral and inextricable part of the future digitized battlefield. Modernization of soldier systems will continue to capitalize on emerging technologies that enhance existing soldier ability and provide new capabilities to ensure land force dominance. Priorities for the future must focus on the ability of the dismounted soldier to acquire targets and observe the battlefield in all weather, day and night; engage targets with lighter weapons possessing greater lethality; and survive both hostile fire and the environment under a wide range of conditions.

Future emphasis on engineer and mine warfare systems will be as diverse as engineer missions. Mobility support to the force must be continued through development and fielding of stand-off mine detection and breaching technologies as well as programs to replace and enhance bridging equipment. The future of countermobility lies in intelligent minefield technology with the HORNET and smart/brilliant mines. The use of unmanned ground vehicles will enhance soldier and system survivability in extremely hazardous or mined environments. Survivability and sustainment are both linked to the quality and quantity of modern construction equipment in order to meet the demands of worldwide support to our force projection Army. Recapitalization of this fleet must receive more attention in the future. Tactical topography must maintain pace with technology if we are to provide rapid generation of terrain database and related products in support of our force projection strategy.

The success of future missions and the survival of our warfighting soldiers depends upon sufficient and stabilized funding to field 21st Century technology. That funding must remain robust enough to field state-of-the-art, high-quality ground combat equipment to our soldiers.

This equipment must be capable of operating effectively with other Army and joint components of the 21st Century armed forces. The goal is to provide to our forces the best capabilities in the shortest amount of time. It should be noted that our modernization plan creates a discrepancy between a superior active force and a less capable reinforcing force, particularly in the area of digital information technology. This discrepancy results in interoperability challenges that we will continue to address through our modernization programs, training, and doctrinal updates.

Concurrent with retaining information dominance and technological overmatch, we must continue to invest in essential research and development initiatives aimed at ensuring Land Force dominance into the Army After Next.

POM FY99-03

	DOES:	DOES *NOT:*
ABRAMS	• Provides FDC+ M1A2 SEP • Completes M1A2 Production	• Complete M1A2 SEP Production • Upgrade/refurbish M1A1 • Accelerate M1A2 SEP Retro
Bradley	• Begins M2/3A3 Production With FUE in 00 • Digitizes the FDD and FDC	• Refurbishment Program • Complete Enhanced Brigade Modernization
FSCS	• Funds ATDs • Begins EMD Phase	
Night Vision	• Accelerates Night Vision Capability to Light Forces	• Fully Maintain NVG/ Aiming Light Modernization • Complete ITAS Fielding to FP 1 Until FY07
Javelin	• Fields to High-Priority Units And Javelin Training Package to Low-Priority Units	• Field Full MTOE to Low-Priority Units
FOTT	• Begins RDTE	
M113A3 FOV		• Field to FP 1 or 2 Until FY07
WOLVERINE	• Fields WOLVERINE in FY00	• Provide Gap Crossing to More Than One Division • Fill The FDD and FDC
Grizzly	• FUE in FY04	• Field Beyond 27% of FP 1 • Fill the FDD and FDC

Figure D-28

ANNEX E: FIRE SUPPORT

SECTION 1: INTRODUCTION

Overview

Army Vision 2010 is the blueprint for the Army's contributions to the enchanced operational concepts of *Joint Vision 2010.* This Annex describes Fire Support's planned modernization efforts to achieve these required capabilities. Fire support modernization is critical for the Army to achieve the capabilities necessary for Army XXI and Army After Next (AAN). The Fire Support modernization strategy provides for measured, logical growth of current and planned systems in support of Army XXI while focusing Research and Development (R&D) efforts on leap-ahead technologies to support Army After Next.

Fire Support is the collective and coordinated employment of indirect fire weapons (mortars, cannon artillery, rocket and missile artillery, and naval gunfire), armed aircraft and other lethal and non-lethal attack means. A true system of systems, fire support must have an accurate means to locate targets (radars, UAVs, mounted and dismounted fire support teams), accurate computations (IFSAS, AFATDS), and accurate delivery systems (MLRS, Paladin, Crusader, LW155) linked by a state-of-the-art command, control and communications system (AFATDS). Because it is essential for fire support to have the ability to rapidly engage the enemy from the close battle to operational depths, it is critical to modernize from our current legacy systems to position the Army to meet the needs of the Army After Next.

While the current force contains a lethal mix of proven systems that contributed significantly to the victory in the Gulf, most of these systems are near the end of their useful lives. Our priorities to meet these challenges are shown in Figure E-1.

Fire Support Priorities

- Field First Crusader Unit by FY05
- Complete AFATDS/FED Fielding by FY07
- Buy and Field Warfighting Rapid Acquisition Program (WRAP) Programs
- Complete SADARM Buy in FY06
- Modernize Light Forces
- Field MFOM/ATACMS
- Complete M270A1 Launcher Upgrade
- Field Firefinder Radar Upgrade

Figure E-1

The current artillery force consists primarily of legacy systems which have been continually product improved (Figure E-2). The predominant artillery piece, the M109A6 Paladin howitzer is the last in a series of improvements on a 1960s howitzer. National Guard divisional units have the M109A5 howitzer, an even older version. The Multiple Launch Rocket System (MLRS) M270 launcher, our most modern artillery system, is already over 15 years old and must be upgraded to fire current and planned munitions. The Fire Support Vehicle (M981) is an awkward hybrid of a lasing platform and a 1960s era M113A1 vehicle which cannot keep pace with maneuver forces in M1 Abrams or M2 Bradleys. Current target acquisition systems, the Firefinder radars (Q-36 and Q-37), were procured in the 1970s and contain 1960s technology. These systems are currently linked to shooters by the Initial Fire Support Automation System (IFSAS), a steppingstone command and control system between the 1970s TACFIRE and the future Advanced Field Artillery Tactical Data System (AFATDS).

Force Structure

The Field Artillery consists of a mix of cannon and rocket units, which provide both direct and general support to maneuver commanders. Every division has a division artillery, which provides support to the force. Two Field Artillery brigades reinforce each division artillery. Additional brigades support the Corps. Near 70% of all Field Artillery units are in the National Guard. Recent analysis in support of Total Army Analysis 05 demonstrated that every non-divisional field artillery unit, active and National Guard, is committed to one of two major theaters of war. Figures E-3 and E-4 show the force flow used in the analysis and indicates that these units are critical to the war fighting capability. In fact, for nondivisional field artillery units, the National Guard outnumbers active Army in both theaters of war (19 National Guard battalions to 17 active battalions in the first MTW and 30 to 1 in the second MTW). Additionally, some of the National Guard battalions actually deploy before some of the active Army battalions.

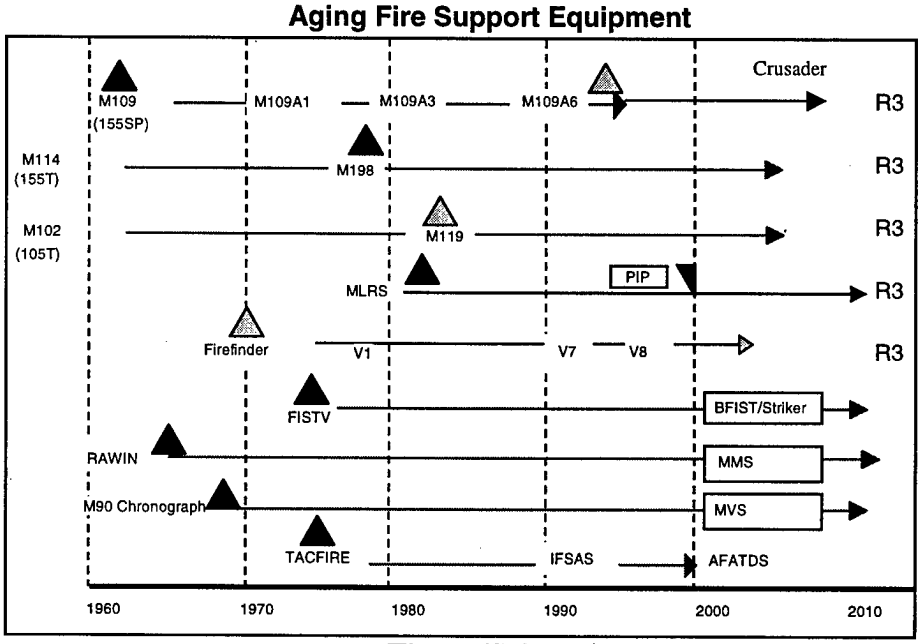


Figure E-2

Impact on Modernization

Fire support modernization is truly a total Force effort. Because of the criticality of these units to the warfight, National Guard Field Artillery modernization is an integral part of the overall fire support modernization strategy. Units are fielded in a first-to-fight sequence based upon their wartime mission, regardless of component. Many National Guard units receive new equipment before some active component field artillery units.

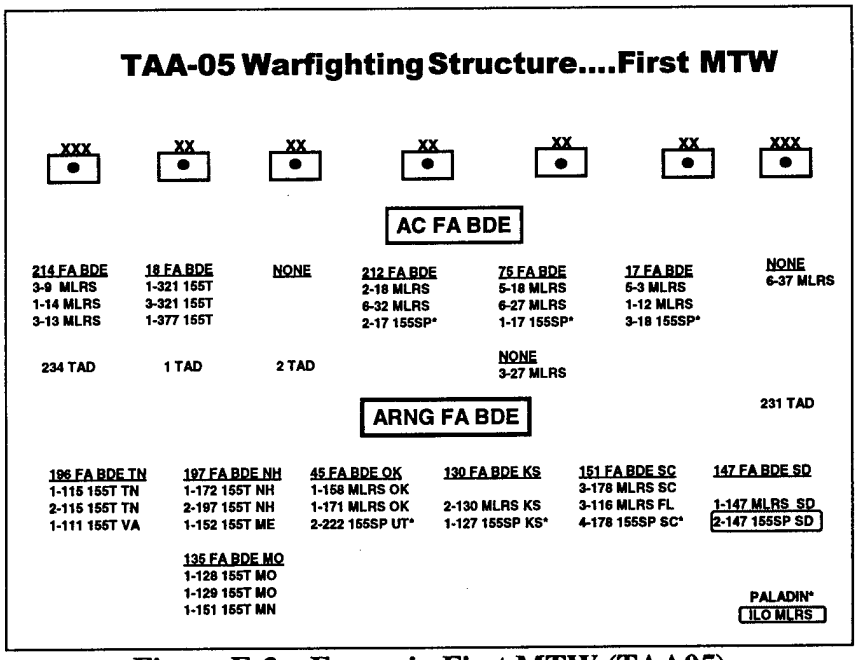


Figure E-3...Forces in First MTW (TAA05)

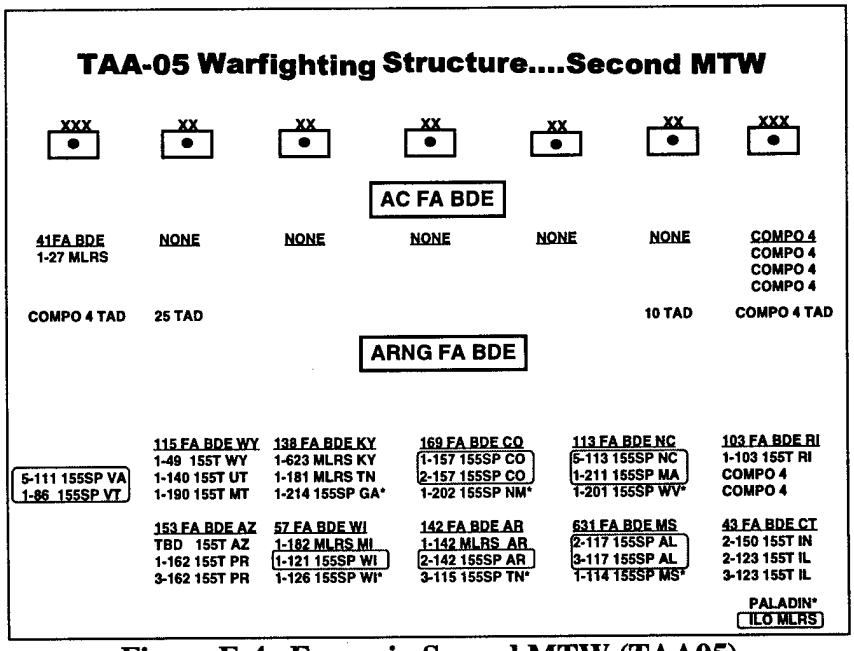


Figure E-4. Forces in Second MTW (TAA05)

Near-term modernization strives to make incremental changes to existing systems, extending their lives and maintaining their relevancy until they can be replaced. These include completion of fielding of the M109A6 Paladin howitzer to the active force and high priority National Guard units, upgrade of the Firefinder radar to Version 8, fielding of AFATDS Version 98, and an upgrade of the MLRS system to enable it to fire the new suite of munitions. Rockets and missiles will be developed and procured which extend their range and lethality and provide the corps commander with a true organic deep strike capability. The Army will also begin production of smart and brilliant cannon and missile munitions, greatly increasing lethality against selected high-value targets while decreasing logistical ammunition requirements. The Bradley FIST vehicle (BFIST), together with Striker, will replace the M981 FISTV in most force packages and provide maneuver with an enhanced fire support platform. The Gun Laying and Positioning System (GLPS) will provide rapid, mobile survey for all light units in the Total Force. AFATDS will provide the C3I link for the Total Force between the improved target acquisition and the improved shooters as well as enhanced fire support coordination. R&D efforts will remain focused on development of the next generation of systems.

In the **mid-term**, fire support modernization will provide the systems for Army XXI while continuing the R&D efforts necessary to achieve Army After Next. We will begin procurement of some of the next generation of systems in support of both light and heavy forces. Key among these are the Crusader howitzer to replace the M109A6 Paladin, the lightweight 155mm (LW155) howitzer to replace the aging M198 howitzer, and the High Mobility Artillery Rocket Systems (HIMARS) to provide a mobile, deployable deep strike capability for early entry operations. Displaced M109A6 howitzers will be cascaded to replace older models of the M109 in National Guard divisions until Crusader can be procured for those units in the far term. LW155 will be fielded to two active and five National Guard battalions. HIMARS will be fielded to two active and fourteen National Guard battalions. Together, these two systems will replace all M198 howitzers in the Total Army. The artillery will field a suite of long-range precision strike weapons that compensate for a smaller force and a Firefinder Block II radar capable of targeting at operational depths. Profiler, the next generation meteorological system, will be fielded to the Total Force and will provide for target area meteorological information critical to accurate fires. Munitions R&D efforts will continue to explore methods to reduce the size and weight of cannon ammunition, rockets, and missiles in support of Army After Next.

In the **far-term**, modernization will focus on Army After Next requirements. Crusader will finish fielding to the Total Force and, with planned improvements, continue to be the key, heavy fire support system for the battle forces of the AAN. Munitions science and technology should provide for the ability to procure smaller, lighter, more mobile weapons platforms capable of effective fire support throughout the battlefield. Future Direct Support Weapon (FDSW) will replace current 105mm howitzers with a lethality equal to 155mm munitions while retaining the mobility of the current howitzer. Displaced M119A1 howitzers will be cascaded to light National Guard division artilleries to replace the aging M102 howitzer. Eventually, the M119A1 howitzer will be replaced by FDSW. Scorpion will provide a lightweight, deployable replacement for the current MLRS launcher. Other leap-ahead technologies will be applied to target accuracy, acquisition, and area meteorology systems in support of Army After Next. Advances in composite materials and ballistic protection technology will be retrofitted to existing systems to reduce weight and increase deployability.

The fire support modernization strategy improves current systems to the maximum extent of their useful lives while developing and procuring new systems with significant technological advancements. As a system of systems, all components of the modernization program are critical to our ability to provide full spectrum fire support. Failure to field any component will adversely affect our ability to provide continuous, timely, and accurate fire support to Army XXI and Army After Next forces. In addition, these systems must be procured in sufficient quantities to allow for modernization of all high priority units, regardless of component. All first-to-fight units must be equipped with the most modern equipment available.

Capabilities Contributing to *Army Vision 2010* Patterns of Operation

The field artillery has the dual mission of destroying, neutralizing, and suppressing the enemy by cannon, rocket, and missile fires and integrating all fire support assets into joint and combined arms operations. As such, each fire support system plays a vital role in delivering fires throughout the battlespace. All aspects of the fire support modernization process must move forward as an **integrated, balanced program**. Figure E-5 shows how near- and mid-term artillery systems support *Army Vision 2010* patterns of operation and capabilities.

Artillery Capabilities Contributing to *Army Vision 2010*

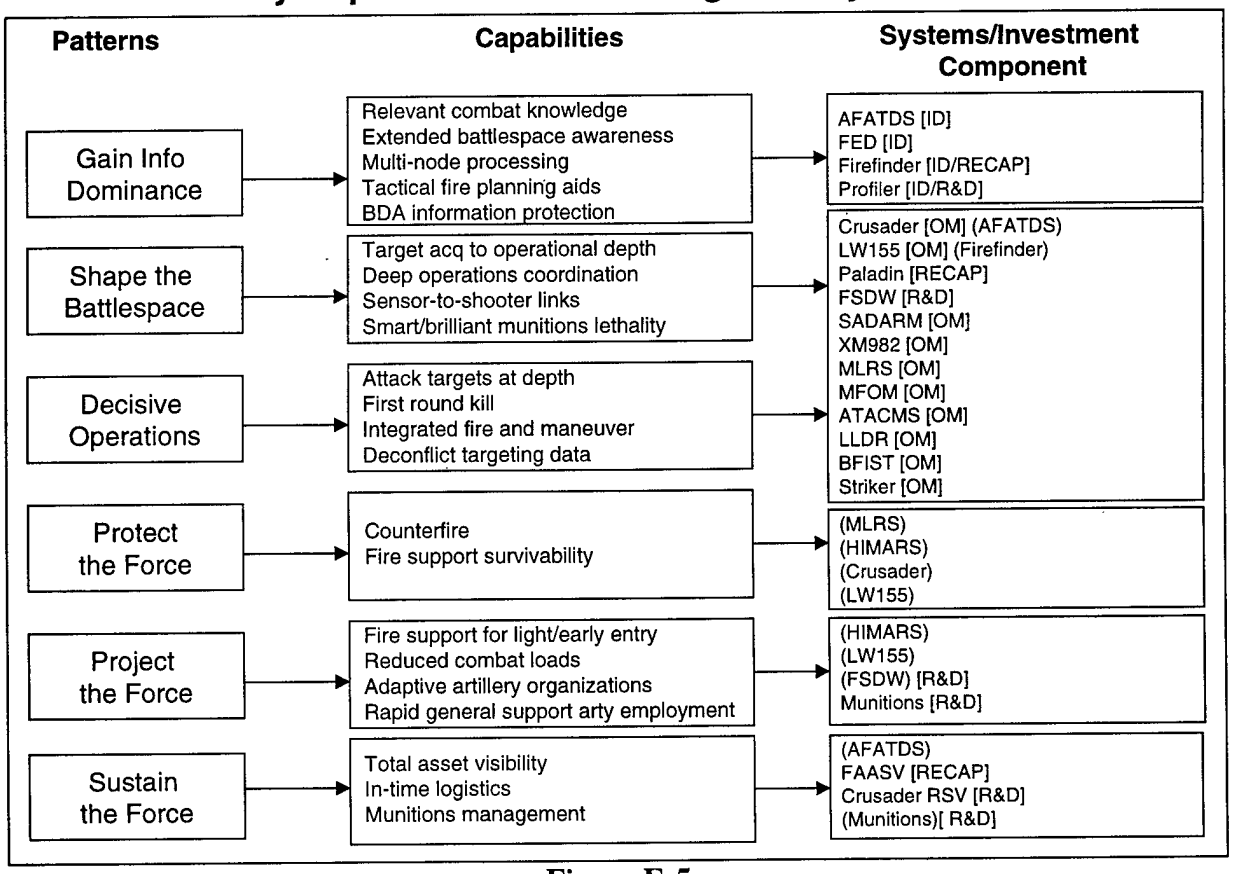


Figure E-5

GAIN INFORMATION DOMINANCE

The fire support system exploits information dominance by providing a robust fire support command, control, and communications system. This system must provide relevant combat knowledge, situational awareness, long-range assured communications, and information protection in support of precision fires throughout the battlespace. All weapons systems/vehicles must have a real-time, continuous, self-location and position/navigation capability. Critical capabilities include situational awareness to facilitate fire support coordination and the information necessary for accurate, predicted fire. AFATDS, FED, Firefinder, and Profiler enable, enhance and support these capabilities.

SHAPE THE BATTLESPACE

Long-range, precision fires with smart/brilliant weapons and munitions shape the battlespace by attacking high-payoff targets in depth. Target acquisition sensors detect, identify, and track high-payoff targets (C3 nodes, TBMs, etc.) at extended ranges. The Fire Support C3 system (AFATDS) ties sensors, deciders, and shooters together in real-time or near-real-time. Critical capabilities include those discussed in information dominance—accurate target and weapons locations, and the command and control necessary for fire support coordination and target processing. Given this information, the fire support system must have lethal munitions capable of effectively engaging targets at operational depths and the weapons platforms required to deliver these munitions.

CONDUCT DECISIVE OPERATIONS

The Fire Support system provides fires in support of decisive operations. These fires can be close support, counterfire, or interdiction fires. Powerful, mobile combined arms elements supported by a responsive, precision fire support system deliver devastating blows to the enemy's ability to maneuver. At every maneuver echelon from company to theater, the field artillery provides Fire Support Elements that integrate all aspects (mortars, field artillery, close air support, naval gunfire, and Army aviation) of fire support. Critical capabilities are a subset of those necessary to shape the battlespace with emphasis on accurate fire and high-lethality munitions in support of the close battle.

PROJECT THE FORCE

The rapid deployment of the Fire Support system provides commanders greater flexibility in projecting combat power. Smart munitions will reduce the logistics burden and, in conjunction with lighter weight weapons, sensors, and C3 systems, facilitate more rapid force projection. HIMARS, LW155, and FDSW will provide more mobile, deployable systems for the light forces and will have capabilities similar to those in the heavy forces. Advances in munitions will allow for reduction in weight, further enhancing deployability.

PROTECT THE FORCE

Protect the force is a two-pronged effort. First, close support fires deprive enemy maneuver systems their freedom and ensure ours. Silencing enemy artillery, mortars, rockets, and missiles protects and preserves our fighting forces. Interdiction fires against enemy surface-to-surface missile systems, air defense systems, and associated logistics and command control facilities deprive the enemy of his deep attack and air defense means. Second, fire support weapons systems and vehicles must be highly survivable. Friendly fire support systems will be considered high priority targets to any adversary. Our systems must be able to out-range an adversary with a high volume of accurate, lethal munitions. Critical capabilities to protect the force are a subset of those necessary to shape the battlespace with emphasis on accurate fire in support of the close battle. Increasing the survivability of fire support systems is accomplished through a combination of lethality, mobility, rate of fire, and survivability characteristics built into the weapons platforms.

SUSTAIN THE FORCE

The fire support sustainment system must be capable of supporting high-tempo operations throughout the battlespace. Smart, smaller, lighter and more effective submunitions reduce the number of rounds required per engagement, thus reducing the logistics burden. Advanced propulsion for weapons systems and munitions will also reduce the logistics burden. Critical capabilities are two-fold. First, the field artillery must be capable of sustaining itself on the battlefield. AFATDS linked to the CSSCS will provide for logistics management. The FAASV provides a companion resupply vehicle for the Paladin howitzer. The Crusader Resupply Vehicle (RSV) enhances this capability for the Crusader with increased ammunition resupply capability as well as a refuel capability not currently found in the FAASV. Second, artillery must reduce the burden on the logistics system. Artillery munitions are currently over 50% of the logistics flow. Commonality of ammunition will reduce this challenge. The Modular Artillery Charge System (MACS) replaces four different propellants with two. The Multi-Option Fuze Artillery (MOFA) replaces eight different fuzes with one. Reduced size and weight of future munitions will further reduce this flow.

The Fire Support modernization strategy emphasizes essential research and development programs that lead to the fielding of Crusader and its attendant capabilities. The development and fielding of improved command, control, and communications systems, and target acquisition systems will enable information dominance through decider to sensor-to-shooter information capabilities. Crusader will restore U.S. cannon supremacy. ATACMS, MLRS launchers and rockets, SADARM, LW155, HIMARS, and XM982, the new long-range DPICM projectile, will integrate new capabilities into the fire support system in a coherent, logical manner that will sustain combat overmatch. Leap-ahead technology focuses on providing the fire support system of systems with truly advanced C3, weapons and munitions, target acquisition, and sustainment systems.

Because the fire support system provides significant and critical contributions across the entire *Army Vision 2010* patterns of operation, modernization of the fire support system is critical to achieving the capabilities required for Army XXI and Army After Next.

CHALLENGES AHEAD

There are many challenges in the future for the field artillery. First, we must procure the weapons and munitions critical to achieving the capabilities in support of Army XXI and Army After Next. These systems must be procured in sufficient quantities to equip the Total Force. Fielding Crusader is key to this effort. The most important challenge in the near- and mid-terms is to maintain improvement programs for the current systems to enhance our capabilities and replace aging equipment. Second, we must fund the R&D efforts to reduce our munitions size and weight in conjunction with the development of lighter, more mobile yet equally lethal weapons platforms. Finally, while focusing on the major weapons platforms and munitions, we cannot lose sight of the smaller, less expensive systems which are critical to accurate, predictable fire support such as Firefinder radar, LLDR, Striker, GLPS, Profiler, and MVS. As a system of systems, fire support modernization must remain a coherent, logical, integrated program.

SECTION 2: CURRENT PROGRAM ASSESSMENT

Overview

This section provides an explanation of the warfighting contributions of current fire support programs and an assessment of the programs in the near-, mid-, and far-terms. Systems are listed by investment category, i.e., where they fit in the investment strategy, not by their inherent battlefield capability.

The Army modernization strategy acknowledges a period without a peer threat where moderate risks are acceptable. The fire support community makes full use of this window of opportunity with the modernization effort coming to fruition in FY10-12. By that time, modernization will include Paladin and Crusader, M270A1 MLRS launchers, and product improved SADARM, BAT, MSTAR, ATACMS, FDSW and LW155. Prior to 2010, the Army will continue to accept some risk in fire support programs in order to pursue promising technology and investment in information dominance systems. It is clear, however, that the Vietnam-era legacy systems, which make up a large part of the fire support contribution to the battlefield are at the absolute limits of their useful lives.

Field Artillery Modernization Driving Factors

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
Digitized div by FY00 Digitized corps by FY04 Relevant combat knowledge	First Round Kill Total Asset Visibility In-Time Logistics	Average Equipment Age in 2020 M109 - 57 years old M198 - 41 years old MLRS - @ 38 years old Q-36/Q-37 - 40 years old Crusader R3 Point is 5 Years
• M109 PIP/SLEP 6 times & out-ranged, outgunned, lacks speed and survivability • M981 is obsolete and creates a unique signature on the battlefield		
	• Smart and brilliant munitions • Multi-node information processing • Target acquisition to operational depth • Sensor-to-shooter links • Shelf life issues for MLRS missile and ATACMS	

Figure E-6

Overall Fire Support Modernization Goals

The Fire Support modernization strategy provides a coherent, integrated approach to ensure that all aspects of fire support are modernized in support of Army XXI while focusing S&T efforts on leap-ahead technologies to support Army After Next.

INFORMATION DOMINANCE

Information dominance is critical to the accomplishment of the fire support mission. Accurate target and weapons platform location coupled with detailed meteorological data are key to accurate predicted fire. Real-time situational awareness is essential to successful fire support coordination. All of these systems must be linked by a state-of-the-art command and control system. AFATDS will provide the common operating network as a part of the ATCCS as well as the command and control necessary for fire support coordination. The BFIST, Striker, and FED will enable company-level fire support teams to provide fire support coordination at that level. The Firefinder radar will enhance target acquisition, first as the Version 8 improvement, then as the Firefinder Block II. Striker and LLDR provide forward observers with the ability to accurately locate and designate close targets. Profiler will provide for target area meteorological information necessary to account for the effects of weather. GLPS will provide non-Paladin units with a rapid and accurate self-location capability, currently embedded in the MLRS and Paladin and to be embedded in Crusader.

Target location is provided by forward observers and by the Firefinder radars. Striker, BFIST, and LLDR (overmatch systems) assist by providing improved targeting capability by observers. Firefinder capability will be significantly enhanced through block improvements. Situational awareness from a common operating picture, and true automated command and control, will become reality with the fielding of AFATDS.

Fire Support—Information Dominance Program Assessment

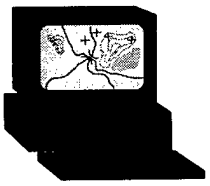
System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
AFATDS	5,328	5,328	2008	AMBER	AMBER	RED	Note 1
FED	4,274	2,568	2010	AMBER	AMBER	RED	Note 2

Notes: 1. Service life expiration with no funding for follow-on system identified. Insufficient quantities of the new FED to mate with the AFATDS fielded throughout the digitized corps.
2. Insufficient quantities in the near- and mid-terms of the new version of the FED to mate with the AFATDS fielded throughout the digitized corps. FY99 plus up of $25.6M will procure an additional 1000 FED (included in # systems funded)

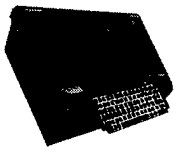
Figure E-7

TACFIRE was the forefront of the digitization efforts that characterize Army XXI. It was replaced by the Initial Fire Support Automated System (IFSAS), which will give way to the objective system, the Advanced Field Artillery Tactical Data System (AFATDS) currently fielded to 4ID, 1CAV, and III Corps Artillery. Fielding to the total force is scheduled for completion in FY07.

AFATDS, the automated fire support command, control, and communications system of the future, will provide shared information. It provides the maximum utilization of the fire support assets available on an expanding battlefield. AFATDS is a multi-service (Army and Marine Corps) system, interfaces with the USAF CTAPS, and will interoperate with the fire support command and control systems of the United Kingdom (BATES), Germany (ADLER), and France (ATLAS). It is a highly successful system that will continue to receive annual upgrades to improve functionality with Joint Fire Support Systems. Software improvements are planned through FY00. Overall, the AFATDS program is rated **AMBER** in the near-term and **RED** in the mid- to far-terms because a replacement system has not been designated. While AFATDS will be fielded to the Total Force, insufficient quantities of the new version of the FED to mate with the AFATDS hinder the effectiveness of the system for the National Guard divisions.



The FED is a complementary system to AFATDS. It is the forward observer's entry to the digital battlefield and gives commanders a mobile, remote digital capability. The current FED is a 286-based, 1200 baud computer system approaching obsolescence. The upgraded FED will interoperate with existing and emerging fire support and EW assets through the AFATDS. Due to a lack of funding for fielding to the total force, the FED program assessment is **AMBER** in the near-term and **RED** in the mid- and far-terms. Recent FY99 initiatives increased the proposed funding for the FED; however, an additional $54 million is required. This funding would procure 1706 FEDs and enable fielding of the Total Force.



Despite the improved capabilities of AFATDS, FED, and other fire support systems that support information dominance, the rating for information dominance is **AMBER** out to the far-term. The R3 point for AFATDS, the backbone of the fire support command, control, and communications (C3) system, is 2008 and it is not fully capable without the FED.

COMBAT OVERMATCH

Fire support achieves combat overmatch from its weapons platforms and its munitions. The weapons platforms must be capable of large volumes of extremely accurate fire with lethal precision munitions which can engage targets from the close battle to operational depths. These platforms must be as mobile and survivable as the supported force (Figure E-6).

Current weapons platforms are reaching the end of their useful lives and, in the case of Paladin, have lost their overmatch. Paladin howitzer is being fielded to extend the life of the current cannon system. Crusader will provide significant increase in both range and rate of fire in support of maneuver forces. Crusader is being developed to displace the Paladin howitzer and will restore the overmatch in cannon artillery. ATACMS variants will engage targets out to 300km with lethal submunitions. Incremental improvements to MLRS munitions (Extended Range-MLRS, Guided MLRS [GMLRS], and MLRS Smart Tactical Rocket [MSTAR]) will increase the range, accuracy, and lethality of rocket fire. In the close battle, SADARM and SADARM Preplanned Product Improvement Program (SADARM P3I) provide a significant improvement to current cannon lethality. Weapons platforms are also being improved to shape

the battlefield through increased range and greater lethality. The M270A1 upgrade to the MLRS launcher is required to fire the new MLRS Family of Munitions. HIMARS is under development to provide MLRS capability to light, early deploying forces. In addition to HIMARS, light force capabilities will be enhanced by the LW155 towed howitzer, a lighter, more mobile system than the current M198 howitzer. Light, direct support force capability will be significantly enhanced by the Future Direct Support Weapon (FDSW) system which will have 155mm lethality (vice current 105mm) while retaining the weight restrictions of the current M119A1 105mm howitzer. The XM982 munition will extend the range of cannons while the Muzzle Velocity System (MVS) and Meteorological Measuring System (MMS) will improve their accuracy.

Fire Support—Overmatch Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Crusader	1,378	1,378	2025	GREEN	GREEN	GREEN	Note 1 & 2
MLRS	1,193	857	2015	AMBER	AMBER	AMBER	Note 3
ATACMS Blk I	1,650	1,650	2001	GREEN	GREEN	AMBER	Note 4
ATACMS Blk IA	652	573	2008	GREEN	GREEN	AMBER	Note 4
ATACMS Blk II	1,206	1,206	2011	GREEN	GREEN	AMBER	Note 5
ATACMS Blk IIA	600	600	2014	GREEN	GREEN	AMBER	Note 5
GMLRS	83K	83K	2014	AMBER	AMBER	GREEN	
MSTAR	25K	12K	2022	AMBER	AMBER	GREEN	Note 6
LW155	297	273	2025	GREEN	GREEN	GREEN	
HIMARS	363	363	TBD	GREEN	GREEN	GREEN	
SADARM	50K	50K	2019	GREEN	GREEN	GREEN	Note 7
MVS	2,476	1,868	2007	AMBER	AMBER	AMBER	Note 8
BFIST	1,011	568	2020	AMBER	AMBER	AMBER	Note 9
Striker	449	296	2020	GREEN	AMBER	AMBER	Note 10
LLDR	1157	715	2020	GREEN	GREEN	AMBER	Note 8
GLPS	525	525	2020	GREEN	GREEN	GREEN	

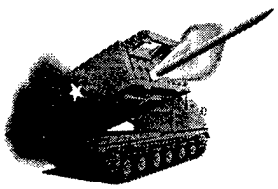
Notes:
1. $23 million decrement in FY98.
2. Quantities insufficient to replace aging Paladin until FY20 or later.
3. Total requirement not procured; no RDTE for M270A1 replacement.
4. Shelf life expiration begins to occur in the mid-term.
5. Shelf life expiration begins to occur in the far-term.
6. Insufficient RDTE in FY02-03.
7. Funding is sufficient providing full support of the P3I program.
8. Insufficient quantities.
9. Out of sync with maneuver fieldings; insufficient quantities funded; will be replaced by Future FIST Vehicle (FSV), a variant of Future Infantry Vehicle.
10. Insufficient quantities; will be replaced by Future COLT Vehicle (FCV), a variant of Future Scout and Cavalry System (FSCS).

Figure E-8

Crusader fulfills a critical need to restore combat overmatch in cannon artillery. It provides a leap-ahead capability and is a revolution in cannon fire support. When fielded in FY05, Crusader will be the premier cannon system in the world, with a significantly greater range, rate of fire, and survivability than any cannon system. Prototype systems have demonstrated the ability to fire 15 rounds in the time a Paladin crew fires four rounds. As the first fully digitized field artillery weapons system, Crusader will provide first-class fire support

to Army XXI and to the battle forces that will constitute the majority of the Army After Next. Additionally, Crusader will possess the mobility to keep pace with the supported maneuver force...a critical deficiency of the current cannon. The resulting increase in firepower has allowed the Army to decrease the size of self-propelled howitzer battalions by one-third. Paladin battalions have already reduced from eight guns to six in anticipation of the Crusaders' capability. A fully automated system, the Crusader will also decrease the manpower required within each section from nine men to six per howitzer system. The net result is a reduction in cannon battalion size from 600 soldiers to 404. Although heavier than the Paladin howitzer it replaces, Crusader provides strategic flexibility to the commander. It currently requires 12 C5 sorties to deploy a Paladin battalion with its ammunition vehicles. Crusader will provide equivalent firepower with six systems that require only six sorties! Finally, as the lead ground combat system, Crusader is a technology carrier for future systems in support of Army After Next. Many of the new technologies under development for Crusader have direct applicability to other future ground combat systems. Crusader will be fielded to all heavy active component artillery battalions and eleven high-priority National Guard (NG) battalions (FP 1, FP 2 and part of FP 3). Because it is not funded for the Total Force, Crusader is rated as **GREEN** in the near- and mid-terms but **AMBER** in the far-term. Recent initiatives should increase funding for Crusader in the Extended Planning Period, which will allow for fielding of the Total Force. Given funding limitations, full fielding will not be achieved before FY20.

The MLRS delivers large volumes of firepower in a short time against critical, time-sensitive targets. The M270A1, a modification of the current launcher, begins fielding in FY98.



These modifications improve the fire control system and improve slew rate to accommodate the needs of the MLRS Family of Munitions (MFOM) systems under development, reduce the aiming time by 70%, and reduce the reload time by 50%. Inadequate funding precludes fielding MLRS to 11 NG battalions. These units have been issued the M109A5 howitzer instead. Therefore, MLRS is **AMBER**. Due to the criticality of these National Guard units to the second major theater of war, the Field Artillery School is examining an alternative that would decrease the number of launchers in current MLRS battalions. This would allow for complete fielding of these 11 National Guard battalions and would complete fielding to the Total Force. The upgrade to the M270A1 allows for increased reliability and speed of firing that would allow for this change, therefore, fielding would be tied to the upgrade of the launchers. This could not begin before FY04/05 unless significant additional funds are added to the launcher upgrade program. If the reduction of launchers is not operationally feasible, an additional $151M per year would be required from FY00-FY10.

ATACMS missiles are being developed as a logical series of improvements to range, accuracy, and lethality. To achieve the greatest efficiencies while maintaining the industrial base capability, missile production is continuous with each new block improvement cut into the existing production line, when ready. ATACMS Block I proved its effectiveness during Operation Desert Storm. ATACMS Block IA improves the range from 165km to 300km, but retains the APAM payload which is effective against stationary, soft targets. ATACMS Block II significantly improves the lethality by incorporating BAT/BAT P3I to effectively engage moving armor formations. ATACMS Block IIA with BAT P3I increases the range to 300km. BAT P3I

will enhance the submunition so that it can effectively engage cold, hard targets. Overall program assessment is **GREEN** in the near- and mid-terms.

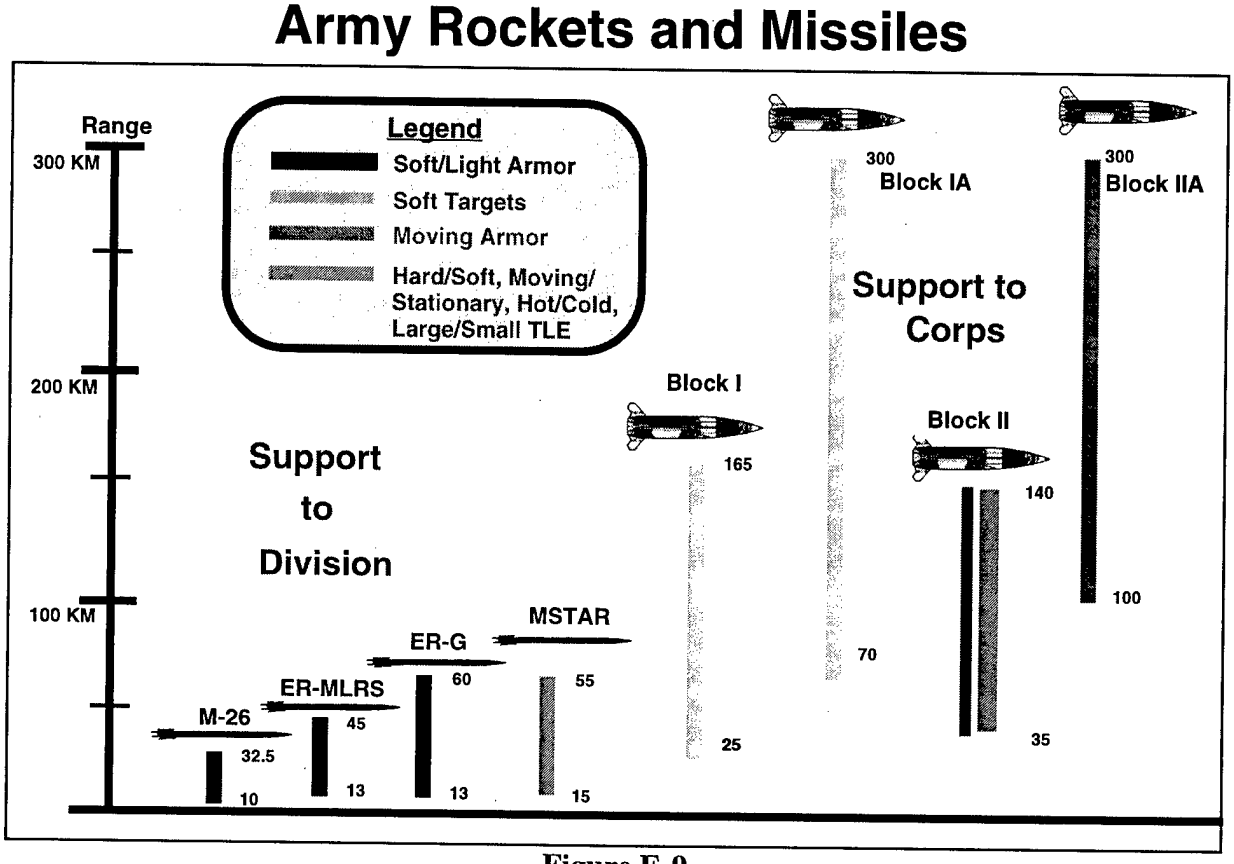


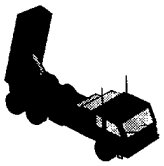
Figure E-9

MLRS rockets are being upgraded in a manner similar to ATACMS. Improvements will be cut into the production line as they become ready. Extended Range MLRS (ER-MLRS) will provide for rocket fire out to 45km. Guided MLRS is an improvement to the accuracy of the ER-MLRS which also extends the range to 60km. MLRS Smart Tactical Rocket (MSTAR) improves the GMLRS submunition to attack armor and other high payoff targets. An ATD is planned for FY99-02. The entire MLRS program assessment is **AMBER** in the near- and mid-terms because the predominate rocket in the inventory is the M26. The ER-MLRS and the GMLRS will enter the inventory in the near- and mid-terms in low numbers. The MSTAR rocket will enter the inventory late in the mid-term. In the far-term, MLRS rockets will be **GREEN**.

The combat overmatch capability of light units will be significantly enhanced. All Corps-level FA brigades (active and National Guard) which support light units will convert from their current configuration (three M198 battalions) to one battalion of LW155 and two battalions of HIMARS. In the far-term, the direct support howitzers in the light units (M119A1) will also be replaced by the FDSW.



The Lightweight 155 howitzer (LW155) will replace the 1980s era M198 howitzer in light corps artillery units. A joint USMC/U.S. Army program, it provides increased strategic and tactical mobility, increased rate of fire, and improved survivability over the M198. In addition, the LW155 will possess self-location capability and will be digitized with the same basic capability as self-propelled howitzers. This howitzer, together with the HIMARS, will replace all M198 howitzers in the Total Force. Current plans call for LW155 to be fielded to 2 active battalions and 5 National Guard battalions. Rating: **GREEN**.

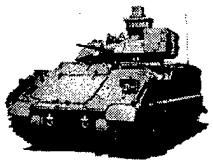


HIMARS will provide early entry forces with MLRS capability in a lighter weight, more deployable system. Mounted on a medium tactical vehicle, HIMARS is transportable on a C-130 aircraft. It provides full MLRS Family of Munitions capability yet requires 70% fewer airlift resources to transport a battery. A three- launcher platoon will serve as a stand-off killer in the Rapid Force Projection Initiative Advanced Concept Technology Demonstration in FY98. Following a two-year user evaluation at Fort Bragg, HIMARS will begin production in FY04. HIMARS, together with LW155, will replace all M198 howitzers in the Total Force. Current plans call for HIMARS to be fielded to 2 active battalions and 14 National Guard battalions. Overall program assessment is **GREEN**.

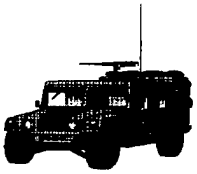


Sense and Destroy Armor (SADARM) munitions are the field artillery's first fire-and-forget, multi-sensor smart munition which will detect and destroy armored vehicles. SADARM has no known foreign counterpart, and full-rate production is scheduled for 1999. Overall SADARM program assessment is **GREEN** given adequate funding for the SADARM P3I program. Without this enhancement, additional quantities of basic SADARM would be required and the program would become **AMBER**.

Precision fire requires measurement of variations in muzzle velocity caused by gun tube wear. The Muzzle Velocity System does this. It is an exponential improvement over the current M90 Chronograph, an archaic and cumbersome system. Fielding has begun and the program is rated **AMBER** due to a shortage of 608 systems for the Total Force. An additional $18 million is required to correct this shortfall.



The Bradley Fire Support Vehicle (BFIST) provides an integrated Bradley-based fire support platform for fire support elements at company level. The BFIST incorporates the same Forward Looking Infrared Radar (FLIR) as mounted on the maneuver force Bradley. Crew survivability and mobility is significantly enhanced over the Vietnam-era M113 currently used. Current funding leaves a three-year gap in synchronization of BFIST fielding with maneuver force Bradleys. In addition, BFIST will be fielded only to those high priority artillery units supporting infantry battalions that receive the M2A2ODS or M2A3 BFV. Other units will receive the Striker in lieu of BFIST. Rating: **AMBER**.



Current Combat Observation Lasing Teams (COLT) with maneuver scouts use a M981 FISTV. This M113-based vehicle lacks the required mobility and provides a unique signature which degrades survivability. Striker, a HMMWV-based capability, is the only digitized vehicle currently in the brigade recon fight. Striker contains a complete AFATDS suite of equipment for the COLT in a vehicle that is compatible with the maneuver scouts. The system is currently funded for procurement to all high priority units and is rated **GREEN** in the near-term. Funding shortages preclude fielding to the Total Force and reduce program assessment to **AMBER** in the mid- and far-terms. Only seven Enhanced Brigades and one National Guard Armored Cavalry Regiment can be fielded. Eight National Guard divisions and ten Enhanced will not receive Striker. An additional $61 million is required to procure 153 systems to allow fielding to the Total Force.



The Lightweight Laser Designator/Rangefinder (LLDR) provides Fire Support Teams with a man-portable system to accurately locate and designate targets. It replaces the current Ground/Vehicular Laser Locator Designator (G/VLLD) which is large and extremely maintenance intensive. LLDR, a new capability for light forces, will also replace the current heavy force system with up-to-date technology and reliability. This program is rated **GREEN** in the near term and **AMBER** in the mid and far terms. Current funding procures LLDR for all active battalions and 13 National Guard Enhanced Brigades. An additional $120 million is required to procure 442 additional LLDR to field the remaining 2 Enhanced Brigades and the National Guard divisions.



In addition to accurate target location, accurate weapons location is required. Self-propelled howitzers and the MLRS contain self-location capabilities. GLPS will provide both positional and directional information to light units to assist them in providing accurate, predicted fire. This program is rated **GREEN**. Recent FY99 additions increased funding to procure additional GLPS and will field the Total Army. GLPS should begin fielding to National Guard units in FY00.

Combat overmatch capabilities will be significantly upgraded over the POM and EPP. Improved weapons and munitions, together with advanced target detection and designation, will provide longer range, more lethal fire support. In spite of this, overmatch is rated **AMBER** for all time frames. Funding problems and inadequate quantities preclude fielding these capabilities to the Total Force.

ESSENTIAL RESEARCH AND DEVELOPMENT (R&D) AND LEAP-AHEAD TECHNOLOGY ASSESSMENT

R&D efforts to modernize the fire support operating system address problems that are relevant for both Army XXI and AAN. A large number of technologies have already transitioned from R&D to the Crusader system. AAN capabilities relate to the needs for high levels of strategic and tactical mobility, overmatching lethality, and reduced logistics burdens. Notable R&D initiatives are those that address very lightweight towed artillery for early entry forces, and the use of Global Positioning System (GPS) technology in cannon and missile artillery ammunition to increase accuracy. The most important programs are described below.

Fire Support—Leap-Ahead Technology Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Profiler	86	86	2021	RED	AMBER	GREEN	Note 1
SADARM P3I	50K	50K	2019	AMBER	AMBER	GREEN	Note 2
FDSW	600	600	2028	RED	AMBER	GREEN	Note 3
XM982	248K	43K	2024	RED	AMBER	AMBER	Note 4
BAT& P3I	19.8K	19.8K	2011	AMBER	GREEN	AMBER	Note 5
Q37 Block II	72	72	2023	GREEN	GREEN	GREEN	

Notes: 1. System unavailable until FY06.
2. Insufficient funding in the near-term.
3. FUE FY11.
4. Three variants are required. Only the DPICM variant is funded at this time.
5. $40 million RDTE decrement in FY98. No RDTE follow-on. FUE 3QFY01.

Figure E-10

Profiler. The Profiler Meteorological System will provide a modernized and enhanced target area meteorological capability to the Combined Arms Commander. Profiler will achieve this through the use of meteorological satellites and sensors aboard UAVs. It will greatly enhance the employment and effectiveness of "smart" munitions. This unique capability will allow the Combined Arms Commander to project lethality up to 500kms forward of the Forward Line of Troops (FLOT). Another unique feature of the Profiler is that it will eventually eliminate the use of meteorological balloons on the battlefield. The program is overall rated as **AMBER**. First unit equipped (FUE) will be in FY06. Although the basic Profiler program is fully funded, Profiler is an upgrade to the Meteorological Measuring System. Current funding is short 8 systems. An additional $8 million is required. If this funding is made available, Profiler can be fielded to the Total Force.

SADARM P3I. The SADARM P3I enhances the performance of the SADARM submunition. The P3I has increased hang angle, an improved sensor array, and a higher altitude which equates to a greater lethal footprint. P3I submunition effectiveness is two times greater than baseline SADARM allowing an over all decrease in projectile quantities. The program is rated **AMBER** in the near- and mid-terms due to funding.



Future Direct Support Weapon (FDSW) will replace the aging M119A1, 105mm howitzer in light, direct support units. It will significantly enhance those units' capability by providing 155mm lethality while retaining the mobility characteristics of the current 105mm howitzer. FDSW will be towed by a HMMWV-class vehicle, and will retain transportability in a C-130 or by UH-60L aircraft. FUE is FY11 and the program is rated AMBER due to technical risk of achieving challenging we ight goal. ***FDSW will replace all 105mm howitzers in the Total Force.***



XM982. The XM982 Field Artillery Projectile is an extended-range, rocket-assisted, 155mm Dual-Purpose Improved Conventional Munition. It utilizes the new XM80 self-destruct bomblet which reduces hazards from duds. The XM982 will replace the M864. It is compatible with all current and future 155mm cannon systems. It represents an increase in range from 28 to 39kms

with current systems, 38 to 47kms with the Crusader. The program is rated as **AMBER** due to production beginning in FY03 and funding.



BAT P3I. The Brilliant Anti-Tank Submunition (BAT) is dual-sensor (acoustic/infared) designed to attack moving armored targets. BAT P3I has autonomous dual mode, millimeter wave, and imaging infrared capability designed to provide deep attack interdiction against an expanded target set to include armored combat vehicles (moving or stationary), stationary targets (hot or cold), surface-to-surface missile transporter erector launchers (SSM TELs), and multiple rocket launchers (MRLs). Initially, 13 BAT submunitions will be carried on the ATACMS Block II missile to ranges in excess of 140 kms. BAT will enter limited production in fourth quarter FY98 with the goal of first unit equipped by FY01. The BAT P3I will enter limited production in FY02 with a first unit equipped date of FY04. Six BAT P3I will be carried by the ATACMS IIA missile, which will extend the range to 300km. Both programs are rated **RED** in the near-term due to a funding decrement.



Q37 (Firefinder) Block II. Future improvements to the Q37 Firefinder system are captured in the Firefinder Block II program, currently rated as **GREEN**. Among other improvements, it will double target acquisition range of cannons and rockets over the Q37 Version 8 upgrade to 60kms and 100kms, respectively, and improve missile location capability to 300kms—SCUD missile range. Currently, 72 systems are funded. This will field Firefinder Block II radars to the Total Force.

Essential Research and Development—Fire Support

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• Theater Precision Strike Operations ACTD • Guided MLRS • Composite Armored Vehicle ATD • 155mm Automated Howitzer • Decision Aides • JPSD Precision/Rapid Counter MRL • Multi-mode Airframe Missile Technology Demonstration	• SADARM Block II	• Mobile Wireless Communications (SRO) • Nanoscience (SRO) • Hypervelocity Physics

Further information may be obtained in the Army Science and Technology Master Plan, Chapters III. N (Fire Support) and III.G (Mounted Forces).

Figure E-11

Near-Term (FY98-03)

Theater Precision Strike Operations (TPSO). The TPSO Advanced Concept Technology Demonstration (ACTD) will develop and demonstrate advanced sensor-to-shooter

connectivity for theater-level precision fires. The demonstration focuses on U.S. Forces Korea (USFK) real-world missions, but the technology has applicability to land component commanders in all CINC areas of responsibility. The ACTD will provide work station displays, database management techniques and decision aids to significantly reduce response time in deep fire coordination between ground, air and sea launched systems.

Guided Multiple Launch Rocket System (GMLRS) Advanced Technology Demonstration (ATD). This ATD will demonstrate a significant improvement in the range and accuracy of the MLRS free-flight artillery rocket. Improved accuracy results in a significant reduction in the number of rockets required to defeat the target (as much as six-fold at extended ranges) with a corresponding reduction in the logistics burden. The ATD will design, fabricate, and flight-test a low-cost guidance and control package to be housed in the nose of the rocket. The package to be demonstrated will result in a rocket which is more cost effective and more lethal while requiring no change to crew training procedures or maintenance procedures (during the 15-year shelf life).

Combat Armored Vehicle (CAV) ATD. This program demonstrated the feasibility of a combat vehicle structure made with composite materials versus traditional metallic solutions. The goal was to achieve a 35% chassis weight reduction, and that goal was met. This technology was transitioned to Crusader, and it has been chosen for the Crusader turret, thereby reducing its weight by about one ton.

155mm Automated Howitzer (AH) Technology Demonstration. This program will demonstrate an automated, digital fire control system for a 155mm towed artillery system. The digital Fire Control System (FCS) has self-location and direction determination capabilities which are expected to increase efficiency, responsiveness, and accuracy.

Decision Aids for Advanced Artillery and Armament Decision Aids Technology Demonstrations. The initial demonstrations evaluate a prototype decision aid system for self-propelled artillery utilizing artificial intelligence and advanced computing techniques. It will reduce planning time required for movement to a new fire position, decrease response time to a new mission, and increase self-survivability capability. The follow-on demonstration (Armament Decision Aids) will build upon previously developed technology and link the individual fire support platform to the digitized battlefield.

JPSD Precision/Rapid Counter MRL ACTD (95-98). This ACTD will demonstrate a significantly enhanced capability for USFK to neutralize the North Korean 240mm Multiple Rocket Launcher (MRL) system.

Multimode Airframe (Missile) Technology (MAT) Technology Demonstration. This technology demonstration will provide the battlefield commander with a long-range (40+kms) precision guided artillery weapon that will provide light forces surgical kill capabilities against heavy armor, helicopter, and bunker targets.

Mid-Term (FY04-10)

SADARM P3I. This effort will demonstrate the application of a common aperture Laser Radar/Infrared (LADAR/IR) transducer to enhance current SADARM smart submunition sensor suite for use in gun launch environments. The sensor suite will improve countermeasure performance and provide target classification capability with specific performance goals to include: probability of detection (Pd) less than .90%; probability of classification (Pc) less than .75%; and 20 times increase in footprint compared to basic SADARM. The enhanced sensor suite will greatly reduce cost per kill for basic SADARM.

Far-Term (FY11-20)

Strategic Research Objectives. The Mobile Wireless Communications SRO will ensure reliable, efficient distribution of target information to support optimal application of fire support assets through sensor-to-shooter linkages. Nanoscience will support the development of the next generation of sensors and guidance systems to significantly enhance the performance of precision munitions. Hypervelocity physics supports the basis for tunable lethality through the application of electric armaments and other hypervelocity weapons.

RECAPITALIZATION

The field artillery must recapitalize several systems to allow them to remain viable for the foreseeable future. Paladin and FAASV fielding must be completed. When replaced by Crusader, these howitzers will be cascaded to the strategic forces in the National Guard until replaced by Crusader in the far term. Firefinder radar contains basic 1960s technology which must be upgraded to remain relevant.

Fire Support—Recapitalization Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Paladin	1,378	950	2012	GREEN	GREEN	GREEN	
FAASV	1,378	950	2012	GREEN	GREEN	GREEN	
Q36(V8)	85	85	2008	GREEN	GREEN	NA	
Q37(V8)	46	32	2008	AMBER	AMBER	NA	Note 1.

Notes: 1. Insufficient quantities. Replacement must be identified.

Figure E-12

M109A6 Paladin. The Paladin is an upgrade to the 1960s M109 howitzer. It includes an onboard ballistic computer and navigation system, automatic gun positioning, automotive improvements, and a Nuclear Biological Chemical (NBC) protection system. While Paladin greatly improves the survivability and responsiveness of a 1960s-era cannon, it still lacks the desired mobility, range, and rate of fire required to maintain a combat overmatch capability as well as embedded information dominance systems. Field Artillery Ammunition Support Vehicle (FAASV) improvements include an upgraded ammunition handling and storage capability, an improved automotive and suspension system, improved ballistic protection, improved crew NBC

protective system, and position/navigation and night driver aids. These improvements greatly enhance the ability to keep our heavy cannon force supplied with ammunition.




Paladin and FAASV are currently being fielded in the Active Component and in the Army National Guard (through FP 3). Active Component fielding will be complete in FY98 and, by FY01, 18 ARNG battalions will be fielded. Current Paladin funding procures 950 vehicles. Current FAASV funding procures 921 vehicles, 29 vehicles short of the APO. The program is rated **GREEN**. In 2012, this weapons system reaches it R3 point with a basic M109 system that is 49 years old. It is unlikely that another refit program could upgrade it enough to meet the combat requirements of the Army After Next. Because of this, Paladin will be replaced by Crusader in the Total Force by FY20. While procurement is short of the requirement (428 systems at a cost of $1.3 billion), no additional Paladin are required. The shortage will be covered through cascading of Paladin howitzers that are replaced by Crusader.

Q36 and Q37 (Firefinder). The Firefinder radars (both Q36 and Q37) are being improved. These radars provide automated locations of enemy mortars, artillery, and rockets. The Q36 Version 8 upgrade will allow throughput of 20 targets per minute, versus the current four, and will have a 30% range improvement. The Q37 Version 8 upgrade will correct transportability deficiencies, improve mobility, and increase range to 130kms. Overall assessment for this area is **AMBER**. Additional funding included in FY02 and FY03 should alleviate current shortfalls. This should allow for upgrades to an additional thirteen Q36 and four Q37 systems for the Active Army, and 46 radars for the National Guard (42 Q36, 4 Q37). An additional $8M is required to upgrade fourteen radars and complete Firefinder upgrades for the Total Force.

Recapitalization will ensure that current artillery systems remain viable until replacements can be procured. Although several systems have funding shortages, the two major systems, Paladin and Firefinder, are adequately funded. Recapitalization is rated **GREEN** in all time frames.

SECTION 3: CONCLUSION

The Fire Support modernization strategy employs an integrated, balanced, system of systems approach aimed at improving operational effectiveness across the entire warfighting spectrum. The primary objectives remain: completing Paladin fielding; completing Crusader development and fielding; updating the fire control electronics and mechanical capabilities of the MLRS launcher fleet; creating an arsenal of smart/brilliant munitions that have increased range and lethality; and developing improved target acquisition, C3, and meteorological systems capable of operating on the Army XXI battlefield.

The Fire Support modernization strategy is effectively geared toward leveraging research, development, and acquisition resources. The long-term goal of the strategy is to ensure the fielding of these capabilities required to fight and win well into the 21st Century. Systems with these capabilities include Crusader, SADARM P3I, Firefinder Block II, MLRS/ATACMS, and AFATDS. These will provide critical combat overmatch and information dominance capabilities to the Total Force and permit the field artillery to contribute to full spectrum dominance.

Fire Support System Status

System	To Total Force?	Short	Funding Required	Comments
AFATDS	Yes			Short FED
FED	No	1706	$54M	
Crusader	Yes			
MLRS	Possible	*236*	*$151M per year FY00-10 if no restructure*	Restructure under review
LW155	Yes			
HIMARS	Yes			
MVS	No	608	$18M	
BFIST	No	443	Cost prohibitive	Cannot field except to M2A2ODS, M2A3 units
Striker	No	153	$61M	
LLDR	No	442	$120M	
GLPS	Yes			
Profiler	No	8	$8M	8 MMS required
FDSW	Yes			
Q37 Block II	Yes			
Paladin/FAASV	No	*428*	*$1.3B*	Cascade
Q36 (V8)	Yes			
Q37 (V8)	No	14	$8M	

Figure E-13

Shortfalls exist throughout the field artillery today; therefore, the overall rating is **AMBER**. Procurement shortfalls preclude fielding all systems to the Total Force...even to high priority units. Figure E-13 provides a recapitulation of these shortfalls. The fire direction and command and control elements continue to increase effectiveness, but will fall short in Army XXI. The greatest challenges facing the fire support system are in the areas of C3 and target acquisition. The C3 system requires the capability for long-range, enhanced situational awareness and relevant combat knowledge. Target acquisition requires the ability to "see"

targets throughout the depth of the battlespace and to assess the effects of our attack of those targets (battle damage assessment). Light forces (light infantry, airborne, and air assault) require a direct support weapons system with increased range, improved responsiveness, and enhanced tactical mobility (UH-60 transportable).

Fire Support—Overall Mission Area Modernization Assessment

System of Systems	Systems	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
Information Dominance	AFATDS and FED	AMBER	AMBER	RED
Combat Overmatch	MLRS, HIMARS, LW155, MFOM, ATACMS, BFIST, Striker, LLDR, GLPS,SADARM	AMBER	AMBER	AMBER
R&D and Leap-Ahead Technology	Crusader, FDSW, Munitions, ATD	AMBER	AMBER	AMBER
Recapitalization	Paladin, FAASV, Firefinder	GREEN	GREEN	GREEN

Figure E-14

POM funding supports AFATDS fielding and the Q-37 P3I production in the near-term. The POM funds MLRS systems that decrease launcher slew time and the production of SADARM. Additionally, the POM funds Joint Technical Architecture compliance in the near-term. The POM doesn't completely fund information dominance due to a partial FED buy. Additionally, the Future Direct Support Weapon is not funded in the near-term and will not begin production until the mid-term.

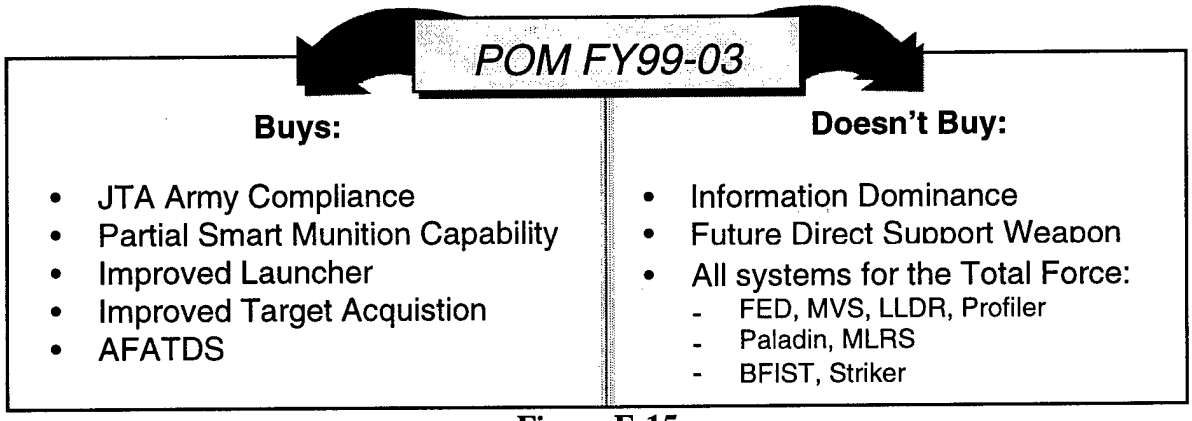


Figure E-15

ANNEX F: AIR AND MISSILE DEFENSE

SECTION 1: INTRODUCTION

Overview

Joint Vision 2010 calls for full-dimension protection for U.S. forces, friends, and allies. *Army Vision 2010* is the blueprint for the Army's contributions to the enhanced operational concepts of *Joint Vision 2010*. This annex describes Air and Missile Defense's planned modernization efforts to achieve these required capabilities. In order to accomplish this, Air and Missile Defense (AMD) modernization planning begins with the evaluation of global trends that could affect the United States military forces. Potential adversaries are expected to utilize existing technologies to acquire low-cost, unmanned, high pay-off systems that provide high operational effectiveness. The threats with increased proliferation trends in the 21st Century are tactical ballistic missiles (TBM), cruise missiles (CM), unmanned aerial vehicles (UAV), and rockets. Either sophisticated or rudimentary versions of these systems pose a danger to our joint forces due to their ability to target any area of the battlefield, in addition to their ability to deliver Weapons of Mass Destruction (WMD). Significantly, these types of weapons can severely disrupt our ability to project our force into theaters of operation, particularly Air and Sea Ports of Debarkation (APODS/SPODS) which are critical to our ability to build up our forces. Also, intercontinental ballistic missiles (ICBM) and traditional air threats, helicopters and fixed-wing aircraft, will continue to exist in the world of tomorrow.

> *. . . The proliferation of weapons of mass destruction—nuclear, chemical, and biological—is one of the most troubling dangers we face. The ongoing efforts to obtain such weapons by a number of countries present great and growing risks for the United States and its allies.*
>
> National Military Strategy *(A Strategy of Flexible and Selective Engagement)*, February 1995

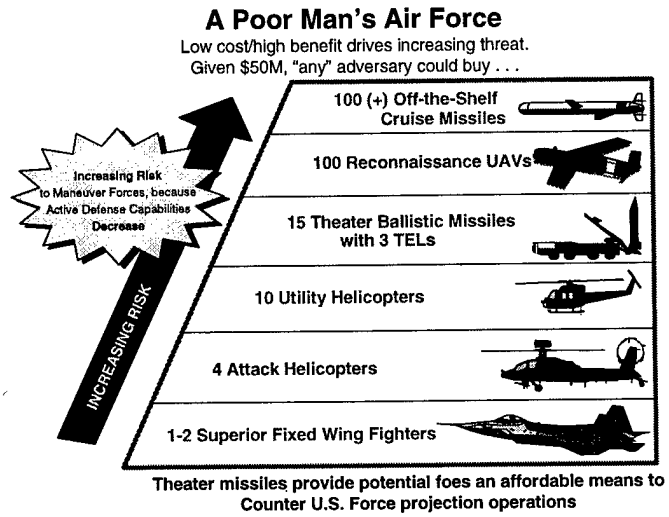


Figure F-1

The mission of Air and Missile Defense in the 21st Century will continue to be to protect the force and selected geopolitical assets from fixed and rotary wing attack, missile attack, and surveillance. Air and Missile Defense organizations operate as part of an integrated joint capability, and protect forces and key assets from the full spectrum of threat aerial vehicles. The modernization goal is simple—*an affordable Air and Missile Defense Force capable of performing missions which support the Joint Forces Commander in execution of National Security Strategy and National Military Strategy, and which meets the objectives of Army Vision 2010/Joint Vision 2010* (Figure F-2).

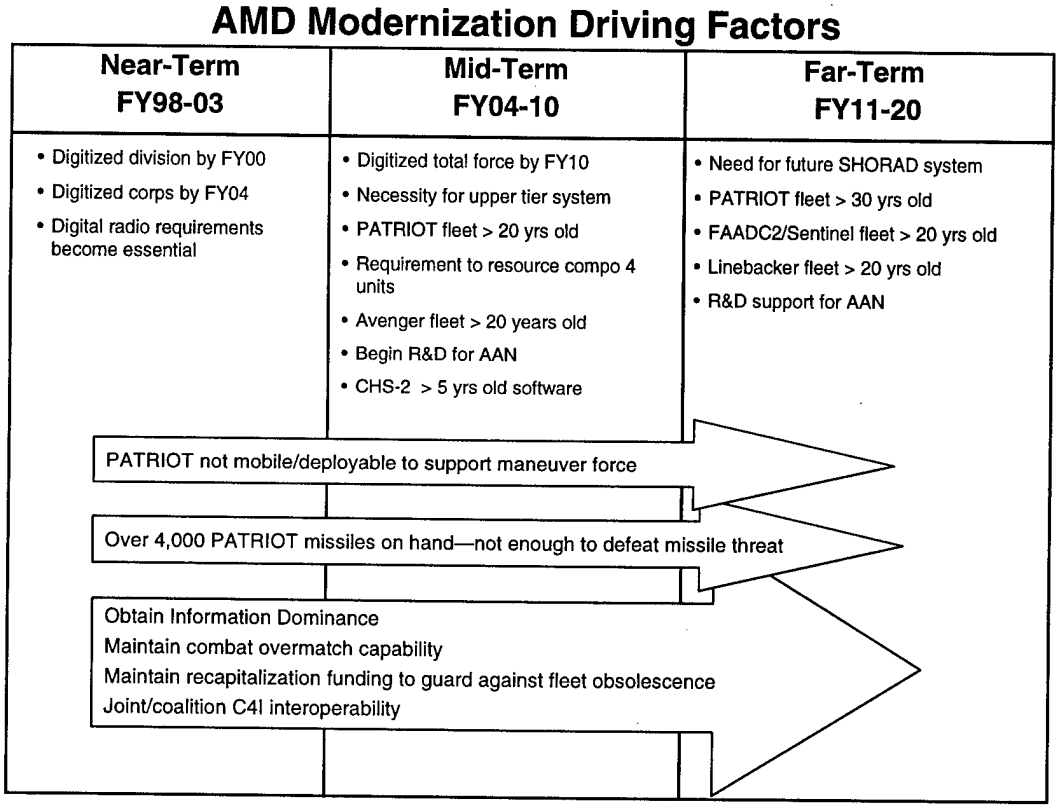


Figure F-2

Systems Providing Required Capabilities

The AMD systems provide near leak-proof, in-depth defense of maneuver forces and critical assets in the divisional/forward areas, corps, and theater, as well as National Missile Defense. Systems that are critical to both the sustainment and modernization of the force are listed below with respect to the area of the battlefield they are designed to protect. Air and missile defense forces will provide a two-tiered defense against medium- and short-range ballistic missiles. PATRIOT and Medium Extended Air Defense System (MEADS) will provide the lower tier defense primarily against short-range ballistic missiles as well as cruise missiles and air-to-surface missiles. PATRIOT, MEADS, and Short Range Air Defense (SHORAD) systems will engage fixed-wing and rotary-wing threats, which penetrate joint defenses. These systems, with their organic communications sensors and data link capabilities provide Information Dominance on the battlefield.

Divisional/Forward Area Air Defense (FAAD) Systems. SHORAD extends protection of the force forward—shaping the battlespace and enhancing Information Dominance with FAAD C2 and Sentinel providing integrated early warning, targeting information, and C2 capabilities to the forward deployed AMD force. SHORAD weapons systems provide overmatch capabilities through in-depth protection of maneuver forces in division, corps, and theater areas throughout all phases of operations, and ensure integrated fighting capabilities against CMs, UAVs, helicopters, and fixed-wing aircraft. SHORAD currently consists of the Bradley Stinger Fighting Vehicle (BSFV), Avenger, FAAD C2, Sentinel (formerly known as Ground-Based Sensor), and Stinger MANPADS. The BSFV will evolve into the Bradley Linebacker. Avenger will be improved with Slew-to Cue enhancements, which increase its capability to attack cruise missiles

Corps Systems. Lower tier TBM and air defense protection of forces in the corps area is currently provided by PATRIOT and Avenger. MEADS will be the future linchpin system for the AMD force and will provide lower tier TBM capability in conjunction with upper tier Theater High Altitude Air Defense (THAAD). Designed to be the eventual replacement for PATRIOT lower tier defense, MEADS will provide an overarching layer of protection for forward maneuver forces against TBMs, CMs, UAVs, helicopters, and fixed-wing aircraft. Each Corps Brigade will have Common Hardware/Software (CHS) equipment providing the three dimensional battle picture for situational awareness.

Theater Systems. Theater Missile Defense (TMD) is an integrated system approach to provide near leak-proof protection of the force and critical assets against tactical ballistic missiles (TBM). TMD is accomplished by integrating a mix of mutually supportive operation elements—active defense, passive defense, attack operations, and command, control, communications, computers, and intelligence (C4I). Consisting currently of PATRIOT, TMD (active defense) systems will expand in the 21st Century to include THAAD and MEADS capabilities. The Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS), formerly known as AEROSTAT, an elevated sensor platform, will meet the Army's requirement to detect, track, and support engagement of low flying threats, with a focus on cruise missiles.

National Missile Defense. National Missile Defense (NMD) will provide protection of the United States against accidental, unauthorized, or intentionally limited ICBM attacks. Program intent is to develop, within three years, an initial system to the point that a limited capability could be fielded within three years of a deployment decision.

Capabilities Contributing to *AV2010* Patterns of Operation

Army Vision 2010 describes six patterns of operation which are inherent to the force of the future. These are Information Dominance, Protect the Force, Decisive Operations, Shape the Battlespace, Project the Force, and Sustain the Force. Air and Missile Defense provides the Land Component Commander the means for success in all six patterns of operation, with primary focus on Information Dominance and Protect the Force (Figure F-3).

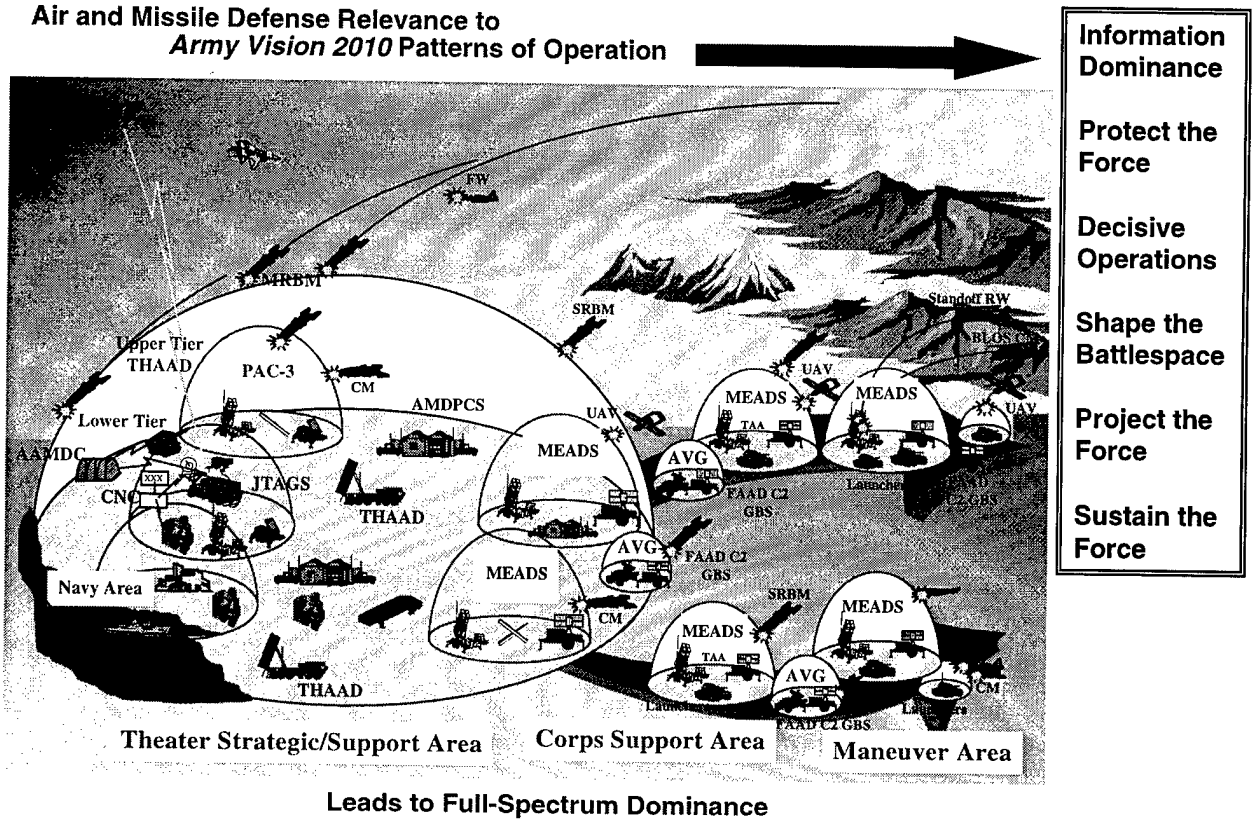


Figure F-3

INFORMATION DOMINANCE

AMD systems are critical components in information warfare, protecting friendly force information and denying information to threat forces. Information system assets will be defended with national, theater, corps, and divisional AMD systems. The AMD forces will engage hostile Unmanned Aerial Vehicle (UAV) reconnaissance and surveillance platforms, denying them aerial intelligence data on friendly force locations, movements, and intentions. Warnings of threat aerial activity will trigger passive defense measures, further preventing enemy situational awareness. In addition, the AMD information systems will collect, process, and disseminate common airspace and C2 information to support information warfare operations. Early Warning provides maximum reaction time for AMD forces, resulting in an increased ability to kill targets. AMD systems also provide other key information that aids in targeting enemy assets on the ground, such as suspected airfields and TBM launch points. The AMD sensor/data network, with input from JTAGS and system radars as well as with connectivity with national sensors/satellites and joint sources, can provide a real-time or near real-time air picture of the air and missile defense battlespace to the force commander. The equipment provided with the Air and Missile Defense Planning and Control System (AMDPCS), deployed with AMD units from Division to Theater, provides command and control of AMD assets in support of ground forces from maneuver brigade to theater level.

PROTECT THE FORCE

From initial entry through redeployment, Protect the Force encompasses the host of AMD weapons and control systems. Defense in-depth exists not only from the rear to the forward areas of the actual groundspace of the battlefield, but vertically as well, to include airspace. This is accomplished through a two-tiered approach to AMD operations. Upper tier and lower tier Theater Missile Defense systems provide defense of critical priorities in theater, as designated by the Joint Force Commander/Land Component Commander/Joint Force Air Component Commander. Overlapping TBM coverage of all assets is preferred to thicken the defense and provide assured, near leak-proof protection of high value assets. The corps and divisional AMD systems move with and defend maneuver forces and their sustainment organizations/facilities against the array of threat TBMs, CMs, UAVs, helicopters, and fixed-wing aircraft. The AMD weapon system capabilities to protect the force are synchronized by supporting C4I systems. AMD sensor platforms provide the requisite air picture to assist in minimizing engagement timelines and maximizing force survivability. The AMDPCS and AMD TOCs ensure interoperability with platforms from the other services, increasing the operational capabilities of joint forces.

DECISIVE OPERATIONS

While operations continue to be conducted throughout the theater, the focus of Decisive Operations is the forward area. The AMD mission focus is the defeat of threat air and missile strikes against the maneuver forces and theater assets, and denial of threat UAV reconnaissance, surveillance, and target acquisition (RSTA) efforts. While theater assets maintain their defense of the APODs, SPODs, and priority geopolitical assets in the rear areas, corps and divisional forward area units provide air and missile defense coverage of the maneuver force and such critical assets as forward refueling and ammunition points, aviation forward operating bases, and potential choke points. Bradley Linebackers, Avenger, and MANPADS accompany the maneuver units as they advance to counter the threat's close battle air support platforms—helicopters and lethal UAVs. Avengers are deployed along routes of advance and Air Avenues of Approach to protect the force against threat fixed-wing/helicopters, cruise missiles, lethal UAVs, and RSTA UAVs. MEADS and/or PATRIOT (if brought forward) provide overwatch protection of maneuvering forces against cruise and ballistic missile threats, in addition to the enemy fixed-wing aircraft.

SHAPE THE BATTLESPACE

Defense of forces against threat missiles is gained through a common, integrated command and control architecture, shared air intelligence, and timely synchronized engagements of threat platforms by capable, lethal AMD forces. Theater and corps AMD systems can limit/deny the threat's use of TBMs and CMs to degrade preparations for decisive operations. Divisional systems can detect and engage CMs and UAVs in the forward areas. Collectively, these systems enable simultaneous operations in the defended airspace and assure the commander the freedom of maneuver, fires, and other airspace operations. Data from Joint Tactical Ground Station (JTAGS) and AMD sensor platforms can assist in determining TBM launch points and

may be transmitted to Army and other joint attack operations systems (e.g., MLRS, ATACMS, Apache) and active AMD systems for engagement.

PROJECT THE FORCE

AMD Project the Force operations focus on mission planning and actions from the United States, or other staging bases, to early entry and initial build-up in the theater of operations. Protection of the force projection base is of paramount importance. The land-based NMD system will protect the United States-based force projection capability as well as the United States population, industrial base, and infrastructure against limited ICBM attack of the American homeland. In deployments where the threat of air and missile strikes exist, the AMD units deploy with the initial force. The AMD deployed force consists of a mix of systems, tailored to meet mission and threat considerations. Theater AMD systems provide a two-tiered defense for the lodgment APOD/SPODs and initial force concentrations. Corps AMD assets are task organized for composite and complementary defense against the other aerial threats. Force warning and alerting to facilitate passive defense of the force is provided by JTAGS, Sentinel, and JLENS systems and is distributed by FAAD C2. MEADS will enhance Force Projection by reducing lift requirements to provide full spectrum protection for early entry forces and facilities.

SUSTAIN THE FORCE

Logistical complexes, embarkation/debarkation ports, and resupply points will be critical force assets and must be protected from air and missile attacks. The AMD units throughout the force provide the requisite warning and defense of these facilities and of the deploying and reconstituting forces.

How Air and Missile Defense Modernization Aligns with the Army Modernization Strategy

The plan to attain modernization goals identifies key AMD capabilities for current and future Army operational concepts (Force XXI, Army Vision 2010, and AAN) and is consistent with *Joint Vision 2010* and the Concept for Future Joint Operations. The strategy supports achieving full spectrum dominance in the far-term by establishing near leak-proof protection against all forms of TBMs, CMs, rotary-wing and fixed-wing platforms, to include protection of the continental United States. AMD investment recommendations are grouped in four components—**Information Dominance, Overmatch Capabilities, Essential Science and Technology/Leap-Ahead Systems**, and **Recapitalization** efforts. The modernization strategy emphasizes information dominance in the near-term by focusing on offensive and defensive efforts to achieve dominant battlespace awareness. This is accomplished through investment in command and control platforms that enhance early warning capabilities and the synchronization of our firepower. It also includes means by which we deny our adversaries the potential to gather information about our own forces on the battlefield. It supports overmatch capabilities throughout by investing in combat systems improvements using advanced technologies, such as PATRIOT Advanced Capability (PAC-3), that maintain an advantage over potential opponents. It provides focus for research and development to provide for future capabilities required for

AAN by identifying leap-ahead technologies that result in more deployable systems, such as MEADS, which can defeat predicted threats. Recapitalization allows us to extend the life of current systems through product improvements in Stinger and PATRIOT PAC-2 in order to maximize their usefulness. The synchronization of these investment component capabilities will lead to achieving full spectrum dominance.

A summation of the patterns of operation, the capabilities provided, the key system contributors to these capabilities, and the associated investment categories is presented in the following (Figure F-4).

Patterns of Operation	Required Capabilities	System/Investment Component
Information Dominance	Early Warning/Cueing/ Target Acquisition/ Army and Joint Interoperability Limit/Deny Surveillance Limit/Deny Surveillance Early Warning/Cueing/ Target Acquisition	FAAD C2/Sentinel/ JTAGS/AMDPCS *Info Dominance* Linebacker/Avenger/ Stinger/ PAC-3 *Overmatch* JLENS/MEADS *Essential R&D/Leap-Ahead*
Protect the Force	Defend Against TBMs/ Cruise Missiles/Helicopters/ UAVs/Rockets/Aircraft Early Warning/Alerting/Cueing	Linebacker/Avenger/Stinger/ PAC-3/THAAD *Overmatch* MEADS/CADEWS/JLENS *Essential R&D/Leap-Ahead* FAADC2/Sentinel/JTAGS/ AMDPCS *Info Dominance*
Decisive Operations	Defend Against TBMs/ Cruise Missiles/Helicopters/ UAVs/Rockets/Aircraft	Linebacker/PAC-3/Avenger/Stinger *Overmatch* MEADS/CADEWS *Essential R&D/Leap-Ahead*
Shape the Battlespace	Promote Freedom of Action by Denial of the 3d Dimension/ Integrate Fires/Provide Back-Tell TBM Launch Point Data	PAC-3/THAAD/ Avenger/Linebacker/Stinger *Overmatch* JLENS/MEADS/CADEWS *Essential R&D/Leap-Ahead* AMDPCS/FAAD C2/JTAGS *Info Dominance*
Project the Force	Early Warning/Integrated C3/ Protect the U.S. (Power Projection Base)	THAAD/PAC-3/Avenger/ Linebacker/Stinger *Overmatch* NMD/JLENS/MEADS *Essential R&D/Leap-Ahead* AMDPCS/FAADC2/Sentinel *Info Dominance*
Sustain the Force	Integrate/Defend Supported Elements	THAAD/PAC-3/Avenger/ Linebacker/Stinger *Overmatch*

Figure F-4

Challenges Ahead

Future air and missile threats will become increasingly sophisticated and increasingly lethal. The potential for TBMs and cruise missiles armed with weapons of mass destruction (WMD) increases. In addition, potential adversaries possess arsenals with large quantities of rockets, artillery, and mortar systems. Though "unsophisticated", these systems can deliver large quantities of munitions at concentrated locations in relatively short periods.

