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THESIS

A HISTORICAL SUMMARY OF THE ARMORED SYSTEMS MODERNIZATION PROGRAM AND THE LESSONS LEARNED FROM ITS INTERACTION WITH THE ACQUISITION ENVIRONMENT

by

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June 1992

Thesis Advisor: Thomas H. Hoivik

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The Armored Systems Modernization (ASM) Program's acquisition environment directly contributed to and was the principal cause of major program modifications and revisions. Determination of the factors that produced program changes and an understanding of their impact provide the basis for important insights and add to acquisition manager's body of knowledge.

This thesis develops a composite summary of the ASM program, determines the significant acquisition related environmental factors that affected it, and explains how these influences altered ASM Program outcomes. Based upon the historical research and analysis, lessons learned applicable to Army acquisition programs in general are provided. Key lessons learned indicate that periodic programmatic reassessment of both internal and external environmental factors should be conducted to ensure that programs are aligned

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A Historical Summary of the Armored Systems Modernization Program and the Lessons Learned from its Interaction with the Acquisition Environment

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Submitted in partial fulfillment
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I. INTRODUCTION

A. PURPOSE

The purpose of this thesis is to develop a composite summary of the Armored Systems Modernization (ASM) Program, determine the significant acquisition related environmental factors that affected it, and explain how these influences altered ASM Program outcomes. Based upon the historical research and analysis, lessons learned and insights applicable to Army acquisition programs in general are provided.

B. BACKGROUND

The ASM Program represented the Army's modernization master plan for its combined arms combat systems. The principal goal of ASM was to significantly increase force effectiveness through the synergistic impact achieved by employing an armored "family" of vehicles. The vehicle family was based upon innovative, non-traditional, leading-edge design and development concepts and was to be produced using a tailored acquisition strategy. This fleet of vehicles was expected to result in substantial cost savings, programmatic economies, and organizational efficiencies. Due to program changes precipitated by a fluctuating acquisition environment, ASM was totally restructured, negating many of its stated advantages and benefits.

C. THESIS OBJECTIVES

This thesis research topic developed through discussions with the Program Executive Office(r) (PEO), Armored Systems Modernization (PEO-ASM). PEO-ASM expressed an interest in the compilation of key defining elements in the ASM Program experience, indicating that it would provide them with a useful resource and reference. During the discussions, PEO-ASM observed that ASM's acquisition environment directly contributed to and was the primary cause behind program modifications and revisions. The PEO believed that determination of the specific factors causing the changes and an understanding of their impact upon ASM would yield important insights and lessons learned which could then be applied to future Army acquisition programs.

To achieve these objectives, this thesis has constructed a historical summary of the ASM Program, from its origins in the pre-ASM studies through the major restructuring efforts conducted in late 1991. The thesis has also identified the major acquisition related environmental factors affecting the program and proposes a set of lessons learned which are applicable to Army program management in general.

D. RESEARCH QUESTIONS

1. Primary Research Question

Based on a historical summary of the ASM Program, what common lessons learned can be derived from an analysis

of acquisition related environmental factors over the life of the program?

2. Subsidiary Research Questions

A. What principal and ancillary events and activities contributed to the inception and evolution of ASM from late 1979 through the December 1991?

B. Identify the major acquisition related environmental factors that resulted in modifications and revisions to ASM Program strategy and planning?

C. What affect did these major factors have on ASM outcomes?

D. What insights and lessons learned, applicable to Army acquisition programs in general, can be derived from the affects of the acquisition environment on ASM?

E. RESEARCH SCOPE AND LIMITATIONS

The history of ASM has been marked by complex interactions between the unmistakable influences of the acquisition environment and the program's strategy. This thesis is primarily concerned with those acquisition related environmental factors which have resulted in the alteration of the program's original and subsequent strategies. Those environmental factors not significantly related to major ASM revisions will not be covered.

Various aspects of ASM programmatics, threat assessments, and other associated factors were based on restricted or classified data. In order to maintain an unclassified thesis, specific restricted and/or classified decision criteria are not discussed. Additionally, some documents that might have provided additional insights into

program decisions were not available due to limited distribution and/or the nature of their security classification.

Finally, this thesis does not represent any official position of Congress, the Office of the Secretary of Defense (OSD), or the Department of the Army (DA). The information and data presented represents the author's observations, interpretations, and conclusions. No inferences, either pro or con, should be drawn or attributed to any of the agencies mentioned.

F. RESEARCH METHODOLOGY

Research for this topic consisted primarily of an in-depth literature review and interviews with DA civilian and military personnel. The literature review included pre-AFV studies and reports, DA and OSD AFV/Heavy Force Modernization (HFM)/ASM program documentation, briefing packets, and memoranda. Congressional Appropriations, Armed Services and Budget Committee hearing records and reports, General Accounting Office (GAO) reports, professional journal articles, and other pertinent written materials were also referenced.

Research travel was conducted to PEO-ASM (in Warren, Michigan), and to the offices of the Deputy Chief of Staff for Operations and Training (DCSOPS), and the Assistant Secretary of the Army for Research, Development, and Acquisition (ASARDA) (at the Pentagon, Washington, D.C.) for

personal interviews and the additional review of on-site references.

II. ARMORED SYSTEMS MODERNIZATION PROGRAM - HISTORICAL SUMMARY

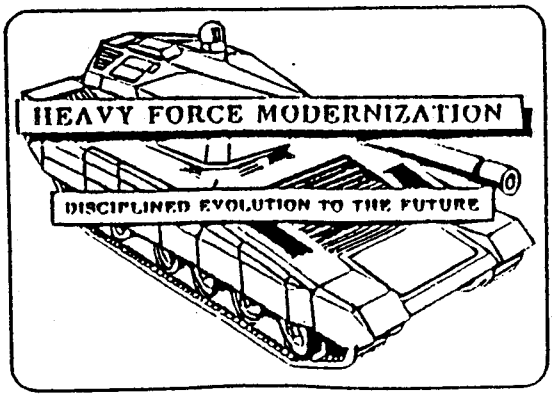
A. GENERAL

Three successive efforts (Figure 1) comprised the overall Armored Systems Modernization (ASM) Program. ASM consisted of the Armored Family of Vehicles Task Force (AFVTF), the Heavy Force Modernization (HFM) Program, and the ASM Acquisition Program.

The historical summary of the ASM Program is divided into two segments. The first segment, beginning, in late 1979, reviews the inception and evolution of ASM concepts and baselines. It primarily discusses the Phase I and II, AFVTF efforts. The second segment, beginning in January 1988, reviews the transition to the HFM Program, the conversion to the ASM Acquisition Program, and subsequent development through December 1991.

B. EVOLUTION OF THE ARMORED FAMILY OF VEHICLES CONCEPT (1979-1988)

This first segment encompasses the formulation and development of the Armored Family of Vehicles (AFV) concept. The AFV effort involved detailed research, analysis, and mandated the start of the complicated program planning and milestone review, documentation process. The AFV concept work involved a substantial investment of time, talent, and



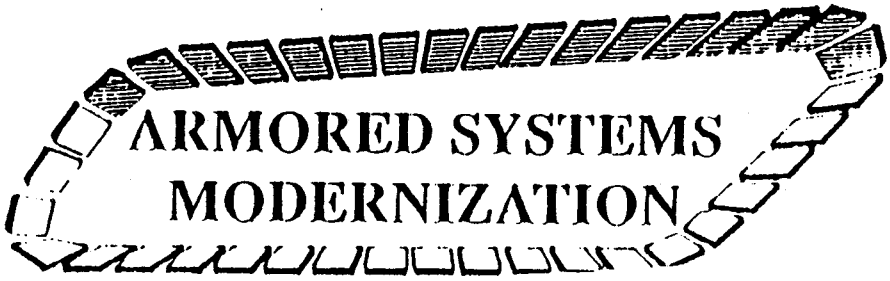


Figure 1. Task Force/Program Letterheads

effort by the Army's research, development, and acquisition (RD&A) and force development communities.

Initial efforts were primarily conducted by the AFVTF but the assistance of other Army commands, most notably the Training and Doctrine Command (TRADOC), the Tank and Automotive Command (TACOM), and the Army Material Command (AMC), were instrumental in achieving an acceptable AFV concept. AFVTF's collaboration with the AirLand Battle - Future study groups and the Armor/Anti-Armor Special Study Group were also vital to realizing the approved concept.

The efforts of organizations committed to the AFV concept definition process were regularly guided by a series of reviews during the Phase II studies. These concept reviews were attended by senior Army leaders and staff who introduced their thoughts, ideas, and concerns into the process. These reviews helped to direct the work of the task force and establish AFV concept parameters. When the approved AFV concept transitioned to program status, it was based on the corporate consensus of the senior Army leadership and had wide support across the Army. Throughout this first segment, ASM remained largely untouched by the pressures and stresses of the external acquisition environment (Table I).

Table I - Event Timeline (1979-1989)

- 1979-85 - Related group studies;
- OCT 1985 - CSA charters AFV effort; draft O&O plan;
- JAN 1986 - AFVTF established and Phase I studies begin (with an unconstrained, revolutionary focus);
- AUG 1986 - AFV JMNS and Milestone 0 approval;
- SEP 1986 - Phase I industry contracts awarded;
- AUG 1987 - Phase I brief-out and AFVTF Phase II authorized;
- SEP 1987 - AFVTF charter updated and Phase II studies begin (with a constrained, evolutionary focus), ALB-F(H) studies begin;
- OCT 1987 - ALB-F studies begin;
- NOV 1987 - 1st RRC (memorandum in lieu of meeting),
- JAN 1988 - AFV RD&A funding reduced (held in Tech Base);
- FEB 1988 - 2nd RRC;
- MAR 1988 - FMSWG meeting, A3STF studies begin;
- APR 1988 - 3rd RRC;
- MAY 1988 - TRADOC redefines Package I;
- JUN 1988 - AFVTF/A3STF collaboration;
- AUG 1988 - 4th RRC and Tank Review program;
- SEP 1988 - 5th RRC and AFV decision review;
- OCT 1988 - CSC AFV strategy review;
- NOV 1988 - Phase II industry Contracts awarded;
- JAN 1989 - AFVTF/HFM transition begins;
- APR 1989 - AFVTF Phase II ends, HFM program begins.

1. Early Conceptual Studies (1979-1984)

The current ASM acquisition program is the direct descendant of a series of related Army analytical research and study efforts which began in late 1979 and continued through 1985 (Table II). The focus of this group of related studies was primarily to determine Army operational shortcomings and armored, ground combat system deficiencies. The objective of these studies was to evaluate and determine operational and organizational solutions and strategies for correcting the problems.