The AMD force must have the capability to counter these threats, literally from "mud to space." System ranges must be sufficient to engage beyond visual range (in the case of Stinger-based platforms) and over-the-horizon (in the case of AMD systems) to effectively negate or counter WMD platforms before they can release their payloads. Command and control must be interoperable, joint, and assured via redundant communications links. **The Nation must be protected against a potential ICBM threat** (Figure F-5).

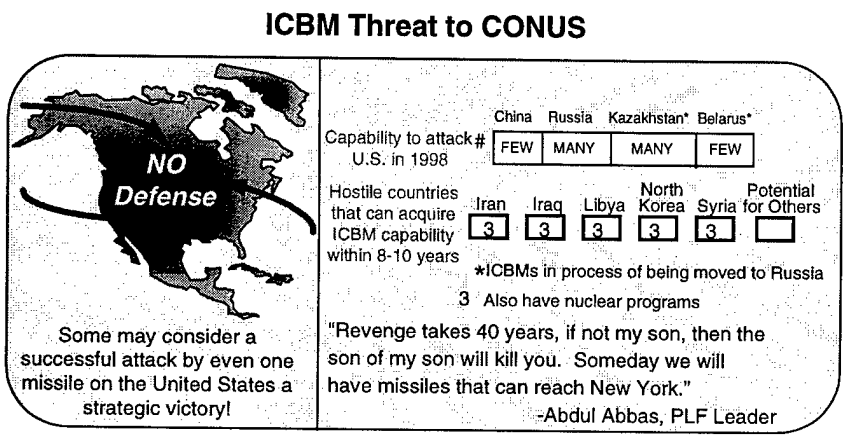


Figure F-5

The following investments achieve the major thrusts of current and future operational concepts. Information dominance is the key enabler for all 21st Century Army and joint operations, and is critical to achieving decisive victory. Maintaining overmatch capabilities will require sustained future investments. Overmatch systems will use increasingly capable improvements to defeat the threat. Investments in research and development will enable the leap-ahead systems envisioned in the Army After Next.

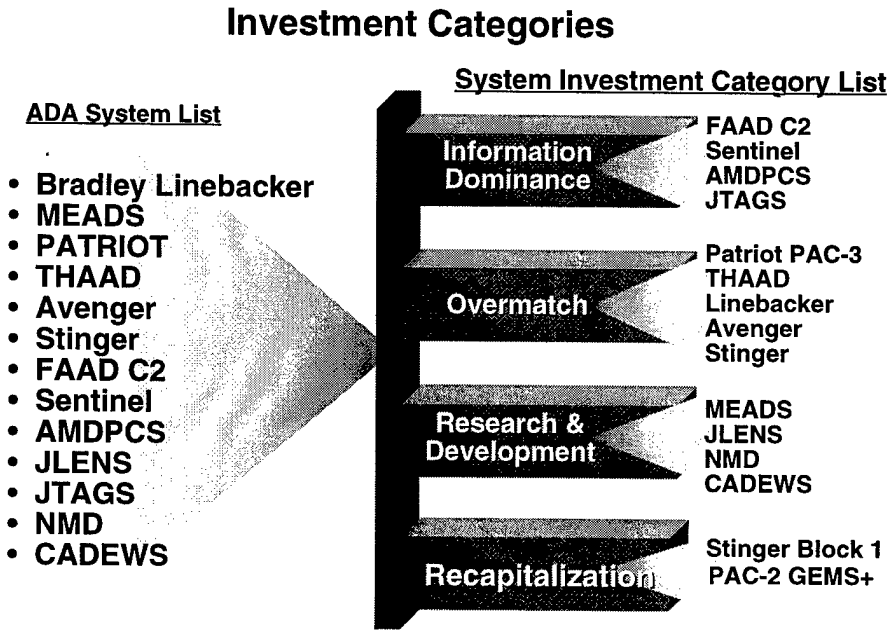


Figure F-6

SECTION 2: CURRENT PROGRAM ASSESSMENT

Overall Mission Area Modernization Assessment and Key System Ratings

This section provides an overview and assessment of our warfighting capabilities from the standpoint of where we are in the near-term and how our modernization strategy fulfills our objective requirements in the mid- to far-terms. While Figure F-7 appears to show a proliferation of ADA systems over the near-, mid-, and far-terms, it must be emphasized that successful air and missile defense depends upon a family of systems which are complementary in nature. These systems must be able to defeat an array of threats, literally, from mud to space. For example, Stinger Blocks 1 and 2 are extremely capable against rotary- and fixed-wing threats, but are of little use against TBMs. PATRIOT PAC-3 provides adequate lower-tier protection for Echelon Above Corps assets but is not deployable or mobile enough to provide protection for corps maneuver units—MEADS fills that gap. THAAD will meet the requirement for our initial capability to provide an upper-tier defense. The AMDPCS synchronizes the defense of these complementary systems of our AMD forces and, ultimately, ensures near-leak-proof defense that allows us to reach full spectrum dominance in the far-term.

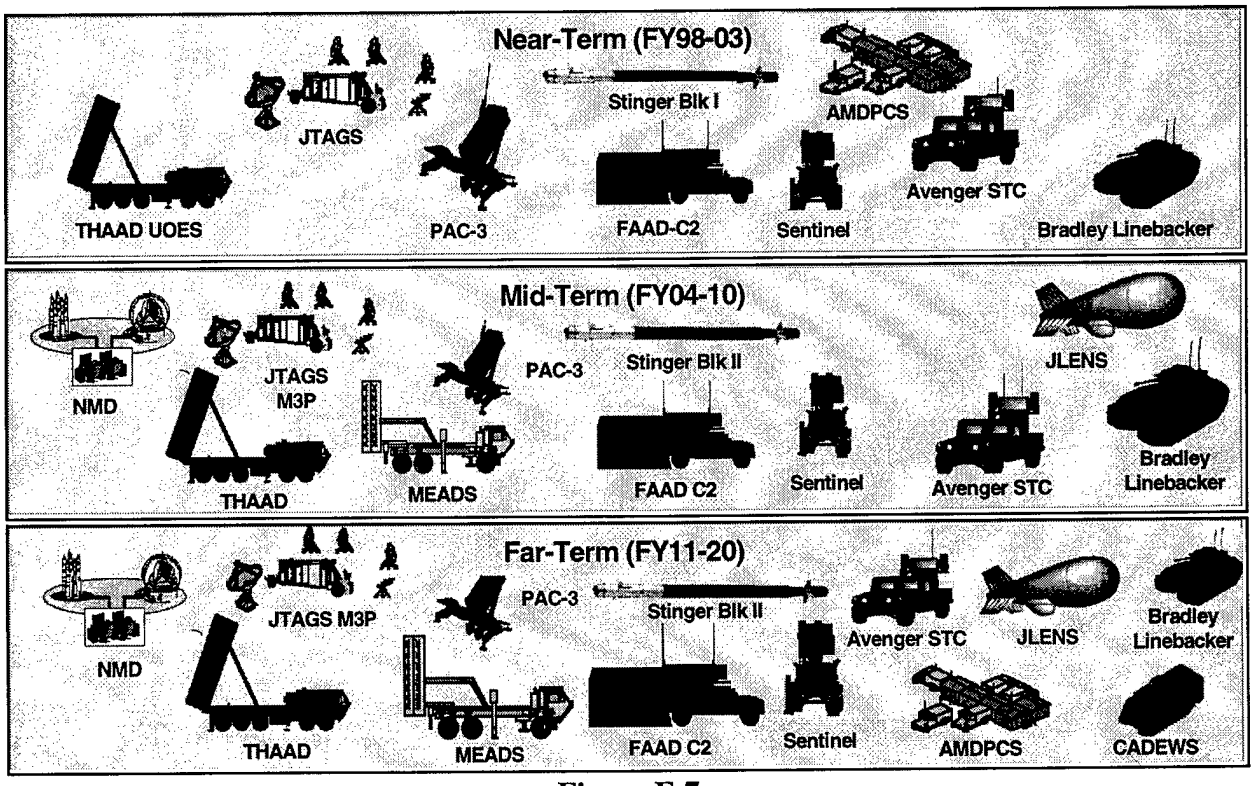


Figure F-7

The following is an assessment of Air and Missile Defense systems listed by investment component. The AMD Force maintains an overall **AMBER** capability to meet mission requirements and defeat the spectrum of aerial threats during the cited near-, mid-, and far-terms.

INFORMATION DOMINANCE: AMBER

System ratings are reflected in Figure F-8.

Air and Missile Defense – Information Dominance Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
FAAD C2	28 Bn Sets 19 Btry Sets	28 Bn Sets 19 Btry Sets	2015	AMBER	GREEN	GREEN	
Sentinel	115	115	2017	GREEN	GREEN	GREEN	
JTAGS	5	5	2017	GREEN	GREEN	GREEN	
AMDPCS	16	4	2015	AMBER	AMBER	AMBER	GREEN pending Result of WRAP ASARC

Figure F-8

FAADC2. The FAADC2 system provides automated engagement operations and force operations to SHORAD battalions and their supported force. The system integrates common hardware and software (CHS) equipment into a Standard Integrated Command Post (SICPS) subsystem and vehicular-and track-mounted SHORAD weapons (Figure F-9). Common Hardware and Software 1 (CHS-1) equipment in the initially fielded units, becomes logistically unsupportable in FY00/01 and is not interoperable with SINCGARS-SIP (being fielded to these divisions in the FY00/01 timeframe). The FAADC2/FBCB2 integrated software is being developed and will be tested during the FBCB2 LUT. This unforeseen HTI resulted in slipping BLOCK III (version 5.2) and BLOCK IV software up-grades by one year. Rating: **AMBER** turning to **GREEN.**

FAAD C2



Mission

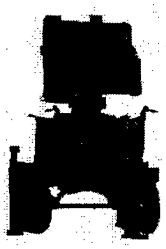
Provides an automated means of providing timely target data to SHORAD weapons to prevent fratricide and manage the air battle.

Key Features

- Provides a composite air picture to SHORAD weapon systems from air and missile defense sources
- Distributes threat and air battle control info to the supported force
- Reduces fratricide
- Provides 24-hour continuous opns
- Nets organic sensors

Figure F-9

Sentinel. The Sentinel system provides the required critical track surveillance of the forward areas, automatically detecting, tracking, and reporting targets (cruise missiles, UAVs, helicopters, and fixed-wing aircraft). The Sentinel P3I program provides extended range detection of the low-flying, reduced-signature platforms, such as cruise missiles and UAVs with a smaller radar cross section (Figure F-10). Rating: **GREEN**



Sentinel

Mission

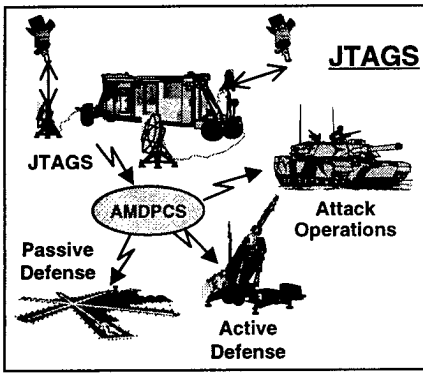
Provide acquisition, tracking, classification, and ID of cruise missiles, UAVS, RW and FW aircraft, and provide adequate target location to cue SHORAD weapons into field of view.

Key Features

- Detects cruise missiles, UAVS, rotary wing aircraft, and fixed wing leakers
- Reports location, flight parameters, classification of air tracks, identifies friendly aircraft
- Provides high mobility, reliability, ARM and ECM resistance

Figure F-10

Joint Tactical Ground Station. JTAGS (Figure F-11) provides the necessary connectivity and intelligence through the Defense Support Program (DSP) to expeditiously broadcast in-theater TBM warnings. In the latter part of the near-term, the JTAGS P3I Phase II will upgrade the five fielded JTAGS into Multi-Mission Processors (M3P) for integration into the Space-Based Infrared System (SBIRS). Phase II is necessary for continued JTAGS in-theater operations with the new constellation of SBIRS satellites, scheduled to replace the aging DSP in FY02-04. Rating: **GREEN**



JTAGS

Mission

Provide theater with real-time, space-based infrared warning of TBM launches and other tactical events.

Key Features

- Threat warning and cueing directly to theater commanders
- Allows destruction of TBM launchers via accurate launch point prediction
- Direct access to commo nets
- Supports all operational elements of TMD
- Air, truck, and sea transportable

Figure F-11

AMDPCS. The AMDPCS (Air and Missile Defense Planning and Control System) is underfunded. Preliminary indications are that this system will receive WRAP funding. Should this be the case the system will go to **GREEN.** The development and fielding of the AMDPCS to brigades and battalions will enhance engagement and administrative/logistical operations and result in the requisite interoperability across the force. Currently prototype equipment is fielded which has software not thoroughly tested. Funding shortfalls in the mid-term and beyond will result in insufficient quantities procured to defeat the emerging threat. Additionally, lack of RDT&E funding prevents integration of SHORAD, PATRIOT, and THAAD units into the C^2 network. Rating: **AMBER.**

OVERMATCH: AMBER

System ratings are shown in Figure F-12.

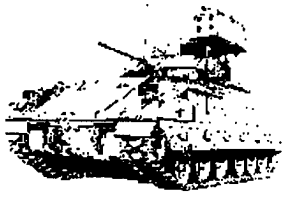
Air and Missile Defense - Overmatch Program Assessment

System	#Systems Required	#Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
BSFV/ Linebacker	99 2A2(ODS) 136 M2A3	99 136	2021	**AMBER** **RED**	**GREEN** **GREEN**	**GREEN** **GREEN**	RDT&E short fall in 99-01 for M2A3
Avenger	1381	1009	2008	**AMBER**	**AMBER**	**AMBER**	Amber in mid- and far-terms due to P3I shortfall
Stinger Block II	13819	9520	2008	**AMBER**	**AMBER**	**AMBER**	Funding does not meet objective requirements
Patriot	54 AC/6 ARNG	54 AC/4 ARNG	2010	**GREEN**	**GREEN**	**GREEN**	Not enough PAC3 missiles to meet predicted threat
THAAD	8	8	TBD	**AMBER**	**GREEN**	**GREEN**	Program restructured in FY97; FUE slipped FY04 to FY06

Figure F-12

BSFV/Bradley Linebacker. The currently fielded BSFV system (Figure F-13) has some capabilities against the fixed-wing aircraft, helicopter, UAV, and cruise missile threats. It is hampered, however, by its inability to receive "cueing" data—positioning information that directs the gunner to the target. Without such cueing, the gunners have difficulty detecting small signature platforms. Additionally, BSFV cannot maintain continuous protection of the maneuver force (the vehicle must stop while engaging), and crew survivability is at risk (Stinger team must dismount the vehicle to engage). The Bradley Linebacker M2A2 (ODS), with an integrated slew-to-cue and shoot-on-the-move capability, provides the mobility, survivability, and lethality required to protect the future maneuver force. The M2A3 RDT&E, which allows for the conversion of existing M2A3s to Linebacker, is currently unfunded in the near-term. Rating: **AMBER** turning to **GREEN.**

Bradley Linebacker



Mission

Provide maneuver forces with low altitude AD against CMS, UAVS, RW and FW aircraft

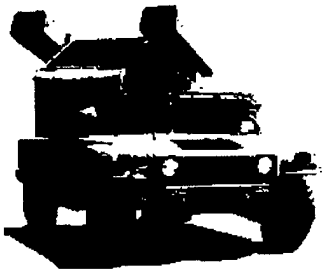
Key Features

- Kills CMS, UAVS, RW, and FW in close combat
- Can maneuver with supported force
- Multiple AD weapon system
  - Stinger
  - 25 MM gun

Figure F-13

Avenger. The Avenger system has the same capabilities and shortcomings (inability to receive "cueing data") as the BSFV. The addition of the Slew-To-Cue (STC) capability enhances the Avenger's detection, acquisition, and engagement of the low-flying, low observable cruise missiles and UAVs. STC digitally accepts sensor track data from the FAAD C2/Sentinel and automatically slews the Avenger turret, placing targets in the gunner's field of view. This lengthens the target engagement window and ultimately increases the probability of a kill (Figure F-14). System shortages exist due to the requirement to upgun the heavy divisional battalions from 24 to 36 Avengers. In addition, there is a lack of funding for other P3I items including the remote control, unit video tracking upgrades to the forward looking infrared (FLIR) system (improving visual positive identification capability of the current FLIR by 1.5 times), and fire control computer enhancements (improving integration with the combined arms team). Rating: **AMBER**

Avenger



Mission

Protect the force
- **BDE, div, & corps rear assets with low altitude air defense**
- **Protect against**
  - **UAVS**
  - **CMS**
  - **RW**
  - **FW**

Key Features

- Multi-service
- Rapidly deployable/lightweight
- All weather/day night
- 8 ready to fire stinger missiles
- .50 cal machine gun
- Shoot on the move
- 2 man crew

Figure F-14

Stinger. The follow-on Block II upgrade provides the requisite capability against the advanced cruise missile, UAV, helicopter, and fixed-wing aircraft threats. Incorporating an advanced focal plane array seeker, the Block II tracks cruise missiles at extended ranges, counters the stand-off helicopter in clutter, improves accuracy and infrared counter-countermeasures, and adds a full night capability. The Block II lacks sufficient RDTE funding to reduce schedule and technical risk (Figure F-15). Rating: **AMBER**

Stinger



Mission

Provide low altitude AD against cruise missiles, unmanned aerial vehicles, rotary wing and fixed wing aircraft for brigade through EAC forces and critical assets.

Key Features

- Fire and forget
- Guidance - IR/UV
- Reprogrammable microprocessor
- Used on multiple platforms
- Only AD system in forward area
  - Block I - defeats current through mid-term threat
  - Block II - defeats far-term threat

Figure F-15

PATRIOT. The PAC-2 does not provide the increase in battlespace and enhanced lethality to counter the proliferating and evolving TBM threat. As a result, PATRIOT is evolving to the PAC-3 configuration through a series of hardware "sweepdowns" to all fielded equipment and accompanying software changes. PAC-3 incorporates upgrades to the radar set, engagement control station, and launchers with the new design, high velocity, hit-to-kill PAC-3 missile. The PAC-3 capabilities will more than double the current defended area on the ground against TBMs, kill TBMs with twice the range of the Gulf War threat, and increase missile accuracy and lethality to effectively intercept and destroy TBMs/cruise missiles with WMD warheads and air breathing threats (Figure F-16). The funded PAC-3 missile procurement is 1200 missiles, which is projected to resource only 5 of the 10 PAC3 battalions. Rating: **AMBER**

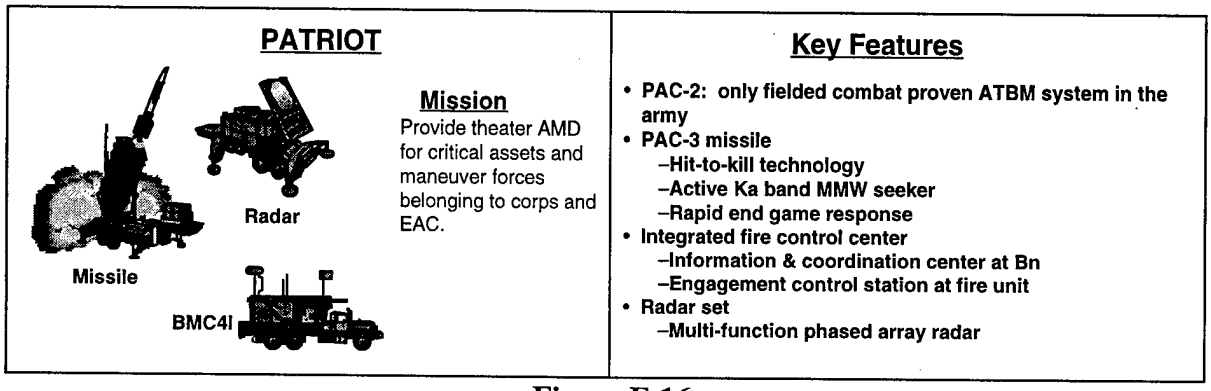


Figure F-16

THAAD. The Theater High Altitude Area Defense System (THAAD), currently in development, will provide wide area protection against medium range ballistic missiles (MRBM) and short range ballistic missiles (SRBM). It will assure near leak-proof TBM defense in conjunction with lower tier systems. The THAAD User Operational Evaluation System (UOES), to be fielded in FY00, complements PATRIOT by providing some capability against medium range TBMs. The UOES will be used in testing to provide early user input into the design of the objective system and will be available for limited use during a national emergency. The UOES, however, is unable to defend multiple high priority assets over extended distances due to limited numbers of missiles, sensors, and supporting equipment. The objective THAAD fielding in 2006 provides the objective two-tiered defense of CINC critical assets in theater in the mid-term. Rating: **AMBER** turning to **GREEN.**

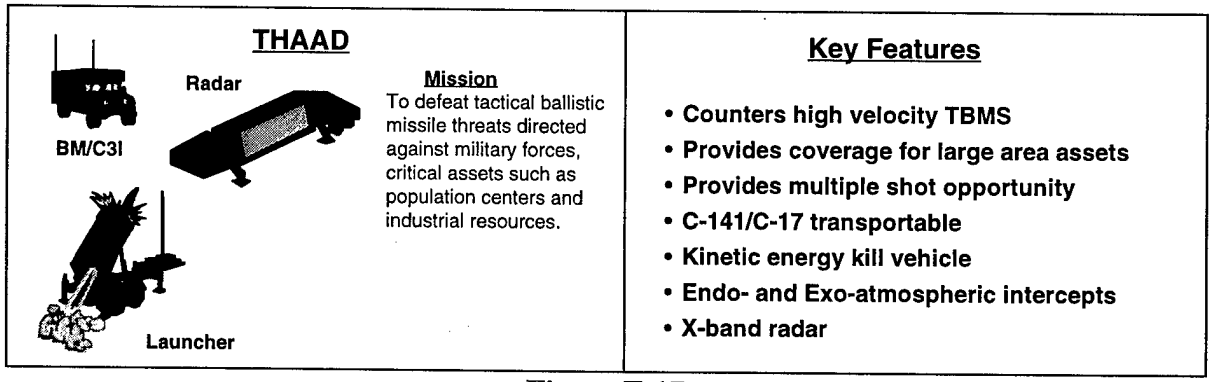


Figure F-17

ESSENTIAL RESEARCH AND DEVELOPMENT AND LEAP-AHEAD TECHNOLOGY

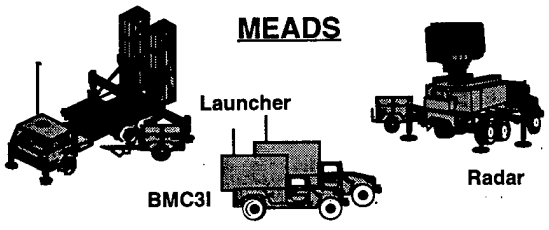
Air & Missile Defense - Essential R&D and Leap-Ahead Programs

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• MEADS • JLENS • NMD • CADEWS	• BMDO R&D Program	• Nanoscience (SRO) • Microminiature, Multifunctional Sensors (SRO(E)) • Hypervelocity Physics • BMDO R&D Program

Figure F-18

Near-Term (FY98-03)

Medium Extended Air Defense System (MEADS). MEADS is being designed to provide deployable lower-tier (low-to-medium altitude) air and missile defense for rapid and deliberate force projections and maneuver forces. Intended to replace PATRIOT in the corps ADA brigades, MEADS is significantly lighter, more mobile, and provides greater protection for our forces (Figure F-19). It will be fully capable against short range TBMs, CMs, UAVs, helicopters, and fixed-wing aircraft. It will complement the SHORAD system capabilities by providing an overarching layer of protection for the forward maneuvering forces. However, adequate funding for full development and fielding is lacking. Currently, funding ends in FY99 with the completion of the program definition/validation phase.



Mission

Defends corps maneuver forces and critical Assets against the ballistic missile and air Breathing threats in force projection operations.

Key Features

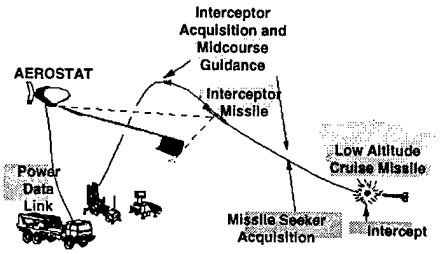
- Defeats both tactical missiles and air breathing threats
- Air transportable by C-130, C-141, CH-47, and C-160
- Tactically mobile to protect maneuver forces
- Interoperable with other army services and allied systems
- 360 degree coverage against all threats

Figure F-19

Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS). The JLENS is being explored as a cost-effective, airborne sensor platform to support over-the-horizon engagements of cruise missiles. JLENS will enhance cruise missile defense capabilities by significantly extending the detection/warning range and the defended area footprint for AMD systems (Figure F-20). The joint program (Army lead, with Navy and Air Force support) will yield one small/tactical JLENS operational unit set by FY03 with an option for two deployable prototype (large/strategic) systems available in FY05. The JLENS's limited availability (only one

system projected/funded for fielding) and status (deployable prototype) restrict optimal use of its surveillance capabilities.

JLENS



Mission

Provide over-the-horizon surveillance and precision tracking data to enable the air directed surface to air missile concept to increase battlespace for CM defense.

Key features

- Expand battlefield surveillance and engagement against land attack CM
- Expand battlespace for systems such as PATRIOT, MEADS, and AEGIS

Figure F-20

NMD. The National Missile Defense (NMD) program is being designed to provide effective protection of all 50 states against small attacks (a few missiles) of limited sophistication. The program approach allows the preservation of a capability to deploy a NMD system within three years, while allowing the United States to continue the advancement of technology, add new elements to the system, and possibly reduce deployment timelines. There is no fielding decision/timeline. The initial NMD system, even if fielded, would provide only a limited capability against accidental, unauthorized, or intentionally limited ICBM attack and does not have the additional missiles, sensors, or sensor netting required to counter a sophisticated attack.

CADEWS. The Counter Air Directed Energy Weapons System (CADEWS) is envisioned to provide warfighting capabilities utilizing directed energy (i.e., laser and high power microwave) technologies in a strategically deployable, tactically mobile, surface-to-air weapons system. The system will utilize an integrated suite of directed energy systems to provide protection of forces in the forward area and defense of scarce, high value assets. It will be capable of engaging an expanded threat set which includes TBMs, CMs, UAVs, rockets, artillery and mortar rounds, helicopters, and fixed-wing aircraft. RDT&E is projected to begin in 2006. CADEWS is currently unfunded.

Mid-Term (FY04-10)

Many of the Army's R&D program investments are applicable across mission areas. Many of the advanced sensors, C4, and missile technology developments described in other annexes apply to the air and missile defense annex. The Ballistic Missile Defense Office's (BMDO) Advanced Interceptor Technology (AIT) program can provide significant opportunities for air defense systems. However, the Army does not direct the BMDO AIT program and must assess leveraging opportunities after technology developments are completed.

Far-Term (FY11-20)

For the far-term, Army basic research in three areas may be key to enable AAN missile and defense capabilities: Nanoscience, Microminiature, Multi-Functional Sensors, and Hypervelocity Physics.

The Strategic Research Objective (SRO) for nanoscience will support the development of the next generation of sensors and guidance systems to significantly enhance the performance of precision weapons. The emerging (SRO) on microminiature, multifunctional sensors will enable the use of an adaptive, integrated network of sensors for threat tracking, targeting, and intercept. Hypervelocity physics provides the basis for tunable lethality through the application of electric armaments and hypervelocity weapons.

RECAPITALIZATION: AMBER

Air & Missile Defense--Recapitalization Program Assessment

System	#Systems Required	#Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Stinger Block I	12,250	10,487		AMBER	AMBER	AMBER	Funding does not meet program objectives
PAC-2 (GEM+)	1100	0		RED	RED	RED	Unfunded

Figure F-21

Stinger Block I. The Stinger reprogrammable microprocessor missile is currently being improved to increase missile accuracy and performance against slow moving targets and those employing advanced counter-countermeasures, provide a capability against cruise missiles, and improve night capability. The Block I is insufficiently funded for the missile (only 10,597 missiles to be modified) upgrade of Force Packages 3 and 4 platforms to fully utilize missile capability. Rating: **AMBER**

PAC2 Upgrade (GEM+). The PATRIOT system continues to improve over time. The current PAC2 system has some capability against the short range ballistic missiles, UAVs, and high altitude CMs and full capability against fixed-wing aircraft. Improvements to the PAC2 missile, such as the Guided Enhanced Missile + upgrade, enhance system capabilities against current/future cruise missile threats. GEM+ allows PATRIOT units to defend a larger area, and therefore, more assets at a greater range. **GEM+ is unfunded.** Rating: **RED**

SECTION 3: CONCLUSION

Force protection from such third-dimensional threats as TBMs, CMs, UAVs, helicopters, fixed-wing aircraft, and rockets is critical to the achievement of full spectrum dominance. AMD will play an increasingly important warfighting role as threat aerial systems proliferate and improve. While currently fielded systems provide capability against today's threat, additional systems/capabilities are required to meet tomorrow's threat.

The AMD modernization strategy identifies the capabilities needed to meet and overmatch the evolving threat. This strategy incorporates procurement of new systems (e.g., THAAD, MEADS), modifications/upgrades to fielded systems (e.g., Bradley Linebacker, PAC-3, Stinger Block II, Sentinel, AMDPCS, FAAD C2), and consideration of and experimentation with emerging technologies (e.g., JLENS, CADEWS). While funding constraints preclude the timely fulfillment of the overall AMD modernization strategy, significant portions of the strategy are being implemented. **Unfortunately, key "show-stoppers" such as MEADS, Bradley Linebacker, and AMDPCS are either unfunded or underfunded. The inability to field these systems in the quantities/configurations required will degrade the AMD force protection capabilities. POM 99-03 issues are described in Figure F-22. These shortfalls require reliance on other Services and allied capabilities to accomplish full spectrum dominance and the protection of key theater assets, in addition to friendly maneuver forces.**

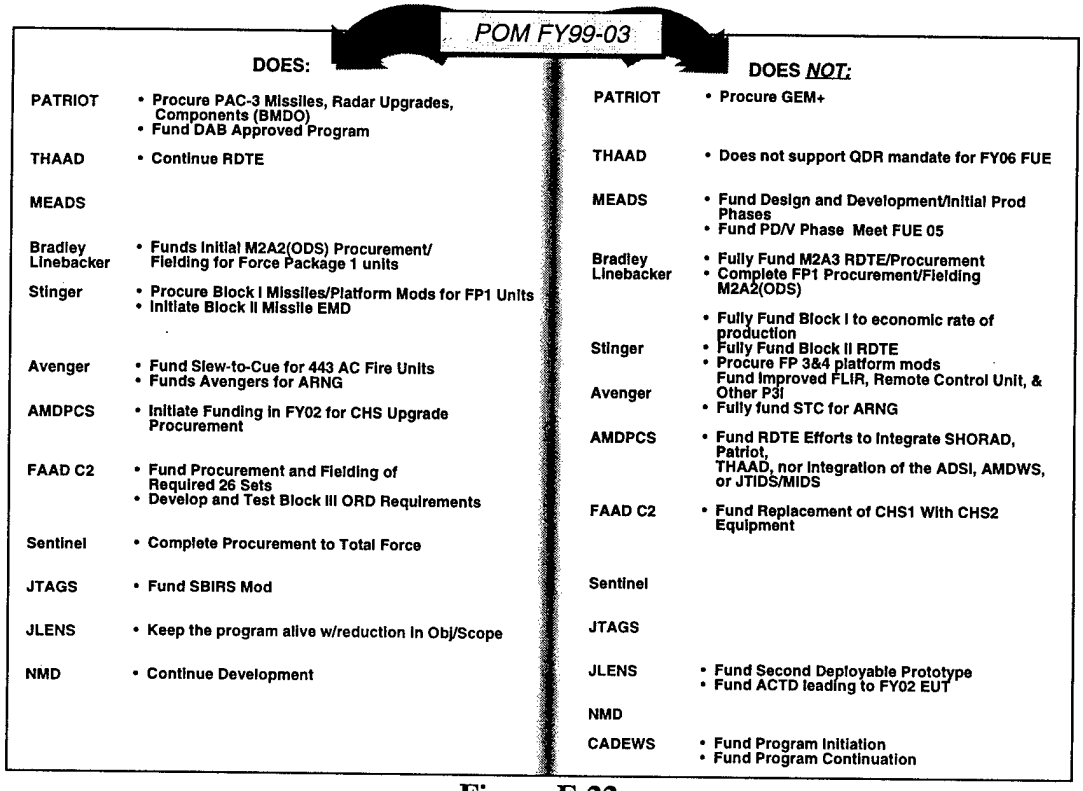


Figure F-22

ANNEX G: AVIATION

SECTION 1: INTRODUCTION

Overview

The challenges of the 21st Century demand a highly mobile and responsive force, capable of leveraging information technologies for effective and synchronized operations. Aviation's modernization strategy is a total Army plan, providing the response to meet these challenges and to move beyond them, to the full-spectrum dominance objective of Army Vision 2010 and beyond. Coupled with Army aviation's inherent strengths of mobility, lethality, and versatility (Figure G-1), a total Army approach to aviation modernization ensures continued relevance as the Army reshapes to meet the evolving threat and mission requirements of the Army After Next (AAN) timeframe.

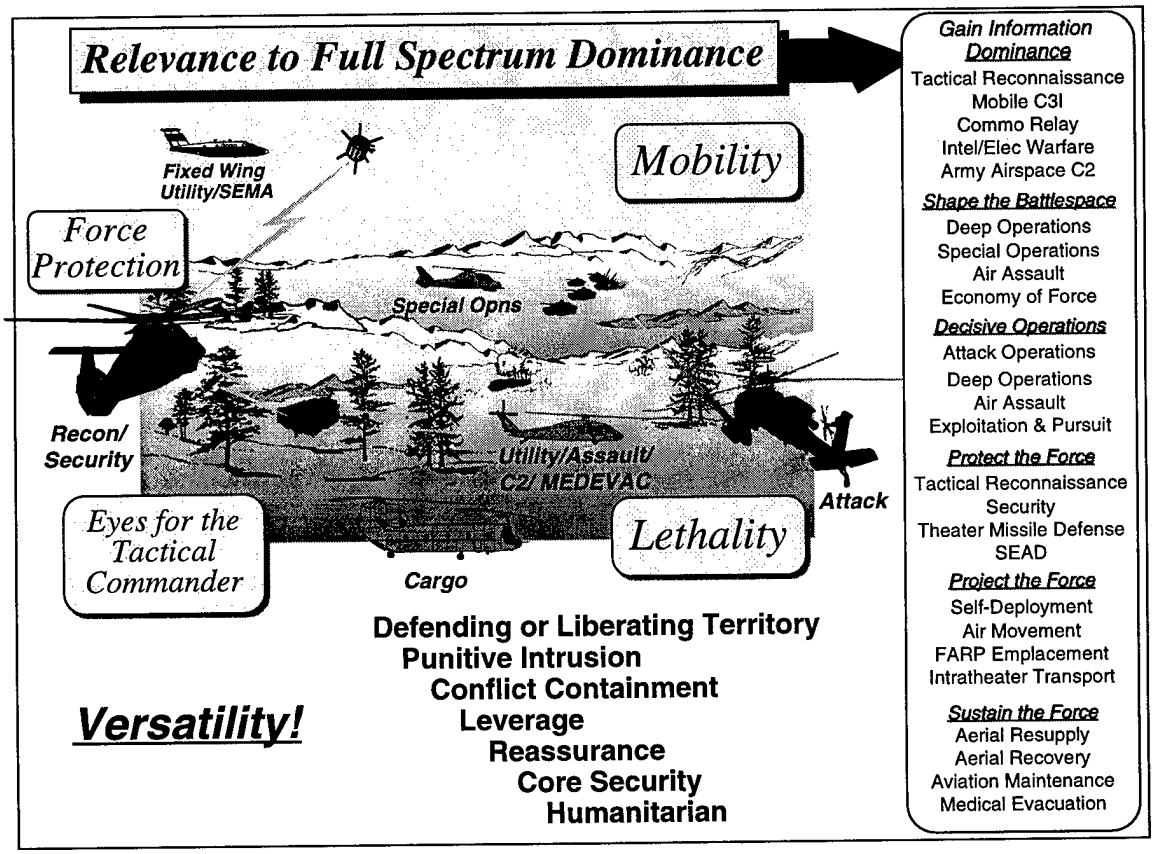


Figure G-1

Aviation provides combat, combat support, combat service support, and special operations across the spectrum of full-dimensional operations. *Air Cavalry/Reconnaissance* units conduct reconnaissance and security operations to provide the tactical commander critical combat information, early warning, and force protection. *Attack helicopter* units, with the

capability to deliver precise, lethal fires without massing forces, provide a unique maneuver force that contributes to all forms of offensive and defensive combat. *Utility and cargo helicopter* units provide tactical air movement of combat forces and their assets, allowing commanders and their staffs to command, rapidly traverse, see the battlefield, and perform front line medical evacuations. *Special Operations Aviation (SOA)* conducts a broad spectrum of combat and combat support missions. *Fixed wing aircraft* deliver essential combat support and combat service support, conducting operational airlift, intelligence and electronic warfare, and intratheater personnel and cargo transportation. *Special Electronic Mission Aircraft (SEMA)* provide communications/ signal intelligence and electronics countermeasures. *Tactical Air Traffic Services (ATS)* units provide a continuous flow of joint airspace information between commanders and airspace users to enhance airspace management, situation awareness, and combat effectiveness. Collectively, Army aviation is ideally suited to provide the joint force the lethality, speed, mobility, and versatility required for responsive worldwide demands.

Priority in resourcing aviation readiness is given to modern, sophisticated, high impact aircraft. Risk is balanced by accepting inadequate numbers of aircraft in the sustaining accounts and by providing reduced resources in lower priority units. Recapitalization funding is maintained to guard against fleet obsolescence and rising operating and support (O&S) costs. This plan provides the Army roadmap to meet near-term priorities, then move to meet the challenges of the mid- and far- terms to help the Army achieve its ultimate objective—full-spectrum dominance.

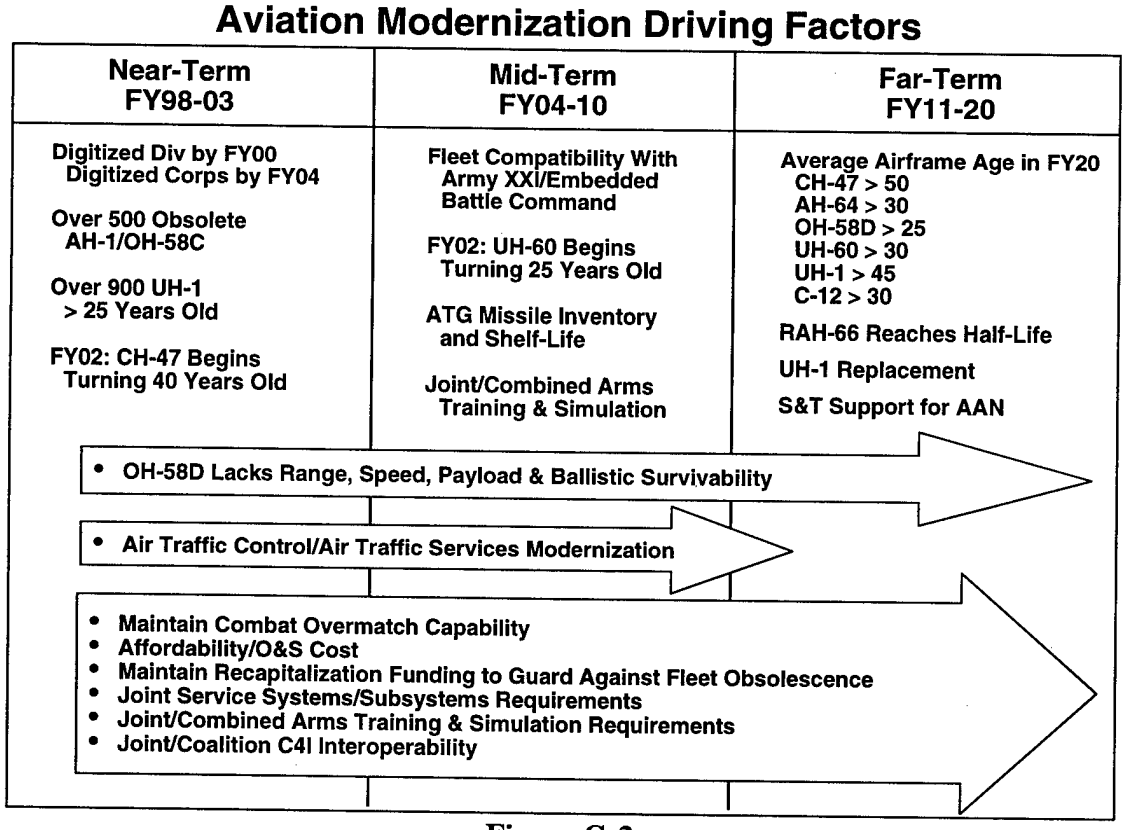


Figure G-2

Aviation modernization is driven by a number of critical factors as shown in Figure G-2. A past and current focus on recapitalization (OH-58C to OH-58D, CH-47A/B/C to CH-47D to ICH, AH-64A to AH-64D), and stretched, delayed, and/or canceled procurements (UH-60L, RAH-66, and Joint Transport Rotorcraft (JTR)) have created a predicament for future modernization. Significant numbers of obsolete AH-1 and OH-58C remain in the inventory. Decisions to delay the procurement of the RAH-66 force retention of the OH-58D Kiowa Warrior beyond the FY 2020 timeframe, requiring additional refurbishment efforts to be programmed and budgeted in the far-term. Shortages of UH-60 aircraft force the retention of aging UH-1. Both the UH-60 and CH-47 fleets begin exceeding their projected useful life at the turn of the century and require service life extension and modifications for Army XXI interoperability. The problems of an aging fleet are compounded by battlefield digitization requirements and the interoperability challenges of an aviation force which frequently crosses division boundaries, conducts deep operations, and requires joint airspace coordination. Aviation's supporting programs (avionics, aircraft survivability equipment, air traffic services, aircrew integrated systems, aviation ground support equipment, weapons) and Science and Technology (S&T) base must remain postured for life extension efforts and future/next generation aircraft procurement. Additional challenges lie ahead in addressing combined arms and joint training and simulation needs.

These driving factors focus aviation modernization to the primary objectives shown in Figure G-3. These objectives are: (1) solve Army aviation's most critical battlefield deficiency—tactical reconnaissance and security, (2) maintain attack overmatch and world class attack helicopter capability into the 21st Century, (3) enhance Command, Control, Communications, and Intelligence (C3I) and joint/combined interoperability through battlefield digitization, (4) recapitalize aging utility, cargo, and fixed wing fleet until replacement is possible, and (5) develop technology underpinnings for *Joint Vision 2010*/AAN requirements.

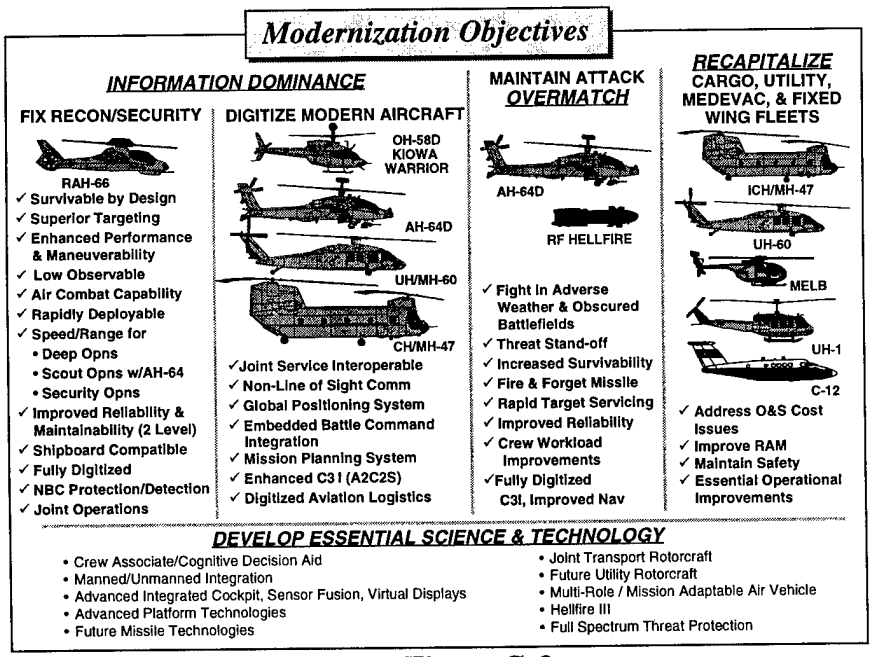


Figure G-3

The RAH-66 remains Army aviation's highest priority —providing leap-ahead capabilities enhancing the Army's information dominance and combat overmatch objectives. The Comanche, which executed its first flight in 1996, introduces major technological advances in the acquisition and processing of battlefield information, rotary wing aircraft signature reduction, and logistical support features. Comanche is one of the key systems of the joint digital battlefield. Fielding strategies place Comanche first in Air Cavalry units, where it will provide accurate and timely response to the tactical commander's firepower or combat information needs and security for the fast paced, transitional forces of the future. It will also provide critical combat power during early/forced entry operations as the attack aircraft in light divisions, complement the Longbow Apache in a scout role by closing undetected to acquire targets, and meet the requirements for the SOA light attack platform.

The OH-58D Kiowa Warrior, as an interim aircraft until Comanche is fielded, provides some of these capabilities, although with some risk due to deficiencies in range, speed, survivability, and weapons payload. Equipped with electro-optical target acquisition and armament, the OH-58D Kiowa Warrior has improved night fighting and reconnaissance capabilities not provided by the AH-1. As Comanche is fielded, Kiowa Warrior is cascaded to lower priority units allowing AH-1 retirement. At a minimum, Kiowa Warriors cascaded to the Strategic Reserve divisional cavalry squadrons and light infantry division beginning in FY 2009 will require additional refurbishment and capability enhancement to remain relevant to Army XXI. These aircraft will average approximately 17 years of age when cascaded and will not be fully retired in the strategic reserve until FY2022.

Aviation modernization also occurs in vital supporting programs that provide essential hardware, support equipment, and the new technologies required to modernize and digitize the force. Aviation's primary digitization thrusts are toward programs which enhance planning, situational awareness, joint/long range communications, command and control, airspace management, logistical responsiveness, and operational tempo. Special emphasis is placed on transferring threat and target information to/from sensor and weapons platforms (such as JSTARS, national satellite assets, RAH-66, or AH-64D) to the deciders and shooters in as close to real time as possible. Logistics modernization focuses on digitization and automation initiatives to improve diagnostics/functionality and to automate routine maintenance and logistics procedures. Air Traffic Services modernization replaces old, outdated equipment with smaller, lighter, digital systems. Aviation must also equip aircraft to avoid operational restrictions under emerging requirements for civil airspace utilization. Aircraft Survivability Equipment programs seek to provide countermeasures ahead of advances in threat air defense capabilities in an integrated approach which improves effectiveness and aircrew situation awareness. The focus of Aircrew Integrated Systems modernization is providing a mission tailorable aircrew ensemble which integrates components to improve safety of flight, crewmember survivability, and efficiency. In addition to the RF HELLFIRE missile program, aviation weapons development is driven by laser HELLFIRE shelf life and warhead effectiveness, air-to-air missile effectiveness in clutter, and the need for a light weight/low cost precision munition suitable against soft to lightly armored targets.

Battlefield digitization and modernized systems increase the criticality of a concurrent training/simulation strategy. This strategy complements aircraft modernization by harnessing computer technology for the appropriate integration of live, virtual, and constructive simulation to train and sustain combat ready crews and units. Central to this strategy are four unfunded/underfunded training systems: Aviation Combined Arms Tactical Trainer (AVCATT), Home Station Instrumentation (HSI), Area Weapons Scoring System (AWSS), and Kiowa Warrior Crew Trainer.

The AH-64D Longbow Apache is a key element of the Army's "maintain combat overmatch" objective. The AH-64D, with First Unit Equipped (FUE) scheduled to occur in 1998, provides unprecedented survivability, firepower, and capability to fight worldwide in day/night, adverse weather, and obscured battlefields. The Longbow millimeter wave Fire Control Radar (FCR), Radio Frequency Interferometer (RFI), fire and forget Radio Frequency (RF) HELLFIRE missile, precision direction finding to threat RF emitters, and cockpit management and digitization enhancements give the Army attack helicopter technological superiority well into the 21st Century.

The Mission Enhancement Little Bird (MELB) will modernize the SOA MH/AH-6J fleet to a standardized multi-mission aircraft by upgrading power and gross weight, insertion of digital technologies, and safety and other upgrades to meet a variety of special mission requirements. SOA MH-60 and MH-47 aircraft will require service life extension and incorporation of Army common upgrades in the mid-term.

The UH-60 Black Hawk remains the foundation of the Army's utility helicopter force. UH-60L procurement is currently programmed to end in FY 1999. However, the recognized doctrinal requirement for a third assault company in the Air Assault Division and warfight light infantry divisions, coupled with existing TOE shortages in the warfight, create a critical unfunded need for approximately 90 additional UH-60L aircraft. The UH-60Q Black Hawk modification program will provide first to fight units with helicopters which satisfy MEDEVAC mission requirements. A UH-60 Modernization/Service Life Extension Program (SLEP), programmed to begin in FY02, will address requirements to extend the UH-60's operational effectiveness through the FY25 timeframe and insert technologies required to effectively communicate and navigate on the digital battlefield.

The UH-1 continues to fill UH-60 shortages for general support, command, light utility, and assault missions, and for documented Table of Distribution and Allowances (TDA) needs. Approximately 900 aging UH-1 Iroquois must be retained in table of organization and equipment (TOE) and TDA units without continued UH-60 or follow-on utility aircraft procurement. An immediate priority is replacing reserve component UH-1s in the warfight in Light Utility Helicopter (LUH) battalions at Corps. The Army is accelerating the requirements determination process to identify a replacement for these aircraft beginning in the FY 2001 timeframe. Long term retention of the UH-1 in the strategic reserve and in TDA units will require capability enhancements and life extension. An in-depth assessment of alternatives and the associated costs for enhancements and life extension initiatives is planned for completion NLT 1st quarter FY

1999. Even with a near-term program start, realistic UH-1 SLEP or replacement rates will stretch UH-1 fleet modernization well beyond FY 2010.

The CH-47D sustainment program includes an engine upgrade and an Improved Cargo Helicopter (ICH) initiative. These efforts substantially improve CH-47D lift capabilities, insert digital capabilities, and extend aircraft life, thus keeping this aircraft relevant to our modernized force. The CH-47 ICH will remain the Army's primary cargo helicopter until the JTR can be procured in the 2020 timeframe.

The Army must also tackle the pressing problem of sustaining Vietnam-era legacy systems (OH-58A/C Kiowa, AH-1 Cobra) until they can be retired. The Force Design Update 97-1 decisions eliminate OH-58A/C from the TOE force by removing target acquisition and reconnaissance companies/platoons. The AH-1 will be retained in the Strategic Reserve until finally displaced by OH-58D Kiowa Warrior and AH-64D Apache made available through RAH-66 fielding. Initiatives underway by the National Guard will accelerate AH-1 retirement . Remaining AH-1s must be sustained until cascading aircraft finally eliminate them from the inventory in the FY16 timeframe; complicating personnel management, training, and logistics.

The objective of fixed wing aircraft modernization is five standard platforms for short, medium, and long range utility, cargo, and SEMA requirements. Army fixed wing aircraft dedicated to Operational Support Airlift (OSA) will complete their migration into the Joint Operational Support Airlift Command's integrated scheduling system and provide visibility of all Army OSA aircraft to the joint community. Ownership of OSA assets will remain with the Army. The short range workhorse of the OSA fleet will continue to be the C-12, with the UC-35A satisfying the medium range requirement.

Essential enabling technologies in electronics, systems and man-machine integration, advanced air platforms, propulsion systems, and weaponization provide Army aviation with key capabilities for insertion into current systems or incorporation into next generation/future systems in the mid- and far-term. Key capabilities include: cognitive decision aiding to reduce crew workload and increase situation awareness; a third-generation cockpit that takes advantage of leap-aheads in open-system architectures, avionics and sensor fusion, virtual displays and human interfaces; advanced rotor designs and controls; significant reductions in specific fuel consumption and increases in power-to-weight ratios; and improved target acquisition and precision engagement that increase stand-off range and lethality. These capabilities will maintain aviation's versatility and relevance for *Army Vision 2010* and AAN, providing the bridge from information dominance to full-spectrum dominance.

Aviation's modernization strategy is a balanced, risk minimizing approach. Sustainment programs address reliability and safety upgrade requirements where current and projected needs are being met. Technology insertions are used to recapitalize existing systems to adjust to evolving mission requirements, capitalize on leap-ahead technologies, or extend aircraft life when new aircraft procurement is not cost effective or feasible. New system acquisition and aging aircraft retirement are outlined when recapitalization is not viable. The aviation modernization strategy contributes to total Army effectiveness, involving both active and reserve

components. As illustrated in Figure G-4, as new systems are fielded to first to fight units, more capable systems are cascaded into the Reinforcing Force and Strategic Reserve. It also illustrates the funding challenges that lie ahead. FY 2020 projections show Reserve Component LUH battalions in the warfight and Strategic Reserve utility organizations continue to operate with UH-1s approaching 50 years old. Implementation of this strategy focuses resources on aviation's highest priority needs and provides the greatest return on investment for the Army.

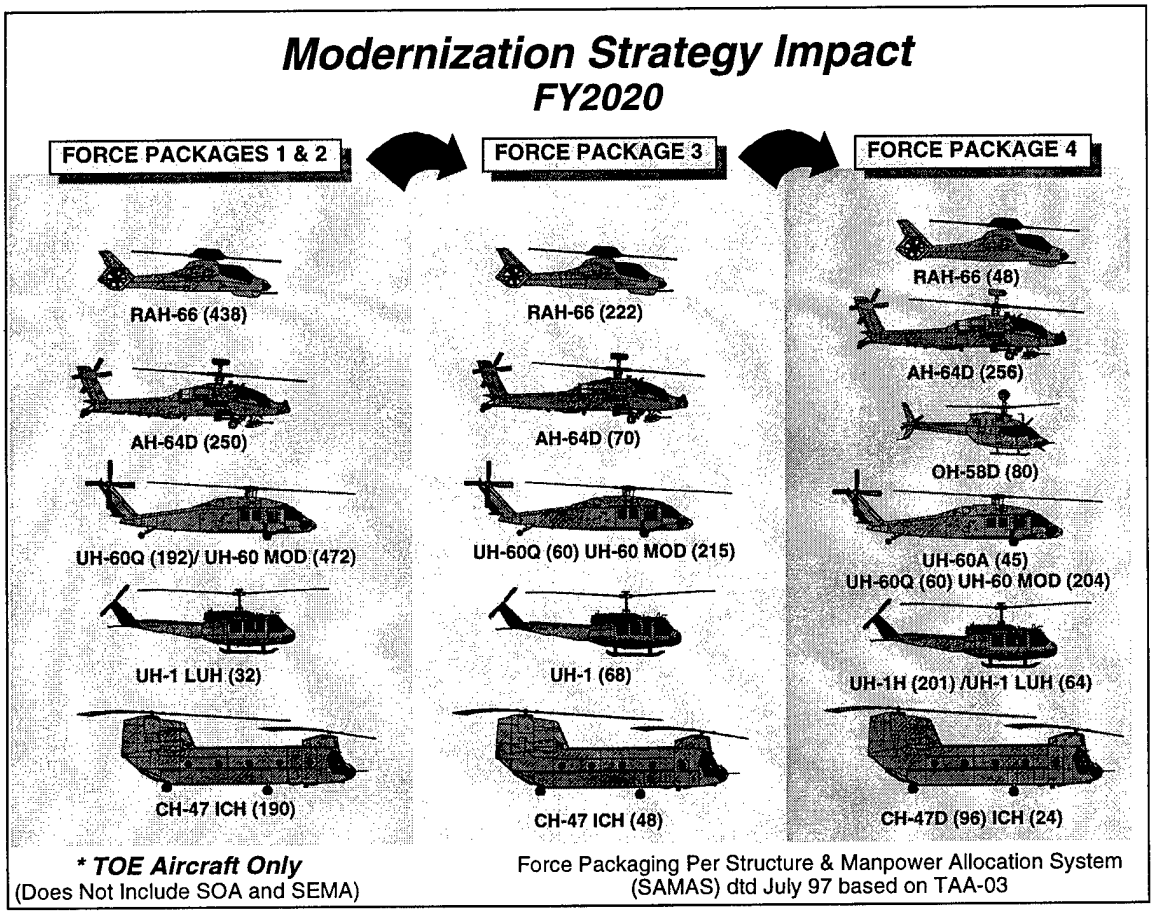


Figure G-4

SECTION 2: CURRENT PROGRAM ASSESSMENT

Overview

This section provides an overview and assessment of our warfighting capabilities from the standpoint of where we are in the near-term, and how our modernization strategy fulfills our objective requirements in the mid- to far-terms.

ROTARY WING MODERNIZATION DESIGN GOALS

Figure G-5 depicts unit structure for the basic building blocks of the rotary wing aviation force. The impact of the Aviation Restructure Initiative (ARI) is evident in the near-term as the number of aircraft types within a unit are reduced and utility aircraft support is consolidated to reduce personnel and support costs. The RAH-66 Comanche is the centerpiece of this plan, replacing the 1960 technology AH-1 aircraft and the OH-58D Kiowa Warrior in air cavalry units and light division attack battalions. In addition, it will replace AH-64 aircraft employed in the scout role in all heavy division/corps attack battalions.

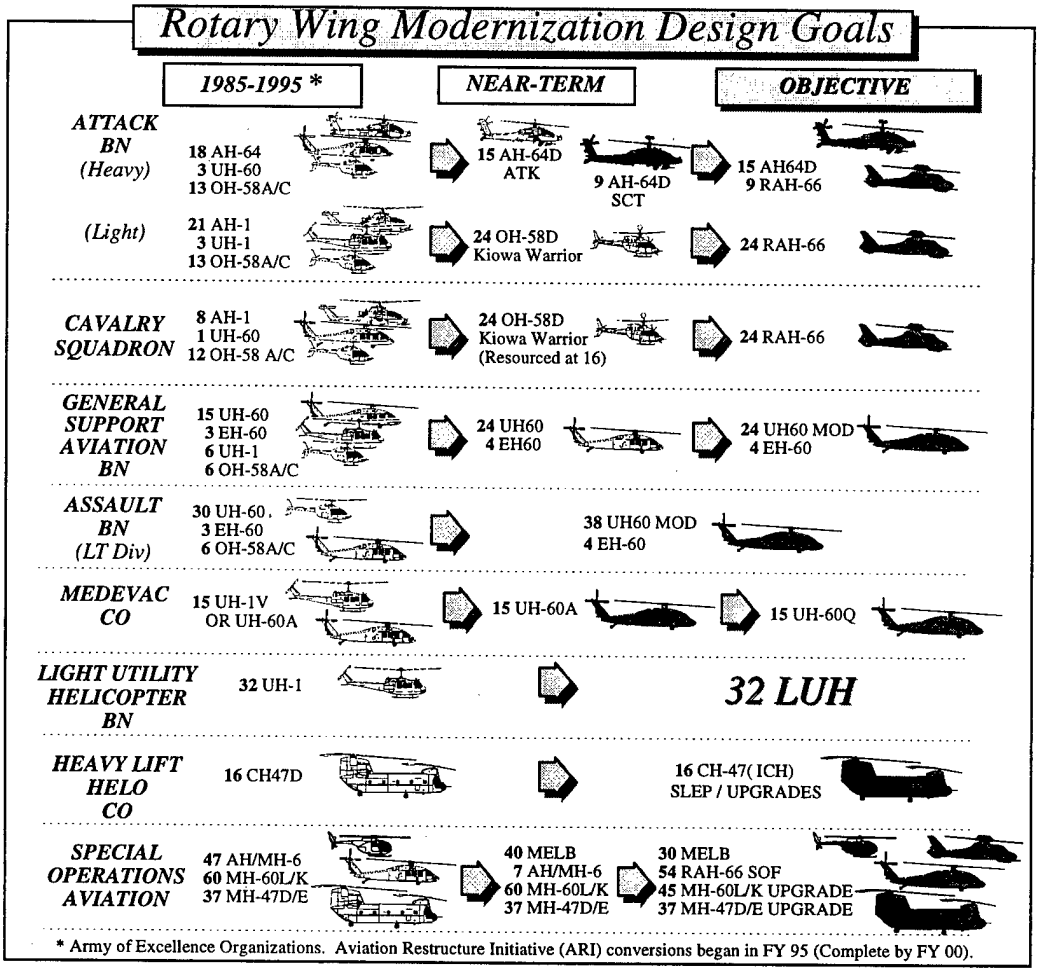


Figure G-5

Total rotary wing requirements are shown at Figure G-6. This total force requirement of 4147 rotary wing aircraft represents more than a 50% reduction in aircraft over the FY87 level.

Objective Force Requirements



RAH-66	AH-64D	Light Utility		UH-60L/ UH-60MOD	UH-60Q	CH-47 ICH JTR
288	160	32	*Force Package 1*	301	117	112
150	90	0	*Force Package 2*	179	75	78
222	70	0	*Force Package 3*	253	60	48
297	135	64	*Force Package 4*	360	105	120
240	114	24	*Float, Attrition, TDA & Training*	333	30	90
1197[1]	569 758[2]	120[3]	*Total Requirements*	1426	387	448

[1] Assumes deactivation of TARCs/TARPs

[2] Interim requirement until RAH-66 Fielding to heavy division/corps attack battalions. Far-term AH-64 requirement after RAH-66 fielding = 569.

[3] Requirement = 128 TOE + 32 Sustaining Acct = 160 given expected approval of V Corps Rqmts.

Sustainment Account (Float, Attrition, TDA, Training) = 25%. Combined UH-60 Sustainment Account = 25%.
Requirements Do Not Include Special Electronics Mission Aircraft (SEMA) EH-60 (80 plus float)
SOA Objective Requirements Not Included (45 MH-60L/K, 37 MH-47D/E, 54 RAH-66, 30 MELB)

** Force Packaging Per SAMIS under TAA-03*

Figure G-6

FIXED WING MODERNIZATION DESIGN GOALS

Fixed wing modernization design goals are shown in Figure G-7. This strategy recommends five standard platforms to satisfy short, medium, and long range utility, cargo, and SEMA requirements. Modernization of the fixed wing fleet avionics to meet future air navigation requirements must continue to ensure the capability of the fleet to operate in national and international airspace systems.

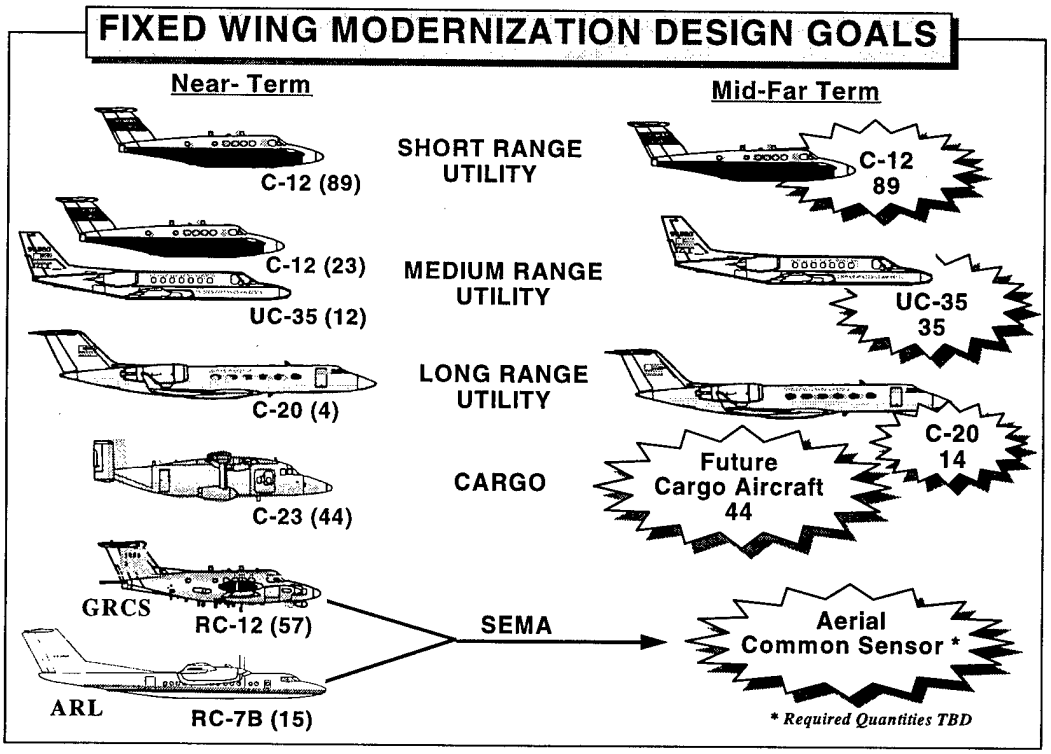


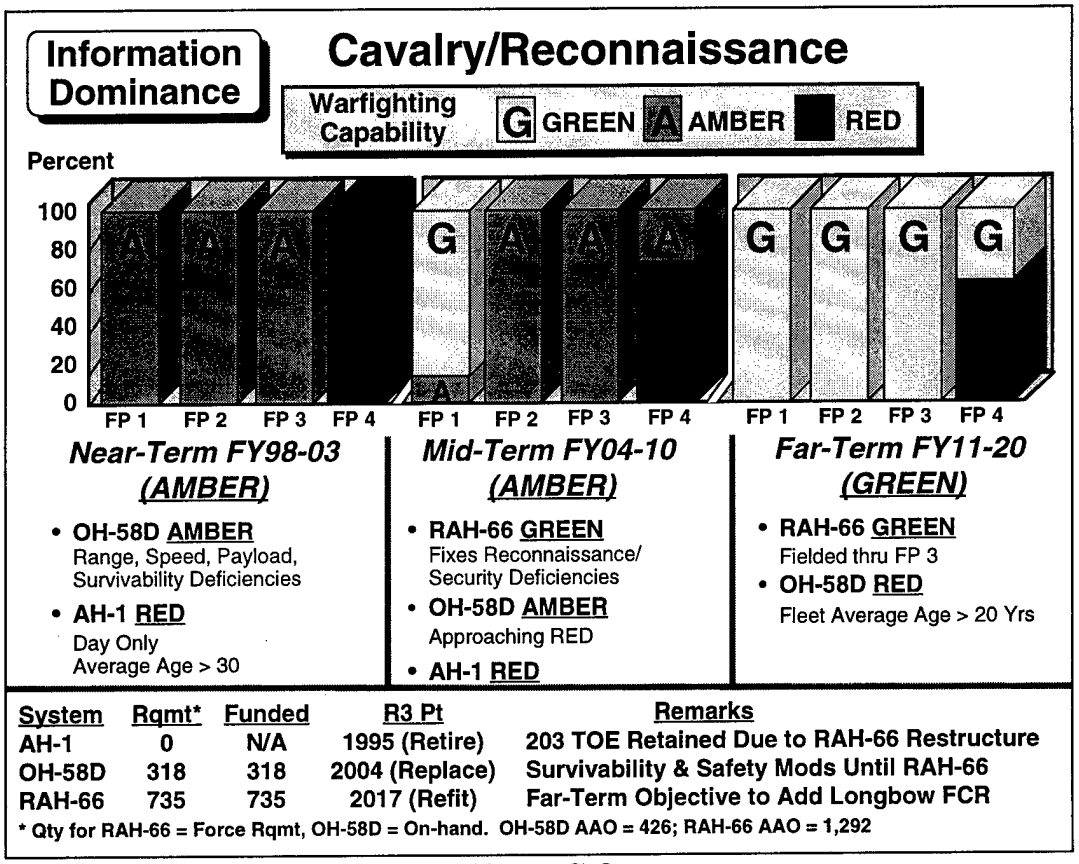
Figure G-7

Capabilities Assessment

INFORMATION DOMINANCE

Information dominance programs for aviation include RAH-66 Comanche, digitization initiatives in support of Force XXI, the Airborne Command Vehicle (UH-60 with Army Airborne Command and Control System (A2C2S)), and the EH-60L Advanced QuickFix (AQF) SEMA. Automation/digitization and the Comanche are critical to attaining the Army's "information dominance" objective. Digitization funding issues and limitations of the interim OH-58D Kiowa Warrior result in an overall assessment of AMBER for information dominance programs.

Armed tactical reconnaissance/security is Army aviation's number one deficiency. The RAH-66 Comanche, with its revolutionary mission equipment package, advanced survivability features, and superior maintainability features will solve this deficiency. Comanche will provide tactical targeting, prioritization, and enemy information to joint force tactical commanders at all levels. Figure G-8 provides an assessment of cavalry/reconnaissance capabilities by force package for the near-, mid-, and far-term timeframes. The RAH-66 acquisition strategy builds two prototypes in FY95 and FY98, and six Early Operational Capability (EOC) aircraft equipped with the reconnaissance mission equipment package in FY01-03. The objective is to place these aircraft, with their embedded training capability, into operational units for soldier evaluation, thus confirming revolutionary capabilities and reducing program risk. Full production and Initial Operational Capability (IOC) remain in 2006, beyond the replacement point for AH-1 and OH-58D.



System	Rqmt*	Funded	R3 Pt	Remarks
AH-1	0	N/A	1995 (Retire)	203 TOE Retained Due to RAH-66 Restructure
OH-58D	318	318	2004 (Replace)	Survivability & Safety Mods Until RAH-66
RAH-66	735	735	2017 (Refit)	Far-Term Objective to Add Longbow FCR

* Qty for RAH-66 = Force Rqmt, OH-58D = On-hand. OH-58D AAO = 426; RAH-66 AAO = 1,292

Figure G-8

The OH-58D Kiowa Warrior is a significant improvement over the AH-1 and bridges the gap until the Comanche is fielded. However, the Kiowa Warrior offers limited airframe growth potential and suffers from range, speed, survivability, and weapon payload deficiencies. The retrofit and production of OH-58D to the Kiowa Warrior configuration (armed with Semi-Active Laser HELLFIRE, Air-to-Air Stinger, 2.75 inch rockets, .50 caliber machine gun) will be complete in 1999. RAH-66 fielding allows cascading of OH-58D aircraft to the Strategic Reserve beginning in FY 2009. Current Comanche production schedules will require retention of OH-58D until they are retired in FY 2022. This long-term retention of these aircraft will require future safety and sustainment upgrades to keep these aircraft viable. At a minimum, 190 aircraft (includes 8 cavalry squadrons, 1 light division attack battalion, and 38 aircraft to satisfy training base and sustainment needs) will require additional refurbishment beyond that currently programmed in the POM or Extended Planning Period. Rough order of magnitude estimates of funding requirements for this refurbishment are $1-2M per aircraft.

The AH-1 Cobra, with the exception of approximately 70 C-NITE equipped aircraft, lacks the capability to operate effectively at night and in reduced visibility. All AH-1 have inadequate flight performance for global operations, are not capable of adequate threat stand-off against air defense threats and are not compatible with the digital battlefield. AH-1 continues to be RED. Initiatives to reduce the authorized level of AH-1 aircraft in Strategic Reserve reconnaissance units until RAH-66 fielding allows OH-58D cascading to these units are still in the planning stages. This initiative is similar to the Associate Unit Strategy for attack battalions

discussed in the Combat Overmatch Section. The objective of this effort is to further accelerate AH-1 retirement to the point where all remaining AH-1s would be C-NITE Forward Looking Infrared (FLIR) equipped for night target acquisition.

Additional aviation information dominance programs are assessed in Figure G-9. These digitization programs ensure interoperability, from within organic units to among joint force participants, and provide rapid sharing of enemy and friendly information among all digitized forces for near-real time situation awareness and synchronization of combat power. The overall assessment for aviation digitization is AMBER.

Aviation—Information Dominance Program Assessment

System	# Systems Required	# Systems Funded	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
A2C2S	207	133	**AMBER**	**AMBER**	**AMBER**	FP 1 & FP 2, 50% FP 3
AVTOC	374	15	**AMBER**	**RED**	**RED**	Funded Only for Initial Dig Divs/Corps
AMPS	1,101	923	**AMBER**	**GREEN**	**GREEN**	Bde/Bn/Co Level
EBC Integration	TBD	0	**RED**	**RED**	**RED**	Required for Digital Connectivity
TAIS	28	28	**AMBER**	**GREEN**	**GREEN**	ATS Node of ATCCS

Note: R3 Points for these systems have not been determined. Digital technology life is less than 10 years.

Figure G-9

With few exceptions, aviation digitization programs are not resourced beyond the Contingency Corps and Regional Response Forces. Fully funded programs (GREEN) include the AN/ARC-220 High Frequency Radio, GPS, the Tactical Airspace Integration System (TAIS), and initiatives for automated logistics supply reporting/tracking and diagnostics. The AN/ARC-220 High Frequency Radio allows non-line-of-sight (voice and limited data) communications between the aviator and commander/Tactical Operations Center (TOC). The Aviation Mission Planning System (AMPS) provides automated mission planning, rehearsal, synchronization, and transfer of essential mission data to aircraft systems. The Aviation Tactical Operations Center (AVTOC), funded only for the Force XXI initial digitized divisions/Corps, provides aviation brigade, battalion, and separate company commanders the capability to plan, control, and report aviation operations. Integration of Embedded Battle Command (EBC) software functionality onto aviation platforms for linkage to the digital battlefield is significantly under funded.

The TAIS is linked to the ATCCS and the USAF Contingency Theater Automated Planning System (CTAPS), providing joint airspace management and airspace deconfliction with other combat arms. Future plans for a new air traffic architecture are based upon satellite based navigation, increased use of data links rather than voice for pilot/controller communications, and improved surveillance for enhanced ground and cockpit situational awareness. To avoid potential flight restrictions, aviation must address necessary aircraft modifications for future OCONUS/CONUS civil airspace compliance.

Logistics digitization objectives include consolidating the Unit Level Logistics System-Aviation (ULLS-A), Soldier Portable On-site Repair Tool (SPORT), and an Integrated Electronic Technical Manual (IETM) into a single laptop computer with a CD-ROM. The intent is for this system to interface with the unfunded Digital Source Collector (DSC) to enhance preventive maintenance and diagnostics. The aviation implementation of the Integrated Combat Service Support System (ICS3) Standard Maintenance System (SMS) module will provide a single integrated system that meets all maintenance information processing requirements.

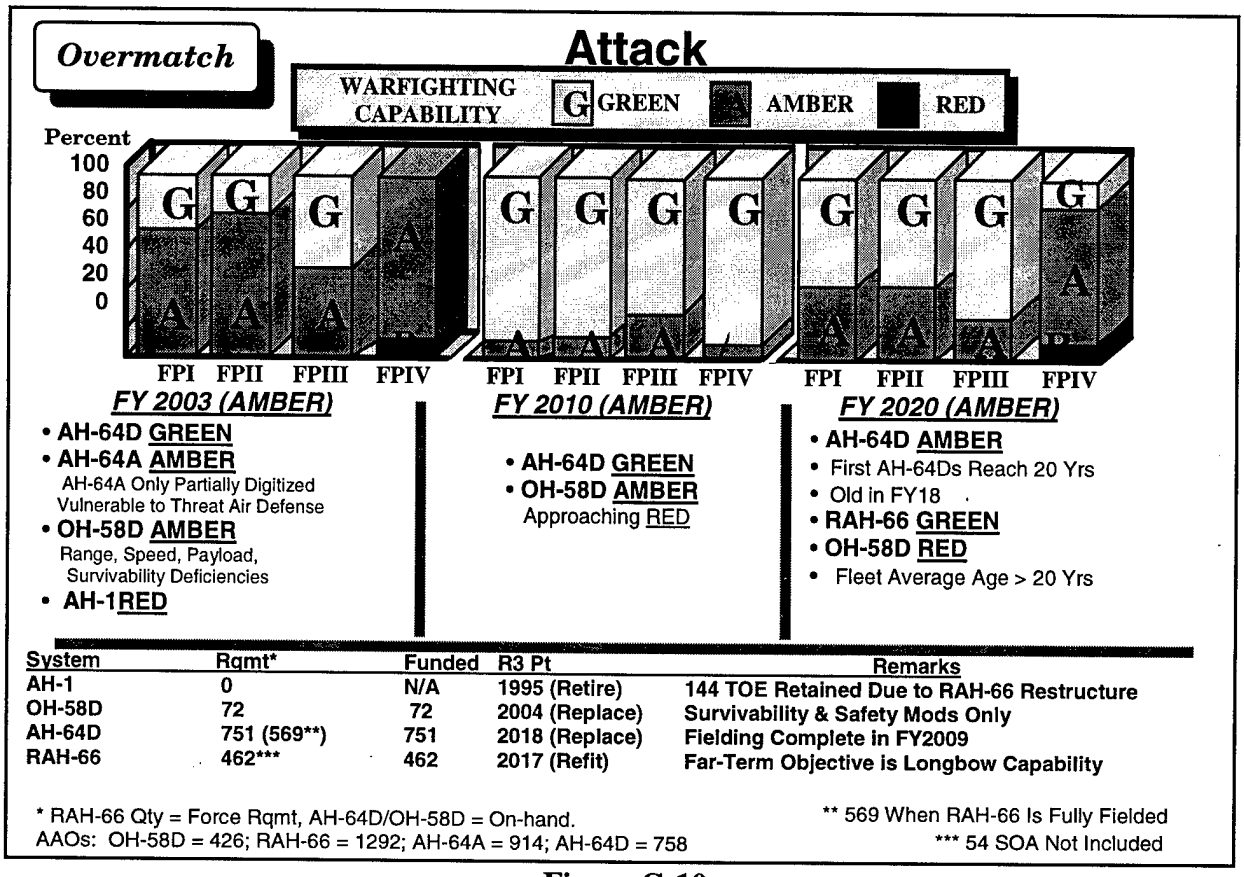
The Airborne Command Vehicle, a UH-60 fitted with the Army Airborne Command and Control System (A2C2S), will serve as a Corps, division, or maneuver brigade commander's airborne tactical command post. A2C2S allows the maneuver commander to fight over large expanses and accommodate the fluidity of the 21st century battlefield. It features situational awareness that fosters a commander's common view of the battlefield and voice/data equipment that provides battlefield information processing and connectivity equivalent to ground tactical command posts and the Battle Command Vehicle.

The EH-60L AQF program modernizes the aircraft electronics suite and upgrades the engine and fuel pods to address flight performance/range deficiencies. The AQF provides electronic support and attack to address emerging threat, precision location data for first fire, and improved mission duration. Requirements for the Aerial Common Sensor (ACS), the future SEMA platform, are being developed to create a multi-functional aerial intelligence platform.

COMBAT OVERMATCH

Aviation combat overmatch programs include AH-64D Longbow Apache, the RF HELLFIRE missile, Aircraft Survivability Equipment (ASE), and Air Warrior. The Longbow Apache, RF HELLFIRE missile, and improved ASE will give the Army attack helicopter technological superiority well into the 21st Century. However, limitations of interim OH-58D and AH-64A aircraft coupled with funding issues with ASE and weapon procurement result in an overall assessment of AMBER for combat overmatch.

Figure G-10 assesses attack helicopter combat overmatch capability. The impact of the Associate Unit Strategy (discussed below) is significant as all AH-1 attack aircraft are retired in Strategic Reserve attack battalions by FY 2003, more than 10 years ahead of previous schedules. The attack mission is currently performed by three different aircraft. In some units (5 heavy/medium divisions, 1 light division, 1 armored cavalry regiment), AH-1s continue to perform the attack mission. These aircraft (rated RED) fight blind at night (with the exception of limited quantities of AH-1F C-NITE aircraft) and lack the weapon systems and mission equipment required for effective combat operations. The OH-58D serves as the attack aircraft in the remaining three light divisions and two armored cavalry regiments. The OH-58D suffers the same deficiencies discussed above, particularly inadequate weapon payload.



System	Rqmt*	Funded	R3 Pt	Remarks
AH-1	0	N/A	1995 (Retire)	144 TOE Retained Due to RAH-66 Restructure
OH-58D	72	72	2004 (Replace)	Survivability & Safety Mods Only
AH-64D	751 (569**)	751	2018 (Replace)	Fielding Complete in FY2009
RAH-66	462***	462	2017 (Refit)	Far-Term Objective is Longbow Capability

* RAH-66 Qty = Force Rqmt, AH-64D/OH-58D = On-hand.
AAOs: OH-58D = 426; RAH-66 = 1292; AH-64A = 914; AH-64D = 758

** 569 When RAH-66 Is Fully Fielded
*** 54 SOA Not Included

Figure G-10

The Associate Unit Attack Aircraft Strategy has been embraced by both the active and reserve components as a means to accelerate AH-1 aircraft retirement, modernize reserve component aircraft, and maintain soldier skills (pilot/maintainer) relevant to the strategic reserve requirements to support reconstitution and regeneration of the force. Implementation of this strategy, shown in Figure G-11, allows early retirement of 120 TOE AH-1 aircraft at a cost avoidance approaching $200M. Implementation of this strategy is expected to be complete in the near-term. It consists of the following adjustments to current structure:

- Reduce the authorized level of aircraft for reserve component heavy division/Corps attack battalions in the warfight from 24 to between 12 and 18 aircraft. This frees up over 40 AH-64 aircraft for redistribution. Additional aircraft will be made available in FY 2009 with the completion of Longbow fielding and as early as FY 2000 if emerging Army XXI force structure changes are adopted. Trainup and equipment costs associated with this alternative are about $11M.
- Reduce the authorized level of aircraft in the five Strategic Reserve heavy division attack battalions to between 8 and 12 aircraft.
- Field AH-64 aircraft to Strategic Reserve attack battalions at a reduced authorization level until cascading AH-64s, made available through RAH-66 fieldings, allow fielding the full complement of 24 AH-64 aircraft per battalion.

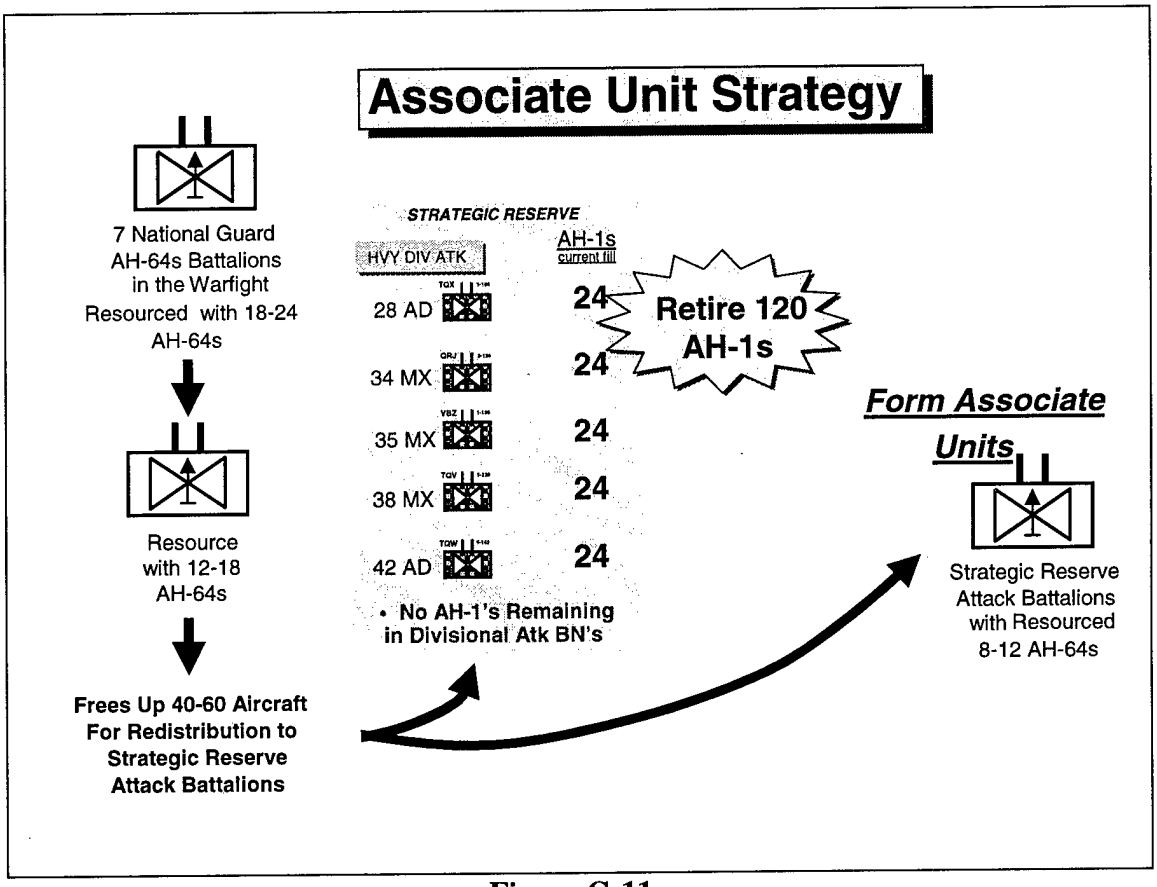


Figure G-11

The AH-64 is the world's premier heavy attack helicopter. Remanufacture of the AH-64A to the AH-64D Longbow Apache configuration provides extended range targeting and adverse weather target acquisition coupled with a fire and forget RF HELLFIRE missile. The Longbow millimeter wave FCR, RFI, and T700-GE-701C engines are programmed for 227 AH-64Ds. All AH-64D aircraft will receive precision inertial and GPS navigation, state of the art weaponry, enhanced displays, redundant processors, MANPRINT cockpit; structural upgrades; joint compatible digital communications suite, interactive electronic manuals, and aircraft reliability improvements. The program also includes training devices and simulators. From constructive simulation/analysis to operational experiments such as the Task Force XXI Advanced Warfighting Experiment (AWE), the AH-64D has proven itself a true combat multiplier for the Army.

Until Comanche is fielded to heavy division/corps attack battalions in the far-term, the AH-64 will also serve as the scout in heavy attack units. However, the AH-64 remains vulnerable to modern threat air defenses when employed in the close-in scout role. Fielding the RAH-66 Comanche as the scout aircraft in these heavy division/corps attack battalions and as the light division attack aircraft will provide a survivable aircraft with the speed, range, payload, and logistical supportability features required by these units.

Other aviation combat overmatch programs are shown in Figure G-12. The RF HELLFIRE missile permits precision engagements by AH-64D and RAH-66 in Electro-Optical (EO) countermeasure environments and through adverse weather/battlefield obscurants. The RF HELLFIRE missile uses the HELLFIRE II missile bus and warhead, and incorporates a millimeter wave seeker. Production of the RF HELLFIRE began in FY97. Approximately 13,000 RF HELLFIRE will be procured through FY03, short of the requirement for the AH-64D. The Block II Stinger (FUE 2004) will improve air-to-air missile performance against targets in clutter. Concepts are being evaluated for a low cost Advanced Precision Kill Weapon System (APKWS) guided munition (to complement the Hydra-70 family of rockets and supplement HELLFIRE) to provide a lower cost, more capable means of defeating soft or lightly armored targets in clutter and urban terrain. In the mid-term, RAH-66 Comanche missile requirements and laser HELLFIRE shelf life extension must be addressed.

Aviation—Overmatch Program Assessment

System	# Systems Required	# Systems Funded	R3 Point*	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
SAL HELLFIRE	N/A	0	97	AMBER	RED	N/A	Inadequate Shelf Life
HELLFIRE II	**	7,888	08	GREEN	AMBER	RED	Inadequate Quantities
RF HELLFIRE	**	13,311	12	GREEN	GREEN	AMBER	RAH-66 Rqmts, Shelf Life Concerns
SIIRCM	2,882	1,047	14	AMBER	AMBER	AMBER	AH-64, OH-58D, UH-60 L/Q, CH-47D
SIRFC	1,108	1,108	14	AMBER	GREEN	GREEN	AH-64, UH-60, CH-47D, SOA
Air Warrior	15,956	10,286	21	AMBER	GREEN	GREEN	1 per Aircrew Member
APKWS	TBD	0	---	RED	RED	RED	Procurement Unfunded

* Retrofit/Replace/Retire R3 Point based on approx. 20-Yr life, 15 years for HELLFIRE.
** Total HELLFIRE (HELLFIRE II and RF HELLFIRE) requirement is approximately 25,000 missiles to support AH-64.

Figure G-12

The ASE program includes RF, Infrared (IR), and EO countermeasure devices to detect and defeat threat anti-aircraft systems. As Army aviation continues to modernize, aircraft systems must have the necessary ASE items installed at the production line or via field retrofit. The Suite of Integrated IR Countermeasures (SIIRCM) and Suite of Integrated RF Countermeasures (SIRFC) are the two most critical ASE programs for Army aviation. They provide necessary situation awareness, improved target identification, interfaces for digital target handover, missionized electronic order of battle, and substantially improved effectiveness against current and projected air defense threat. The mid-term solution for SOA includes components of the SIIRCM and SIRFC.

The Aircrew Integrated Systems program encompasses those items of equipment that are used to protect, sustain, and enhance the performance of Army aircrews and passengers. The Air Warrior program develops a modular, tailorable aviator ensemble for rotary wing aircraft crewmembers. Its aim is to reduce the aviator's equipment weight and volume to lessen the physical burden, improve survivability, and enhance the aviator's ability to accomplish the mission. Subsystem programs which feed Air Warrior include: Aircrew Integrated Common

Helmet, Helmet Mounted Display, Laser Protective Visor, Magnetic Head Tracker System, the Aircrew Microclimate Cooling System, and an Electronic Kneeboard.

ESSENTIAL RESEARCH AND DEVELOPMENT AND LEAP-AHEAD TECHNOLOGIES

Aviation is supported by a robust S&T program fully aligned with *Army Vision 2010* and AAN timelines. The S&T program supports development of new systems / concepts and the technologies required for upgrades of existing rotorcraft. Detailed descriptions of these programs are contained in the Army's Science and Technology Master Plan.

The aviation S&T program consists of efforts focused on developing and demonstrating technologies for advanced rotors, transmissions, structures / airframes, weapons integration, engines, survivability, cockpit / mission equipment packages, and flight controls. The major S&T programs for aviation, as shown in Figure G-13, support a three pronged strategy: (1) development of a Joint Transport Rotorcraft (JTR) as a potential replacement for CH-47 and CH-53 helicopters; (2) support for Army After Next rotary wing concepts; (3) potential technology insertions for RAH-66 and AH-64D.

Aviation Essential R&D Programs

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• Rotorcraft Pilot's Associate ATD • Adv. Rotorcraft Transmission II TD • Helicopter Active Controls Tech TD • Rotary Wing Structures Tech TD • Adv. Rotorcraft Aeromechanics Tech ID • Joint Turbine Advanced Gas Generator TD • Air/Land Enhanced Reconnaissance and Targeting ATD • HELLFIRE III TD • Airborne Manned/Unmanned Systems Tech ATD	• 3rd Generation Adv. Rotor Demonstration TD • Joint Transport Rotorcraft ATD	• 4th Generation Crew Station TD • Smart Structures SRO • Intelligent Systems SRO • Signature Management & Control SRO

Figure G-12

The JTR will demand significant warfighting performance advancements in range, speed, payload, mobility, and acquisition costs. These advancements will result from technology improvements in structures, cruise efficiency, specific fuel consumption, and maneuverability/agility. The Rotary Wing Structures Technology (RWST), Advanced Rotorcraft Aeromechanics Technology (ARCAT), 3rd Generation Advanced Rotors Demonstration (3rdGARD), Helicopter Active Controls Technology (HACT), Advanced Rotorcraft Transmission (ART), and Joint Turbine Advanced Gas Generator (JTAGG) Technology Demonstrations (TD) will transition technologies to develop this potential new JTR system.

Potential technology insertions to the RAH-66 Comanche and AH-64D in support of the evolving digital battlefield will include crew station workloads enhancements, advanced pilotage/displays (such as Virtual Retinal Display technology), vehicle management, and interoperability between manned and unmanned scout/attack teams. Future needs require significant technology improvements in cognitive decision aids, sensor fusion, displays/symbology, and enhanced processing for voice and data communications. The Rotorcraft Pilot's Associate Advanced Technology Demonstration (ATD), Airborne Manned/Unmanned Systems Technology ATD, and 4th Generation Crew Station ATD will mature technology required for these improvements.

NEAR-TERM (FY98-03)

Rotorcraft Pilot's Associated (RPA) Advanced Technology Demonstration (ATD)

The objective of this program is to improve combat helicopter mission effectiveness through the application of artificial intelligence for cognitive decision aiding and the integration of advanced pilotage sensors, target acquisition, armament and fire control, communications, cockpit controls and displays, navigation, survivability, and flight control technologies. RPA technologies greatly enhance aviation crew's ability to see and assimilate the battlefield in all conditions.

Advanced Rotorcraft Transmission (ART) II Technology Demonstration

The ART TD incorporates key emerging material and component technologies for advanced rotorcraft transmissions and makes a quantum jump in the state of the art. Advanced concepts including split torque path, highly loaded gears, high reduction ratios per gear stage, low noise gear configurations, and high temperature corrosion resistant materials will be integrated into an advanced transmission demonstrator. The ART demonstrator objectives are to provide a 25% increase in shaft horsepower to weight ratio, 100% increase in mean time between removal, 10 dB reduction in noise, and 10% reduction in production costs.

Helicopter Active Control Technology (HACT) Technology Demonstration

The HACT TD will demonstrate a second generation fly-by-light technology and integration of flight control and mission functions into a Vehicle Management System (VMS). It will demonstrate high bandwidth active control technologies, multimode stabilization, and carefree maneuvering with robust control law design methodologies for affordable high performance helicopter control systems.

Rotary Wing Structures Technology (RWST)

RWST will demonstrate advanced lightweight, tailorable structures and ballistically tolerant airframe configurations that incorporate state-of-the-art computer design/analysis techniques, improved test methods, and affordable fabrication processes. The objectives are to increase structural efficiency by 15%, improve structural loads prediction accuracy to 75%, and reduce costs by 25%.

Advanced Rotorcraft Aeromechanics Technology (ARCAT)

ARCAT will develop and demonstrate critical technologies in rotorcraft aeromechanics focused on increasing maximum blade loading, increasing rotor aerodynamic efficiency and adverse forces, reducing aircraft loads and vibration loads, reducing acoustic radiation, increasing inherent rotor lag damping, and increasing rotorcraft aeromechanics predictive effectiveness. Achievement of aeromechanics technology objectives will contribute to rotorcraft system payoffs in range, payload, cruise speed, maneuverability/agility, reliability, maintainability, and reduced RDT&E, production, and O&S costs.

Joint Turbine Advanced Gas Generator (JTAGG)

JTAGG is a tri-Service / NASA / DARPA Integrated High Performance Turbine Engine Technology (IHPTET) demonstrator effort focused on achieving a 40% reduction in specific fuel consumption and a 120% increase in power to weight ratio over current production engines. The JTAGG demonstrator will integrate compressor, combustor, turbine, and mechanical components using advanced materials and materials processing, simulation and modeling, computational fluid dynamics, and manufacturing science. A full engine demonstration of the improvements in gas turbine technology resulting from the JTAGG program will be conducted as required to support JTR development.

Air/Land Enhanced Reconnaissance and Targeting (ALERT) ATD

The ALERT ATD will demonstrate on-the-move, automatic aided target acquisition (ATR) and enhanced identification via the use of a second generation FLIR/multi-function laser sensor suite for application to future aviation assets which do not have radar. ALERT will leverage ongoing Air Force and DARPA developments for search on-the-move ATR including the use of temporal FLIR processing for MTI. This approach will also enable application of the ATR capability to all weapons systems with integrated FLIR/laser sensors. The demonstration will be a real-time, fully operational flying testbed emulation of all modes of the basic RAH-66 target acquisition system. ALERT will integrate laser range mapping and laser profiling capability with FLIR imagery to demonstrate on-the-move aided target acquisition and identification with acceptable false alarms as a lower cost alternative to FLIR/radar fusion.

Hellfire III Technology Demonstration

Hellfire III demonstrates an improved Hellfire missile that remains compatible with current and future Hellfire launchers at a possible reduction in weight and/or cost. The technology demonstration will utilize enhancements in propulsion, warhead, and aerodynamic technologies to allow missions to be performed at extended ranges (12 km), at reduced times of flight, and on a greater variety of target sets.

Airborne Manned/Unmanned System Technology (AMUST)

AMUST will assess, develop, and demonstrate the software, components, and procedures needed to enable unmanned aerial vehicles (UAV) to perform as intelligent and autonomous members of a rotary wing aviation team in support of the maneuver commander. The program will use existing or planned UAVs and manned rotorcraft to demonstrate the enabling airborne manned/unmanned teaming technologies. AMUST will use the aviators mission requirements and plans, manned system capabilities, threat information, and UAV flight and payload performance capabilities to automatically develop an optimum manned/unmanned team flight, payload, and communication management plan.

MID-TERM (FY04-10)

3rd Generation Advanced Rotor Demonstration (3rd GARD)

The 3rd GARD TD will demonstrate advanced rotors/concepts developed in the ARCAT program to enhance current rotor performance ceilings. Increased performance will result through the application of high lift airfoils/devices, tailored platforms and tip shapes, elastic/dynamic tailoring methods, active on-blade control methods, acoustic signature reduction techniques and integration of advanced rotors/concepts with advanced active control systems. 3rd GARD technology will provide for increased survivability via reduced acoustic signature and increased maneuverability/agility, increased rotorcraft speed capability, increased range and payload, and reduced O&S cost via reduced vibration and loads.

Joint Transport Rotorcraft (JTR) ATD

The ATD will serve as a risk reduction demonstration program to allow transition of rotary wing platform technologies to a JTR EMD program as the replacement for the aging CH-47 Chinook and CH-53 Super Stallion helicopter fleets. Integration of technologies from the RWST, HACT, ART, ARCAT, 3rd GARD, and JTAGG programs will be included in the ATD demonstration vehicle. This integration demonstration will result with a lightweight reliable transmission, advanced flight controls, smart structures to include materials and manufacturing, 2X increase in propulsion capability and increase maneuverability, agility, and cargo handling capability. The ATD will use simulation and virtual prototyping and platform ground and flight testing to demonstrate the technologies' greatest potential for dual-use and reducing development, production, and operating costs.

FAR-TERM (FY11-20)

4th Generation Crew Station (4th GCS) Technology Demonstration

This TD will demonstrate the next generation of air vehicle crew station architecture. The effort will develop/incorporate advanced displays for full glass cockpit/crew station; three-dimensional display technology; selectable touch, cyclic grip cursor, or pupil tracked cursor information access capability; rapid pilot-reconfigurable information layout on displays; automated artificial

intelligence (AI) "Advisor" aiding; intelligent, adaptive interfaces, advanced selectable "windowless" cockpit synthetic vision systems; advanced information display symbology; and advanced flight control designs. Displays, AI, and crew station technology from Air Force, Navy, and NASA programs will be incorporated into the system design. The TD will demonstrate increased pilot performance and overall reduced pilot susceptibility to injury by laser, directed energy, or other sources in hostile electromagnetic environments.

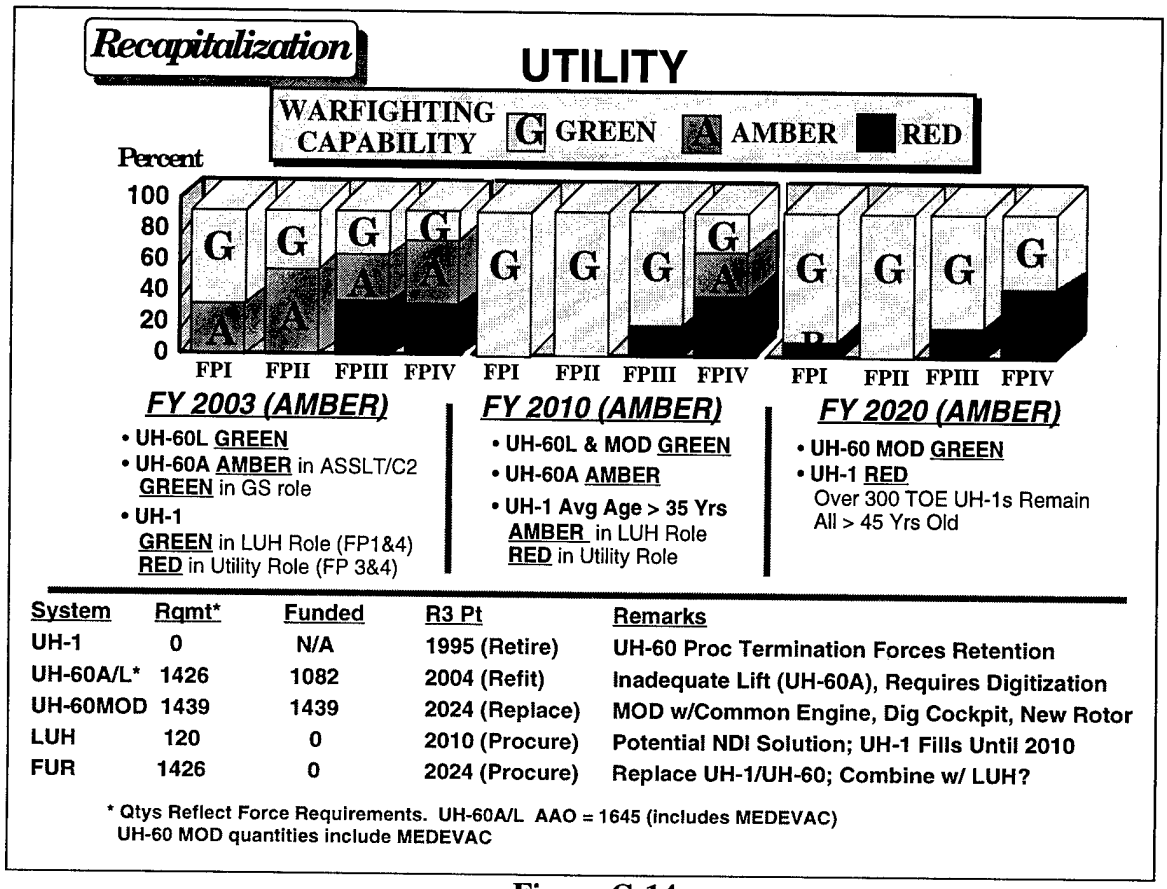
Strategic Research Objectives (SRO)

The Smart Structures SRO focuses on the development of adaptive structures for airframe and rotors as well as embedded sensors to measure the performance and "health" of vehicle structures. The Intelligent Systems SRO includes the development of "associate systems" to aid the pilot/operator in systems monitoring, decision making, and tactical operations. The Signature Management and Control SRO will enable the development of advanced methodologies for enhancing survivability against future threats.

RECAPITALIZATION PROGRAM

Aviation's major recapitalization programs are the UH-60 Modernization/Life Extension, the UH-60Q MEDEVAC, the CH-47 ICH, OH-58D System Safety Enhancement Program (SSEP), and tactical ATS/fixed base air traffic control (ATC). The aging aviation fleet coupled with delayed procurements increases the significance of these programs. Funding shortfalls to address UH-1 recapitalization and/or replacement as well as low procurement rates for funded programs (ICH, UH-60Q, UH-60 Mod) result in an overall AMBER assessment for recapitalization.

Utility and MEDEVAC modernization is assessed in Figure G-14. The current utility fleet includes the UH-1 and UH-60A/L. The UH-1H is an old airframe that possesses inadequate lift, speed, range, and survivability to accomplish General Support, Air Assault, MEDEVAC, or Command and Control mission requirements. Consequently, approximately 250 TOE UH-1s are assessed as RED. As the UH-1 is considered supportable until the 2010 timeframe, the 96 TOE UH-1 aircraft in the Light Utility Helicopter (LUH) role are assessed as GREEN in the near-term. However, emerging T-53 engine reliability issues and the need to enhance mission equipment have raised questions on the feasibility to sustain the UH-1 fleet until 2010 without additional upgrades. Potential upgrade requirements for the UH-1 vary from $0.5M to $1M per aircraft, not including the remanufacture costs required for life extension. Eventual replacement for these TOE UH-1s is also complicated by the significant number (approximately 280) of TDA requirements for UH-1 above and beyond the 25% sustainment account planning factor. Completely eliminating the UH-1 from the Army inventory necessitates a relook at these requirements and consideration of the most appropriate replacement on a case by case basis.



System	Rqmt*	Funded	R3 Pt	Remarks
UH-1	0	N/A	1995 (Retire)	UH-60 Proc Termination Forces Retention
UH-60A/L*	1426	1082	2004 (Refit)	Inadequate Lift (UH-60A), Requires Digitization
UH-60MOD	1439	1439	2024 (Replace)	MOD w/Common Engine, Dig Cockpit, New Rotor
LUH	120	0	2010 (Procure)	Potential NDI Solution; UH-1 Fills Until 2010
FUR	1426	0	2024 (Procure)	Replace UH-1/UH-60; Combine w/ LUH?

* Qtys Reflect Force Requirements. UH-60A/L AAO = 1645 (includes MEDEVAC)
UH-60 MOD quantities include MEDEVAC

Figure G-14

The Program Objective Memorandum (POM) terminates UH-60 procurement after FY03 at 1569. Approximately 900 of these UH-60s are 'A' models. The UH-60 program includes standardization of 300 pre-1985 A-models to the 1989 A-model baseline configuration (less hardpoints), electromagnetic environment protection, and improved radar warning upgrades. These efforts will be complete by the end of the POM. These UH-60A, first fielded in 1978, have insufficient lift to fully meet Air Assault and Command and Control mission requirements. A UH-60 Modernization/Life Extension Program is scheduled to begin in FY02. This program will address this deficiency, and include digitization, airframe upgrades, and capability enhancements required to keep the UH-60 fleet viable until Future Utility Rotorcraft (FUR) can be procured in the FY25 timeframe. Funding the sustainment of simulator concurrency is also critical for aircrews to receive training which mirrors actual aircraft mission equipment and flight performance.

While current POM funding provides the highest possible return on investment, significant deficiencies remain in the utility mission area. Although the UH-1 aircraft is deemed supportable until the 2010 timeframe, fleet size alone demands immediate attention given realistic UH-1 SLEP or replacement rates.

The recognized need to dual-mission reserve component aircraft to meet the requirement for a third assault company in the three air assault division battalions and in the three Light

Divisions in the warfight requires priority attention. Dual-missioning aircraft in the Strategic Reserve to meet this requirement necessitates procurement of 60 additional UH-60 aircraft. UH-60 attrition over the last 20 years has also led to some of the UH-60 companies being resourced at less than their authorized level. These losses have caused a requirement for an additional 30 aircraft. These combined requirements create a need for 90 additional Black Hawks at a cost of approximately $925M, assuming additional production begins in the POM.

The Army is accelerating the requirements determination process to facilitate replacement of UH-1 Light Utility Helicopter (LUH) aircraft beginning in the 2001 timeframe. These aircraft, in the warfight at Corps, have mission requirements which include flights for staff transport, liaison, air messenger service, and air movement of supplies. Additionally, the LUH aircraft augments Corps air ambulance resources. Although UH-1 sustainment is possible until the 2010 timeframe; commercial off-the-shelf (COTS), Non-developmental Item (NDI), or leased aircraft appear the most practical options given the nature of LUH mission requirements and the emerging need for UH-1 modifications to maintain UH-1 viability. This aircraft will also be a candidate to replace UH-1s performing non-warfight utility and MEDEVAC duties as well as selected TDA missions. Funding LUH procurement requires $507-625M.

Addressing the problem of obsolescing UH-1s in Air Assault, Command, General Support, and selected TDA roles is complicated by the sheer size of this fleet (approximately 550 aircraft) and the concurrent requirement to sustain this fleet while SLEP and/or replacement options are executed. An assessment of UH-1 sustainment and SLEP viability and costs is being initiated to address these concerns and help determine the best long term option. Anticipate completion of this assessment by 1st quarter FY 1999.

Cargo Modernization is depicted in Figure G-15. The CH-47D modernization program extended aircraft useful economic life of the original CH-47A/B/C by approximately 20 years; consequently, the aircraft remanufacture point will be reached in FY 2002. An immediate requirement is to upgrade the T55-GA-714A engine to recapture lift and range requirements lost over years of aircraft modifications. Life extension efforts will be centered on the CH-47 ICH program by extending aircraft life through vibration reduction, structural modifications, and addition of a minimum essential data bus for digitization compatibility. The objective is to modernize a minimum of 300 CH-47 through an ICH remanufacture with a service life extension program until a replacement system, the JTR is fielded.

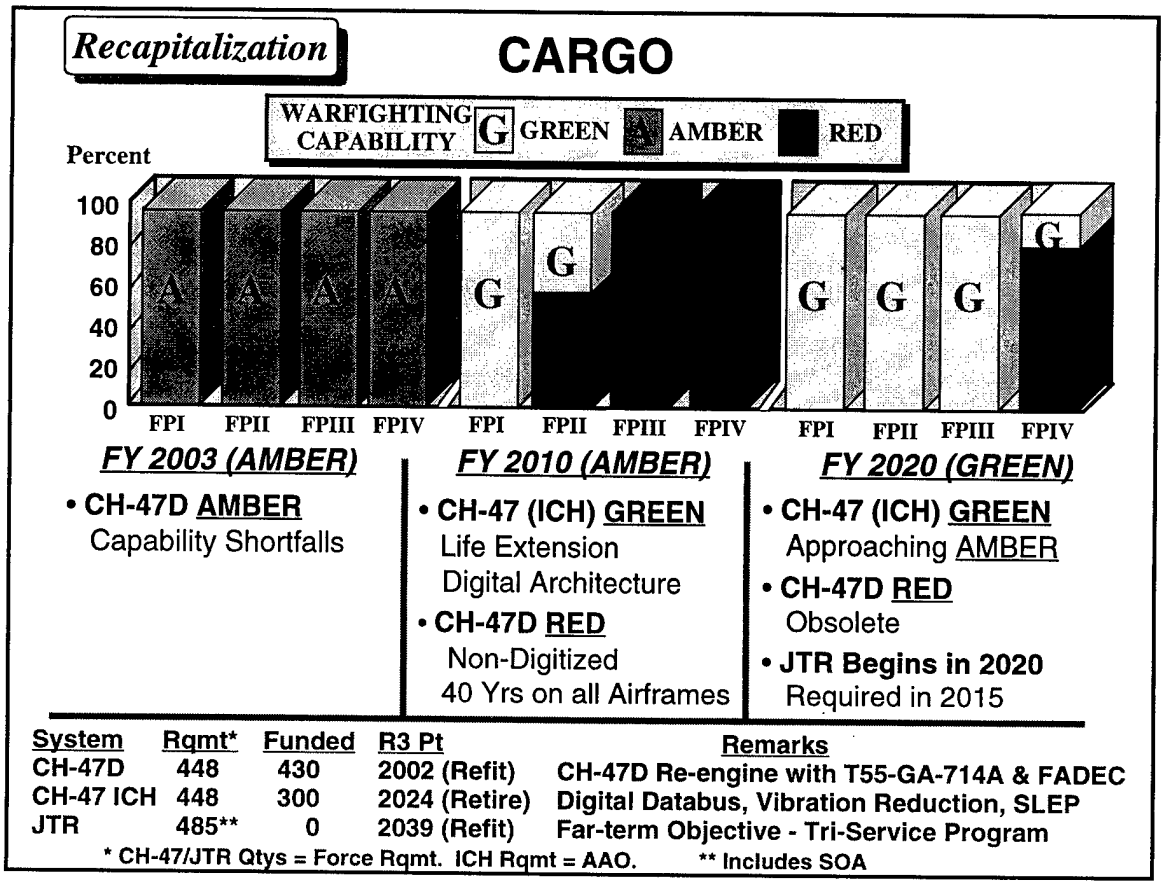


Figure G-15

Figure G-16 provides an assessment of other aviation recapitalization programs. Aviation Ground Support Equipment (GSE) programs develop and procure GSE; Sets, Kits, and Outfits (SKO); and cargo handling equipment. The program maximizes the use of Non-Developmental Item (NDI) for materiel development and acquisition. Efforts include a Containerization and Modernization Program for AVIM shop sets that refurbishes them and improves their deployability and support to task force missions, Unit Maintenance Aerial Recovery Kit (UMARK), Shop Equipment-Contact Maintenance (SECM), common Maintenance Free Battery, Environmental Sensitive Maintenance concepts, and Turbine Engine Diagnostic System. Current cargo handling equipment programs and plans are focused on developing improved and standardized internal and external cargo systems to meet requirements for the CH-47D, ICH, and JTR. The Advanced Aviation Forward Area Refueling System (AAFARS) will provide more reliable, rapid, and safer tactical refueling of aircraft.

Air Traffic Services (ATS) focus primarily on support of Army and land component commanders' airspace command and control requirements. Three tactical ATS systems are funded for development and acquisition: Air Traffic Navigation, Integration, and Coordination System (ATNAVICS); Tactical Airspace Integration System (TAIS); and Mobile Tower System (MOTS). These systems provide the digital link among airspace users and the Army Tactical Command and Control System (ATCCS). Fixed base Air Traffic Control (ATC) supports joint, combined, and individual Service training; provides military controller training; and provides

equipment to support force projection deployment airfields. The upgrade of fixed base ATC facilities will leverage off FAA National Airspace System (NAS) modernization efforts.

The OH-58D Kiowa Warrior System Safety Enhancement Program (SSEP) installs the R-3 engine, crashworthy seats, cockpit airbags, improved mission processors, GPS, IDM, and tactical internet compatible radios.

Aviation—Recapitalization Program Assessment

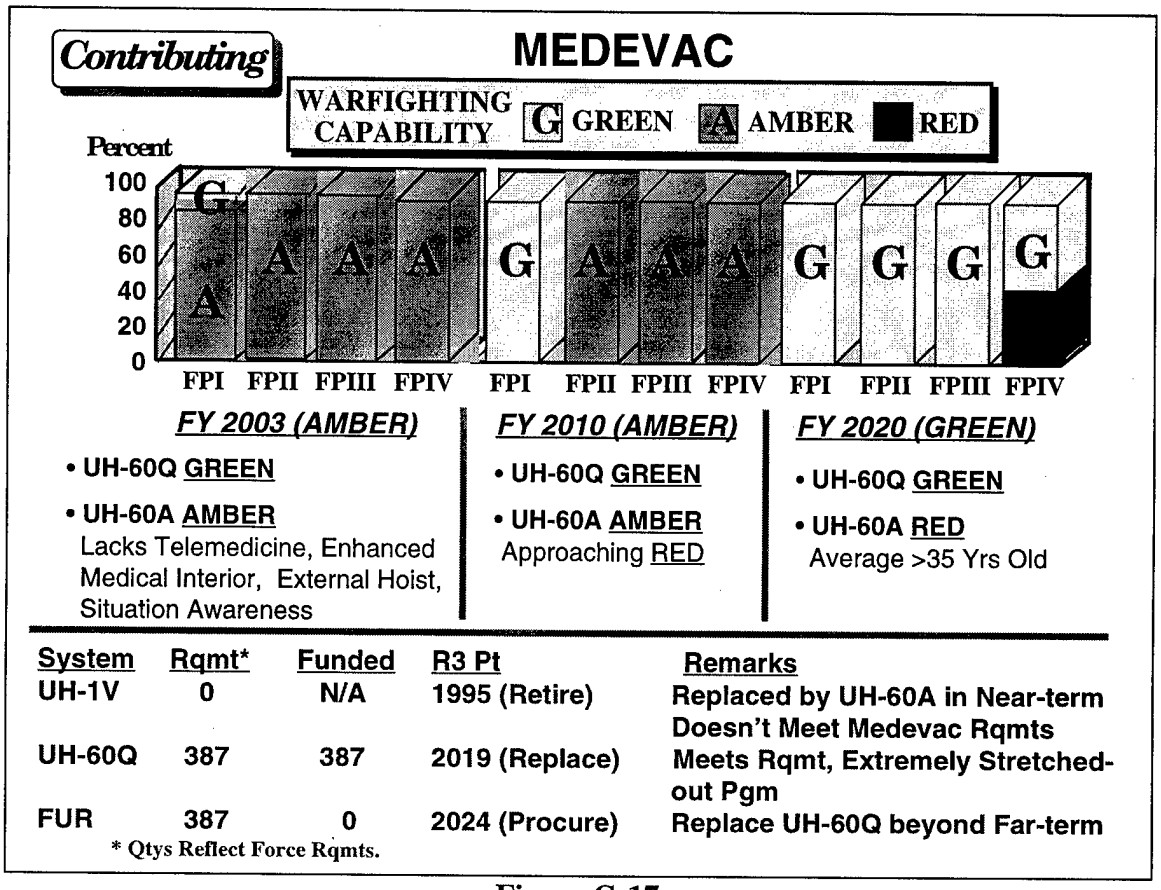
System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
CH-47D Mod (714 Engine)	467	467	02	**GREEN**	**GREEN**	**GREEN**	Restores Range and Lift Perform
OH-58D SSEP	411	77	12	**AMBER**	**RED**	**RED**	Safety/Surviv/Perform
ATS / ATC							FP 1 & FP 2 Only
ATNAVICS	38	38	20	**AMBER**	**AMBER**	**AMBER**	Replace TSQ-71B
MOTS	38	38	20	**AMBER**	**GREEN**	**GREEN**	Dig Mobile ATC Tower
NAS	N/A	N/A	22	**AMBER**	**GREEN**	**GREEN**	FAA Leads Fixed Base Prog
Avn GSE	Multiple	Multiple	96	**AMBER**	**AMBER**	**AMBER**	GREEN for SECM, UMARK, GANG AMBER or RED Other Rqmts
Acft Engine Comp Impr	N/A	N/A	N/A	**AMBER**	**AMBER**	**AMBER**	Inserts New Tech Components. Fixes Field Deficiencies

Figure G-16

CONTRIBUTING CAPABILITIES

MEDEVAC, fixed wing utility aircraft, and training/simulation initiatives are the primary contributing capability programs for aviation. The overall assessment for this area is **AMBER**.

The MEDEVAC fleet is assessed as **AMBER** (Figure G-17). The UH-1V MEDEVAC (assessed **RED**) lacks the speed, range, endurance, patient regulating capability, and survivability to adequately support maneuver forces. As configured, the aircraft no longer meets mission requirements. These shortfalls are magnified during high/hot environment operations (above 4,000 feet and 95 degrees). After the current multi-year deliveries, the MEDEVAC fleet will be fielded entirely with UH-60s. The UH-60A MEDEVAC (assessed **AMBER**) lacks the capability to meet many of its assigned missions: sustainment of casualties over extended distances, shore to ship evacuation, supporting combat search and rescue, and patient regulating. Additionally, the UH-60A MEDEVAC is not capable of functioning on the digitized battlefield or using telemedicine technology. MEDEVAC capability improves to **GREEN** with the modification of UH-60As to the "Q" configuration. The UH-60Q includes medical equipment upgrades (telemedicine, enhanced MEDEVAC kit, built-in rescue hoist, onboard oxygen generator), digital communications (data bus, HF radio, SINCGARS SIP), and navigation equipment (GPS, FLIR).



System	Rqmt*	Funded	R3 Pt	Remarks
UH-1V	0	N/A	1995 (Retire)	Replaced by UH-60A in Near-term Doesn't Meet Medevac Rqmts
UH-60Q	387	387	2019 (Replace)	Meets Rqmt, Extremely Stretched-out Pgm
FUR	387	0	2024 (Procure)	Replace UH-60Q beyond Far-term

* Qtys Reflect Force Rqmts.

Figure G-17

The fixed wing fleet is assessed **AMBER** (Figure G-18) for the near- through far-term. The Army's fixed wing fleet consists of 15 different types of aircraft. Although much progress has been made over the last five years (26 different aircraft types five years ago), this diverse and varied fleet remains difficult to manage and is expensive to operate and sustain. Additionally, the lack of a standardized fleet and the numerous cockpit configurations have an adverse impact upon training and operational standardization.

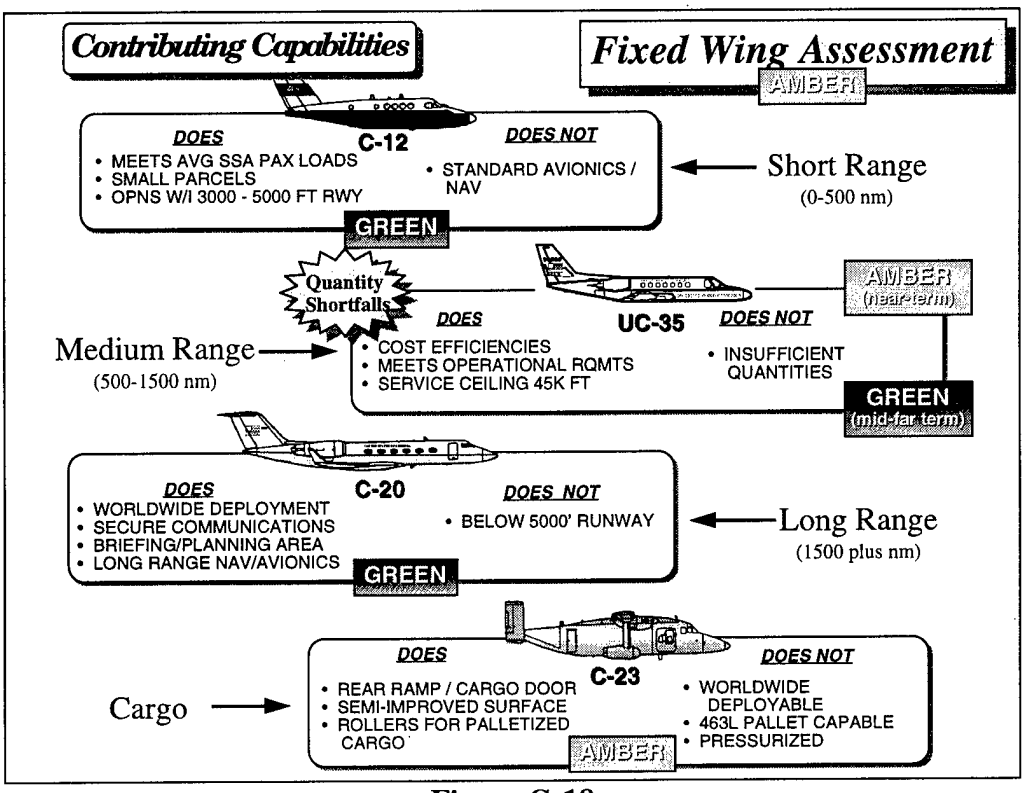


Figure G-18

The C-12 (**GREEN**) is fulfilling the short range mission. A near-term avionics upgrade is needed to standardize the myriad of cockpit configurations in the C-12 fleet. This upgrade will ensure the C-12 fleet is capable of operating in modernized national and international airspace systems. The newly designated UC-35A (**AMBER** due to limited quantities) is being procured to fulfill the medium range requirement. The C-20 (**GREEN**) will continue to perform the long range mission. The C-23 (**AMBER**) currently fills the cargo mission, but lacks the payload, range, or speed desired for the Army's future cargo requirement. Modernization of the fleet includes an avionics upgrade to standardize C-12 cockpits, upgrades to commercial standards for the C-20 fleet, and the acquisition of 35 UC-35A jets to meet the Medium Range (MR) requirement. The UC-35A supplements the C-20, C-21, and C-12 by rapidly deploying senior leaders during initial operations and sustained theater operations like those found in Europe. The C-12, with avionics standardization and refurbishment, will meet the short range (SR) requirement. The recent transfer of additional C-12s from the Air Force permits the retirement of all remaining U-21s. The RC-12 and RC-7B currently satisfy the Army SEMA requirement. Requirements for the Aerial Common Sensor (ACS), the future SEMA platform, are being developed to create a multi-functional aerial intelligence platform.

Aviation Training and Simulation Initiatives are assessed **AMBER**, approaching **RED**. Reductions in flight hours coupled with funding shortfalls are leading to an increasing disparity between simulators and the aircraft they are replicating (simulator concurrency) and are certain to erode combat skills. The AVCATT (**RED**) is an unfunded element of the Army's Combined Arms Tactical Trainers family of networked trainers. The AVCATT is essential for aviation to participate in distributed simulation combined arms training, exercises, rehearsals, and

experiments. The AWSS, Kiowa Warrior Crew Trainer, and HSI are other critical unfunded/under funded initiatives.

Summary

The Comanche and Longbow Apache helicopters solve reconnaissance and attack deficiencies; they remain Army aviation's major focus to correct critical warfighting shortfalls. However, a life extension for the UH-60 and CH-47D, initiation of the fixed wing investment strategy, and attention to Strategic Reserve fleet obsolescence are equally important to a balanced strategy. Modernization of our core programs (avionics, aircraft survivability equipment, aviation life support equipment, air traffic services, and aviation support equipment) is essential to the support and sustainment of our aircraft programs and compatibility with the digital battlefield of the future. Aviation training and simulation initiatives require funding support to address future individual, collective, and combined arms combat training requirements. Without attention to outyear fleet sustainment/modernization issues, the obsolescing fleet problems of today (AH-1, OH-58A/C, and UH-1) will be compounded by aging UH-60, CH-47, OH-58D, AH-64D, and C-12s. A robust R&D program is required to meet Army aviation's future requirements for recapitalization and next generation/future systems.

SECTION 3: CONCLUSION

The future of Army aviation has been mapped out along a path to achieve a modernized, Force XXI-capable combat arm. This plan is a realistic, proactive course of continuous improvement supporting the National Military Strategy, Army XXI, and *Army Vision 2010.* It represents the Army's best return on investment given current fiscal constraints. The impact of this strategy results in an **AMBER** assessment for aviation. Under current modernization plans, older, obsolescing aircraft will remain in the inventory into the foreseeable future. This is portrayed for the rotary wing aviation fleet in Figure G-19. Warfighting, training, logistical support, and operating and support costs are impacted by the presence of these legacy systems.

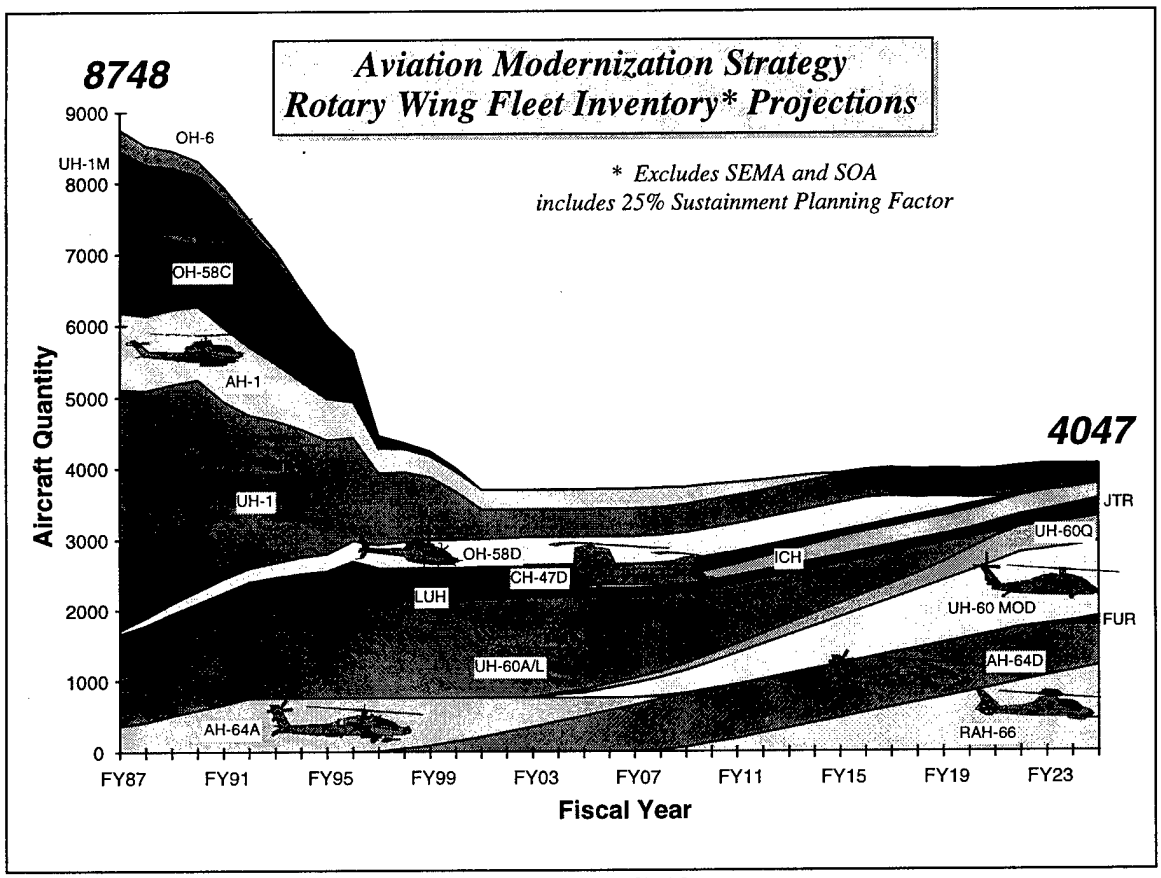


Figure G-19

Reconnaissance/security represents the single greatest deficiency in Army aviation. The Army remains completely committed to the Comanche, a variant of which may be considered as the possible long-term solution for the attack helicopter beyond the Longbow Apache. Until the Comanche's introduction, however, this mission area will suffer with significant numbers of AH-1 Cobras in the Strategic Reserve and Kiowa Warrior as the interim aircraft. Long term retention of the Kiowa Warrior will necessitate additional refurbishment funding in the far-term.

Longbow Apache is the logical progression of the world's finest attack helicopter. It represents a fusion of emerging technologies, enhancing proven capabilities. Longbow ensures U.S. forces maintain world-class attack helicopter capability into the 21st Century. An extremely capable aircraft, the Longbow Apache nevertheless will still be limited in pilotage by its first generation FLIR. We must find ways to insert second generation FLIR technology. The Associate Unit Strategy accelerates AH-1 retirement in Strategic Reserve attack battalions and modernizes these units with reduced quantities of AH-64 aircraft until RAH-66 fielding allows AH-64 cascading to bring these units back to authorized levels. This strategy maintains attack battalion relevance in the Strategic Reserve, ensuring a pool of pilots/maintainers are available to support reconstitution/regeneration of the force.

With few exceptions, aviation digitization programs are under funded. The requirement for seamless sensor-to-shooter connectivity across the vast battlespace and need to capitalize on the emerging information exchange capability of the tactical internet demand a maneuverable Airborne Command Vehicle and tactical internet compatibility for aviation platforms.

The utility and MEDEVAC mission area deficiencies also require attention. Approximately 300 TOE UH-1s must be retained in General Support, Air Assault, and Command Companies without continued UH-60 procurement beyond 1999. The UH-60 Modernization/Life Extension Program will address the aging of the UH-60 fleet, but does not resolve quantity shortfalls. A near-term priority to procure additional UH-60s to meet assault mission requirements remains unfunded. The Light Utility Helicopter (LUH) requirement is satisfied with the UH-1 until the 2010 timeframe, although upgrading mission capability must be addressed. Emerging UH-1 reliability concerns and the requirement to upgrade this aircraft to achieve compatibility and interoperability with the force drive consideration for replacement in the near-term. The Army is accelerating efforts to identify solutions to the complex issues associated with UH-1 obsolescence in assault, command, general support, and TDA roles.

The UH-60A requires significant modifications to fully meet MEDEVAC mission requirements. The UH-60Q modification is the objective solution to address these deficiencies. Although UH-60Q procurement begins in FY02, it has been stretched out to the far-term due to funding constraints.

The age of the CH-47D fleet is forcing the Army to address performance, digital compatibility, and rising support costs. The ICH initiative will address these shortcomings in the mid- and far-term period. The JTR remains the long term solution for the Army's cargo helicopter. The ICH program is designed to accommodate the JTR, modernizing only the number of CH-47Ds required to bridge the gap until JTR can be fielded in the 2020 timeframe.

Figure G-20 summarizes aviation program resourcing under the FY99-03 Program Objective Memorandum (POM). Funding shortfalls will require the Army to make new investments in the mid-term, not only in RDA accounts for the development of next generation systems, but in OMA accounts to sustain the older modernized and non-modernized fleets to keep them relevant to the warfight. Retaining older aircraft longer will also require modification of training and personnel strategies.

POM FY99-03

	DOES:	DOES NOT:
RAH-66	• RDT&E Streamlined Funding • Build 2 Prototypes & 6 EOC Aircraft	• Procure Any Mission Aircraft for First Digitized Division/Corps
AH-64D	• Procure 448 AH-64D Thru FY03	• Upgrade with II Generation FLIR
Hellfire	• Procure 13,311 LB RF HELLFIRE Missiles	• Continue HELLFIRE II
AH-64A	• RAM and Desert Storm Fixes • Fund TADS/PNVS/CATB	
Support Programs	• Minimum ATC, ALSE, ASE, AGSE • Digitize Most of FP 1/2 • AVTOC for 2 Div & 1 Corps	• Procure AVTOC Rqmt, DSC • Integrate Embedded Battle Command Into All Modern Aircraft
UH-60	• Complete Refurb Program • Procure UH-60 through FY03 • Initiate UH-60Q and UH-60 Modernization	• Meet Priority Assault/TOE Rqmts • Meet UH-60 Digitization Rqmts • Procure MEDEVAC First to Fight Rqmts
OH-58D	• Partially Complete SSEP	• Complete SSEP • Procure Kiowa Warrior Crew Trainer
CH-47	• Initiate ICH and Engine Upgrades	• Field CH-47 ICH • Meet CH-47 Digitization Rqmts
FW, AH-1, UH-1	• Provide Min Safety of Flight Mods	***FW*** • Buy UC-35A Rqmt • Upgrade C-12 Avionics
		UH-1 • Adequately Sustain/Upgrade Fleet • Procure Replacement for LUH
		AVCATT • Provide Aviation Unique Rqmts/Integration

Figure G-20

The aviation modernization strategy ensures aviation will continue to provide support across the range of military operations. Although aviation modernization enjoys the planned introduction of newer, more capable systems in the future; slipped, stretched, and canceled programs have led to a situation where attack, reconnaissance, utility, and cargo aircraft all require modernization or replacement decisions in the near-term. This is compounded by significant UH-60 shortages, risk in the sustaining accounts for all modern aircraft (AH-64, UH-60, CH-47, OH-58D), and the need to address emerging digitization/air traffic control requirements. Continued pressures on the defense budget have forced the Army to trade-off aviation modernization requirements (given no increases in the research, development and acquisition budget) and consider reduced aircraft resourcing strategies. Reduced procurement rates and deferred programs will create increasing disparity between first to fight and lower priority units and limit efforts to improve efficiencies and reduce costs.

ANNEX H: NUCLEAR, BIOLOGICAL, AND CHEMICAL

SECTION 1: INTRODUCTION

Overview

The Nuclear, Biological, and Chemical (NBC) modernization plan focuses on leveraging technological opportunities to achieve new levels of NBC effectiveness in support of *Army Vision 2010 (AV2010).* It endeavors to identify, develop, and utilize new and improved NBC defense capabilities and technology applications to achieve the Army's role in accomplishing full spectrum dominance within *Army Vision 2010.* It assures a disciplined approach to meeting mission-based requirements and secures an orderly modernistic change as we transition through *Army XXI to the Army After Next (AAN)* (Figure H-1). *Army Vision 2010* is the blueprint for the Army's contributions to the enhanced operational concepts of *Joint Vision 2010.* This annex describes planned modernization efforts to achieve these required capabilities.

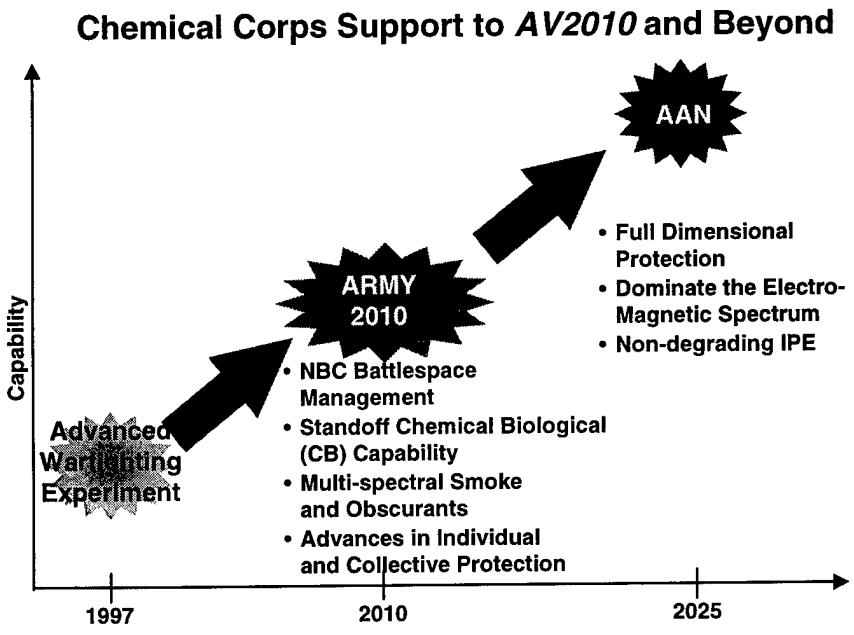


Figure H-1

Since the end of the Gulf War, significant and measurable progress has been made in modernizing NBC defense. Specific examples of new and improved systems that have been fielded include new protective masks, advanced chemical and biological protective garments, stand-off chemical detectors, and first-ever capabilities for biological agent point detection and stand-off aerosol/particulate detection. An integrated system-of-systems approach to NBC defense incorporates detection systems, force protection, smoke and obscuration programs, and decontamination to provide the most effective means to ensure that U.S. forces will be ready to fight at the time and place of our choosing.

Although we have made significant progress, technological advances will provide even more improvement. We must continue to resource and fund a strong NBC modernization plan in order for our Nation to continue to dominate this arena. Funding constraints have made it difficult to capitalize on ongoing work in the technology base and to introduce next generation capabilities. It is critical that we vigorously pursue new and improved NBC defense capabilities

to negate or minimize the effects of Weapons of Mass Destruction (WMD) and other NBC hazards on our forces. This plan explains the capabilities we are pursuing for NBC force modernization to meet the needs of *Army Vision 2010* and set the conditions for AAN. It assesses the future NBC capabilities which must be pursued to support the Total Army and accomplish full spectrum dominance.

Threat—Why We Need to Modernize

The need for a strong NBC defense program is indisputable. The threat and proliferation of WMD continue to expand. Besides the five declared nuclear states, four and possibly five other states have nuclear weapons, as many as 14 nations are developing biological weapons, and as many as 25 nations are producing and stockpiling chemical weapons. Nations with limited military capability often pursue NBC weapons programs to shift the balance of power. When these weapons are used or threatened, regional conflicts quickly escalate to international concern and complicate efforts at crisis resolution. The Toxic Industrial Hazard (TIH) and Low-level Radiation (LLR) threat in Bosnia and the terrorist chemical attack in Japan have provided convincing examples of the need to expand NBC defense capabilities beyond those required for defense against WMD in a major theater war. Even the Continental United States (CONUS) may be a target of terrorists either directly employing NBC weapons or creating an NBC event by an attack which releases toxic industrial chemicals. Additionally, the Army's expanding role in stability operations and support operations has developed new missions which direct our forces toward the world's trouble spots, where our capability to quickly fight, win, and survive on the NBC battlefield is critical. The capability to employ fully trained, highly motivated military forces, equipped with modern NBC defense systems, serves as a credible deterrent to adversaries who may attempt to use NBC weapons against U.S. forces.

NBC Defense Modernization Driving Factors

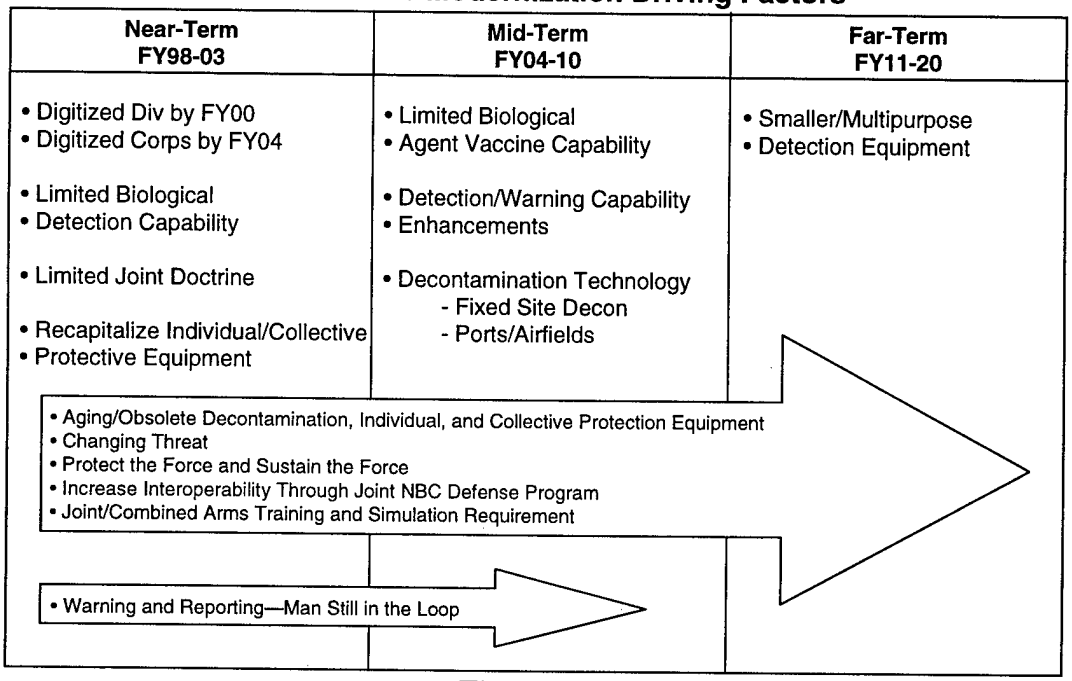


Figure H-2

Capabilities Contributing to *Army Vision 2010* Patterns of Operation

To achieve *Army Vision 2010*, the Army must take advantage of the revolution in military affairs by advancing capabilities that will enable it to effectively support a power projection force able to accomplish its mission in all operational environments. To meet these challenges, the chemical corps is actively exploiting information dominance systems, improving overmatch capabilities, recapitalizing existing programs, and pursuing essential research and development and leap-ahead technologies to develop future operational capabilities to Protect the Force, Sustain the Force, and Shape the Battlespace (Figure H-3).

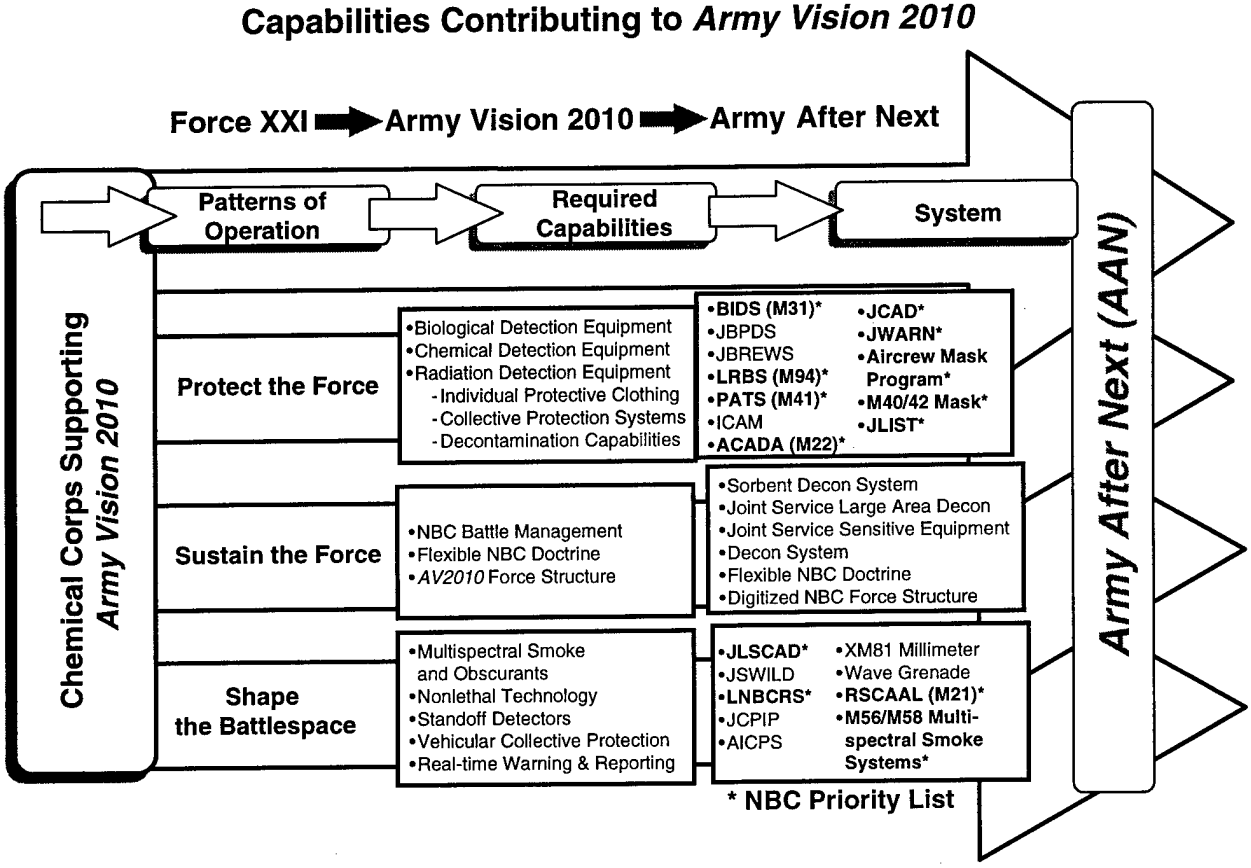


Figure H-3

Protect the Force will benefit from information technological advances in NBC battle management, reconnaissance, detection, identification, individual and collective protection, and decontamination. Primary protection capability enablers, such as advancements in the Joint Service Lightweight Integrated Suit Technology (JLIST), and the Joint Service General Purpose Mask (JSGPM), will greatly enhance individual soldier performance and survivability. The Joint Warning and Reporting Network (JWARN) and enhanced stand-off sensors and identification capabilities such as the Long-Range Biological Stand-off Detector System (LRBSDS) will protect soldiers by providing early warning of an NBC hazard.

The nuclear, biological, and chemical survivability of tactical systems continues to be a critical element in the modernization plan. To maintain our current dominance in the face of an increasing WMD threat, we will continue to build NBC survivability into our tactical systems. Mission-essential equipment hardened against WMD effects remains an essential element in support of the Army's mission of deterrence and has the support of the senior leadership of the Army. Department of Defense (DoD) instructions and Army regulations require that combat developers address NBC survivability for mission-critical systems. As a minimum, high-altitude electromagnetic pulse (HEMP) survivability is required for mission-critical equipment to preclude theater-wide loss. If addressed early in the development cycle, NBC survivability will have a minimal effect on technology risk and program schedule. The materiel developer must understand the NBC survivability requirements, select the materiel that will enhance a system's ability to meet the survivability requirements, and then conduct survivability testing and assessments to verify that the system is NBC survivable. The use of Commercial Off-the-Shelf (COTS) and non-developmental items (NDIs) do not negate the requirement to be HEMP- and NBC-survivable.

Sustain the Force will benefit from the NBC Battle Management System, which will continually maintain and update NBC asset status throughout the battlespace. The NBC battle management system will also integrate battlespace sensors and provide commanders with a full sensor-to-soldier NBC situational awareness capability. This situational awareness will increase operational tempo and lethality by providing real-time focused defense to selective units within the hazard area and provide analytical risk assessment and decision tools for commanders and staffs. Digitized diagnostics embedded within NBC defense items will automatically monitor their serviceability throughout their life cycle and assess battle damage when required. Joint Service Large Area Decontamination, Joint Service Sensitive Equipment Decontamination System, Modular Decontamination Systems (MDS), and Sorbent Decontamination System, in concert with flexible NBC doctrine and force structure changes, will also enhance the battlespace sustainability of the overall force.

Shape the Battlespace will require decisive control of the electromagnetic spectrum, the capability to defeat threat target acquisition, and the need to limit casualties. The M56 and M58 Smoke Systems will provide mobile smoke capable of defeating current and future Reconnaissance, Intelligence, Surveillance, Targeting and Acquisition (RISTA) systems operating in the visual through infrared (IR) range. The XM81 Millimeter Wave Grenade, along with other multi-spectral smoke and obscurant technologies, will expand frequency control and remain integral components to shape the battlespace. Non-lethal technologies will provide additional options in stability operations and support operations when the force must be able to maintain and enforce peace while minimizing casualties. Real-time NBC warnings will allow commanders to make critical and time-sensitive decisions regarding hazard protection and avoidance while on the move.

Joint Service Program

The DoD has implemented Public Law 103-160, the National Defense Authorization Act for FY94, which mandated coordination and integration of all service Chemical Biological (CB)

Defense Research, Development, and Acquisition (RDA). The joint NBC Defense Program Objective Memorandum (POM) (most recently the FY99-03 POM) provides funding for all service NBC defense requirements based on a joint priority list. The Joint Service NBC Defense Modernization Plan, and the Joint Service NBC Defense Research, Development, and Acquisition (RDA) Plan have been developed to chart the future course of the NBC defense for the next 15 years. This program supports readiness and modernization by developing and procuring NBC defense equipment which has multi-service application and can be horizontally integrated into existing and future military systems. Continued modernization of individual and collective protection, medical support, detection, identification, warning, and decontamination systems is required to ensure force survivability and mission accomplishment under NBC conditions. Coordination and synchronization of joint service doctrine and training programs will be enhanced by applications of technology to allow realistic mission rehearsals and training under NBC conditions. Smoke, obscurant and target defeating systems were not consolidated in the Joint CB Defense Program and remain Army managed.

NBC Doctrinal Modernization for the 21st Century

The (draft) *Joint Nuclear, Biological and Chemical Defense Concept* has developed new doctrinal tenets from joint NBC capabilities, current Army doctrine, and future warfighting capabilities and equipment needs. These emerging doctrinal tenets of battlespace management, visualization, protection, and restoration operations provide an overarching framework and common focus for the NBC modernization strategy.

- **NBC Battlespace Management.** NBC battlespace management provides NBC vulnerability analysis, planning, rehearsal, and decision tools for commanders and staffs. The system incorporates all Command, Control, Communications, Computers, and Intelligence (C4I) information with horizontal integration of visualization, protection, and restoration data; analyzes the data; and then selectively exports NBC data to enhance battlespace situational awareness and assist commanders and staffs with critical NBC decisions.
- **Visualization.** Visualization (situational awareness) is the ability to determine whether an NBC hazard is present or absent in air, water, or land; or on personnel, equipment, or facilities.
- **Protection.** Protection consists of the measures that are taken to keep NBC hazards from having adverse effects on personnel, equipment, or critical assets and facilities.
- **Restoration Operations.** Restoration operations are the measures taken to return personnel and units to a near-normal operating capability after an NBC attack.

Force Structure Modernization

Chemical force structure provides combat support to units at maneuver battalion through theater Army. Chemical companies provide large area smoke, thorough decontamination, NBC reconnaissance, and biological detection to these forces. Cellular augmentation teams provide

NBC warning and reporting to selected organizations in the force which do not have organic capabilities.

Training and Doctrine Command (TRADOC) is currently redesigning division and echelons above division (EAD) force structure as part of the Force XXI experiments. Under these initiatives, the U.S. Army Chemical School is currently developing new designs to support heavy divisions and EAD. TRADOC has also developed chemical force structure for experimentation under the Force XXI Advanced Warfighting Experiment (AWE), which will evaluate chemical combat support for the heavy division and EAD. Following the AWE and force design efforts, the Army leadership will make a decision on unit designs in the near-term (Feb 98).

In the near-term, the Army is completing conversion of all Chemical Companies (Motor Smoke) (Corps) and Chemical Companies (Decontamination) (EAD) to dual purpose companies. These new units will be equipped with the Modular Decontamination System and the M56 Smoke Generator System. Large area multi-spectral smoke support and thorough decontamination support will be provided to warfighting forces by these modern dual-purpose companies.

Chemical Companies (NBC Reconnaissance) (Corps), Chemical Companies (Airborne/Air Assault), and Chemical Companies (Light Cavalry Regiment) will be equipped in the future with the Lightweight NBC Reconnaissance System (LNBCRS). The LNBCRS is currently under development and will meet the critical need for NBC support to the Army's lightfighters.

The Army continues to activate biological detection companies to defend against surprise, large-area biological attacks. In 1996, the 310th Chemical Company activated with one active and four reserve platoons. This unit is equipped with the Biological Integrated Detection System (BIDS) and the Long-Range Biological Stand-off Detection System (LRBSDS). In the near-term, the Army will activate one active and two USAR biological detection companies equipped with the BIDS and the LRBSDS.

Counterproliferation (CP) Support Program

Counterproliferation involves stemming the proliferation of weapons of mass destruction and their missile delivery systems. Effective counterproliferation capabilities devalue the potential political and military benefits of NBC weapons for a would-be proliferant. In addition, capabilities developed for the battlefield to deal with NBC proliferation—especially intelligence, surveillance, and reconnaissance means—can support international regimes, export controls, and other international monitoring efforts to prevent the spread of NBC weapons, related technologies, and delivery means (especially missiles). The CP Support Program enhances the NBC Defense Program by leveraging funds to accelerate fielding or development of critical programs, including remote biological agent detection systems.

Training the Force—Training Devices, Simulations, and Simulators

Challenging and realistic training remains integral to future success. Future NBC defense and smoke and obscurant training will provide a "virtual combat" experience for the joint force. The focus of the training modernization effort will be on world-class unit training opportunities. Technology, such as distributive interactive simulation, will provide cost-effective, unparalleled realism. Training through joint, multinational, and interagency exercises is critical. The force must "train as it will fight." This is especially true in NBC defense. The strategic and political ramifications of NBC defense demand integrated and orchestrated support on the first day of combat.

The key to training the force cost effectively is realistic training devices, simulations, and simulators. This area plays an increased role in maintaining the NBC readiness of the total force. Due to environmental constraints, the force will increasingly rely on training devices and simulators. These devices cross all areas of NBC and smoke and obscurants and can support the full spectrum of conflict training. The very nature of NBC, smoke, and obscurants dictates that trainers are fielded concurrently with the system they support. The top five modernization training systems for NBC are the Simulated Area Weapons Effects, Global Positioning System (SAWE) (GPS); the M82 Smoke Grenade; Biological Integrated Detection Simulation System (BIDSS); the Long-Range Biological Stand-off Detection System Trainer (LR-BSDST); and the Chemical Agent Monitor (CAM) simulator. Additionally, all developmental systems must have embedded self-tests and training or simulation routines.

SECTION 2: CAPABILITIES ASSESSMENT

Overall NBC Mission Area Program Assessment

Funding and personnel shortages continue to impact NBC defense readiness. The overall NBC program assessment is **AMBER** even with current resource increases.

Information Dominance

CONTAMINATION AVOIDANCE

Contamination avoidance programs support information dominance by providing complete NBC situational awareness. This area remains **AMBER** throughout the modernization period. Limiting factors in the near- and mid-terms are stand-off chemical detection limitations; the remote, early warning capability and limited quantities of reconnaissance; unit detection; and automated warning and reporting of equipment and software. To meet near-term needs while detection technology matures, nondevelopmental systems are being assessed, and a number of stand-alone sensors are being developed. These include advanced and multi-agent chemical agent alarms for vehicle and manportable detection devices of chemical agent vapors. Mid-term biological point detection needs will be met by integrating Biological Integrated Detection System (BIDS), Integrated Biological Agent Detection (IBAD), emerging and improved technologies, and discrimination software to develop the Joint Biological Point Detection System (JBPDS); remote early warning requirements will be fulfilled by the Joint Warning and Reporting Network (JWARN), Joint Biological Remote Early Warning System (JBREWS), and networked NBC detectors (Figure H-4). Fielding of the Block I modification to the Fox NBC reconnaissance system will begin in FY98. The Joint Lightweight NBC Reconnaissance System (JLNACRS) will be fielded to the Army, Air Force, and Marines starting in FY01. The far-term objective is to integrate chemical and biological point and early warning capabilities into a single system. Technology focuses on (1) detection sensitivity and specificity across the evolving spectrum of threat agents; (2) system miniaturization, range, and minimizing false alarms; and (3) integration of automated NBC detectors into command and control networks to provide common (joint) warning and reporting (Figure H-4).

Information Dominance—Contamination Avoidance
Biological Detection

System	# Systems Required	# Systems Funded FY(99-03) BES	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
BIDS NDI	124	83	2005	**AMBER**	**AMBER**	**AMBER**	Incl P3I in FY99
JBPDS	180	63	2012	**AMBER**	**AMBER**	**AMBER**	Replaces BIDS
JBREWS	3,816	1,771	2012	**RED**	**AMBER**	**AMBER**	No BW early warning until FY03

Figure H-4

CONTAMINATION AVOIDANCE RDA STRATEGY

Biological Detection, Warning, and Reporting

The goal of the biological detection area is to provide a real-time capability to detect, identify, locate, and quantify biological warfare agents (BWs) below incapacitating levels. The current strategy includes the fielding of ground-based biological agent point detection capability and a long-range stand-off aerosol cloud detector. Current emphasis is on multi-agent point detection with identification, stand-off detection, ranging, and mapping. In the near-term, complementary detectors will be developed to improve reliability and reduce false alarms. The mid-term technology focus is to improve range, detection sensitivity, and identification specificity across the spectrum of biological agents, while reducing system size, weight, and false alarm rate (Figure H-5).

Biological Detection, Warning, and Reporting RDA Strategy

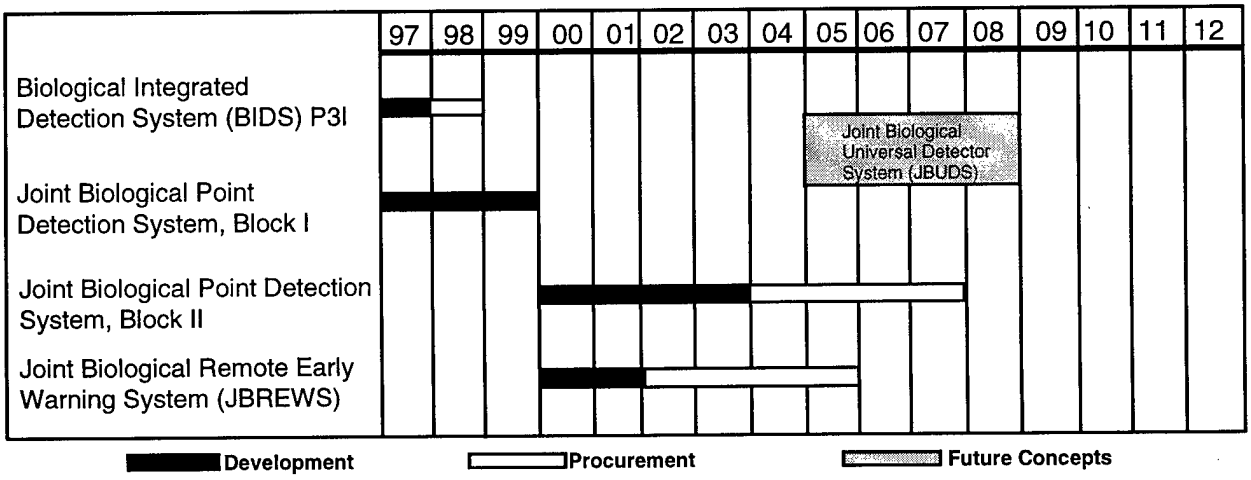


Figure H-5

Biological Integrated Detection System (BIDS) NDI. The current BIDS NDI provides the capability to detect a biological attack and identify a limited number of agents within 30 minutes. Planned improvements to the BIDS, known as Preplanned Product Improvement (P3I), will increase sensitivity, decrease response time, and identify additional agents.

Joint Biological Point Detection System (JBPDS). The JBPDS Block I is an integration of Army, Navy, Marines, and Air Force programs. The sensor suite will be capable of detecting BW agents in less than 15 minutes and in quantities below levels that impact combat effectiveness. The JBPDS Block II upgrades the BW detection capability through advanced technologies.

Joint Biological Remote Early Warning System (JBREWS). The JBREWS will visualize the theater of operations. The JBREWS will enhance situational awareness throughout the battlespace by providing automated biological warfare agent remote early warning and real-time hazard information for force warning. A biological remote early warning Advanced Concept Technology Demonstration (ACTD), proposed for FY98-00, will transition into a two-year development phase in FY00 followed by a four-year production phase.

Chemical and Nuclear Detection and Warning

The goal of the detection and warning area is to improve operational effectiveness by minimizing the time that personnel must remain in Mission Oriented Protective Posture (MOPP). The focus of the detection area is on multi-agent sensors and detectors to provide real-time detection, identification, and reporting of chemical and radiological contamination. Stand-off sensors are being developed for manned and unmanned aerial platforms to enhance contamination avoidance and reconnaissance capabilities. The strategy for company level-detection and warning focuses on fielding an automatic chemical point detector in the near-term and improved miniature sensors in the mid- and far-terms. These enhanced multi-agent sensors exploit advances in biotechnology, microelectronics, and miniaturization techniques.

Warning and reporting form the critical link between CB detection and CB protection. The goal of this effort is to provide sufficient, timely information to commanders at all levels through early and direct warning capabilities so they may develop options on how to conduct their missions and decide the appropriate protective postures to assume. Warning and reporting remain critical issues in contamination avoidance. Automated hazard analysis software and fully integrated warning and reporting will replace both voice reporting of NBC attacks and manual hazard prediction.

Information Dominance—Contamination Avoidance
Chemical and Nuclear Detection

System	# Systems Required	# Systems Funded FY(99-03) BES	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
JSLSCAD	330	67	2012	AMBER	AMBER	AMBER
PKT RADIAC	32,414	32,414		GREEN	GREEN	GREEN
ICAM	14,170	8,785		AMBER	GREEN	GREEN
ACADA	29,357	19,059		AMBER	GREEN	GREEN
JCAD	40,000	39,838		AMBER	GREEN	GREEN
NBCRS (FOX)	195	95		AMBER	AMBER	AMBER
CBMS	195	95		AMBER	AMBER	AMBER
JLNBCRS	449	105		RED	AMBER	AMBER
MICAD	23,356	1,117		RED	AMBER	AMBER
JWARN	23,356	1,117		RED	AMBER	AMBER

Figure H-6

Chemical and Nuclear Detection & Warning RDA Strategy

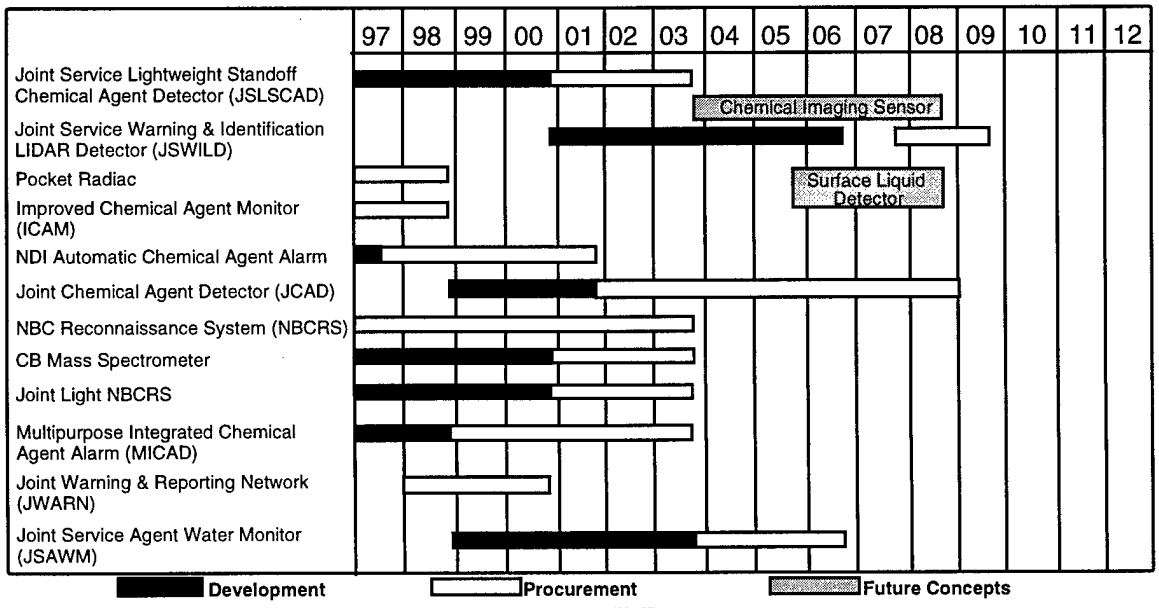
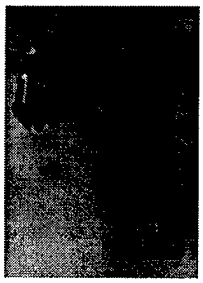


Figure H-7

Joint Service Lightweight Stand-off Chemical Agent Detector (JSLSCAD) (DEV FY97-00/PROC FY01-04). The current JSLSCAD is designed to operate on the move for detection of chemical agent clouds out to 5kms. It can be integrated on ground or aerial recon platforms.

Joint Service Warning and Identification LIDAR Detector (JSWILD) (DEV FY01-06/ PROC FY07-09). The JSWILD will detect, quantify, and map chemical agent rain, vapors, aerosols, and ground contamination in a stand-off mode from ranges up to 5kms. The JSWILD will have the capability to operate from both fixed sites and ground vehicles including the NBCRS and will transmit information digitally to a battlefield information network.

Automatic Chemical Agent Alarm (ACADA-NDI) (DEV FY97/PROC FY98-01). The ACADA-NDI is an advanced point sampling chemical agent alarm system which meets critical current deficiencies. It permits concurrent detection of nerve and blister agents and has improved sensitivity, faster response time, agent identification, significantly improved interference rejection, and a data communications interface. ACADA-NDI is manportable, operates unattended after system start-up, and provides both audible and visible alarms.

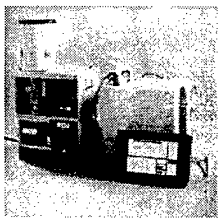


Joint Chemical Agent Detector (JCAD) (DEV FY98-01/PROC FY01-06). The JCAD will be an advanced, miniature, lightweight chemical alarm capable of detecting chemical agents at levels below incapacitation and physiologically significant effects. The JCAD will be capable of integration with 21st Century Land Warrior sensors and communications equipment. The program is evaluating ion mobility spectrometry and surface acoustic waveguide technologies.

M93A1 NBC Reconnaissance System (NBCRS) (PROC FY97-03). The M93A1, an upgrade to the fielded Fox NBCRS interim system, provides organic maintenance and reduces crew size to three. The M93A1 has the capability to detect chemical contamination in its immediate environment through improved point detection, and at a distance through the use of a stand-off detector (M21 RSCAAL). It integrates contamination information from all detector systems, onboard navigation and meteorological systems, and transmits digital NBC warning messages through the Maneuver Control System (MCS) to warn follow-on forces.

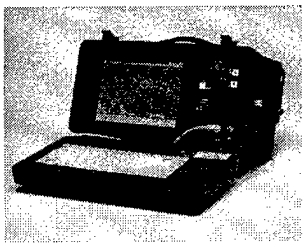


CB Mass Spectrometer (CBMS) (DEV FY97-00/PROC FY01-03). The CBMS is a developmental component of the BIDS and the NBCRS. The CBMS is being designed as an ion trap mass spectrometer to detect and presumptively identify threat biological and chemical agents. The CBMS includes a mass analyzer capable of tandem mass spectrometry.



Light NBCRS (DEV FY97-00/PROC FY01-03). The LNBCRS will consist of an NBC detection suite which will electronically map CB contaminated areas and provide meteorological data to Marine and Army forces. The system can be mounted on the Light Armored Vehicle (LAV) and a standard HMMWV, and it will have similar capabilities as the current M93 Fox NBCRS.

Multipurpose Integrated Chemical Agent Detector (MICAD) Network (DEV FY97-98/PROC FY99-03). MICAD is a near-real-time integrated NBC warning and reporting system to be employed in area warning, armored vehicles, and tactical vans and shelters. It automates the NBC warning and reporting process throughout the battlefield, automatically formatting and transmitting alarms and NBC 1 and NBC 4 reports. It greatly accelerates the sharing of NBC information through the chain of command and permits synchronization of battle requirements created by the NBC conditions.



Joint Warning and Reporting Network (JWARN). This battlefield decision aid will provide a near-real-time picture of the contaminated battlefield (situational awareness), assist in alerting all forces of WMD hazards, and minimize casualties by providing a contaminated avoidance capability. The JWARN Phase I will provide an interim capability in FY97 using Commercial-Off-the Shelf (COTS) software and existing reporting systems to process and transmit digitized NBC information. The JWARN Phase II in FY00 will link multiple existing and developmental detectors/sensors to C4I systems. Phase III in FY04 will use advanced modeling and simulation and artificial intelligence technologies, and provide NBC hazard predictions, scenario preplay, and combat effectiveness measures for battlefield commanders.

Joint Service Agent Water Monitor (JSAWM) (DEV FY99-03/PROC FY04-06). The JSAWM will provide both an in-line water monitor and a portable batch water test capability. The JSAWM will be capable of detecting chemical agents below the revised U.S. Army Surgeon General's requirements for chemical agents and also be able to detect a range of waterborne biological agent contaminants down to parts per million.

Overmatch Capabilities

PROTECTION

Both individual and collective protection systems support overmatch capabilities by denying the adversary the expected military advantage sought by attack with NBC weapons.

Overmatch Capabilities—Protection

Individual and Collective Protection

System	# Systems Required	# Systems Funded FY(99-03) BES	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
CBPS	792	279		**RED**	**RED**	**RED**	
M40 MASK	1,268,000	1,010,676	2012	**GREEN**	**GREEN**	**GREEN**	
M45 AVN MASK	26,311	26,311		**GREEN**	**GREEN**	**GREEN**	Gen Avn
M48 AVN MASK	3,889	3,889		**GREEN**	**GREEN**	**GREEN**	Apache Only
JSLIST	2,346,000	1,342,125		**AMBER**	**AMBER**	**AMBER**	

Figure H-8

Individual Protection

Funding shortages, delayed procurement, and deficiencies in protective gear that degrade personnel efficiency cause protection to be rated **AMBER**. To meet near-term needs, the M40A1/42A1 mask is being fielded through Force Package IV and improved aviator masks are being procured. Development and fielding of an improved protective ensemble will be completed under the Joint Service Lightweight Integrated Suit Technology (JSLIST) program. Mid- and far-term objective technologies seek to optimize performance, compatibility and comfort, and to reduce logistical burdens. Materials that detoxify a broad range of threat agents on contact and can be incorporated into fibers, fabrics, and semipermeable membranes will be investigated using biotechnology and other, more conventional approaches. In addition, we will identify mask readiness criteria and complete fielding of protection assessment test systems.

Collective Protection

Shortages in collective protection equipment (CPE) and CPE that is bulky and logistically difficult to support result in a RED rating throughout the planning period. Our goal for collective protection is to provide a "clean" environment for personnel operating in armored vehicles, command and control centers, and other enclosures. Lightweight shelters with integrated environmental control and power-generation capabilities are being developed for integration into a number of host systems. Mid- and far-term technology objectives seek to protect against novel agents and reduce system weight, size, and assembly time. Development of longer lifetime filters for CP systems is a goal; regenerative filtration materials will be studied to reduce maintenance and logistical burdens.