Table II - Related Study Groups

Study Group	Date Convened
• Armored Combat Vehicle Technology (ACVT)	MARCH 1979
• Future Close Combat Vehicle Study (FCCVS)	FEBRUARY 1980
• Tank Armament Review Group (TARG)	JANUARY 1981
• Army Tank Program Analysis (ATPA)	JULY 1981
• Future Armored Combat System (FACS)	JANUARY 1982
• Special Study Group, Armor (SSGA)	JANUARY 1983
• Armor Investment Strategy (AIS) Group	APRIL 1983
• Armored Combat Vehicle, Science Technology (ACVST)	AUGUST 1983
• Platform Modernization Program (PMP)	MARCH 1984
• Defense Science Board (DSB) - Armor/ Anti-Armor Study	JUNE 1984

One central theme that repeatedly received the attention of these study groups was that of an armored family of vehicles. Employment of a vehicle family appeared to resolve many of the shortcomings and weaknesses that were being assessed in the research. The Army had long recognized the advantages and utility of planning and developing a fleet of vehicles that stressed maximum chassis and component commonality. Although this was not a new concept, development and procurement of a vehicle family entailed a major departure from the Army's traditional item-by-item development process and its "by eaches" approach (one type of vehicle at a time) to systems procurement. This, however, had long been thought unachievable by Army leaders.

Army leaders and logisticians were also becoming concerned by the increasing proliferation of major armored vehicle components. In 1976, the Army's heavy armored force had

> ...five different armored vehicle chassis (consisting of hull, suspension, and drivetrain), five different types of track, three different engines, and four different transmissions. After ten years of modernization [(through 1986)], the counts increased to eight different chassis (with 17 different hull designs), eight different track designs, five different engines (with 14 different propulsion system configurations) and eight different transmissions. [Ref. 1] (Figure 2)

COMPONENT REDUCTION

VEHICLE	ENGINE	TRANSMISSION	TRACK	SUSPENSION	ELECTRONICS
CURRENT					
M1A1 TANK	AGT-1500	XT-1100-3B	T-158	UNIQUE TORSION	UNIQUE
M2A2 BFVS	VTA-903	HMPT-500-3	T-157	UNIQUE TORSION	UNIQUE
M728 CEV	AVDS-1790-2D	CD-850-6A	T-142	UNIQUE TORSION	UNIQUE
M109 HOW	8V71T	XGT-411	T-136	M109 TORSION	UNIQUE
M901 ITV	6V53T	XT-100	T-130	UNIQUE TORSION	UNIQUE
M929 FAASV	8V71T	XGT-411	T-136	M109 TORSION	UNIQUE
TOTAL	5	5	5	5	5
HFM					
BLOCK III FIFV CMV AFAS LOSAT FARV-A	HFM-HEAVY ↓ VTA-903	HFM-HEAVY ↓ HMPT-500-3	HFM-H ↓ T-157	HFM-HEAVY ↓ BFVS TORSION	SAVA ↓
TOTAL	②	②	②	②	①

Figure 2. Family Concept: Component Reduction

In addition to the expansion of chassis and automotive components, other vehicle system components were also growing; the opportunity to capitalize upon any form of vehicle system commonality was quickly being lost.

Development of a vehicle family provided the Army with the chance to reverse this trend. Combined with the conclusions of the study groups, the concerns of the logisticians helped the notion of system commonality and the family of vehicles gain favor within Army combat development and the RD&A communities.

a. Special Study Group, Armor

In 1984, the Special Study Group, Armor (SSGA) reached the conclusion that it would be substantially more cost effective to combine vehicles into a common family rather than field unique systems. SSGA maintained that the item-by-item process resulted in a "stovepiped" (Figure 3) development process and didn't lend itself to future across-the-force (total force) requirements. In the stovepipe process, individual systems were planned from the bottom-up rather than using a top-down approach. This bottom-up method integrated an already existing baseline chassis with a specific mission module. While this method resulted in the rapid development and fielding of required systems, the design based trade-offs inherent in this process frequently yielded sub-optimized systems. The operational

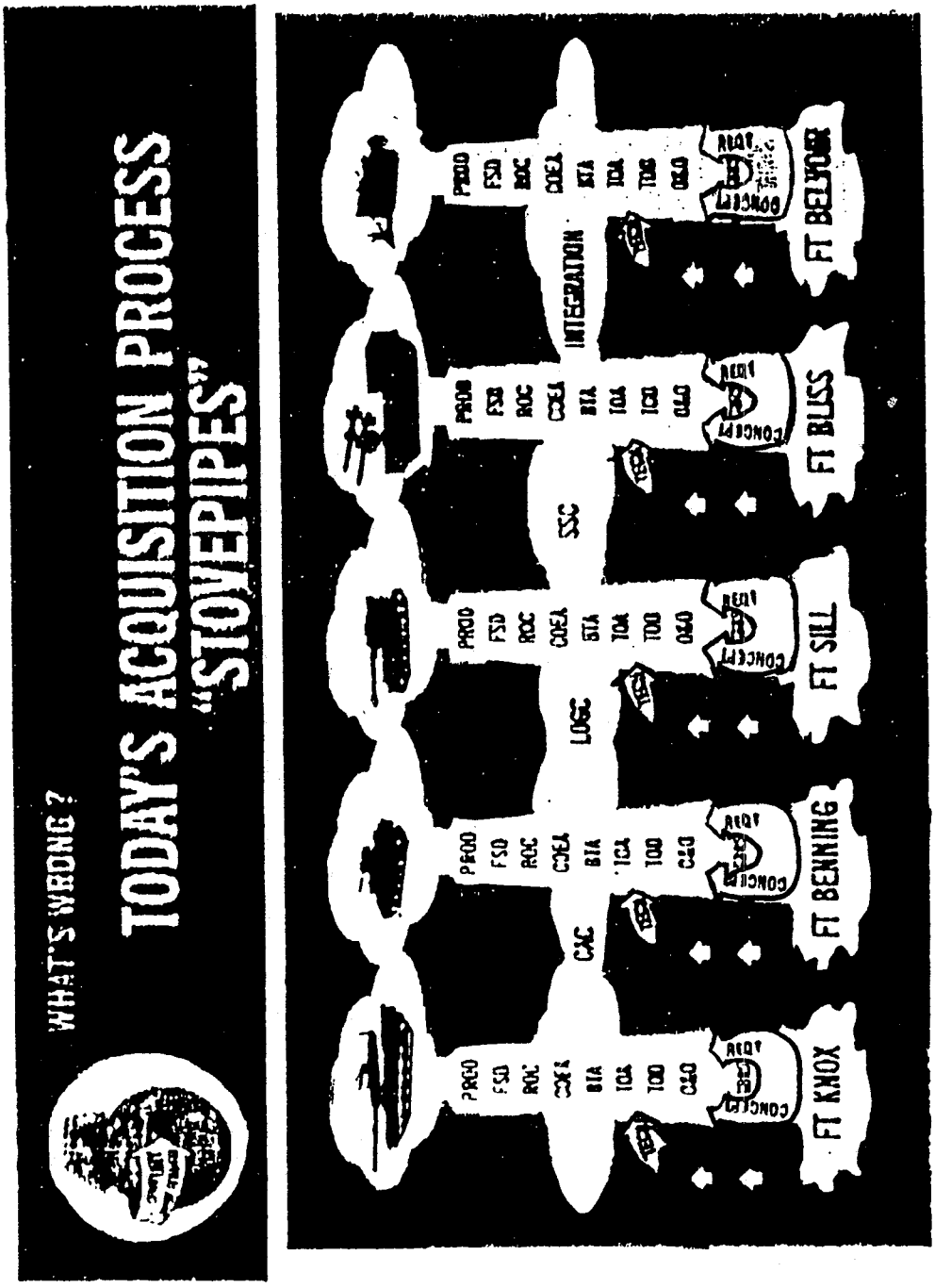


Figure 3. "Stovepiped" Acquisition Process

effectiveness of these vehicles was often considered to be marginal by their commanders and crews.

The baseline chassis for the M113, Personnel Carrier provides an example of the bottom-up approach. Various types of mission module packages have been adapted to this chassis and produced over the last 25 years. Vehicles such as the M577 Command Carrier, the M548 Ammunition Carrier, the M901 Improved Tow Vehicle, and the M106 Mortar Carrier incorporate a number of design trade-offs which resulted from the bottom-up approach to development of these systems.

The SSGA study concluded that "...the Army's top leadership must demand common solutions from [its] developers [Ref. 2]". The "...success of [a] family of vehicles concept depends upon...[an] emphasis on common rather than unique solutions [Ref. 3]".

b. Defense Science Board

In 1985, the Defense Science Board's (DSB) Armor/Anti-Armor Study arrived at conclusions, regarding the Army's need to upgrade U.S. armored capabilities, that were similar to those of the previous studies. In commenting upon the status of Army combat system development and procurement, the DSB expressed that "U.S. ability to convert R&D to fielded systems lags [behind] Soviet performance by a wide margin.... [Ref. 4]" "...fault for this situation must be laid at the feet of the Services, OSD

[(Office of the Secretary of Defense)], and the Congress....for each in its [own] unique way has contributed to the problem [Ref. 5]". Commenting on the Army's inability to mount a credible response to ongoing Soviet modernization efforts, the DSB concluded that "...because we lack a coordinated focus, we are unable to realize the [battlefield] synergism which could be ours.... [Ref. 6]". The DSB concluded that future system acquisition should be proactive not reactive. "We need to catch up in [our operational] capabilities by bringing into being and fielding systems that will match the expected threat....not the fielded threat." [Ref. 7]

In their final report, DSB recommended that the Army "...initiate [the] development of an operational concept and requirements for a family of heavy, close-combat vehicles oriented around a future U.S. tank..." [Ref. 8]. "The design objectives [for the vehicle family] are to reduce operating and support costs by maximizing commonality... [Ref. 9]". Finally, the DSB "...strongly recommend[s] that the Chief of Staff of the Army charter a Task Force to develop [the] operational requirements and concepts for a future...family of...vehicles.." [Ref. 10]

2. Threat Assessment and Trends (1979-1988)

Since the late 1970s, intelligence sources warned that Soviet modernization of conventional, land based systems was rapidly eroding the scientific and technological superiority held by U.S. weapon systems. For years, U.S. technological superiority had provided a substantial counter to Soviet political and military aspirations but sophisticated threat weapon systems were beginning to be designed, developed, produced, and fielded in increasing numbers. Analysts studying Soviet armored vehicle technology and production capabilities cautioned that the numerically superior Soviets were quickly narrowing the quality gap (level of capability) between their systems and those of the U.S. The rate of technological closure caused some sources to speculate that the Soviets would achieve parity and possibly move ahead of the U.S. in certain critical armored vehicle technologies by the end of the 20th century. In the early 1980s, intelligence reports indicated that the Soviet Union was rapidly narrowing the qualitative lead that the U.S. had long held in science and technology (Figure 4).

a. Soviet Military Modernization

A persistent Soviet military build-up, guided by national priorities, strategic objectives, and operational concepts, had continued unabated since the 1950s. Emerging Soviet warfighting doctrine theorized that "...future wars