Individual and Collective Protection RDA Strategy

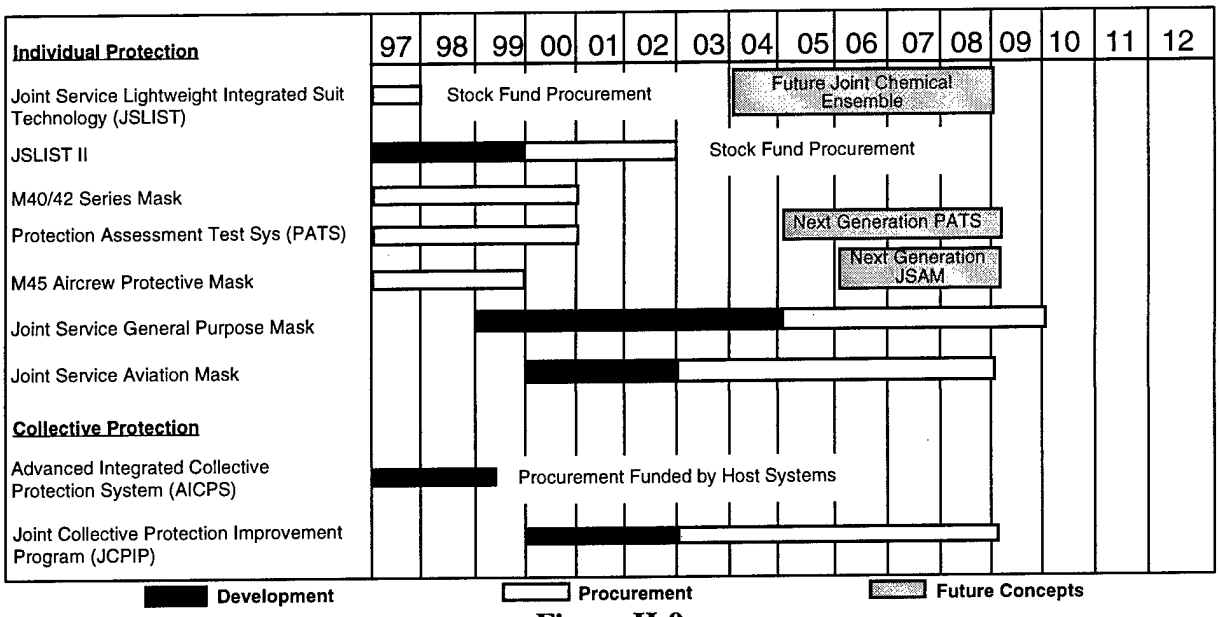


Figure H-9

Individual Protection

The goals of individual protection technology efforts are to (1) improve protection against current threats and add protection against future threats, (2) minimize mission degradation by reducing the impact of individual protection on the soldier's performance, and (3) reduce logistics burdens. The key components of individual protection are ocular, respiratory, and percutaneous protection. Advanced filtration technologies will reduce breathing resistance and increase comfort. These technologies will reduce individual performance degradation and integrate CB protection as well as provide protection from environmental, ballistic, laser, or other threats.



M40/42

M40/42 CB Mask (PROC FY97-00). The M40/M42 mask provides respiratory, eye, and face protection against chemical and biological agents, radioactive particles, and battlefield contaminants.

M45 Aircrew Mask (PROC FY97-99). The M45 mask is the replacement for the M24 and M49 (formerly designated M43 Type II) aircraft masks. The M45 mask will be used by all Army aircrew members except AH-64 helicopter pilots in the conduct of aviation missions in a CB environment. CB protection will be provided without the use of a motor blower while maintaining compatibility with aircraft sighting systems and night vision devices. The M45 mask will also be integrated into the Land Warrior Program.

M48 Apache Aviator Mask (PROC FY97-03). The M48 replaces the M43 Type I mask as the standard issue for Army attack aviators. It provides improved eye relief and complete compatibility with the Apache's Integrated Headgear and Display System (IHADS).

Joint Service Lightweight Integrated Suit Technology (JSLIST). The JSLIST is a three-phased program to develop improved protective clothing which meets all Service performance requirements. Protective clothing research is focused on developing new air permeable materials that provide improved protection against CB warfare threats while minimizing the physiological and psychological burdens.



JSLIST

Collective Protection (CP)

Collective protection equipment, with regenerable filtration capability, will be available for integration into weapons platforms providing continuous air, eliminating the logistics and maintenance burdens of filter replacement, and providing protection against anticipated future threats. Future CP equipment will be smaller, lighter, and require less power.

Advanced Integrated Collective Protection System (AICPS) (DEV FY97-99). The AICPS NBC filtration system is integrated with an environmental control unit and an integral power unit. The AICPS on vehicles and shelters will be activated by the next generation of NBC detectors and alarms.

Chemical Biological Protective Shelter (CBPS) (DEV FY96-98/PROC FY99-03). The CBPS provides NBC collective protection for front-line medical units and replaces the M51 shelter system which was retired in FY96. The NBC filtration system includes an environmental control unit which provides conditioned air for patients and aid station staff. The system is made of lightweight materials and is transportable by HMMWV and 1½-ton trailer.

Recapitalization Program

DECONTAMINATION

Current decontamination systems are being replaced, retrofitted and retired as part of a recapitalization program to improve the efficiency and effectiveness of existing decontaminating methods. Decontamination will remain **RED** throughout the planning period unless a technological breakthrough occurs in less corrosive decontaminants. Problems include inadequate electronic equipment decontamination, deficiencies in large area/port/airfield decontamination, and reliance on DS2 and water. The goals for decontamination are to find technology which removes and detoxifies contaminants from materials without injuring personnel or damaging the equipment or environment, and to reduce the logistical and manpower burden. Possible technologies include enzymes, catalysts that improve reactivity, decontaminants that are effective in both fresh and salt water, reactive coatings, and improved reactive sorbents. Near- and mid-term efforts focus on potential replacements for DS2 and supertropical bleach (STB) for use on combat equipment, as well as

decontaminants for personnel gear and skin. The Modular Decontamination System will enhance current capabilities, but the lack of decontamination for aircraft, sensitive equipment, and port and airfield facilities will remain a major problem for the digitized Army. The recapitalization systems identified in Figure H-10 address only a portion of the problem. More R&D is required to enhance current decontamination capabilities. The **RED** rating in this area will remain until technological breakthroughs are made in decontaminants.

Recapitalization—Decontamination

System	# Systems Required	# Systems Funded FY(99-03) BES	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
M17 LDS	2516	2078		AMBER	AMBER	GREEN	No fixed-site decon capability
MDS	578	578		AMBER	GREEN	GREEN	No sensitive equipment decon

Figure H-10

Decontamination RDA Strategy

Decontamination is defined as the process of removing or neutralizing a surface hazard resulting from a chemical or biological agent attack. The objective of decontamination technology efforts is to develop methods that are effective and environmentally safe, that react with chemical agents or disinfect biological agents, and that do not impact the operational effectiveness of the surface or equipment being decontaminated. Critical studies are needed to define the decontamination technology issues that must be addressed as part of the national global force projection and our ability to simultaneously deploy in two potentially contaminated Major Theater Wars (MTWs).

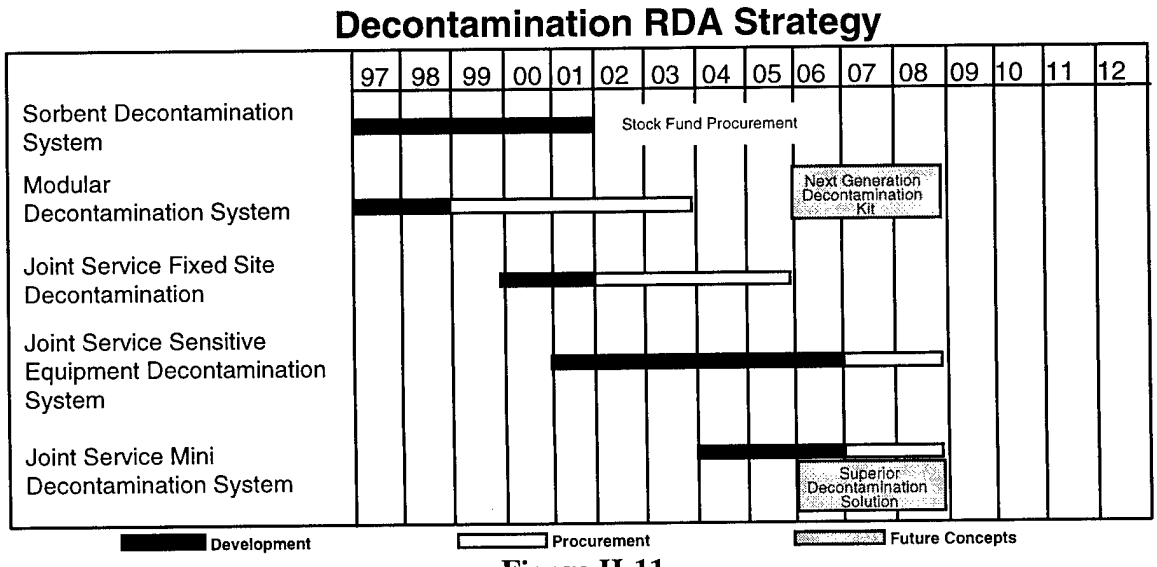


Figure H-11

Sorbent Decontamination System. This program will develop a decontaminant for immediate level of decontamination which is superior to the XE555 carboneous and ion exchange resin mix now used in the M295 kit. The new adsorbent will also eliminate DS2 from the operator's spraydown procedures.

Modular Decontamination System (MDS). The MDS contains a decontaminant pumper module (XM21) to mechanically dispense and brush/scrub DS2 and liquid field expedient decontaminants. With the high pressure washer (XM22), the MDS will provide the soldier an improved capability to perform decontamination on the battlefield with reduced water usage, labor, and processing time.

Essential Research and Development and Leap-Ahead Technologies

The Army Science and Technology Master Plan describes the joint NBC defense research and development (R&D) strategy as applicable to Army needs. The goal in NBC defense R&D is to maximize limited resources by pursuing new technologies that enhance current warfighting capabilities, reduce or eliminate battlefield deficiencies, and provide affordable solutions for NBC defense. The technology base program is focused on joint, high-priority needs in contamination avoidance technology, especially biological point detection, early warning, and CB stand-off detection. Resources are also allocated for decontamination, modeling and simulation of NBC environments and systems, and individual and collective protection. Smoke and obscurants and target defeat technologies are funded in the Army program. The non-medical joint NBC defense program consists of four commodity areas supported by a science and technology infrastructure and reflects a joint service technology base strategy.

NBC Essential R&D

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• Integrated Bio-Detection (ATD)	• Chemical/Biological (CB) Protective Duty Uniform (STO)	• Biometrics (SRO)
• Millimeter Wave Screening (STO)		• Nanoscience (SRO)
• Millimeter Wave Material and Dissemination Technology (STO)		
• Joint Biological Remote Early Warning System (JBREWS) (ACTD)		

Figure H-12

NEAR-TERM (FY98-03)

Integrated Bio-Detection

This ATD will demonstrate two technologies: a pre-exposure warning for a biological attack and an order-of-magnitude increased sensitivity to agents while adding a first-time virus identification capability. It supports the Joint Biological Point Detection System (JBPDS) and Joint Biological Remote Early Warning Systems (JBREWS).

Millimeter Wave Screening

This Science and Technology Objective (STO) will demonstrate the capability of obscurant materials to block or defeat enemy RSTA assets in the millimeter wave region of the electromagnetic spectrum. It supports the Multi-spectral Expendable Obscurant Generating System and the XM56 MMW Module P3I.

Millimeter Wave Material and Dissemination Technology

This STO will use novel material technology to reduce the cost and the logistics of the millimeter wave (MMW) obscurant smoke by evaluating both the dissemination and the obscurant material. It supports the M56 Large Area Smoke Generator-Motorized and M58 Large Area Smoke Generator-Mechanized.

Joint Biological Remote Early Warning system (JBREWS)

This ACTD will enhance situational awareness throughout the battlespace by providing automated biological warfare agent remote early warning and real-time hazard information for force warning. A biological remote early warning ACTD, proposed for FY98-00, will transition into a two-year development phase in FY00 followed by a four-year production phase.

MID-TERM (FY04-10)

Chemical/Biological (CB) Protective Duty Uniform

This STO will provide, by the end of FY00, the CB duty uniform. It will be launderable, 30% lighter, and less bulky than the standard duty uniform/overgarment system (JSLIST) with equivalent durability.

FAR-TERM (FY11-20)

Strategic Research Objectives (SROs)

The Biometrics and Nanoscience SROs will enable the development of advanced NBC detection and characterization systems, including the exploitation of biologically based detectors.

Leap-Ahead Technologies

CONTAMINATION AVOIDANCE

Contamination avoidance is the ability to detect, identify, and warn of CB attacks combined with advanced warning and reporting systems with mapping capabilities for nuclear contamination and CB agents.

Joint Biological Universal Detector System (JBUDS)

The JBUDS concept will be the universal biological detector for the Armed Forces that fully integrates both point and remote sensors into one detector. The JBUDS will be miniaturized, multitechnology-based, fully automatic in manned or unmanned mode, all-agent capable with automatic warning and reporting linked to the theater C4I system.

Chemical Imaging Sensor (CIS)

The CIS concept will expand the capability of current passive interferometry and signal processing to allow long-range chemical imaging. The sensor will be capable of detecting known chemical agents and can be programmed to detect other militarily significant spectral data and provide a visual display of the hazard area.

Surface Liquid Detector (SLD)

The SLD concept will have the capability of both active and passive systems for detection and identification of chemical agent liquid surface contamination for use in reconnaissance, contamination avoidance, and decontamination effectiveness roles.

INDIVIDUAL PROTECTION

Individual protection includes eye/respiratory protection, clothing ensembles, and handwear/footwear for percutaneous protection against nuclear contamination and CB agents.

Joint Service General Purpose Mask (JSGPM) (DEV FY99-04/PROC FY05-09)

The JSGPM is being designed as the replacement for the M40, M42, M45, and M49 masks. The JSGPM is intended to reduce mission degradation greatly while remaining compatible with future equipment and soldier systems. The mask will be virtually maintenance free. Unit costs may be low enough cost to allow for disposal after contamination.

Joint Service Aviation Mask (JSAM) (DEV FY00-02/PROC FY03-08)

The JSAM is a technology effort to develop a protective mask system for high-performance aviation requirements and possibly for use by rotary-wing pilots. This effort will

focus on consolidation of requirements from a series of high-performance aviation mask systems, some of which are not intended to provide protection against chemical or biological agents.

COLLECTIVE PROTECTION

Collective protection encompasses filters and filtration technology for protection against nuclear contamination and CB agents for individuals operating in ground and aerial vehicles as well as in shelters and other large-area enclosures.

Joint Collective Protection Improvement Program (JCPIP) (DEV FY00-03/PROC FY03-09)

The JCPIP will evaluate several advanced CB filtration concepts to prove feasibility of implementing improved filtration technologies into various combat system applications.

DECONTAMINATION

This area includes decontaminants and equipment for personal equipment, vehicles, supplies, weapon systems, airfields, ports, and other fixed sites.

Joint Service Mini-Decontamination System

This program will provide for a manportable modular decontamination system for dismounted forces and the Marine Corps.

Next Generation Decontamination Kit

This program will demonstrate the use of nontoxic material and environmentally safe decontamination.

Superior Decontamination Solution (SDS)

Current methods of decontamination are labor- and time-intensive, having corrosive properties that create environmental, safety, and health hazards. SDS will replace existing decontamination solutions and may be used to safely destroy CB material in sensitive applications. Technologies to be investigated include novel, high-capacity surfactants, reactive organic/water solvent systems with nucleophiles to destroy agents, and enzyme-based systems.

Smoke, Obscurants, and Target-Defeating Capabilities

RECAPITALIZATION

Smoke and obscurants protect the force and can attack the enemy capability to gain information dominance. Smoke and obscurants consist of obscurant materials and the smoke generators, grenades, and projectiles used to counter enemy reconnaissance, surveillance, and target acquisition systems. Target defeat weapons include flame and incendiary devices, riot control technologies, and materiel-defeating munitions that minimize collateral damage. Funding for smoke, obscurants, and target defeat modernization was not consolidated into the Joint NBC Defense Program and remains an Army mission area responsibility.

Smoke and Obscurants

The modernization plan for smoke and obscurants upgrades the large area smoke capability by adding multi-spectral obscurants to the smoke generator systems being fielded in the mid-term. A two-year break (FY00-01) in production of the M56 Motorized Smoke System and lack of Vehicle Engine Exhaust Smoke System (VEESS) causes an **AMBER** rating through the near- and mid-terms. The lack of environmentally safe smoke material keeps this rating **AMBER** in the mid-term. The limited availability of multi-spectral smoke, along with limited vehicle self-screening systems, and the continued lack of alternative environmentally safe smoke material and individual soldier screening capability, keep this area rated **AMBER** through the mid- and far-terms.

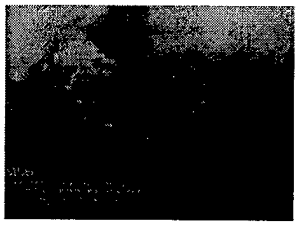
Smoke and Obscurants—Recapitalization Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
M56 Motor	969	448	2010	**AMBER**	**GREEN**	**GREEN**	
M58 Mech	350	280	2010	**AMBER**	**GREEN**	**GREEN**	

Strategy:
- Obscurants for all spectral ranges
- Improved smoke producing system
- Less-hazardous smoke materials

Figure H-13

M56 and M58 Smoke Systems (PROC FY97-03). The M56 wheeled vehicle and the M58 tracked vehicle-mounted smoke generators can dispense smokes capable of defeating current and future threat Reconnaissance, Surveillance, Target, and Acquisition (RSTA) systems operating in the visual through infrared (IR) range. Millimeter wave (MMW) defeat is a preplanned product improvement that will provide the Army's first large area radar obscuration capability.



M157A2 Smoke Generator (PROC FY97-99). This class of smoke generator comprises two-thirds of the total force requirements. The M157A2 eliminates the requirement for gasoline and eliminates several recurring safety deficiencies throughout the force.

LEAP-AHEAD TECHNOLOGIES

Smoke and Obscurants RDA Strategy

In response to the proliferation of increasingly sophisticated enemy RSTA capabilities throughout the electromagnetic spectrum, the smoke and obscurant RDA strategy capitalizes on technologies capable of providing multi-spectral screening.

XM81 Millimeter Wave Grenade (PROC FY97-00)

The XM81 multi-spectral smoke grenade provides IR and MMW obscuration for armored vehicles. This system significantly enhances armored forces survivability on current and future battlefields.

Light Vehicle Obscuration Smoke System (LVOSS) (DEV FY97/PROC FY98-03)

The LVOSS is a soft launched, nonfragmenting, pyrotechnic smoke dispenser. The LVOSS will counter threat weapons systems operating in the visible and near-IR portions of the electromagnetic spectrum, enhancing the survivability of the vehicle.

Multi-spectral Projected Directed Energy Neutralization System (DENS)

The DENS concept will provide the maneuver commander with a projectile capable of delivering materiel to neutralize (defeat or degrade) directed energy weapons. Other multi-spectral concepts include a smoke pot that will defeat enemy visual, IR, and MMW sensors, and a system that uses an existing smoke generator to disperse a smoke/obscurant cloud to a sufficient height above the ground such that the cloud will provide overhead screening but permit friendly operation under the cloud in an unobscured or minimally obscured environment.

Future smoke and target defeat concepts include the following:

- **Direct Fire Smoke** provides maneuver commanders the capability of generating projected and large area screens to shield their forces from visual, IR, and MMW RSTA threats.
- **Electro-Optical System Marking Smoke** provides the capability to release an obscurant detectable only with a mid- or far-IR sighting device. The grenade is intended for use by ground forces as a signaling device to mark landing and drop zones, etc.

- **Flame/Incendiary Indirect Firing System (F/IFS)** will increase the operational effectiveness of conventional weapons. The F/IFS will be used to defeat, degrade, or immobilize enemy targets using indirect fire support capabilities across the battlefield.
- **Enhanced Incendiary Projectile (EIP)** will demonstrate the increase in terminal effectiveness from combined effects greater than conventional warheads of the same caliber and explosive weight.

Flame, Incendiary, and Non-lethal (FINL)

The assessment of FINL remains **RED** due to continued deficiencies in this area (Figure H-14). Limited flame and incendiary delivery capability, a lack of antimateriel munitions, and no non-lethal munitions developments are the major deficiencies. This area has not been a high priority, and there is limited funding for technology advancements.

Flame, Incendiary, and Non-lethal (FINL)

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Materiel Management Objectives				RED	RED	RED	• New delivery capabilities • Non-lethal materiel development

Figure H-14

SECTION 3: CONCLUSION

The NBC modernization plan assures a disciplined approach to meeting mission-based requirements and secures an orderly, modernistic change as we transition through Force XXI, *Army Vision 2010*, and AAN. This modernization plan, while only a first step into the future, is a key element in our Nation's defense and commitment to gain full spectrum dominance.

Although the overall rating of the Army's NBC defense is **AMBER**, significant and measurable progress has been made in NBC defense modernization (Figure H-15). However, it is not just changes to technology that will define the chemical corps' role in *Army Vision 2010*. It will also be based on how we redesign our force structure, update our doctrine, and train future leaders in other branches, as well as chemical soldiers, to support the Army of tomorrow. While this commitment is a bridge into the 21st Century, it is also a costly investment of limited funding for R&D, field testing, and fielding of equipment to soldiers. Neglecting to provide funding for modernization can have a lasting and dangerous liability on the defense of our Nation. Failure to maintain a robust NBC defense capability may result in unwanted risk to U.S. forces and the general population. This investment provides a force multiplier that cannot be matched by any other element of U.S. military forces.

POM FY99-03

	DOES:	DOES ***NOT:***
Protection	• Meet M40-Series Rqmt* • Meet M48 (Apache) Rqmt • Support AICPS Dev • Support Dev of Next Gen Mask (JSGPM) • Meet M45 Gen Avn Mask Rqmt	• Meet JSLIST Rqmt • Meet CBPS Rqmt
Contamination Avoidance	• Improve Bio Det (BIDS P3I, JPBDS) • Provide Long-range Bio Det	• Upgrade Entire Fox NBCRS Fleet W/ Standoff Chem Det Capability • Meet Light NBCRS Rqmt • Meet Point Det Rqmt (ACADA, JCAD, ICAM)
Decon	• Meet M17 LDS Rqmt	• Meet MDS Rqmt • Support Dev, Procurement of Fixed-site Capability
Smoke	• Procure Multi-spectral, Near-IR Capabilities for Armored Vehicles • Support Dev of Directed Energy Neutralization System	• Meet M56, M58 Rqmt • Support Flame, Incendiary, & Non-Lethal (FINL) Wpns Development

* 1-MRC rqmt

Figure H-15

Of critical concern to NBC defense modernization is the $732 million plus-up (for FY98-03) for CB passive defense approved by the Secretary of Defense. Appropriation of this funding would dramatically improve NBC defense program assessments across the board. In the near-term, the Army would be able to completely modernize NBC defense equipment across one major theater war (1-MTW) force. In the mid- and far-terms, this plus-up would provide additional RDT&E funding that would accelerate development and acquisition of next generation detection and protection systems. The Army has developed a detailed, prioritized list of programs against which this plus-up is to be applied. This list addresses the most critical NBC defense needs across the total force, both Active and Reserve Components.

Since the end of the Cold War, the proliferation of chemical and biological weapons to nations looking to gain asymmetrical advantages has heightened the threat to our forces. Continuing modernization of our ability to rapidly detect, identify and decontaminate CB agents is essential to maintaining an edge over the continuing threat.

ANNEX I: COMMAND, CONTROL, COMMUNICATIONS, AND COMPUTERS (C4)

SECTION 1: INTRODUCTION

Overview

Army Vision 2010 is the blueprint for the Army's contributions to the enhanced operational concepts of *Joint Vision 2010*. This annex describes the Command, Control, Communications, and Computers (C4) planned modernization efforts to achieve these required capabilities. The Army's vision of dominance across the full spectrum of potential missions suggests that commanders at each echelon must gain information dominance. In a capabilities-based force, information dominance is measured by the speed, accuracy, and precision demonstrated in the use of force. "Near-perfect" mission selection, assignment, execution, and timely understanding of mission effects will characterize the Army's contribution to joint operations in support of the National Military Strategy (NMS) in the 21st Century.

Army XXI information systems will be relevant across the full spectrum of operations—from humanitarian assistance through high-intensity conflict. Deployed forces will be connected to their power projection/sustaining bases by communications links that support command and control, intelligence, and logistics information requirements. Headquarters and tactical formations in the Area of Responsibility (AOR) will be linked with a seamless, internet-like data network that facilitates the synchronized, decisive operations of mobile forces. Commanders and staffs will conduct planning, rehearsal, and execution on interoperable information systems using a relevant, common picture and featuring integrated, distributed simulations capabilities. *Developing and fielding these capabilities to the Total Force is a top priority of the Army's Modernization Strategy.*

Power Projection—Army XXI

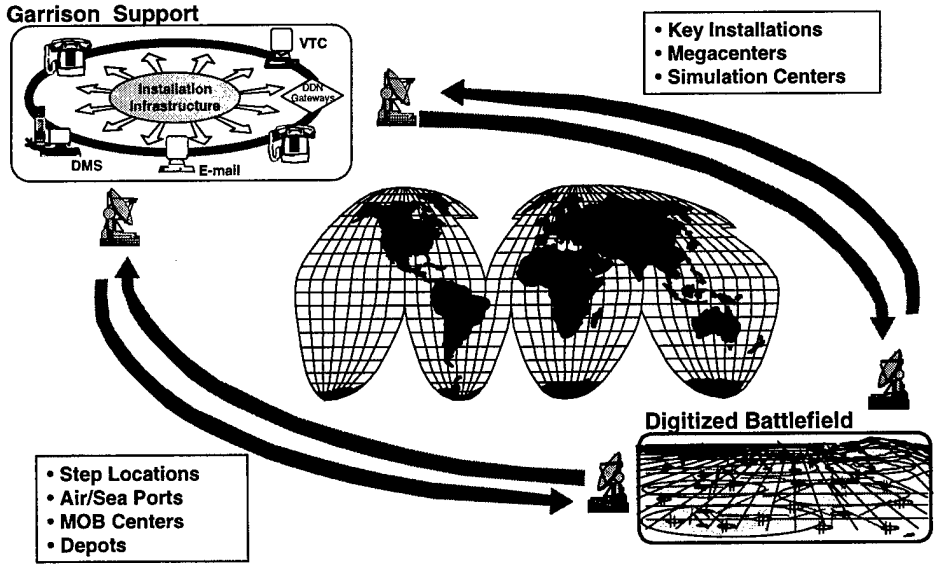


Figure I-1

How C4 Modernization Aligns with the Army Modernization Strategy

Delivering the operational advantages of information dominance starts with the Army Enterprise Architecture (AEA)—a single, unified vision for the Army C4/Information Technology (IT) community. The AEA aligns and focuses existing joint and Army efforts to maximize benefits to the warfighter. It synchronizes Army requirements in *Army Vision 2010* with the Joint Staff's Command, Control, Communications, Computers, and Intelligence (C4I) for the Land Warrior concept, approved business practices, and the Defense Information Infrastructure's Common Operating Environment (DII COE). This synchronization is imperative to achieving Joint/Combined Interoperability. Use of the AEA and Joint Technical Architecture (JTA) is mandated for Army materiel developers. The AEA focuses the C4/IT community on a common goal and establishes a structure to guide the system development process. In addition, it has developed economic, functional, and technical guidelines, as well as criteria to aid resource managers in making C4/IT system assessments.

In conjunction with the AEA, Army doctrine in FM 100-6, *Information Operations (IO),* dictates a Warfighter Information Network (WIN) with the essential C4/IT capabilities Army XXI will employ in the 21st Century. WIN is an evolving integrated network comprising commercially based, advanced technology information and communications systems. WIN increases the capacity and velocity of information distribution to gain information dominance throughout the battlespace. WIN also maximizes information services for the warfighter and supports the power projection force from the sustaining base to the foxhole. In addition to the AEA, the Army has designated key components of WIN as information dominance investment component systems. These high-priority systems must be in place by 2010 to achieve the mental agility described in the Army's Modernization Strategy.

The component threads (Figure I-2) of the Warfighter Information Network summarize and categorize the Army's current and future C4 capability. C4 modernization efforts described in this annex will provide the necessary improvements to information collection/decision support/information dissemination capabilities across the tactical, operational, and strategic echelons of Army XXI.

WIN Major Component Threads and Modernization Programs

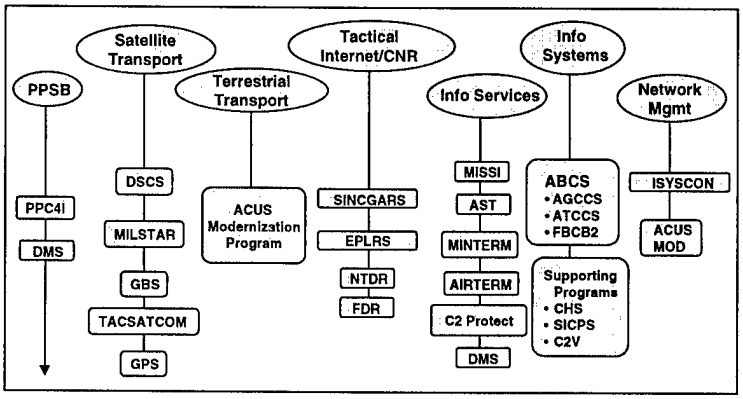


Figure I-2

POWER PROJECTION/SUSTAINING BASE

Capable power projection platforms and sustaining base installations are essential to the Project the Force and Sustain the Force patterns of operation. Power Projection Command, Control, Communications, and Computers Infrastructure (PPC4I) programs provide modernized information infrastructures at Continental United States (CONUS) and forward-presence bases which will support mobilization and movement control, provide the gateway for deployed forces, and support split-based operations. Infrastructure upgrades needed to make this a reality include fiber optics, data gateways, and Asynchronous Transfer Mode (ATM) switches. AEA-compliant technology used at power projection locations will allow the warfighter to use the same type of telephone or personal computer in the field that he uses in garrison, thus reducing the training burden. Standardized Tactical Entry Point (STEP) will provide standardized access by deployed forces to strategic infrastructure services such as telephone and data networks. The Defense Messaging System (DMS) provides a comprehensive, seamless messaging system that will support information flow between strategic and tactical commanders/staffs. Both PPC4I and DMS are information dominance investment component programs.

SATELLITE TRANSPORT SYSTEMS

Satellite communications support every aspect of Army XXI operations, from force projection and split-based operations to providing connectivity among deployed formations. Satellite transport support will include the proper mix of both commercial and military assets. Because Military Satellite Communications Systems (MILSATCOM) support the full spectrum of military operations, they are considered under the Gain Information Dominance pattern of operation. Protected MILSTAR systems, spectrum-efficient Tactical Satellite Communications (TACSATCOM) systems, Global Broadcast Service (GBS), and the Global Positioning System (GPS) are information dominance investment component systems. GBS provides tailored, multimedia, intelligence broadcast service for Army XXI commanders and their staffs, while GPS remains the Army's primary position/location and navigational aid. The Defense Satellite Communications System (DSCS) provides strategic connectivity for warfighting CINCs, as well as the Defense Information System Network (DISN) entry points for deployed force networks. The upgrades required to maintain the viability of DSCS are recapitalization investment component programs.

TERRESTRIAL TRANSPORT SYSTEM

This portion of the WIN will carry the bulk of the data required by division-, corps-, and theater-level commanders to gain information dominance. Future voice and data networks will have higher capacity, make more efficient use of available bandwidth, provide required information services, and support highly mobile headquarters. To accomplish this, the objective WIN terrestrial transport system will comprise ATM backbone switches, Integrated Services Digital Network (ISDN) access switches, and High-Capacity Line-of-Sight (HCLOS) radios, as well as wireless communications such as wireless Local Area Network (LAN) and Personal Communications Services (PCS). These capabilities will be achieved primarily through technology insertion into the Army's current Mobile Subscriber Equipment (MSE) at

division/corps and Tri-Service Tactical (TRITAC) equipment at echelons above corps. Coupled with the other components of WIN, this will result in the complete overhaul of the copper-based, low-bandwidth telecommunications technology. WIN terrestrial transport is an information dominance investment component system.

TACTICAL INTERNET/COMBAT NET RADIO

At brigade and below, the Tactical Internet will extend the Army Battle Command System (ABCS) to the soldier/weapons platform. The Tactical Internet passes the battle command and situational awareness data required to gain information dominance at the tactical echelon. The Tactical Internet, as referred to here and depicted in Figure I-3, is used to describe the communications pathways only, not the information processors connected to the radio network. This network will integrate the legacy Single Channel Ground and Airborne Radio Systems (SINCGARS), Enhanced Position and Location Reporting System (EPLRS) radio, and emerging wideband data radios in the near-term. In the mid-term, the multi-band Joint Tactical Radio (JTR) will provide embedded voice, data, and routing in one radio. The EPLRS and other data radios are considered information dominance investment component systems. The JTR is a leap-ahead technology investment component system. The older generation SINCGARS, used primarily for voice communications, is being cascaded to Force Package 3 and 4 units as a recapitalization investment component effort.

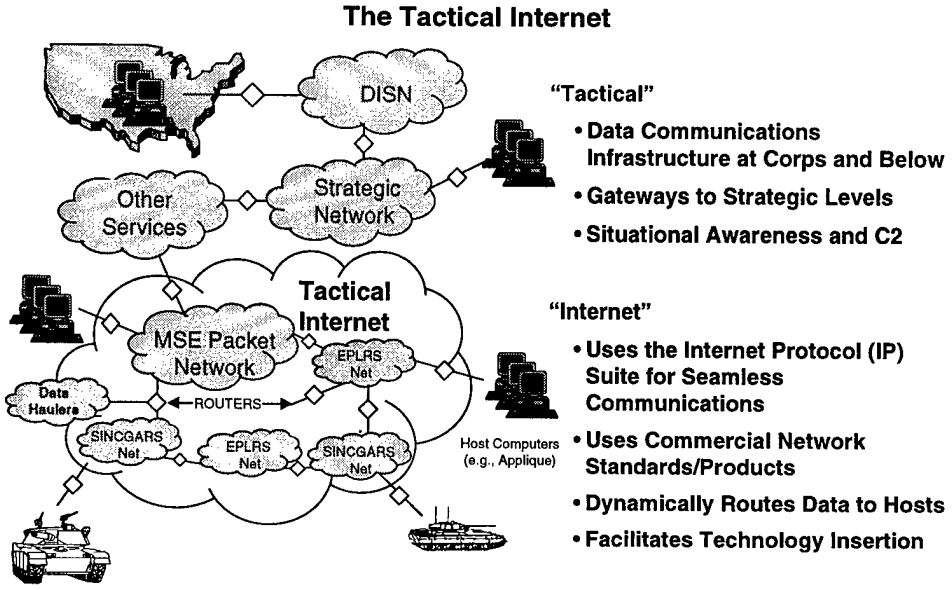


Figure I-3

INFORMATION SERVICES

Critical network services provided by the WIN include distributed databases with access at all command and control nodes, battlefield video teleconferencing "white board" collaborative planning, multi-level security, and seamless messaging from the warfighter to the sustaining base. These services will be fully integrated into the information networks and will be

interoperable across echelon boundaries. Information Security (INFOSEC) is required to protect the force. Command and Control (C2) protect programs will integrate hardware and software solutions designed to preserve the integrity and availability of Army XXI information networks. These capabilities will be embedded in WIN programs such as PPC4I, terrestrial transport, Army Battle Command System (ABCS), and INFOSEC, which are information dominance investment component programs.

INFORMATION SYSTEMS

A constant element of all the patterns of operation described in *Army Vision 2010* is the capability to supply the warfighter with key decision-making information in a timely manner. Commanders and staffs will use information processors that will translate the situational awareness into the knowledge required to accomplish missions. Providing and processing widely disparate elements of information for the warfighter require the integration of various information systems into one homogeneous "system of systems." These will encompass the strategic, operational, and tactical levels; they will also support joint operations. There are three categories of WIN information systems: Global Command and Control System (GCCS), Army Battle Command System (ABCS), and Standard Army Management Information Systems (STAMIS). Linked together with transport systems, they form a seamless, secure, and adaptable information architecture. Global Command and Control System and the Army Battle Command System are information dominance investment component programs. The supporting Common Hardware/Software (CHS) and Standard Integrated Command Post System (SICPS) programs are listed in the Maintain Overmatch investment component.

NETWORK MANAGEMENT

WIN network management is crucial to planning, building, and maintaining the dynamic information networks required to gain information dominance. Efficient bandwidth management, positive control of network services, and allocation of communications assets for the wide variety of systems described above demands integrated management solutions. Key elements of the Integrated System Control (ISYSCON), the tactical network management system, are battlefield spectrum management, Communications Security (COMSEC) management, Wide Area Network (WAN) management, network engineering, and signal command and control. The ISYSCON program is an information dominance investment component system.

Challenges Ahead

Architectures and technical standards will continue to evolve. The Army must remain flexible in procurement strategies while ensuring that emerging technology does not lead down a dead-end path. Discipline in the Army Enterprise Architecture process, focused research and development efforts, and cooperation with industry are essential to attaining Army XXI information dominance (Figure I-4).

C4 Modernization Driving Factors

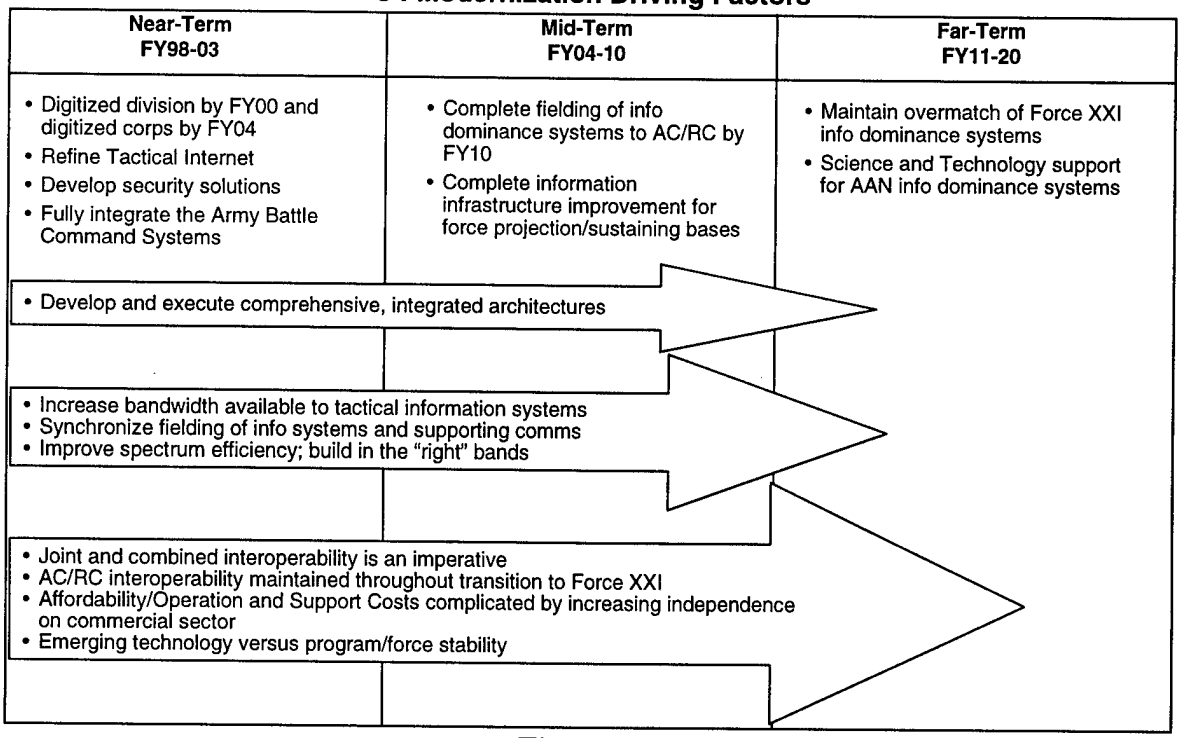


Figure I-4

Synchronization of information systems and communications systems is critical. Investments must be synchronized so that information systems are procured and fielded in concert with the communications systems that are designed to support them. Failure to synchronize results in sub-optimal performance of the new information system and the unit.

Interoperability of C4 across the joint force is an imperative. The Army can expect jointness to occur at lower levels than previously experienced—i.e., at brigades and battalions. Open cooperation within the joint community is essential so that architectures and standards can be agreed upon and adhered to.

Maintaining combined and Active Component (AC)/Reserve Component (RC) interoperability during this period of rapid modernization will require constant vigilance. Direct dialog with military allies on modernization initiatives should continue. Minimum essential compatibility with last generation equipment is required so that the Army maintains baseline interoperability during the transition period. Investment in Army XXI information dominance systems must ensure that the Total Force is equipped by FY10. Digitized systems are listed in Figure I-5.

Priority C4 Systems for the Digitized Force

First Digitized Division:
- Maneuver Control System
- SINCGARS-SIP Radio
- EPLRS/Data Radio
- Global Broadcast System
- MILSTAR (SMART-T/SCAMP)
- SPITFIRE Radio
- Warfighter Information Network—Terrestrial Transport
- Integrated System Control (ISYSCON)

First Digitized Corps:
- Command and Control Vehicle

Objective Digitized Force:
- Joint Tactical Radio
- Airborne Communications Node
- Personal Communications Services
- Defense Messaging System

Figure I-5

SECTION 2: CURRENT PROGRAM ASSESSMENT

Overall C4 Modernization Assessment

The C4 mission area rating for the near-term is **AMBER**. Capability shortfalls across the current Warfighter Information Network systems in the areas of data capacity, security, and network management restrict the warfighter's ability to satisfy today's information requirements. Army Battle Command System interoperability is immature, and fieldings have not been synchronized with transport system modernization, which creates additional burdens for these 1980s technology systems. Ongoing development should produce command and control systems that share a common operational picture by FY01. The additional data requirements generated by the Army's digitization efforts are being considered in the C4 modernization plans so the current capabilities shortfall should be eliminated as the upgraded C4 systems are fielded.

The mid-term goal of the Modernization Strategy is to achieve Total Force information dominance by FY10. C4 rating is **AMBER** in the mid-term because the procurement rates for the modernized C4 systems required to achieve information dominance are too low to completely field the Total Force (AC/RC) by 2010. The rating in the far-term is **AMBER**—obsolescence caused by technology turnover must be addressed through maintain overmatch and recapitalization investments. However, these requirements will compete for C4 funding with the mid-term requirement to complete fielding of the Total Force with the basic information dominance systems. Therefore, even systems that are projected to have completed fieldings are rated **AMBER** in the far-term.

The following is an assessment of C4/IT systems by investment component. Within each investment category the systems are grouped and prioritized according to the Warfighter Information Network (WIN) component threads they support.

Information Dominance Assessment

POWER PROJECTION/SUSTAINING BASE

Modernization of the communications infrastructure is a major initiative for supporting the Army's global information architecture. These programs focus first on modernizing backbone information processing and transfer capabilities vital to the daily operations of Major Commands (MACOMs), installations, and deployment facilities. The primary focus is on those installations where warfighters maintain optimum readiness and are able to mobilize and deploy in support of the National Military Strategy.

Power Projection/Sustaining Base—Information Dominance Programs

WIN Component	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
PPC4I	95	95	2005	**AMBER**	**AMBER**	**AMBER** to **RED**	Requires EPA resources to complete
DMS	62,800	62,800	2005	**AMBER**	**AMBER**	**AMBER**	Requires EPA resources to complete

Figure I-6

The following programs provide strategic C4/IT modernization required to establish the seamless information networks that support force projection and sustainment operations:

Power Projection Command, Control, Communications, and Computer Infrastructure (PPC4I)

PPC4I upgrades telecommunications infrastructure at Army installations to ensure that it supports power projection and split-based operations, and represents the installation-level distribution portion of WIN. For the program period, PPC4I upgrades infrastructures on those installations which project early deploying forces and combines the four existing telecommunications infrastructure programs that improve telephone switch, outside transmission media cable plant, backbone data network, and the data gateway to communications networks external to the installation. PPC4I will synchronize the upgrades of all four component programs to reduce costs and disruptions at installations and to prepare for the arrival of programs whose data transmission will require enhanced transmission capability.

PPC4I is **AMBER** in the near-term due to fiscal constraints, which limit C4 infrastructure modernization to 25 of the 95 installations required by FY03. Mid- and far-term ratings are **AMBER** turning **RED** because basic modernization of all installations will not occur before recapitalization efforts must begin (FY05). Installations will be modernized in accordance with the Army Installation Sequence List (ISL) priorities.

Defense Messaging System (DMS)

The DMS is the primary messaging system for the Department of Defense (DoD). It provides the warfighter with a single, secure, global, reach-back messaging capability extending from the deployed force to the sustaining base. DMS tactical implementation provides primary command and control messaging support for WIN and the Joint Task Force (JTF) environment across the continuum of Army operations. DMS features (1) a user-operated service, (2) a single form of message service and simplified message format, (3) multi-level, secure message processing through the use of Multi-level Information Systems Security Initiative (MISSI) products as they become available, (4) automated local distribution via information transfer networks, and (5) multifunction workstations for most Army users.

The DMS is **AMBER** throughout due to funding shortfalls for individual user access and extension of DMS network services to deployed forces. The program will be fielded in accordance with the Army Installation Sequence List (ISL). The objective goal is to provide a secure, seamless, global C2 messaging capability to support the WIN, Army Battlefield Communications Systems (ABCS), Global Command and Control System (GCCS), and PPC4I. The current funding level allows us to provide a secure DMS capability to the organizational level (approximately 11% of Army users), allowing the Army to continue to close resource-intensive telecommunications centers and AUTODIN switching centers by FY00. Fielding of DMS program components will begin in 2QFY98 and will be integrated to provide the warfighter writer-to-reader messaging capability across the battlespace using a single C4 application on a single platform.

SATELLITE TRANSPORT SYSTEMS

The Army's focus for modernizing its space assets is to leverage technology developments for the warfighter. The Army must continue to influence satellite design and operational architectures to ensure direct access to the required capabilities that Satellite Communications (SATCOM) provides. Some of the SATCOM capabilities required for Army XXI are interconnecting split-based operations with medium and high data rate links, providing flexible "on-the-move" communications to the mobile commanders, broadcasting communication of large-scale command and control and intelligence databases, and navigating accurately across featureless terrain in all weather.

Satellite Transport—Information Dominance Programs

WIN Component	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
MILSTAR	869	559	2013	**AMBER**	**GREEN**	**AMBER**	SCAMP at 50% in near-term
TACSATCOM	3632	2550	2013	**AMBER**	**AMBER**	**AMBER**	Spitfire shortfall
GBS	504	504	2013	**AMBER**	**GREEN**	**AMBER**	R3 in 2013
GPS	106,000	75,000	1999	**AMBER**	**AMBER**	**AMBER**	NAVWAR sys avail in FY01?

Figure I-7

Army MILSTAR

This program is developing the Secure Mobile Anti-Jam Reliable Tactical Terminal (SMART-T) and the Single-Channel Anti-Jam Manportable (SCAMP) Terminal that will interface with the Extra High Frequency (EHF) MILSTAR satellite. Currently, there are two Low Data Rate (LDR) MILSTAR satellites in orbit, with future launches for four medium data rate satellites in the mid-term. MILSTAR accesses a new space segment that gives warfighter

forces (corps and below) a protected anti-jam range extension capability. SMART-T provides a multi-channel range extension to the Army's Mobile Subscriber Equipment (MSE). SMART-T operates in both low and medium data rates (LDR/MDR) and has the inherent capability of low probability of intercept/low probability of detection (LPI/LPD). SCAMP is a single-channel terminal designed to interface with the MILSTAR LDR payload which operates in point-to-point and broadcast modes. SCAMP Block I (Manportable) provides critical command and control communications for echelon corps and below forces. SCAMP Block II (Manpackable) augments and/or replaces SCAMP Block I in the mid- and far-terms and significantly reduces terminal weight and provides point-to-point and Combat Net Radio range extension for conventional and special operations forces.

SMART-T procurement is fully funded and rated **GREEN.** Approximately half of SCAMP Block I requirements are funded, so the rating is **AMBER** in the near-term. SCAMP Block II is funded in the mid-term to field the acquisition objective for SCAMP; therefore, the program is rated **GREEN.**

Tactical Satellite Communications (TACSATCOM)

TACSATCOM provides primary tactical range extension satellite communications (multi-channel and single-channel) for C2 operating in the ultrahigh and superhigh frequency (UHF and SHF) ranges. Current modernization programs are the AN/PSC-5 Spitfire, an enhanced manpackable UHF terminal and the SHF Tri-band Advanced Range Extension Terminal (STAR-T). The AN/PSC-5 Spitfire program replaces the existing family of single-channel radios with embedded encryption and Demand Assigned Multiple Access (DAMA) capability. This allows better support of user demands for increased satellite access and better portability. STAR-T is a HMMWV-mounted, C-130 transportable (Roll-On/Roll-Off), multi-channel TACSAT terminal which operates with any commercial or military transponder-based satellite system within the X (DSCS), C, and Ku (commercial) frequency bands. STAR-T will have two versions: standard and switch. The standard version will consist of communications equipment, power generation, and an antenna system. The switch version will be identical to the standard unit with the addition of embedded automatic switching equipment. STAR-T will replace AN/TSC-85B/93B ground mobile forces multi-channel TACSAT terminals at EAC.

Tactical satellite communications systems are rated **AMBER** in all terms because procurement levels of single-channel DAMA radios do not meet overall Army requirements. The joint multi-band programmable radio program is considering this waveform; if it is successful, the new radio will be available for procurement in the mid-term.

Global Broadcast Service (GBS)

GBS is a newly initiated joint DoD program that will provide the capability to broadcast large volumes of information (data, video, imagery, etc.) to tactical forces on a worldwide basis. The GBS system consists of an information management element, a space segment, and a user element made up of injection terminals and user receiver terminals. The program will be implemented in three phases. Phase 1 (near-term) will use commercially available leased

satellites and receiver terminal capabilities. Phase 2 (mid-term) will use military satellite capabilities on Navy UHF Follow-On (UFO) satellites using the military portion of the Ka frequency band. Phase 3 (far-term) will implement a fully capable system of DoD satellites and terminals that leverage the follow-on to DSCS and the military portion of the Ka frequency band.

The Air Force is designated as the executive agent for the program. The Army will acquire injection terminals and common receiver terminals for all users. The Army requirement is for theater injection points to support joint task force and joint special operations task force operations. Army ground receiver terminals will be fielded down to battalion level.

The Army GBS program is funded to field the first digitized corps by FY04 but is rated **AMBER** in the near-term because the Total Army Requirement is not fielded until FY05. The program is **GREEN** in the mid-term and **AMBER** in the far-term because of projected equipment obsolescence as technology advances.

NAVSTAR Global Positioning System (GPS)

GPS is a satellite-based, global, all-weather radio navigation system that provides highly accurate positioning, velocity, and precise timing information, as well as a common military grid for an unlimited number of users. It consists of three segments: Space segment [GPS satellites operated by U.S. Air Force Space Command (USAFSPACOM)], control segment (ground control stations operated by the USAF), and user segment (GPS receivers). Army GPS user equipment consists of passive receivers for air, ground, and sea users. These provide accurate navigation information for maneuver and support forces; precise positioning for firing platforms and target location for precise munitions in support of deep fires, indirect fire systems; and precise timing for Communications and Command And Control (C3) systems. GPS is capable of denying military accuracy to unauthorized users [Selective Availability (SA)] and overcoming the threat's ability to alter GPS signals to the warfighter. GPS is considered essential to dominating the maneuver battle.

The current constellation of GPS satellites reached initial operational capability (IOC) in FY93, with full operational capability (FOC) achieved in FY94, and will continue at FOC with follow-on replacements as required. All weapons systems and aircraft are projected to have at least an interim GPS capability by the year 2000. The User Equipment (UE) segment is rated **AMBER** in the near-term because of incomplete development for all air applications, insufficient funding to complete the current handheld program, and limited capability to initiate a follow-on program that incorporates protect and denial capabilities. The UE mid-term rating is **AMBER** because approved protection and denial technology is expected to be available after FY01. These major concerns are the subject of a DoD study called Navigation Warfare (NAVWAR).

TERRESTRIAL TRANSPORT SYSTEMS

Area Common User System (ACUS)

ACUS is an all-digital telecommunications system for the battlefield composed of switching, transmission, network control, and subscriber terminal equipment. The corps and below area common user system is the Mobile Subscriber Equipment (MSE). Echelons above corps (EAC) communications are provided by Tri-Services Tactical (TRI-TAC) systems. TRI-TAC switches have been modified to possess the MSE technology by incorporating a common flood search voice and data switched network. Interoperability is provided via gateways to provide automated, secure voice and data communications between the two echelons. ACUS links command posts from maneuver brigade to the JTF/Army Forces (ARFOR) headquarters, provides "cellular-like" access for mobile subscribers, and interfaces with strategic voice and data systems. The Tactical Packet Network (TPN) aspect of ACUS will allow subscribers to exchange data with SINCGARS/Enhanced Position Locating and Reporting System (EPLRS) users via router gateways and bridges, thus forming a Tactical Internet.

The technologies used in the current ACUS equipment have recognized limitations that will hinder seamless, robust support of the digital battlefield. Consequently, the Army initiated the ACUS Modernization Program, a comprehensive plan to implement ongoing and planned improvements to the system. The program is designed to transition the ACUS to commercial technologies such as Asynchronous Transfer Mode (ATM), Integrated Services Digital Network (ISDN), High-Capacity Line-of-Sight Radios (HCLOS), and router-based data networks. These improvements will provide the efficient use of increased bandwidth required to support multimedia subscriber devices, personal communications services, video teleconferencing, and the tremendously expanded data traffic expected on the future battlefield. The future ACUS system will become the backbone of the WIN.

To accommodate and synchronize enhancements to all facets of the ACUS, the modernization program places improvements to circuit switching, data switching, terminal devices, transmission terminals, and network management into three phases as rated in Figure I-8. Near- and mid-term improvements are required to move the ACUS incrementally toward the functions and services of the objective WIN architecture. The timing and speed of this movement is heavily dependent on funding availability and technological advances.

Terrestrial Transport—Information Dominance Programs

WIN Component	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
ACUS	56	56	2013	**AMBER**	**AMBER**	**AMBER**	Initial fielding completed FY14

Figure I-8

The objective WIN architecture will utilize the latest state-of-the-art technologies to the greatest extent that funding resources will allow. Commercial standards, technology, and products will be used to the maximum extent wherever and whenever possible; however, the major goal will always be to satisfy the user's requirements in the most cost-effective way possible. A major goal of the objective WIN architecture will be to allow the soldier to perform functions the same way in the field as in the garrison, using the same subscriber instruments where possible. The far-term objective architecture will feature smaller, lighter, more mobile equipment to reduce crew-size, permit rapid deployment in times of crisis, and provide a high level of reliability and flexibility. The objective ACUS will provide increased trunk capacity for voice, video, and data, and the flexibility to shift bandwidth among all three as required. This will permit bandwidth/overhead intensive applications, such as the Defense Message System (DMS), to operate over the ACUS data network. Command posts supported by the objective system will be able to use wireless subscriber terminals. Network services and network management systems will be greatly improved in the objective architecture and will utilize Open Systems Interconnection (OSI) standards. Many components of the ACUS network will incorporate embedded training to reduce training costs.

ACUS modernization is rated **AMBER** in the near-term because the fielding rate for crucial technology insertion will only support the first digitized corps and contingency force beginning in 2001. Non-modernized ACUS lacks the bandwidth capacity and network management capabilities necessary to support today's pre-digitized information requirements fully; ongoing fielding of the Army Battle Command System (ABCS) exacerbate the problem.

The mid-term rating is **AMBER,** as the current fielding rate will not modernize the Total Force (AC/RC) by FY10. Development and integration of crucial technologies (PCS, Wireless LAN), currently deferred until the mid-term, will compete for C4 resources with ongoing efforts to upgrade ACUS with commercial switching, router, and transmission technologies. The far-term rating is **AMBER** as the Army Modernization Strategy shifts its priority to weapons platforms before Total Force C4 modernization is complete.

TACTICAL INTERNET/COMBAT NET RADIO (CNR)

This section covers those radio modernization programs, outside the ACUS, which comprise the Tactical Internet (Figure (I-9).

Tactical Internet—Information Dominance Programs

WIN Component	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
SINCGARS-SIP	108,000	108,000	2005	**GREEN**	**AMBER**	**AMBER**	Total fielded SINCGARS is 227,000
EPLRS	5,015	5,015	2005	**AMBER**	**AMBER**	**AMBER**	Joint Tactical Radio?

Figure I-9

SINCGARS-System Improvement Program (SIP)

This program specifies an interface with Global Positioning System (GPS) receivers; improved data throughput rates; decreased weight; and an automated interface, both voice and data, with Mobile Subscriber Equipment (MSE) and with EPLRS through use of Internet controllers. The SINCGARS-SIP, which is an integral component of the Tactical Internet, debuted in FY96 and will be retrofitted to Force Package 1 and 2 units. SINCGARS A/B model radios will be cascaded to lower priority units. The program will complete fielding of SINCGARS-SIP to the contingency and reinforcing forces in FY00.

The SINCGARS-SIP is on schedule with final year of procurement in FY98. Recent digitized division/corps architecture changes indicate that the overall requirement for voice and data radios is growing. Additional requirements for SINCGARS-SIP must be analyzed in conjunction with development of requirements for the Joint Tactical Radio, a multi-band programmable radio currently expected to be available in FY04.

Enhanced Position Locating and Reporting System (EPLRS)

EPLRS is a robust, reliable system that provides passage of targeting data, combat orders, Situation Reports (SITREPS), intelligence data, and messages between friendly units at the tactical level. EPLRS enhances situational awareness by automatically tracking and identifying friendly units to other EPLRS-equipped units. The system reduces the potential for fratricide and is interoperable with the Marine Corps Position Locating and Reporting System (PLRS) with regard to POS/NAV functionality.

Currently, EPLRS is approved for fielding to Force Package 1 units at a reduced Basis of Issue Plan (BOIP) level. The EPLRS acquisition strategy is viewed as an evolutionary step to the Near-Term Digital Radio (NTDR) and, ultimately, to the Joint Tactical Radio (JTR). Wideband Data Radios are rated **AMBER** in the near-term due to uncertainty in the migration strategy. EPLRS' last procurement year is FY99, and programmed quantities will not satisfy data radio requirements beyond the first digitized corps. The NTDR is expected to be available in FY00. The JTR is currently expected to be available in FY04. Mid-term funding projections appear adequate to field the Total Force (AC/RC) with the required data radio by FY10 in accordance with the Army's Modernization Strategy.

INFORMATION SERVICES

Information Services—Information Dominance Programs

WIN Component	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
INFOSEC	Varies*	Varies*	Varies*	**AMBER**	**AMBER**	**AMBER**	
C2 Protect	Varies*	Varies*	N/A	**AMBER**	**AMBER**	**AMBER**	

*INFOSEC modernization consists of many subprograms involving legacy and emerging communications security requirements.

Figure I-10

Information Systems Security (INFOSEC) secures Army-wide tactical, strategic, and sustaining base communications. It contributes to the C2 Protect aspects of information warfare and supports security of strategic requirements for the National Command Authority. INFOSEC is integrated into the Total Package Fielding (TPF) from multiple sources in order to support all weapons and telecommunications systems.

The Army's C2 Protect program is a key component in addressing vulnerabilities of the military information environment and countering threats to warfighting information assets. The scope of C2 Protect includes protection for information assets ranging from the National Command Authority down to the soldier's foxhole, to ensure that vital information required for decision making and force control is not compromised or corrupted. Dependence on commercial systems increases the vulnerability of military information and puts tremendous demands on the C2 Protect program.

INFOSEC will field a variety of tools from the Multi-level Information Systems Security Initiative (MISSI) program. MISSI products include Secure Network Servers (SNS), TACLANE (a tactical in-line encryption device with Asynchronous Transfer Mode (ATM) capability), and tactical guards and firewall systems that will be used in securing the Army's portion of the Defense Information Infrastructure (DII).

MISSI products are designed to be the Multi-level Security (MLS) solution. MLS will permit communications over the entire classification spectrum to share the same transmission paths. Due to the past proliferation of many non standard information system platforms, the MLS objective solution is one of the most difficult issues to solve under current technical and budgetary constraints.

INFOSEC will field Army Secure Terminals (AST) to strategic units. The AST is a terminal device that provides secure (end-to-end encrypted) voice and data communications in support of any mission and any level.

Replacement of legacy loop encryption devices and VINSON systems with new Miniature Terminal (MINTERM) and Airborne Terminal (AIRTERM) systems is unfunded. While the encryption technology in VINSON is still good, the speed and data-handling capabilities are inadequate to support emerging requirements. AIRTERM, a narrowband/wideband terminal that provides secure voice and data on tactical air platforms, will be fielded to high-priority units in support of the AN/ARC-220 radio fieldings.

INFOSEC is **AMBER** in the near-term due to insufficient funds to pay the large bill that the Army will incur when all the Defense Information Infrastructure initiatives are implemented. The C2 Protect program, which provides automated common tools and risk management assessment to counter hacker threats to Army XXI strategic and tactical information networks, is also underfunded. INFOSEC is **AMBER** in the mid-term because current funding will not achieve required information dominance capabilities for the total force by FY10.

INFORMATION SYSTEMS

Army Battle Command System (ABCS) is the Army's overarching command and control system; it provides the framework for today's digitized battlefield to become interoperable. The current developmental programs of ABCS extend from the joint/strategic Command, Control, Communications, Computers, and Intelligence (C4I) systems via Global Command and Control System-Army (GCCS-A) through the theater of operations, to the operational/tactical headquarters, and culminates in near-real-time, digital links among the tactical battlefield operating systems functions at brigade level and below. ABCS will mature as each battlefield automated system migrates to the Defense Information Infrastructure (DII) Common Operating Environment (COE), and as common and unique applications are developed. Key fielded and developmental systems in this integration effort are:

- Global Command and Control System-Army (GCCS-A)
- Army Tactical Command and Control System (ATCCS)
- Force XXI Battle Command, Brigade and Below (FBCB2)

ABCS is a conceptual and technical evolution of the existing Army Tactical Command and Control System (ATCCS). The FBCB2 initiative is the centerpiece of the Army's efforts to digitize a brigade at Task Force XXI Advanced Warfighting Experiment (AWE).

Information Systems—Information Dominance Programs

WIN Component	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
GCCS-A	2,616	2,616	2006	**AMBER**	**GREEN**	**AMBER**	
MCS	1,358	1,358	2006	**AMBER**	**RED**	**AMBER**	EPP resources required to complete fielding
FBCB2	TBD	TBD	TBD	**AMBER**	**GREEN**	**AMBER**	

Figure I-11

Global Command and Control System-Army (GCCS-Army)

GCCS-A is part of the overall GCCS. GCCS-A is the Army's strategic and theater functions built on the DII COE. GCCS-A functionality supports operations from peace to war, including contingency and natural disaster operations. GCCS-A, along with other GCCS functions, supports the Army component commands, Army CINCs, Army Joint Task Force commands and components, and Headquarters, Department of the Army. As part of GCCS, GCCS-A provides a single seamless command and control system that supports joint, multi-national, and strategic/operational levels of conflict.

GCCS-A is built around the joint DII COE and is an interoperable component of the GCCS. Its design ensures software and technology reuse and minimizes duplication among command and control systems.

The GCCS-A objective system is being achieved through the evolutionary process of fielding hardware, software, and communications components. These components provide commanders and staff officers the functional capabilities currently possessed by the Army Worldwide Military Command and Control System (WWMCCS) Information System (AWIS), Standard Theater Army Command and Control System (STACCS), Theater Automated Command and Control Information Management System (TACCMS), and Combat Service Support Control System (CSSCS).

System development is fully funded in the near- and mid-terms. However, GCCS-A is rated **AMBER** in the near-term because of several remaining deficiencies identified during operational testing prior to reaching Initial Operating Capability (IOC). The mid-term is rated **GREEN** because all the hardware and software requirements will be developed and fielded.

Army Tactical Command and Control System (ATCCS)

ATCCS incorporates both the development of software applications to support the force commander and his staff, and the integration of applications from the ATCCS Battlefield Functional Area (BFA) command systems: Maneuver Control System/Phoenix (MCS/P), Advanced Field Artillery Tactical Data System (AFATDS), Combat Service Support Control System (CSSCS), All Source Analysis System (ASAS), and Forward Area Air Defense Command and Control (FAADC2) System into the Common Applications Support Software (CASS). These systems will be in compliance with the Army Technical Architecture (ATA) and the Defense Information Infrastructure Common Operating Environment (DII COE). The DII COE integrates modernization of these five computerized/automated command and control systems. The DII COE specifies common protocols, system languages, report formats, and necessary interfaces for each of the five independently developed systems to ensure an overall cohesive and compatible Command and Control (C2) system for the force. Additionally, DII COE provides the common connectivity means among the five arms of the C2 architecture and allows battlefield commanders to rapidly acquire and integrate information, determine optimal battlefield actions, direct their implementation, and control their execution in joint and/or multi-national environments. Only MCS is discussed in detail in this annex. For information on AFATDS, see Annex E; for CSSCS, see Annex L; for ASAS, see Annex J; and for FAADC2, see Annex F.

Maneuver Control System (MCS) is the primary battle command system providing the common picture, decision aids, and overlay capabilities to support the tactical commander and the operational staff via interface with the force level database. MCS features maximum interoperability, hardware and software commonality, and a digitized database.

MCS is rated **AMBER** in the near-term because funding does not support fielding to the Total Force (AC/RC). The MCS Initial Operational Test and Evaluation (IOT&E) will be

conducted in 3QFY98. Software integration was conducted to support Task Force XXI and Division XXI Advanced Warfighting Experiments. Active Component MCS fielding is scheduled to be complete in FY02. MCS is rated **RED** in the mid-term because Total Force modernization will not be complete by 2010 due to the current funding level. Development of an R3 point solution is programmed for FY06.

Force XXI Battle Command, Brigade and Below (FBCB2)/Applique

FBCB2 will be a suite of digitally interoperable, Battlefield Operating System (BOS)-specific functional applications, designed to provide on-the-move, near-real-time situational information to tactical combat, combat support, and combat service support leaders from ATCCS to the platform and soldier levels. FBCB2 will help populate the database with automated positional friendly information and current tactical battlefield geometry for friendly and known/suspected enemy forces. It will also pull information from the force level database to provide leaders with situational reporting, calls for fire, and close air support via graphic and textual orders.

Currently, very few elements at brigade and below possess digital capabilities; therefore, these capabilities must be added as an "applique." The applique program centers on a system of strap-on computers, along with digital radios (SINCGARS-SIP or EPLRS), and POS/NAV devices (GPS) which enable current, tailorable situation displays of the battlespace showing friendly and enemy platforms aligned over a scalable map/grid display background. Applique software will be the Army's brigade and below command and control software. The initial set of appliques will be used primarily for situational awareness and operational control. The Army awarded the contract in 1995 to acquire four types of computer processors, develop software, design and produce installation kits, provide logistics support, and integrate the applique with the platforms and the communications. The first phase of this streamlined acquisition approach was conducted in conjunction with a brigade rotation at the National Training Center (NTC) in the form of an Advanced Warfighting Experiment (AWE) titled Task Force XXI. Technical challenges with integration require an **AMBER** rating for the near-term. The FBCB2 program is adequately funded and is therefore rated **GREEN** in the mid-term. The command and control functionality demonstrated by the objective FBCB2 will be embedded in the weapons platforms that will be fielded in the far-term.

NETWORK MANAGEMENT

Current ACUS Network Management improvements are provided under the Integrated System Control (ISYSCON) program.

Network Management—Information Dominance Programs

WIN Component	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
ISYSCON	153	153	2008	**GREEN**	**AMBER**	**AMBER**	Mid-term requirements for tactical internet management under development

Figure I-12

Integrated System Control (ISYSCON)

ISYSCON is an automated theater-wide system that signal operations staffs will use to manage battlefield information systems. ISYSCON is an evolutionary system that will provide the common thread for management for all tactical communications systems. Ultimately, the high-level management functions of the Area Common User System (ACUS), data radio, and satellite systems will be incorporated into the ISYSCON. In the far-term, NCFs will no longer be required, and this will result in a change from the current "three-tiered" architecture to a "two-tiered" architecture of network management and control. ISYSCON's expanded responsibilities will include network management of Military Satellite Communications (MILSATCOM) and SINCGARS.

ISYSCON is rated **GREEN** in the near-term because current funding provides comprehensive, dynamic network management to the Total Force (AC/RC) by 2005. Software integration of commercial router management is critical for optimizing the information networks emerging from the Army's digitization efforts. The rating is **AMBER** through the far-term because requirements to provide network management facilities for the tactical internet at maneuver brigade are still under development.

Maintain Overmatch Assessment

Maintain Overmatch Programs

WIN Component/ System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Information Systems/CHS	NA	NA	2006	**GREEN**	**GREEN**	**AMBER**	
Information Systems/SICPS	6,022	6,022	2006	**RED**	**GREEN**	**AMBER**	48% underfunded to meet near-term ATCCS rqmts

Figure I-13

INFORMATION SYSTEMS

ABCS Supporting Programs

Common Hardware/Software (CHS) is provided to the Army battlefield functional areas to minimize the number of unique hardware and software systems (including common logistics) used for Army command and control. Hardware and software will evolve through a series of buys, each infused with the latest technology.

CHS is adequately funded. Funding provides support for the research, development, and acquisition requirements of current and future hardware/software systems. The program is rated **GREEN** in the near- and mid-terms. Requirements and fielding schedules are linked directly to the various ABCS system requirements and fielding schedules. The CHS 1 and 2 contracts are open-ended to suit this need for flexibility. R3 point (replace) for CHS 2 with CHS 3 is projected for FY06. The Common Software Initiative (CSI) ensures that common applications that support the ABCS are compliant with the Defense Information Infrastructure Common Operating Environment (DII COE).

Standard Integrated Command Post System (SICPS) is a family of standardized command post platforms developed to transport and/or shelter ABCS across all battlefield functional areas. Variants include a Modular Command Post Tent (MCPT), Rigid Wall Shelter (RWS), track vehicle CP (M1068), 5-ton expando van CP, and heavy HMMWV CP. SICPS variants facilitate C2 functions at corps through battalion. Fielding of the MCPT to light divisions has been completed. The bulk of fielding to Contingency Forces began in FY97.

SICPS is rated **RED** in the near-term because of a 48% funding shortfall. SICPS is rated **GREEN** in the mid-term because of adequate projected funding. The Army projects that 6,022 systems are required.

Essential Research and Development and Leap-Ahead Technologies

Essential R&D for C4

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• Joint Combat Identification ACTD • Battlespace Command and Control ATD • Tactical Command and Control Protect ATD • Digital Battlefield Communications ATD • SATCOM (TD) • Communications Integration and Cosite Mitigation • Commercial Communications Technology Testbed (C2TL)	• Range Extension • Universal Transaction Services	• Mobile Wireless Communications (SRO) • Nanoscience (SRO)

Figure I-14

NEAR-TERM (FY98-03)

Joint Combat Identification (JCID) ACTD

The JCID ACTD is designed to demonstrate a joint, integrated air-to-surface and surface-to-surface combat ID capability. It will quantify the contributions of identification technologies in increasing combat effectiveness and reducing fratricide, and support a Joint and Army Analysis of Alternatives (AOA) through assessment of Measures of Performance (MOP) and Measures of Effectiveness (MOE) from exercises and simulations. The ACTD will leverage the investment in the digitized battlefield initiative to explore synergism between situational awareness and target identification.

Battlespace Command and Control (BC2) ATD

This ATD will develop and demonstrate information- and knowledge-based technology. It will provide a common, integrated situation display with selectable detail and resolution, providing battlefield visualization and supporting systems architectures. A multi-service system architecture will interoperate with multi-echelon joint/allied assets to provide faster, more accurate, intuitive, and tailored battlespace information to the mobile strike force and Force XXI.

Tactical Command and Control Protect ATD

The Tactical C2 Protect ATD will demonstrate the ability to protect the Army's tactical information systems, components, and data from modern network attacks. This ATD will leverage existing commercial off-the-shelf and Department of Defense programs which target network security technology. The approach will be to develop tactical network protection and assessment capabilities, then use the assessment techniques against the protection mechanisms to determine the effectiveness of both. The security architecture developed will be an integrated solution, which provides advanced network access control, intrusion detection, and response mechanisms within tactical communications networks.

Digital Battlefield Communications (DBC) ATD

This ATD will exploit emerging commercial communications technologies to support multimedia communications in a highly mobile dynamic battlefield environment, the "digitized battlefield," and split-based operations. Commercial Asynchronous Transfer Mode (ATM) technology will be integrated into tactical communications networks to provide "bandwidth on demand" to support multimedia information requirements.

SATCOM Technology Demonstration

This TD will extend the applications and capabilities of SATCOM terminals by providing higher data rates, improvements in throughput, and reduced life-cycle costs. Throughput improvement will utilize emerging techniques and architectures such as Demand Assigned

Multiple Access (DAMA) on a per-call basis. Overall improvements to systems and equipment will reduce size and increase mobility for military and commercial SATCOM terminals.

Communications Integration and Cosite Mitigation Technology Demonstration

The objective of this demonstration is to reduce the size, weight, power, and cosite interference problems that occur when multiple radios in either the same or dissimilar frequency bands are integrated within a communications system. The physical space constraints of mobile platforms exacerbate these problems. Technology from ongoing developments will be coupled with new efforts to address the problem within the continuous frequency band from 2 MHz to 2 GHz while also attacking the cosite interference in the HF, VHF, and UHF bands.

Commercial Communications Technology Testbed (C2TL)

C2TL is designed to take advantage of breakthroughs in commercial communications technology and assess their utility for military applications. The objective is successful technology insertion. It provides a means for rapidly evaluating and characterizing commercial products. The most promising candidates are introduced to the Battle Labs and field users for evaluation and incorporation into warfighting experiments.

MID-TERM (FY04-10)

Range Extension Technology Demonstration

This program directly supports the Army C4 modernization "key azimuth" of range extension through the development and integration of a multitude of SATCOM and related technologies. It will identify and develop key technologies required for airborne applications of a suite of communications packages, design and integrate specific systems, and conduct system tests and demonstrations of intratheater communications range extension at a variety of data rates.

Universal Transaction Communications/Services Technology Demonstration

Seamless connectivity and integration across communications media will be demonstrated. The goal is to provide the commander the ability to exchange and understand information unimpeded by differences in connectivity, processing, or systems interface characteristics.

FAR-TERM (FY11-20)

Strategic Research Objectives (SRO)

The Mobile Wireless Communications SRO will support the development of the "backbone" for the "living Internet" that supports future tactical and strategic systems. Nanoscience will enable next generation data storage, computing, and analysis capabilities.

Leap-Ahead Technology Assessment

Leap-Ahead Technology Programs

WIN Component	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Tactical Internet/Joint Tactical Radio	TBD	TBD	TBD	**AMBER**	**GREEN**	**AMBER**	Not expected for procurement until FY04

Figure I-15

Joint Tactical Radio (JTR)

The JTR program will develop programmable digital radio solutions that, in aggregate, can meet the services' requirements for an affordable, integrated family of tactical voice and data radios. The joint requirements documents are under development, and the Joint Program Office will be established in FY98. The Army is primarily interested in the wideband, netted radio that will serve as the objective data radio for the Tactical Internet in the mid-term. The narrowband JTR will be required to satisfy Army voice and limited data requirements in the far-term. JTR is rated **AMBER** in the near-term as the technical solutions for a netted wideband are not expected until FY04. Adequate funding in the mid-term brings a **GREEN** rating.

Recapitalization Assessment

Recapitalization Programs

WIN Component	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Satellite Trans/ Defense Sat Comm System	Varies	Varies	Varies	**AMBER**	**GREEN**	**AMBER**	Essential upgrades not completed until mid-term
Tactical Internet/ SINCGARS	215,000	215,000	2006	**AMBER**	**AMBER**	**AMBER**	Upgrades for data trans-mission req'd in near-term
Information Systems/C2V	439	439	2012	**AMBER**	**GREEN**	**AMBER**	

Figure I-16

SATELLITE TRANSPORT SYSTEMS

Defense Satellite Communications System (DSCS)

DSCS is a joint worldwide military satellite system which supports long-haul communications requirements of deployed warfighters. DSCS provides superhigh frequency (SHF) wideband and anti-jam satellite communications supporting critical national C3 requirements as well as reach back to the sustaining base for the deployed warfighter. The Army is

the designated executive agent for the DSCS ground segment and is responsible for five DSCS Operations Centers that control and maintain communications networks. The AN/GSC-39 and AN/GSC-52 medium terminals and AN/FSC-78/79 heavy terminals provide strategic satellite communications support to the Defense Communications System (DCS) via DSCS satellites. The DSCS ground terminal modernization programs outlined below will bring the DSCS program more in line with 1990s technology and extend the life of satellite communications terminals to the year 2010 and beyond, while reducing operations and sustainment costs. The following are major sub-components of DSCS:

Heavy Terminal/Medium Terminal/Light Terminal (HT/MT/LT) and AN/GSC-52 Modernization Program

This program replaces aging, labor-intensive equipment with state-of-the-art equipment and extends terminal life by 15 years. This program also maintains performance requirements and reduces operating and overall support costs.

Universal Modem System (UMS)

UMS is being developed as the first modem to fully implement a waveform standard that is accepted by NATO. The UMS, which is a combined U.S., U.K., and French program, will be used in strategic and tactical applications, providing a seamless architecture for joint/combined operations.

DSCS Operation Control Systems (DOCS)

DOCS provides critical subsystem enhancements that will remedy technological obsolescence, decrease facility manpower requirements, combine control functions on common computer systems, and enhance mission performance through modernization of the Army's SATCOM control capability.

The DSCS program is rated **AMBER** in the near-term because the Universal Modem System (UMS) is not fully fielded. The program is rated **GREEN** in the mid-term based on UMS fielding completion.

TACTICAL INTERNET/COMBAT NET RADIO (CNR)

Single-Channel Ground and Airborne Radio System (SINCGARS)

SINCGARS replaced the VRC-12 family of radios to provide commanders with a reliable, easily maintained, secure radio for command and control. SINCGARS incorporates effective electronic countermeasures against threat jamming through the use of frequency hopping spread spectrum technology. The radio has been consistently improved through technology insertion. The SINCGARS-SIP (System Improvement Program), which is an integral component of the Tactical Internet, debuted in FY96 and will be fielded to Force Package 1 and 2

units. Displaced SINCGARS A/B model radios will be cascaded to lower priority units. The program is scheduled to complete fielding of SINCGARS to the Total Force by FY01.

The SINCGARS cascading program is rated **AMBER** due to funding shortfalls. Failure to program adequate Operations and Maintenance (O&M) funding will result in a lengthened cascading window during which reinforcing forces and strategic reserves must maintain the antiquated VRC-12 radio.

INFORMATION SYSTEMS

ABCS Supporting Program

Command and Control Vehicle (C2V) provides a tactical platform for state-of-the-art communications/command and control systems and is capable of housing up to eight members of a battle staff. The C2V is designed for robust integration of systems which are able to receive or transmit digital voice/data, significantly enhancing the decision-making process. Key features are up to four computer workstations, an environmental control system, Nuclear, Biological, and Chemical (NBC) overpressure, wireless Local Area Network (LAN), a 600-horsepower engine, and a Bradley derivative chassis, thus enabling it to keep up with the maneuver force.

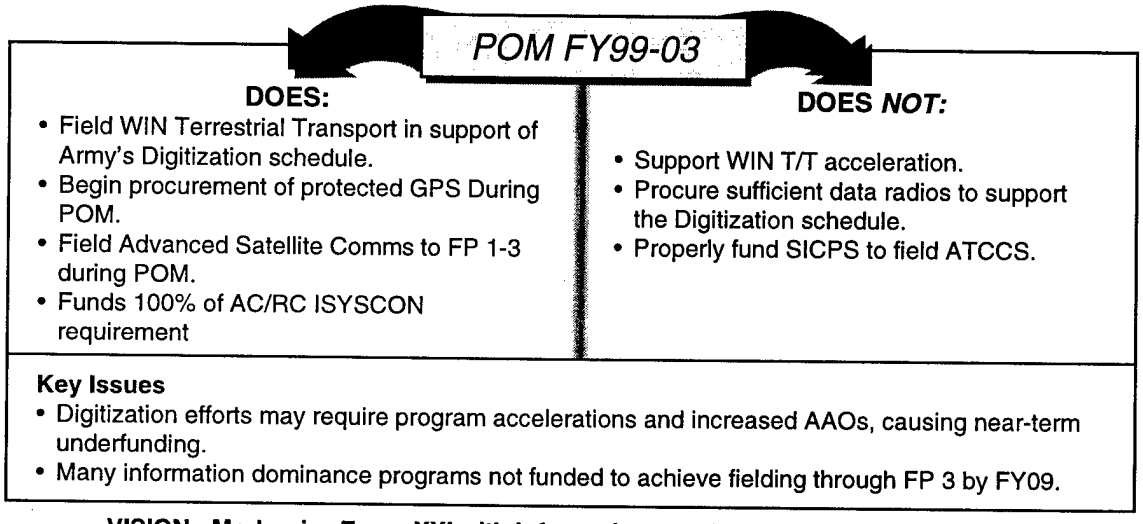
The C2V program is in the Low Rate Initial Production (LRIP) phase. The program is rated **RED** in the near-term because limited funding slows fielding. The first digitized division will not be capable of mobile command and control until FY03. The program is funded, in the mid-term, to field the acquisition objective of 439 vehicles by FY10; therefore, the C2V program is rated **GREEN,** assuming continued funding into the EPA. Only 81 vehicles are funded in the current POM. The R3 point for the first vehicles produced is 2012 for refit.

SECTION 3: CONCLUSION

The information-age environment is characterized by decreasing trends in manpower and dollars while the Army projects increasing trends in information technology, the Command and Control Warfare (C2W) threat, jointness, and complexity of information systems. Our communications systems will see an increase in competition for throughput as additional requirements for information services continue to emerge. The division area digitized battlefield will consist of over 5,000 computers with machine-to-machine "chatter" becoming the norm over communications pathways. With the advent of the Tactical Internet, the trend will be to push information and automated systems forward from battalion to fighting platform. Unfortunately, today's communications "pipes" were built to carry voice and low-rate data. The Army XXI information environment, however, demands much more.

C4 modernization is a central *Army Vision 2010* effort. The Army has mapped a path which proposes an integrated "foxhole to sustaining base" Warfighter Information Network. The objective is an evolving integrated C4 network that is comprised of commercially based high technology information and communications systems that support Army XXI requirements well into the 21st Century. WIN contributes directly to the full spectrum of military operations by increasing the capacity and velocity of information distribution throughout the battlespace that is required to gain information dominance.

Overall, Army C4 systems are rated **AMBER**. The following chart summarizes current resourcing issues with the FY99-03 Program Objective Memorandum (POM). Funding shortfalls continue to limit our ability to transition to a totally digitized force. The ongoing and future efforts in C4 technology insertion and implementation of the enterprise strategy will continue to move communications architectures towards achieving a seamless digitized force. **Future investments in WIN will equip the warfighter with information networks required to achieve the mental agility called for in the Army's Modernization Strategy.**



VISION: Modernize Force XXI with Information Dominance Capabilities Through Implementation of the Warfighter Information Network Architecture

Figure I-17

ANNEX J: INTELLIGENCE AND ELECTRONIC WARFARE

SECTION 1: INTRODUCTION

Overview

Intelligence modernization and resulting Intelligence and Electronic Warfare (IEW) capabilities enable the U.S. Army to gain information dominance, which is key to achieving the enhanced operational concepts outlined in *Joint Vision 2010*: dominant maneuver, precision strike, focused logistics, and full-dimensional protection. Achieving information dominance has three equally important facets:

- Building up and protecting friendly information capabilities
- Exploiting enemy information systems
- Degrading enemy information capabilities

Relevant information and intelligence is the foundation of knowledge-based warfare. It enables commanders to coordinate, integrate, and synchronize combat functions on the battlefield. To gain the relative advantage of position (maneuver) and massing of effects (firepower), commanders must act while information is relevant and before the adversary can react. It is absolutely essential that friendly knowledge and understanding of the situation be more certain, more timely, and more accurate than the adversary's.

Execution of information operations provides the commander a common, current, and relevant picture of the battlespace, reducing uncertainty and shortening the commander's decision-making process. The primary purpose of intelligence is to enable well-informed operational decisions based on an accurate understanding of the situation. The essence of intelligence is to direct, collect, process, analyze, disseminate, and present information required by the commander.

Commanders in Force XXI operations will have at their disposal the most precise and lethal weapons systems and agile organizations the world has ever known. To employ these potent capabilities fully, future commanders must have the capability to:

- Conduct multidimensional, simultaneous operations
- "See" their battlespace in depth, often in real-time
- Share an accurate, common picture of the joint battlespace horizontally and vertically
- Precisely locate, identify, track, and attack High Payoff Targets (HPT) with both lethal and non-lethal means, and conduct battle damage assessments (BDA)
- Protect their forces throughout the operation

- Operate with combined, joint, and multinational forces and governmental and non-governmental agencies
- Track friendly forces

Capabilities Contributing to *Army Vision 2010* Patterns of Operation

Force XXI commanders will need faster, more accurate intelligence to gain information dominance. Army Military Intelligence is synchronizing doctrine, equipment, and force structure now to meet those needs. Fewer, but more capable, systems will collect, analyze, and display more information in less time. These systems will be fully compatible with other Services. Figure J-1 outlines IEW system convergence from the Cold War through Army After Next (AAN).

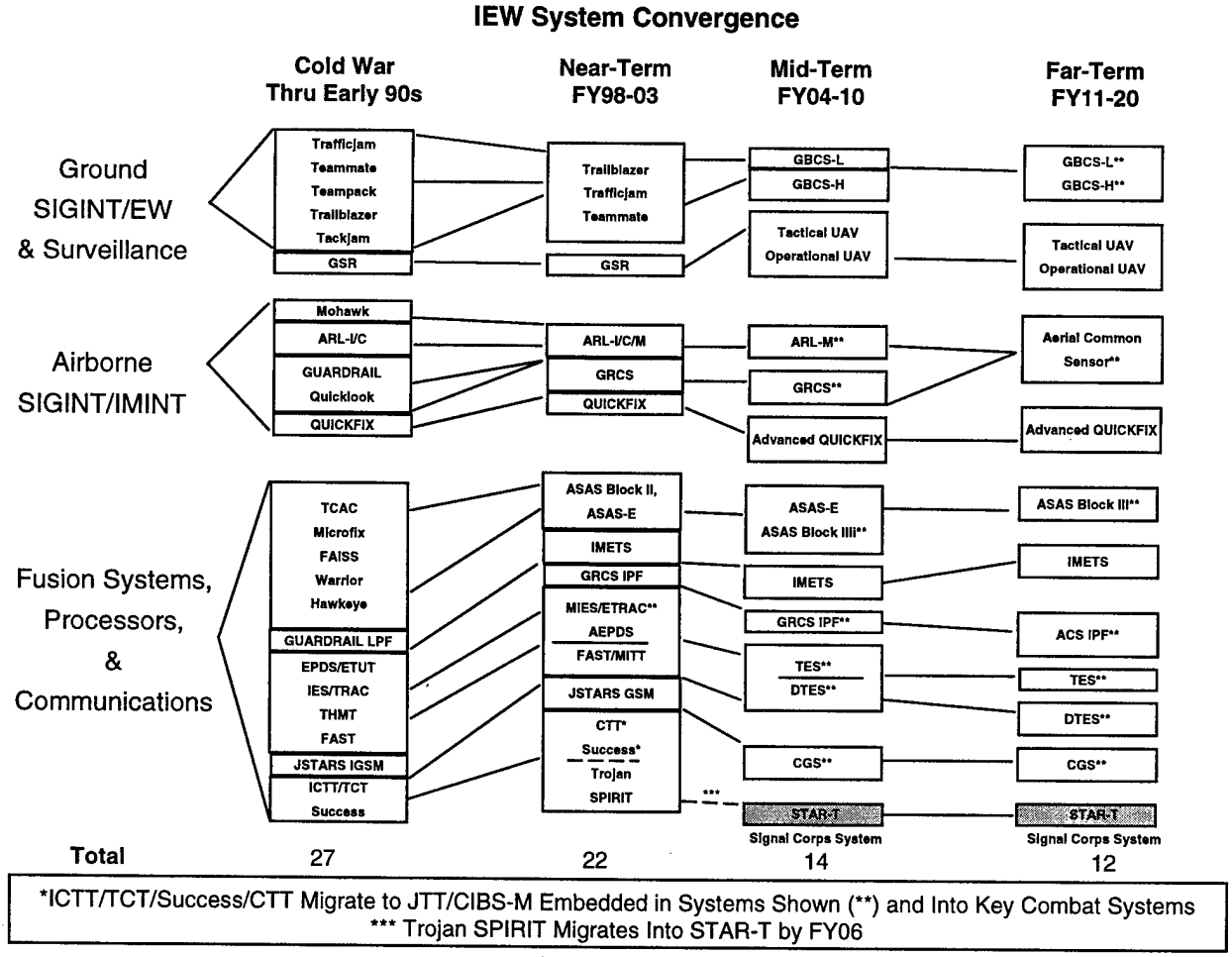


Figure J-1

Systems Providing Required Capabilities

IEW systems are an integral part of the Army's 21st Century warfighting strategy. Intelligence processors correlate national, theater, and tactical sensor information; filter huge amounts of data; and provide a powerful tool to analyze and fuse resulting information from all intelligence disciplines. Army intelligence processing systems give the commander the superior information advantage of a nearly instantaneous and complete battlespace picture. Sensors quickly and accurately pinpoint enemy personnel, units, facilities, and systems. Their range, versatility, and resolution provide an unprecedented view of the battlespace environment. Armed with this view, the commander can posture his forces in the battlespace to best set the conditions for victory.

The IEW Battlefield Operating System (BOS) consists of a "systems of systems" that provides commanders at all levels a broad, near-real-time view of the battlespace environment and the necessary information to integrate all available combat multipliers to take advantage of the operational environment. Central to this system is the All Source Analysis System (ASAS), the Army's premier intelligence processor, which fuses data from imagery, signals, human, and measurement intelligence into a coherent picture of the battlespace.

This intelligence information is provided by both airborne and ground systems. The Tactical Unmanned Aerial Vehicle (TUAV), cued by intelligence from other air- and ground-based systems, will verify the identification and location of these targets and perform timely battle damage assessment.

The Intelligence and Electronic Warfare Common Sensor (IEWCS) consists of an air and ground system, Ground Based Common Sensor (GBCS) and, Advanced QUICKFIX. Together with TUAV they provide precise, targetable enemy locations, allowing the commander to further shape the battlespace according to his scheme of maneuver.

Aerial platforms like the GUARDRAIL Common Sensor (GRCS), Airborne Reconnaissance-Low (ARL), and the follow-on Aerial Common Sensor (ACS) system, are designed to identify high-payoff ground threat maneuver forces, and air defense weapons systems, and provide high accuracy locations of these targets operating from the Forward Line of Troops (FLOT) to at least 250kms forward of the FLOT.

Tactical Exploitation Systems (TES) at corps and division (DTES) will enhance the tactical echelon's ability to access and rapidly exploit strategic and theater level intelligence.

The Counterintelligence/Human Intelligence Automated Tool Set (CHATS) allows field agents to rapidly format, send, store, search, and retrieve information from a number of databases. The Integrated Meteorological System (IMETS) produces vital weather information overlays and other decision tools.

Broadcast systems such as the Commander's Tactical Terminal/Joint Tactical Terminal (CTT/JTT) permit timely receipt of intelligence originating from national, theater, and other

service intelligence systems and centers through satellite communications. The CTT/JTT also supports dissemination of intelligence information via line-of-sight (LOS) communications relay on GRCS and other platforms. The Joint Tactical Terminal (JTT) provides the Common Ground Station (CGS), All Source Analysis System (ASAS), and the corps/division Tactical Exploitation System (TES/DTES) access to timely intelligence broadcast.

Finally, Trojan SPIRIT provides assured, dedicated communications pathways, from strategic collection systems and databases down to the soldier on the ground. The timely and accurate receipt and dissemination of intelligence information is critical to the commander's ability to achieve information dominance and enables the accomplishment of other patterns of operation.

How IEW Modernization Aligns With the Army Modernization Strategy

IEW Modernization

Patterns of Operation	Required Capabilities	System/Investment Component
Information Dominance	• Intelligence Fusion • Intelligence Dissemination • Weather Dissemination • CI/HUMINT Workstation • High-Capacity SATCOM	• ASAS—Info Dominance • CTT/JTT—Info Dominance • IMETS—Info Dominance • CHATS—Info Dominance • Trojan SPIRIT—Recapitalization
Shape the Battlespace	• EAC Abn IMINT/SIGINT/MTI • Division & Bde RSTA • Division Abn SIGINT • Corps Abn IMINT/SIGINT • Corps National IMINT/SIGINT • Aerial Surveillance Target Acquisition • Corps Airborne SIGINT • Div National IMINT/SIGINT • Division Ground SIGINT/EW	• ARL—Info Dominance • TUAV—Info Dominance • AQF—Recapitalization • ACS—Essential S&T/Leap-Ahead • TES—Essential S&T/Leap-Ahead • CGS—Info Dominance • GRCS—Info Dominance • DTES—Essential S&T/Leap-Ahead • GBCS—L/H-Info Dominance

Figure J-2

Figure J-2 reflects IEW systems and functions being developed and fielded to meet warfighter requirements on the Joint battlefield.

This architecture includes a balance of national, joint, and tactical signals, imagery, and human intelligence collection capabilities with processing and fusion systems that correlate and present the right intelligence to the right commander at the right time. It employs the power of ASAS workstations, combined with downlinks from multiple space and airborne sensors, to allow a common understanding of the battlefield. This structure also employs sensors with targetable accuracy, focused by a common understanding of the battlefield. Employed to detect high payoff targets, these sensors are linked through broadcast intelligence nets to the Common Ground Station and to shooters to meet the commander's targeting needs.

IEW supports the Army Modernization Strategy by integrating national, joint, theater, other service, and Special Operations Forces (SOF) systems into a seamless "system of systems" to gain and maintain information dominance in the near-term. Systems such as TUAV are key components developed and procured by the Department of Defense (DoD) for fielding to the Army. Recapitalization of Advanced QUICKFIX and Trojan SPIRIT will ensure the Army maintains its capability to locate and target key threat systems while providing assured intelligence pathways from national agencies to the soldier on the ground. Investment in science and technology (S&T) for the far-term will greatly enhance the commander's ability to leverage national intelligence systems and databases, exponentially increasing his ability to see the entire battlespace. While Figure J-2 and this annex focus on requirements and capabilities that specifically belong to the Army's IEW Battlefield Operating System (BOS), the comprehensive intelligence and combat information structure includes assets such as scouts, reconnaissance helicopters, air defense and artillery radar systems, and Army Special Operations Forces with organic collection and processing capabilities.

Challenges Ahead

Figure J-3 lists IEW modernization priorities. The list underscores the near-term modernization emphasis on information dominance. It reflects ASAS as a priority digitization system under *The Army Plan*; ASAS is essential to fully digitizing a division by FY00 and a corps by FY04.

IEW Modernization Priorities

1. Tactical Unmanned Aerial Vehicle (TUAV)*
2. All Source Analysis System (ASAS)
3. Joint Surveillance Target Attack Radar System (JSTARS) Common Ground Station (CGS)
4. Tactical Exploitation of National Capabilities (TENCAP)
5. Trojan SPIRIT
6. GUARDRAIL Common Sensor (GRCS)
7. Airborne Reconnaissance Low (ARL)
8. Ground Based Common Sensor (GBCS)/Advanced QUICKFIX (AQF)
9. Counterintelligence / Human Intelligence Automated Tool Set (CHATS)
10. Integrated Meteorological System (IMETS)

*TUAV is jointly managed

Figure J-3

The primary factors driving IEW modernization are captured in Figure J-4.

IEW Modernization Driving Factors

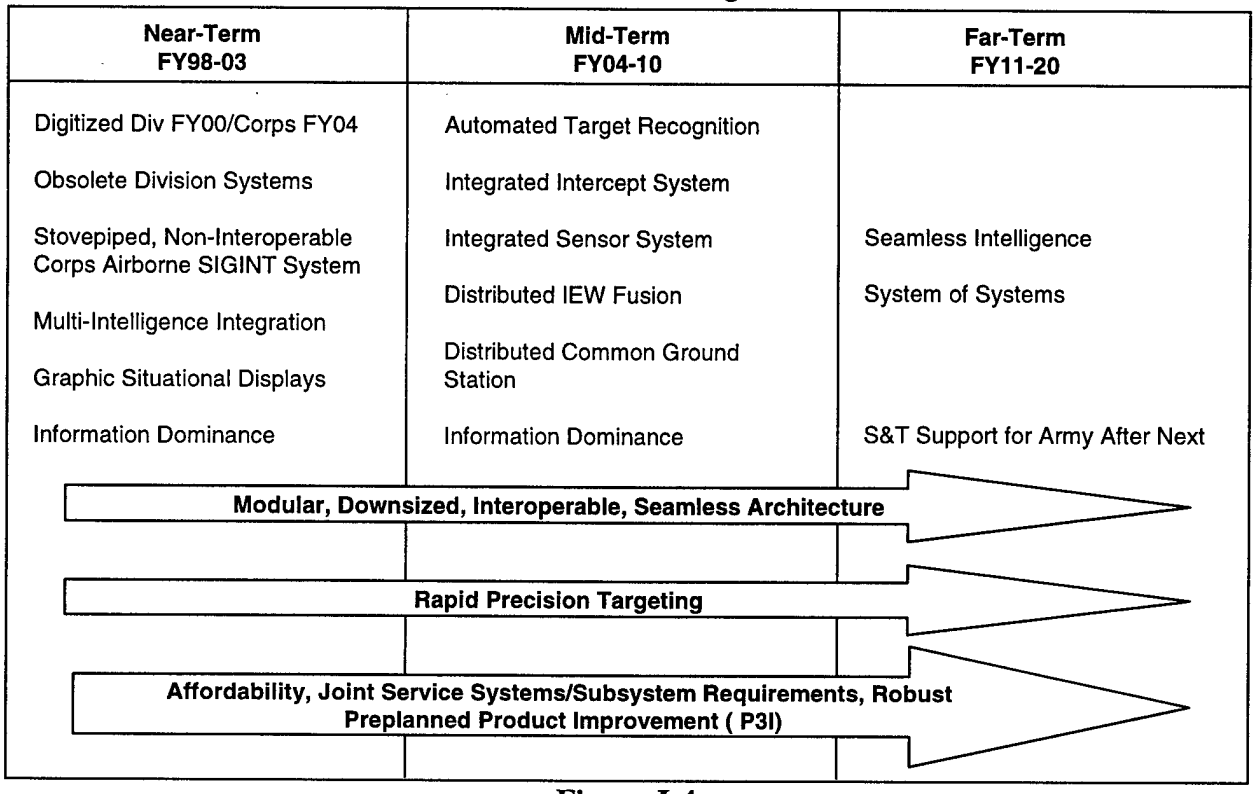


Figure J-4

IEW strategy calls for increased capability despite combining 27 systems down to 12. However, reducing the number of Intelligence and Electronic Warfare (IEW) systems by more than 50% carries risk. The role of each system in the overall intelligence architecture becomes magnified. Convergence eliminates redundancy, resulting in a leaner and more fragile force structure. The loss or delay of even one system would reduce capability and have a severe impact on the entire intelligence architecture. Additionally, fiscal constraints have slowed acquisition rates, resulting in extended fielding schedules and introducing risk by reducing procurement below the optimum quantities required for some systems.

SECTION 2: CURRENT PROGRAM ASSESSMENT

Overall Mission Area Modernization Assessment and Key System Ratings

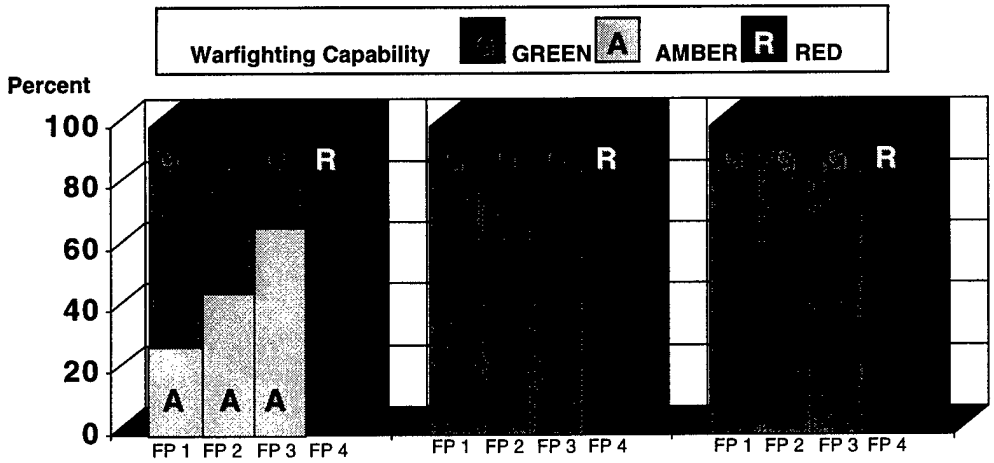
Acquisition rates are a major IEW program concern. Low acquisition rates have extended fielding schedules of many systems and reduced others below the stated requirements. Consequently, several programs are AMBER in the near- and mid-terms. In an architecture concentrating on fewer, more capable systems, each system's impact is magnified. Any delay or loss to even one of the remaining integral parts jeopardizes the ability to successfully accomplish the mission. Overall, IEW is rated **AMBER**.

Capabilities Assessment

INFORMATION DOMINANCE

IEW major information dominance programs are ASAS, CGS, TUAV, and GBCS (Figure J-5).

IEW Information Dominance



Near-Term (FY98-03)

ASAS AMBER: Completes Block I & II Upgrades Featuring DII/COE Compliant Open Architecture

CGS GREEN: Develops and Integrates SIDS into GSM to Transition to CGS

TUAV AMBER: Develops Essential Capability for Bdes to "See Over Next Hill"; ACTD Critical to LRIP FY99 Fielding

GBCS-L/H AMBER: Quantum Leap Forward to Collect Emerging Threats; Legacy Systems Largely Obsolete; Very Limited Nos. of "Lights" Fielded

Mid-Term (FY04-10)

ASAS GREEN: Upgrades to Block III & Full Objective Capability

CGS GREEN: Begins Development of P3I.

TUAV GREEN: Adds Sensor Packages Providing Expanded Capabilities

GBCS AMBER: Only Fielded to FPs 1 & 2

Far-Term (FY11-20)

ASAS GREEN: Development of P3I Continues

CGS GREEN: Continues Development of P3I and Block Upgrades to Fielded Systems, Improving Capability

TUAV GREEN: Continues Upgrades

GBCS AMBER: Continue P3I

System	Required	Funded	R3 Pt
ASAS	28	27	2010
CGS	98	98	2006
TUAV	42 (Est)	N/A	2019
GBCS	72	72	2015

FPs 1-4 reflect DA Force Packages IAW FY 97-02 B Master Priority List (DAMPL)

Figure J-5

All Source Analysis System (ASAS)



The All Source Analysis System (ASAS), the intelligence component of the Army Tactical Command and Control System (ATCCS), brings together all available intelligence data, correlates and fuses the data, and provides the commander the relevant intelligence he needs to understand enemy deployments, capabilities, vulnerabilities, and potential courses of action. ASAS supports rapid targeting, automates collection management, and provides a common relevant intelligence picture to warfighters at all echelons.

ASAS Block I combined government developed militarized equipment and software and provided an initial operating capability to Army priority units by FY95. ASAS-Extended (ASAS Block I software on non-developmental item (NDI) hardware) provided an ASAS capability to the remainder of the Active Component (AC) by FY97, and will provide it to the Reserve Component (RC) enhanced readiness brigades by FY99. ASAS Block II features a Defense Information Infrastructure (DII) Common Operating Environment (COE) compliant open architecture. It embeds CTT/JTT, Joint Deployable Intelligence Support System (JDISS), and Joint Collection Management Tools (JCMT) capabilities. ASAS Block III will provide full objective functionality as well as the full complement of required computer terminals.

Basis of Issue: One ASAS system, including Remote Workstation (RWS), for each theater military intelligence (MI) brigade/group, corps, division, separate brigade/Armored Cavalry Regiment (ACR), and selected RC Enhanced Readiness Brigades. Only RWS is planned at Army Special Operating Forces (ARSOF) group/regiment and battalion.

ASAS is rated **AMBER** in the near-term, until Block II Initial Operational Testing and Evaluation (IOT&E) and a Milestone III decision is made, allowing Block II fielding to all units. ASAS is **GREEN** in the mid-term, as all units are upgraded to Block III objective functionality. ASAS is **GREEN** in the far-term as technology insertion allows the system to maintain currency.

JSTARS Ground Station Module/Common Ground Station



The Common Ground Station (CGS) serves as the ground commander's battle station, providing a dynamic link between sensors and shooters. CGS receives, processes, manipulates, and disseminates data from the airborne JSTARS radar, unmanned aerial vehicles, CTT/JTT, and other tactical, theater, and national systems for targeting, situation development, and battle management simultaneously. The Common Ground Station is the objective variant of the JSTARS Ground Station Module (GSM).

GSM consists of communications systems to receive data and two workstations to display and correlate Moving Target Indicator (MTI), Fixed Target Indicator (FTI), and Synthetic Aperture Radar (SAR) data from JSTARS; MTI and SAR data from ARL; video from UAV; and intelligence reports from GRCS, U-2, RC-135, EP-3, and TENCAP via the CTT/JTT. GSM are

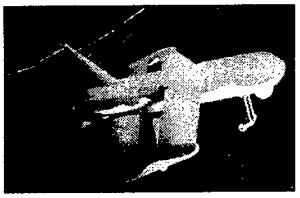
HMMWV- or 5-ton truck-mounted. First Unit Equipped (FUE) with GSM was in FY95, with low-rate initial production units mounted on 5-ton trucks.

The CGS transition allows access to Secondary Imagery Dissemination System (SIDS) and Apache Longbow fire control radar in systems being fielded in FY98 and beyond. Receipt of IEW Common Sensor reports, RAH-66 Comanche imagery and digital data, and other sensor information are P3Is in the far-term. CGS is mounted on a heavy HMMWV.

Basis of Issue: Two per selected echelon above corps (EAC) MI brigade, six per corps, six per division, one per ACR, and one per separate brigade.

CGS is rated **GREEN** in the near-, mid-, and far-terms, as full rate production and fielding is completed. Insertion of upgrades linking CGS to additional systems is planned beginning in the mid-term.

Tactical UAV (Outrider) Program



The Outrider Tactical Unmanned Aerial Vehicle (TUAV) will provide reconnaissance, surveillance, target acquisition, and battle damage assessment (BDA) beyond the FLOT in direct support of the brigade fight. Its manpower requirements, small launch and recovery area, and minimal deployability assets are consistent with operating from the brigade area. However, it is fully capable of providing the brigade commander the essential ability to "see over the next hill" in real-time without putting soldiers or combat systems at risk.

Outrider systems will consist of the common, interoperable Tactical Control Systems (TCS) electronically linked to an air vehicle carrying electro-optic (EO) and infrared (IR) sensor payloads; auto launch and recovery systems; and remote video or graphic display terminals to receive imagery at tactical locations separate from the Ground Control Station (GCS). Objective systems will include an adverse weather sensor and digital data link capability.

Basis of Issue: The basis of issue will be determined during evaluation and demonstration of system capabilities. Current assessments call for four systems per light division, three systems per heavy division, and two systems per ACR.

The status of Outrider is **AMBER** in the near-term because the outcome of the Advanced Concept Technology Demonstration (ACTD), fielding, and training issues remain unresolved. The Outrider ACTD began in May 1996; the system was first available for demonstration in FY97. Any delay in the ACTD could result in a 12-18 month slippage in the program and would change the status to **RED**, further delaying providing this system's unique capabilities to the field. Assuming a successful military utility assessment and acquisition decision, the Outrider TUAV is **GREEN** in the mid- and far-terms following completed fielding.

Ground Based Common Sensor—Heavy and Light (GBCS-H/GBCS-L)

Ground Based Common Sensor (GBCS) will provide division commanders with precision emitter location, signals intelligence, and electronic attack (EA) capabilities. It will provide twenty-four hour, day/night, all-weather operations against emerging threats and signals types, and (in tandem with Advanced QUICKFIX) meet artillery target selection standards for target accuracy. It will be fielded in a wheeled variant for the light division and a tracked variant for the heavy division.

Initial limited procurement GBCS-L systems provide signals intercept and precision location capabilities on a heavy HMMWV, with FUE in FY99. The objective GBCS-L adds the EA subsystem on a second HMMWV. GBCS-H will integrate all components on a tracked carrier which will provide the survivability, collection-on-the-move capability, and mobility required by heavy forces.

Basis of Issue: Four GBCS-L systems will be fielded to each light division and the light ACR. Six GBCS-H systems will be fielded to each heavy division and four GBCS-H to the heavy ACR.

GBCS is rated **AMBER** in the near-term, as a small number of limited procurement-urgent systems begin fielding in FY99. However, GBCS will drop to **RED** in the near-term if it is subjected to any further procurement delays, denying units enhanced targeting capability. It remains **AMBER** in the mid-term, as current funding does not support fielding to all Active Component divisions and ACRs. It remains **AMBER** as programmed P3I allows the fielded systems to maintain technological currency.

Other IEW information dominance programs are described below. Figure J-6 summarizes the status of these programs.

Other IEW Information Dominance Systems Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
ARL	9	8	2011	**AMBER**	**N/A**	**N/A**	Near: Short quantities. Mid/Far: Migrates to ACS.
CHATS	452	452	2000	**GREEN**	**GREEN**	**GREEN**	Near: Fully fielded. Mid/Far: P3I
CTT/JTT	465	465	2015	**GREEN**	**GREEN**	**GREEN**	Near/Mid/Far: Fully fielded.
GRCS	4	4	2012	**AMBER**	**AMBER**	**N/A**	Near: Fully fielded, yet maintenance intensive. Mid/Far: Transition to ACS.
IMETS	32	27	2000 (Block I) 2010 (Block II & III)	**AMBER**	**AMBER**	**AMBER**	Near/Mid/Far: Short quantities.

Figure J-6

ARL Program



Airborne Reconnaissance-Low (ARL) is a low-profile airborne platform providing communications intelligence, live imagery information, and Moving Target Indicator (MTI)/Synthetic Aperture Radar (SAR) imagery to tactical commanders. Using a four-engine DeHavilland aircraft as a platform, this sensor system gives the tactical commander a unique early warning and surveillance capability.

The ARL program will ultimately provide six multi-sensor (ARL-M) systems combining infrared/electro-optical sensors, an MTI/SAR radar, and an Electronic Support Measures (ESM) suite capable of communications intercept and direction finding. Live video from the infrared/electro-optical sensors can be downlinked to the ground in real time. Data from ARL-M's MTI radar and SAR can also be downlinked directly to the JSTARS GSM/CGS. Three interim capable ARLs (two communications intelligence (COMINT)-only ARL-C and one IMINT-only ARL-I) aircraft were fielded in 1993. Two ARL-Ms with MTI were fielded to Korea in 4QFY96. The third ARL-M was fielded in 4QFY97, and the fourth and fifth ARL-Ms will be funded in 1QFY99. The currently fielded ARL-I will be upgraded to ARL-M beginning in FY98, and refielded in 2QFY00. The two ARL-C aircraft will be upgraded with Joint Tactical Terminals (JTT) in FY99 to improve dissemination of ARL information to tactical commanders. Current program funding supports upgrading six of eight aircraft with Joint Signals Intelligence (SIGINT) Avionics Family (JSAF) Low Band Subsystem (LBSS) COMINT payloads during the FY00 to FY02 time frame.

Basis of Issue: A requirement for nine ARL aircraft has been identified. Only eight aircraft are funded at this time. Basis of issue is six aircraft in the CONUS-based theater MI brigade and three aircraft in the Korea-based theater MI brigade.

ARL is rated **AMBER** for the near-term due to the shortfall between required and programmed system quantities. ARL transitions to ACS in the mid-term.

Counterintelligence (CI)/Human Intelligence (HUMINT) Automated Tool Set (CHATS)

CI/HUMINT Automated Tool Set (CHATS) is a suitcase-sized automated system which assists tactical counterintelligence/human intelligence operators to collect, store, correlate, retrieve, and disseminate Counterintelligence (CI)/Human Intelligence (HUMINT) information critical to security, stability, and force protection operations. CHATS is a recently funded procurement that enables expeditious exploitation of interrogation and counterintelligence information—a long overdue tactical capability.

CHATS is the result of soldier initiated prototyping previously known as the Theater Rapid Response Intelligence Package (TRRIP). It provides tactical human intelligence soldiers an automated system to manage assets and analyze information collected through interrogations, collection, and document exploitation.

Basis of Issue: 46 per EAC MI Brigade, 24 per corps, 10 per heavy division, 13 per light division, 5 per ACR/separate brigade, 25 for the ARSOF, and 45 for the RC Enhanced Readiness Brigades.

CHATS is rated **GREEN** in the near-, mid-, and far-terms.

Commander's Tactical Terminal/Joint Tactical Terminal (CTT/JTT)

The Commander's Tactical Terminal/Joint Tactical Terminal (CTT/JTT) allows tactical commanders to exploit broadcast intelligence networks and collection sensors for situation development and targeting applications. CTT/JTT will receive and relay information from Army GRCS and ARL, Air Force U-2 and rivet joint systems, Navy EP-3, and national broadcast nets. Integration of the Common Integrated Broadcast Service Module (CIBS-M) expands the CTT's capabilities through reception of information via the Intelligence Broadcast System (IBS). The JTT is the joint service objective system.

CTT/JTT is being embedded in Army intelligence systems including ASAS, CGS, ACS, TES, and the GBCS. It is also being embedded into combat systems such as Advanced Field Artillery Tactical Data System (AFATDS), Forward Area Air Defense System (FAADS), Theater High Altitude Area Defense (THAAD), and Army Airborne Command and Control (A2C2). Other Services are procuring and integrating JTT into their intelligence systems.

The requirement for joint interoperability will result in migration to CIBS-M in the mid-term. Migration will build on proven capabilities and establish joint standards to maximize both interoperability and efficiency. Army procurement and integration of CTT/JTT/CIBS-M is programmed for completion in the far-term.

CTT/JTT is rated **GREEN** in the near-, mid-, and far-terms.

GUARDRAIL Common Sensor (GRCS)



GUARDRAIL Common Sensor (GRCS) provides airborne Signals Intelligence (SIGINT) and precision location information to corps commanders. It broadcasts intelligence directly to joint Tactical Intelligence Broadcast System (TIBS) and Tactical Reconnaissance Intelligence Exchange System (TRIXS) equipped forces, the Army's Common Ground Station (CGS), and the All Source Analysis System (ASAS). GRCS enhances battlefield awareness by providing near-real-time targetable locational data.

Principal GRCS components are the Airborne Relay Facility (ARF), Common Data Link (CDL), Integrated Processing Facility (IPF), CTT/JTT, and Auxiliary Ground Equipment (AGE) vans. Both the Communications High Accuracy Location System-Expanded (CHALS-X) and Advanced QUICKLOOK (AQL) electronic intelligence (ELINT) subsystem provide emitter location information with targetable accuracy. The CDL transfers signals information between

the aircraft and IPF for processing, and relays processed intelligence reports among the IPF, aircraft, and CTT/JTT for dissemination and exploitation. An objective set consists of 12 RC-12 aircraft with associated ground support and processing equipment, which is sufficient to maintain adequate corps battlespace coverage.

Basis of Issue: A total of four GRCS systems (consisting of 12 aircraft each) are fielded with one system each at III Corps, V Corps, XVIII Airborne Corps, and Eighth Army (Korea).

GRCS is rated **AMBER** in the near-term. Despite FY99 fielding of the newest GRCS, retirement of the final Improved GUARDRAIL V (IGRV) system, and completion of selected upgrades to earlier GRCS systems, the status of GRCS capabilities will remain **AMBER** in the mid-term as all four systems will still retain unique characteristics requiring unique maintenance and training until they are replaced by the Aerial Common Sensor (ACS).

Integrated Meteorological System (IMETS)

Integrated Meteorological System (IMETS) is an automated processing system that receives, processes, and collates weather data to provide products such as nuclear, biological, and chemical (NBC)/smoke effects, illumination or visibility overlays, and tactical weather effect depictions tailored to meet supported commanders' requirements. The data processed includes forecasts, weather observations, weather effects, and climatological information. IMETS provides automation and communications support to Air Force weather teams assigned to Army S2/G2 sections.

Fielding at a reduced basis of issue will be completed in FY99 and provide some capability to each corps, division, ACR, separate brigade, and to selected aviation brigades, special forces groups, and EAC headquarters. Block I systems will be upgraded to Block II beginning in FY00.

IMETS is **AMBER** in the near-term due to a reduced number of systems procured. The program remains **AMBER** until funding supports the acquisition objective.

Essential Research and Development and Leap-Ahead Technology

Essential R&D for Intelligence and Electronic Warfare

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• Rapid Terrain Visualization ACTD • Multispectral Countermeasures ATD • Multi-Mission UAV Sensors ATD • Tactical Intel Data Fusion • Digital Communications Electronic Attack	• Low Cost Electro-Optic/Infrared (EO/IR) Countermeasures • Modern Command and Control (C2) Warfare • Advanced Radio Frequency (RF) Countermeasures	• Full Dimensional Protection/Attack for Information Systems [SRO(E)] • Microminiature, Multifunctional Sensors [SRO(E)] • Signature Management & Control [SRO(E)]

For detailed descriptions of Army IEW S&T efforts, see Volume I, Chapter III.F (Intelligence Electronic Warfare), and Volume II, ASTMP, for STO descriptions.

Figure J-7

Near-Term (FY98-03)

Rapid Terrain Visualization (RTV) ACTD. The objective of the Rapid Terrain Visualization Advanced Concept Technology Demonstration is to integrate and demonstrate capabilities to rapidly collect and process: 1) high resolution digital terrain elevation data needed to accurately represent the 3-D battlefield; 2) basic feature data such as roads, rivers and vegetation required for military planning and analysis; and 3) corresponding high resolution imagery for photo-realism. The RTV ACTD will demonstrate an infrastructure to provide digital topographic data more rapidly to support military operations anywhere in the world. An operational testbed will be established with the XVIII Corps at Ft. Bragg. Leave behind capabilities will be provided to the XVIII Corps in FY99.

Multi-spectral Countermeasures ATD. The purpose of the Multispectral Countermeasures ATD is to develop prototype jamming techniques, a fiber optic coupled multi-line laser and a miniature tracker as a system upgrade to the AN/ALQ212 system to protect Army helicopters from imaging surface-to-air missiles.

Multimission/Common Modular UAV Sensors. This technology demonstration will provide two low-cost, lightweight, rapidly interchangeable payloads for integration on future tactical UAVs: 1) an electro-optic/infrared sensor and 2) a moving target indicator/synthetic aperture radar. The radar payload will build upon a current low-cost radar-development program and will likely utilize Monolithic Microwave Integrated Circuit (MMIC). The Forward Looking Infrared (FLIR) will take advantage of high quantum efficiency, 3-5-micron staring arrays.

Tactical Intelligence Data Fusion. Tactical Intelligence Data Fusion develops and integrates enhanced MI collection and asset management tools, terrain reasoning tools, multiple source correlation and fusion tools, enhanced information dissemination tools and techniques, and Battle Damage Assessment (BDA) tools and techniques. It evaluates non-conventional sources to gather intelligence, demonstrates multiple-source fusion using terrain reasoning tool and techniques and Moving Target Indicator (MTI) automatic tracking, and develops advanced airborne planning algorithms and effectiveness for multi-sensor tasking and reporting tools using database to database interfaces.

Digital Communications Electronic Attack. Digital Communications Electronic Attack provides technology to intercept and bring under electronic attack advanced communications signals being used by adversarial command and control networks on the digital battlefield. Through electronic attack strategies demonstrated with prototype hardware and software, these digital communication signals will be disrupted, denied, and/or modified to render the communications system ineffective and unreliable to the threat command and control function.

MID-TERM (FY04-10)

Low-Cost EO/IR Countermeasures. Low-Cost EO/IR countermeasures will develop active/passive devices to protect aircraft and ground vehicles with conventional and suppressed signatures from EO/IR guided threats. Countermeasures to IR missiles are the number one DoD EW priority. IR Imaging missiles plus multispectral IR/EO/RF seekers that are being fielded must be countered. Technology development will focus on key components such as sources, optics, pointing/tracking devices, missile plume and laser sensors, and advanced jamming techniques against passive homing command to line-of-sight, beamrider missiles, and missile-detection algorithms. Emphasis will be on horizontal technology integration of EW architecture infused with low cost and adapted NDI technologies for air and ground vehicle protection.

Modern C2 Warfare. The Modern C2 Warfare program will demonstrate the ability to intercept, locate, and disrupt emerging high priority threat systems utilizing advanced communications technologies. This program will also investigate the advanced digital signal processing, encryption, and complex modulation techniques being incorporated into many of the commercial systems proliferating throughout the world.

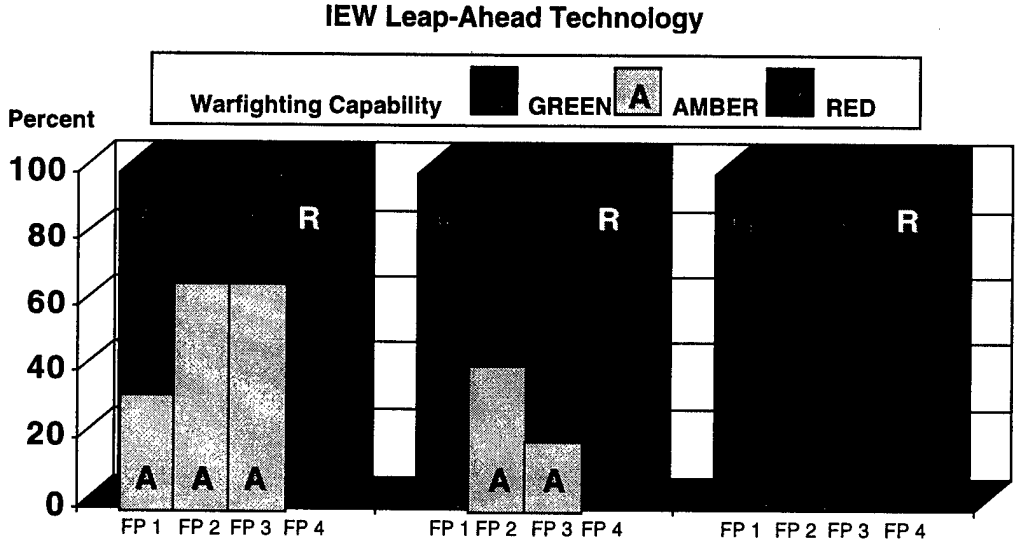
Advanced RF Countermeasures. Advanced RF countermeasures demonstrates jamming techniques against multi-spectral top attack smart munitions, ECM modulator with the capability to jam monopulse millimeter wave radar. Linkage of countermeasures (CM) and situational awareness (SA) will provide increased survivability. The program will develop phased array model for digital ECM modeling; integrates advanced fuze simulators and conducts jamming simulations; demonstrates high-accuracy LO RF direction finding, targeting assist for Comanche and increased CM effectiveness against monopulse phased array Surface-Air Missile (SAM) radar through the use of digital models; and initiates advanced countermeasures against bi-static, impulse and low probability of intercept radars.

FAR-TERM (FY11-20)

Strategic Research Objectives (SRO). The emerging SRO on Full Dimensional Protection/Attack for Information Systems will provide essential tools for exploiting and disrupting enemy information systems. The microminiature, multifunctional sensor will enable the fielding of an integrated, adaptive sensor network to support intelligence collection and exploitation. Signature management and control will facilitate the synergistic use of Electronic Warfare (EW) capabilities to enhance system survivability.

LEAP-AHEAD ASSESSMENT

Leap-Ahead Program Assessments are shown in Figure J-8.



Near-Term (FY98-03)

TES AMBER: 65% Fielded

DTES GREEN: 100% Fielded

ACS AMBER: See ARL/GRCS

Mid-Term (FY04-10)

TES GREEN: 100% Fielded

DTES GREEN: Robust P3I Effort Maintains Currency

ACS AMBER: Partially Fielded (FP 1)

Far-Term (FY11-20)

TES GREEN:Robust P3I Effort Maintains Currency

DTES GREEN: Robust P3I Effort Maintains Currency

ACS GREEN: 100% Fielded

System	Required	Funded	R3 Pt
TES	6	6	2010
DTES	10	10	2010
ACS	6	6	2016

FPs 1-4 reflect DA Force Packages IAW FY97-02 B Master Priority List (DAMPL)

Figure J-8

To achieve full spectrum dominance in the far-term (FY11-20), the modernization strategy calls for fielding leap-ahead capabilities such as the Tactical Exploitation System (TES), the Division Tactical Exploitation System (DTES), and the Aerial Common Sensor (ACS) system. They not only provide assured access to intelligence from national and selected theater

systems for tactical decision making, targeting, battle planning, and BDA, but they represent critical capabilities required to move Army XXI forward to the Army After Next.

Tactical Exploitation of National Capabilities (TENCAP). TENCAP provides the tactical commander assured access to intelligence from national and selected theater collectors, dramatically increasing his ability to see the entire battlefield and anticipate enemy actions. At the corps level, the Tactical Exploitation System (TES) will be the critical link between national/theater systems and ASAS. The Division Tactical Exploitation System (DTES) will provide a scaled-down capability at the division level.

The Army is migrating from the current family of TENCAP processors at corps and divisions to a single, objective TENCAP system—the Tactical Exploitation System (TES). The TES will be a highly flexible, scaleable, and modular system which will serve as a preprocessor for all national systems data and for data from selected theater and corps systems. A scaled down version of the TES, the Division Tactical Exploitation System (DTES), will be fielded to all divisions. Until development and fielding of TES/DTES, the Army TENCAP program uses a series of Preplanned Product Improvements (P3I) to insert the latest technology into fielded systems, keeping these systems current with national architectures. The focus of these interim upgrades is to eliminate stovepipe systems and migrate to systems which are multidisciplined, provide joint interoperability, and can be tailored to meet commanders' requirements.

Tactical Exploitation System (TES). TES will be the objective TENCAP preprocessor for ASAS and CGS. TES is a multidiscipline processing system that will be highly mobile, modular, and therefore, able to provide an early entry capability. TES will provide crucial intelligence links to theater and national collection platforms.

TENCAP convergence to TES, as shown in Figure J-9, will supplant and integrate the technologies of three systems: the Enhanced Tactical Radar Correlator (ETRAC), the Modernized Imagery Exploitation System (MIES), and the Advanced Electronic Processing and Dissemination System (AEPDS). TES will employ high performance computing technology to receive, process, exploit, correlate, store, manage, and disseminate imagery and signals intelligence from national and selected theater collectors. FUE for TES is FY00.

Basis of Issue: One TES per corps and theater MI brigade.

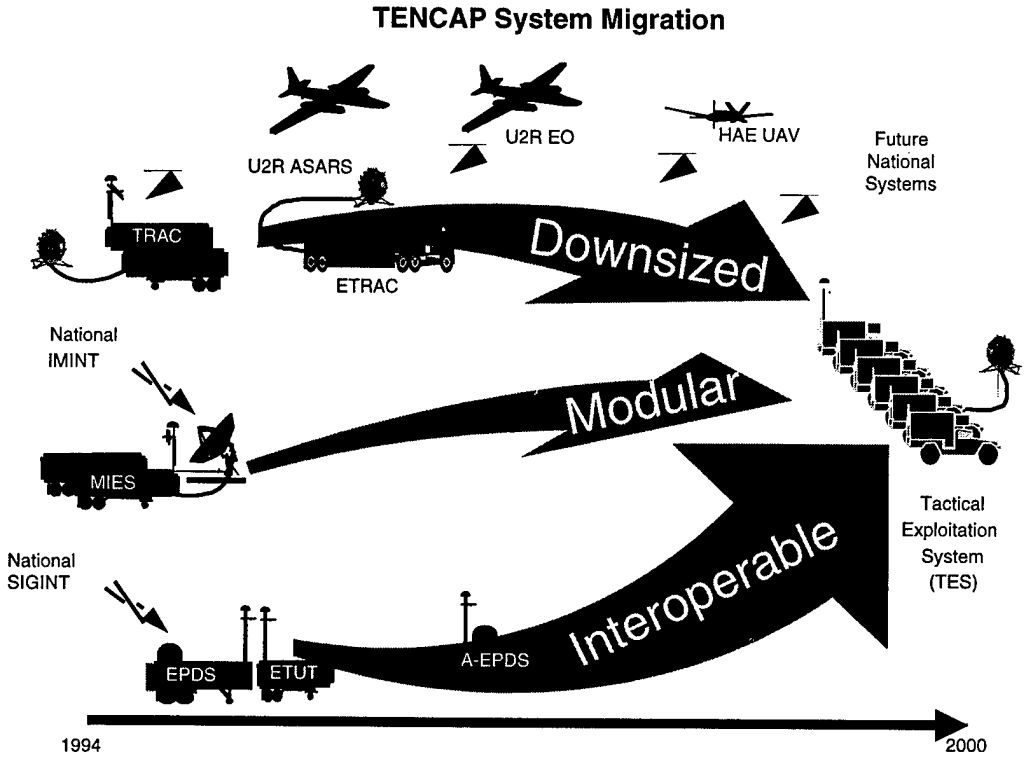


Figure J-9

TENCAP capabilities are rated **GREEN** in the near-, mid-, and far-terms, as open architecture upgrades to existing systems and fielding of new systems will keep capabilities at levels needed to meet increasing requirements.

Division Tactical Exploitation System (DTES)

DTES is the objective TENCAP system for support to the division. It is a HMMWV-mounted, multidisciplined processing and analysis system able to provide crucial intelligence links to theater and national collection platforms.

The DTES replaces the Mobile Integrated Tactical Terminal (MITT) as the objective division TENCAP system. The DTES has identical components as part of the TES-forward subelement. It will have compatible UHF, GBS, and S-Band radios; JWICS/SIPRNET/ AUTODIN/DMS capability; imagery and SIGINT processing/analysis systems; and an imagery storage capability. Since it is a subset of the TES, modular components from a corps TES such as national SIGINT or theater imagery downlinks can be incorporated with the DTES, providing a very robust capability to a division.

Basis of Issue: One DTES per division.

DTES capabilities are rated **GREEN** for all periods.

Aerial Common Sensor (ACS) Program

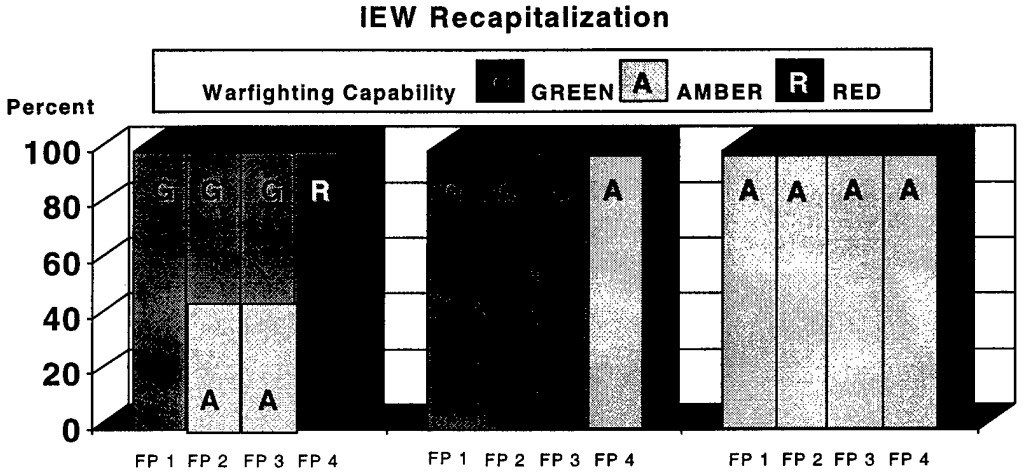
Aerial Common Sensor (ACS) is the next step in the evolution of aerial reconnaissance in the Army. ACS will combine GRCS and ARL functions into a single platform in the mid-term. A decision will be made by the FY04 time frame if ACS will be manned, unmanned, optionally piloted, or a combination of any or all three type systems. The Army will work with the Defense Airborne Reconnaissance Office (DARO) to ensure the ACS is interoperable and consistent with the future joint aerial reconnaissance architectures while it meets the ground commander's needs.

Basis of Issue: A total of five systems consisting of six aircraft each (objective is nine each) by FY12 will be fielded: one system per corps and one system for the echelons above corps (EAC) MI brigade.

ACS is rated **AMBER** in the mid-term. Current scheduled funding is for non-SIGINT portions of ACS; the Defense Cryptologic Program (DCP) funds SIGINT development. ACS is rated **GREEN** in the far-term since fielding will be complete.

RECAPITALIZATION

IEW recapitalization systems are listed in Figure J-10.



Near-Term (FY98-03)

AQF AMBER: Limited Quantities Fielded

Trojan GREEN: 100% Fielded to Reduced BOIP

Mid-Term (FY04-10)

AQF GREEN: 100% Fielded

Trojan N/A: Functionality Transitions to STAR-T

Far-Term (FY11-20)

AQF AMBER:A/C Reaches R3 Point

Trojan N/A: STAR-T Fielded

System	Required	Funded	R3 Pt
AQF	66	66	2015
Trojan	38	38	2006

FPs 1-4 reflect DA Force Packages IAW FY97-02 B Master Priority List (DAMPL)

Figure J-10

Advanced QUICKFIX Program



Operating in tandem with the Ground Based Common Sensor (GBCS) in both heavy and light divisions, the heliborne Advanced QUICKFIX (AQF) improves the accuracy of locational data to provide intelligence on deeper threats.

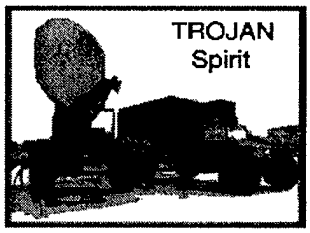
AQF is an evolution of the fielded EH-60A QUICKFIX. The AQF mix of sensors is identical to that of GBCS; it includes COMINT, ELINT, Electronic Attack (EA), and precision emitter location with cross-sensor cueing. It integrates these components on an EH-60L helicopter with FUE in FY00.

Basis of Issue: Four aircraft per division and ACR.

AQF is rated **AMBER** in the near-term, as low rate production in FY96 through FY98 will bring a minimal number of systems into the force with FUE in FY00. It becomes **GREEN** in the mid-term, upon completion of procurement and final system fielding in FY10. It returns to **AMBER** in the far-term as EH-60L reaches its R3 point.

Trojan SPIRIT Program

Trojan SPIRIT provides high-capacity satellite communications (SATCOM) capabilities to Army tactical commanders. It rapidly disseminates high volume intelligence products, databases, and imagery from national to tactical levels throughout extended areas of operations.



A non-developmental SATCOM and tactical communications terminal in HMMWV-mounted shelter, Trojan SPIRIT, provides dedicated high capacity point-to-point communications for dissemination of intelligence products and information between strategic and tactical levels.

Trojan SPIRIT fielding is at a reduced basis of issue that will provide some capability to all units. Fielding was completed in FY97, with upgrades programmed from FY97-FY99. Fielding is to corps, division, ACR, separate brigade, and EAC MI brigades. Trojan SPIRIT is also fielded to the USMC and the DARO to support the PREDATOR UAV. Trojan SPIRIT will be incorporated into the Warfighter Information Network (WIN) in the mid-term.

Trojan SPIRIT is rated **GREEN** for the near-term since the fielding objective is completed. It transitions to STAR-T (a Signal Corps managed system) in the mid-term.

SECTION 3: CONCLUSION

IEW modernization efforts are on track to produce more capable, interoperable, and modular systems, significantly contributing to full spectrum dominance. Since production and fielding of several key capabilities are not realized until the mid-term, this results in an overall assessment rating of **AMBER** for IEW. Figure J-11 provides a summary of current POM successes and issues.

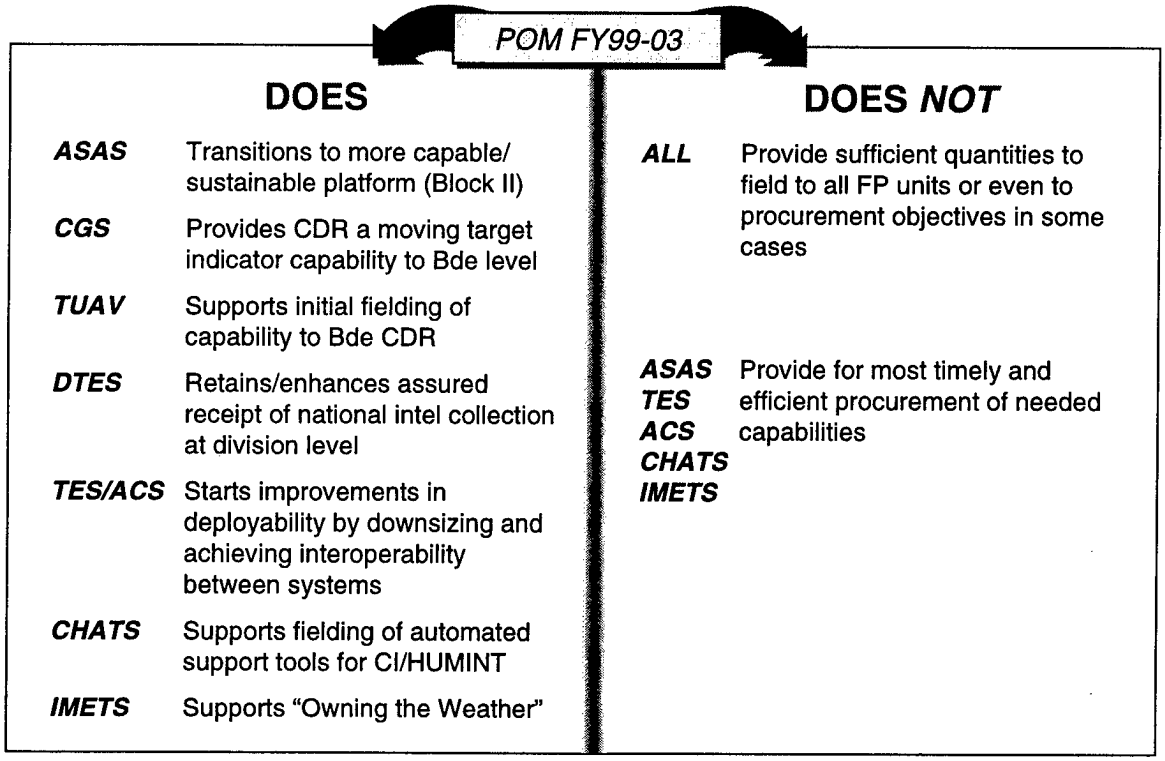


Figure J-11

In the near-term, critical intelligence shortfalls at lower echelons are being addressed with the joint TUAV program and the extension of ASAS Remote Workstations (RWS) to brigade and battalion levels. These programs are integral to the successful implementation of a fully digitized division in FY00 and corps in FY04. GRCS, CTT/JTT, CHATS, Trojan SPIRIT, and DTES will be fully fielded; AQF begins fielding limited quantities.

During the mid-term, IEW will achieve an order of magnitude increase in overall capability as objective collection, processing, exploitation, and dissemination systems are fielded to the majority of FP 1, FP 2, and FP 3 units. With the exception of IMETS and GBCS, all information dominance systems will be **GREEN**; AQF will be fully fielded; and ACS will begin partial fielding. Accurate sensors, enhanced communications, and faster processing capabilities will ensure timely targeting information to the shooter.

The ability to maintain success in the far-term depends upon robust technology insertion efforts to keep pace with the rapidly changing environment.

ANNEX K: TACTICAL WHEELED VEHICLES

SECTION 1: INTRODUCTION

Overview

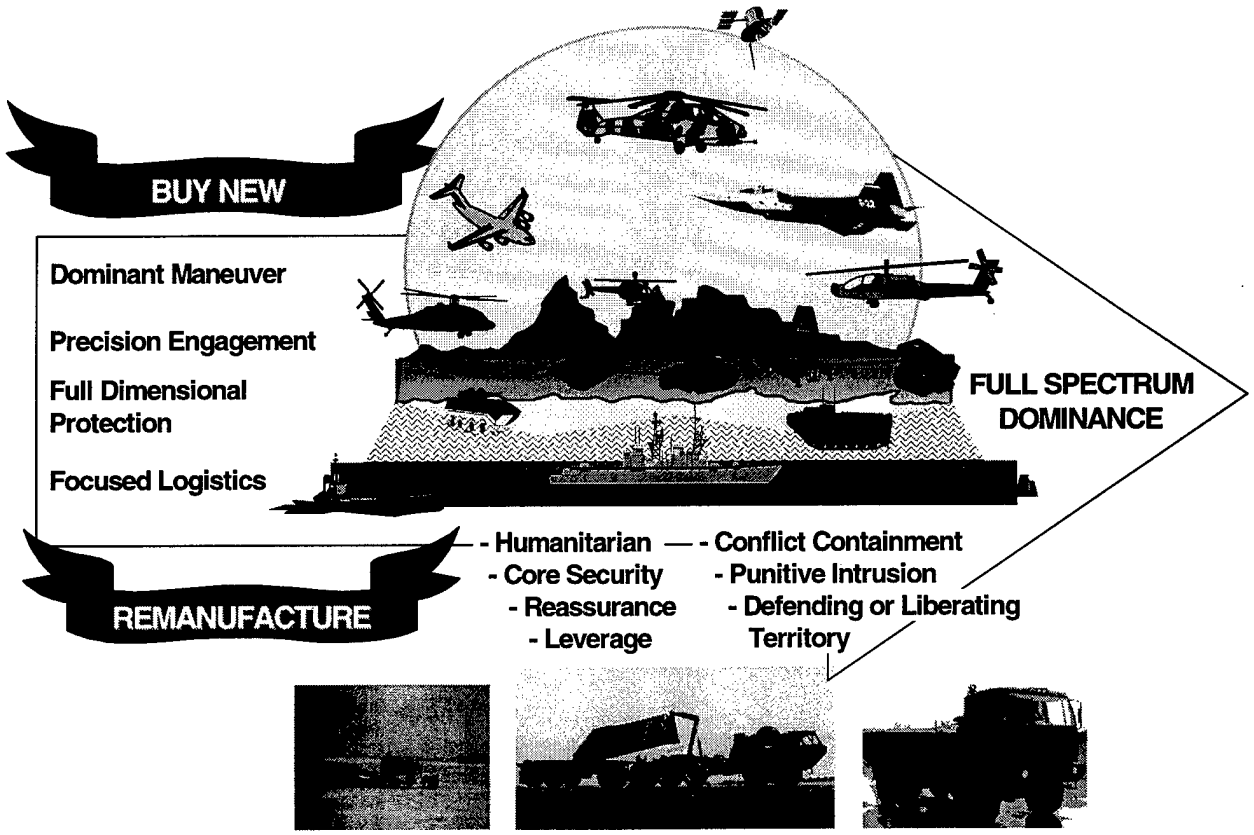


Figure K-1

THERE IS A LOT RIDING ON TRUCKS!

Army Vision 2010 is the blueprint for the Army's contributions to the enhanced operational concepts of *Joint Vision 2010.* This annex describes Tactical Wheeled Vehicle (TWV) planned modernization efforts to achieve these required capabilities. As shown in Figure K-1, perhaps no class of hardware systems contributes more broadly to every facet of land warfare than Tactical Wheeled Vehicles (TWV). *Army Vision 2010* depends heavily upon mobile, capable, and reliable TWV to provide battlefield mobility and agility. All patterns of operation are supported by TWV. Many of the systems which contribute to Information Dominance, Shape the Battlespace, Decisive Operations, Project the Force, and Sustain the Force are mounted on TWV. It is the TWV fleet which permits Army units to be mobile about the battlefield, transport and position critical communications and intelligence systems, serve as platforms for many weapons systems, and arm, fuel, and fix others. ***There truly is a lot riding on trucks!***

TWV modernization is driven by a number of critical factors (Figure K-2). The primary factor is the percentage of over age systems. If the Army is to have the vehicles needed to support the current force, Army XXI and the Army After Next (AAN), then modern TWV are required. Because modernization is a continuum, there will always be legacy systems in transition. That is why TWV modernization will consist of buy new and remanufacture programs. The objective is to ensure that the highest priority units have the most modern and technologically advanced TWV.

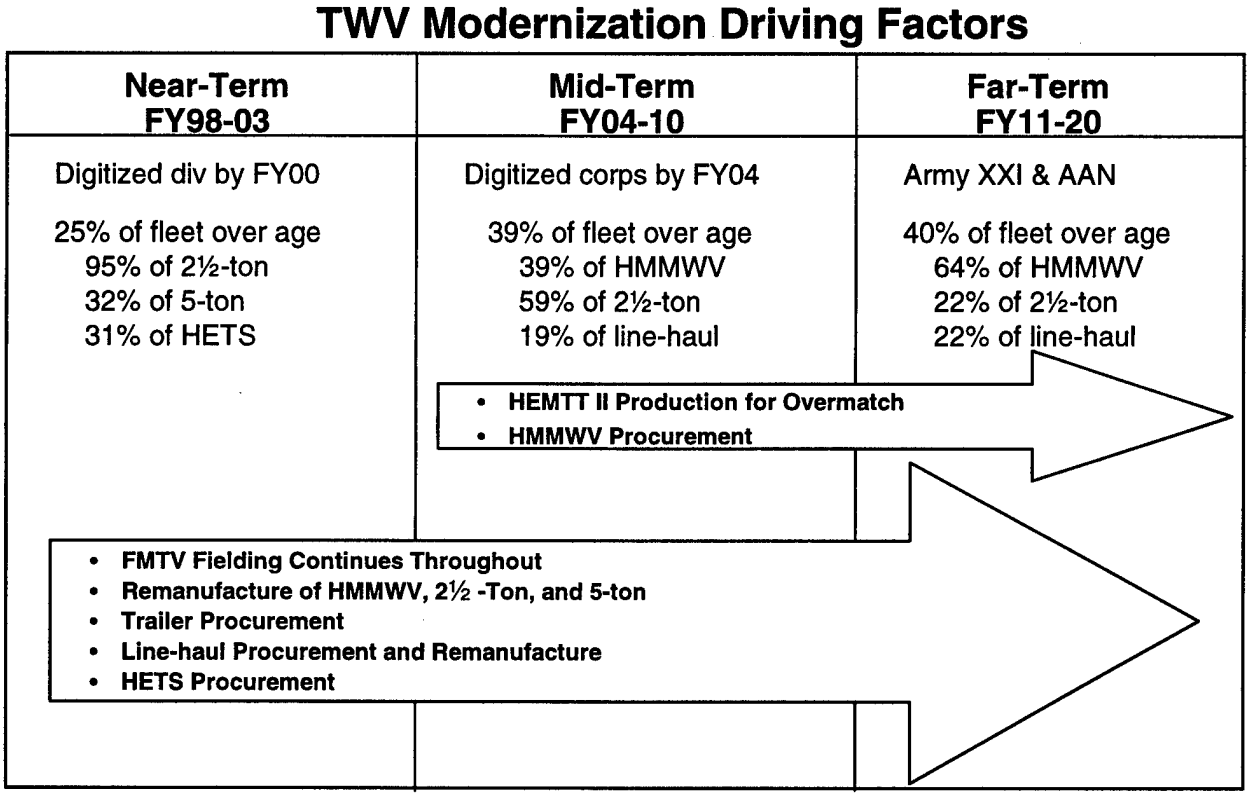


Figure K-2

INFORMATION DOMINANCE

Most of the systems which currently provide overmatch capabilities, or will eventually provide for information dominance, are either directly dependent upon TWV for mobility about the battlefield or in direct support. Mobile information dominance cannot be achieved without capable TWV.

SHAPE THE BATTLESPACE

Many systems which shape the battlespace, such as EFOGM, HIMARS, etc., are TWV-mounted and depend upon TWV for mobility and munitions support. Other key systems contributing to shaping the battlespace also depend upon TWV for direct support. During Desert Storm, reliable TWV were essential contributors to success (Figure K-3).

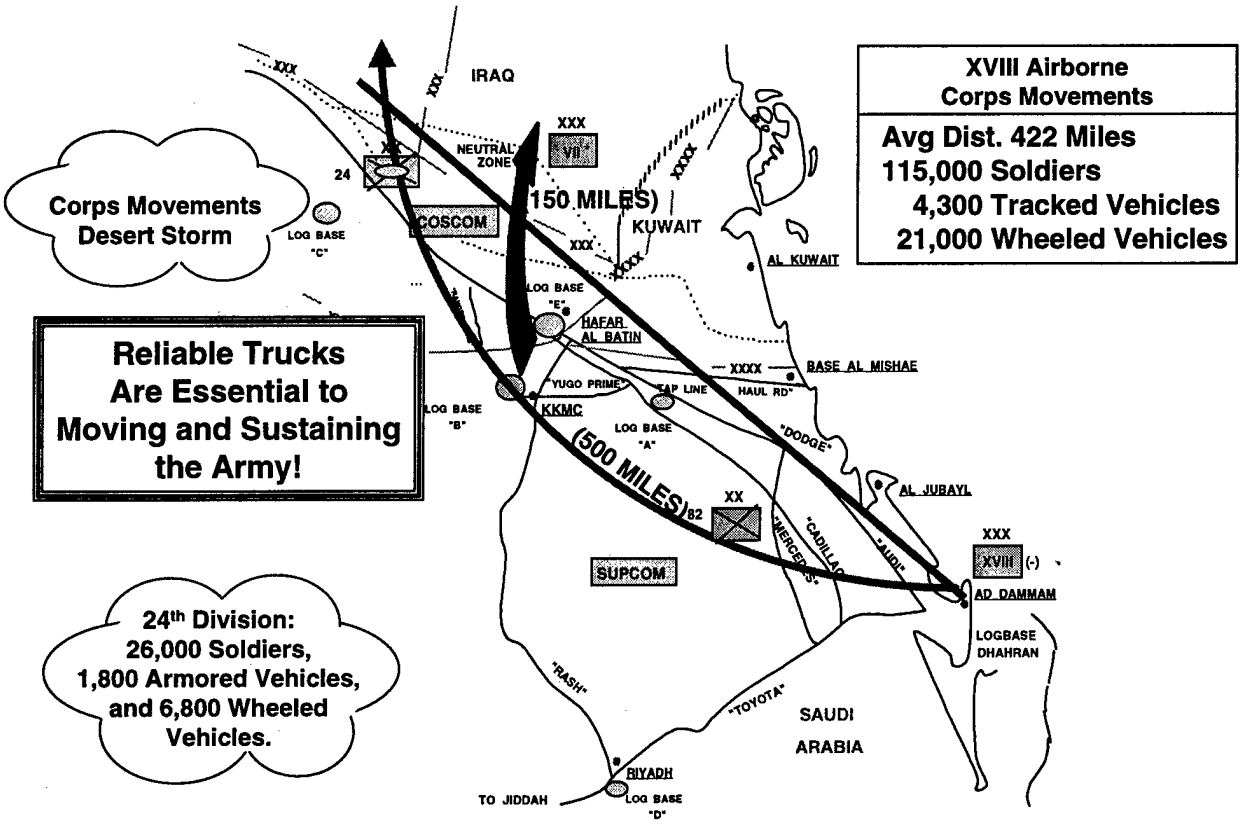


Figure K-3

DECISIVE OPERATIONS

All systems contributing to decisive operations, such as M1A1/A2, Crusader, Paladin, STRIKER, Apache, etc., are either tied to TWV for arm, fuel, or fix functions, or are TWV-mounted, such as STRIKER.

PROTECT THE FORCE

Vehicles such as the Armored Security Vehicle and Up-Armored HMMWV are designed specifically to protect the force. Other TWV are integral components of force protection systems like HMMWV-mounted Avenger, PLS-mounted THAAD, and HEMTT-towed PATRIOT.

SUSTAIN THE FORCE

TWV are most often viewed as sustainment systems. They are the distribution platforms at all echelons delivering fuel and ammunition to weapons systems; food, water, medical evacuation, and other vital services to soldiers; and moving units about the battlefield (Figure K-4).

Truck Missions

	HMMWV	CUCV	FMTV	HEMTT	PLS	LINE HAUL	ENGR TRAC	HET	TRLR'S
Weapons Prime Mover	X		X	X					
Weapons Platform	X		X		X				X
Tank Transporter								X	X
Comm Systems Trans	X	X	X						
Pol/Water Distribution			X	X		X			X
Troop Transport	X	X	X						
Ammo Distribution			X	X	X	X			X
Tactical Ops Center	X		X						
Medical Evacuation	X								
Command & Control	X								
General Cargo	X	X	X			X			X
Recovery			X	X					
Engineer Equip Ops			X	X	X		X		X
Shop Equipment	X	X	X						X
Power Gen Equip	X		X						X
Containers					X				X

Figure K-4

Congruence With Army Modernization Strategy

The TWV modernization strategy aligns with the Army modernization strategy in important ways. The TWV strategy is essentially to acquire as much capability as resources will permit. With limited dollars, this translates into a practice of buying new, fully capable vehicles, for the first deploying units, and remanufacturing current vehicles for lower priority units. All vehicles are distributed in Department of the Army Master Priority List (DAMPL) sequence regardless of whether the unit is Active, Guard or Reserve. With the activation of new TAA-03 truck units, the Guard and Reserve will be receiving equipment right off the production line. This modernization plan includes procurement of fully capable Family of Medium Tactical Vehicles (FMTV) for first deploying units while remanufacturing the existing, less capable 2½-ton and 5-ton trucks for others. This strategy also applies to the HMMWV fleet, the HEMTT fleet, and the M915 line-haul tractors. This two-pronged approach to modernization represents the best balance between acquiring capability increments, and controlling or reducing the cost of ownership, via recapitalization.

TWV funding is emerging from the trough that was experienced in the mid-1990s. Since the Army Modernization Plan in 1996, Office of the Secretary of Defense (OSD) and Congress have provided significant help in resourcing the procurement of TWV over and above that which the Army could afford. The Army has also reprioritized the POM and added money for the most pressing needs. The sum of these resources will do much to slow the rate of advanced aging of the medium fleet, and fill some of the light and heavy fleet shortages. Changes in force structure

to add much needed line-haul capacity for both fuel and dry cargo, as well as the National Guard redesign, have recently increased TWV requirements and resulted in additional budgetary pressures. The current level of annual resources needed to meet TWV modernization objectives is approximately $1.2B. The POM funding is beginning to approach these levels. However, the question is always: "When the outyears become the budget years, how much money will actually remain?"

The Army uses a combination of "buy new" and "remanufacture" or a special development process to provide modern TWV to meet requirements. High-priority units receive the most modern and technologically advanced TWV. Risk is taken on lower priority units by cascading the older, less sophisticated equipment to them. This strategy ensures that those units with the highest Operation Tempo (OPTEMPO) have the most reliable and least costly to operate equipment. Therefore, readiness is increased and operation and support costs are reduced across the force for the Active Component (AC), National Guard (NG), and Reserve Component (RC). TWV remain the backbone of the Army.

Challenge Ahead

TWV play a vital role in today's capable Army. With an ever-increasing emphasis on information dominance, which can dramatically increase the tempo of battle, the TWV of the future will still be heavily relied upon for an increasing array of functions. The faster tempo will also require more highly capable TWV to "keep pace" with the combatants. Shown below are the TWV priorities for achieving full spectrum dominance (Figure K-5).

TWV Priorities

Priority	System	Purpose	Capability
1	FMTV	Fix Over age Support ADRS & TAA-03	A More Mobile, Reliable 21st Century Fleet
2	HEMTT II	Replace HEMTT When Over Age	Mobility Increment for Higher Army XXI, AAN OPTEMPO
3	HMMWV (LTV)	Procure Heavy Variant	Advanced Platform for Digitized Systems/Up Armor
4	Line-Haul Tractors	Replace Over Age TAA-03/ADRS	Required for Theater Lift & Reception, Staging, Onward Movement, and Integration (RSOI) Reduce O&S
5	Heavy Tactical	Fill Shortages Stand-Up Units	PLS for Army XXI, HETS for M1A2, HEMTTS for Short
6	Retire Over Age	Reduce Operating and Support Costs Reduce Poor Performers	Modest Capability Loss, Shift $$ to Modernization
7	Reman HMMWV, HEMTT 2½-, 5-Ton	Extend Life, Reduce O&S Costs	Army XXI, Fill In Until New Fielded
8	Trailers Semitrailers	Fill Shortages Force Projection	More Deployable, Mobile, Reduces O&S Costs
9	Yard Tractors	Replace Worn-Out Tractors	Key Force Projection System

Figure K-5

SECTION 2: CURRENT PROGRAM ASSESSMENT

> *"Without trucks the Army stops."*
> **GEN Wesley Clark, SACEUR**

Required numbers of TWV have generally been re-proportioned to the shrinking size of the Army. Some requirements have seen increases to support Army Prepositioned Stocks (APS), war reserve stocks, operational project stocks, and more recently force structure (TAA-03) transportation company increases. Also underway is a National Guard redesign that is expected to increase TWV aggregate requirements.

Major Changes Since 1996

Since the last Army Modernization Plan was published, several events have occurred which affect the relative health of the fleet, such as:

- Family of Medium Tactical Vehicles (FMTV) First Unit Equipped (FUE) occurred on 29 January 1996 with the XVIII Corps.
- Programmed Army funding for the POM period has improved.
- The number of transportation truck companies has increased significantly as a result of TAA-03.
- Congress provided plus-ups in FY96-98 for HETS, PLS, HEMTT, HMMWV, FMTV, ASV and trailers to maintain the industrial base, fill shortages, and activate NG and RC units.
- Congress deleted funding for line-haul tractors in the FY98 budget; and reduced funding for 5,000-gallon tankers, 7,500-gallon tankers, and 22½-ton semitrailers. This will delay fielding of the tanker units by up to two years, prevent upgrade of the line-haul fleet that goes over age in 1998, and prevent fill of shortage and activating units that need the 22½-ton semitrailer. The reductions delay modernization of the line-haul tractor fleet and extend the risk to support of two major theaters of war.
- The XM 1114 Up-Armored HMMWV was fielded to soldiers in Bosnia in March 1996. An Armored Security Vehicle (ASV) prototype contract was awarded on 12 December 1995. The Up-Armored HMMWV has saved soldiers' lives. The ASV will provide Military Police with a capability for force protection in operations other than war. Ultimately, this is a requirement for future development (force protection).

Information Dominance Assessment

TWV — Information Dominance Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
LMTV (2½-ton)	40,320	28,610	2013	AMBER	AMBER	GREEN	Fills FPs 1, 2, & 3
MTV (5-ton)	45,174	28,945	2015	AMBER	AMBER	GREEN	Fills FPs 1, 2, & 3
HMMWV (LTV)	119,500	24,600	1999	GREEN	AMBER	AMBER	FP 1 only in EPP; OK near

Figure K-6

The TWV listed below do not have information dominance as their main mission, but they provide the platforms for many of those systems providing information dominance. Without a modern platform, the most sophisticated equipment in the force will be useless. The fleet assessment area will provide more details concerning these fleets. The systems funded numbers reflect the quantities procured with prior year and projected funding through FY03.

Overmatch Assessment

There is one TWV program that is considered an overmatch system. It is currently designated the Heavy Expanded Mobility Tactical Truck (HEMTT) II (Figure K-7). Replacing the current HEMTT, the HEMTT II will possess significantly greater mobility (speed and terrain capability), will utilize the most current smart vehicle technology, and will possess a fuel-efficient and EPA emission-compliant engine and a Palletized Load System (PLS) type Load Handling System (LHS) to maximize logistics throughput. It will be a key vehicle for the Army XXI and Army After Next. The POM contains sufficient Research, Development, Test and Evaluation (RDTE) funding for the program, and production award is scheduled for FY04. Systems funded data reflects FY04-12 production.

TWV — Overmatch Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
HEMTT II	13,203	13,203	2025	N/A	GREEN	GREEN	Fills 100%

Figure K-7

Essential Research and Development and Leap-Ahead Technology

Research and Development and Leap-Ahead Technology for Tactical Wheeled Vehicles

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• Synthetic Lubricants • Electronic Power Train Controls • Automated Guidance and Position Location • Diagnostic Computers • Collision Warning • Converting Crankcase Oil Into Vehicle Fuel	• Improved Diesel Engines for Improved Fuel Efficiency • Lightweight Armor and Blast Resistance for Tactical Trucks	• Improved Diesel Engines and Alternative Vehicle Propulsion

Figure K-8

The majority of the Army's TWV requirements are met by the commercial truck industry. However, military TWV, unlike their commercial counterpart, must be able to operate in wider environmental extremes. Additionally, military TWV have requirements for increased crew and passenger protection from small arms and landmines.

Because TWV are generally commercial vehicles or modifications thereof, which are acquired through performance specifications, the government has a limited say in what basic technologies, components and subsystems are included. Resource constraints also make it difficult to find opportunities to modify TWV. The National Automotive Center (NAC), located at the U.S. Army Tank-Automotive Research, Development and Engineering Center, Warren, MI is a cooperative effort that identifies dual-use technologies that can benefit both defense and commercial industries, as well as structures cooperative programs. Goals of this approach are affordable innovation, faster product development, improved production methods, better manufacturing and product quality, economies of scale, and lower costs. Some NAC accomplishments include:

- Synthetic lubricants that can stand up to high temperatures and pressures
- Electronic power train controls for more efficient engine operation and improved fuel economy
- Embedded or automated guidance and position location to enhance efficiency and reduce fuel use
- Diagnostic computers to improve maintenance. These improved diagnostics prevent replacing the pack early and improve preventive maintenance
- Collision warning systems to save lives and equipment
- Converting crankcase oil into vehicle fuel to save fuel costs and make use of oil that would otherwise require disposal

Improved Diesel Engines

Currently, TWV have whatever engine is proposed by the prime contractor. This situation results in a large number of different engines in the Army's inventory, for which maintainers must be trained, unique parts must be kept in stock, and special tools are required. A possible solution is adoption of a family of diesel engines that can meet the needs of medium and heavy trucks, as well as combat vehicles up to medium class. The Army is currently exploring this strategy. The Army expects to have a major role in a new White House initiative, "21st Century Truck," which will involve government and industry teaming to improve fuel efficiency and reduce the impact of internal combustion engines on the global climate.

Lightweight Armor and Blast Resistance

In support of several recent operations, lightweight armor technologies have been applied to TWV to improve protection against small arms and landmines. These technologies were developed by the Defense Advanced Research Projects Agency, the Army Research Laboratory, and the Tank-Automotive Research, Development and Engineering Center. Armored TWV have seen service in Haiti and Bosnia, among other places, in recent years. The armor appliques do a commendable job against threats for which TWV were never designed to withstand. Areas for improvement in the future are TWV designs that are inherently more survivable, both in terms of blast and fragmentation effects, and initiatives to protect occupants against serious collision injuries.

Recapitalization Program Assessment

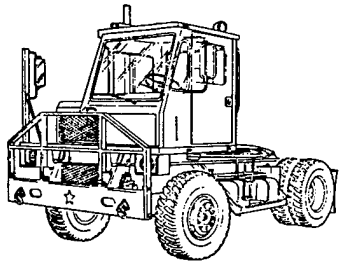
The majority of TWV systems falls into the recapitalization category. Recapitalization is the replacing or retrofitting of an existing system due to mechanical aging, technological obsolescence, or excessive expense to maintain. The intent is to economically sustain the current capability, as opposed to a significant capability improvement. Recapitalization can be achieved through replacement, Extended Service Program (ESP), Preplanned Product Improvement (P3I), depot rebuild or technological insertion. The fill against requirements is based on prior year buys, POM, and Extended Planning Period (EPP) projections. The requirements shown in Figure K-9 for Extended Service Program (ESP) vehicles are candidates rather than hard requirements. The only exception is the HMMWV program. The current acquisition strategy states that 73% of the required vehicles will be re-manufactured. The remaining 27% will be a new buy. Funding at this time does not meet the requirement. The shortfall will be addressed in the FY00-05 POM build.

TWV Recapitalization Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
CUCV	10,380	30,415	1997	AMBER	NA	NA	Rolls to HMMWV
PLS	3,711	3,711	2012	GREEN	GREEN	GREEN	
HETS	2,412	2,412	2012	AMBER	GREEN	GREEN	
HEMTT	13,203	13,203	2004	GREEN	GREEN	GREEN	OK
Line-Haul Tractors	6,552	5,068	1998	AMBER	GREEN	GREEN	Meets rqmt
Engineer Tractors	2,813	604	1998	GREEN	AMBER	AMBER	FP 1 only
ASV	1,740	155	2018	RED	RED	RED	Less than FP 1
Line-Haul ESP	1,857	1,484	2015	GREEN	GREEN	GREEN	New & Reman
HEMTT ESP	2,814	786	2018	AMBER	AMBER	AMBER	Late in POM
HMMWV ESP	78,841	20,588	2011	AMBER	AMBER	AMBER	Short
2½-Ton ESP	14,000	6,278	2012	AMBER	AMBER	AMBER	Short
5-Ton ESP	12,321	5,042	2017	AMBER	AMBER	AMBER	Short

Figure K-9

Contributing Capabilities: Infrastructure Program Assessment



There is one TWV program in the infrastructure assessment, the yard tractor. The yard tractor is a key piece of equipment for port opening packages for Army Prepositional Sets (APS) ships, and for cargo transfer units. Non-affordability has prevented the Army from taking action to fix this program sooner than FY99 (Figure K-10).

TWV—Other Requirements—Infrastructure

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Yard Tractors	419	419	1990	AMBER	GREEN	GREEN	230 old on-hand

Figure K-10

Assessment Methodology

The Army continually assesses its TWV fleet for required capabilities, operating cost characteristics, and other ownership measures of effectiveness. The Army Modernization Plan provides an opportunity to document those assessments and to support the execution of program decisions such as initiation and retirement. Army fleet asset management uses the concept of Economic Useful Life (EUL) developed by the TACOM Fleet Planning Office, to measure or predict the age at which a fleet of vehicles should be replaced. The Training and Doctrine Command (TRADOC) performs periodic capability assessments to determine if required capabilities are still being achieved with fielded systems.

Overall TWV Fleet Assessment

Overall, the TWV fleet should be considered **AMBER**, with selected segments as **RED**. Added resources in the outyears, if they materialize, will improve the long-term picture. Today, approximately 25% of the TWV fleet is over age (i.e., beyond Economic Useful Life) with virtually all that being medium vehicles (Figure K-11). By FY10, when Army XXI is to be fully operational, the medium fleet over age condition will have been halved, but the light and heavy fleet segments will have significant numbers over age. The percent of the fleet over age at that time will have grown to approximately 40%.

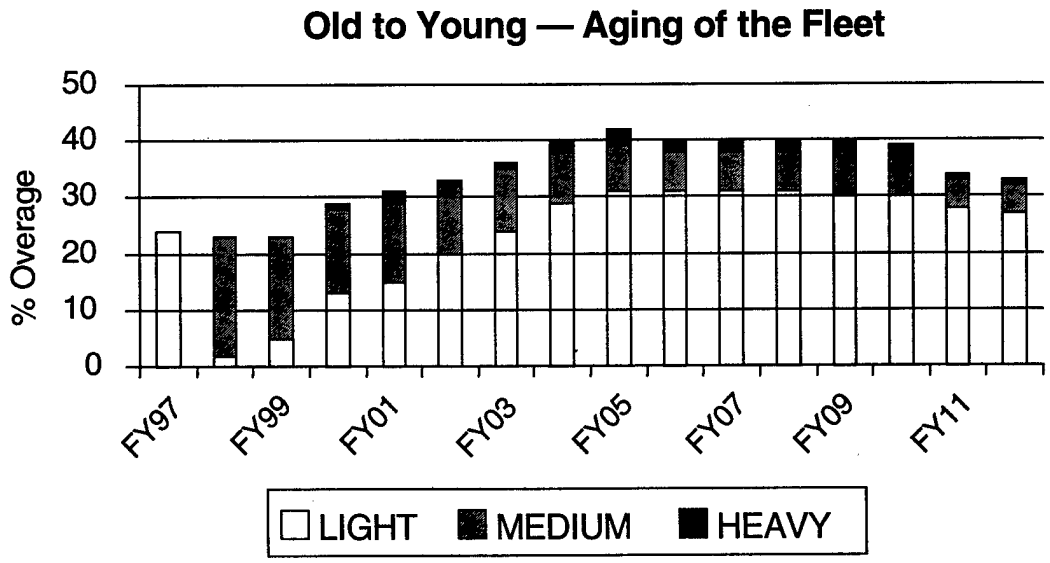


Figure K-11

LIGHT FLEET ASSESSMENT

The light fleet consists of the High Mobility Multipurpose Wheeled Vehicle (HMMWV), Commercial Utility Cargo Vehicle (CUCV), Small Unit Support Vehicle (SUSV), and Armored Security Vehicle (ASV).

High Mobility Multipurpose Wheeled Vehicle (HMMWV)

The HMMWV is rated **GREEN** in the near-term and **AMBER** in both the mid- and far-terms. Funding levels are not sufficient to maintain over Force Package 1 requirements with new or Extended Service Program (ESP) vehicles (Figure K-12). Up-Armored HMMWVs do not meet Force Package 1 requirements.

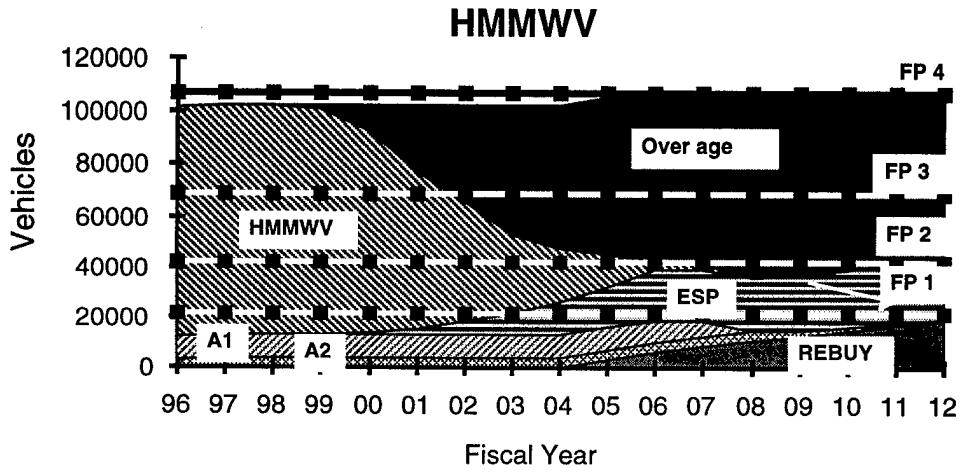


Figure K-12

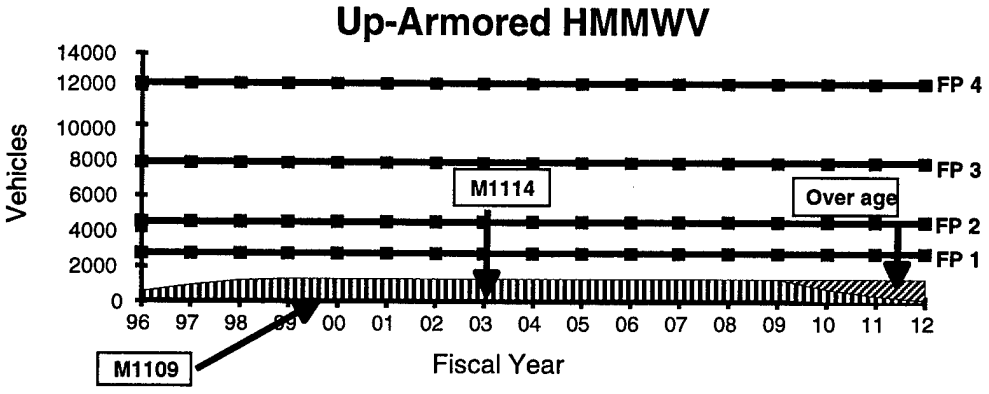


Figure K-13

Armored Security Vehicle (ASV)

The ASV is not shown graphically since none are yet fielded. The ASV will be the prime vehicle for the Military Police, providing protection, convoy support, and rear area security. Funding for the vehicle does not meet Force Package 1 requirements. Fielding is expected to begin in late FY99. It is rated **RED** in all three periods.