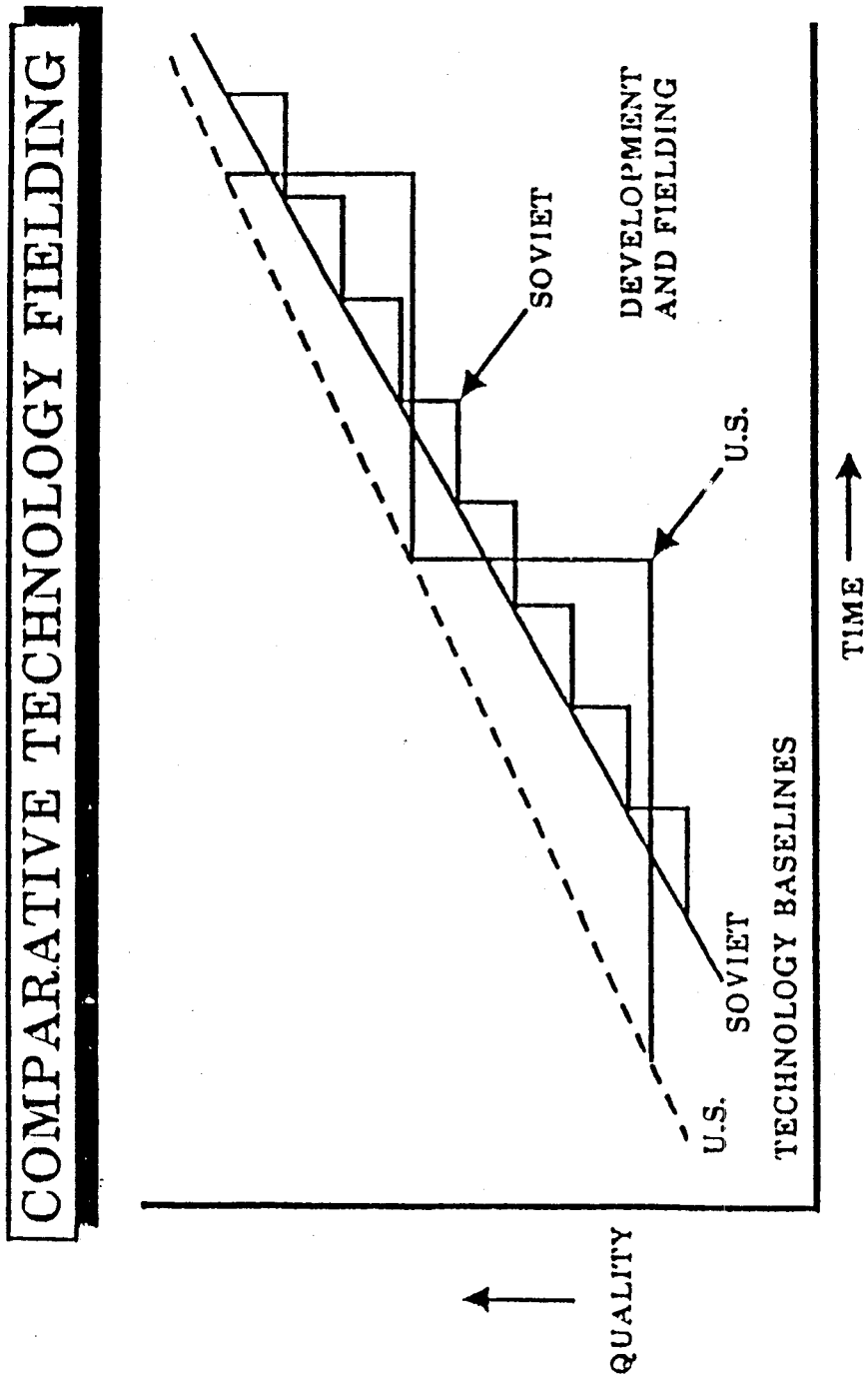


Figure 4. Narrowing of the US-Soviet Quality Gap - Projected

would be characterized by rapid and continuous maneuver, conducted over constantly changing battlefields... [Ref. 11]" and distinguished by "...many combat penetrations deep into enemy areas of operation... [Ref. 12]". Soviet doctrine emphasized heavy reliance on combined arms to achieve and exploit the deep penetrations into enemy areas of operation. These combined arms operations, in turn, stressed the use of massive armored thrusts to achieve these penetrations. Soviet dedication to this highly, maneuver-oriented doctrine is seen in the large numbers of armored vehicles in Soviet units. "Soviet tank divisions have approximately 328 tanks and a Motorized Rifle Division (MRD) has approximately 271. Both include combat and combat support units equipped with a wide variety of other types of armored vehicles [Ref. 13]."

Despite political attempts to curb U.S. and Soviet strategic and conventional forces in the 1980s (Figure 5), intelligence sources speculated that the Soviet conventional build-up would continue regardless of U.S. or NATO strategic reductions. Reports indicated expansion of combined arms units, increases in equipment quality and quantity, continued improvements in force command and control, application of emerging technologies, and a continuous cycle of modernization. These developments were

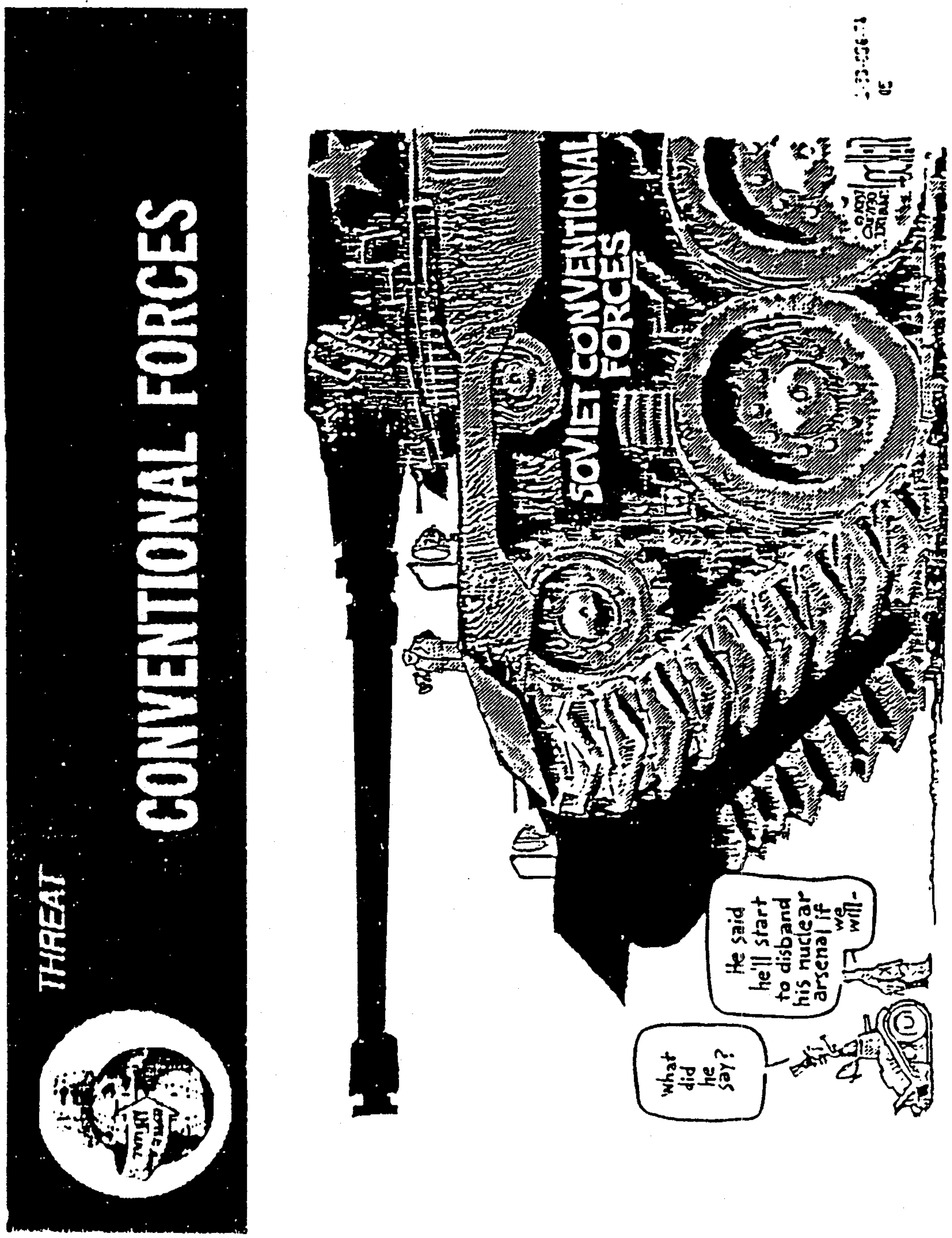


Figure 5. Soviet-US Conventional Force, Quantitative Disparity

expected to significantly change the nature of the modern battlefield. Potential new capabilities included massed precision artillery fires, development and employment of directed energy (DE), laser, and microwave weapons, increased use of electronic warfare, improved reconnaissance capabilities, and a greater possibility for the use of offensive and defensive chemical and nuclear weapons. [Ref. 14]

b. The Tank and Soviet Operational Doctrine

A principal component of Soviet modernization has been the steady improvement in design and development of its armored forces. The Soviets have continued to mechanize their ground forces since the end of World War II increasing armored vehicle lethality, survivability, and mobility. This emphasis on mechanization has succeeded in increasing the tempo (accelerated pace) of Soviet ground maneuver warfare.

The centerpiece of the Soviet's highly maneuverable form of land warfare is the tank. Soviet support for the tank has remained despite recent debates over its future viability. The Soviets believe that with continued scientific and technological development, their designers can improve tanks to allow continued operation on the future battlefield despite the proliferation and increasing lethality of modern anti-armor weapons. Commenting on the prominence and role of the tank in future

armed conflicts, General V.M. Gordiyenko, Chief of the Malinovsky Armored Troops Academy, stated in September 1987 that "...tanks have greater potential to further enhance their combat efficiency on the basis of the modern achievements of science and technology. Hence, I believe that both now and in the future, there is no alternative to the tank as the leading weapon system of the ground forces". [Ref. 15]

Intelligence sources in 1985, indicated that Soviet commitment to the tank as the primary, tactical land system combined with their vast ground vehicle research and development (R&D) organization, would probably lead to a succession of new, highly capable tanks and infantry fighting vehicles over the next two decades. Projections for Soviet armored vehicle design, development, and fielding, through the year 2005, indicated that the tank would remain the key component of armored shock and firepower although the wide use of other specialized armored vehicles would continue. Additionally, while modernization efforts would primarily upgrade current and older armored vehicles with advanced characteristics in the near to mid-term, periodic revolutionary tank design developments would compliment the standard evolutionary tank improvements [Ref. 16].