Commercial Support Cargo Vehicle (CUCV)

The CUCV requirements will be eliminated and all requirements will become HMMWV requirements. The CUCV is expected to be eliminated from the fleet by 2003 (Figure K-14).

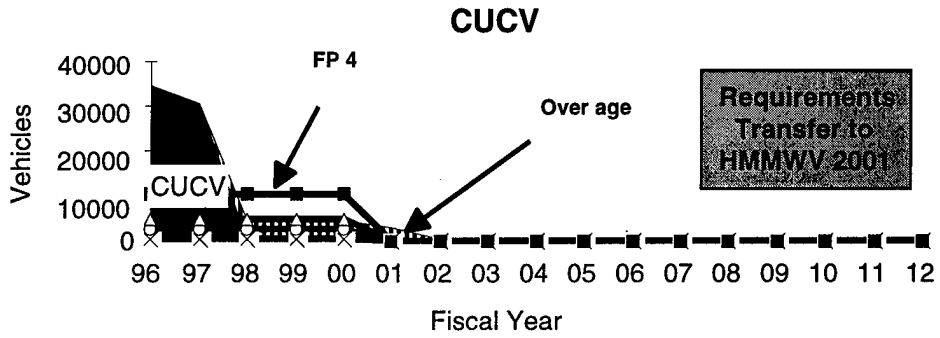


Figure K-14

Small Unit Support Vehicle (SUSV)

Although this vehicle is tracked, it is considered a TWV. There is no graphic for this item. The vehicle is used in arctic regions, marsh areas and other areas of extreme terrain conditions. It is **GREEN** in the POM, but will become **RED** in the mid- and far-terms unless an upgrade or replacement program is developed such as that for the 2½- and 5-ton programs.

MEDIUM FLEET ASSESSMENT

For the past decade, the medium fleet has been in the most need of significant modernization. Now, with FMTV vehicles being fielded, that situation is beginning to improve. Outyear funding helps arrest the age creep but is insufficient to eliminate it.

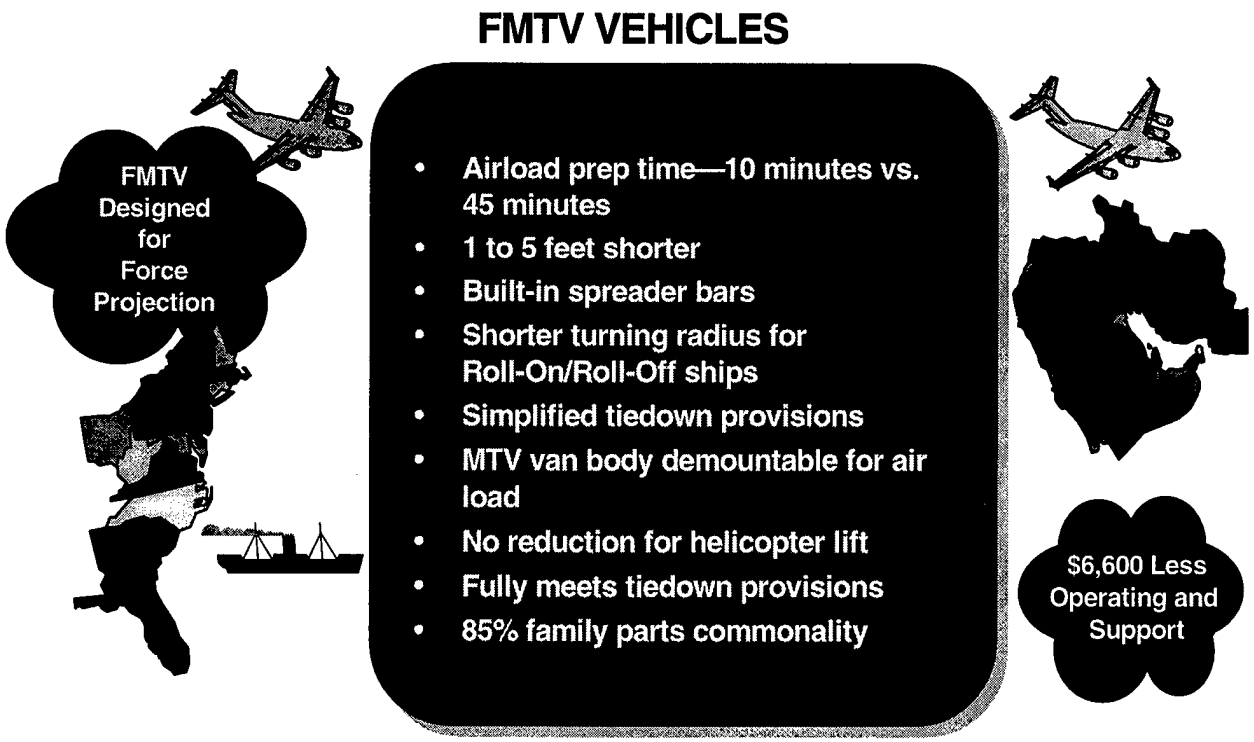


Figure K-15

2½-Ton

The 2½-ton situation has improved with fielding of the LMTV and the ESP. As shown in Figure K-16, FP 1 and FP 2 situations improve in the POM. Overall, the system is **AMBER** going **GREEN**.

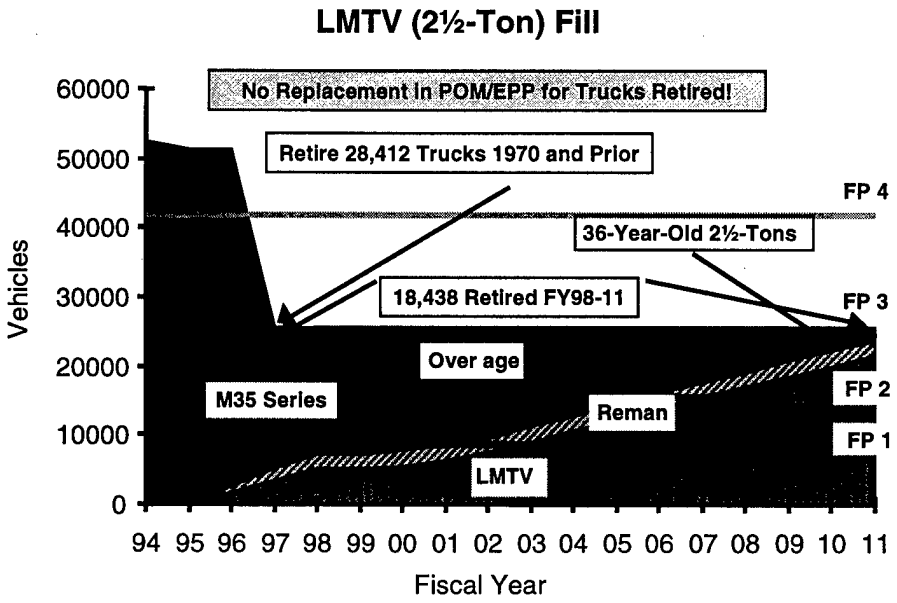


Figure K-16

5-Ton

Because of continued procurement of the 5-ton truck, the overall situation is much better than the 2½-ton. The major problem within the 5-ton fleet is model mix. TAA-03 truck units have greatly increased the requirement for 5-ton tractors and decreased the requirement for dump trucks. Requirements for 5-ton tractors will not be met until 2004. Overall the system is **AMBER** going **GREEN** (Figure K-17).

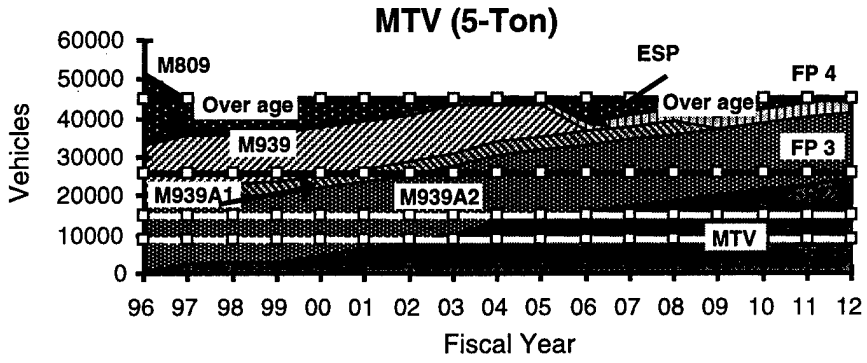


Figure K-17

Yard Tractor

There is no graphic for this vehicle. The yard tractor is **AMBER** going **GREEN**. POM funding does meet Force Package 1 requirements. The yard tractor is a key piece of equipment for port opening.

HEAVY FLEET ASSESSMENT

Heavy Expanded Mobility Tactical Truck (HEMTT)

The HEMTT II is the key overmatch system for TWV (Figure K-18). The vehicle is important to Army operations now and will be for Army XXI and the Army After Next. The current HEMTT has critical model shortages in the wrecker and tanker versions. Cargo versions are being converted to common bridge transporters and tankers. This reduces the need to buy new vehicles. The HEMTT ESP does not start until 2002. POM FY00-05 will address moving the starting date forward. The HEMTT program is **GREEN** overall.

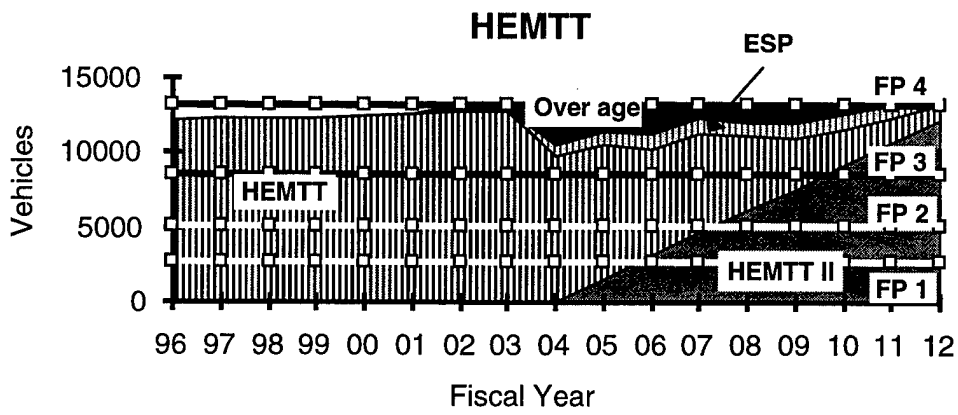


Figure K-18

Palletized Load System (PLS)

PLS is **GREEN.** (Figure K-19) PLS is being equipped with PLS-Enhanced, Movement Tracking System (PLS-E (MTS)). The system provides the capability for movement control and allows dispatch personnel to know the exact location of the vehicle and status of its cargo. It provides two-way communications between the operator and the dispatcher. The PLS-E (MTS) is a Warfighting Rapid Acquisition Program (WRAP) item. It is a priority 2 system for the digitized division and corps. It will start fielding in the 3QFY98. The new PLS flatrack is known as the Container Roll-On/Off Platform (CROP). It is designed to fit in a 20-foot International Standards Organization (ISO) container. The CROP provides the capability to ship directly from factory or depot to foxhole.

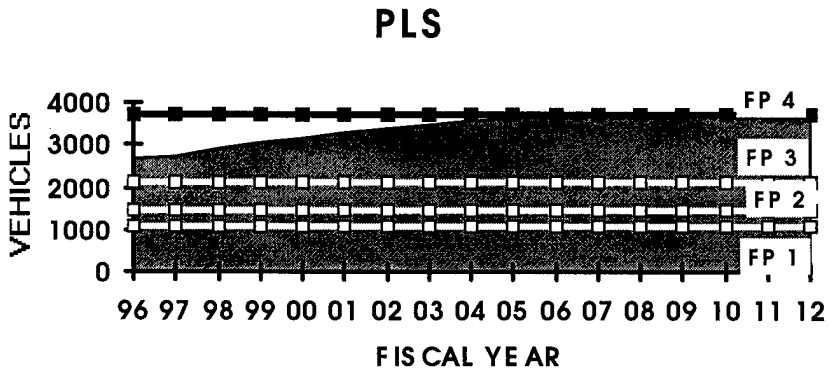


Figure K-19

Heavy Equipment Transporter System (HETS)

As shown in Figure K-20, the HETS will meet the requirement and be **GREEN.** The new HETS provides the capability to transport the tank on the trailer and the tank crew in the cab of the truck. This saves wear and tear on the tank and enables the tank crew to arrive rested and ready to fight. More tanks arrive in battle-ready condition since they did not have to move by their own power to the assembly area.

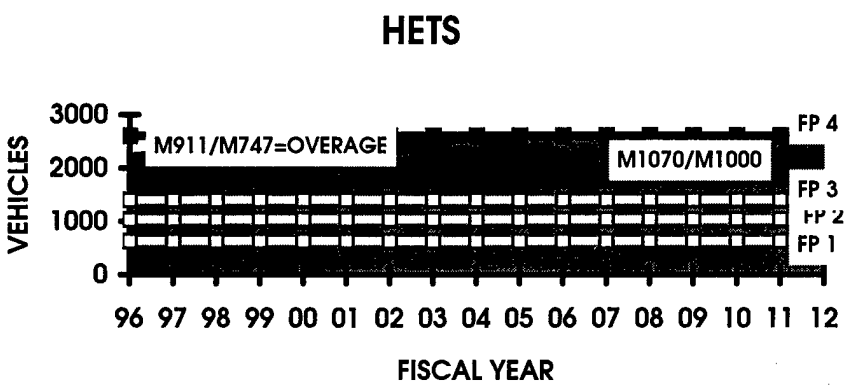


Figure K-20

Line-Haul Tractors

Line-haul tractors do meet requirements until the end of the POM (Figure K-21). Funding for the FY98 buy was denied by Congress. Over age assets are kept throughout the period. These vehicles are critical to TAA-03 unit activation for the National Guard and the Army Reserve. Line-haul tractors overall are **AMBER** going **GREEN**.

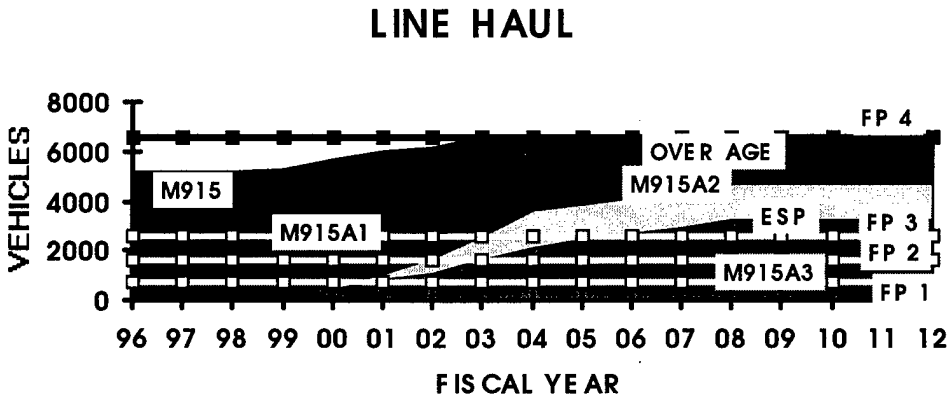


Figure K-21

Engineer Tractors

Engineer tractor rebuy maintains modern assets in Force Package 1 while Force Packages 2 and 3 are filled with older assets. Engineer tractors are **GREEN** going **AMBER**. (Figure K-22).

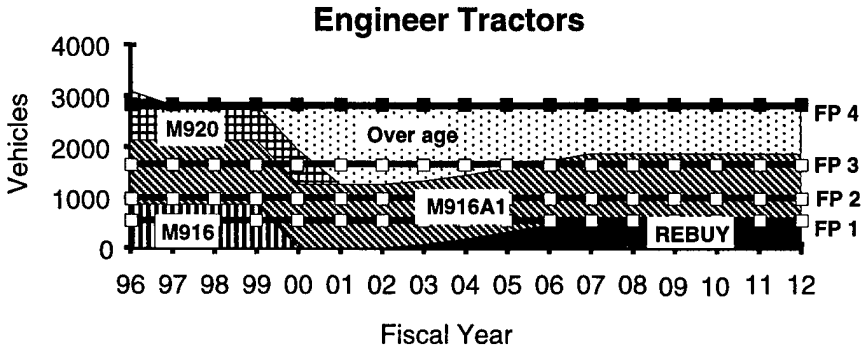


Figure K-22

Trailers

Trailers are significant for the Army in that they haul bulk cargo such as fuel and dry cargo. Funding for trailer programs has improved in the POM. Trailers programs that would have supported activation of new units in the National Guard and Army Reserve were delayed because Congress reduced the funding for 5,000-gallon tankers, 7,500-gallon tankers and 22½-ton semitrailers. **AMBER.**

Initiatives and Efficiencies

The Army TWV community has long sought ways to constrain the number of TWV required, reduce the cost to acquire, and reduce the cost to sustain the fleet over time. Two major initiatives are the Tactical Wheeled Vehicle Requirements Management Office and the Tactical Wheeled Vehicle Retirement Program.

Virtually all Army units organized under Tables of Organization and Equipment (TOE) require, and are expected to require, some TWV as they represent the most flexible and cost-effective mode of transport available. The determination of TWV requirements at the unit level and validation at the aggregate level, is vested in the Training and Doctrine Command's Tactical Wheeled Vehicle Requirements Management Office (TWVRMO). The TWVRMO analyzes each TOE unit design as it is being constructed, and determines the most cost and operationally effective mix of vehicles to satisfy mission needs. **TWVRMO is Army's TWV appetite suppressant!**

The Army established a TWV retirement program with the first TWV modernization plan in 1989. The Army then recognized that with declining budgets on the horizon, coupled with aging fleet components, especially the medium fleet, action was required to retire selected vehicles. In 1995, that process got renewed emphasis when Army leadership saw an opportunity to accelerate TWV retirements and to reallocate avoided Operating and Support (O&S) costs into procurement dollars. The TWV retirement program has retired over 20,000 vehicles since April 1995.

SECTION 3: CONCLUSION

> *"Sometimes soldiers like me need to be reminded that trucks are as important as tanks."*
>
> General Norman Schwarzkopf

Significant improvements have been made in TWV outyear funding. If it is made available, it will approach the level now required. If it is not, however, the current situation will continue and become worse.

This TWV annex reaffirms the goals, objectives, and fleet architecture of each Army modernization plan and the seminal 1989 TWV modernization plan. Recent funding decisions made by the Army, OSD, and the Congress have recognized the TWV fleet condition and battlefield contributions. The precept of EUL is still appropriate and results in retiring or refitting fleets before they become too maintenance intensive, resources permitting. The chart below summarizes what the POM and EPP does and does not do for TWV.

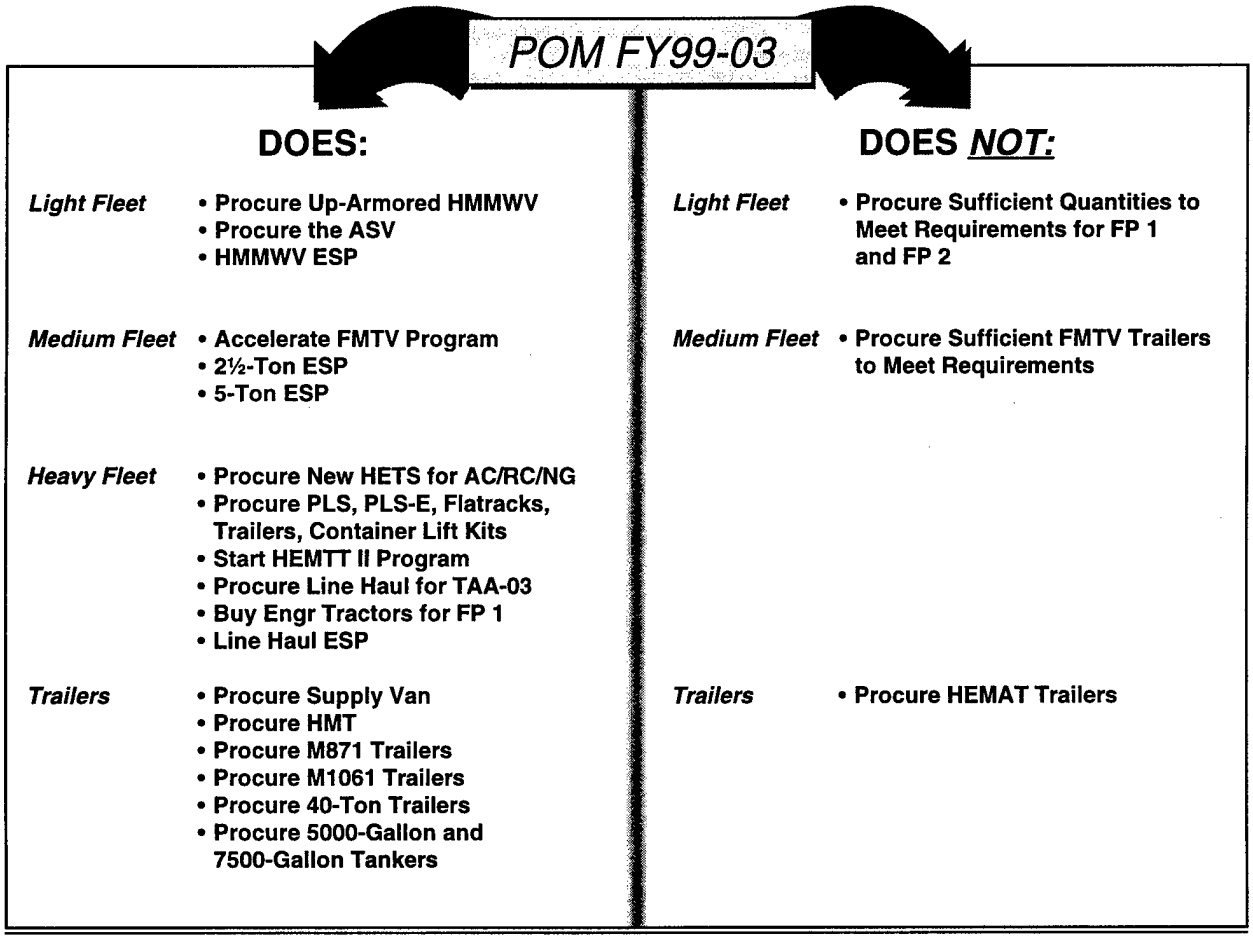


Figure K-23

This final fleet assessment, made against the criteria of capabilities required and sound business practices, results in the ages by vehicle type as noted in Figure K-24.

Fleet Average Age
1996 vs. End POM/EPP

Vehicle	Economic Life	Max Fleet Ave Age Objective	% Over	Fleet Average Age 1996	2012
CUCV	12	6	14	9.8	N/A
HMMWV	14	7	0	5.0	11.1
SUSV	15	7.5	0	5.8	20.0
M151	15	N/A	100	17.7	N/A
M880	7	N/A	100	17.1	N/A
2½-Ton	20	10	98	25.5	13.9
5-Ton	22	11	31	13.6	13.7
PLS	20	10	0	0.5	15.7
HEMTT	20	10	0	8.1	5.6
Engineer Tractor	20	10	0	12.1	22.8
Line-Haul Tractor	20	10	0	12.7	13.1
HET	20	10	40	8.4	13.7
Yard Tractor	10	5	100	14.9	29.9
Total Avg.		8.8	23	11.9	12.8

Figure K-24

To bring all fleet segments in line with modernization objectives, i.e., at half-life, approximately an additional $300M per year would have to be added to the POM. The increase in truck units added to the Army by TAA-03 and National Guard redesign requires more trucks. Thus, although more vehicles are being bought, they are filling new shortages rather than replacing old.

Summary

TWVs provide a significant contribution to today's battlefield and to operations other than war. *Joint Vision 2010* and *Army Vision 2010* increase expectation of even greater future importance. This, combined with an aging fleet and increased requirements in selected fleets, has garnered POM and congressional support for TWV modernization. The Army challenge is to maintain this momentum to acquire required quantities of capable TWV while keeping the cost of ownership at affordable levels. Maintenance of planned levels is key to both. Should the planned funding picture in the outyears not materialize, the TWV fleet, perhaps the most important yet unheralded contributor to all patterns of operation, will continue to decline in capability and increase in cost of ownership. Efficient fleet management requires scheduled recapitalization. **Soldiers deserve capable TWV, and the taxpayer deserves affordability!**

ANNEX L: LOGISTICS

SECTION 1: INTRODUCTION

Army Vision 2010 is the blueprint for the Army's contributions to the enhanced operational concepts of *Joint Vision 2010*. This annex describes Logistics' planned modernization efforts to achieve these required capabilities. Focused logistics will fuse information, logistics, and transportation technologies to allow the Army to deliver the right support at the right place on the battlefield at the right time. It will be fully adaptive to the needs of our increasingly dispersed and mobile forces, providing support in hours or days versus weeks. Focused logistics will enable joint forces of the future to be more mobile, versatile, and projectable from anywhere in the world. Accompanying a remarkable evolution of the fighting force, the support logistics tail will experience a revolution of its own, assuring the resulting land force is globally mobile and sustainable. Army prepositioned sets of equipment will facilitate operational positioning and dissemination. Increased commonality in design and materials between military and civilian-use equipment will enhance surge and regeneration capabilities in times of crisis.

The Army After Next will be a high-tech, rapidly deployed force, with less of a logistics tail and more lethal than the post-Cold War Army. Freed of a traditionally heavy logistical tail, the Army will be able to quickly move troops and supplies by land, sea, or air. The range of military logistics operations is described in Figure L-1.

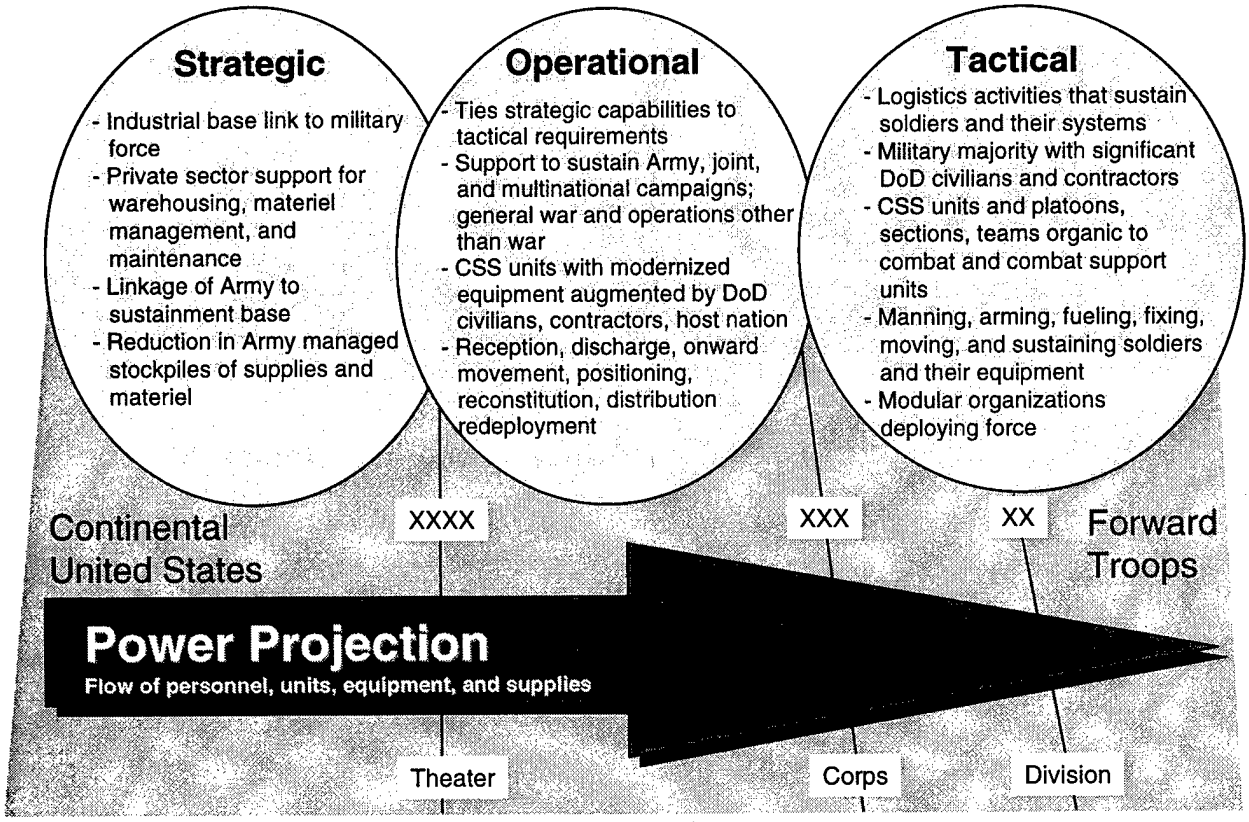


Figure L-1

The mobility, deployability, and sustainability essential to the Army of 2010, as well as the Army After Next, cannot be achieved without a revolutionary change in support concepts. The Army's revolution in military logistics will be an integral part of the revolution in military affairs. It is the visionary document to transform logistics into a global, distribution-based logistics system that substitutes logistics velocity for logistics mass, taking maximum advantage of technological breakthroughs.

Technology is a great enabler of focused logistics. Smaller fighting elements with easily maintainable equipment made of more durable materials, supported by systems such as water, laundries, food and shelters, will significantly reduce the volume and complexity of the resupply system. Precision weapons with increased lethality and survivability and fuel efficient systems will generate quantum reductions in demands on systems like petroleum distribution. Advanced business solutions for inventory control, materiel management and distribution, transportation (heavy equipment transport, palletized loading, and medium tactical vehicles), warehousing, and automatic cross-leveling and rerouting will greatly expand current Army Total Asset Visibility and Objective Supply Capability concepts. Use of electronic diagnostics and prognostic sensors, along with interactive digitized technical data, artificial intelligence, and enhanced test program sets associated with state-of-the-art commercial off-the-shelf test measurement diagnostic equipment will identify anticipated failure conditions and initiate resupply and repair activities. In the same manner in which combat crews train using built-in weapons systems situational understanding software, the Combat Service Support Control System (CSSCS) will be used to train logisticians. The situational understanding logistical network will not only enable suppliers to train, but it will also be used to war game operations so that logistics operators can develop better alternatives and test logistics plans before operations occur.

The current objective of a distribution-based logistics system is moving away from extensive stockage to a velocity-managed, customer-friendly system. Modernization must provide vastly improved operational capabilities resulting in visibility (Total Asset Visibility, communications, situational awareness), capacity (throughput per day), and control (centralized distribution management through hub and spoke distribution). The measure of success is time, whether it is supply (from time of need to receipt by the user) or maintenance (from time of breakdown to a repaired system available for use). Digitization will be an enabler throughout all Combat Service Support (CSS) operations and systems with the goal to reduce the time it takes to satisfy the customer.

Focused logistics applies across the spectrum of crisis—from disaster relief to full-scale war. No other concept is executable without focused logistics. The introduction of the Palletized Loading System (PLS) in 1994, the container Roll-In/Roll-Out Pallet fielding in FY99, the M1 flatrack fielded in FY97, Movement Tracking System fielding in FY98, and the radio frequency tag will provide true factory to foxhole capability. These systems support the revolution in military logistics and will result in significantly shortened time-lines for ammunition throughput to units. Given that ammunition logistics is a large part of the burden on CSS units, the ability to bypass ammunition storage and supply facilities at certain levels and deliver to, or near, using units is a combat enhancement of significance. This system will permit tracking of the cargo

from the moment it is picked up to the instant it is delivered and will work not only for ammunition but also for other commodities.

Focused logistics is also an operation that can stand alone, particularly in humanitarian operations. An example of a stand-alone system is Force Provider, which is organized and equipped to sustain itself in long-term, austere operational environments, and is especially suited to react quickly when called upon to provide logistics support for both domestic and foreign, natural or man-made disasters.

The Army's requirement to project the force creates an image in the mind of an adversary of an unstoppable force of unequaled competence. Augmented with critical equipment prepositioned where the need is most likely, air and naval components of the joint force will commence transport of a versatile, tailorable, modular land force within hours of the decision to deploy. This power projection force will be equipped with lighter, more durable, more lethal multipurpose warfighting systems, thus reducing the amount of lift required as well as the size and complexity of the logistics tail needed to sustain the force.

Information technologies will enhance airlift, sealift, and pre-positioning capabilities to lighten deployment loads, assist pinpoint logistics delivery systems such as Logistics-Over-the-Shore, and extend the reach and longevity of systems currently in the inventory. The combined impact of these improvements will be a smaller, more capable deployed force. It will require less continuous support with a smaller logistics footprint, decreasing the vulnerability of our in-theater streamlined logistics structure.

The Army's Logistics modernization program is primarily focused on these patterns of operation: Project the Force, Sustain the Force, and Protect the Force. Figure L-2 describes the patterns of operation and where the key logistics systems fit in relation to modernization investment components.

Logistics Systems

Investment Components						Other Requirements
Patterns of Operation	**Information Dominance**	**Overmatch**	**Essential R&D & Leap-Ahead Technologies**	**Recapitalization**	**Contributing Capabilities**	**Infrastructure**
Project the Force The movement of personnel, equipment, and supplies from factory to foxhole		Airlift Sealift	Logistics-Over-the-Shore			Rail
Sustain the Force Provide water, food, fuel, personnel hygiene, and automation support for battlefield support and improving soldier quality of life	CSS Control System Tactical Electrical Power CSS Automation Systems	War Reserve Ammo	Air Drop	CSS Equipment Petroleum Dist. Equipment Maintenance Equipment Materiel Handling Equipment Water Mod.		
Protect the Force Protect forces from attack by weapons, NBC, munitions, and electronic warfare			Explosive Ord. Disp.			
Maintain Readiness Training ammunition, ammunition base support, materiel handling equipment, power generation, and test and diagnostic support to keep the Army operating efficiently		Integrated Family of Test Equip. Test Equip. Mod. Training Ammo				

Figure L-2

Logistics modernization is driven by a number of critical factors as shown in Figure L-3. The first division will be digitized by FY00, the first corps by FY04, and the total Army by FY10. There is a shortage of training and war reserves ammunition through FY10. There is a critical shortage of generators which will be used to power the digitized battlefield, and the current generators are aging. Explosive ordnance disposal funds were moved to FY98-03, creating shortages in the mid- and far-terms. Near-term shortages exist for Logistics-Over-the-Shore. Far-term shortages and limited capacity of petroleum distribution equipment, maintenance equipment, aerial delivery systems, food service, and water modernization are also concerns.

Logistics Modernization Driving Factors

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
Digitized div by FY00	Digitized Total Army	Advanced Long Range Aerial Delivery Systems
Food Service—rapid deployment for Force Projection	Ammunition—Training and War Reserves—shortage	Water Modernization—more production capability
Ammunition—Training and War Reserves—shortage	Tactical Electrical Power—aging and shortage	Shortage of Petroleum Dist Eq and Maintenance Equipment
Tactical Electrical Power—aging and shortage	Integrated Combat Service Support System and other logistics automated systems in place	
Logistics-Over-the-Shore—critical shortages		
Explosive Ordnance Disposal		

- Operating and sustainment cost reduction—save dollars for the Army
- Digitized battlefield—real-time situational reports and C2 improvements
- Enabling Technologies—revolution in military logistics provides efficient and capable systems

Figure L-3

SECTION 2: CURRENT PROGRAM ASSESSMENT

Information Dominance

To provide responsive logistical support, the system must know what commodity is required, who needs it and in what priority, where the commodity is located, and how long it takes to arrive at the user unit. This logistical information is critical to a commander's assessment of his ability to conduct operations.

Logistics—Information Dominance Program Assessment

System	# Systems Req	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Combat Service Support Control System	1651	1651	2008	**GREEN**	**GREEN**	**GREEN**	Approved full rate production
Logistics Automation Systems	N/A	N/A	N/A	**AMBER**	**AMBER**	**AMBER**	Requirements have not been determined (Note 1)
Tactical Electrical Power (Note 2)	66,700	15,293	2008	**AMBER**	**AMBER**	**AMBER**	Supports contingency forces only

Notes:
1. Narrative explains why requirements have not been determined.
2. Breakdown by small, medium, and large generators is in Figure L-5.

Figure L-4

COMBAT SERVICE SUPPORT CONTROL SYSTEM

This system is part of the Army Tactical Command and Control System (ATCCS). It provides command and staff with automated critical command and control information to effectively manage resources in support of battlefield operations. It provides logistical near-real-time situational awareness from brigade though corps level. It is one of the five principal decision-making systems supporting the Army Global Command and Control System (GCCS). This system replaces an unstructured, slow, labor-intensive manual system unresponsive to present-day battlefield command and control requirements. Automatic connectivity between the system and consumption sensors eliminates the need for manual input from logistical, medical, financial, and personnel systems. Integrated, automated decision-making capabilities will replace less efficient, slower, manual information management tools. This is a key piece of logistics digitization. As part of the Army Battle Command System (ABCS), it links combat service support functions with maneuver, fire support, and air defense through common communications networks. The Army Battle Command System cannot fully achieve the objective force level operational capability until the Combat Service Support Control System is fielded. Recent deployments of Reserve Components and the movement of infrastructure support to the Army Reserves increase the urgency for concurrent fielding to the Reserve Components. The program is **GREEN** due to receipt of additional research and procurement funds.

Current research funds allow completion of Version 5 objective software and the ability to place software on smaller hardware systems, such as laptops, for battalion entry data. The first

production began 4QFY97. Fielding to Contingency and Rapid Response Forces will occur by FY03 and the total Army by FY08. The replacement point for hardware is 10 years and the replacement point for software upgrade is 5 years. R3 point is 2008.

LOGISTICS AUTOMATION SYSTEMS

State-of-the-art communications and automation are critical to the modernization effort. Logisticians require the same real-time situational understanding and improved command and control capabilities as the warfighters they support.

Several logistics automation systems will support the Army digitized system architecture. These are the Standard Installation Division Personnel System, Transportation Coordinators' Automated Information for Movement System II (TC AIMS II), Integrated Combat Service Support System, Tactical Interactive Ground Equipment Repair Initiative, Radio Frequency Tags, and "smart" personnel cards. TC AIMS II, a joint system, is currently in development and will be the Army's unit deployment system for the 21st Century. It will replace TC ACCIS as the Army's system that maintains unit equipment lists and the source system for unit deployment data and in-transit visibility (ITV) during a contingency. TC AIMS II will eventually provide the warfighting CINC with ITV by providing theater movement control and mode management organizations with a theater transportation capability.

The most critical initiative of logistics automation is the Integrated Combat Service Support System (ICSSS). The Integrated Combat Service Support System is the Army's interactive modular CSS information management and operations system. It is the centerpiece of CSS automation. This system addresses the Army's current CSS automation dilemma of having "stovepiped" systems without an overall system architecture. This diversity of hardware, operating systems, and database management systems creates serious supportability and training problems. Integrating these functions in relational databases gives the user several significant improvements over existing systems, reducing total processing and delivery time for all supplies and services. The use of common databases greatly increases the accuracy of all actions. Full implementation with common hardware and software reduces the costs to train soldiers and to maintain the systems. The Integrated Combat Service Support System will interface with the Army Global Command and Control System (AGCCS) at the strategic level through the Combat Service Support Control System (CSSCS), and the Warfighter Information Network (WIN) at the tactical level. This system will provide logistics support based on the Warfighter requirements. Specifically, it will support joint, allied, and split-based operations, as well as Army XXI, revolution in military logistics, and the Army After Next.

The ICSSS program is **GREEN** for the near-term, but **AMBER** for the mid- and far-terms. Future funding is uncertain as business practice reengineering is ongoing to define Phases 2 and 3 of the program. These phases provide wholesale logistics, and joint linkages and requirements.

Total Distribution Program provides asset visibility from "factory to foxhole." The program's main objective is to develop an objective distribution system focused on 1) an assured

logistics communications capability connecting the theater of operations with the sustaining base; 2) essential materiel handling equipment and transportation requirements; and 3) linkage of logistics information systems and in-container, in-transit, and in-process asset visibility. This program will mesh with the Department of Defense initiatives for Total Asset Visibility and Intransit Visibility. Total Asset Visibility/Intransit Visibility provides materiel managers with information on location, quantity, condition, and movement of assets. Software has been installed throughout the Army at installations, depots, and arsenals, and automated identification technology is used for sustainment operations throughout the Army. This program is part of the Revolution in Military Logistics and will provide increased capability and efficiency to track materiel. Two places where this program has been successful are Haiti and Bosnia. The Army has approved a Warfighting Rapid Acquisition Program to evaluate the employment of automated identification technology equipment within a maneuver brigade. If successful, this will establish the final visibility link between supporting activities and the tactical elements. The Total Distribution program is **AMBER** for all years. The Army will not be able to provide key links in the communications network extending the Total Asset Visibility/Intransit Visibility capability to the tactical logistician.

Split-Based Operations Corps/Theater Automation Data Processing Service Center-Phase II supports a split-based operation configuration with fly-away capability. The mini-computer at the sustainment base is connected by various communications modes to microcomputers and laptops in the area of operations. Fly-away boxes provide corps-wide asset visibility and a remote query capability. The program is funded under the Total Distribution Program for active Army and Reserves and under the National Guard for their systems. The program is **GREEN**.

TACTICAL ELECTRICAL POWER

The Tactical Electric Power modernization program is critical to the overall Army XXI modernization effort. This program is considered information dominance because it is one of the key components for the Army digitized battlefield. New digitization initiatives require constant and reliable electrical power and the proper equipment is crucial to ensure the success of that effort. Generators are needed to operate the Tactical Operations Centers, the central communications area for the digitized battlefield.

The Tactical Electric Power modernization program provides improved capability and reduced operational and support costs at an affordable price due to its use of off-the-shelf equipment components. The program is expected to produce systems/platforms with useful lives of 15 to 20 years with product improvements incorporated when applicable to further enhance system performance. The previous military-standard generators, nearly 28% gasoline-fueled, average 20 to 25 years old. They are difficult and expensive to maintain, have low readiness rates, and lack many of the critical operational features required for Army XXI. Tactical quiet generators markedly improve battlefield survivability by reducing noise and detectability by 80%, virtually eliminate infrared signatures, and are hardened against electromagnetic pulse effects. Mobility, transportability, and deployability have been enhanced by reducing size/weight by 19% (equivalent to four C-141 sorties per typical division), and by integrating the smaller sets onto the

generator ready trailers. Overall maintainability/supportability has seen a 100% improvement in reliability, 65% reduction in frequency of preventive maintenance checks and services, and 16% reduction in fuel use, thereby significantly reducing operating and support costs.

The 5-60kW Tactical Quiet Generator Program was initiated in 1988. The 30 and 60kW tactical quiet generators will incorporate improvements in digital controls/diagnostics and Environmental Protection Agency certifiable engines. Further improvements through technology insertion are anticipated/planned for FY01-FY03. There are two auxiliary power unit efforts being fielded. One is the 5kW/28 VDC auxiliary power unit for the 1068/M577 tracked Standard Integrated Command Post System (SICPS) and the other is the 10kW 60Hz tunnel-mounted auxiliary power unit for Standard Integrated Command Post shelter. The 5kW/28 VDC unit is replacing the 4.2kW gasoline set now being used.

System Required	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Small Tactical Electrical Power Program (<4kW)	24,131	1,692	2008	**RED**	**AMBER**	**AMBER**	TQG fielded in limited qtys
Medium Tactical Electrical Power Program (5kW-60kW)	45,545	13,601	2008	**AMBER**	**AMBER**	**RED**	Limited capability fielded
Large Tactical Electrical Power Program (100kW-750kW)	589	0	2008	**RED**	**RED**	**AMBER**	Joint program begins in FY98

Figure L-5

The near-term rating for the Small Tactical Electrical Power Program (3kW sets) is **RED**. The 3kW tactical quiet generator will be fielded in limited quantities in FY99 with production quantities and major fielding 12-18 months later. Inadequate funding to support fielding to forward deployed and follow-on forces contributes to mid- and far-term ratings being **AMBER.** A limited quantity of the newly adopted 2kW military tactical generator was fielded initially only to contingency forces. By FY00 the 2kW will be completely fielded to contingency forces due to recent increases in POM funding. The Medium Tactical Electrical Power Program (5-60kW) is rated **AMBER** in the near- and mid-terms because the follow-on forces will not be fielded. The far-term rating for the 5-60kW program is **RED** because funding is uncertain in the outyears to recapitalize systems that reach their R3 point. A replacement effort must begin before reaching FY10 for all systems 60kW and under. The Large Tactical Electrical Power Program (100-750kW) is rated **RED** in the near- and mid-terms, and **AMBER** in the far-term. The 100-200kW Joint Service Program is scheduled to start in FY98. A program to develop a modernized prime power generator (750kW or larger) begins in FY98. Significant fielding of modernized prime power sets will not begin until about FY05.

Overmatch

Logistics overmatch programs include lift capabilities, ammunition stockage, and diagnostic test equipment.

Logistics—Overmatch Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Airlift (C-17)	120	120	N/A	**GREEN**	**GREEN**	**GREEN**	Procurement of 120 C-17 aircraft by FY03 (Note 1)
Sealift	See remarks	See remarks	N/A	**AMBER**	**GREEN**	**GREEN**	Short 5 Roll-On/Roll-Off or equivalent capacity (Note 2)
War Reserve Ammo	See remarks	See remarks	N/A	**AMBER**	**AMBER**	**RED**	Based on capabilities-based munitions requirements (Note 3)
Integrated Family of Test Equipment	21,264	21,264	N/A	**GREEN**	**GREEN**	**GREEN**	All systems funded by FY10 (Note 4)
Test, Measurement, & Diagnostic Equipment	N/A	N/A	N/A	**AMBER**	**AMBER**	**AMBER**	Only 25% force requirements met (Note 5)

Notes:
1. The C-17 is currently shown as GREEN. However, the program could be downgraded to AMBER if issues relating to Strategic Brigade Airdrop are not resolved prior to publication of the next modernization plan.
2. 19 large medium-speed Roll-On/Roll-Off ships (required and funded); 36 Roll-On/Roll-Off ships (31 funded); 8 fast Sealift (required and funded).
3. Breakdown of different munitions is shown in Figure L-7. Chart supports Fire Support and Combat Maneuver annexes. Training munitions are included in Training annex.
4. Consists of Base Test Shop Facility, SPORT, Electronic Repair Facility, Electro-Optical Test Facility. See Figure L-8.
5. Strategy focuses on commercially available technology.

Figure L-10

AIRLIFT

Airlift is one leg of the strategic deployment triad of airlift, pre-positioned equipment, and fast deployment ships. The C-17 aircraft, an Air Force program, is the primary capability enabler for airlift. The Mobility Requirements Study and the Mobility Requirements Study Bottom-Up Review Update determined that 120-140 C-17 aircraft were required for force projection. The C-17 is now operational in the Air Force and supported deployments in Operation Joint Endeavor. The C-17 is really three planes in one. It carries heavy cargo as if it were a C-5 (more efficient operation), lands on airfields like a C-130 (with four times the cargo), and is about the size of a C-141 (carries double the cargo). Plans are for procurement of 120 aircraft by 2003. The C-17 is an overmatch system because it provides unique capabilities to the Army. The C-17 can transport outsized/oversized equipment directly from the CONUS to anywhere in the world, access short runways, operate in austere environments with minimum materiel handling equipment, and conduct Strategic Brigade Airdrop (SBA) of paratroopers and equipment. DoD analysis indicates that the C-17 can operate in as many as four times as many airfields as the C-5. The C-17 meets the Army's requirement for a forced entry—Strategic Brigade Airdrop of soldiers and equipment to arrive as a cohesive fighting force. Near-term, mid-term, and far-term ratings are **GREEN**. Though the C-17 is currently shown as **GREEN**, the program could be downgraded to **AMBER** if issues relating to Strategic Brigade Airdrop are not resolved prior to publication of the next modernization plan.

SEALIFT CAPABILITY

The Army supports the Navy's programming for additional Roll-On/Roll-Off ships, or equivalent capacity, to meet the Mobility Requirements Study/Bottom-Up Review Update lift objectives of 36 Roll-On/Roll-Off ships in the Ready Reserve Fleet. The Army supports the acquisition of all 19 large, medium-speed Roll-On/Roll-Off Ships to meet its strategic sealift requirements. These assets are critical in the deployment of Army materiel. Historically, 90% of Army equipment and sustainment stocks are deployed by sea. At present, DoD is about 2.9 million square feet short of meeting the Mobility Requirements Study/Bottom-Up Review Update surge fleet requirements. When Avondale Shipyard delivers the nineteenth and final surge of large, medium-speed Roll-On/Roll-Off ships (FY01), and depending on Transportation Command's success in offsetting the 550,000 square feet Rapid Response Forces shortfall, DoD will be approximately 300,000 square feet short of meeting its end-state requirements. The near-term rating is **AMBER** until the large, medium-speed Roll-On/Roll-Off ships for pre-positioned equipment are procured and transloaded in late FY01. The mid- and far-term statuses are **GREEN,** provided the additional capacity is obtained.

AMMUNITION SUSTAINABILITY (WAR RESERVES)

The assessment for modern war reserve items is provided in Figure L-7.

War Reserve Modernization Items (POM FY99-03)

System/Ammunition Item	Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Tank						
• 120mm APFSDS-T (M829A2 & M829E3)	Yes	1999	AMBER	AMBER	AMBER	Procurement Complete
• 120mm MPA-T HEAT-MP-7(M830A1)	No	2015	GREEN	GREEN	GREEN	Procurement Complete
Bradley						
• 25mm APFSDS-T (M919)	Yes	2015	RED	AMBER	AMBER	
M119 Howitzer						
• 105mm Arty DPICM (M915/M916)	No	N/A	RED	RED	RED	Insufficient Quantities
• 105mm HERA (M913)	No	2015	GREEN	GREEN	GREEN	Procurement Complete
Artillery						
• 155mm SADARM	Yes	2015	RED	RED	AMBER	Extended Procurement
• 155mm Enhanced Range HE (M795)	No	2020	AMBER	AMBER	AMBER	Procurement Complete
120mm Mortar						
• 120mm Mortar Multi-Option (M934)	Yes	2020	AMBER	AMBER	AMBER	
• 120mm Mortar Smoke (M929)	No	2020	GREEN	GREEN	GREEN	Procurement Complete
• 120mm Mortar Illum (M930)	No	2020	GREEN	GREEN	GREEN	Procurement Complete
60mm Mortar						
• 60 mm Mortar Illum (M721)	No	2020	AMBER	AMBER	AMBER	Procurement Complete
Mines						
• WAM	Yes	2015	RED	RED	RED	Extended Procurement
• SLAM	No	2015	RED	AMBER	AMBER	Insufficient Quantities
• Volcano (M87)	No	2015	RED	RED	RED	Insufficient Quantities

Figure L-7

INTEGRATED FAMILY OF TEST EQUIPMENT

The Integrated Family of Test Equipment Program develops general-purpose, automatic test equipment to affordably diagnose and repair weapon systems at all levels of maintenance from organizational to depot. This program is one of two families of test equipment designated as Department of Defense (DoD) standard.

Efficiencies are realized by producing automatic testers which exploit commercial state-of-the-art and by upgrading them as commercial capabilities improve. More significant is the role of the integrated family of test equipment in the effort to retire aging and obsolete test equipment currently used by the Army in the field today. Specifically, the Land Combat Support System which supports TOW and Dragon, the Test Support System which supports Army aviation, and the electronic quality assurance test equipment which supports communications and electronics are all old technology (vintage 1960/1970) and increasingly unreliable. They are scheduled to be replaced by the integrated family of test equipment. Rehosting the workload from these system-specific testers onto the more modern and general-purpose testers will markedly improve readiness and will reduce the overall logistics footprint in the field.

The integrated family of test equipment is also critical to Army initiatives to modernize weapons system diagnostics through built-in test and embedded sensor technology. Development efforts are focused on smaller automatic testers which can be tailored to supplement a weapons system's ability to diagnose itself. In that way, test equipment can be procured economically in quantity and can be configured to meet the specific test needs of the weapons system instead of buying separate test equipment. As built-in diagnostics become more affordable and as testers continue to shrink in size, more and more maintenance will be performed directly on the weapons system by either the operator or the organizational mechanic. The goal of this program's modernization effort is to complement progress being made in onboard testing and to provide those test capabilities which cannot be affordably embedded within Army weapons system platform.

This program is rated **GREEN** for all terms. All systems are funded by FY10.

System	# System Required	# System Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Base Test Shop Facility	106	106		**GREEN**	**GREEN**	**GREEN**	Funded
SPORT	21,108	21,108		**GREEN**	**GREEN**	**GREEN**	Funded
Electronic Repair Facility	16	16		**GREEN**	**GREEN**	**GREEN**	Funded
Electro-Optical Test Facility	34	34		**GREEN**	**GREEN**	**GREEN**	Funded

Figure L-8

TEST MEASUREMENT AND DIAGNOSTIC EQUIPMENT

This program procures state-of-the-art, cost-effective, commercial off-the-shelf hardware required for support of Horizontal Technology Integration, digitization, and new weapons systems. Acquisition strategy focuses almost exclusively on commercially available technology. Approximately 2,500 makes and models of general-purpose test equipment items are being replaced with less than 75 non developmental items. Modernization requirements are identified and defined by the combat developer, and are generally traceable to new technologies, obsolescence, or sustainment costs of items currently in use. The current program includes, but is not limited to, network analyzers, ammeters, frequency counters, multimeters, oscilloscopes, pitot-static test sets, radio test sets, signal generators, spectrum analyzers, and voltmeters. This program is rated **AMBER** for all terms because only 50% of total force requirements will be met. Current antiquated and unsupportable test equipment and calibration standards in the field continue to impede effective maintenance programs. A near-term projected increase in funding will allow procurement of critically needed Identification Friend or Foe radar test sets, but only in minimal quantities to support contingency response forces. The key element of the test equipment modernization objective is standardization, or reduction of types and models of the test equipment, since sustainment costs tend to be amplified by make and model proliferation.

Essential Research and Development and Leap-Ahead Technologies

Essential research and development (R&D) programs are designed to provide future capabilities required for full spectrum dominance. They are those high-leverage or critical technologies that enable the Army's patterns of operation such as airdrop delivery. Programs are Precision Offset High-Glide Aerial Delivery of Munitions and Equipment, Logistics-Over-the-Shore, Silent Energy Source for Tactical Applications, 5kW Advanced Light Portable Power System and Rapid Deployment Food Service for Force Projection. Logistics-Over-the Shore and Advanced Lightweight Portable Power System provide critical capability of the right support at the right time to enable *Army Vision 2010* patterns of operation. Precision Offset High Glide Aerial Delivery of Munitions and Equipment, Silent Energy Source for Tactical Applications, and Rapid Deployment Food Service for Force Projection provide enhanced capability. Leap-ahead technologies are those that can provide a significant, almost revolutionary improvement over current capabilities. Priorities will be placed on common usages between services such as Logistics-Over-The-Shore. Explosive Ordnance Disposal is another technology essential to force protection.

Essential R&D for Logistics

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• Precision Offset High Glide Aerial Delivery of Munitions and Equipment • Logistics-Over-the-Shore (includes Rapidly Installed Breakwater Systems) • Silent Energy Source for Tactical Applications • 5kW Advanced Lightweight Portable Power Systems • Rapid Deployment Food Service for Force Projection • Science Research Ojectives	• Programs recommended by the ongoing Board on Army Science and Technology Study for reducing Logistics demand	• Compact Power SRO • Smart Structures SRO

Note: Further information may be obtained in the Army Science and Technology Master Plan, Chapter III.O (Logistics)

Figure L-9

Precision Offset High Glide Aerial Delivery of Munitions and Equipment

This program demonstrates revolutionary technologies for the reliable precision-guided delivery of combat-essential munitions/sensors and equipment using high glide wing technology and incorporating a low-cost, modular Global Positioning System (GPS) guidance and control system. High-glide technology will significantly enhance the military aerial delivery capability through substantially higher glide ratios than are possible with ram air parachutes and will directly benefit the initial deployment of early entry forces.

Logistics-Over-the-Shore

The two primary objectives of this effort are to demonstrate 1) a full-scale prototype version of the Rapidly Installed Breakwater System for application in Logistics-Over-the Shore (LOTS) and Joint Logistics-Over-the Shore (JLOTS) operations and 2) construction materials and techniques to provide roadway linkages to the inland infrastructure from LOTS/JLOTS sites. Present LOTS operations are limited to wave conditions in the mid-range of sea-state 2. Based on considerations of global wave climates, CINCs require that LOTS operations be able to continue through sea-state 3. There is also a significant need to minimize construction time and materiels in moving personnel and equipment from the beach to the inland transportation infrastructure.

Silent Energy Source for Tactical Applications

This program demonstrate silent, lightweight liquid fueled fuel cell power sources in the 50-150W range for various soldier applications. These power sources will offer lighter, more

energetic power sources than are currently available and would extend mission time, reduce weight and decrease the logistics burden associated with batteries.

5kW Advanced Lightweight Portable Power Systems

This program demonstrates an efficient, portable engine driven generator set operable with multiple fuels for tactically mobile use. The design shall be based on the integration of commercially available engines and state-of-the-art alternator and power electronic technologies. The goal is to enhance electrical generation, storage, and conditioning capabilities required to support TOCs, communications/weapons systems, and sensors of the 21st Century battlefield.

Rapid Deployment Food Service for Force Projection

By the end of FY98, this program will demonstrate integral power generation, advanced insulative materials, and non-low-powered regenerative refrigeration. By the end of FY99, it will fully integrate these technologies for the demonstration of a highly mobile, rapidly deployable, field feeding system that is more reliable (50% increase in Mean Time Between Failures (MTBF)) and more efficient (50% decrease in fuel), that can be operational in minutes instead of hours, and that expands the range of tactical situations in which hot meals can be prepared and delivered by 40%.

Science Research Objectives (SROs)

An ongoing study by the Board on Army Science and Technology is in the process of defining an investment strategy for technologies to reduce the logistics demand of systems for the Army After Next time frame. The Compact Power SRO will enable the fielding of lighter weight, higher power density systems. The Smart Structures SRO will enable the development of systems with enhanced reliability through the application of predictive maintenance methodologies and structural "health" measurement.

Leap-Ahead Assessment

Logistics—Leap-Ahead Program Assessment

System	# Systems Req	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Logistics-Over-the-Shore	See remarks	See remarks		RED	AMBER	GREEN	See Figure L-11 for breakdown of various systems (Note 1)
Aerial Delivery	N/A	N/A	N/A	RED	RED	RED	Inadequate funding for RDA and procurement (Note 2)
Explosive Ordnance Disposal	See remarks	See remarks		GREEN	AMBER	AMBER	Funds moved to FY99-03 (Note 3)

Notes:
1. **RED** rating for critical shortages of Roll-On/Roll-Off discharge facilities and other key systems. See Figure L-11. Funding has been reprogrammed to support the research, development and acquisition of key Joint Logistics-Over-the-Shore.
2. See Figure L-12 for breakdown of systems.
3. See Figure L-13 for breakdown of systems. Funds moved to FY99-03 for Remote Ordnance Neutralization System, Advanced Radiographic System, Remote Demolition Firing Device, and MK32 X-ray. Need a follow-on program for those systems.

Figure L-10

LOGISTICS-OVER-THE-SHORE

Logistics-Over-the-Shore operations ensure the Army can deploy "the last two miles" in the strategic sealift deployment process. These operations are conducted over unimproved shorelines, through restricted access ports, or at an improved port. Equipment required to conduct Logistics-Over-the-Shore operations include vessels to transport cargo from the strategic sealift ship to the beach, pier, or shore and other utility craft such as floating cranes, tugs, and Roll-On/Roll-Off discharge facilities. Watercraft units also provide movement services of equipment and supply via intercoastal and inland waterways. These capabilities are critical to successful completion of many DoD missions.

The Army Reserves provides 48% of the Army's watercraft. Army watercraft provide the foundation for theater opening and reception of Army and joint forces that are an integral part of Force XXI for projecting and sustaining combat power. Waterborne logistics delivers 90% of all unit equipment and supplies of U.S. forces. Army Reserves watercraft units must be able to deploy at any time to fulfill the objectives of the National Military Strategy and the Army Strategic Mobility Program which implements the recommendations of the DoD Mobility Requirements Study.

The Vice Chief of Staff of the Army and the Vice Chief of Naval Operations signed a memorandum of agreement in August 1996 that defined the protocol for the coordination between the two services in the development of Joint Logistics-Over-the-Shore capabilities. This memorandum led to the formation of a Joint Logistics-Over-the-Shore Master Plan that is the synthesis of critical interdependent enabling technologies to meet service and unified command Army and joint requirements. Significant progress has been made in this effort and funding has been reprogrammed to support the research, development, and acquisition of key programs. This includes development of the Joint Modular Lighterage System with the Navy that can operate in Sea State 3, with waves 3.5 to 5 feet high.

The Logistics-Over-the-Shore equipment currently funded from FY98 to FY03 includes three floating cranes, eight small tugs, three Logistics Support Vessels (LSVs), three containerized maintenance facilities, and causeway systems. The causeway systems include the floating causeway, causeway ferry, and Roll-On/Roll-Off discharge facilities systems. Three Roll-On/Roll-Off Discharge Facilities are programmed for procurement in FY99. This critical system enables vehicles to drive off the strategic sealift ships so they can be loaded aboard Army lighterage more quickly.

Logistics-Over-the-Shore will provide increased capabilities and efficiencies. For example, the Joint Modular Lighterage System is projected to have significantly lower operating and sustainment costs and will provide an operational improvement of over 50% at likely JLOTS locations.

The near-term capabilities are **AMBER** due to the critical shortages of Roll-On/Roll-Off discharge facilities and other key systems. The mid-term rating is **AMBER** due to shortages in causeway systems, however the far-term rating is **GREEN**.

Logistics-Over-the-Shore Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Roll-On/Roll-Off Discharge Facility (RRDF)	7	7	2019	RED	GREEN	GREEN	Begin procurement in FY99
Powered Causeway	17	4	2019	RED	AMBER	GREEN	2 systems in production
Floating Causeway	4	2	2019	RED	AMBER	GREEN	2 systems in production
Logistics Support Vessel (LSV)	9	9	1999	AMBER	GREEN	GREEN	
Landing Craft Utility (LCU)	47	47	2002	GREEN	GREEN	GREEN	13 LCU 1600 used ILO New procure in FY04
Landing Craft Mechanized (LCM-8)	51	65	1995	GREEN	GREEN	GREEN	Divesting excess LCMs
128 FT Tug	15	6	2012	GREEN	GREEN	GREEN	100 ft substitute for 9 each
Small Tug, 900 Class	12	12	2017	AMBER	GREEN	GREEN	Complete buy in FY99 4 65' Small Tug ILO
Floating Cranes	5	3	2017	AMBER	GREEN	GREEN	Procure 3 115 Ton by FY98 2 SLEP 89 Ton ILO
Lighter Amphibious Resupply Cargo 60	12	22	2005	GREEN	GREEN	GREEN	Divesting excess LARC

Figure L-11

AERIAL DELIVERY SYSTEMS

Advanced aerial delivery technology will permit rapid worldwide insertion of CONUS-based forces, allow for battlefield resupply, and furnish a low-cost aerial delivery capability for stability and support operations. Improved personnel parachutes and aerial delivery systems are required to increase our force projection capability and to sustain forces throughout the range of military operations. Precision-guided, high-offset cargo systems are required to accurately deliver warfighting and sustainment provisions as well as reduce aircraft vulnerability and the numbers of aircraft needed to conduct aerial delivery operations. Improved aerial delivery systems, including the 60,000 pound Low-Velocity Aerial Delivery System and the Enhanced Container Delivery System, can increase cargo capability to nearly double the current tonnage per aircraft, per pass, thereby maximizing aircraft capacity and reducing dispersion on the drop zone.

The assessment for near-, mid-, and far-terms is **AMBER** due to inadequate funds being available for research and development for all systems and for procurement of the Advanced Tactical Parachute System and the Enhanced Container Delivery System. Funding constraints delay research and development of the extracting parachute jettison device which enhances the safety of cargo aerial delivery operations until FY04. Research and development of the 500-foot Aerial Delivery System required for early entry forces for rapid insertion of essential warfighting equipment, and the family of advanced precision airborne delivery systems needed for precise delivery of resupply for early entry force sustainment, have been delayed indefinitely because of funding constraints.

The Advanced Tactical Parachute System will replace the current personnel parachute system and is scheduled to begin fielding in FY02.

Aerial Delivery Systems Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Advanced Tactical Parachute System	52,260	31,486		AMBER	AMBER	AMBER	Lacks procurement funds
Extraction Parachute Jettison Device	1,000	1,000		RED	AMBER	GREEN	Safety issue on all Air Force aircraft
Enhanced Container Delivery System	1,000	0		RED	RED	RED	Complements C-17 Dual Row Airdrop
500' Low-Velocity Aerial Delivery System	500	0		RED	RED	RED	Stock funded

Figure L-12

EXPLOSIVE ORDNANCE DISPOSAL

Explosive Ordnance Disposal has a unique and viable role in force protection and sustainment by eliminating hazards of unexploded ordnance and improvised explosive devices, such as pipe bombs, during military operations. Explosive Ordnance Disposal lacks remote capability to access and render safe the increasing array of sophisticated munitions with improved magnetic proximity, anti-disturbance, electronic fusing systems. This program develops and procures the specialized tools, protective clothing, and equipment required by Explosive Ordnance Disposal soldiers to perform dangerous, render safe, operations on unexploded ordnance. Proper equipment is essential for soldiers to work in joint, combined, coalition, and interagency operations to ensure maneuverability, survivability, and supportability on the battlefield. Present tools and equipment are based on pre-1970s technology, requiring manned emplacement and operation. Improvements are required in sensing, diagnosis, and remote or robotic neutralization of unexploded ordnance, particularly sophisticated electronic area denial munitions. Modernization items include the Remote Ordnance Neutralization System, remote electronic circuitry sensing device, remote listening device, Advanced Radiographic System, advanced imaging ordnance locator, advanced bomb suit, laser neutralization systems, small caliber dearmer and lightweight disposable disrupters. These systems will replace or augment antiquated items currently in the field.

The Remote Ordnance Neutralization System is a key system in clearing mines and does a better job of mine detection than current systems. The system is a modification of the existing Explosive Ordnance Disposal robotic vehicle that increases the range, speed, and manipulator capability; improves the camera and display; and extends the service life of the system. This increases safety by enabling the Explosive Ordnance Disposal soldier to perform more reconnaissance, access and render safe operations remotely.

The Advanced Radiographic System increases the capability of the existing MK 32 portable x-ray by providing digital images at an operator's remote location. This filmless system increases operator safety because it eliminates the requirement for the return to the unexploded

ordnance to retrieve and process film. Repeated and varying exposures can be made to obtain a satisfactory image in order to determine more efficiently the procedures to be employed and the placement of Explosive Ordnance Disposal tools. The system also enables image enhancement for rapid identification of internal components and image storage as standard-format computer graphic files. It reduces the operating costs and logistics burden of storing shelf-like item and disposing of waste materiel.

Even though the U.S. Navy, the DoD's single manager for this program, is developing or has developed these systems, the Army historically has not programmed sufficient funds to procure these items. Due to recent plus-ups, these programs are rated **GREEN** for the near-term and **AMBER** for mid- and far-terms.

Explosive Ordnance Disposal Systems Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Charge, Demolition: Shaped, Clipper	N/A	YES	2018	**GREEN**	**GREEN**	**GREEN**	Class V item
Lightweight Disposable Disrupter	N/A	YES		**RED**	**RED**	**RED**	Class V item
Remote Ordnance Neutralization System	58	58	2008	**GREEN**	**AMBER**	**RED**	Need follow-on program
Advanced Radiographic System	400	400	2008	**GREEN**	**AMBER**	**RED**	Funds moved to FY99-03
Remote Demolition Firing Device	115	115	2010	**GREEN**	**GREEN**	**RED**	Need follow-on program
MK32 Portable X-ray	73	73	2007	**GREEN**	**AMBER**	**RED**	Funds moved to FY99-03
Remote Electronic Circuitry Sensing	TBD	0		**RED**	**RED**	**RED**	6.2 program
Laser Neutralization	TBD	0		**RED**	**RED**	**RED**	6.2 program

Figure L-13

Recapitalization

The Army must devote resources to replace or refit existing systems to ensure that equipment is safe to operate, provides the soldier with reliable systems to go to war, and does not require excessive time and money to maintain. Recapitalization can be achieved through replacement, extended service programs, preplanned product improvements, depot rebuild, or technology insertion.

Logistics—Recapitalization Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
CSS Equipment	See remarks	See remarks	N/A	**AMBER**	**AMBER**	**AMBER**	Funding shortfalls for many systems. See Figure L-15 (Note 1)
Force Provider	36	36	N/A	**GREEN**	**GREEN**	**GREEN**	Improvements in supporting systems
Water Modernization	3,663	3,527	N/A	**AMBER**	**AMBER**	**AMBER**	Inadequate water production capability (Note 2)
Petroleum Distribution Equipment	763	420	N/A	**AMBER**	**AMBER**	**AMBER**	Funding shortfalls for many systems. See Figure H-13 (Note 3)
Maintenance Equipment	N/A	N/A	N/A	**AMBER**	**AMBER**	**RED**	Fielding to digitized and contingency corps (Note 4)
Materiel Handling Equipment	2,993	2,962	N/A	**AMBER**	**GREEN**	**GREEN**	Shortages and overage equipment in near-term (Note 5)

Notes:
1. Breakdown of various systems are in Figure L-15. Funding shortfalls have delayed R&D for Laundry Advanced System and shelter programs.
2. Breakdown of different water systems in Figure L-16. Water production and distribution equipment does not meet the total support and sustainment requirements.
3. Breakdown of different petroleum systems in Figure L-17.
4. Consists of Contact Maintenance Truck (digitized battlefield), Welding Shop (contingency corps) and Forward Repair System. See Figure L-18.
5. Consists of All-Terrain Lifter, Army System, Rough-Terrain Container Handler, and Rough-Terrain Container Crane. See Figure L-19.

Figure L-14

COMBAT SERVICE SUPPORT EQUIPMENT

The Combat Service Support Equipment Program is rated **AMBER** for near-, mid-, and far-terms. Combat service support equipment systems provide for the personal needs and sustainment of troops in the field and are essential to maintaining the soldier's morale and quality of life. Current programs include the Laundry Advanced System, the Containerized Self Service Laundry, Environmental Control Units, the Family of Field Latrines, the Army Field Feeding System-Future, and Shelter programs. Funding shortfalls have delayed the research and development of the Laundry Advanced System and shelter programs. Mid- and far-term funding is not sufficient to carry out planned field and food service equipment and shelter modernization programs.

Laundry

The Laundry Advanced System, now in development, is a water saving field laundering system that uses approximately 500 gallons of water per 20 hour day to launder 400 pounds of clothing per hour. The system consists of two 200-pound capacity laundry machines mounted on a dedicated M-871 trailer, hauled by a medium truck vehicle tractor and powered by a 30KW

tactical quiet generator. Each new system will replace four of the current M85 laundry units in Field Service Companies, resulting in an estimated Operating and Support (O&S) cost savings of $2500 per mission in water, waste disposal, and in the use of vehicles, generators, and personnel. The Laundry Advanced System is scheduled for technical and operational testing in FY98, with type classification in 1QFY99. Procurement is scheduled to begin in FY99.

The Containerized Self-Service Laundry consists of nondevelopmental, self-service type washing machines and clothes drying equipment that will allow soldiers in rear areas to wash their personal clothing items. The Containerized Self-Service Laundry Program is scheduled to be type-classified in 1QFY99. Procurement is scheduled to begin in FY99. This system will be stored in the Collective Support System Operational Project and be available to support CINC requirements.

Latrines

The Family of Latrines Program, under development, includes the modular initial deployment latrine, the maturing theater latrine, and the follow-on latrine. Latrines help the Army control waste management and improve soldiers' health and morale. The modular initial deployment latrine will be a portable system that can accompany deploying personnel into the theater of operations (D0 to D+30) and is programmed to be classified as a Common Table of Allowance item. The maturing theater latrine is a more stable, durable system that will be made available in the theater following initial deployment (D+30 to D+120) for use as the theater matures. The follow-on latrine will be the final latrine to reach the mature theater (D+120) for use in rear areas. The maturing theater latrine and the follow-on latrine are programmed to be stored in the Collective Support System Operational Project and be available to support CINC requirements. Latrines are scheduled for type classification in 2QFY99. O&S costs savings will be realized in latrine rentals and labor savings in the preparation of field latrines.

Feeding

The Army Field Feeding System-Future consists of a combination of new and currently fielded equipment which will provide the capability to prepare and distribute three hot meals including one A/B meal per day at the battalion level. It includes the Mobile Kitchen Trailer, Food Sanitation Center, and Kitchen Company Level Field Feeding-Enhanced (includes the High-Mobility Multipurpose Wheeled Vehicle and High-Mobility Trailer). Mobile Kitchen Trailers are currently fielded and will be replaced in some units by the Containerized Kitchen, now in development. New and improved equipment will have labor-saving devices, reducing O&S costs, as well as reducing the logistical burden by eliminating the need for gasoline and moving towards the goal of one fuel on the battlefield of the future. The Containerized Kitchen will double the current capacity of the Mobile Kitchen Trailer, allowing a two-for-one exchange and offering a more resource-efficient (fuel, manpower, time) field kitchen. Component systems of the Army Field Feeding System-Future are being procured to support FP 1 fieldings. The Containerized Kitchen is scheduled for type classification in 4QFY98 with procurement to begin in FY99.

Shelters

Shelters support the warfighter in all areas of the battlefield from manportable tentage for dismounted soldiers and vehicle crew tents, tentage for vehicle and aviation maintenance, to solar protection for ammunition and perishable supplies. Shelters provide protection from climatic extremes as well as battlefield threats, while minimizing weight and volume. The new shelters utilize modular technology which will save O&S costs through a reduction in the number of personnel required to maintain the systems, components required for each system and the national stock numbers that must be maintained. Current programs include the Lightweight Maintenance Enclosure, Modular General-Purpose Tent System, Aviation Maintenance Shelter, Ballistic Protection System, and Ammunition Solar Covers. All systems except the Aviation Maintenance Shelter are scheduled for type classification standard in FY98. The Aviation Maintenance Shelter is scheduled for type classification in FY00. Due to funding constraints, procurement of the Lightweight Maintenance Enclosure will be delayed indefinitely. The Modular General-Purpose Tent System, Ballistic Protection System, and Ammunition Solar Covers will be classified as Common Table of Allowance items, procured by the Defense Logistics Agency, and obtained by unit using Operations and Maintenance funds.

Rigid wall shelters provide high-quality workspace capable of sustaining, protecting, and transporting new and existing systems on the battlefield. Shelters provide a survivable and protected environment during chemical agent attack, provide protection against the effects of electromagnetic interference, and provide the mobility and transportability required for strategic and tactical deployments. A large number of battlefield systems depend on the capabilities of rigid wall shelters; such systems include command and control, medical, communications, maintenance, and field feeding. Currently all rigid wall shelters are customer-funded and procured periodically. Current development programs include cargo bed covers, which provide a family of low-cost, securable enclosures for vehicles and trailers.

Heaters/Environmental Control Units

The family of improved environmental control units, currently in research and development, will offer better reliability, maintainability, and efficiency than present fielded environmental control units, and will also use a non-ozone depleting refrigerant. These environmental control units are designed for the broad range of command and control intelligence electronic warfare tactical shelter applications, and are required for successful operation of sensitive mission critical equipment in adverse environments. Various sizes of air conditioners are currently in production but procurement is limited due to funding constraints.

Powered field heaters will be developed through a non-developmental effort which will provide 60,000-BTU and 400,000-BTU heaters for billeting and maintenance tents/shelters. These heaters will also be used by combat armor and aviation units for readiness and maintenance of equipment. These will be electronically powered multi-fuel heaters, and will be used to replace dangerous and over age gasoline heaters currently fielded. The 120,000-BTU Army space heater is currently in production but procurement is limited due to funding constraints.

The family of space heaters consists of four systems: Space Heater-Small, intended for use with the newly fielded Soldier Crew Tent; Space Heater-Arctic, for use in Alaska and other cold climates; Space Heater-Medium, for use in general-purpose and TEMPER Tents; and Space Heater-Connective, for use in the Modular Command Post System tent and other applications that require a clean environment and more accurate temperature control. These heaters operate cleanly, efficiently, and safely on JP8 and diesel fuels and need no external power sources. The Family of Space Heaters planned type-classification date is 3QFY98 for the Space Heater-Small and Space Heater-Arctic, with procurement scheduled for FY98. The Space Heater-Convective was type classified standard in 3QFY96 to support the Modular Command Post.

Improved Environmental Control Units combine the functions of air conditioning, heating, and dehumidification into one unit using more environmentally acceptable refrigerants in compliance with Environmental Protection Agency policies. The digitized battlefield demands these capabilities while worldwide restrictions demand our compliance in many of our expected missions.

CSS Systems Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Laundry Advanced System	293	293		AMBER	GREEN	GREEN	Saves over 2,000 manpower spaces
Containerized Self-Service Laundry	40	40		GREEN	GREEN	GREEN	Operational project stock
Modular Initial Deployment Latrine	TBD	N/A		GREEN	GREEN	GREEN	Stock funded
Maturing Theater Latrine	2,000	1,422		AMBER	GREEN	GREEN	Operational project stock
Follow-on Latrine	100	40		AMBER	GREEN	GREEN	Operational project stock
Containerized Kitchen	2,124	1,666		RED	AMBER	AMBER	Component of Army Field Feeding System—Future
Food Sanitation Center	5,098	2,708		RED	AMBER	AMBER	Component of Army Field Feeding System—Future
Lightweight Maintenance Enclosure	3000	0		RED	RED	RED	Replaces Fritsche tent
Aviation Maintenance Enclosure	88	0		RED	RED	RED	Operational project stock
Modular General-Purpose Tent System	TBD	N/A		GREEN	GREEN	GREEN	Stock funded
Ballistic Protective Shelter	TBD	N/A		GREEN	GREEN	GREEN	Stock funded
Ammunition Solar Cover	TBD	N/A		GREEN	GREEN	GREEN	Stock funded
Cargo Bed Cover	TBD	N/A		AMBER	GREEN	GREEN	Stock funded
Army Space Heater	4,980	3,396		AMBER	AMBER	AMBER	Replaces over age, dangerous Herman Nelson
Space Heater—Small	TBD	N/A		GREEN	GREEN	GREEN	Stock funded
Space Heater—Arctic	TBD	N/A		GREEN	GREEN	GREEN	Stock funded
Space Heater—Convective	TBD	N/A		GREEN	GREEN	GREEN	Stock funded
Force Provider	36	36		GREEN	GREEN	GREEN	Brief respite for soldiers from rigors of war

Figure L-15

FORCE PROVIDER

The Force Provider collective support system contains all materiel necessary to provide quality food, billeting, hygiene services, and morale, welfare, and recreation activities for 550 soldiers. Facilities such as well-lit, air-conditioned tents, kitchens, showers, and latrines are included. The primary mission is to provide the front-line soldier a brief respite from the rigors of the combat theater. Additionally, it provides an increased capability for humanitarian aid, disaster relief, theater reception, and reconstitution missions. Force Provider enhanced the Army's capability to rapidly and economically house units deployed to Bosnia. As an operational project stock, Force Provider will be stored in Army prepositioned stocks-3 or CONUS depots and is **GREEN** for all years.

Force Provider modules will be packaged and stored in shipping containers ready for operations and will provide support above organic capability. The total requirement is 36 modules to support the contingency force. Six modules are deployed to support Operation Joint Endeavor, six are stored in Army Preposition Stocks-3, three are positioned at Sierra Army Depot ready to support deployments, six are being assembled, and 15 are programmed for FY98-03. One-hundred percent of the 36 module requirement is funded throughout the POM.

Improvements have been made in the laundry and latrine subsystems. These improved subsystems will be incorporated into the production modules. As part of the production program, a winterization kit is to be assembled to expand Force Provider's deployment capabilities. The winterization kit will be purchased in sufficient quantities to support up to one-third of the total Force Provider capability. The kits will remain in operational project stock until required to support Force Provider modules deployed to climates with temperatures below +32°F. The winterization kit is available for production and provides capabilities to operate Force Provider at temperatures down to -15°F. Cold-weather kits are funded in the POM.

WATER MODERNIZATION PROGRAM

Assessment for the Army Water Modernization Program for near-, mid-, and far-terms is **AMBER**. Water production and distribution equipment does not meet the total support and sustainment requirements. The Army is the DoD executive agent for land-based water resources in support of contingency operations. To accomplish this mission effectively, improvements in water support and sustainment are required, for example, faster bulk distribution of water to unit trains and logistics transfer points, increased water storage assets, improved water packaging capabilities, and additional water purification capabilities.

Procurement for additional 3,000-gallons-per-hour Reverse Osmosis Water Purification Units is scheduled to begin in FY00. Only 71% of FP 1 requirements are satisfied by quantities currently available. This water unit provides corps units the capability to produce required quantities of potable water.

The 1,500-gallons-per-hour Reverse Osmosis Water Purification Unit is being developed to replace the 600-gallons-per-hour Reverse Osmosis Water Purification Unit on a one-for-two

basis, reducing equipment and operator requirements while enhancing water purification capabilities for division and brigade units. The 600-gallons-per-hour Reverse Osmosis Water Purification Units are reaching the end of their life expectancy, are expensive to maintain, and do not have the capability to operate in cold environments or with sources of high salinity. The 1,500-gallons-per-hour Reverse Osmosis Water Purification Unit, currently in research and development, will correct these deficiencies and is scheduled to begin production in FY00.

The Small Mobile Water Chiller is designed to chill water (normally stored in 400-gallon water tankers) from 120°F to 60°F. Personal water consumption requirements are a minimum of three gallons per day in arid environments. Cool water encourages consumption and minimizes heat exposure related casualties. Procurement of additional Small Mobile Water Chillers is scheduled to begin in FY99. The quantity currently available meets only 50% of contingency requirements.

The Lightweight Water Purifier is a lightweight, modular, portable water purification unit that will provide water purification capability to small units, medical assistance teams, Rangers, and Special Operations Forces during tactical movement and independent operations. Candidate systems are currently being evaluated that produce 75 to 125 gallons per hour from all raw water sources. Initial operational test and evaluation is scheduled for 4QFY98 with production scheduled to begin in FY00.

The Packaged Water System will provide the capability to package water in disposable one liter containers to refill canteens and is scheduled to be type classified standard in 2QFY99 with production beginning in FY00. The Packaged Water System will reduce the requirement to transport water into the theater.

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
3,000-gallons-per-hour Reverse Osmosis Water Purification Unit	435	376		**AMBER**	**AMBER**	**AMBER**	Insufficient quantity
1,500-gallons-per-hour Reverse Osmosis Water Purification Unit	200	200		**AMBER**	**GREEN**	**GREEN**	
Small Mobile Water Chiller	2,700	2,628		**AMBER**	**AMBER**	**GREEN**	
Lightweight Water Purifier	320	315		**AMBER**	**GREEN**	**GREEN**	
Packaged Water System	8	8		**GREEN**	**GREEN**	**GREEN**	

Figure L-16

PETROLEUM DISTRIBUTION EQUIPMENT

The Petroleum Distribution Equipment Program is rated **AMBER** for near-, mid-, and far-terms. This program provides the capability to perform battlefield sustainment operations, including receiving and transferring petroleum from trucks, ships, and permanent and temporary storage facilities; moving petroleum between storage to and within corps and division areas; quality surveillance testing; and dispensing in support of tactical operations, including rapid refueling of airfields. Systems to accomplish such operations include systems described below and a variety of test kits, fuel pumps and collapsible tanks. These systems support the Army's mission to supply fuel for all land-based forces, including the Marines and the Air Force.

The **Petroleum Quality Analysis System,** currently in research and development, allows units to use captured and locally procured fuels. The system is scheduled to be type classified standard in 4QFY98 and production is funded to begin in FY00. Funds are needed in FY02 and FY03 to eliminate a break in production of the Petroleum Quality Analysis System.

The **Advanced Aviation Forward Area Refueling System** replaced the current Forward Area Refueling Equipment on a one-for-two basis and will increase aircraft availability by reducing time and distance to fuel points. The Advanced Aviation Forward Area Refueling System is funded to begin production in FY99.

Inland Petroleum Distribution System components are funded through the Program Objective Memorandum and Extended Program. Assembly/containerization of this system is ongoing at the Sierra Army Depot. A 40% shortage for the Inland Petroleum Distribution System, plus a shortage of associated pumps and pipeline assembly equipment, critically impedes the capability for operations in Southwest Asia and Korea.

Petroleum Quality Surveillance Lab research and development is scheduled to start in FY98. This newer lab will replace the Semitrailer-Mounted Petroleum Lab and will incorporate Army Oil Analysis Program capability.

The **Rearming, Remote, Refueling, Deployable Distribution System** is currently in research and development with type classification standard scheduled for FY99. The R^3D^2S will provide the capability to refuel two OH-58 aircraft simultaneously from the external fuel tanks of a UH-60 **and when configured with two Hellfire racks or M-261 rocket pods will provide simultaneous rearming and refueling capabilities.**

The **Improved Tactical Fuel Distribution and Storage System**, currently in research and development, will incorporate improvements such as lightweight materiels, compatibility with future fuels and drybreak sexless couplings into future procurements of pumps, storage tanks, and hoses.

Petroleum Distribution Equipment Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Petroleum Quality Analysis System	18	6		AMBER	AMBER	AMBER	Limited capability fielded
Advanced Aviation Forward Area Refueling System	303	169		AMBER	AMBER	AMBER	
Inland Petroleum Distribution System (5-Mile Pipeline Sets)	267	157		AMBER	AMBER	AMBER	
Petroleum Quality Surveillance Lab	43	28		AMBER	AMBER	AMBER	
Remote, Rearming, Refueling, Deployable Distribution System	72	0		RED	RED	RED	Unfunded
Improved Tactical Fuel Distribution and Storage System	60	60		AMBER	GREEN	GREEN	

Figure L-17

MAINTENANCE EQUIPMENT

The **Contact Maintenance Truck** is a self-contained, multi-capable, highly mobile repair system that will allow mechanics and repairers to perform on-site organizational and direct support-level repair of wheeled vehicles and ground-support equipment. It consists of hand and power tools, welding and cutting equipment, an air compressor, and test, measurement, and diagnostic equipment mounted on a High-Mobility Multipurpose Wheeled Vehicle. The Contact Maintenance Truck is a one of the systems for the Army's first digitized division and corps. Initial production began in 1995, and almost 400 systems have been ordered and fielded to date. There will be a delay in production as the contract is recompeted. The fielding is expected to continue in late FY99.

The **Trailer-Mounted Welding Shop** is a 2½-ton, trailer-mounted, self-contained unit with provisions for accomplishing oxyacetylene, electric arc, metal inert gas, tungsten inert gas, and carbon arc welding for ferrous and nonferrous metals. This is a high-use, multi-application system that provides critical fix forward capabilities using modern welding technologies. The system will be provisioned to accomplish safely manual oxypropylene braze, straight-stick electric arc, metal inert gas, tungsten inert gas, air carbon arc cutting, and flux cored wire welding of ferrous and nonferrous metals. The acquisition objective is 1523; approximately 400 have been reported as on-hand. The fabrication of the reconfigured system will be finished by

mid-1998. Current program supports fielding to Force Package 1 and a limited number of Force Package 2 units.

The **Forward Repair System** is a self-contained, multi-capable heavy repair system consisting of hand-powered tools, test and diagnostic equipment, welding and cutting equipment, an air compressor in an enclosure, a 50kW generator set; and a 7.7 crane carried on an Palletized Loading System (PLS) vehicle chassis. This system's capability will greatly reduce total repair time. This system enhances the operational readiness and force effectiveness of the supported heavy units. Development and evaluation will determine if this repair workstation can be mounted on a flat rack that is off-loaded at a field site. The heavy repair workstation would be self-contained and independent from the chassis.

The Maintenance Equipment Program is **AMBER** for the near-term, **AMBER** for the mid-term, and **RED** for the far-term due to reduced procurement funds.

Maintenance Equipment Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Contact Maintenance Truck	400	400	N/A	**AMBER**	**GREEN**	**GREEN**	
Welding Shop	1,523	400	N/A	**AMBER**	**RED**	**RED**	Limited capability fielded
Forward Repair System	N/A	0	N/A	**RED**	**RED**	**RED**	Unfunded

Figure L-18

MATERIEL-HANDLING EQUIPMENT

The Army Materiel-Handling Equipment (MHE) Program is rated **AMBER** for the near-term due to shortages and the over-aged condition of the current fleet. Materiel-handling equipment modernization consists of three major systems described below. Procurement of new systems raises the rating for MHE to **GREEN** in the mid- and far-terms.

The **All-Terrain Lifter, Army System,** is a 10,000-pound-capacity forklift which replaces the current over age 6,000- and 10,000-pound forklifts on a one-for-one basis. This system's extendible boom provides an interface with aircraft cargo systems and provides a new container pallet stuffing and unstuffing capability. Procurement began in FY96 for a non-developmental item with subsequent buys scheduled through FY03 to support Contingency Force operations.

The **Rough Terrain Container Handler** is used in transportation units to transfer, lift, move, and stack 20- and 40-foot-long International Standardization Organization (ISO) containers weighing up to 50,000 pounds. This equipment provides essential container handling capabilities for Logistics-Over-the-Shore as well as aerial, rail and seaport operations. A FY96 procurement effort bought a limited number of Rough Terrain Container Handlers to equip two

companies, and subsequent buys are scheduled to begin in FY99. Future versions will be capable of lifting up to 55,000 pounds.

The **Rough Terrain Container Crane (RTCC)** is used to transfer 20- and 40-foot ISO containers weighing up to 67,000 pounds from one mode of transportation to another. The current shortage of RTCC is principally due to the conversion of units to, and activation of, the Improved Container Handling Companies, scheduled to begin in FY99. The RTCC is scheduled for procurement in FY99 with the current POM buying the remaining requirements.

Materiel-Handling Equipment Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
All-Terrain Lifter, Army System	1,988	1,988		GREEN	GREEN	GREEN	
Rough Terrain Container Handler	651	620		AMBER	GREEN	GREEN	
Rough Terrain Container Crane	354	354		GREEN	GREEN	GREEN	

Figure L-19

Infrastructure

Infrastructure is part of the other requirements not covered under investment components. Rail is the only system for logistics considered in this category.

Logistics Infrastructure Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Deployment Outload Rail Cars	1,405	1,405	N/A	AMBER	GREEN	GREEN	Buys majority of remaining 179 rail cars by FY00 requirement

Figure L-20

DEPLOYMENT OUTLOAD RAIL CARS

Rail cars are an integral part of the Army Strategic Mobility Program. Prepositioned rail cars at selected installations will enable key warfighting units to deploy quickly to selected ports. The prepositioned rail car requirement is 1,405. The Army began purchasing used rail cars in FY97 and has programmed to procure 168 of the remaining 179 requirement by FY00. The near-term rating is **GREEN**; however, minor shortages still exist. The mid- and far-term ratings are **GREEN**.

SECTION 3: CONCLUSION

Logistics is a critical component of the Army's modernization effort, especially as the National Military Strategy and *Joint Vision 2010*'s focus on full spectrum dominance places a new emphasis in the areas of peacekeeping, peace enforcement, humanitarian assistance, nation building, and disaster relief, as well as the continuing requirement to simultaneously support two major theater wars.

Much of the POM logistics investment is in modernization of the logistics infrastructure such as container/materiel-handling equipment, Logistics-Over-the-Shore systems, shelters, water/petroleum systems, power generation, maintenance systems, and railcars.

Continuing funding shortfalls in the POM, however, create significant risks for several programs as detailed in the body of this annex. The most critical shortcomings within the logistics arena and the areas where additional dollars are required, in priority order, are:

- Ammunition—Training and War Reserve
- Tactical Electrical Power
- Logistics-Over-the-Shore

Figure L-21 provides a summary of current POM issues.

The need for Roll-On/Roll-Off discharge facilities, rail cars, improved generators, materiel-handling equipment, and quality-of-life items remains a challenge in the upcoming POM. With the limited dollars available for defense, we are faced with doing more with less; therefore, we must ensure that we procure those items which best support the Army.

The Army still faces significant logistics capability shortfalls in the following areas: operating and sustainment cost reduction, the digitized battlefield, and enabling technologies. This risk and the need to provide solutions to the Army logistical shortfalls are recognized by Army leadership. The modernization of key sustainment enablers will support both operations and equipment. In the meantime, the Army will operate with a shortage of materiel in areas of Roll-On/Roll-Off discharge facilities, rail cars (bought by FY99), improved generators, materiel-handling equipment, and quality-of-life items.

The logistics modernization strategy ensures logistical systems will continue to provide sustainment across the range of military operations. To project and sustain the force in support of Army XXI and the Army After Next, the Army will need to fund these systems at an adequate level to overcome the realities of previous and projected reductions.

POM FY99-03

	DOES:	DOES *NOT:*
Info Dominance	Combat Service Support Control System—100% for FPs 1 & 2	Combat Service Support Control System—FPs 3&4
	Tactical Electrical Power—2kW-60kW—FPs 1, 2, & 45% FP3, 60kW-750kW-50% FP 1	Tactical Electrical Power—Wear-outs and Humanitarian
Overmatch	Ammunition—Minimal Training Ammo, Minimal Downsizing Ammo Plants and Closure Plans	Ammunition—Demilitarization
	Integrated Family of Test Equipment—100% Base Shop Test Facility, 97% SPORT Requirements	Integrated Family of Test Equipment—Delays Electro-optical Test Facilities
	Test Equipment—25% of Total Army	Test Equipment—75% of Total Army
Essential Research and Development and Leap-Ahead Technologies	Logistics-Over-the-Shore—2 Causeway Ferries, 2 Causeway Piers, 3 Floating Cranes, 8 Small Tugs, 3 Logistics Support Vehicles, and 3 Containerized Maintenance Facilities	Logistics-Over-the-Shore—Roll-On/Roll Off Discharge Facilities
	Airdrop Delivery Systems—RDT&E Wedge for Adv Tactical Parachute System, Enhanced Container Delivery Systems, Parachute Jettison System	Airdrop Delivery Systems—RDT&E for Adv Tactical Parachute System, Enhanced Container Delivery Systems, Parachute Jettison System
	Explosive Ordnance Disposal—Equipment Essential to EOD Units	Explosive Ordnance Disposal—New and Improved Equipment to Replace Antiquated Equipment
Recapitalization	Combat Service Support Equipment—Space Heaters, FP 1 & 2 Sanitation Ctrs, 90% FPs 1 & 2, Containerized Kitchen, 50% FP 1, Air Cond, 34% Req, Laundry 68% FP 3	Combat Service Support Equipment—Procurement for Remainder FP
	Force Provider—100% Requirement for Total Army	
	Petroleum Distribution—Fuel Sys Supply Point 55% FP 1	Petroleum Distribution—Remainder Fuel Sys Supply Pt, HEMTT Refuel Sys, Pol Qual Analysis, Tact Fuel Dist Sys
		Tactical Rigid Wall Shelters—RDT&E for All Programs
	Maintenance Equipment—Sets, Kits, Outfits, (Weld Shop, Steam Cleaners), FP 1, Contract Maintenance Truck 46% FP 1	Maintenance Equipment—Remainder of Sets, Kits, Contract Maint Truck, Forward Support System
	Materiel-Handling Equipment—Rough Terrain Container Handler, FPs 1, 2, 3, 65% FP 4, All-Terrain Lifter, FPs 1, 2, 3, 4	Materiel Handling Equipment—35% Rough Terrain Container Handler for FP 4
	Water Modernization—3K ROWPU, Small Mobile Water Chiller, Lightweight Water Purifier, Tactical Water Dist Sys—FPs 1, 2, 3, 4	Water Modernization—1,500-Gallon-Per-Hour Reverse Osmosis Water Purification Unit to Replace 600K
Infrastructure	Deployment Outload (Rail Cars)—100% for FP 1	Deployment Outload (Rail Cars)—500 Cars to Fill Req

Figure L-21

ANNEX M: COMBAT HEALTH SUPPORT

SECTION 1: INTRODUCTION

Overview

The Army Medical Department (AMEDD) modernization plan provides for an integrated, seamless Combat Health Support (CHS) system capable of rapid, worldwide deployment in support of military operations. This requires a CHS system that provides treatment, evacuation, hospitalization, and focused logistics support to the warfighter.

Army Vision 2010 is the blueprint for the Army's contributions to the enhanced operational concepts of *Joint Vision 2010*. This annex describes Combat Health Support's planned modernization efforts to achieve these required capabilities. It focuses on improving CHS capabilities and supports Force XXI by leveraging existing air and ground platforms and by adding digital capabilities and information management technologies to provide situational awareness on the battlefield. Modern platforms with linkages to the digital battlefield are core capabilities required to medically support the Army. Organizational changes recommended by the medical reengineering initiative provide the capability for split-based operations and complement these materiel modernization initiatives to successfully support the Army into the 21st Century. The AMEDD plan supports Sustain the Force, Information Dominance, and Protect the Force patterns of operation (Figure M-1).

Capabilities Contributing to *Army Vision 2010* Patterns of Operation

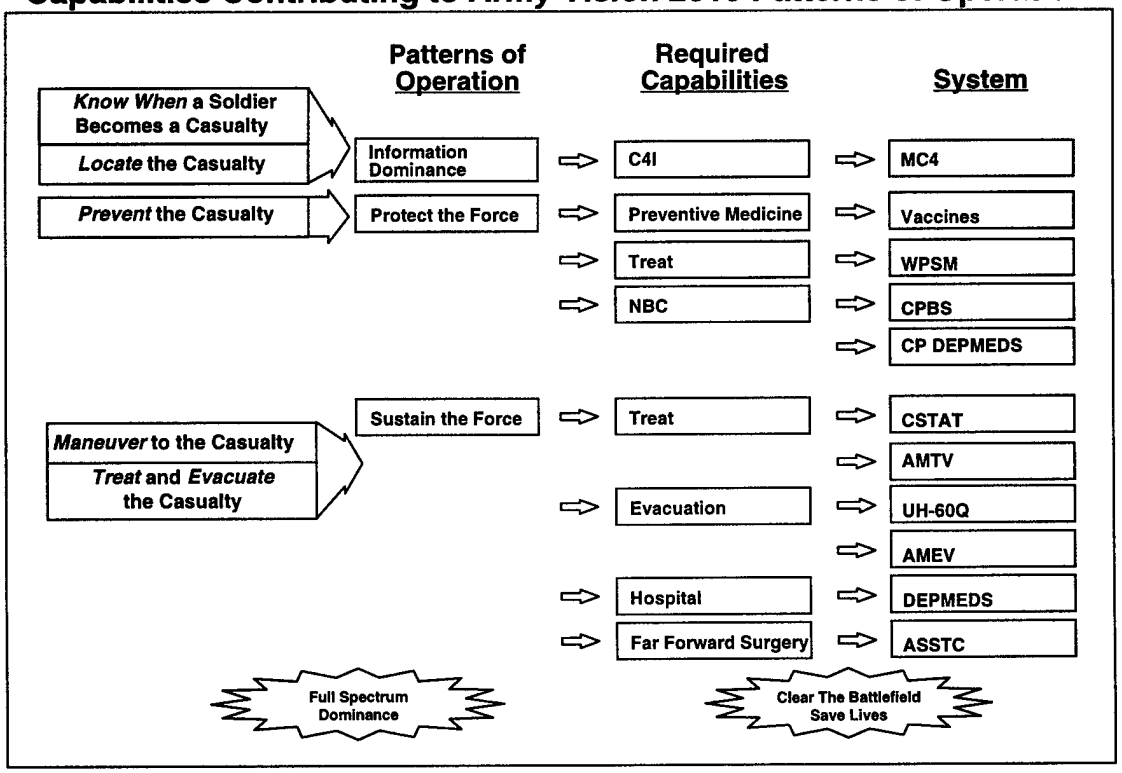


Figure M-1

SUSTAIN THE FORCE

Patient Evacuation

Army operations require a responsive air and ground medical evacuation system that functions efficiently across the entire spectrum of conflict. The evacuation system must:

- Provide continuous patient evacuation support, day and night
- Be able to operate under nuclear, biological, and chemical (NBC) contamination conditions
- Provide evacuation vehicles and aircraft able to communicate with supported and supporting units
- Share a common battlefield situational awareness with supported units
- Provide onboard advanced trauma management for patients en route

Key systems providing these capabilities are the UH-60Q and the Armored Medical Treatment Vehicle, both included under Contributing Capabilities. The Critical Care Support for Trauma and Transport (CSTAT) is discussed under Leap-Ahead Technologies.

Hospitalization

Combat Health Support sustainment requires the ability to provide full hospital care across the range of military operations, including NBC environments. Medical surveillance and health hazard assessment capabilities includes the full range of NBC threats, from peacetime regulatory exposure limits to high-intensity conflict. Hospital personnel must provide definitive care for return-to-duty or stabilizing care for evacuation out of theater. Within this area, required capabilities include:

- Telemedicine
- Inpatient care and outpatient care
- Consultant medical services (with digitized medical record capability)
- Rapid relocation and set-up of some medical/surgical modules

The Deployable Medical Systems (DEPMEDS) and Chemically and Biologically Protected Shelter (CBPS) are discussed in detail in Section 2 under Recapitalization. Chemically Protected DEPMEDS is discussed under Contributing Capabilities.

Patient Treatment

Soldier combat readiness and casualty determination requires timely transmission of the soldier's location and status to health providers. Reducing the Killed-in-Action (KIA) and Died of Wounds (DOW) rates requires battlefield medics to have information and communications systems that rapidly locate and identify casualties, improve triage, and apply improved treatment modalities. The capabilities for digital diagnostics and monitoring and digitized patient health records are required to ensure quality medical treatment at all echelons. The Warfighter Physiological Status Monitor (WPSM) is covered in Section 2 under Leap-Ahead Technologies.

Far Forward Surgery

The need to provide urgent resuscitative surgery for casualties requiring surgical stabilization prior to further evacuation increases as a result of the extended battlefield. Combat health support units must have the capability to perform medical support operations in all environments, including the full range of NBC threats, from peacetime regulatory exposure limits to high-intensity conflict. Materiel modernization initiatives are required for improved lightweight shelter systems that:

- Allow both tactical and strategic deployment
- Allow quick set-up
- Embed environmentally controlled conditions
- Allow provision of surgical support in a contaminated environment

Highly mobile Forward Surgical Teams (FSTs) provide care to 10-15% of casualties requiring surgical stabilization prior to further evacuation. This capability reduces KIA rates and the morbidity associated with critical wounds. Far-forward surgery requires lightweight shelter systems that allow for strategic deployability, quick set-up, and rapid response under biological/chemical environmental conditions. The FSTs also require future technology insertion, including Medical Communications for Combat Casualty Care (MC4) systems, to enhance casualty treatment. The Advanced Surgical Suite for Trauma Care (ASSTC), a high-payoff program in this area, is covered in detail in Section 2 under Leap-Ahead Technologies.

GAIN INFORMATION DOMINANCE

Command, Control, Communications, Computers, and Intelligence (C4I)

Medical command and control provides the communications, information, and automated systems required for battlefield situational awareness. In addition, the C4I capability provides:

- Telemedicine at all echelons
- Synchronized planning and execution for all medical functional areas
- A system for determining patient accountability
- The ability to track patient movement across echelons during evacuation or "return to duty"
- Manage patient regulation
- Coordination and assessment of theater class VIII (medical logistics) system status
- The required ability to access patient condition data

Comprehensive medical C4I requires integration with other Services and with allied, coalition partners, and host nation systems. The C4I system is discussed under Information Dominance in Section 2.

PROTECT THE FORCE

Preventive Medicine

The capability to assess the soldier's health continuously and improve soldier sustainability is required to protect the force. Through vaccines, chemoprophylaxes, and the prevention of combat stress; soldier protection from environmental, occupational and radiation exposures, and endemic, food, waterborne and other diseases is enhanced. The ability to rapidly deploy a modular, lightweight support package that provides comprehensive preventive medicine and laboratory diagnostic services is needed. In addition, the ability for a real-time disease and non-battle injury surveillance information reporting/archiving system which integrates tactically significant disease, environmental, and operational surveillance data for the warfighter would greatly enhance Combat Health Support. Vaccines are discussed in Section 2 under Leap-Ahead Technologies.

Modernization Driving Factors

The driving factors for the AMEDD modernization are linked to long-standing deficiencies in the capability to clear the battlefield of casualties. The capability to clear the battlefield of casualties is dependent upon first knowing when a soldier becomes a casualty, accurately locating that casualty, then being able to maneuver to the casualty at night and in all weather conditions, provide advanced trauma management on-site, and then rapidly evacuate the casualty while providing continued advanced trauma management en route. Linkage and integration with digital battlefield systems are critical to the information and situational awareness required to clear the battlefield. The well-documented capabilities shortfall in existing evacuation systems is exacerbated by the extended, non-linear battlefield.

In the near-term, the requirement is to provide modernized, enhanced capability systems through the integration of digital technologies into mature vehicle platforms. The UH-60Q and the Armored Medical Treatment Vehicle (AMTV) are the highest priority systems to address this shortfall. Continued sustainment and modernization of DEPMEDS equipment is required in the near-term, driven by equipment obsolescence and increased operations and maintenance costs.

In the mid-term, the factors driving AMEDD modernization are *Joint Vision 2010* and the Joint Health Service Support (JHSS) Vision 2010, and the need for a strategically deployable, tactically mobile, digitally capable Table of Equipment (TOE) hospital. Continued modernization of DEPMEDS' medical and non-medical equipment, and integrating digital information and communications systems into the TOE force also drive mid-term modernization efforts.

The factors driving far-term AMEDD modernization will be the results of ongoing research and development efforts in vaccine programs, and new technologies to enhance performance, cure disease, and care for trauma casualties (Figure M-2). Commercial advances will assist military medicine to maintain the standard of care in TOE evacuation and treatment systems. Advances in high-energy thermal, laser, and other weapons will produce casualties requiring intensive management and care. Digital diagnostics, artificial intelligence, and remote embedded sensor and feedback systems also drive the AMEDD equipment and software modernization program in the far-term.

Combat Health Support Modernization Driving Factors

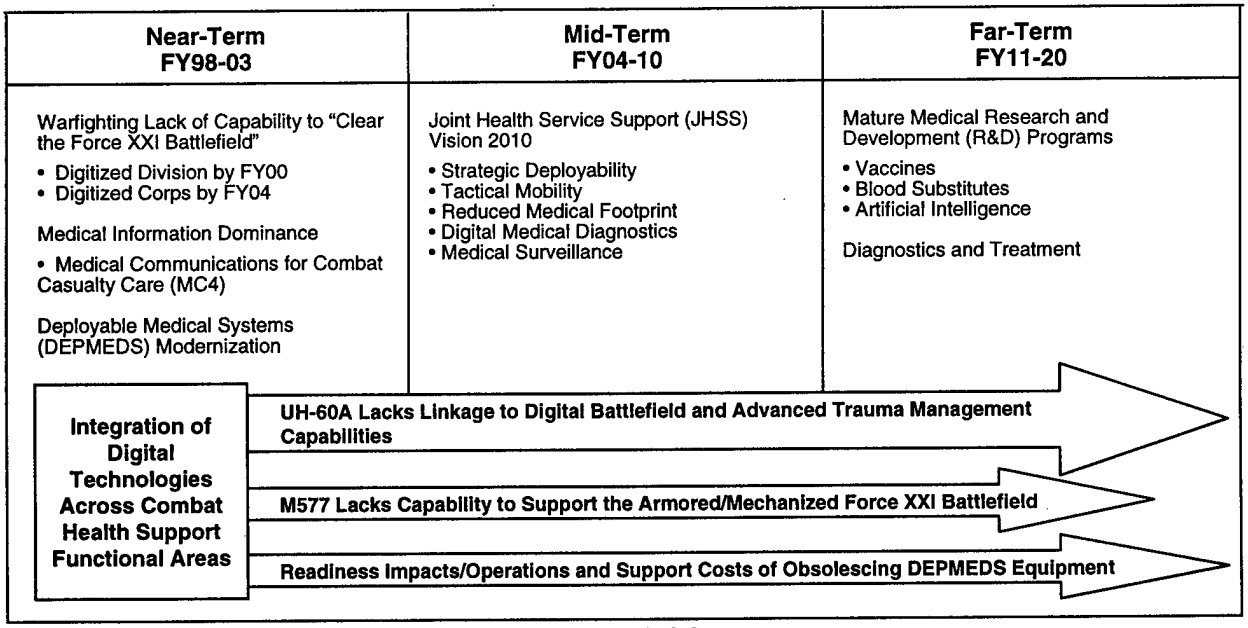


Figure M-2

Challenges Ahead

As knowledge and technology in medicine have improved during the 20th Century, the increasing specialization and sub-specialization of all types of health care providers have

characterized health care. Figure M-3 describes the most pressing challenges facing the Combat Health Support system. A medical treatment facility now requires an enormous range of these highly specialized health care providers to supply comprehensive care. Current Table of Organizational Equipment (TOE) hospitals are large. To have access to a full range of medical services, soldiers often have to be evacuated to these TOE hospitals or to medical centers outside the theater of operations. This ever-increasing specialization of health care providers and its impact upon medical treatment facility size is in conflict with the increased tempo and maneuver and the expanded battlespace of Force XXI. Force XXI will require smaller medical treatment facilities with greater mobility. Evacuation vehicle programs are critical to force sustainment. The medical support system requires the same battlefield situational awareness as the front-line commander so that medical support is available, at the right level, and at the right time. Preventive medicine through immunizations is a combat multiplier. Finally, medical systems must be deployable and capable of operating under all environmental conditions including in an NBC contaminated area.

Challenges Ahead

- Improve Evacuation to Reduce "Killed-In-Action" and "Died of Wounds" by Fielding UH-60Q and the AMTV
- Increase Situational Awareness to Significantly Enable Far-Forward Medical Care by Fielding MC4
- Provide Immunizations Against Endemic Diseases and Biological Agents Through Continued Vaccine Development
- Modernize Treatment Facilities to Decrease Weight and Cube and Enhance Diagnostic and Treatment Capabilities
- Enable Selected Treatment Facilities to Operate in NBC Environments with CBPS And CPDEPMEDS Fielding

Figure M-3

SECTION 2: CURRENT PROGRAM ASSESSMENT

The AMEDD evaluated its capabilities within each mission area and developed a modernization plan to address the specific shortfalls. Advanced technologies will include embedded training and simulation to allow rapid insertion into the force.

Overall Mission Area Modernization Assessment and Key System Ratings

The AMEDD has critical shortfalls in air and ground patient evacuation capabilities, information systems required to ensure scarce medical resources are effectively and efficiently employed on the battlefield, and casualty treatment. These systems represent the top AMEDD priorities to address major shortfalls in these capabilities. Figures M-4 through M-8 provide a rating of AMEDD systems. All quantities of systems required represent the Army acquisition objective.

INFORMATION DOMINANCE

Combat Health Support—
Information Dominance Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
MC4	348	12 *	2020	**AMBER**	**AMBER**	**AMBER**	Limited capability fielded

* Buys equipment sets of Medical Detachment Telemedicine (MDT), only part of MC4.

Figure M-4

Medical Communications for Combat Casualty Care (MC4)

The MC4 program is inclusive of current and future medical information systems and databases, communications systems, digitized medical diagnostic monitoring and patient treatment systems, and communications mounted on evacuation platforms. MC4 relies on the integration of existing and emerging digital communications and other advanced diagnostic and information technologies.

Deployment of the Medical Situational Awareness and Control (MSAC) system through the Combat Service Support Control System (CSSCS) will provide common battlefield situational awareness for commanders of medical organizations in real-time or near-real-time. The Personal Information Carrier (PIC) will digitize patient information from predeployment to deployment and continue throughout casualty management to ensure seamless medical treatment and documented medical care while in theater. Telemedicine will improve triage, enhance provision of advanced trauma management and resuscitative surgery, as well as aid in the prompt and accurate diagnoses of disease and injury.

A Milestone 0 is planned for early FY98 and refinement of requirement capabilities is ongoing. Since the acquisition strategy will predominantly center on commercial off-the-shelf (COTS) items and many component products can be initially fielded as stand-alones, a transition to Milestone 3 limited procurement is expected by FY99. The MC4 program is rated **AMBER** in the near-, mid-, and far-terms with limited capability fielded.

ESSENTIAL RESEARCH AND DEVELOPMENT AND LEAP-AHEAD TECHNOLOGIES

To achieve the Army's vision for Army After Next, successful development and transitioning of advanced technologies to systems will be essential. The most notable science and technology programs are summarized below. Details of CHS initiatives are contained in the Army Science and Technology Master Plan (ASTMP).

Essential R&D

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• Computer-Aided Diagnosis and Treatment • Multi-Agent Vaccines for Biological Threat Agents • Common Diagnostic Systems for Biological Threats and Endemic Infectious Diseases • Field Wake/Rest Discipline in Sustained and Continuous Operations	• Deployment Exposure Assessment System for Environmental Contaminant • Warfighter Readiness and Sustainability Assessment • Chemical Agent Prophylaxes • Minimizing Blood Loss and Optimizing Fluid Resuscitation	• Medical Countermeasures for Deployment Stressors • Multi-Agent Vaccines

Figure M-5

Near-Term (FY98-03)

Computer Aided Diagnosis and Treatment integrates all of the various individual soldier, medically-oriented advanced technology, and routes the data gathering, calculation, decisionmaking, and communications through the Soldier Individual Computer (SIC) common to all 21st Century Land Warriors.

Multi-Agent Vaccines for Biological Threat Agents research will identify vaccine candidates that will concurrently provide protective immune response against a range of biological threat agents.

Common Diagnostic Systems for Biological Threats and Endemic Infectious Diseases research will identify diagnostic assays and reagents that will provide rapid laboratory diagnoses for a broad array of biological threats and infectious diseases using common diagnostic technologies.

Field Wake/Rest Discipline in Sustained and Continuous Operations develops and demonstrates effective means for counteracting the effects of inadequate restorative sleep and rest on military performance.

Mid-Term (FY04-10)

Deployment Exposure Assessment for Environmental Containment seeks technologies focused to protect soldiers deploying into environments contaminated with industrial and agricultural wastes which pose either short-term threats to military performance or long-term threats to health.

Warfighter Readiness and Sustainability Assessment identifies a family of physiological sensors in order to gather useful data on soldier status and to guide the development of a wear-and-forget, soldier acceptable Warfighter Physiological Status Monitor (WPSM).

Chemical Agent Prophylaxes demonstrates the feasibility of a reactive/catalytic scavenger pretreatment effective against chemical agents that reduce chemical agent toxicity without operationally significant physiological or psychological side effects.

Minimizing Blood Loss and Optimizing Fluid Resuscitation provides products for management and control of hemorrhage. This program will define mechanisms of toxicity of blood substitutes and complete evaluation of status of commercial blood substitute development to define future research and development needs.

Far-Term (FY11-20)

Medical Countermeasures for Deployment Stressors and Multi-Agent Vaccines represent future research initiatives for the Army After Next. Emerging research addresses nutritional and physiological interventions to improve performance under stress and enhance endurance.

LEAP-AHEAD TECHNOLOGY ASSESSMENT

Combat Health Support—Leap-Ahead Technology Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Vaccines	R&D	0	N/A	**RED**	**RED**	**AMBER**	Not fully developed for production
WPSM	R&D	0	N/A	**RED**	**RED**	**RED**	Early dev 6.1/6.2
CSTAT	R&D	0	N/A	**RED**	**RED**	**RED**	Unfunded
ASSTC	R&D	0	N/A	**RED**	**RED**	**RED**	Early dev 6.1/6.2

Figure M-6

Vaccines

The purpose of vaccines is to build immune responses to protect soldiers from disease, significantly reducing disease and non-battlefield injury (DNBI) totals. The infectious disease research program focuses on endemic diseases that will be encountered during deployment to most foreign theaters. The leading threats are malaria, acute diarrhea, and insect-borne viruses. The biological and chemical programs counter threats listed as "weapons of mass destruction." Biotechnology breakthroughs will provide the capability to counteract multiple agents with one immunization.

The vaccine program is **RED** in the near- and mid-terms due to of a lack of vaccines ready for production, and **AMBER** in the far-term. Research and Development for vaccines should come to fruition in the far-term.

Warfighter Physiological Status Monitor (WPSM)

The initial fielding of the WPSM system will be a technology insertion into Force XXI Land Warrior. The WPSM consists of an ensemble of "wear and forget" physiological monitors that gauge individual soldier status. WPSM is modular in design and through different interface capabilities will enable use in armor, artillery, and aviation systems. It provides information on work/rest status and stress, detects and signals the occurrence of trauma, and supports far forward triage. The ability to rapidly assess soldier and unit status is a vital element of battlespace situational awareness. When combined with other digital battlefield capabilities such as geolocation and navigation, the "first response" time to the casualty will be significantly shortened. The program is rated **RED** due to no current capability fielded.

Critical Care Support Systems for Trauma and Transport (CSTAT)

This mobile critical care platform will dramatically increase the ability to render treatment within the first critical hours after injury, and will allow stabilization and resuscitation during transport. The CSTAT patient movement platform provides a self-contained suite of medical devices that provide continuous care for critically injured patients throughout extended evacuations. It will contain an oxygen blender, an air pressure compensated electronic ventilator, continuous or intermittent suction, a 3-channel IV infusion pump, an automated external defibrillator, vital signs monitor, blood chemistry analyzer, and patient isolation and environment control capabilities. All medical and system parameters are captured by an onboard data logging system which is displayed on a secondary display. This mobile critical care platform will allow stabilization and resuscitation during transport.

A U.S. patent on the CSTAT has been issued to the Army and is now available for licensing. The first functional prototype has been completed and is undergoing the MIL Standard testing required for airworthiness testing. A Milestone 0 and a draft Operational Requirements Document (ORD) have been completed. In addition, the Food and Drug Administration (FDA) has favorably reviewed the CSTAT design strategy which principally uses FDA-approved components. An initial analysis of alternatives (AOA) is ongoing. The CSTAT program is **RED**

through the far-term as it is unfunded, resulting in potentially sub-optimal care for critically injured/wounded soldiers during evacuation.

Advanced Surgical Suite for Trauma Care (ASSTC)

The ASSTC shelter platform, with its potential multi-modal transport, ease of operational establishment/dis-establishment, and self-sufficient nature, makes it a high-payoff project of the future. This newly established technology base research project utilizes advanced materials and new packaging techniques to develop a lightweight, expandable shelter capable of supporting far-forward surgical requirements and specific hospital functional areas.

An initial prototype was delivered in September 1997. The project has gained Joint Service interest with the U.S. Marine Corps providing initial requirements and test criteria. The Army will initially leverage test data from the U.S. Marine Corps to determine applicability, feasibility, and potential redesign of the ASSTC to meet Army requirements. It is too early in the process to determine procurement costs or timing, and as a result it is rated **RED**.

RECAPITALIZATION

Combat Health Support—Recapitalization Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
DEPMEDS	38	5	2000	**AMBER**	**AMBER**	**AMBER**	Requires continual modernization
Dental Services	N/A	N/A	N/A	**AMBER**	**AMBER**	**AMBER**	Rapidly obsolescing dental equipment
CBPS	770	116	2018	**AMBER**	**AMBER**	**GREEN**	Limited capability fielded

Figure M-7

Deployable Medical Systems (DEPMEDS)

This system forms the foundation of the AMEDD hospital force structure with over 30 medical modules directly supporting all functional areas such as the operating room, intensive care units, laboratory, x-ray, etc. This system was initially fielded in the late 1980s and has started to reach life expectancies of both medical and non-medical associated support items of equipment. Sustainment of modules and incremental modernization of individual equipment items are essential actions to maintain currency into the next decade.

Redesign work is ongoing to better focus efforts to the most critical functional areas within the hospital. Incremental modernization of FP 1 units is on line with procurement of new vital sign monitors, digital x-ray systems, and water distribution systems.

The deployment of functional hospital increments in lightweight shelter systems supports the requirements for task organization, incremental deployment, and split-based operations. Battlefield hospitalization overall is rated **AMBER** in the near-, mid-, and far-terms due to weight and volume impact on deployability and mobility, and the requirement to update and modernize DEPMEDS hospitals with improved diagnostic and information technologies.

Dental Services

The combat multiplier resulting from sustained and expedient dental care is fewer soldiers lost from units due to dental emergencies. Dental materials and instruments in current dental equipment sets do not meet today's standards of care, which include modern restorative, periodontic, and endodontic procedures. Dental capability is rated **AMBER** in the near-, mid-, and far-terms due to the composition of the dental equipment sets, the lack of appropriate Distribution Illumination System Electric (DISE), and the age of the dental operating system.

Chemically and Biologically Protected Shelter (CBPS)

CBPS provides the collective shelter to allow brigade medical company and trauma treatment teams to receive and treat critically injured patients within a chemically or biologically contaminated area on a highly mobile, wheeled vehicle platform. The CBPS is a highly mobile, self-contained, rapidly deployable shelter system which provides a contamination-free, environmentally controlled work area for forward medical treatment. This lightweight shelter is mounted onto the back of a heavy HMMWV and uses the truck engine for primary power with a towed, trailer mounted, 10kw Tactical Quiet Generator as an auxiliary power source.

The system has been in production since October 1997. Type classification is scheduled for May 1998 and first unit equipped (FUE) for September 1998. The CBPS is **AMBER** in the near- and mid-terms, and **GREEN** in the far-term given the fielding schedule for deployment of this critical capability to the force.

CONTRIBUTING CAPABILITIES

Combat Health Support—Contributing Capabilities Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
UH-60Q	357*	184	2018	**AMBER**	**AMBER**	**GREEN**	Number funded through FY13
AMTV	142	0	2020	**AMBER**	**AMBER**	**AMBER**	M577 limited capability
CP DEPMEDS	17	17	2020	**RED**	**RED**	**RED**	Lacks critical subcomponents for hardening
CH Logistics & Blood Management				**RED**	**RED**	**RED**	Lacks AWR stocks & potency & dated materiel sustainment
Preventive Medicine				**RED**	**RED**	**AMBER**	Increased DoD funding for R&D
Medical Lab Support				**AMBER**	**AMBER**	**AMBER**	Mod required at all levels to sustain currency
Veterinary Services				**AMBER**	**AMBER**	**AMBER**	Can't detect NBC-contaminated foods

* Does not include 30 UH-60Qs for Operational Readiness Float and Attrition.

Figure M-8

Patient Evacuation (Air)—UH-60Q Helicopter

The UH-60Q helicopter is an advanced, medically equipped version of the Army's UH-60 utility helicopter. The UH-60Q is designed to perform the mission of medical evacuation, search and rescue, dedicated rapid transport of medical personnel, equipment, and supplies, and ship-to-shore evacuation. The UH-60Q embodies significant technological updates over previous MEDEVAC aircraft, specifically in the realm of medical equipment (telemedicine capabilities, onboard oxygen and suction, integrated power/storage for Medical Equipment Sets, built in rescue hoist), navigational equipment (GPS, FLIR, TACAN), and communications equipment (data bus, HF radio, digital command and control capabilities). The Army's concept for the use of digital systems on the future battlefield makes insertion of digital equipment compatible with the supported force and the medical system essential. This aircraft will have improved situational awareness, survivability, and safety. Fielding of the UH-60Q will improve the deployability, flexibility, and supportability of MEDEVAC forces, and will yield a corresponding increase in quality of care to supported units (Figure M-9).

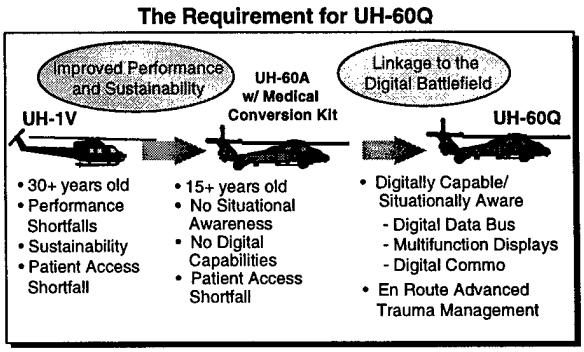


Figure M-9

The current aeromedical evacuation fleet of aircraft, UH-1V and UH-60As, are approaching 30 years of age. Requiring MEDEVAC units to continue operating without enhanced medical, navigational, and communications capabilities will result in a significant degradation of medical support to soldiers on the extended battlefield. Failure to convert to the UH-60Q will result in continued erosion of the evacuation fleet and its ability to keep pace with supported combat units.

The UH-60Q is currently in Phase II, Engineering and Manufacturing Development. An integration and qualification contract with Sikorsky was signed 9 February 1996. The first flight occurred on 9 May 1997. Developmental testing was completed in September 1997. The Operational Test will be conducted January through March 1998. A type classification In Progress review (IPR) is scheduled for June 1998.

The UH-60Q is **AMBER** in the near- and mid-terms due to limited capability, and **GREEN** in the far-term.

Patient Evacuation (Ground)

The current ground evacuation capability is rated **RED** because the current M113 and M577 armored medical evacuation and treatment vehicles have inadequate operational mobility and survivability. Ground evacuation units continue to use outdated ground ambulances that cannot keep pace with supported maneuver units. They do not have onboard medical treatment under the protection of armor. The result is significant degradation of ground evacuation support to units and unacceptable risk to soldiers.

Armored Medical Treatment Vehicle (AMTV). The AMTV provides an enhanced battalion aid station (trauma treatment teams) through installation of state-of-the-art medical equipment and MC4 link-up for specialty consultation on an improved armored vehicle that maintains full contact with its supported heavy division units.

The AMTV project uses the Army standard Bradley C2V/MLRS chassis with a distinctive medical equipment set to both modernize the current M577 based fleet as well as provide additional capabilities. The vehicle will have tactical mobility commensurate with its support forces; ballistic, chemical, and biological protection for patients and staff; connectivity with the battlefield digital CSS and medical MC4 nets; specialized medical equipment for treatment on the move; and transport capacity for at least four litter patients.

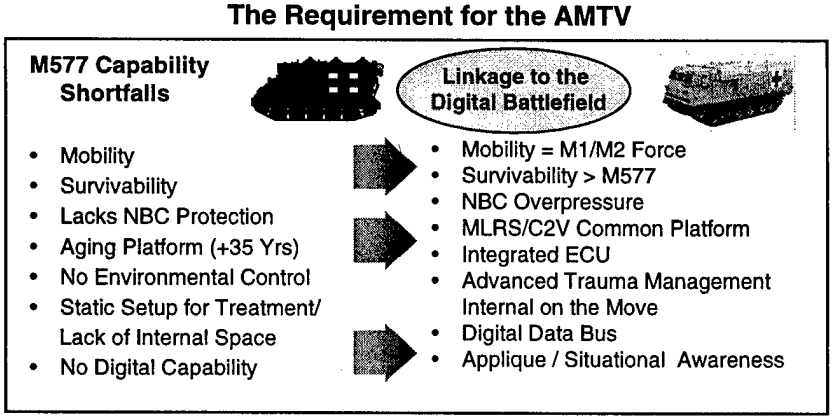


Figure M-10

Milestones I/II were recently completed and a Milestone III is tentatively scheduled for FY99. The prototype successfully participated in Task Force XXI and completed a Concept Exploration Plan test this past fiscal year. The AMTV program is rated **AMBER** in the near-, mid-, and far-terms due to limited capability in the current M577.

Chemically Protected (CPDEPMEDS)

This system integrates independently developed M28 liners, hardened environmental control unit (ECU) air conditioners, and modified ISO shelters into one system that provides a contamination-free operating area within the already existing DEPMEDS equipped Combat Support Hospitals. This system will be designed to support either the Medical Force 2000 (MF2K) configured Hospital Unit Base or the newly configured 84-bed module. CPDEPMEDS provides a "short sleeve shirt" environment in which medical personnel can operate effectively.

A final operational test was completed during July-August 1997 with expected type classification in FY98. Contract award for the liner is completed and the awards for ECUs is expected in FY98. ISO Shelter modifications will begin in FY98.

CPDEPMEDS is **RED** in the near-, mid-, and far-terms, with no collective protection capability because of the lack of critical sub-components required to complete hardening of 17 hospitals.

Combat Health Logistics System and Blood Management

The Combat Health Logistics System must manage, maintain, and coordinate distribution of critical medical equipment, supplies, and blood products and future blood substitutes in support of the Joint Service, single integrated medical logistics management mission of the AMEDD. The Combat Health Logistics System is rated **RED** in the near-, mid-, and far-terms due to insufficient resourcing for Class VIII Army War Reserve stocks and Potency and Dated (P&D) materiel sustainment. The Combat Health Logistics System also has unfunded requirements for fully integrated automated information technology and advanced cargo handling capability. The continued reliance on limited external transportation assets to support unit distribution and lack of Global Positioning System (GPS) equipment preclude efficient medical materiel distribution. The lack of total asset and in-transit visibility continues to hamper the ability of the Combat Health Logistics System to work in concert with the Army's focused logistics vision.

Preventive Medicine

The Preventive Medicine system directly impacts sustainment and protection of the force through the prevention of endemic disease or injury from environmental, occupational, and NBC warfare agent hazards and directed energy hazards. The Desert Storm experience attests to the need to conduct disease, hazardous agent, and environmental surveillance from the forward line of troops to CONUS, using state-of-the-art automation and communications systems to produce a tactically significant threat and risk exposure profile and database to support the warfighter. The

system contributes directly to the warfight by reducing the casualties suffered from disease and non-battlefield injuries.

Infectious Diseases/Environmental Injury/Occupational Hazards. This capability is rated **AMBER** in the near-, mid-, and far-terms due to the limited scope of automated programs, lack of equipment for disease and environmental hazard surveillance, and under-resourced programs for infectious disease prevention and treatment.

Biological/Chemical Agent Casualty Prevention. Biological Agent Casualty Prevention is rated **RED** in the near- and mid-terms because of the low rate of vaccine production, current vaccine inventory and stockage levels, immunization protocol time requirements, and the long delay between identification of the threat, development of a vaccine, and FDA approval. Far-term improvement to **AMBER** is expected with increased DoD emphasis and funding for research and development programs to counter the biological threat. Chemical Agent Casualty Prevention is rated **AMBER** in the near-, mid-, and far-terms due to a lack of effective prophylaxes for chemical agents. A continued baseline research program will maintain the far-term rating at **AMBER.**

Medical Laboratory Support

The overall projection and sustainment of medical laboratory support in the near-, mid-, and far-terms is rated **AMBER**. Laboratory modernization at all levels is necessary to support rapid diagnostic procedures and equipment in support of patient monitoring, surgical resuscitation, and trauma management of combat casualties. The theater-level area medical laboratory will focus on the assessment and in-theater field confirmation of health threats to deployed forces posed by endemic diseases, environmental and occupational hazards, radiological/nuclear hazards, and chemical and biological warfare agents, and will provide rapid diagnostic tests for identification and confirmation of biological and chemical warfare agents and toxins.

Veterinary Services

The Army Veterinary Corps is the DoD executive agent for all theater-level veterinary services and support. Veterinary services are required for procuring safe foods at origin; inspecting all military operational rations; inspecting of commercial food, water, and ice establishments; detecting of NBC contaminated foods; animal diseases of military significance; and maintaining the health and welfare of the military working dog pools of the Army, Navy, Marines, and Air Force. Veterinary capability is rated **AMBER** in the near-, mid-, and far-terms due to a lack of capability for detecting NBC contaminated foods.

SECTION 3: CONCLUSION

The AMEDD modernization plan redesigns the CHS system to support the Army After Next (AAN). The plan focuses on identified shortfalls in CHS capabilities and employs a balanced strategy of technology insertions, system retrofit, and COTS procurement. Figure M-11 summarizes AMEDD program resourcing under the FY99-03 Program Objective Memorandum (POM).

The AMEDD's top priority is to remedy the critical capability shortfall in patient evacuation.

POM FY99-03

	DOES:	DOES *NOT:*
UH-60Q	• Procure 27 aircraft. 20% of FP1 rqmt.	• Procure 117 needed for FP 1.
MC4	• Procure FP 1. Continued development of MSAC (Medical Situation Awareness Control).	• Procure Total Force rqmts (Medical Command, Control, and Communications).
AMTV		• Procure any vehicles.
CBPS	• Procure FP 1 in the Joint NBC Defense POM.	• Procure complete rqmts.
CPDEPMEDS	• Procure major ASIOE items (chemical protected hospitals).	• Procure secondary components.
DEPMEDS	• Provide for incremental modernization of FP 1 and FP 2 (deployable medical hospitals).	• Modernize Total Force. • Sustain module rebuild.
Vaccines	• Provide limited funds for product RDT&E.	• Fund all RDT&E. • Procure products to fight infections or chemical agents.
WPSM	• Fund hardware. • Fund RDT&E to leverage Land Warrior technology.	
ASSTC		• Continue RDT&E to MS III (shelter platform).
CSTAT		• Continue RDT&E to MS III (critical care platform).

Figure M-11

It is essential the AMEDD's top priorities be resourced in order to provide the capabilities required on the future battlefield. Other requirements, while partially funded in many cases, stretch the fielding of critically required capabilities to the total force beyond the introduction of a peer threat in 2010. Potentially U.S. soldiers could, for the first time ever, be committed to conflict without the most modern medical care and evacuation capabilities available.

ANNEX N: TRAINING

SECTION 1: INTRODUCTION

Overview

Training is a major component in achieving and maintaining forces trained, ready, and equipped to conduct full-spectrum operations. Good training retains quality people, brings doctrine to life, melds individuals into combat ready units, makes soldiers and units proficient on new equipment, and develops competent, confident leaders. The training goal has always been to execute tough, live, realistic field exercises to maintain combat readiness. However, decreasing resources, increasing weapons system range and lethality, increased deployments, and environmental constraints limit the Army's ability to train in a field environment. The Army is also evolving towards using smaller, dispersed units that must rely on precise communication and synchronization to accomplish their missions in digitized environments. Training requirements for new levels of capabilities include the broad force projection mission, the need for mission and planning rehearsal capabilities, and the digitization of future forces. Shrinking resources and digitization, point out a need to leverage the rapid growth in technology to improve training proficiency with the smart use of Training Aids, Devices, Simulators, and Simulations (TADSS) and automated command and control (C2) systems. In order to meet these challenges the Army is developing new training strategies and technologies that have a high potential payoff. Maximum training effectiveness is sought at the lowest cost. Training modernization is a critical component of the Army's modernization strategy to achieve full-spectrum dominance. *Army Vision 2010* is the blueprint for the Army's contributions to the enhanced operational concepts of *Joint Vision 2010*. This annex describes Training's planned modernization efforts to achieve these required capabilities.

Capabilities Contributing to *Army Vision 2010* Patterns of Operation

Effective training transforms people, equipment, and doctrine into a capable fighting force. Army training develops both mental and physical agility. Training, combined with superior information systems and equipment, ensures that soldiers are prepared to win on the complex battlefield of the future in all patterns of operation. A trained force allows the commander to seize the initiative and dominate maneuver on future battlefields, effectively using the systems, weapons and technologies that provide information dominance and overmatch capabilities. Mirroring the modernization effort of digitizing the battlefield, Army training initiatives are being developed to embed the complex structured training of the future into the digitized force.

Systems Providing Required Capabilities

Training Aids, Devices, Simulators, and Simulations (TADSS) enhance the training of soldiers at all levels. Training Aids are items that assist in the conduct of training and the process of learning. Training Devices are three-dimensional objects that are substitutes for actual

equipment and improve training. Training Simulators are devices that imitate or replicate all or most of a system's functions. Training Simulations are computer-driven wargaming systems that provide leaders effective training alternatives when maneuver and gunnery training opportunities are limited or restricted. They are a means to replicate the whole force structure through C4I systems and provide training for complex operations. The Army's goal is to fund, develop, and field TADSS as part of each weapon systems package or to embed training devices in the weapon systems themselves (**embedded training**). Use of TADSS will enhance and maintain individual, crew, and collective skill proficiency. From a modernization viewpoint, this objective is supported by the effective and efficient integration of training technologies and development within the three simulation environments: **live**, **virtual**, and **constructive**.

Live

Live simulation training is executed under battlefield conditions using tactical equipment. It includes individual and collective field training performed at training institutions, home station, Combat Training Centers (CTCs), live fire ranges, and while deployed in support of military operations. Live training emphasizes the fidelity of field training under battlefield conditions and standards and is supported by a toolbox of TADSS, instrumentation systems, targetry, and training unique ammunition. Aside from gunnery training, live maneuver training normally incorporates Tactical Engagement Systems (TES) to simulate combat conditions. TES training methodology is characterized by free interplay of forces, using a real-time casualty assessment system that reinforces training tasks through immediate feedback response to correct and incorrect individual and collective task accomplishment. Live training is the most resource intensive form of training and is used to reinforce skills previously trained during the crawl and walk stages of the crawl-walk-run training progression. While live training can never be totally replaced, the application of technology can provide simulations to enhance traditional field/range training and offset restrictions imposed on live training by high technology weapons systems, safety, environmental sensitivities, and higher training costs.

Capabilities required for modernizing the live simulation training environment for the near- and mid-term period are:

- Integration of new/upgraded systems, weapons, and Opposing Force (OPFOR) into the current collective training battlefield;
- Collection of C2 digital data to realistically simulate exchanges of digital information between higher/adjacent units and joint elements;
- Conduct of force-on-force and precision military operations in urban terrain;
- Optimization of individual/collective skills to synchronize and employ combined arms assets through realistic live fire training exercises.

Capabilities required for modernizing the live training environment for the far-term period are:

- Integration of new/upgraded systems and weapons into the future collective training battlefield;

- Dissemination of lessons learned through interactive systems and weapons into future collective training battlefields;
- Dissemination of lessons-learned through interactive systems to units at home station
- Tie-in of units undergoing a CTC rotation with higher headquarters, parent, and sister units training at home station;
- Instrumentation of training ranges for analyzing and providing feedback on exercises at home station.

Virtual

Virtual simulation training is executed using computer-generated battlefields in simulators that approximate the physical layout of tactical weapons systems and vehicles. In the virtual environment simulators take the place of terrain and weapons systems and can be linked together to expand the scope of the training event. Virtual training also has the advantage of allowing soldiers to perform tasks too dangerous for the live environment (such as calling for artillery fires on or near an occupied friendly position), as well as providing the capability for rapid changes to scenario and retraining specific tasks. Virtual training is relatively new, and current technology is both expensive (initial investment) and limited to individual, crew, and small unit training.

Capabilities required for modernizing the virtual training environment in the mid-term are:

- Repeated iterations of training and sustaining combined arms tasks unrestricted by ecological concerns, safety issues, and resources (e.g., budget, property/terrain, weather, etc.);
- Repeated iterations of conduct of mission rehearsal during deployment and while equipment is in deployment-ready status or in transit;
- Upgraded/enhanced After-Action Review (AAR) capability;
- Integration of training requirements into an aggregate virtual simulation environment.

Capabilities required for modernizing the virtual training environment in the far-term are:

- Affordable training in a combined arms environment (armor, infantry, artillery, aviation, low altitude air defense, and engineers) while economizing time by combining precision gunnery with maneuver training;
- Integration of follow-on systems training requirements into an aggregate virtual system environment that employs actual C4I systems.

Constructive

Constructive simulation training is the use of computer models and simulations to exercise the command and staff functions of units from platoon through joint task force. Constructive simulations permit multiple echelons of command and staff to execute their normal warfighting tasks in extensive exercises without the resource expenditure for using a large number of troops.

Each constructive simulation requires supporting resources in the form of personnel in response cells with appropriate workstations.

Capabilities required for modernizing the constructive training environment for the mid-term period are repeated iterations of realistic commander and staff C2 training in a Synthetic Environment (SE). The constructive and virtual simulations need to be linked seamlessly so that the interface is transparent to the user. Commanders from platoon through theater level will actively participate.

Capabilities required for modernizing the constructive training environment for the far-term period are:

- Linking of Command, Control, Communications, Computers, and Intelligence (C4I) for enhanced mission planning and rehearsal capability;
- Affordable conduct of realistic commander and staff C2 training in a combined arms or joint environment by embedding constructive simulations into combat systems;
- Dissemination of lessons learned through interactive media to units at home station;
- Forming of a synthetic environment (SE) where live, virtual, and constructive simulations are seamless and transparent to the training audience.

Total Army Distance Learning Program (TADLP): The TADLP addresses how the Army will integrate Distance Learning (DL) technologies to train the total force (Active, USAR, NG, and civilian) in a cost-effective manner and achieve Army XXI training goals. The plan specifically includes AC/RC courses identified for multimedia conversion, course conversion costs, schoolhouse infrastructure costs, DL transmit/receive costs, course length reductions, savings, funding required, and implementation strategy. The Total Army Distance Learning Program is in its beginning stages of implementation, and starting to make changes in Army training methods. The Army will have fielded over 183 classrooms by the end of FY98.

Figure N-1 provides a conceptual picture of future Army training evolution.

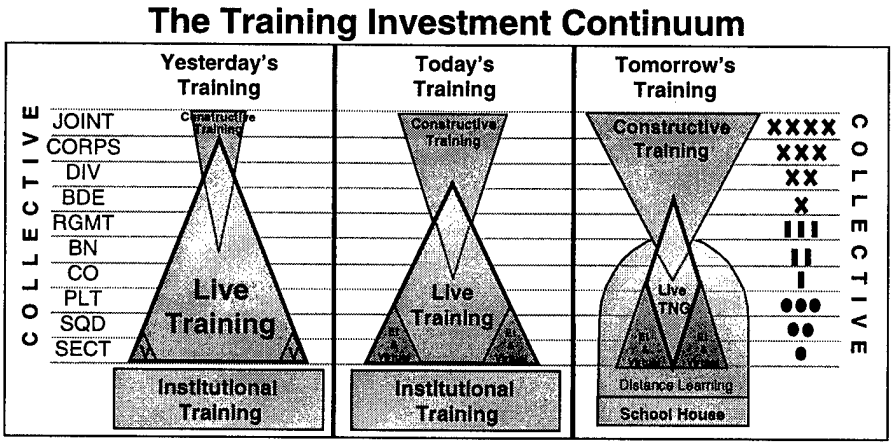


Figure N-1

Challenges Ahead

The Army continues to examine methods to improve training. Future training will use innovative technologies to improve readiness. The challenge is to train and sustain the most combat ready and deployable force in the world. The Army must research and develop initiatives to identify technology that may offset decreasing force structure and ensure the means of providing realistic, dynamic training to our soldiers—today and tomorrow.

Training Modernization Driving Factors

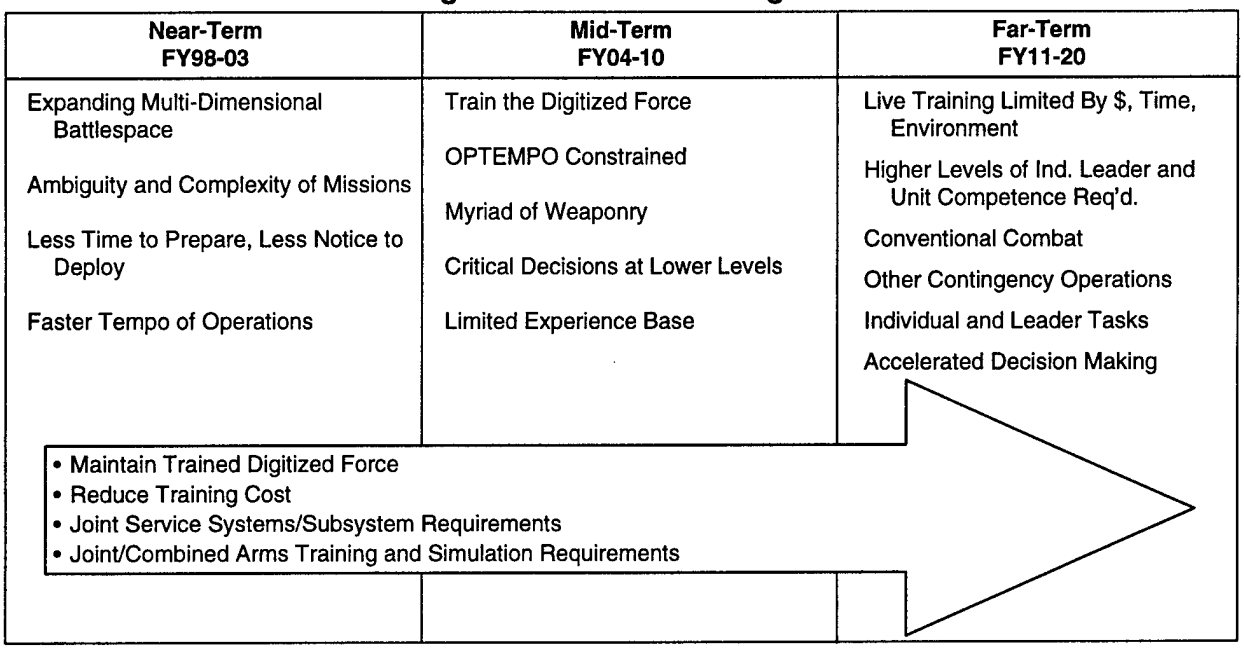


Figure N-2

While today's TADSS supplement live training, tomorrow's TADSS must provide the trainer with mission planning and rehearsal capabilities and options to train segments of the force to standard before entering into a crucial, and resource intensive or safety constrained training environment. The vision is to build this synthetic battlefield environment, integrate it with today's live training, and use automated training management tools to provide trainers with a flexible, mission essential task list (METL)-driven menu of structured exercises. The objective training system will feature a robust synthetic environment (SE) that integrates live, virtual, and constructive simulations. The SE allows commanders to simultaneously train all battlefield operating systems, in real-time and on the terrain of choice, under all operating conditions demanded of a force projection Army conducting military operations in a joint environment. Using Distributed Interactive Simulation (DIS) and DoD High-Level Architecture (HLA), geographically separate and split-based units will be able to train as a force package prior to deployment. The SE will also enable combat, materiel, and force developers, and analysts to test, evaluate, and refine new doctrine, weapons systems, and organizations in compressed time schedules.

The transition from a TADSS-supported, high OPTEMPO/live fire training program to a TADSS-based training program will use significantly lower levels of OPTEMPO/live fire. There will be a reduction in the requirements for ammunition, fuel, repair parts, etc. when using TADSS. Some measures of performance and effectiveness of training are easily determined for individuals, crews, and small units. These assessments occur during activities such as marksmanship and gunnery tests. However, determining the right amount and type of TADSS to train division, corps and JTF-level tasks is more difficult. The challenge will be to find the right balance of TADSS and live training to achieve and maintain full-spectrum dominance on the future battlefield. The Army must develop measures of training performance and effectiveness. It must also develop effective training support materials to keep pace with the changes in TADSS, advanced weapons, and digitized technologies of the future.

SECTION 2: CURRENT PROGRAM ASSESSMENT

Overall Mission Area Modernization Assessment and Key System Ratings

The overall rating of TADSS is **AMBER** due to shortages of TADSS across the Army. In some areas there is a lack of required TADSS improvements to achieve and maintain information dominance and overmatch capability in the future digitized battlefield. Some of the simulation systems do not have all the required capabilities. Fielded TADSS have been categorized as in the investment category as contributing capabilities.

Essential Research and Development and Leap-Ahead Technologies

Digitization of the force, increasingly diverse missions, and the integration of existing TADSS and emerging technologies present significant training challenges to the Army. To meet these challenges, the Army must design, in partnership with TADSS development, new training strategies and techniques that have a high potential payoff (i.e., maximum effectiveness at the lowest cost). The Army's training research program is striving to meet this need with much of the work focused on achieving maximum training effectiveness through TADSS (Figure N-3). A more complete description of the Army's training research program and Science and Technology Objectives (STO) is provided in the Army Science and Technology Master Plan.

Essential R&D — Training

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• Performance-based Metrics for the Digitized Battlefield (STO) • Combined Arms Training Strategy for Aviation • Force XXI Training Strategy (STO) • Joint Training Readiness (STO)	• Cognitive Engineering of the Digital Battlefield (STO)	• Mobile Wireless Communications (SRO) • Compact Power (SRO) • Enhanced Solider Performance (SRO)

Figure N-3

Given the nature of combat training and the shrinking resources available, simulated environments provide a means of realistic training across a wide spectrum of conflicts. This is especially true for aviation where realistic live combat training is extremely expensive and dangerous and for the Reserve Component (RC) where time constraints are severe. Reliable, valid training methods, technology assessments, and performance measures are needed to support the development of more effective, lower cost aviation and combined arms training for AC and RC soldiers and units. Examples of current R&D include:

NEAR TERM (FY98-03)

Performance-Based Metrics for the Digitized Battlefield (STO). This STO develops standardized, field-operational measurement scales for use by the Battle Labs, Army Digitization Office, and Army Research and Engineering Centers (RDECs) in defining and evaluating integrated soldier-information system performance on the digitized battlefield. The resulting metrics will provide both technology developers and field users with a common, standard framework for specifying performance requirements and assessing the contribution of digital information system technology across a variety of battlefield settings (e.g., brigade TOC staff, tank crew, individual dismounted soldier).

Combined Arms Training Strategy for Aviation (STO). This STO has as its purpose the determination through R&D of the most effective training strategies utilizing an affordable mix of existing TADSS and live exercises for initial flight skills through unit combat tasks. It will establish minimum fidelity requirements for utilization and upgrades to existing simulators and will deliver an experimentally validated prototype aviation training strategy for Initial Entry Rotary Wing training.

Force XXI Training Strategies (STO). This training research will incorporate the use of virtual, constructive, and live simulations to demonstrate and evaluate selected prototype training techniques. It will evaluate training and performance assessment tools developed for the digitized battlefield and develop and demonstrate new training and evaluation technologies that prepare operators and commanders to take maximum advantage of evolving digitized C3 systems.

Joint Training Readiness (STO). This STO develops and tests new training tools, techniques, and metrics for commanders and training developers to use in planning, managing, and executing operational exercises using distributed simulation for Inter-Service and Joint forces. It will also develop performance measures and training feedback systems for echelons from brigade through corps as a Joint Task Force (JTF). Demonstrations will be conducted in a Joint and Multi-Service Distributed Training Testbed (JMDT2) using analytic, quasi-experimental, and case study techniques.

MID-TERM (FY04-10)

Training must keep pace as the Force XXI Army and the Army After Next (AAN) evolve toward smaller, dispersed units that must rely on precise communication and synchronization for mission accomplishment. The increasing complexity of weapon systems and combat, including digitization, requires significant changes in how the Army trains. This requires an emphasis on R&D to ensure that the soldier gets the right training and mission rehearsal with essential performance measurement and feedback. Some issues that must be addressed include: (1) how to transition from training conventional skills to training digital skills, (2) determining the rate of decay of various digital skills and maintaining a balance between conventional and digital skills to accommodate potential system failure, (3) how to manage the increasing amount and speed of data and information that can enhance situational awareness, but can also increase "noise" and

cognitive overload, and (4) determining the best methods to train and assess performance in increasingly joint operations. The current R&D efforts include:

Cognitive Engineering of the Digital Battlefield (STO). Battle Command operations at brigade and above are increasingly being characterized by component capabilities that focus on the cognitive aspects of a distributed decision-making process. This STO effort focuses research at better understanding cognitive processes as they are shaped by time stress, team structure, level of staff training and experience, and the introduction of digitization technology. Through experimentation and constructive exercises, the STO develops a set of predictive models and performance metrics for assessing TOC design tradeoffs among information display and decision support technology, team structure, skill and experience level, and cognitive workload. Research findings will be used to refine battle staff training approaches that address a broad range of staff officer cognitive skills and functions.

FAR-TERM (FY11-20)

Strategic Research Objectives (SRO). The Mobile Wireless Communications SRO will facilitate the deployment of high bandwidth networks that will support the application of advanced distributed interactive simulation (DIS) for integrated force training. The Compact Power SRO will enable the fielding of lighter weight, higher power density sources for training, including embedded training. The emerging Enhanced Soldier Performance SRO includes the development and application of advanced training systems and strategies to increase combat readiness.

Contributing Capabilities Assessment

SIMULATION TADSS

Cost-effective, realistic computer generated battle simulations are designed to train leaders to optimize their abilities to conduct mission analysis, OPLAN development, and course-of-action development. This training improves the effectiveness of battle commanders and their staffs, with a focus on improving cognitive thinking and problem solving skills required by increased digitization, information overload, and new mission demands. This includes the diagnostic assessment of battle staffs in live, virtual, and constructive simulations. This training is useful for assessing, training, and maintaining the knowledge and skills commanders and their staffs require for successful command on the battlefield. The related intelligence TADSS provides scenario generation architecture and systems to train for battle staffs and MI personnel on C4I equipment and target information exploitation. Figure N-4 summarizes major simulation TADSS in the near-, mid-, and far-term.

Simulation TADDS System

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Corps Battle Simulation	10 Primary	10 Primary	2004	**GREEN**	**AMBER**	**N/A**	Baselined legacy system Replaced by WARSIM
Warfighters Simulation 2000	3 Regional Trng Sites 36 Battle Sim Ctrs	3 Regional Trng Sites 36 Battle Sim Ctrs	N/A	**AMBER**	**AMBER**	**GREEN**	
Warsim Intel Module	3 Regional Trng Sites 36 Battle Sim Ctrs	3 Regional Trng Sites 36 Battle Sim Ctrs	N/A	**AMBER**	**GREEN**	**GREEN**	
DIS	1	1	N/A	**AMBER**	**AMBER**	**AMBER**	Partially funded
STOW-A	1	1	N/A	**AMBER**	**AMBER**	**GREEN**	

Figure N-4

Corps Battle Simulation (CBS) Program. CBS supports training in the command and control skills needed to conduct operations for commanders and staffs at levels from brigade through theater. It also supports training for joint operations. It is funded at sustainment levels. WARSIM will replace CBS. CBS cannot continue to support large scale CPXs and maintain its compatibility with the ALSP confederation models. CBS has been baselined with no new funds programmed for enhancements. **AMBER**

Warfighters Simulation (WARSIM) 2000. WARSIM 2000 will support training for commanders and staffs at levels from battalion through theater. It will replace BBS, CBS, CSSTSS, and TACSIM. It will provide the land warfare functionality to the Joint Simulation System (JSIMS). JSIMS will provide the capability to train at the joint task force level. This program is funded. **GREEN**

WARSIM Intel Module (WIM). WIM is the intelligence driver for WARSIM 2000. It can replicate division through national intelligence collection sources. WIM supports training of corps and division command posts and their associated military intelligence (MI) staffs. WIM is fully funded. **GREEN**

DIS. DIS is a linked architecture within which humans may interact through simulation(s) and/or simulators at multiple networked sites using compliant architecture, modeling, protocols, standards, and databases. DIS provides for the interconnection of dissimilar simulations and simulators, interoperability in joint simulation, enhanced technology, digital terrain data, modular semi-automated forces, reconfigurable simulator technology, and credible environments suitable for any combination of live, constructive, and virtual simulations. DIS will also support analyses, tests/evaluations, and advanced concept experiments and new technologies to refine requirements for the Force XXI Army. It is partially funded. Funding shortfalls will have both quality and quantity impacts. Primarily it will prevent the four Core DIS facilities from pursuing engineering development for terrain database developments, simulator upgrades, and user enhancements. **AMBER**

STOW-A. STOW-A is an application of DIS technology. It serves as the infrastructure that will link any combination of selected computer-based constructive models and simulations, virtual simulators, emulators, and instrumented live maneuver activity to support training, exercise and military operations, advanced concepts requirements, and research, development and acquisition objectives using units, commanders and battle staffs. STOW-A will allow the Army to conduct worldwide, multi-echelon exercises in high-resolution virtual, constructive, or live environments without regard to local constraints such as limited maneuver area or diminished OPTEMPO funding. It will provide the capability to research, develop, test, and evaluate prototypical weapons, equipment, and organizations, and allow for the analysis of new doctrine, tactics, techniques, and procedures necessary for the evolution of Force XXI. The STOW-A program buys hardware, software, and the training development required to field a comprehensive and validated system able to support training and mission rehearsals, operational analysis, and experimentation within a core DIS interoperable network. STOW-A will augment (not replace) currently fielded and planned live, virtual, and constructive training simulation systems. Shortfalls in program funding have both quality and quantity impacts. The STOW-A program will proceed with system experimentation/design. This shortfall degrades Army capability to provide units a flexible simulation-based training system to support immediate and recurring training requirements. Training of geographically separated, specialized/tailored force packages via a common "battlefield" will not be realized. **AMBER**

CTC TADSS Programs

Figure N-5 depicts the CTC programs assessments.

CTC TADSS System

	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
JRTC Objective Instrumentation	1	1	N/A	**AMBER**	**AMBER**	**GREEN**	
JRTC Live Fire Objective	1	1	N/A	**AMBER**	**AMBER**	**AMBER**	Partially funded
JRTC Mout Force-On-Force	1	1	N/A	**GREEN**	**GREEN**	**GREEN**	
NTC Objective Instrumentation	1	1	N/A	**AMBER**	**AMBER**	**GREEN**	
NTC Live Fire Objective System	1	1	N/A	**AMBER**	**AMBER**	**GREEN**	
NTC ABCS Integration	1	1	N/A	**AMBER**	**AMBER**	**GREEN**	
OPFOR Surrogate Vehicle Replacement	236	236	N/A	**GREEN**	**GREEN**	**GREEN**	
OPFOR Aviation Replacement	TBD	0	N/A	**AMBER**	**AMBER**	**AMBER**	Unfunded until far-term
OPFOR Track Replacement	128	51	N/A	**AMBER**	**AMBER**	**AMBER**	Partially funded
OPFOR Wheel Replacement	166	0	N/A	**AMBER**	**AMBER**	**GREEN**	Unfunded until far-term
CMTC	1	1	N/A	**AMBER**	**AMBER**	**AMBER**	Partially funded

Figure N-5

The Combat Training Center (CTC) program is the centerpiece of the Army's collective training. It includes the National Training Center (NTC), the Joint Readiness Training Center (JRTC), the Combat Maneuver Training Center (CMTC), and the Battle Command Training Program (BCTP). The instrumented battlefields of the three CTCs inextricably support army training needs. NTC, CMTC, and JRTC integrate advanced technology, instrumented maneuver areas with observers/controllers, and a dedicated and highly skilled OPFOR to exercise units in realistic force-on-force engagements, Military Operations in Urban Terrain (MOUT), and live fire exercises. Modernized systems must be delivered with the components needed for them to be fully integrated into the CTC battlefield. The CTC battlefield provides the capability to record, assess, and replay the complex battlefield dynamics of exercises that can provide useful feedback for After Action Reviews (AAR).

Joint Readiness Training Center (JRTC) Program. JRTC is sponsored by Forces Command (FORSCOM). The training focus is on light battalion task force on a light brigade battlefield. The scope of training is low to mid-intensity combat including peace enforcement. Special Operations Forces and Air Force combat and airlift units are also trained. JRTC is located at Fort Polk, LA. TADSS for JRTC include:

- **JRTC Objective Instrumentation System.** It is a computer-controlled training system that provides a full data collection and objective feedback capability to units training at JRTC. The basic system is fully funded. Additional capabilities (integration of the Single Channel Ground/Airborne Radio System (SINCGARS) and Army Battle Command System (ABCS)) are not funded until FY07. **AMBER**

- **JRTC Live Fire Objective.** The system is designed to provide full instrumentation and integration of ground targetry in support of company and platoon level force-on-force exercises. Unfunded until the far-term. **AMBER**

- **JRTC Military Operations in Urbanized Terrain (MOUT) Force-on-Force.** Phase I is funded and provides stand-alone basic instrumentation capabilities to parts of the MOUT complex. Phase II is funded starting in FY98. It will provide individual soldier tracking and position location data, real-time data for After Action Reviews, advanced friend-foe targetry for force-on-force and live fire MOUT training, centralized scenario control, and visual observation throughout the entire MOUT complex. **GREEN**

National Training Center (NTC). NTC supports an armor/mechanized battalion task force on an armor/mechanized brigade battlefield. The scope of training includes mid- to high-intensity combat. NTC is located at Fort Irwin, CA. TADSS for NTC include:

- **NTC Objective Instrumentation System.** The NTC Objective Instrumentation System supports data collection and feedback capability to train a full brigade. Development is scheduled to start in FY98. Due to later funding, **AMBER.**

- **NTC Live Fire**. This system supports upgrade of the existing NTC Live Fire Instrumentation System and expansion of the system from two battalion task forces to three battalions (brigade operations). It includes a new command and control facility. Unfunded until the far-term. **AMBER**

- **NTC Army Battle Command System (ABCS) Integration**. Integration of the Army Battle Command System into CTC instrumentation systems. Development for NTC begins in FY98, with JRTC and CMTC scheduled for the far-term. Partially funded. **AMBER**.

OPFOR Surrogate Vehicle (OSV). System designed to replicate threat infantry fighting vehicles (primarily BMPs). NTC requirements are fully funded in the near-term. JRTC requirement is fully funded, but CMTC requirement is unfunded. **GREEN**

NTC (OPFOR) Aviation. Provide OPFOR aircraft to be used in force-on-force training at NTC. Unfunded until the far-term, **AMBER.**

OPFOR Track Vehicle. Provides functionally correct OPFOR main battle tanks and self-propelled (SP) howitzers, and SP Air Defense Artillery (ADA) vehicles at the CTCs. Main battle tank variant is funded; SP howitzer and SP ADA are unfunded. **AMBER**

NTC OPFOR Wheeled Vehicle. Provides visually modified reconnaissance vehicles, towed artillery decoys, antitank guided missiles, and rocket artillery devices for NTC. Not funded until the mid-term. **AMBER**

Combat Maneuver Training Center (CMTC). CMTC is sponsored by U.S. Army, Europe (USAREUR). Supports armor/mechanized battalion task force training on an armor/mechanized brigade battlefield. The scope of training covers low to high-intensity combat. Both conventional operations and regional response scenarios are replicated. CMTC is located at Hohenfels Major Training Area (MTA), Germany. It is the only U.S. training area in Europe capable of supporting battalion level maneuvers. Fully funded except for SINCGARS integration, ABCS integration, and Live Fire Instrumentation, which are not funded to start until the far-term. **AMBER**

Maneuver and Range Systems TADSS

Figure N-6 summarizes major TADSS in the near-, mid-, and far-terms for the Maneuver and Range TADSS.

Maneuver/Range TADSS Systems

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
CCTT	366	366	N/A	GREEN	GREEN	GREEN	
Abrams Tank TADSS	Multiple		N/A	GREEN	GREEN	GREEN	
Bradley TADSS	Multiple		N/A	AMBER	AMBER	AMBER	Partially funded
Javelin TADSS	Multiple		N/A	GREEN	GREEN	GREEN	
Miles Replacement	Multiple		N/A	GREEN	GREEN	GREEN	
TWGSS / PGS	1,191 / 1,147	1,191 / 1,147	N/A	GREEN	GREEN	GREEN	
EST	368	368	N/A	GREEN	GREEN	GREEN	
Home Station Instrumentation	16		N/A	AMBER	AMBER	AMBER	Unfunded until FY02
IEW Tactical Proficiency	Multiple		N/A	AMBER	AMBER	GREEN	
Rets / NGATS	Multiple		N/A	AMBER	AMBER	AMBER	
Training Ammo	Multiple		N/A	AMBER	AMBER	AMBER	Partially funded

Figure N-6

To achieve and maintain overmatch capabilities, TADSS are being used or developed for the whole spectrum of combat and combat support equipment. TADSS are used from individual to crew served weapons. Live, virtual, and constructive simulation environments are all used to achieve the right balance of training from individual to JTF level. An example of TADSS in this area is the Close Combat Tactical Trainer (CCTT). TADSS train and prepare soldiers for direct fire close combat by adding realism of force-on-force training while improving crew gunnery skills. Simulated environments can be tailored to provide realistic training for these missions. A major challenge in training is minimizing cost while maximizing effectiveness. This is especially true in aviation training where live training of aviators is extremely expensive. Reliable, valid training methods and technologies support the development of lower cost aviation training and combined arms training; to exploit virtual environments (VE) for individual and small unit training; and to develop efficient and effective training for RC soldiers and units. Training the Reserve Component (RC) is improved by using TADSS when time constraints are severe.

Close Combat Tactical Trainer (CCTT) (formerly CATT CORE). This TADSS is the core of the Synthetic Environment (SE) program, the future family of virtual simulators. CCTT uses various simulators, emulators, and semi-automated forces replicating combat vehicles, weapons systems, dismounted forces, combat support, combat service support, command and control, and opposing forces. It is networked to provide fully interactive unit task training on a computer-generated terrain. It will be fielded in mobile/transportable configuration (platoon level) for the National Guard and at fixed (company/team level) sites to support armor and mechanized infantry training for the Active Component. SE Core will be the common architecture and framework for aviation, air defense, fire support, and engineer simulations which follow-on virtual simulators will link into. It supports the armored/mechanized components of the Army. The replacement point of CCTT is dependent on development of the new main battle tank (2015). Fully funded. **GREEN**

Abrams Tank TADSS. System training devices for the M1A1 and M1A2 currently programmed include a wide range of TADSS. The Conduct of Fire Trainer (COFT) which supports the M1 and M1A1 tanks, and both the Institutional COFT (ICOFT) and the Mobile COFT (MCOFT) which are used by the Reserve Component (RC), provide precision gunnery training for commanders and gunners over a variety of combat situations using simulation. The Advanced Gunnery Training System (AGTS) is an enhanced COFT which provides a target acquisition, identification, and engagement capability using fire control and sighting equipment. The Crew Station Trainer provides an interactive training tool for the display panels (commander, gunner, and driver) in the M1A2 tank. A family of Maintenance Trainers provides training in the critical unit and in direct support/general support tasks required by the Abrams. System training devices for Abrams are funded in the near- and mid-term. **GREEN**

Bradley Fighting Vehicle TADSS. System training devices for the Bradley currently programmed include the AGTS, the COFT, and the Bradley Maintenance Trainers. These system training devices are partially funded and will result in some shortages in some locations. **AMBER**

Javelin TADSS. The Field Tactical Trainer (FTT), the Basic Skills Trainer (BST), and the Missile Simulation Round (MSR) are three programmed system training devices for the Javelin. They are currently fully funded through the far-term. **GREEN**

Multiple Integrated Laser Engagement Systems (MILES). MILES is a live simulation used to train individual and collective maneuver skills on the force-on-force battlefield. MILES 2000 will begin replacing MILES I in FY99-03. MILES 2000 provides real-time casualty effects necessary for a realistic force-on-force training scenario. Enhancements include: discrete player identification for all participants, enhanced audio-visual cueing effects, event recording and display, increased programmability of weapon characteristics, and increased ability to account for side, flank, corner, and rear shots. Fully funded. **GREEN**

Tank Weapons Gunnery Simulation System/Precision Gunnery System (TWGSS/PGS). These systems are vehicle-appended, two-way laser gunnery training systems used to simulate main gun and coaxial machine gun firing for M1-series tanks, and M2/M3 Bradley Fighting Vehicles (whose system also includes TOW). They provide a precision gunnery capability for home station training. Fully funded. **GREEN**

Engagement Skills Trainer (EST). EST provides instructors a resource to support marksmanship training at all skill levels for individuals, fire teams, and squads. It offers an opportunity to conduct and evaluate tactical training in a simulated environment. EST is adaptable to any weapon or shooting course, can support training with up to 13 weapons at the same time, and can simulate artillery Call-For-Fire procedures. Fully funded. **GREEN**

Home Station Instrumentation (HS-IS). HS-IS complements the Combat Training Center program by providing commanders instrumented capabilities to prepare, conduct, and assess live training in information warfare skills within the context of a SE. This gives the units at home station the opportunity to train with MILES and instrumented ranges. Partially funded.

Shortfalls preclude enhancing capability to develop and sustain collective training skill in garrison and tactical environments against credible threat capabilities. Training support tools to support analysis and feedback of training will not be provided. Impact is both on quantity of systems provided and quality of training that can be attained. **AMBER**

Intelligence/Electronic Warfare Tactical Proficiency Trainer (IEWTPT). IEWTPT will be embedded in or strapped on individual MI tactical collection systems. It will provide training from the operator/crew level through the corps Military Intelligence battle staff. Partially funded in the outyears. The MI community will have to continue to train without a fully capable collective trainer. **AMBER**

Remoted Target System (RETS)/New Generation Automated Targetry System (NGATS). RETS is a standard marksmanship and gunnery range targetry system, including target lifting mechanisms, target moving devices, controlling devices/computer system, simulators, and interfacing devices. NGATS is the future of Army ground targetry. Utilizing commercial-off-the-shelf technology, NGATS will provide a more reliable system at lower cost. Partially funded. **AMBER**

Training Ammunition. Training ammunition provides units the ability to meet the training standards outlined in DA Pamphlet 350-38, Standards in Weapons Training. The total training ammunition program includes funding for standard ammo used for training and training unique ammo. Tank ammunition is fully supported at 92% in the near-term, going to 83% in the mid- to far-terms. Training ammunition for Apache, Bradley, and MK-19 GMG is at 80-90%. Other training ammunition items are supported at approximately 80% and below. To offset training ammunition procurement shortfalls, the Army adopted a risk strategy of periodically drawing down selected war reserve items (those prestocked for use under wartime conditions). Replacement point is evaluated on an annual basis. The near-term is 95% funded. Out years are partially funded at 90%. Dependency on war reserve draw down will essentially end after FY04. **AMBER**

Aviation Systems TADSS

Figure N-7 summarizes major TADSS in the near-, mid-, and far-terms for the Aviation TADSS.

Aviation TADSS Systems

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
AH-64 Apache	10	10	N/A	**AMBER**	**GREEN**	**GREEN**	Fully funded
AH-64D Longbow Apache	TBD	TBD	N/A	**GREEN**	**GREEN**	**GREEN**	
Comanche RAH-66	TBD	TBD	N/A	**AMBER**	**AMBER**	**AMBER**	Partially funded
MILES AGES II			N/A	**AMBER**	**AMBER**	**AMBER**	Partially funded
ASET IV	8	8	N/A	**AMBER**	**GREEN**	**GREEN**	

Figure N-7

AH-64 Apache TADSS. There are a number of system training devices currently programmed for the AH-64. The Combat Mission Simulator utilizes visual systems, provides realistic weapons, combat skills, and flight emergency procedure training to both the pilot and co-pilot/gunner (CPG). The Tactical Engagement Simulation System (TESS) simulates weapons fire in force-on-force collective training. The Apache Crew Trainer (ACT) provides pilot and co-pilot/gunner training in normal flight and emergency conditions, and weapon systems skill training under all weather conditions. The Apache Crew Training System (ACTS) trains the AH-64A team in a combined arms environment. The Airframe and Engine Drive System Trainer enhances the removal and installation critical skills to maintain the AH-64A weapon system. The Armament/Electrical Trainer (AET-A7) provides a platform for developing the skills for the armament/electrical repairer. System training devices are partially funded in the mid-term only and not all the Apaches will have dedicated TADSS. **AMBER**

AH-64D Longbow Apache (LBA) TADSS. The currently programmed training devices include the Longbow Crew Trainer (LCT) which uses advanced computers, image generators, and visual display systems to provide Pilot and Copilot-Gunner procedural training in cockpit operations to include normal and emergency flight, sensors, Target Acquisition Designation Sight (TADS), and Fire Control Radar (FCR). LCT also provides support to weapons (including Semi-Active Laser (SAL) and Radar Frequency (RF) HELLFIRE missiles) employment as well as air crew and team training under simulated battlefield conditions in a combined arms environment. The Longbow Crew Trainer System (LCTS) provides team, unit, and staff training/mission rehearsal under simulated battlefield conditions using combined arms scenarios. TESS simulates all on-board weapons fire (line-of-sight (LOS) and non-line-of-sight (NLOS)) in live force-on-force collective training. The Longbow Airframe and Engine Drivetrain Systems Trainer (AEDST) trains the removal and installation critical skills to maintain the LBA weapon system. The Multiplex, Armament, Visionics, Weapons, Electrical Systems Trainer (MAVWEST) develops skills for the armament/electrical/avionics repairer. The LCT, LCTS, AEDST, and MAVWEST are integrated and use much of the actual aircraft software. The LCT and LCTS are DIS compliant and can network with synthetic environment systems. TESS is partially funded; other LBA devices are fully funded. **GREEN**

Comanche RAH-66 TADSS. The currently programmed RAH-66 training devices include the Cockpit Procedures Trainer (CPT) which trains individual aviators in normal operational and emergency procedures. The Cockpit/Sensor/Turret Gun (CSTG) Trainer trains the Comanche crew on airframe, cockpit, and gun turret operations. The Integrated Composite Maintenance Trainer is a full size, fully integrated replica of the Comanche that trains maintenance personnel on all aspects of the aircraft. Partially funded. **AMBER**

MILES Air-to-Ground Engagement System (AGES) II. The AGES II system is an addition to the MILES force-on-force training system, integrating the AH-64A, CH-47D, UH-60 HELLFIRE Ground Support System (HGSS), OH-58D, and a controller device. AGES II augments the MILES training capability by incorporating additional corps/division aviation assets into the training environment. The CH-47D, the UH-60, and the HGSS systems will be fielded both to units and to the CTCs. The AH-64A and OH-58Ds will be fielded to the CTCs only. Funding for the Combat Training Center's OH-58D requirement begins in FY02. Capability to integrate new/upgraded TA Capability to integrate new/upgraded systems training requirements into the Combat Training Center collective training battlefield will be degraded. Quality of training and training feedback for aviation forces will be negatively impacted. **AMBER**

Aircraft Survivability Equipment Trainer (ASET) IV. ASET IV is a group of ground-based emitters that replicate a threat air defense battery. These emitters simulate infrared and radar frequency defense systems. ASET IV tests the pilot's ability to employ aircraft survivability equipment and tactics to survive. It has been integrated into the OPFOR at the Combat Training Centers. Fully funded. **GREEN**

Fire Support Systems TADSS

Figure N-8 summarizes major TADSS in the near-, mid-, and far-terms for the Fire Support TADSS.