Soviet tank analysis concluded that the development cycle for upgrading systems with advanced

capabilities averaged five years with about ten years required to design and deploy vehicles with major technological changes using emerging technologies. Both development cycles were notably faster than U.S. development. Modernized Soviet vehicles containing offensive and defensive upgrades threaten the ability of U.S. weapons to defeat them. [Ref. 17]

Of particular concern to the U.S. military was the next series of future Soviet tanks (FST). These were presumed to be revolutionary in design. FST I and II were projected to be fielded in the 1990s and FST II and III were expected to have significantly improved capabilities. Many within the Army expressed serious doubts that U.S. M1 or M1A1 tanks would be able to defeat or withstand the anticipated Soviet FST II or III tanks. The threat of the FST tanks produced serious concern within the Army, OSD and Congress accelerating calls for the total modernization of all U.S. armored forces.

3. Armored Family of Vehicles Task Force (1986-1988)

By late 1985, Congressional and Department of Defense (DOD) concerns could be characterized by apprehension over Soviet modernization efforts, Soviet qualitative advances, and the FST series tanks. Additionally, OSD was grappling with a decline in defense funds and the Army was troubled by rising operations and support (O&S) costs and decreasing budgets. Nevertheless,

in response to the Soviets, the complete modernization of all U.S. armored forces was strongly advised as a counter to "...emerging threat capabilities and [to correct] existing [U.S.] force deficiencies". [Ref. 18] With the tacit support of Congress and OSD, the Army made the decision to modernize current forces to achieve significant improvements in vehicle capabilities.

In October 1985, the Chief of Staff of the Army (CSA) chartered a study effort to plan the total modernization of the Army's heavy forces. The Armored Family of Vehicles Task Force was given the mission "...to develop and field an armored vehicle fleet, based on advanced technology and commonality, to defeat the threat of the late 1990s and beyond.... [Ref. 19]". The AFVTF effort was to be executed in two phases with a decision to begin Phase II being contingent upon the success of Phase I.

In concert with the AFVTF charter, a draft, "umbrella" Operational and Organizational (O&O) plan was developed prior to the start of task force operations. The O&O plan was written to support technology base research and development programs leading to the eventual production and fielding of an AFV and to serve as a guideline for the development of individual systems in response to current and future battlefield deficiencies. The O&O plan detailed characteristics of the vehicle family and basic aspects of

AFV operational employment. The plan also described the tentative distribution and fielding procedures for the family. The O&O plan specified that vehicles would use common components, mission specific turrets or modules (mission modules), and employ a minimum number of chassis. Commonality was to be optimized throughout the fleet but use of unique, innovative design characteristics. State-of-the-art and emerging technologies were also to be stressed [Ref. 20] (Table III).

The AFV fleet was intended to replace and/or supplement all existing armored vehicles and most wheeled vehicles in the Army inventory. In addition, it was to be fielded in battalion or brigade sets. Present vehicle crew size, job specialties, and support requirements were also required to be reduced. Finally, overall design objectives directed a 40% reduction in total fleet costs. [Ref. 21]

4. Phase I, Program Development

Phase I task force operations began in January 1986 and were officially scheduled to conclude in August 1987. Based on the CSA's guidance, the primary objective of Phase I was to develop a program to accomplish the AFV mission, secure approval of a Joint Mission Needs Statement (JMNS), and achieve a Milestone 0 (concept exploration and definition (CE/D)) decision. Supplementary Phase I tasks,

aside from standard programmatic considerations, were to use

Table III - AFV Design Characteristics [Ref. 22]

- Common chassis and components integrated with mission modules;
- Advanced survivability technologies/techniques;
- Applique and tunable armor;
- External, adjustable suspension systems;
- Human engineering (MANPRINT);
- Preplanned product improvements (P3I) engineering;
- Modular components;
- Use of robotics and artificial intelligence;
- Common "friend or foe" vehicle signatures;
- Electromagnetic pulse and directed energy weapons protection;
- Built in diagnostic and prognostic test equipment;
- Common vehicle electronics architecture (vetronics);
- Position location and navigation capabilities;
- Enhanced target acquisition and fire distribution capabilities;
- Significant system upgrades (e.g. lethality, survivability, mobility);
- Increase supportability, transportability, and deployability.

innovative technological approaches, develop abbreviated acquisition schedules, revise and field AFV within the principles of a 21st century up-date of the AirLand Battle (ALB) operational doctrine, and guide the Army toward a

Milestone 1 (demonstration and validation (DEM/VAL)) decision. [Ref. 23]

AFVTF initially consolidated and reviewed the data generated from the group studies. Using those ideas and recommendations and the CSA's missions as a baseline, elementary task force design guidelines stressed commonality in chassis and system components, a heavy maneuver focus, concurrent production, and non-traditional acquisition methods. A first unit equipped (FUE) date of fiscal year (FY) 1996 was planned. Planning of the AFV was to be unconstrained and revolutionary [Ref. 24].

a. Design Characteristics

Underlying the planned procurement of new armored vehicles, AFV represented a significant change in the way that the Army intended to fight, resupply, train, man, and equip itself in the 21st century. A principal objective of AFV research was to attain significant warfighting improvements and achieve substantial O&S savings through emphasis on the family approach, commonality, common components, mission specific modules, and multi-mission capabilities (Figure 6). A major departure from past design efforts, AFVTF used a requirements-based vehicle design process. This process was predicated upon satisfying a needed battlefield capability (missions and roles) rather than the more traditional vehicle-based design methods.

Over 30 family vehicles were designed to fulfill these battlefield roles (Table IV-A, B, & C).

Table IV-A - AFV Assault Force

Vehicle	Mission Role
• CEM	Combat Earthmover
• CEX	Combat Excavator
• CGC	Combat Gap Crosser (BRDGE)
• CMV	Combat Mobility Vehicle
• DEW-V	Directed Energy Weapons - Vehicle (DEW)
• FACS	Future Armored Combat System (Tank)
• FIFV	Future Infantry Fighting Vehicle (IFV)
• FRV	Future Reconnaissance Vehicle (RECON)
• FS/COLS	Fire Support/Combat Observation, Line of Sight (FIST)
• LOS-AT (KEM-V)	Line of Sight, Anti-Tank (Kinetic Energy Missile - Vehicle, LOSAT)
• LOS-AD (LOS-A-H)	Line of Sight, Air Defense (LOSAD)
• LTFACS	Light, Future Armored Combat System (Light Tank or LFACS/AGS)
• RV	Recovery Vehicle (RCVY)
• SV	Sapper Vehicle (ENGR)

Table IV-B - AFV Assault Support Force

Vehicle	Mission Role
• AFAS-C	Advanced Field Artillery System - Cannon (HWTZR)
• ASV	Armored Security Vehicle
• CSSV	Combat Support Smoke Vehicle (Smoke)
• FARV-A	Future Armored Rearm Vehicle - Artillery (REARM)
• FARV-F	Future Armored Refuel Vehicle - Fleet (REFUEL)
• GPC	General Purpose Carrier (Resupply, MDV)
• MARS	Maintenance Assistance and Repair System (MAINT)
• MEV	Medical Evacuation Vehicle (AMBUL, BNAID)
• MWS-V	Mortar Weapons System - Vehicle (MRTR)
• NBCRS	Nuclear, Chemical, and Biological Reconnaissance System

Table IV-C - AFV Battle Support Force

Vehicle	Mission Role
• ETAS	Elevated Target Acquisition System
• FC2V	Future Command and Control Vehicle (CMDGRP, C2V)
• IEWV	Intelligence and Electronic Warfare - Vehicle (IEW)
• NLOSS-AT/AD	Non-Line of Sight System - Anti-Tank/Air Defense (NLOS-AT/AD)
• RAMS	Rocket and Missile System (RCKT, MSL)

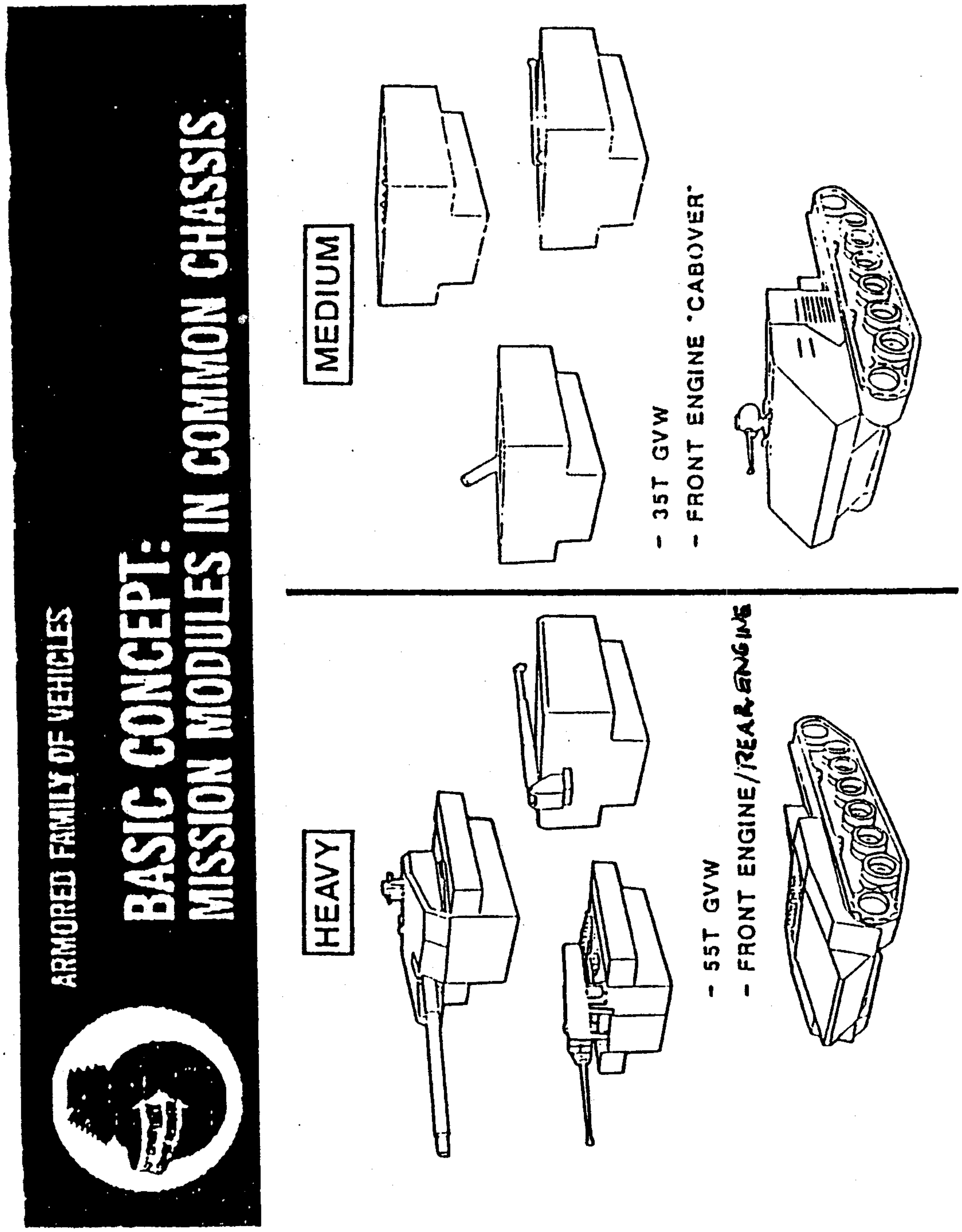


Figure 6. Family Concept: Common Chassis and Mission Modules

The AFV fleet planned to utilize a minimum number of vehicle chassis and a maximum number of common system components. Each vehicle was to be based on a heavy, medium, or light protection chassis according to its mission and location on the battlefield. Systems were subsequently assigned to one of three battlefield echelons: the assault force, assault support force, or battle support force (Figure 7). The common vehicle chassis and components were to be integrated with an individual mission module designed to optimally perform one or more specific combat tasks or battlefield functions. When combined with a chassis, these mission modules, in effect, created an assault (e.g. tank-like), assault support (e.g. artillery), or battlefield support (e.g. rearm/refuel) vehicle as required by Army combat tables of organization and equipment (TOE). When employed, the fleet was expected to achieve significant operational (battlefield) synergy (Figure 8).