Fire Support TADSS Systems

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
FSCATT	1,290	1,290	N/A	GREEN	GREEN	GREEN	
SAWE-RF	24,170	24,170	N/A	AMBER	GREEN	GREEN	Partially funded
GUARDFIST II	337	194	N/A	AMBER	AMBER	AMBER	Partially funded

Figure N-8

Fire Support Combined Arms Tactical Trainer I (FSCATT I). FSCATT I trains and assesses the entire field artillery team, from forward observer to gun crew, on required tasks. FSCATT I consists of a target acquisition subsystem, a fire direction subsystem, and a weapons delivery subsystem. The subsystems have three operational modes: stand-alone, interactive, and closed-loop. GUARDFIST II links with FSCATT I as the primary target acquisition subsystem. FSCATT I is funded through the far-term. **GREEN.** Funding shortfalls in GUARDFIST II will

decrease the number of systems provided to the force, and degrade unit capability to train in a closed loop, interactive fashion, and may increase recurring OPTEMPO costs. Shortfall in systems will also impact training with other Combined Arms Tactical Trainer (CATT) systems.

Simulation of Area Weapons Effects-Radio Frequency (SAWE-RF). SAWE-RF accurately simulates in real-time the effects of direct and indirect fire and surface area weapons. It ties in with MILES II and will only be fielded at the CTCs. Funding for SAWE-RF lightweight personnel detection device begins in FY02 for replacement of MAN-WORN devices at the CTCs. Partially funded. Program funding will satisfy only 2/3 of vehicle kit requirements, and does not address integration of new battlefield systems. Funding does not completely address Light Weight Personnel Detection Device requirements in FY02. Rotational units at the combat training centers will not be able to exercise the complete combined arms team, with a corresponding shortfall in training realism and feedback. **AMBER**

Guard Unit Armory Device Full Crew Interactive Simulation Trainer II Field Artillery (GUARDFIST II). GUARDFIST II trains Active Component (AC) and RC forward observers in call for fire techniques, target acquisition, and identification. It uses computer-generated graphics and an audio system to simulate the sights and sounds of the battlefield. It also provides a record of student performance for After Action Reviews (AARs). It supports both the AC and RC. There are two versions (based on instructor to student ratio): the one-to-one trainer and the one-to-thirty trainer. GUARDFIST II replaces the Training Set Fire Observation (TSFO). It is unfunded in the near-term. Guardfist II near-term funding will impact the quantity of systems provided to the force. Training will be negatively impacted for units unable to replace obsolete Training Set Fire Observation (TSFO) systems. **AMBER**

Air Defense Systems TADSS

Figure N-9 summarizes major TADSS in the near-, mid-, and far-terms for the Air Defense.

Air Defense TADSS Systems

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
Avenger	TBD	TBD	N/A	**AMBER**	**AMBER**	**AMBER**	Partially funded
Stinger	TBD	TBD	N/A	**AMBER**	**AMBER**	**AMBER**	Partially funded
Patriot	TBD	TBD	N/A	**AMBER**	**AMBER**	**AMBER**	Partially funded
Bradley Linebacker	TBD	TBD	N/A	**AMBER**	**AMBER**	**AMBER**	Partially funded

Figure N-9

Avenger TADSS. The Force-on-Force Trainer (FOFT) provides tactical simulation of missile and gun firings, weapons effect signature simulation, and is integrated with a real-time casualty assessment capability. The Troop Proficiency Trainer (TPT) provides real-time, free play, and interactive simulation of stationary and remote operations. Institutional Conduct of Fire Trainer (COFT) provides full training of operator engagement tasks through the use of

computer-generated battlefield scenarios. Avenger lacks funding for key platform improvements including slew-to-cue, Improved Forward Looking Infrared (FLIR), and digitized Avenger Control Electronics (ACE). The system is partially funded. **AMBER**

Stinger TADSS. Stinger is the infrared missile system for Avenger, Bradley Linebacker, Manportable Air Defense System (MANPADS), and air-to-air missiles. The manportable FOFT provides tactical simulation of missile firing and weapons effect signature simulation integrated with a real-time casualty assessment. The TPT is used at unit level to train and sustain crewmember engagement skills. The ICOFT provides full training of operator engagement tasks through the use of computer-generated battlefield scenarios. System TADSS are currently fielded, but future upgrades are unfunded. There is a funding shortfall for Block II TADSS development in FY98-99. Until the Block II TADSS is funded, training will have to be live or outdated Block I TADSS will have to be used. **AMBER**

Patriot TADSS. The TPT is a software program, which allows Patriot operator training in the field. The Patriot Conduct of Fire Trainer Post Deployment Build IV Upgrade (PCOFT PDB IV) is a computer-driven battlefield system, which allows one instructor to assist eight students on operation of the tactical system operator consoles. The Patriot Organizational Maintenance Trainer Post Deployment Build IV Upgrade (POMT PDB IV) provides a realistic trainer for Patriot missile maintenance personnel. The Patriot Intermediate Maintenance Training Device (PIMIT) simulates realistic system faults, which require the application of maintenance concepts, tools, and techniques. Partially funded through the far-term. This will result in a shortage of fully equipped trainers. **AMBER**

Bradley Linebacker TADSS. The Conduct of Fire Trainer Upgrade, a gunnery trainer for the Bradley Linebacker commander/squad leader and gunner, and the Enhanced Force-on-Force Trainer, an integrated laser engagement simulator used in conducting force-on-force training at the CTCs, are the programmed system training devices. Partial funding does not begin until the far-term. Bradley Linebacker crews may use the standard COFT to train with the Bradley weapons. **AMBER**

SECTION 3: CONCLUSION

The National Military Strategy (NMS) calls for a Total Army that is deployable, lethal, versatile, and capable of deterrence. Only by maintaining a trained and ready total force can the Army meet the expectations of the American people. This annex maps future actions on how the total force trains and identifies resources required for training. The transition from a TADSS supported, high OPTEMPO/live fire training program to a predominately TADSS-based training program would result in significantly lower levels of OPTEMPO/live fire. The Army of the 21st Century needs a mix of field training and simulators for individual crew training, and simulations for unit training at company level through echelons above corps. Units organize for training as they organize for combat. This strategy enhances combined arms and service support operations.

The training strategy described in this annex supports a holistic approach to Army modernization. Each program contributes a critical piece to the Army's integrated training system and offers necessary linkages to combat readiness. Additionally, these programs together have a synergistic effect; each interacts with other training programs to provide an exponential benefit. Training Mission Area programs must be sufficiently resourced to ensure the training readiness of the Army. System TADSS must be procured and fielded with their respective systems. TADSS must be completely integrated to avoid duplication and ensure all requirements are satisfied. The Army faces significant changes in the future. These changes will challenge the Army's capability to train; it must train more effectively and efficiently. The maturing of current technologies and emergence of new concepts offer opportunities to improve the training of soldiers, leaders, and units. At the same time, constrained resources demand that the Army reshape the current training strategy to preserve the progress already made, take advantage of new opportunities, and reduce the strains on both dollars and soldiers. Effective training enhances soldier confidence, increases morale, unit cohesion and spirit, and allows leaders to master command and control functions for operations at all echelons.

ANNEX O: SPACE

SECTION 1: INTRODUCTION

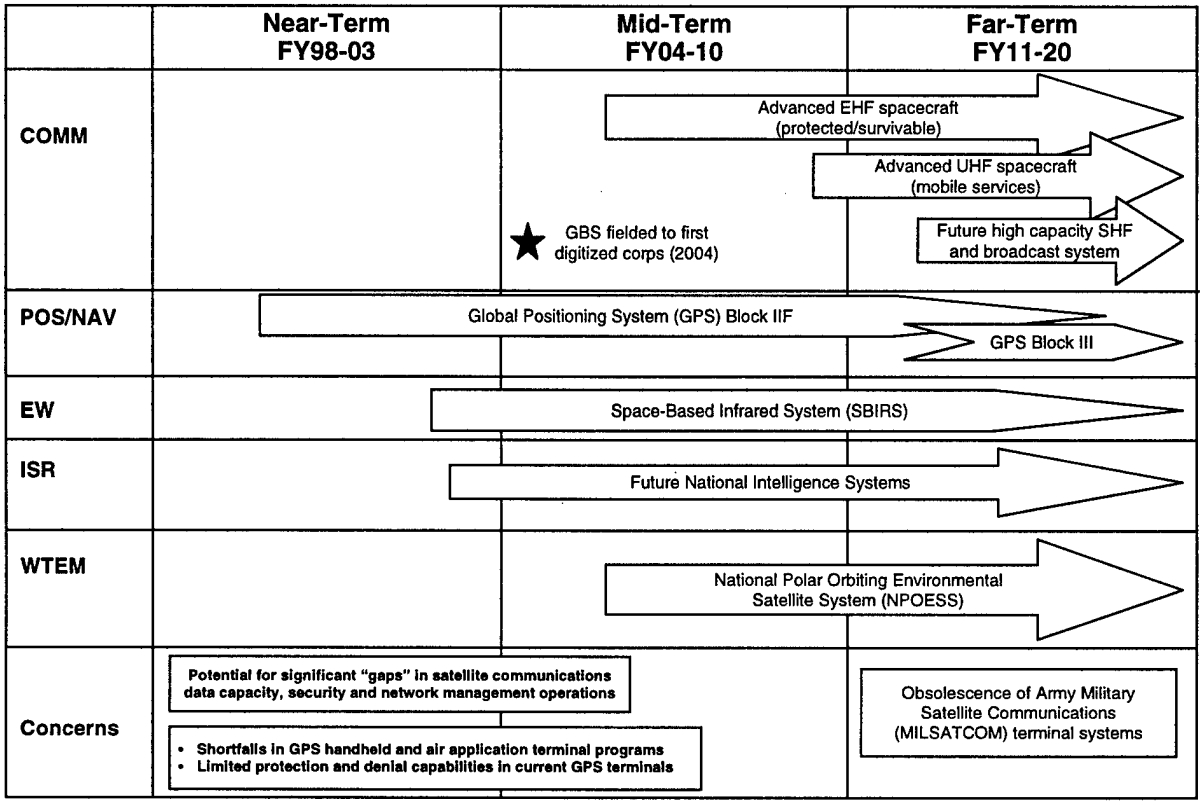
Overview

Space capabilities and products are critical enablers to global land, sea, and air operations. The military employs space assets to enhance operations across the spectrum of military conflict at all echelons of command. Space products provide capabilities and products that allow military commanders to gain and maintain information superiority and full spectrum dominance. The Army is already the DoD's largest consumer of space products, and Army requirements will increase exponentially over the next two decades. Space operations is in many instances the most efficient means to provide command and control, communications, intelligence, surveillance, target acquisition, early warning, environmental and navigation information to military forces. Technical advances and rapid expansion of space capabilities in the commercial sector will result in the Army making much greater use of commercial assets.

Army Vision 2010 is the blueprint for the Army's contributions to the enhanced operational concepts of *Joint Vision 2010.* This annex describes Army space program planned modernization efforts to achieve the required capabilities. Program information on space capabilities and products to achieve specific missions is covered in several annexes of this plan. This annex consolidates and assesses that information from an overall space perspective. The vision for Army modernization is to equip a capabilities-based Army to achieve full spectrum dominance against potential adversaries. Space-based assets, capabilities, and products help the Army attain its modernization vision by supporting the commander's ability to shape, control and dominate the battlespace and its tempo, as well as by enabling continuous operations, day and night, and in adverse weather.

The Army's space modernization efforts are driven by two primary groups of factors. First, current Army space systems must be upgraded to keep pace with user demands for increased information accuracy, security, timeliness and user requirements for continuous operations in service denial environments (jamming, spoofing, etc.). Second, since the Army's investment in space consists primarily of ground terminals, Army space systems and Preplanned Product Improvements (P3I) must account for future architecture and spacecraft advancements. The Department of Defense has programs under review and, in some cases, under development in all space system functional areas that provide support to land force operations. The space system functional areas are depicted in Figure O-1 and consist of communications; position and navigation; early warning; intelligence, surveillance and reconnaissance; and weather, terrain and environmental monitoring. Changes in spacecraft architectures and space system characteristics (orbits, frequencies, modulation schemes, etc.) have great impact on the Army's terminal programs. The Army participates in the development of future space system architectures to minimize required modifications to ground programs and to ensure that ground terminal programs keep pace with spacecraft and system architecture advancements.

Space Modernization Driving Factors



COMM: Communications EHF: Extremely High Frequency EW: Early Warning GBS: Global Broadcast System
ISR: Intelligence, Surveillance and Reconnaissance POS NAV: Position-Navigation SHF: Super High Frequency
UHF: Ultra High Frequency WTEM: Weather, Terrain and Environmental Monitoring

Figure O-1

Capabilities Contributing to *Army Vision 2010* Patterns of Operation

Space systems provide a means to address requirements and future operational capabilities identified in each of the Army patterns of operation. The following sections outline the impact space systems have on each of the *Army Vision 2010* patterns of operation.

PROJECT THE FORCE

To meet most National Military Strategy missions, the majority of forces must be projected from CONUS. Space systems provide assets by which the Army conducts strategic level deployments under the *Joint Vision 2010* operational concept of **Dominant Maneuver**. Intelligence Preparation of the Battlefield (IPB) is vital throughout all phases of operations. During peacetime, terrain and weather data gathered and catalogued provide the basis for multi-echeloned planning. Space capabilities and products provide near-real-time imagery, signals intelligence data, weather, terrain data, map updates and force disposition information which are essential to IPB and en route battle command and mission rehearsals. For early entry and force build-up phases, space systems provide a majority of the available reconnaissance and surveillance capabilities. Additionally, commanders require worldwide communications to

provide en route, real-time updates on the tactical situation and target data. Space services are particularly important when the operational area lacks the infrastructure to support Army operations. In these instances, space services may provide the only connectivity for Army split-based operations. This communications connectivity is provided via Military Satellite Communications (MILSATCOM) systems as well as Global Broadcast Services (GBS).

DECISIVE OPERATIONS

Space products are key to the conduct of decisive operations, the Army's operational element of the *Joint Vision 2010* operational concept of **Dominant Maneuver**. Decisive operations are vastly enhanced by the precision navigation and timing capabilities afforded by the Global Positioning System (GPS), near-real-time reconnaissance, intelligence, surveillance and target acquisition (RISTA) capabilities of space-based sensors, and the capability to communicate "*precise information*" via MILSATCOM, GBS and national intelligence assets. The Army uses space products to shorten the command and control time line and the commander's decision cycle. Advanced MILSATCOM architectures and systems will provide the means by which Army commanders and forces orchestrate decisive operations. This will be possible whether the force is stationary or on the move. To dominate the fight, Army satellite information must be brought directly from the satellite to the theater. Space assets enable the commander to shape the battlespace by providing detailed information on enemy and friendly force disposition. Space systems also provide environmental and terrain conditions in threat-occupied areas where directly observed surface information is needed but denied. Finally, mission rehearsals are enabled through space-based communications and enhanced through real-time situational awareness provided by space assets.

SHAPE THE BATTLESPACE

Space products provide the capability for the Army to see, hear and locate deep, high payoff targets, and locate obstacles in near-real-time. This information supports the Army's use of precision guided weapons systems in engaging targets at extended ranges with a high probability of kill. Space assets provide a means to quickly assess battle damage in order to determine the need for re-engagement. Space-based communications assets provide sensor-to-shooter links that enable the fusion of precise intelligence data on enemy unit locations, movement and intentions. Rapid transmission of friendly unit information enables greater situational awareness of combat force locations essential for eliminating fratricide.

PROTECT THE FORCE

The Army takes a holistic approach to force protection. The Army applies organizational, materiel, and procedural solutions to the challenges of protecting not only soldiers and tanks, but also information and space systems. One of the required capabilities under this pattern of operation is early warning of missile attack. The Army's Joint Tactical Ground Station (JTAGS) enables early warning of theater forces by providing the joint commander an in-theater processing capability for satellite-generated, infrared data that provides highly accurate theater ballistic missile (TBM) launch and impact point predictions. JTAGS is an information

dominance system that expands the theater commander's view of the battlespace. The Army must be able to protect its force during predeployment, deployment, operations, redeployment, and reconstitution. The global coverage of the Defense Support Program (DSP) provides depth and breadth to the theater commander's battlespace impossible to achieve from terrestrial-based sensors. Space-based assets provide tactical warning of attacking forces. Weather and remote sensing space systems provide time critical environmental information of severe weather and contaminated areas. Space assets allow commanders to determine enemy force dispositions and locations, anticipate situations, and respond with greater agility and capability than the enemy force.

SUSTAIN THE FORCE

Future logisticians will leverage space-based global positioning data and communications, intelligence, weather, and remote sensing data via Global Broadcast Service (GBS) and direct downlinks. Access to this information will enable improved logistical situational awareness, which in turn enables total asset visibility and just-in-time logistics. These improved operational methods eliminate the need for large holding yards of equipment and containers. This change in the way logistics operations are currently conducted will enable flexibility and agility of future joint forces. Space assets such as MILSATCOM, GBS and the GPS will enable "*the fusion of logistics and information technologies*" by providing the means for the flow of large amounts of precise logistics information and data.

GAIN INFORMATION DOMINANCE

Space programs provide the sensors, processors and dissemination means to achieve information dominance. Developing superior information and gaining an information dominance advantage requires an integrated architecture of supporting space systems. Space systems collect, process and disseminate relevant information directly to the warfighter. Controlling space and integrating space applications to gain information dominance is fundamental to achieving battlespace dominance and supporting our force projection operations with timely, relevant and protected information. Future Army operations and equipment will enable information dominance methods that exploit adversary space systems and protect friendly forces from space-based observation through non-lethal, reversible, non-physical attack, and deception capabilities. The space systems contributing to the attainment of capabilities required by this pattern of operation include MILSATCOM, GPS, weather and remote sensing platforms such as the Integrated Meteorological System (IMETS), JTAGS and Tactical Exploitation of National Capabilities (TENCAP) systems.

Challenges

In the future, it is crucial for the Army to play a greater role in influencing what is placed in orbit to support Army requirements for Army XXI and the Army After Next (AAN). The Army must increase efforts to influence the design and development of space-based intelligence, missile warning, and data dissemination systems through national, service and civil organizations, and commercial space agencies.

The Army's increasing dependence on space warrants expanded efforts to exploit and leverage space capabilities. The Army must continue to leverage and participate substantively in investments made by other services and organizations to include the National Reconnaissance Office (NRO), Department of Energy, National Aeronautics and Space Administration (NASA), and the intelligence community. However, land force unique applications such as tactical mapping and specialized land navigation will be aggressively pursued by the Army and shared with other users.

The Army must continually assess the commercial and civil markets to determine their applicability to Army modernization efforts and future warfighting. We appear to be in a period of transition with respect to space capabilities. Industry invested heavily in space-based communications in the 1960s. Industry and civil portions of the U.S. Government embraced the capabilities inherent in the Department of Defense's Global Positioning System (GPS) in the late 1980s. LANDSAT, SPOT and other commercial imagery systems forged new markets for remote sensing and high-resolution, electro-optical, synthetic aperture radar, infrared, multi-spectral and hyperspectral commercial imagery. The military and intelligence community may become secondary customers (and potentially insignificant customers when viewed from the profit-minded, corporate vantage point) in each of these "exploding" commercial markets. The Army must assess requirements that may be satisfied through the use of these systems and invest resources now to achieve a potential, significant return in the future.

Space Modernization Priorities

The Army's modernization priorities for space-related programs and systems are complex due to the very nature of space operations. Army planners must be capable of interfacing with a diverse set of players from other military services, governmental agencies and, potentially, foreign consortia. In the past, the Army utilized a reactive modernization strategy with respect to space systems. The Army developed user terminals based on space systems that were already built and in orbit. The Army merely had to determine a space system's operational and technical capabilities and develop terminals to receive data. This strategy worked well during a time frame when space products were critical to Army strategic planning and operations but only of limited use at the operational and tactical levels. In the past, response time lines for space imagery products were measured in days to meet strategic requirements. The environment has changed. Today, we possess near-real-time space capabilities that have operational and perhaps tactical utility. To capitalize on this change, the Army must assume a more proactive modernization approach. The Army must become involved in space system design and the requirements generation processes to ensure future space systems adequately address land warfighting requirements.

NEAR-TERM (FY98-03)

The Army's near-term modernization priority is information dominance. There are a number of near-term modernization programs that will have a major impact on the Army's ability to achieve and maintain information dominance. These programs provide communications,

navigation, missile warning, weather and remote sensing capabilities. Of particular interest are the efforts of the Department of Defense (DoD) to investigate navigation warfare vulnerabilities in the GPS system. Protection of the precise position and timing data and the denial of the same to an adversary are of critical importance to Army forces.

MID-TERM (FY04-10) AND FAR-TERM (FY11-20)

Space assets and capabilities will have a major impact on Army operations in the mid- and far-terms. The Army's Advanced Warfighting Experiments and the Army After Next wargame efforts are attempting to define the nature of future land warfare. These activities indicate that the future of the Army is tied to space. The primary mid-term priorities involve:

- Modernization efforts directed at protecting GPS terminals from jamming and deception,
- First steps in the migration of the current MILSATCOM systems to more advanced systems included in the Advanced MILSATCOM architecture,
- Migration of JTAGS from DSP to the Space-Based Infrared System (SBIRS), and
- Exploitation of satellite on board processing, direct downlinks, and joint multifunction user equipment integrated in the battlefield operating systems.

SECTION 2: CURRENT PROGRAM ASSESSMENT

Overall Space Modernization Assessment

This assessment highlights and expands upon space system individual program assessments found in the following Modernization Plan annexes:

- Annex F for Air and Missile Defense
- Annex I for Command, Control, Communications, and Computers (C4)
- Annex J for Intelligence and Electronic Warfare (IEW)

The overall assessment of space systems is **AMBER** in the near-term due to:

- Shortfalls in the GPS user equipment segment
  - Incomplete development for all air applications
  - Insufficient funding to complete the current handheld program
  - Limited capability to initiate a follow-on program that incorporates protection and denial capabilities
- Potential for significant gaps in satellite communications data capacity, security and network management capabilities

The overall assessment of space systems in the mid-term is **GREEN** due to corrective efforts in both the GPS and MILSATCOM near-term shortfall areas.

The overall assessment of space systems in the far-term is **AMBER** due to obsolescence of the Army's military satellite communications systems. This obsolescence must be addressed in future Army modernization efforts.

Information Dominance Assessment

The Army's space effort is heavily invested in the information dominance component. Space systems collect, process and disseminate relevant information directly to the warfighter to gain information superiority. Satellite communications systems support every aspect of Army XXI operations, from force projection and split-based operations to providing connectivity between deployed formations. Several space programs support this component of the investment strategy (Figure O-2). The satellite communications programs include protected **MILSTAR** systems, spectrum-efficient **Tactical Satellite Communications (TACSATCOM)** systems and the **Global Broadcast Service (GBS).** Other space systems include the **Global Positioning System (GPS),** the **Integrated Meteorological System (IMETS)** and the **Joint Tactical Ground Station (JTAGS).**

Space—Information Dominance Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
MILSTAR	869	559	2013	**AMBER**	**GREEN**	**AMBER**	Potential gaps in EHF coverage in the far-term
TACSATCOM	3,632	2,550	2013	**AMBER**	**AMBER**	**AMBER**	Shortage in procurement levels
GBS	504	504	2013	**AMBER**	**GREEN**	**AMBER**	Terminal fielding not complete until mid-term. Far-term requirements not identified.
GPS	106,000	75,000	1999	**AMBER**	**AMBER**	**AMBER**	Near-term terminal shortfalls in air applications. Insufficient funding for handheld terminals. Limited protection and denial capabilities.
IMETS	32	27	2000	**AMBER**	**AMBER**	**AMBER**	Limited fielding to corps, division, ACR, Sep Bde, SFG, and EAC
JTAGS	5	5	2017	**GREEN**	**GREEN**	**GREEN**	

Figure O-2

MILITARY SATELLITE COMMUNICATIONS (SATCOM) SYSTEMS

The Army uses military and commercial communications satellites to carry large portions of intercontinental, intertheater and intratheater traffic at brigade level and above. Some tactical intratheater users are also supported. The Army's focus for modernizing its satellite communications (SATCOM) assets is to leverage technology developments for the warfighter. The Army must continue to influence satellite design and operational architectures to ensure direct access to the required capabilities that SATCOM provides.

SATCOM capability is critical to support the range extension requirements of a force projection Army. These requirements are driven by a global strategy and operations doctrine that envisions split-based operations and units widely dispersed on the battlefield. During crisis, the demand for SATCOM exceeds current capabilities. Modernization efforts must correct this shortfall as well as assure access to the critical data flow enabled by the tactical internet. Assured access to SATCOM nets and paths is a critical requirement.

Army MILSTAR

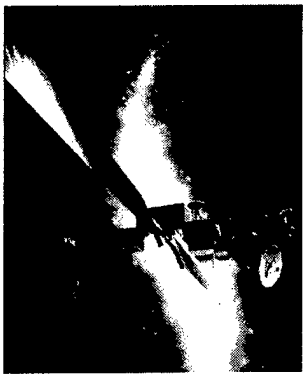


Figure O-3

The MILSTAR (Figure O-3) system provides secure, anti-jam communications capabilities to the land warfighter. Presently, there are two MILSTAR satellites on orbit, with future launches for four additional satellites in the mid-term. MILSTAR provides the warfighter (corps and below) protected, anti-jam, range extension capabilities.

Within the MILSTAR program, the Army is developing the Secure Mobile Anti-Jam Reliable Tactical Terminal (SMART-T) and the Single Channel Anti-Jam Manportable (SCAMP) terminal. Each of these terminal systems interface directly with the Extremely High Frequency (EHF) MILSTAR satellite.



Figure O-4

SMART-T (Figure O-4) provides multi-channel range extension to the Army's Mobile Subscriber Equipment (MSE) and has the inherent capability of low probability of intercept/low probability of detection (LPI/LPD). SMART-T procurement is fully funded and rated **GREEN**.

The Army's single-channel MILSTAR terminal is the SCAMP (Figure O-5). This terminal operates in both the point-to-point and broadcast modes via the MILSTAR Low Data Rate (LDR) payload. The Army is acquiring these terminals in two blocks. SCAMP Block I, a manportable equipment set, provides critical command and control communications for tactical forces through corps level. SCAMP Block II, a manpackable terminal that augments and, in some cases, replaces SCAMP Block I in the mid- and far-terms, significantly reduces terminal size and weight and provides point-to-point and Combat Net Radio (CNR) range extension for conventional and Special Operations Forces. SCAMP Block I is partially funded in the mid-term resulting in an **AMBER** rating. In the far-term, SCAMP Block II is fully funded resulting in a **GREEN** rating.

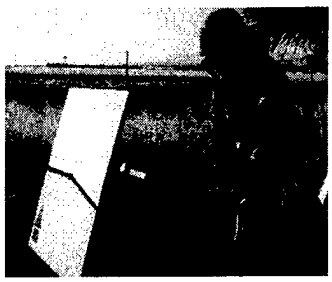


Figure O-5

Based on these terminal program assessments, MILSTAR is rated **AMBER** in the near-term. MILSTAR is rated **GREEN** in the mid-term due to SCAMP Block II fielding to augment near-term Block I shortages. The MILSTAR acquisition program provides service through the first 10 to 15 years of the 21st Century. MILSTAR is rated **AMBER** in the far-term due to potential gaps in capability for EHF services in the latter part of the far-term period.

Tactical Satellite Communications (TACSATCOM)

This Army terminal program provides communications in both the ultrahigh and superhigh frequency (UHF and SHF) ranges to users from the soldier level through Echelons Above Corps (EAC). In the UHF range, the terminals are capable of communicating via either of

two existing military SATCOM systems, the Fleet Satellite Communications System (FLTSATCOM) or the UHF Follow-On (UFO) satellites. In the SHF range, the terminals are capable of communicating via the Defense Satellite Communications System (DSCS) and several commercial systems. The Army has two terminal programs that provide tactical SATCOM capabilities. These programs (described in greater detail in Annex I) are:

- **AN/PSC-5, Spitfire**. A portable, manpackable system providing tactical range extension satellite communications (multi-channel and single-channel) for tactical command and control. The Spitfire program adds embedded encryption and Demand Assigned Multiple Access (DAMA) to the existing family of single-channel radios.
- **SHF Tri-band Advanced Range Extension Terminal (STAR-T)**. A HMMWV-mounted, C-130 transportable (roll on/roll off), multichannel terminal which operates with commercial or military transponder-based satellite systems.

Tactical satellite communications systems are rated **AMBER** throughout the investment time frame due to a shortage in procurement levels (approximately 70% funded).

Global Broadcast Service (GBS)

The Global Broadcast Service is a joint DoD program that will provide the capability to broadcast large volumes of information (data, video, imagery, etc.) to tactical forces on a worldwide basis. The system provides a "Direct TV" like capability for deployed forces. Users will be able to select channels to view a wide range of information relevant to mission operations and soldier welfare. Channels will include intelligence, weather, CNN and recreational services, to list just a few.

The program will be implemented in three phases:

- Phase 1 (near-term) uses commercial leased satellites and receiver terminal capabilities.
- Phase 2 (mid-term) will use military satellite capabilities on Navy UHF Follow-On (UFO) satellites using the military portion of the Ka frequency band.
- Phase 3 (far-term) will implement a fully capable system of DoD satellites and terminals that leverage DSCS follow-on and the military portion of the Ka band.

The Air Force is designated as the Executive Agent for the program. The Army requirement is for theater-injection terminals fielded to corps signal brigades and receiver terminals fielded at battalion level and above.

The Army GBS program is funded to field the First Digitized Corps by 2004, but is rated **AMBER** due to insufficient funds to procure and field terminals to meet total Army requirements in the near-term. Funding to complete GBS fielding is available in the mid-term resulting in a rating of **GREEN**. Army requirements for the Phase 3 objective system have not

been identified. Projected equipment obsolescence due to technology advancements results in a far-term rating of **AMBER**.

Global Positioning System (GPS)

GPS (Figure O-6) is a satellite-based, global, all-weather radio navigation system that provides precise positioning, velocity, and timing information across a common military grid for an unlimited number of users. Army GPS user equipment consists of passive receivers for air, ground, and sea users. These receivers provide accurate navigation information for maneuver and support forces; precise positioning for firing platforms and target location for precise munitions in support of deep fires, indirect fire systems; and precise timing for communications and command and control systems.



Figure O-6

The Army is fielding the Precision Location GPS Receiver (PLGR) (Figure O-7). The PLGR provides location accuracy to within 16 meters spherical error probable. Continued proliferation and use of these GPS devices enhance the Army's overall combat, combat support, and combat service support capabilities in the near- and mid-terms.

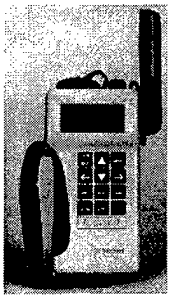


Figure O-7

Precision guided weapons systems are integrating GPS technology to improve accuracy, target location, and lethality. This provides added value by increasing weapons platform stand-off range and survivability, reduces munitions payload weight and logistics resupply, and reduces collateral damage to surroundings in the target area.

Combat identification initiatives to reduce fratricide depend on GPS data to determine friendly locations. Army modernization efforts include the incorporation of GPS receivers in combat net radio communications, and an embedded capability will eventually be included in all vehicles/individual equipment modernization efforts.

The current constellation of GPS satellites reached initial operational capability (IOC) in 1993 with full operational capability (FOC) achieved in 1994. The current system will continue at FOC with follow-on replacement spacecraft launches through the first ten years of the 21st Century. GPS user equipment is rated **AMBER** throughout the investment timeframe for three reasons:

- Incomplete development for Army air applications
- Insufficient funding to complete the current handheld program
- Limited capability to initiate a follow-on program that incorporates protection and denial capabilities

INTEGRATED METEOROLOGICAL SYSTEM (IMETS)

Accurate and timely weather information is critical to any military operation. In the near-term, the Defense Meteorological Satellite Program (DMSP) (Figure O-8) provides accurate, near-real-time, high-resolution cloud imagery and other weather elements. In the mid-term, the National Polar Orbiting Environmental Satellite System (NPOESS) will replace both the DMSP and the National Oceanic and Atmospheric Administration (NOAA) Polar Orbiting Environmental Satellites (POES) to provide advanced sensors capable of providing higher resolution imagery and data as well as soil moisture information. The availability of soil moisture content data will provide critical information for terrain and target analysis resulting in more accurate planning factors for military operations.



Figure O-8

The Army currently uses a mix of military and commercial receivers to obtain data and imagery from military, civil and allied weather satellites and weather information services. The Integrated Meteorological System (IMETS) is an Army modernization effort that will replace current weather terminals. IMETS will receive, process and collate weather data to provide a wide range of products tailored to meet the commander's requirements. These products include nuclear, biological and chemical (NBC) effects, illumination and visibility overlays and tactical weather effect depictions. The data obtained from IMETS will also complement other Army modernization programs such as the Artillery Profiler System (Annex E). IMETS will provide high atmospheric sounding of wind, temperature and pressure elements that will be linked to the Artillery Profiler System to improve the accuracy of artillery missile fires.

IMETS fielding, at a reduced basis of issue, will be completed in FY99. This fielding results in limited capability to each corps, division, ACR, separate brigade, and to selected aviation brigades, special forces groups, and EAC headquarters. IMETS is **AMBER** in the near-term due to this reduced fielding. The program remains **AMBER** until funding supports the acquisition objective.

JOINT TACTICAL GROUND STATION (JTAGS)

Army space capabilities to warn the force are a cost-effective survivability enhancement for protecting the force. Space-based warning enhances all four elements of the Army's Theater Missile Defense (TMD) capabilities (active defense, passive defense, attack operations, and Battle Management/Command, Control, Communications, Computers, and Intelligence). Overhead coverage allows surveillance of enemy TBM systems, alerts active theater missile defenses and attack operations forces, and permits forces to assume defensive postures. Protection of the force is enhanced in the near- and mid-terms through the use of the Defense Support Program (DSP) (Figure O-9) data processed by the Joint Tactical Ground Station (JTAGS).



Figure O-9

JTAGS (Figure O-10) is a transportable system that provides in-theater processing of TBM launch information through a direct downlink (DDL) of spacecraft data. The availability of a DDL from the DSP spacecraft reduces response time for friendly forces to assume defensive postures. The reduced time lines also increase opportunities to conduct attack operations against adversary TBM launch platforms. R&D efforts are underway to improve JTAGS's ability to predict TBM launch points through the collection of more accurate missile burnout data and fusion of that data with data collected by other means. These efforts will further enhance JTAGS's ability to provide impact point prediction and warning to theater forces. JTAGS is the transportable, in-theater element of the U.S. Space Command's Tactical Event System (TES).



Figure O-10

JTAGS is rated **GREEN** throughout the time periods. JTAGS has the necessary connectivity and intelligence through DSP to expeditiously broadcast in-theater TBM warnings. In the latter part of the near term, the JTAGS P3I Phase II will upgrade the five fielded JTAGS into multi-mission processors for integration into the Space-Based Infrared System (SBIRS). Phase II is necessary for continued JTAGS in-theater operations with the new constellation of SBIRS satellites, scheduled to replace the aging DSP in FY02-04.

Essential Research and Development and Leap-Ahead Technologies

The Army's research and development effort uses four approaches:

- The Army's **in-house research and development effort primarily focuses on the ground segment** of space systems (e.g., receiver terminals, antennae, and processors). Army R&D institutions have ongoing sensor, software and processor development programs to aid in automatic target recognition, battlefield visualization, and theater missile defense applications. In-house R&D efforts seek to develop space science and technology objectives, Advanced Technology Demonstrations (ATDs) and Advanced Concept Technology Demonstrations (ACTDs) while participating in Advanced Concept Technology II (ACT II) efforts.
- **Partnerships with other DoD and government science and technology organizations** to include industry and academia. Army space R&D offices will integrate and transition viable space technologies with Army Research, Development and Engineering Centers (RDECs), Program Executive Offices (PEOs), Fast Track Acquisition, and Army digitization efforts.
- **Leveraging and acquiring space technologies** from other services, governmental agencies and commercial/industry sources.

Horizontal Technology Integration (HTI) is the common application of enabling technologies across multiple systems to increase force effectiveness. GBS and GPS technologies are excellent examples of HTI. The HTI process reinforces the integration of highly classified space capabilities with commercial, civil and unclassified military capabilities.

Space—Essential R&D Programs

Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20
• Laser Boresight Calibration (STO) • Theater Laser Comms (STO)	• Overhead Sensor Technology for Battlefield Characterization (STO) • Battlefield Ordnance Awareness (STO)	• Mobile Wireless Communications (SRO) • Nanoscience (SRO)

Figure O-11

NEAR-TERM (FY98-03)

Laser Boresight Calibration (Figure O-12)



Figure O-12

This program provides a solid-state laser calibration capability for the JTAGS system. The laser calibrator provides a known ground registration point for space-based sensors. The program is designed to reduce target location errors of the Defense Satellite Program (DSP) and other defense satellites. Laser Boresight improves sensor pointing accuracies of DSP spacecraft by improving satellite calibration. The improved line-of-sight target accuracy will result in higher quality missile warning, alerting, and cueing information.

Theater Laser Communications

Laser Communications, or Lasercom, provides a high bandwidth overhead and ground sensor capability while reducing size, weight, power, and cost. This capability enables near-real-time battlefield visualization with high volume imagery and video data required for Army XXI. Lasercom provides radio silent data transfer of sensitive information and is very difficult for an adversary to intercept and detect. Lasercom technology is lightweight and compact with very low power requirements. Potential applications are directed toward airborne reconnaissance missions using a layered architecture involving satellites, manned and unmanned aircraft, aerostatic vehicles, and portable/fixed ground terminals.

Current program focus is on the ability to use a layered architecture consisting of a network of satellite-to-air-to-ground sensor platforms. The technology utilizes laser diodes for transmission, tracking and alignment; low noise avalanche photodiodes for collecting data transmissions; and charge-coupled device arrays for tracking and alignment. Future advanced technology development will address high bandwidth potential ($\geq$10 gigabits per second) and other issues such as improving laser output power and maximizing link availability.

MID-TERM (FY04-10)

Overhead Sensor Technology for Battlefield Characterization

This program is developing a passive optical sensor for overhead platforms that uses hyperspectral, polarimetric, and on-focal plane array processing to support battlefield awareness with wide area, near-real-time target detection, discrimination, identification, and location. This sensor will be able to detect camouflaged and concealed threats, such as tactical vehicles and aircraft, with target location accuracies that are comparable to those obtained from airborne synthetic aperture radar. The program will use sensor and processing technologies to reduce requirements on communications links and ground processing while providing near-real-time targeting data to support the warfighter. This sensor provides a significant advancement over current sensors in detecting, discriminating, identifying, and locating masked, concealed and low signature targets such as cruise missiles.

Battlefield Ordnance Awareness (BOA)

This program applies modern space-based and aircraft-mounted sensor technology to address the needs of the Army warfighter through battlefield visualization. The BOA sensor detects and classifies ordnance events such as muzzle flashes, bomb detonations, missile firings, and cruise missile ejector motors. The BOA system then generates and reports information in near-real-time on these ordnance events (time, type, rate, and precise location) to be displayed as new layer for the warfighter's battlefield visualization. This information gives the level of conflict, ordnance delivery location, launch time, and enhanced impact point prediction.

While systems exist to locate and track vehicle traffic and radio frequency transmitters for intelligence preparation of the battlefield, no system currently exists that reports type, time, and sightings of either friendly or adversary ordnance. BOA will identify ordnance by type, provide positional information for counterfire operations, battle damage assessment, ordnance inventory and information for dispatch of logistical, medical and search and rescue support. BOA also has the potential to classify launch systems using time domain intensity information in specific spectral bands. Advanced processor technology will be used with state-of-the-art staring focal plane arrays to provide this critical information to battlefield commanders.

FAR-TERM (FY11-20)

Strategic Research Objectives (SRO)

The success of the Mobile Wireless Communications SRO is directly dependent on the availability of space-based assets. The Nanoscience SRO is developing the next generation of computing systems that will enhance satellite-based sensors and real-time analysis capabilities.

Leap-Ahead Technologies

The Army's Leap-Ahead modernization efforts include the Tactical Exploitation of National Capabilities (TENCAP) program, the Army Space Exploitation Demonstration Program (ASEDP), Eagle Vision II and Grenadier Beyond Line of Sight Reporting and Targeting (BRAT) (Figure O-13).

Space—Leap-Ahead Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
TENCAP	6 TES 10 DTES	6 TES 10 DTES	2010	**GREEN**	**GREEN**	**GREEN**	
ASEDP	N/A	N/A	N/A	**AMBER**	**AMBER**	**AMBER**	Limited funding level
Eagle Vision II	N/A	N/A	N/A	**AMBER**	**AMBER**	**AMBER**	NRO/ Army funding negotiations
Grenadier BRAT	N/A	N/A	N/A	**AMBER**	**AMBER**	**AMBER**	Awaiting funding authorization

Figure O-13

TACTICAL EXPLOITATION OF NATIONAL CAPABILITIES (TENCAP)

The TENCAP program focuses on exploiting national space intelligence systems and integrating the capabilities into the Army's decision-making process. Army TENCAP systems provide data from national imagery and signals intelligence (SIGINT) systems. The Army has successfully fielded more than 60 systems and is constantly exploring ways to integrate advanced technologies into its inventory.

The Army's modernization efforts in the TENCAP arena focus on the integration of the current systems into a single system capable of providing multi-source intelligence data from improved national sensors.

Improvements in the near-term include product improvements to the Advanced EPDS (AEPDS), Modernized Imagery Exploitation System (MIES) (Figure O-14), Enhanced Tactical Radar Correlator (ETRAC), and the Mobile Integrated Tactical Terminal (MITT).

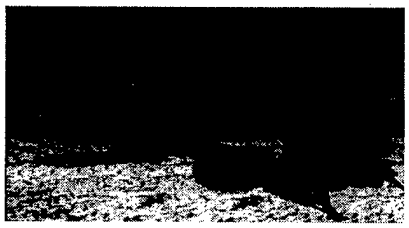


Figure O-14

In the mid-term, the Tactical Exploitation System (TES) will combine the capabilities of three ground processors (AEPDS, Modernized Imagery Exploitation System, and Enhanced Tactical Radar Correlator) into a single, integrated, modular system specifically designed for split-based operations. The TES will serve as the corps/theater interface between national imagery and SIGINT collectors and tactical forces. TES will receive data from theater and tactical assets. TES will be fielded on the basis of one TES per Army Corps and theater MI brigade. The Division Tactical

Exploitation System (DTES) is the objective TENCAP system for support to the division in the mid-term. The DTES is a HMMWV-mounted, multidiscipline processing and analysis system that provides links to theater and national intelligence platforms. The DTES replaces the MITT as the objective division TENCAP system. The DTES will have compatible UHF, GBS, and S-band radios as well as multiple methods of processing and analyzing SIGINT and imagery products. Since DTES is a subset of the TES, modular components from a Corps TES can be incorporated with the divisional system, thus providing a very robust capability. DTES is fielded on a basis of issue of one DTES per division.

In the far-term, the enhanced TES (ETES) will replace the TES. Plans call for ETES to conduct direct tasking of space systems with control of on board satellite processing and direct dissemination from the spacecraft to the warfighter.

TENCAP is rated **GREEN** in the near-, mid-, and far-terms as TES is 100% fielded with robust P3I efforts planned to ensure the systems remain current and applicable to both evolving technologies and warfighter needs.

ARMY SPACE EXPLOITATION DEMONSTRATION PROGRAM

The Army Space Exploitation Demonstration Program (ASEDP) incorporates new technologies, educates tactical commanders on the use of space assets to enhance Army operations, assists in defining/refining requirements for further documentation, and, where appropriate, supports subsequent materiel developments.

ASEDP consists of two types of demonstrations, Concept and Operational. Each type is focused on a different level of technological maturity and different Army organizations. Concept demonstrations generally involve items that are rugged enough to be taken to various Army locations to be demonstrated in a controlled environment. The demonstration item is examined in the context of a Battlefield Operating System/Functional Area to determine if it contributes to the Army's concept of operation. Operational demonstrations primarily involve prototypes that have matured from technologies evaluated by the Space Technology Directorate of U.S. Army Space and Missile Defense Command (SMDC). These demonstration items are sufficiently advanced and rugged for use by soldiers during field exercises. If the demonstrated capability is useful, appropriate transition partners work to ensure development and fielding of that capability within the Army.

ASEDP products include:

- Multispectral imagery to provide geographic and topographic data to tactical units for areas where existing map coverage is inadequate
- Weather satellite receivers to provide timely environmental information for planning purposes
- Precision Location GPS Receivers (PLGRs) for both mounted and dismounted soldier navigation (Annex I)

- Gun Laying Position System (GLPS) to provide azimuth for non-Paladin howitzers, mortars, radar, and missile systems (Annex E)

As a result of ASEDP and the GBS demonstrations, GBS was transitioned to the digital division and the Army has approved funding for 500 ground receiver terminals and three theater injection points under Program Objective Memorandum (POM) 98-03. In addition, as a result of the Low-Earth Orbit Mobile Data Communications (LEOCOMM) demonstration, the Army's Combined Arms Support Command is purchasing LEOCOMM capabilities for the Army's Movement Tracking System (MTS). The Palletized Loading System (PLS) is the first recipient of MTS technology.

The Army does not currently have a separate ASEDP funding line. The program is executed through judicious leveraging of a modest amount of SMDC funds, resulting in a smaller number of demonstrations than desired. This limited funding level results in an AMBER rating throughout the investment time frame.

EAGLE VISION II

Eagle Vision II (EV II) is a technology demonstration effort currently led by the National Reconnaissance Office (NRO) and supported by SMDC. This C-130 deployable system provides direct, in-theater, near-real-time downlink of unclassified imagery (panchromatic, multi-spectral and radar) from commercial satellites to tactically deployed warfighting commanders. The products are used to support planning, operations and intelligence. Current EV II funding will develop a prototype that will be used to determine a concept of operations and assess tactical utility. EV II components include a 30-foot expandable shelter with a 5.4-meter X-band antenna.

The Deputy Director of the NRO and the Commanding General, SMDC have agreed to transition funding and program control to the Army. Details of the transition are currently under review within each of the organizations. The EV II program is rated AMBER throughout the investment time frame due to continuing NRO and Army funding negotiations.

GRENADIER BRAT

Grenadier BRAT (GB) is another Army technology demonstration program that provides a cost-effective means of enhancing situational awareness through a mechanism to track friendly forces on the battlefield. The system consists of a small transmitter box and two antennas. The system uses low output power, spread spectrum and short burst UHF transmissions. The system receives location and time location via the Global Positioning System and transmits this information along with a unique vehicle, equipment or personnel identifier to friendly command centers. GB offers worldwide operations, uses existing space and terminal systems, and addresses joint interoperability requirements through the use of existing joint communications protocols and methods. GB has been demonstrated since July 1995 in Europe, Korea and CONUS and is a candidate for the Warfighter Rapid Acquisition Program (WRAP).

The GB program is rated AMBER throughout the investment time frame while the program awaits decisions on future funding.

Recapitalization Program Assessment

SATELLITE COMMUNICATIONS (SATCOM) SYSTEMS (FIGURE O-15)

Space—Recapitalization Program Assessment

System	# Systems Required	# Systems Funded	R3 Point	Near-Term FY98-03	Mid-Term FY04-10	Far-Term FY11-20	Remarks
DSCS	Varies	Varies	Varies	AMBER	GREEN	AMBER	Limited fielding of critical user components

Figure O-15

Defense Satellite Communications System (DSCS) (Figure O-16) is a joint, worldwide military satellite system that supports long-haul communications requirements of deployed warfighters. As a communications asset serving Army customers at all levels of command, DSCS provides the deployed warfighter super-high frequency (SHF) wideband and anti-jam satellite communications. DSCS supports senior Army leadership command, control and communications (C3) and provides deployed forces a capability to reach back to the CONUS sustaining base. The Army is the executive agent for the DSCS ground segment and is responsible for five DSCS Operations Centers that control and maintain communications networks. DSCS ground terminal modernization programs will bring the DSCS program more in line with 1990s technology and extend the life of satellite communications terminals to the year 2010 and beyond, while reducing operations and sustainment costs.

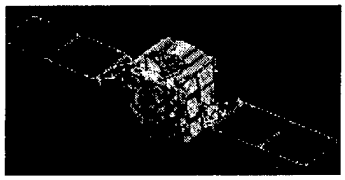


Figure O-16

The DSCS program is rated **AMBER** in the near-term due to limited fielding of critical user components. The program is rated **GREEN** in the mid-term based on fielding completion. DSCS will be replaced in the far-term with an advanced SHF satellite system. The advanced system is included in the DoD's Advanced MILSATCOM architecture.

Summary

Space products are necessary for the Army to properly discharge its responsibilities in the enhanced joint operational concepts of *Joint Vision 2010* and in achieving full spectrum dominance. In the near-term, Army decisive operations capabilities are limited by shortfalls in the GPS and Military Satellite Communications (MILSATCOM) programs. These limitations are overcome in the mid-term, but increased requirements and aging satellite communications systems in the far-term are matters that must be considered in future modernization efforts.

SECTION 3: CONCLUSION

The Army's future is closely linked to space. The Army has a long history of firsts in space. It was the Army in 1958 that launched America's first satellite. The Army was the first service to initiate a Tactical Exploitation of National Capabilities (TENCAP) program. The Army must continue this legacy of leadership to ensure the future Army is capable of achieving and maintaining full spectrum dominance.

Increasingly, the Army is institutionalizing space into its normal, everyday operations. One of the most significant aspects of this posturing involves the Army's proponent for space, the U.S. Army Space and Missile Defense Command (SMDC). SMDC is now the Army's specified proponent for space and national missile defense issues and the Army's integrator for Theater Missile Defense (TMD) issues. SMDC is the Army lead for the generation and definition of space and national missile defense requirements. Of particular note, SMDC established a Space and Missile Defense Battle Lab to execute a variety of experimentation efforts including Battle Lab experiments, Advanced Technology Demonstrations, Advanced Concept Technology Demonstrations and Advanced Warfighting Experiments involving space and missile defense. SMDC has a unique role as a technology developer and integrator, combat developer, materiel developer, tester, evaluator and operational command.



Figure O-17

Another significant action that underscores the added emphasis space has on Army operations is the approval of an officer personnel management Functional Area (FA) for space operations. The management area, FA 40, provides new challenges and opportunities for innovative warfighters via a career path for officers with a technical space-oriented education or assignment experience in commands that focus on space operations. FA 40 emphasizes space activities from communications and weather satellites, to satellite-based intelligence and reconnaissance collection means, to joint space activities. The institution of FA 40 into the Army will have a significant effect on modernization over the long-term. As Army officers become more and more literate in this technical area of warfighting, the Army will be better positioned to develop and defend requirements in the joint environment. These officers will also be prepared to influence and leverage the design of future military, civil and commercial space systems.

The efforts outlined in this annex place the Army on the right path. However, there is a great deal of work that must still be accomplished. Army space programs must capitalize on the Army's near- and mid-term emphasis on information dominance. In addition to the modernization efforts outlined in this annex, three areas require attention:

- The Army must play a greater role in influencing what is placed in orbit and influence the design and development of space systems to support Army requirements for Army XXI and the Army After Next (AAN).
- The Army must expand efforts to exploit and leverage space capabilities and participate substantively in investments made by other services and organizations.

- The Army must continually assess the commercial and civil markets to determine their applicability to Army modernization efforts and future warfighting. The Army must assess requirements that may be satisfied through the use of commercial systems and invest resources now to achieve a potential, significant return in the future.

The POM FY99-03 makes headway in the near-term. Figure O-18 below highlights critical space related POM items.

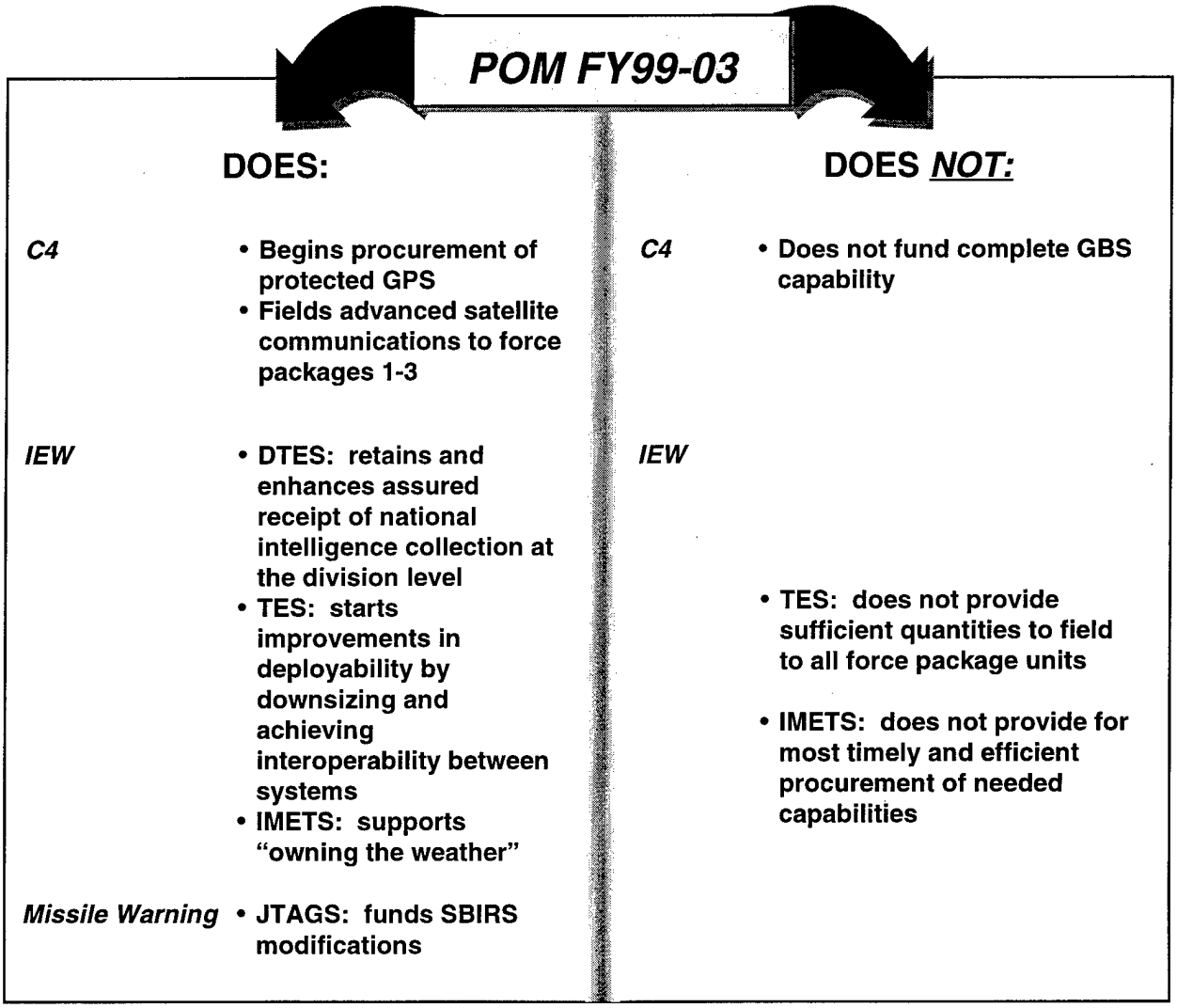


Figure O-18

Glossary

(E)TLOS	(Enhanced) Target Location Observation System
A2C2S	Army Airborne Command and Control System
AAFARS	Advanced Aviation Forward Area Refueling System
AAN	Army After Next
AAO	Army Acquisition Objective
AAR	After Action Review
ABCS	Army Battle Command System
Abn	Airborne
ABS	Advanced Bomb Suit
AC	Active Component
ACADA	Automatic Chemical Agent Detector Alarm
ACE	Armored Combat Earthmover
ACE	Avenger Control Electronics
ACOE	Army Common Operating Environment
ACR	Armored Cavalry Regiment
ACS	Aerial Common Sensor
ACT	Apache Crew Trainer
ACTD	Advanced Concept Technology Demonstration
ACTS	Apache Crew Training System
ACUS	Area Common User System
ADA	Air Defense Artillery
ADLP	Army Distance Learning Program
ADO	Army Digitization Office
ADRS	ARNG Division Redesign Study
AEA	Army Enterprise Architecture
AEDST	Airframe and Engine Drivetrain Systems Trainer
AEPDS	Advanced Electronic Processing and Dissemination System
AET	Armament/Electrical Trainer
AFATDS	Advanced Field Artillery Tactical Data System
AGE	Auxiliary Ground Equipment
AGES	Air-to-Ground Engagement System
AGTS	Advanced Gunnery Training System
AH	Automated Howitzer
AI	Artificial Intelligence
AICPS	Advanced Integrated Collective Protection System
AIM	Abrams Integrated Management
AIRTERM	Airborne Terminal
AIT	Advanced Interceptor Technology
ALSP	Aggregate Level Simulation Protocol
AMD	Air and Missile Defense
AMDPCS	Air and Missile Defense Planning and Control System
AMEDD	Army Medical Department
AMEV	Armored Medical Evacuation Vehicle

AMPS	Aviation Mission Planning System
AMSAA	Army Materiel Systems Analysis Agency
AMTV	Armored Medical Treatment Vehicle
AoA	Analysis of Alternatives
AOR	Area of Responsibility
APAM	Anti-Personnel Anti-Materiel
APES	Advanced Protective Eyewear System
APFSDS-T	Armored Piercing Fin Stabilized Discarding Sabot-Tracer
APO	Army Procurement Objective
APOD	Air Ports of Debarkation
APS	Army Prepositional Sets
AQF	Advanced QUICKFIX
AQL	Advanced QUICKLOOK
ARF	Airborne Relay Facility
ARFOR	Army Force
ARI	Aviation Restructure Initiative
ARL	Airborne Reconnaissance-Low
ARNG	Army National Guard
ARSOF	Army Special Operations Forces
ART	Advanced Rotorcraft Transmission
ASAS	All Source Analysis System
ASE	Aircraft Survivability Equipment
ASEDP	Army Space Exploitation Demonstration Program
ASET	Aircraft Survivability Equipment Trainer
ASIOE	Associated Support Items of Equipment
ASSTC	Advanced Surgical Suite for Trauma Care
AST	Army Secure Terminal
ASTAMIDS	Airborne Standoff Minefield Detection System
ASTMP	Army Science and Technology Master Plan
ASV	Armored Security Vehicle
ATA	Army Technical Architecture
ATACMS	Army Tactical Missile System
ATC	Air Traffic Control
ATCCS	Army Tactical Command and Control System
ATD	Advanced Technology Demonstration
ATM	Asynchronous Transfer Mode
ATNAVICS	Air Traffic Navigation, Integration, and Coordination System
ATS	Air Traffic Services
AUTODIN	Automatic Digital Network
AVCATT	Aviation Combined Arms Tactical Trainer
AVIM	Avionics Intermediate Maintenance
AVLB	Armored Vehicle Launched Bridge
AVTOC	Aviation Tactical Operations Centers
AWE	Advanced Warfighting Experiment
AWIC	Army WWMCCS Information System

AWR	Army War Reserve
AWSS	Area Weapons Scoring System
BAT	Brilliant Anti-Armor Submunition
BBS	Brigade and Battalion Simulation
BC2	Battlespace Command and Control
BCIS	Battlefield Combat Identification System
BCTP	Battle Command Training Program
BDA	Battle Damage Assessment
Bde	Brigade
BFA	Battlefield Functional Area
BFIST	Bradley Fire Support Vehicle
BFV	Bradley Fighting Vehicle
BIDS	Biological Integrated Detection System
BIDSS	Biological Integrated Detection Simulation System
BIT/BITE	Built-In Test Equipment
BITS	Battlefield Information Transmission System
BLWE	Battle Laboratory Warfighting Experiment
BM/C4I	Battle Management/Command, Control, Communications, Computers, and Intelligence
BMDO	Ballistic Missile Defense Organization
BMP	Soviet Vehicle Nomenclature
Bn	Battalion
BOIP	Basis of Issue Plan
BOS	Battlefield Operating System
BRAT	Beyond Line of Sight Reporting and Targeting
BSFV	Bradley Stinger Fighting Vehicle
BSM	Battlefield Spectrum Management
BST	Basic Skills Trainer
C2	Command and Control
C2TL	Commercial Communications Technology Test Lab
C2V	Command and Control Vehicle
C2W	Command and Control Warfare
C3	Command, Control, and Communications
C3I	Command, Control, Communications, and Intelligence
C4	Command, Control, Communications, and Computers
C4I	Command, Control, Communications, Computers, and Intelligence
CADEWS	Counter Air Directed Energy Weapon System
CAM	Chemical Agent Monitor
CASS	Common Applications Support Software
CATT	Combined Arms Tactical Trainer
CB	Chemical Biological
CBMS	Chemical Biological Mass Spectrometer
CBPS	Chemical Biological Protective Shelter
CBS	Corps Battle Simulation
CCTT	Close Combat Tactical Trainer

CDL	Common Data Link
CEP	Circular Error Probability
CFF	Centralized Funding and Fielding
CGS	Common Ground Station
CHALS-X	Communications High Accuracy Location System-Expanded
CHATS	Counterintelligence/Human Intelligence Automated Tool Set
CHS	Common Hardware/Software
CHS	Combat Health Support
CI	Counterintelligence
CIBS-M	Common Integrated Broadcast Service Module
CIDDS	Combat Identification for Dismounted Soldiers
CIE	Clothing and Individual Equipment
CINC	Commander in Chief
CIRCE	Countermobility Remote Control System
CIS	Chemical Imaging Sensor
CITV	Commander's Independent Thermal Viewer
CM	Cruise Missile
CMTC	Combat Maneuver Training Center
CNR	Combat Net Radio
COFT	Conduct of Fire Trainer
COLT	Combat Observation Lasing Team
COMINT	Communications Intelligence
COMSEC	Communications Security
CONUS	Continental United States
COTS	Commercial Off-the-Shelf
CP	Command Post
CP	Counterproliferation
CPDEPMEDS	Collective Protection Deployable Medical System
CPE	Collective Protection Equipment
CPG	Co-Pilot/Gunner
CPT	Cockpit Procedures Trainer
CROP	Container Roll-On/Off Platform
CS	Combat Support
CSH	Combat Support Hospital
CSS	Combat Service Support
CSSCS	Combat Service Support Control System
CSSTSS	Combat Service Support Tactical Simulation System
CSTAT	Critical Care Support for Trauma and Transport
CSTG	Cockpit/Sensor/Turret Gun
CTAPS	Contingency Theater Automated Planning System
CTC	Combat Training Center
CTT/JTT	Commander's Tactical Terminal/Joint Tactical Terminal
CUCV	Commercial Utility Cargo Vehicle
DAC	Department of the Army Civilians
DAMA	Demand Assigned Multiple Access

DAMPL	Department of the Army Master Priority List
DARO	Defense Airborne Reconnaissance Office
DARPA	Defense Advanced Research Projects Agency
DBC	Digital Battlefield Communications
DCP	Defense Cryptologic Program
DCS	Defense Communications System
DENS	Directed Energy Neutralization System
DEPMEDS	Deployable Medical System
DFL	Direct Fire Lethality
DII COE	Defense Information Infrastructure Common Operating Environment
DIS	Distributed Interactive Simulation
DISE	Distribution Illumination System Electric
DISN	Defense Information Systems Network
Div	Division
DL	Distance Learning
DMS	Defense Messaging System
DMSP	Defense Meteorological Satellite Program
DNBI	Disease and Non-Battlefield Injury
DOCS	DSCS Operation Control System
DoD	Department of Defense
DOW	Died of Wounds
DPG	Defense Planning Guidance
DSC	Digital Source Collector
DSCS	Defense Satellite Communications System
DSP	Defense Support Program
DTED	Digital Terrain Elevation Data
DTES	Division Tactical Exploitation System
DTSS	Digital Topographic Support System
DVE	Driver's Vision Enhancer
EA	Electronic Attack
EAC	Echelons Above Corps
EAD	Echelons Above Division
EBC	Embedded Battle Command
ECU	Environmental Control Unit
EFOGM	Enhanced Fiber Optic Guided Missile
EHF	Extremely High Frequency
EIP	Enhanced Incendiary Projectile
ELINT	Electronic Intelligence
EMD	Engineering and Manufacturing Development
EO	Electro-Optic
EOC	Early Operational Capability
EOD	Explosive Ordnance Disposal
EPA	Extended Planning Annex
EPLRS	Enhanced Position Locating and Reporting System

EPP	Extended Planning Period
ERA	Explosively Reactive Armor
ER-G	Extended Range-Guided
ERM	Extended Range Munition
ER-MLRS	Extended Range MLRS
ESE	Engineer Support Equipment
ESM	Electronic Support Measure
ESP	Extended Service Program
EST	Engagement Skills Trainer
ETES	Enhanced Tactical Exploitation System
ETRAC	Enhanced Tactical Radar Correlator
EUL	Economic Useful Life
EXFOR	Experimental Force
F/IIFS	Flame/Incendiary Indirect Firing System
FA	Field Artillery
FA	Functional Area
FAA	Functional Area Assessment
FAA	Federal Aviation Administration
FAADC2	Forward Area Air Defense Command and Control
FAADS	Forward Area Air Defense System
FAASV	Forward Area Ammunition Supply Vehicle
FBCB2	Force XXI Battle Command, Brigade and Below
FCR	Fire Control Radar
FCS	Future Combat System
FCS	Fire Control System
FDA	Food and Drug Administration
FDC	First Digitized Corps
FDD	First Digitized Division
FDR	Future Data Radio
FDSW	Future Direct Support Weapon
FED	Forward Entry Device
FINL	Flame, Incendiary, and Nonlethal
FIS-C	Firefighter Integrated Suit-Combat
FISTV	Fire Support Team Vehicle
FIV	Future Infantry Vehicle
FLIR	Forward Looking Infrared
FLOT	Forward Line of Troops
FLTSATCOM	Fleet Satellite Communications
FMBT	Future Main Battle Tank
FMTV	Family of Medium Tactical Vehicles
FOA	Field Operating Agency
FOC	Full Operational Capability
FOFT	Force-on-Force Trainer
FORSCOM	Forces Command
FOTT	Follow On To Tow

FOV	Family of Vehicles
FP	Force Package
FS	Fire Support
FSAPS	Full Spectrum Active Protection System
FSCATT	Fire Support Combined Arms Tactical Trainer
FSCS	Future Scout Cavalry System
FST	Forward Surgical Team
FTI	Fixed Target Indicator
FTT	Field Tactical Trainer
FUE	First Unit Equipped
FUR	Future Utility Rotorcraft
FW	Fixed Wing
FY	Fiscal Year
G/VLLD	Ground/Vehicular Laser Locator Designator
GARD	Generation Advanced Rotor Demonstration
GBCS	Ground Based Common Sensor
GBS	Global Broadcast Service
GCCS	Global Command and Control System
GCCS-A	Global Command and Control System Army
GEM	Guided Enhanced Missile
GLPS	Gun Laying and Positioning System
GMG	Grenade Machine Gun
GMLRS	Guided MLRS
GPS	Global Positioning System
GRCS	GUARDRAIL Common Sensor
GSE	Ground Support Equipment
GSM	Ground Station Module
GSTAMIDS	Ground Standoff Mine Detection System
GUARDFIST	Guard Unit Armory Device Full Crew Interactive Simulation Trainer
HAB	Heavy Assault Bridge
HACT	Helicopter Active Controls Technology
HCLOS	High-Capacity Line of Sight
HDSB	Heavy Dry Support Bridge
HEMTT	Heavy Expanded Mobility Tactical Truck
HET	Heavy Equipment Trailer
HGSS	Hellfire Ground Support System
HIMARS	High Mobility Artillery Rocket System
HLA	High-Level Architecture
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HMT	High Mobility Trailer
HPT	High Payoff Targets
HQDA	Headquarters, Department of the Army
HS-IS	Home Station Instrumentation
HSTAMIDS	Handheld Standoff Mine Detection System

HT	Heavy Terminal
HTI	Horizontal Technology Integration
HUMINT	Human Intelligence
IBAD	Integrated Biological Agent Detector
IBAS	Improved Bradley Acquisition System
IBS	Intelligence Broadcast System
ICAM	Improved Chemical Agent Monitor
ICBM	Intercontinental Ballistic Missile
ICH	Improved Cargo Helicopter
ICOFT	Institutional Conduct of Fire Trainer
ICS3	Integrated Combat Service Support System
IDM	Improved Data Modem
IED	Improvised Explosive Devices
IETM	Integrated Electronic Technical Manual
IEW	Intelligence and Electronic Warfare
IEWTPT	Intelligence/Electronic Warfare Tactical Proficiency Trainer
IFSAS	Initial Fire Support Automation System
IGRV	Improved GUARDRAIL V
IHADS	Integrated Headgear and Display System
IHAS	Integrated Helmet Assembly Subsystem
IMETS	Integrated Meteorological System
IMINT	Imagery Intelligence
INFOSEC	Information Security
IO	Information Operations
IOC	Initial Operational Capability
IOT&E	Initial Operational Test and Evaluation
IP	Internet Protocol
IPB	Intelligence Preparation of the Battlefield
IPE	Individual Protective Equipment
IPF	Integrated Processing Facility
IPR	In Progress Review
IR	Infrared
IRB	Improved Ribbon Bridge
ISC	Information Systems Command
ISDN	Integrated Services Digital Network
ISL	Installation Sequence List
ISO	International Standards Organization
ISYSCON	Integrated System Control
IT	Information Technology
ITAP	Improved Toxicological Agent Protective
ITAS	Improved Target Acquisition System
IVIS	Intervehicular Information System
IVMMD	Interim Vehicle Mounted Mine Detector
JBPDS	Joint Biological Point Detection System
JBREWS	Joint Biological Remote Early Warning System

JBUDS	Joint Biological Universal Detector System
JCAD	Joint Chemical Agent Detector
JCMT	Joint Collection Management Tools
JCPIP	Joint Collective Protection Improvement Program
JDISS	Joint Deployable Intelligence Support System
JHSS	Joint Health Service Support
JLENS	Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System
JLOTS	Joint Logistics-Over-the-Shore
JPL	Joint Propulsion Laboratory
JRTC	Joint Readiness Training Center
JSAF	Joint SIGINT Avionics Family
JSAM	Joint Service Aviation Mask
JSAWM	Joint Service Agent Water Monitor
JSGPM	Joint Service General Purpose Mask
JSIMS	Joint Simulation System
JSLIST	Joint Service Lightweight Integrated Suit Technology
JSLSCAD	Joint Service Lightweight Standoff Chemical Agent Detector
JSTARS	Joint Surveillance Target Attack Radar System
JSWILD	Joint Service Warning & Identification LIDAR Detector
JTA	Joint Tactical Architecture
JTAGS	Joint Tactical Ground Station
JTF	Joint Task Force
JTIDS	Joint Tactical Information Distribution System
JTR	Joint Tactical Radio
JTR	Joint Transport Rotorcraft
JWARN	Joint Warning and Reporting Network
JWID	Joint Warfighting Interoperability Demonstration
KE	Kinetic Energy
KIA	Killed-in-Action
LADAR/IR	Laser Radar/Infrared
LAM GHQX	Louisianna Maneuvers General HQ Exercise
LAN	Local Area Network
LANDSAT	Land Satellite
LAV	Light Armored Vehicle
LBA	Longbow Apache
LBSS	Low Band Subsystem
LCM	Landing Craft Mechanized
LCT	Longbow Crew Trainer
LCTS	Longbow Crew Trainer System
LCU	Landing Craft Utility
LDR	Low Data Rate
LDTOC	Light Digital Tactical Operations Center
LHS	Load Handling System
LIDAR	Light Detection and Ranging

LLDR	Lightweight Laser Designator/Rangefinder
LLR	Low-Level Radiation
LMTV	Light and Medium Tactical Vehicle
LNBCRS	Lightweight NBC Reconnaissance System
LOC	Line of Communication
LOS	Line-of-Sight
LOSAT	Line of Sight Anti-tank
LOTS	Logistics-Over-the-Shore
LPI/LPD	Low Probability of Intercept/Low Probability of Detection
LRAS3	Long-Range Advanced Scout Surveillance System
LRBSDS	Long Range Biological Standoff Detection System
LR-BSDST	Long Range Biological Standoff Detection System Trainer
LRF	Laser Range Finder
LRIP	Low Rate Initial Production
LSV	Logistics Support Vessel
LT	Light Terminal
LTV	Light Tactical Vehicle
LUH	Light Utility Helicopter
LVOSS	Light Vehicle Obscuration Smoke System
LVRS	Lightweight Video Reconnaissance System
LW	Land Warrior
M3P	Multi-Mission Processor
MACOM	Major Command
MACS	Modular Artillery Charge System
MANPADS	Manportable Air Defense System
MANPRINT	Manpower and Personnel Integration
MAT	Multimode Airframe Technology
MAVWEST	Multiplex, Armament, Visionics, Weapons, Electrical Systems Trainer
MBA	Modular Body Armor
MC4	Medical Communications for Combat Casualty Care
MCOFT	Mobile Conduct of Fire Trainer
MCPT	Modular Command Post Tent
MCS	Maneuver Control System
MCS/P	Maneuver Control System/Phoenix
MDR	Medium Data Rate
MDS	Modular Decontamination System
MDT	Medical Detachment Telemedicine
MEADS	Medium Extended Air Defense System
MEDEVAC	Medical Evacuation
MELB	Mission Enhancement Little Bird
MELIOS	Mini Eyesafe Laser Infrared Observation Set
MEP	Marine Enhancement Program
MEPCOM	Military Enlistment Processing Command
MES	Medical Equipment Set

METL	Mission Essential Task List
METT-T	Mission, Enemy, Terrain and Troops- Time
MF2K	Medical Force 2000
MFCS	Mortar Fire Control System
MFOM	MLRS Family of Munitions
MGB	Medium Girder Bridge
MHE	Materiel Handling Equipment
MI	Military Intelligence
MICAD	Multipurpose Integrated Chemical Agent Detector
MIES	Modernized Imagery Exploitation System
MILES	Multiple Integrated Laser Engagement System
MILSATCOM	Military Satellite Communications
MILSTAR	Military Strategic Tactical Relay
MINTERM	Miniature Terminal
MISSI	Multilevel Information Systems Security Initiative
MITT	Mobile Integrated Tactical Terminal
MLRS	Multiple Launch Rocket System
MLS	Multilevel Security
MMG	Medium Machine Gun
MMIC	Monolithic Microwave Integrated Circuit
MMS	Meteorological Measuring System
MMW	Millimeter Wave
MNVD	Monocular Night Vision Device
MOFA	Multi-Option Fuze, Artillery
MOPMS	Modular Pack Mine System
MOPP	Mission Oriented Protective Posture
MOTS	Mobile Tower System
MOUT	Military Operations in Urban Terrain
MP	Military Police
MPIM	Multipurpose Individual Munition
MR	Medium Range
MRBM	Medium Range Ballistic Missile
MRI	Medical Reengineering Initiative
MSAC	Medical Situation Awareness Control
MSE	Mobile Subscriber Equipment
MSR	Missile Simulation Round
MSTAR	MLRS Smart Tactical Rocket
MT	Medium Terminal
MTA	Major Training Area
MTBF	Mean Time Between Failures
MTI	Moving Target Indicator
MTOE	Modified Table of Equipment
MTW	Major Theater War
MVS	Muzzle Velocity System
MWS	Modular Weapons System

NAC	National Automotive Center
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NAVWAR	Navigation Warfare
NBC	Nuclear, Biological, and Chemical
NBCRS	NBC Reconnaissance System
NCF	Network Control Facility
NDI	Non-Developmental Item
NGATS	New Generation Automated Targetry System
NGB	National Guard Bureau
NLOS	Non-Line-of-Sight
NMD	National Missile Defense
NMS	National Military Strategy
NOAA	National Oceanic and Atmospheric Administration
NPOESS	National Polar Orbiting Environmental Satellite System
NRO	National Reconnaissance Office
NTC	National Training Center
NTDR	Near Term Data Radio
NVD	Night Vision Device
NVG	Night Vision Goggles
O&M	Operations and Maintenance
O&O	Organization and Operations
O&S	Operating and Support
OCAR	Office of the Chief of Army Reserve
OCIE	Organizational Clothing and Individual Equipment
OCSW	Objective Crew Served Weapon
ODS	Operation Desert Shield/Storm
OFSA	Objective Family of Small Arms
OICW	Objective Individual Combat Weapon
OMA	Operations and Maintenance Account
OPFOR	Opposing Force
OPTEMPO	Operation Tempo
ORD	Operational Requirements Document
OSA	Operational Support Airlift
OSD	Office of the Secretary of Defense
OSI	Open Systems Interconnection
OSV	OPFOR Surrogate Vehicle
OTN	Own the Night
P&D	Potency and Dated
P3I	Preplanned Product Improvement Program
PAC-2/3	Patriot Advanced Capability-2/3
PATS	Protection Assessment Test Set
PATRIOT	Phased-Array Tracking-Radar Intercept-on-Target
PCOFT PDB	Patriot Conduct of Fire Trainer Post Deployment Build

PCS	Personal Communications Service
PEM	Proton Exchange Membrane
PEO	Program Executive Office
PGS	Precision Gunnery System
PI	Product Improvement
PIC	Personal Information Carrier
PIMIT	Patriot Intermediate Maintenance Trainer
PIP	Product Improvement Program
PLRS	Position Locating and Reporting System
PLGR	Precision Location GPS Receiver
PLS	Palletized Loading System
PLS-E (MTS)	PLS-Enhanced, Movement Tracking System
POES	Polar Orbiting Environmental Satellites
POM	Program Objective Memorandum
POMT PDB	Patriot Organizational Maintenance Trainer Post Deployment Build
PoP	Proof of Principle
POS/NAV	Position Navigation
PPC4I	Power Projection Command, Control, Communications, and Computers Infrastructure
PPSB	Power Projection Sustaining Base
PREPO	Pre-positioned
PVNTMED	Preventive Medicine
QDR	Quadrennial Defense Review
R&D	Research and Development
R3	Refit, Replace, Retire
R3D2S	Rearming, Remote, Refueling, Deployable Distribution System
RAS	Rail Adapter System
RC	Reserve Component
RDA	Research, Development, and Acquisition
RDEC	Research, Development, and Engineering Center
RDTE	Research, Development, Test, and Evaluation
RETS	Remoted Target System
RF	Radio Frequency
RFI	Radio Frequency Interferometer
RFPI	Rapid Force Projection Initiative
RISE	Reliability Improvement Selected Equipment
RISTA	Reconaissance, Intelligence, Surveillance, and Target Acquisition
RMP	Reprogrammable Microprocessor
ROWPU	Reverse Osmosis Water Purification Unit
RPA	Rotorcraft Pilot's Associated
RRDF	Roll-On/Roll-Off Discharge Facility
RSOI	Reception, Staging, Onward Movement and Integration
RSTA	Reconnaissance, Surveillance, and Target Acquisition
RSV	Resupply Vehicle
RTCC	Rough Terrain Container Crane

RTV	Rapid Terrain Visualization
RW	Rotary Wing
RWS	Rigid Wall Shelter
RWS	Remote Workstation
RWST	Rotary Wing Structures Technology
S&T	Science and Technology
SA	Selective Availability
SADARM	Sense and Destroy Armor
SAL	Semi-Active Laser
SAR	Synthetic Aperture Radar
SATCOM	Satellite Communications
SAW	Squad Automatic Weapon
SAWE	Simulated Area Weapons Effects
SAWE-RF	Simulation of Area Weapons Effects-Radio Frequency
SBA	Strategic Brigade Airdrop
SBIRS	Space-Based Infrared System
SCAMP	Single Channel Anti-Jam Manportable
SDS	Sorbent Decontamination System
SE	Synthetic Environment
SECM	Shop Equipment-Contact Maintenance
SEMA	Special Electronic Mission Aircraft
SEP	Soldier Enhancement Program
SF	Special Forces
SHF	Super High Frequency
SHORAD	Short Range Air Defense
SICPS	Standard Integrated Command Post System
SIDS	Secondary Imagery Dissemination System
SIGINT	Signals Intelligence
SIGM2	Signal Mission Management
SIIRCM	Suite of Integrated IR Countermeasures
SIMLM	Single Integrated Medical Logistics Management
SINCGARS	Single Channel Ground and Airborne Radio System
SIP	System Improvement Program
SIRFC	Suite of Integrated RF Countermeasures
SITREPS	Situation Reports
SKO	Sets, Kits, and Outfits
SLD	Surface Liquid Detector
SLEP	Service Life Extension Program
SMART-T	Secure Mobile Anti-Jam Reliable Tactical Terminal
SMDC	Space and Missile Defense Command
SMS	Standard Maintenance System
SNS	Sniper Night Sight
SNS	Secure Network Server
SOA	Special Operations Aviation
SOF	Special Operations Forces

SP	Self-Propelled
SPEAR	Special Operations Forces Personal Equipment Advanced Requirements
SPOD	Sea Ports of Debarkation
SPORT	Soldier Portable On-Site Repair Tool
SPOT	Satellite Pour l'Observation de la Terre
SR	Short Range
SRAW	Short Range Anti-tank Weapon
SRBM	Short Range Ballistic Missile
SRO	Strategic Research Objective
SSA	Staff Support Activity
SSC	Smaller-Scale Contingency
SSEP	System Safety Enhancement Program
STACCS	Standard Theater Army Command and Control System
STAFF	Smart Target Acquisition Fire and Forget
STAMIS	Standard Army Management Information System
STAR-T	SHF Tri-Band Advanced Range Extension Terminal
STB	Supertropical Bleach
STC	Slew-to-Cue
STEP	Standardized Tactical Entry Point
STEPO	Self-Contained Toxic Environmental Protective Outfit
STO	Science and Technology Objective
STOW	Simulated Theater of War
STP	Space Test Program
SUSV	Small Unit Support Vehicle
SWS	Sniper Weapon System
TA	Target Acquisition
TAA	Total Army Analysis
TACAN	Tactical Air Navigation
TACCMS	Theater Automated Command and Control Information Management System
TACSATCOM	Tactical Satellite Communications
TACSIM	Tactical Simulation
TADS	Target Acquisition Designation Sight
TADSS	Training Aids, Devices, Simulators, and Simulations
TAIS	Tactical Airspace Integration System
TAP	The Army Plan
TBM	Theater Ballistic Missile
TCS	Tactical Control System
TD	Technology Demonstration
TDA	Table of Distribution and Allowance
TEL	Transporter Erector Launcher
TENCAP	Tactical Exploitation of National Capabilities
TES	Tactical Exploitation System
TESS	Tactical Engagement Simulation System

THAAD	Theater High Altitude Area Defense
TI	Tactical Internet
TIBS	Tactical Intelligence Broadcast System
TIH	Toxic Industrial Hazard
TIIP	Topographic Imagery Integration Prototype
TMAS	Tank Main Armament System
TMDE	Test Measurement Diagnostic Equipment
TOA	Total Obligation Authority
TOC	Tactical Operations Center
TOE	Table of Equipment
TOW	Tube Launched, Optically Tracked, Wire Command Link Guided Missile
TPF	Total Package Fielding
TPN	Tactical Packet Network
TPSO	Theater Precision Strike Operation
TPT	Troop Proficiency Trainer
TRADOC	Training and Doctrine Command
TRITAC	Tri-Service Tactical
TRIXS	Tactical Reconnaissance Intelligence Exchange System
TRRIP	Theater Rapid Response Intelligence Package
TSFO	Training Set Fire Observation
TTHS	Trainees, Transients, Holdees, and Students
TUAV	Tactical Unmanned Aerial Vehicle
TWGSS	Tank Weapons Gunnery Simulation System
TWS	Thermal Weapon Sight
TWV	Tactical Wheeled Vehicle
TWVRMO	Tactical Wheeled Vehicle Requirements Management Office
UAV	Unmanned Aerial Vehicle
UE	User Equipment
UFO	UHF Follow-On
UHF	Ultra High Frequency
ULLS-A	Unit Level Logistics System-Aviation
UMARK	Unit Maintenance Aerial Recover Kit
UMS	Universal Modem System
USAF	U.S. Air Force
USAFSPACOM	U.S. Air Force Space Command
USAR	U.S. Army Reserve
USAREC	U.S. Army Recruiting Command
USAREUR	U.S. Army, Europe
USFK	U.S. Forces Korea
USMC	U.S. Marine Corps
UXO	Unexploded Ordnances
VE	Virtual Environment
VEESS	Vehicle Engine Exhaust Smoke System
VMS	Vehicle Management System

WAM	Wide Area Munitions
WAN	Wide Area Network
WARSIM	Warfighter's Simulation
WIM	WARSIM Intelligence Model
WIN	Warfighter Information Network
WMD	Weapons of Mass Destruction
WPSM	Warfighter Physiological Status Monitor
WRAP	Warfighting Rapid Acquisition Program
WSM	Warfighter Status Monitor
WWMCCS	Worldwide Military Command and Control System