Other important AFV design considerations included maximum use of state-of-the-art components, incorporation of leap-ahead lethality and survivability technologies, and engineering the systems for P3I. The future P3I potential allowed for continued vehicle performance upgrades as emerging technologies matured. The plan also envisioned that complete AFV sets would be issued to battalion or brigade size units in order to rapidly

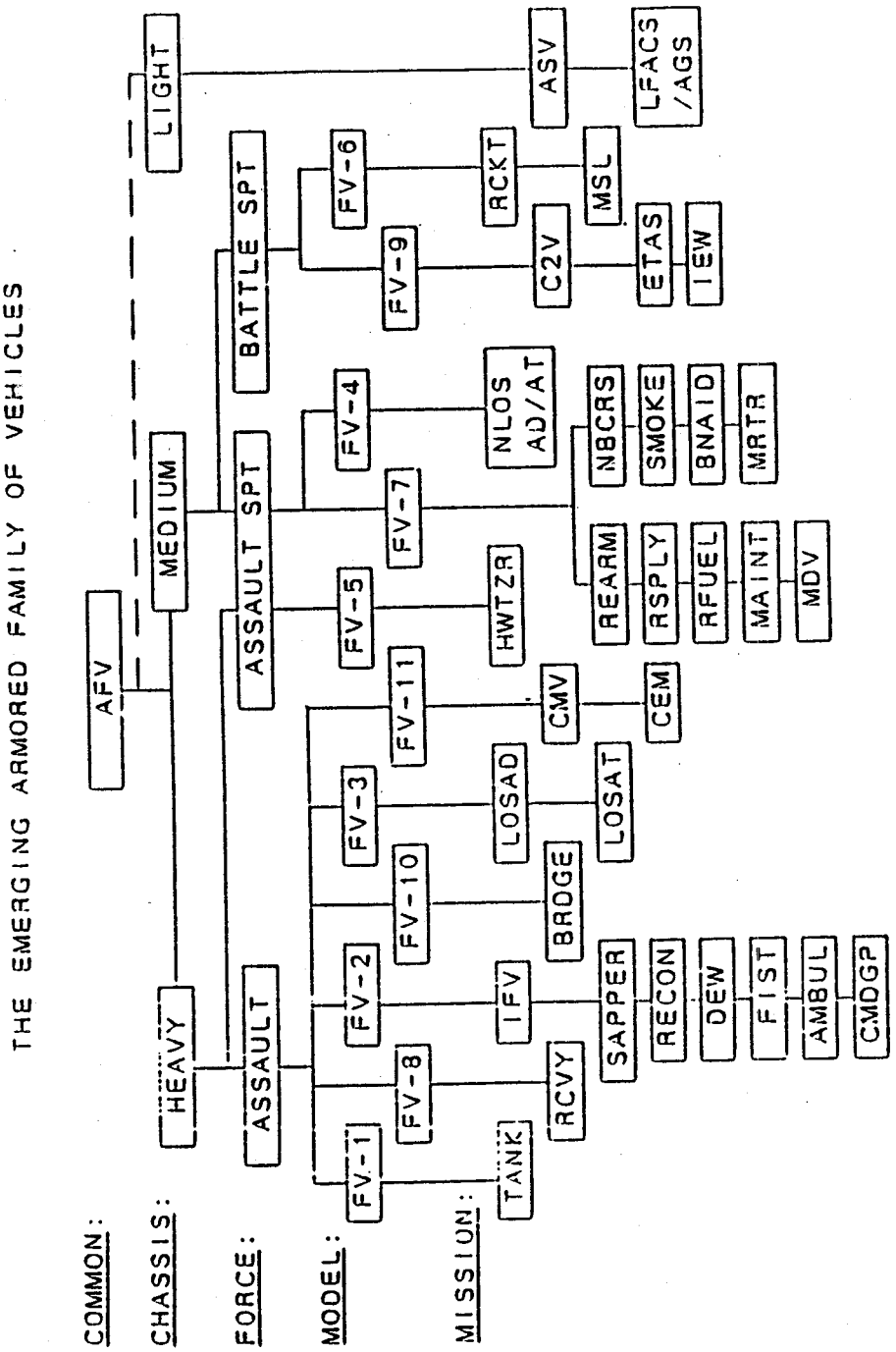


Figure 7. Battlefield Echelons: Assault, Assault Force, Battlefield Support Force.

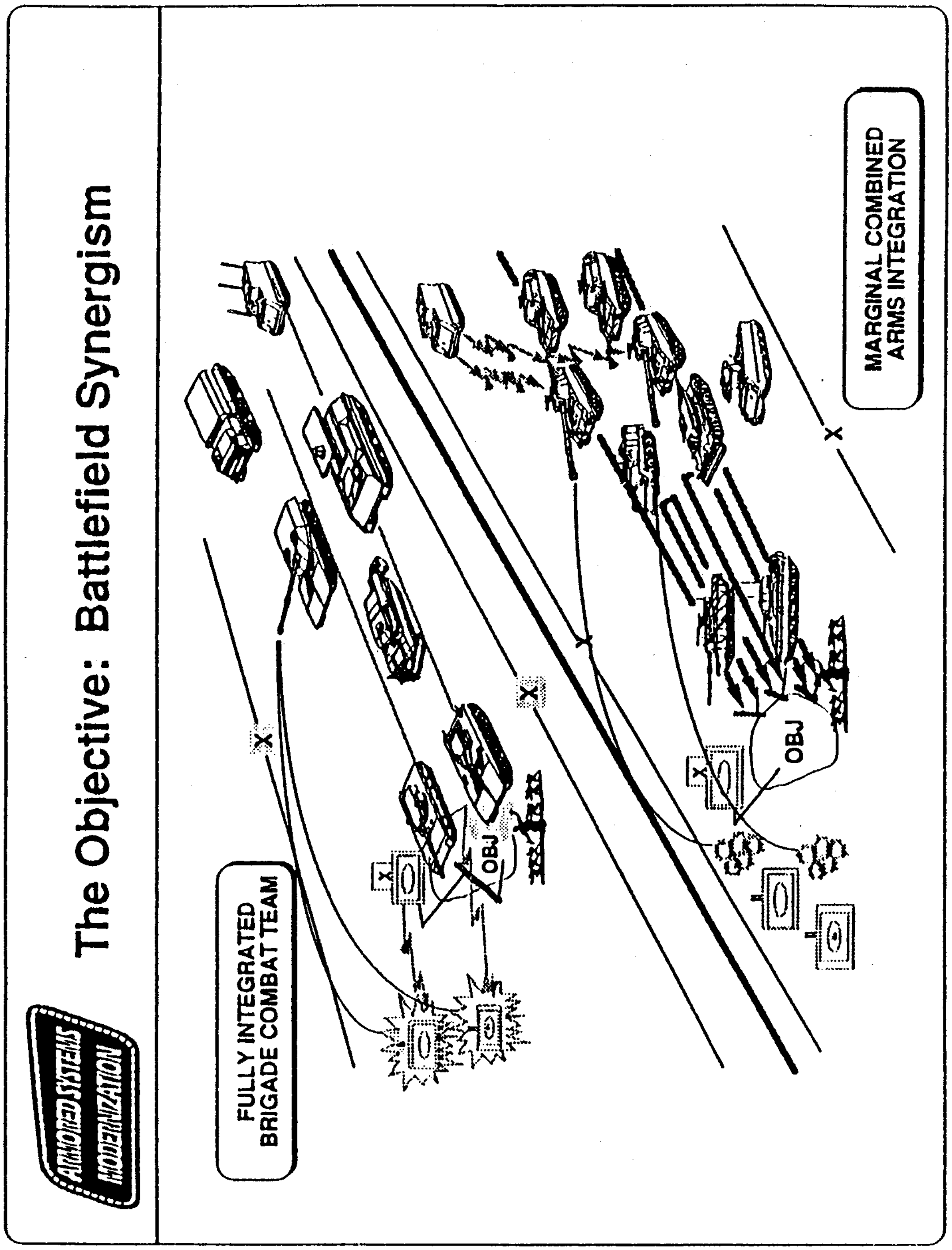


Figure 8. Family Concept: Battlefield Synergy

achieve large scale, initial operational capability (IOC) in the minimum time possible. An abbreviated and tailored design and development cycle was recommended in conjunction with the Army streamlined acquisition system (ASAP). ASAP sought to simplify or eliminate system development phases and it was conceived that vehicles would progress from a non-hardware proof of principle (POP) configuration, bypass the DEM/VAL phase, and proceed directly into full scale development (FSD). Concurrent development was also suggested to capitalize upon the cost reductions associated with the abbreviated design and development procedure. Finally, as a result of common components and modular characteristics, the vehicle family was expected to yield impressive efficiencies and economies of scale in the areas of programmatics, manpower, maintenance, logistics, and training during the families 20 year life cycle.

b. Best Technical Approach

A principal AFVTF requirement was to define and describe the AFV family vehicles. This was accomplished through a series of analyses, computer modeling and simulation exercises resulting in a single best technical approach (BTA) for each individual system. The AFVTF BTA strategy was based on a technique known as an iterative BTA cycle. This method had proven successful during its previous use in the Army's Light Helicopter - Experimental (LHX) program and AFVTF sought to replicate it. In the

iterative AFV cycle, separate agencies conducted BTAs developing a number of different possible approaches for each vehicle. After a thorough analysis of the BTAs, only the design that achieved the highest level of optimization at the lowest cost would be selected for future development.

While not formally completed until AFVTF Phase II, both AFVTF and the TACOM conducted initial BTAs. The efforts were largely generic and used to determine approximate vehicle characteristics, provide data for the initial Cost and Operational Effectiveness Analyses (COEA), the Economic Analyses (EA), and to act as a control group in comparison against subsequent industry BTA results. Data generated from these initial BTAs were used to define three alternative vehicle force sets (Table V). The sets (Appendix B) were then employed in a number of subsequent comparative analyses against a simulated future threat to generate and evaluate the resulting cost and performance data.

Table V - Generic BTA Alternatives [Ref. 25]

- Base case - a projected 1992 force based on current equipment and modernized through standard incremental improvements;
- Alternative #1 - a projected 1996 force consisting of selected system replacements and/or the introduction of new systems and modernized through product improved (PIP) systems and use of non-developmental items (NDI);
- Alternative #2 - the set of AFV vehicles as determined through the BTA process.

In simulations, Alternative #2 demonstrated significant advantages over the Base Case and Alternative #1. Alternative #2 was not officially endorsed until Phase II, when more data had been analyzed (Appendix C).

c. Concept Exploration and Definition, Request for Proposal

A request for proposal (RFP) was issued in September 1986 with project due date of August 1987. The RFP solicited contractors for a one-year CE/D study to determine AFV BTA designs . Five industry consortia responded to the solicitation (Table VI).

Table VI - Industry Consortia [Ref. 26]

- Armored Vehicle Technologies Associated (AVTA)
- Teledyne Continental Motors (TCM), Ground Systems Division
- General Motors Corporation (GMC), Military Vehicle Operations
- PACCAR, Incorporated, Defense Systems Division
- AAI Corporation

Of these, the industry teams of AVTA, TCM, and GMC (Figure 9) received study contracts and became part of the AFV design and development team (Figure 10). These three teams remained involved in the ASM efforts through mid-1990.

d. Phase I, Final Report Recommendations

The Draft AFVTF, Phase I report was released in August 1987 and presented to the Army Requirements Review Council (RRC). Due to the significance of the report and

CED CONTRACTORS *

AVTA (GD/FMC)	GM - MVO	TCM
ARES	BMY	AAI
AVCO LYCOMING	BDM	ALCOA
BATTELLE MEMORIAL	CYPRESS INTERNATIONAL	ALVIS LTD
CADILLAC GAGE	DONALDSON	ARMOFLEX
CATERPILLAR INC.	EMERSON	BOEING
COMPUTING DEVICES	GARRETT	CLS SYSTEMS
CUMMINS ENGINE CORP	GENERAL ELECTRIC	CUMMINS ENGINE CORP
DALMO VICTOR (SINGER)	GM - DELCO SYS OPN	EMERSON ELECTRIC
DETROIT DIESEL ALLISON	GM - HUGHES GND SYS GP	GARRETT
FMC - NORTHERN ORD.	GM - HUGHES MISSILE SYS GP	GE - AIRCRAFT
FMC - STEEL PRODUCTS	GM - ALLISON TRANSMISSION	GE - ORDNANCE
GARRETT	HARRIS	GIAT
GD - FT WORTH	HAZELTINE	HONEYWELL
GENERAL ELECTRIC	HRB - SINGER	ILC SPACE SYSTEMS
HONEYWELL	HUGHES	JOHN DEERE
HUGHES AIRCRAFT	KAMAN AEROSPACE	KOLLMORGAN CORP.
JOHN DEERE	KRAUSS MAFFEI	KRUPP MAK
MCDONNELL DOUGLAS	LOCKHEED	LOCKHEED
MTU	LTV	MAL ASSOCIATES
ROYAL ORDNANCE	MCDONNEL DOUGLAS	MAVRC
TELEDYNE	MTU	QUEST RESEARCH
TEXAS INSTRUMENTS	NOAAH	RCA
VICKERS	PALL	RENK
VERMEER	PERKIN - ELMER	ROYAL ORDNANCE
TITAN CORP	RCA - ASD	SBRC
WESTERN DESIGN CORP	ROCKWELL	THOMPSON CSF
WILLIAMS INTERNATIONAL	STEWART WARNER	TIMONEY
Z-F	TRACOR	UNIDIESEL
	TRW	WILLIAMS RESEARCH

* AS OF CED PHASE II CONTRACT START; SUBJECT TO CHANGE

Figure 9. Industry Team Composition

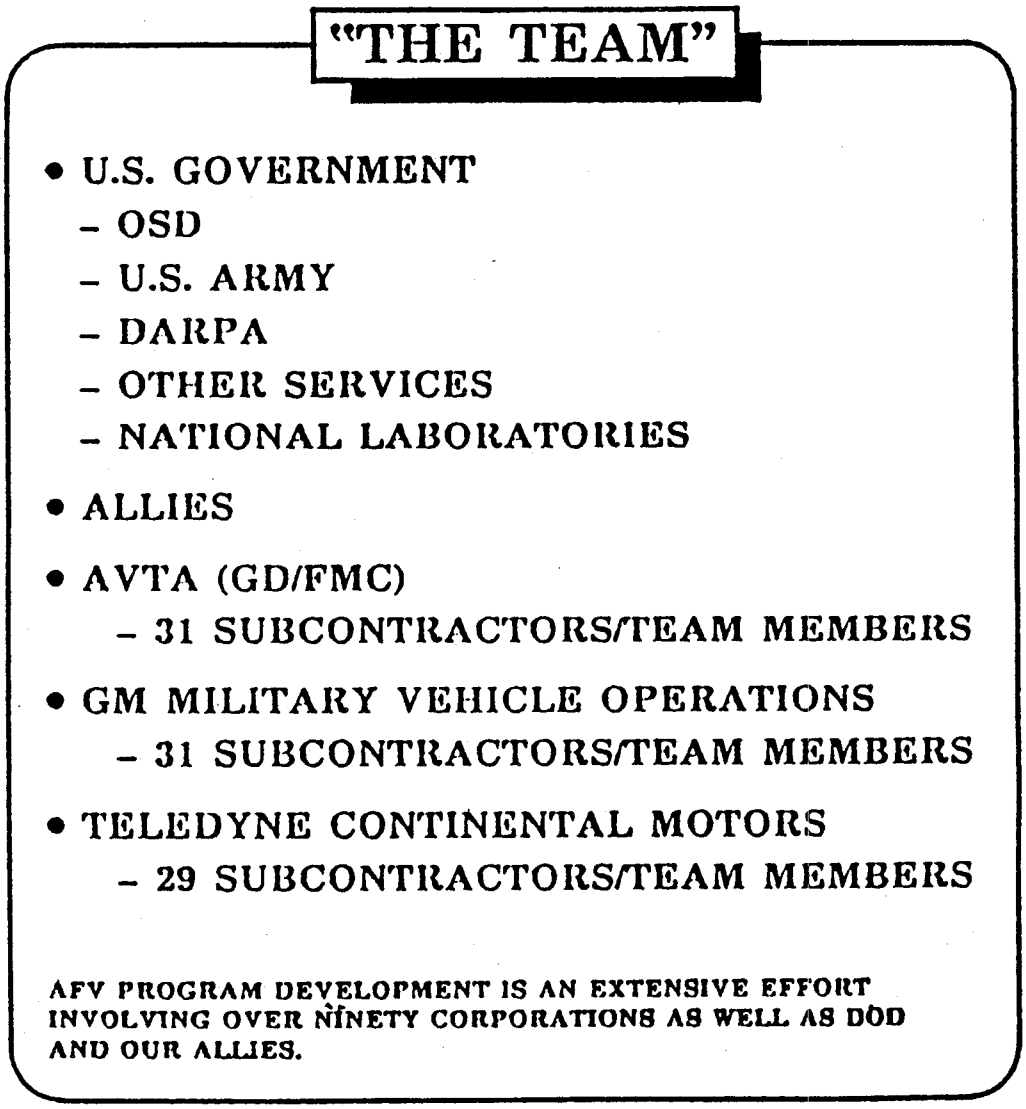


Figure 10. Armored Family of Vehicles Design and Development Team

the potential importance of the subsequent decisions, the RRC meeting was attended by those Army leaders that would normally be convened for an Army Systems Acquisition Review Council (ASARC) meeting. The report validated the AFV design characteristics and parameters and recommended that AFVTF be continued through Phase II with a subsequent Phase III effort to convert task force operations to a Program Office. AFVTF also urged that a detailed required operational capability ((ROC) or operational requirements document (ORD)) be developed [Ref. 27].

e. Requirements Review Council Decision

Initial RRC discussions centered primarily on questions of force affordability and concurrent design, development, production, and fielding of the 28 vehicles determined by the task force to be essential to the AFV family. The CSA concurred with many of the task force recommendations, instructing that the AFVTF charter be extended through Phase II. Rather than follow a revolutionary approach, however, the RRC directed Phase II follow a constrained, evolutionary approach. AFV was also to be integrated into an overall force modernization plan with the AFV concept integrated with concepts established for 21st century conflicts. Finally, the CSA directed that AFV programmatics be developed in detail including finding a way to support AFV within the Army Program Objectives Memorandum (POM), and for RRCs to be conducted quarterly to

guide to progress of the task force [Ref. 28].

Finally, the CSA mandated that a public information program be developed "...to ensure that the Army speaks with one voice.... [Ref. 29]".

5. AirLand Battle Doctrine Review and Reassessment (1987)

The umbrella O&O plan, developed for Phase I, contained abbreviated and incomplete discussions of the AFV missions and roles since no operational concept for AFV existed and it was unknown how the heavy force would be expected to fight. Realizing the importance of a clear AFV operational mission and vehicle roles to the design process, the task force developed its own concept to fill this void. An understanding of the future battlefield, emerging technologies, and mission requirements were extremely important to proper development of the AFV concept. This information had to be developed in the context of Army AirLand Battle operational doctrine and articulated in sufficient detail and depth for use by AFVTF and system proponent material developers. Despite the task force's initial attempts, AFV missions and roles still lacked definition. To resolve this problem, AFVTF requested and subsequently received assistance in constructing a valid operational concept.

a. AirLand Battle - Future, Study Groups

In response to requests by the AFVTF, TRADOC chartered the AirLand Battle - Future (Heavy) Special Study

Group (ALB-F(H)SSG) in September 1987. The SSG's mission was to determine how medium and high intensity conflicts (MIC/HIC) would be conducted from 1989 through 2004, describe the impact on doctrine, organization, and material, and design the force using current resource constraints. Concurrently, the Deputy Chief of Staff for Operations (DCSOPS) directed the Army War College (AWC) to initiate a study aimed at developing a warfighting concept for heavy armored forces in the year 2004 [Ref. 30].

In October 1987, TRADOC also directed the Combined Arms Combat Developments Activity (CACDA) to develop an all encompassing AirLand Battle Future (ALB-F) concept to "...describe how the U.S. Army fights joint and combined Arms operations from the tactical to operational level within a strategic context to meet its worldwide commitments. [Ref. 31]"

b. AirLand Battle Studies

The three study groups examined Phase I findings and maintained a continuous dialogue with AFVTF during Phase II. To ensure that these studies did not diverge, the Army administratively linked them together. AWC was directed to support the ALB-F(H)SSG studies which in-turn supported the CACDA, ALB-F effort. The close working relationship between the AFVTF and ALB-F(H)SSG allowed the AFVTF to provide direct input into the ALB-F(H) concept development process. The collaboration between AFVTF and ALB-F(H)SSG resulted in

warfighting concepts that were highly correlated with the technological opportunities that were available, allowing the AFV system concepts to be firmly supported in the new doctrine.

Mirroring the constrained approach used in Phase II, operational tenants and principles used in ALB-F remained evolutionary in nature. Continuous guidance and involvement by Army senior leaders and staff ensured that doctrinal development and AFV force design and material development evolved from present organizational structures and were closely linked with current ALB warfighting doctrine.

The draft ALB-F studies provided AFVTF with the information needed to revise the original O&O plan, publish the AFV ROC, and ensure that AFV was well coordinated with and synchronized to the requirements of ALB-F(H) and the tenants of ALB-F in general. This process created a great degree of synergy between the new AFV fleet and the future operational doctrine. The emerging ALB-F(H) doctrine included the proposed O&O plan and the required capabilities for AFV equipped units. It also added "endurance" (staying power) as an ALB-F tenant, and advocated that future armored vehicle improvements be synchronized to ALB-F tenants [Ref. 32].

6. Phase II, Program Development

AFVTF, Phase I officially concluded with an August 1987 briefing to the RRC. Phase II began in September 1987 and was conducted through February 1989. Concerns over the high cost of developing and fielding the 28 vehicles proposed by the AFVTF resulted in Phase II's constrained, evolutionary approach. This approach was devised to refocus previous AFV efforts into a more acceptable and achievable program.

The increased emphasis and importance that the CSA placed on AFV Phase II increased support for the Phase II efforts. The Department of the Army staff (ARSTAF), most notably the Deputy Chief of Staff, Operations (DCSOPS) and the Assistant Secretary of the Army for Research, Development, and Acquisition (ASARDA) established AFV-related project/liaison offices in the Major Commands (MACOM). The commanders of AMC, TRADOC (several school commands were already acting as system proponents), and TACOM became closely involved in the Phase II study efforts (Figure 11).

The CSA up-dated and refocused the AFVTF charter after the conclusion of Phase I. The primary Phase II objective was to direct the Army toward achieving a Milestone I (concept demonstration and validation (DEM/VAL)) Defense Acquisition Board (DAB) decision by the 4th quarter of FY89. Supplementary Phase II tasks included tailoring

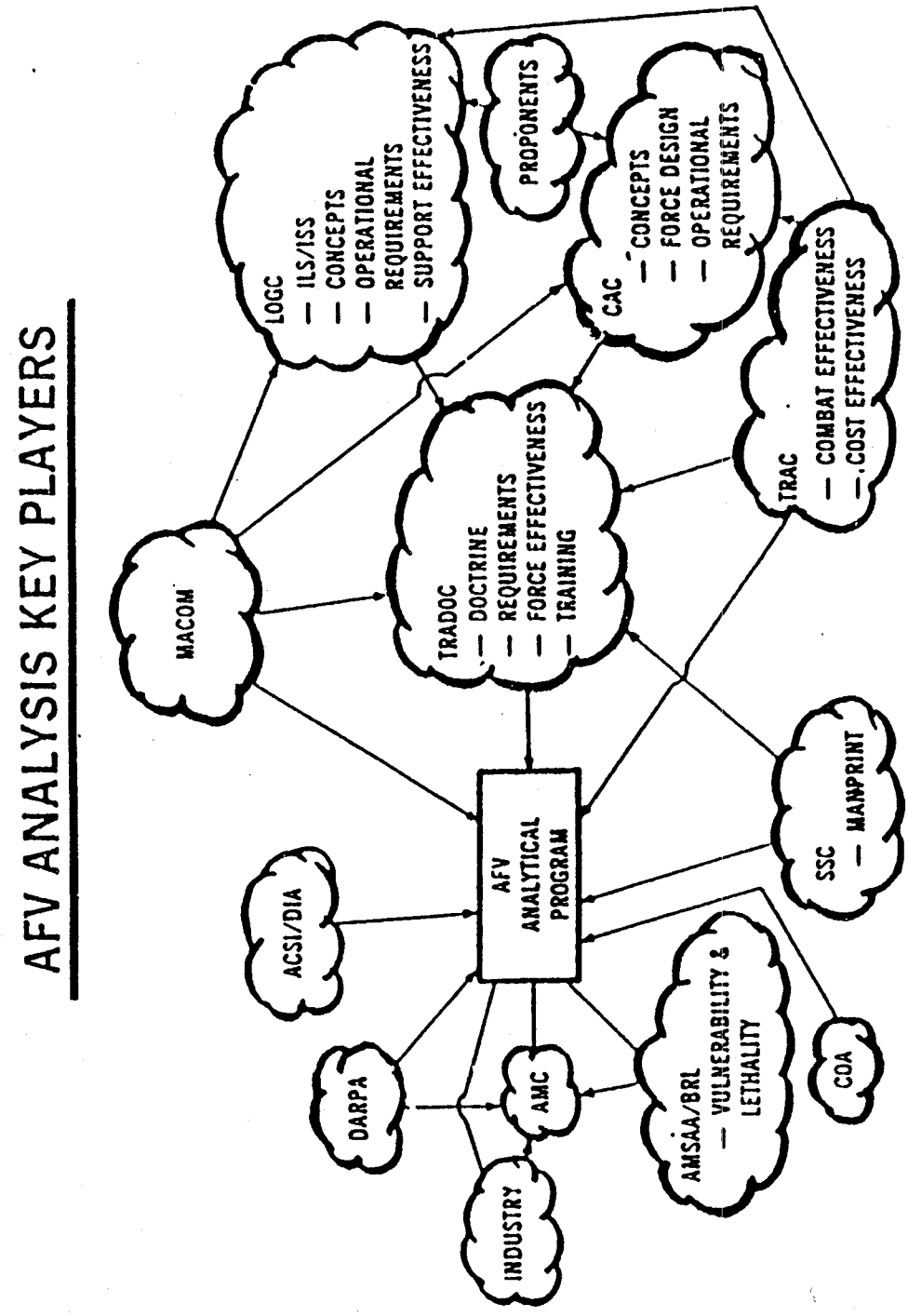


Figure 11. AFVTF Phase II Study Participants

Phase I system concepts and characteristics to affordability, reducing system and force O&S costs, developing strategies to field AFV, maximizing industry involvement and competition, and prioritizing the initial fielding package. [Ref. 33]

a. Requirements Review Council (November 1987) and Concurrent Activities

The guidelines established by the RRC (November 1987 to September 1988) were largely responsible for the direction of AFV development taken throughout this period. The first scheduled RRC in November 1987 was canceled due to scheduling conflicts, however, a message sent to the RRC members detailed a new proposed Phase II study approach. This approach was developed in response to concerns over the Phase I recommendations for accelerated acquisition, near-term affordability, timeline concerns, and integration risks between the overall force and AFV. The message requested and was subsequently approved to slip the AFV timeline to accommodate a full three year DEM/VAL phase (from FY90 through FY92) and move IOC achievement from FY95 to FY98. The approach resulted in the development of new timelines and fielding options that departed from those of Phase I. These new timelines were necessary since the Phase I timelines were out of alignment with the POM building process. The new timelines helped formulate the FY90 to FY94 POM and established initial AFV baselines for Phase II. [Ref. 34]

Based on the schedule change, new developmental assumptions were also devised. A key assumption was that a process of "disciplined evolution" was needed to properly prioritize the proposed 28 vehicle AFV fleet. This process dictated that the AFV vehicles also be packaged (force packaging) into groups by mission/role and chassis for development. The disciplined evolution approach resulted in a detailed examination of the entire Army force structure and future service modernization plans. Additionally, this concept helped blunt attacks that AFV was too radical or not well thought out. The concept of disciplined evolution was to affect all following AFVTF activities. Together with the new timelines, these changes initiated AFVTF's shift from the Phase I baseline. [Ref. 35]

1. 1987 Funding Cut

Responding to a funding shortfall and to subsequent ARSTAF recommendations in December 1987, a pivotal decision was made to reduce the AFV operating budget and redirect the balance of AFV funding from within the R&D science and technology (Tech) base. This action caused major problems for the AFVTF in the months ahead. While the funding cut reduced AFV visibility and vulnerability at a critical time, AFVTF was forced to find funds in other Army R&D technical and scientific base (Tech Base consisting of 6.1, 6.2, and 6.3A funds) programs. This move also caused the industry teams to think that the Army not serious about

the AFV. A great deal of effort had to be expended to keep industry interested in AFV but an additional year passed before industry contract funding was made available again. Congress, sensing a lack of commitment by the Army, canceled the AFV budget causing additional strain in funding AFVTF operations.

b. Requirements Review Council (February 1988) and Concurrent Activities

The second RRC meeting was held in February 1988. AFVTF briefed that OSD and Congress were worried that the AFV concept was not viable and that the budget reductions had sent mixed signals to various constituencies. It was also noted that under the heavy force structure, AFV would be considered a heavy rather than a light force effort and therefore any consideration of light tank development had been dropped. Finally, system prioritization through the disciplined evolution of current and future fleets was briefed as meeting the CSA's guidance to fit AFV into an overall force modernization plan.

The disciplined force evolution concept entailed managing a HI/LO (newer/older) mix of systems in a continuous cycle of modernization using the current force as a start-point. It would access new and retire old systems with a minimum budgetary "bow wave", while keeping the industrial base "warm" for mobilization. [Ref. 36]

The AFV fleet, as envisioned, included different levels of component, chassis, and integrated force

commonality (Figure 12). Component and chassis commonality were routine concepts but the notion of integrated force commonality was new. An integrated force incorporated AFV hardware development and O&S cost reduction concepts within the vehicle family. The resulting integrated, common force coupled with doctrine specifically structured and designed to capitalize on its enhanced battlefield capabilities was expected to create a synergistic impact much greater than its parts.

AFVTF also recommended that a traditional AFV timeline option be used rather than the accelerated ASAP proposals from Phase I. This approach was adopted due to AFVTF sensitivity regarding OSD and Congressional concerns over the streamlined acquisition proposals. AFVTF support for the traditional acquisition cycle, however, hindered ARSTAF acceptance of the AFV concept until the fall 1988. [Ref. 37] Finally, AFVTF recommended that the RRC approve the strategy of disciplined evolution. The strategy consisted of a reduction in the total number of family vehicles to be initially developed, an incremental force development concept, definition of an AFV "Package I" (highest priority systems) and a tentative timeline (Figure 13). [Ref. 38]

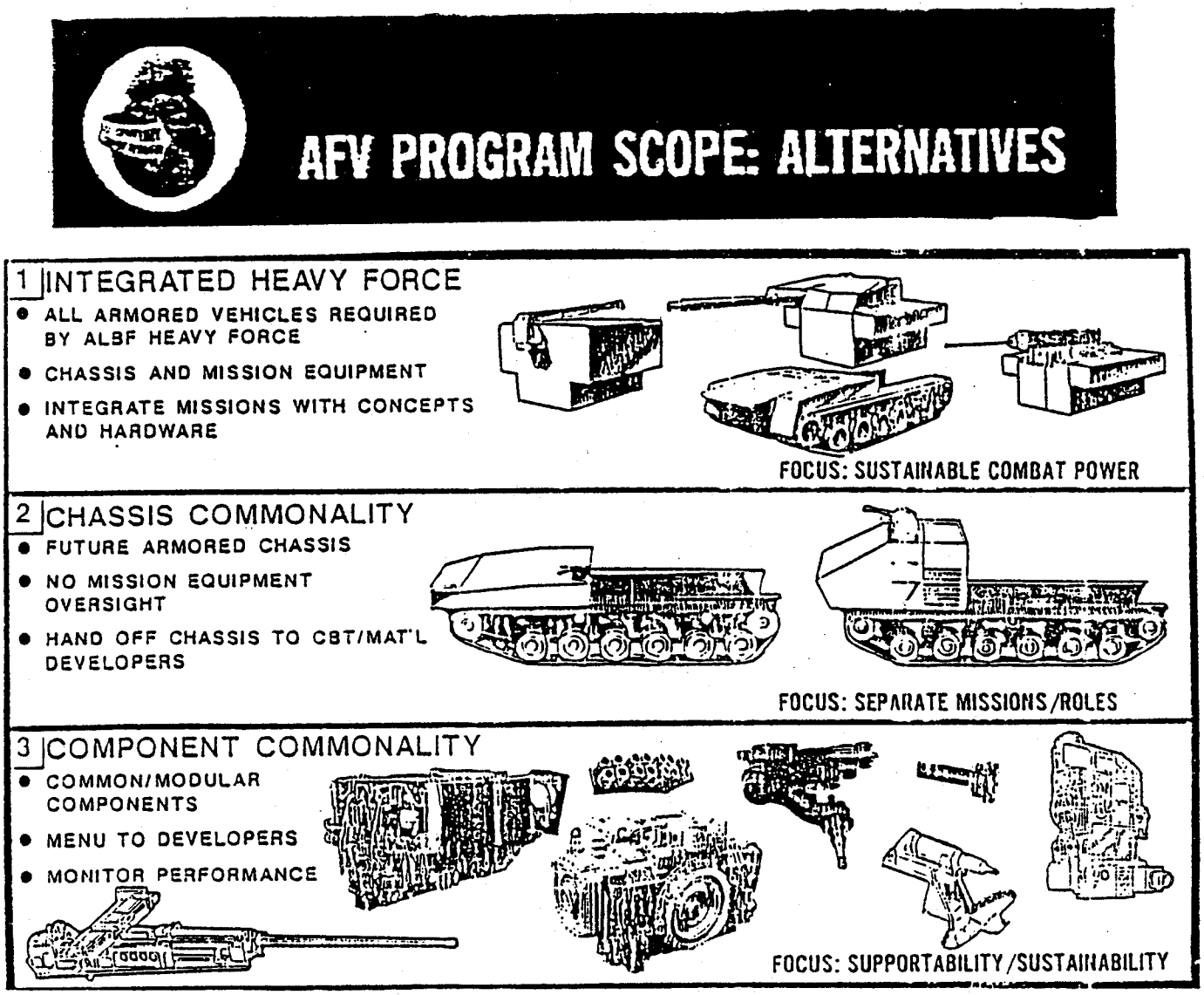


Figure 12. Family Concept: Integrated Force Commonality

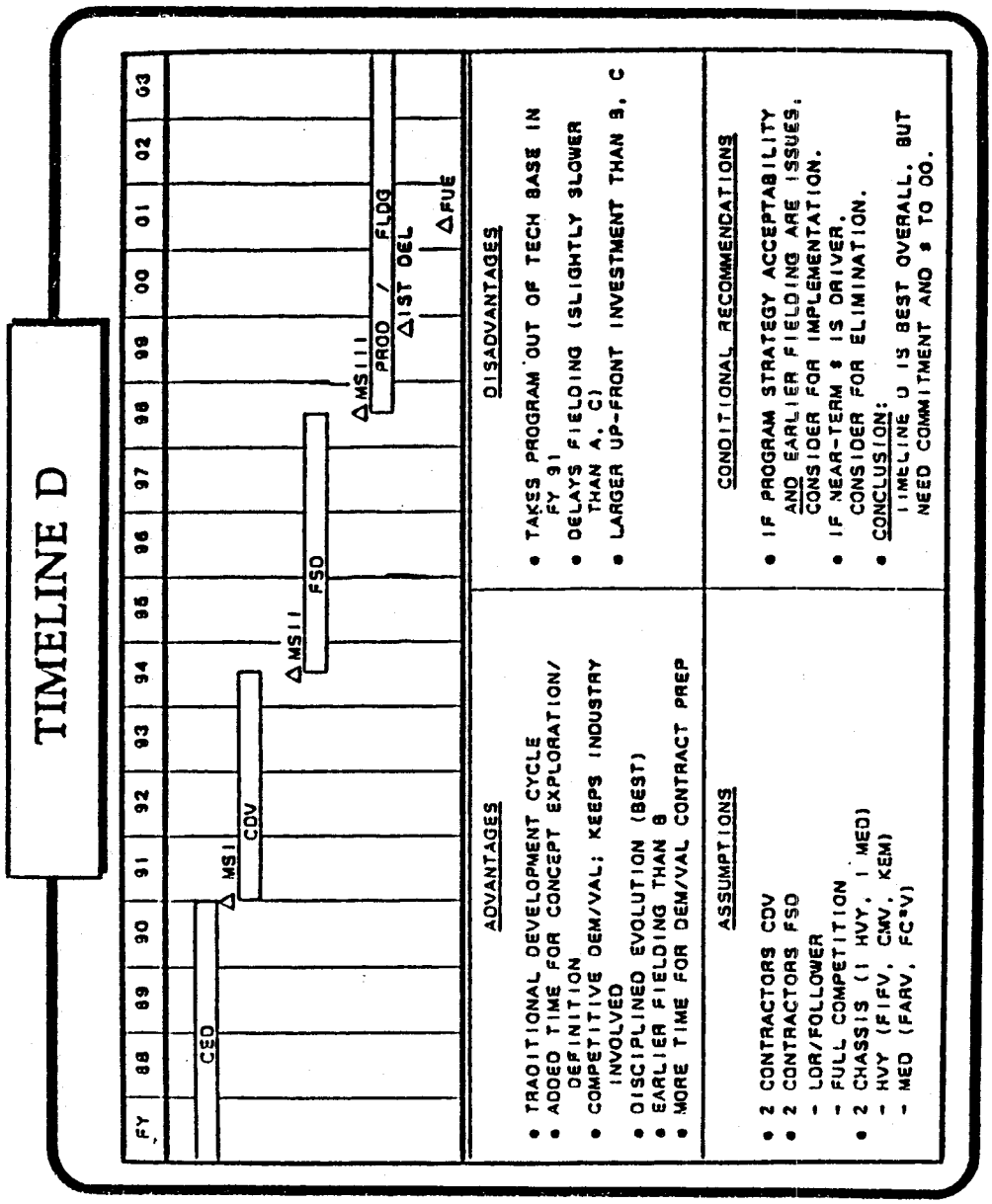


Figure 13. Initial Family Design and Development Timeline

1. Force Modernization Strategy Working Group

Following the AFVTF recommendations, the CSA expressed the need for program movement and directed that a draft AFV Package I be presented at the next RRC. In an attempt to resolve the Package I dilemma, a one-time meeting of the ad-hoc Force Modernization Strategy Working Group ((FMSWG) comprised of key AFVTF, MACOM and ARSTAF personnel) convened in early March 1988 to prioritize the list of AFV vehicles and place them into fielding packages. The working group followed the disciplined evolution theme and included upgrades to current systems in their decision process. The working group also determined that a heavy protection, chassis design would be available for mission module integration in 1991 but that medium chassis powertrain and suspension technologies would not be available until 1994. This resulted in the consideration of the M2/MLRS chassis to support medium vehicles on an interim basis. Finally, FMSWG advised that AFV should be turned over to the institutions regularly constituted to bring new systems through the developmental process (or management evolution) to stabilize system development over time.

The FMSWG, AFV prioritization process was guided by an informal set of principles. The principles determined that current vehicles should be selectively modified to counter the threat based on safety, economy, and efficiency considerations, current production vehicles

continue to be purchased to meet near and mid-term readiness requirements, and cautioned that "...if it ain't broke, don't fix it..." [Ref. 39]. This methodology was adopted as the basis for the analysis of current and future force requirements and resulted in a detailed review of the total force using the current force as a start-point and building a heavy force package based on total force needs.

2. Working Group Prioritization Proposal

An initial fielding package was drawn up by the FMSWG and DCSOPS. After several changes, a final Package I was recommended for the upcoming RRC meeting (Table VII).

Table VII - DCSOPS Candidate Systems [Ref. 40]

HEAVY PROTECTION CHASSIS	MEDIUM PROTECTION CHASSIS
LOS-AT*	IEWV
CMV	FARV
SV	FC2V

* The LOS-AT mission module had reached Milestone I in August 1986 under separate development initiatives.

The entire family was organized into three packages, each representing approximately one third of the AFV fleet. The force packages proposed by the FMSWG allowed the draft Package I to be inserted into the FY90-FY94 POM.

c. Requirements Review Council (April 1988) and Concurrent Activities

Controversy over the supportability of the FMSWG/DCSOPS Package I proposal led to the cancellation of

the AFV package review portion of the third RRC, held in April 1988. An information paper on the status of the AFVTF concept was presented instead. The CSA expressed mounting frustration that a defensible and supportable Package I necessary for budget formulation had not yet been achieved. This package was needed to reduce the risk of AFV being dropped from the budget again, and to gain OSD and Congressional support. The CSA directed that a supportable first fielding package for planning the FY90-FY94 POM be developed and that the plan entail a clear view of "what the Army wants [Ref. 41]". The CSA, concerned about efforts to begin the management evolution process, also warned, "Don't rush to acquire, don't rush to build [Ref. 42]". Evolution at this stage could, in the eyes of OSD and Congress, create the impression that the Army was making a hasty move. [Ref. 43]

1. Technical Assessments

Despite the CSA's desire for a resolution to the Package I dilemma, the effort to produce a supportable first package was a long, slow process. The solution eventually emerged from a set of exhaustive Tech assessments that AFVTF had conducted during Phase I and the subsequent AMC comprehensive Tech review, completed in the spring of 1988. These assessments provided estimates of the available key technologies associated with each AFV's mission/role. Discussions regarding these assessments led to a TRADOC

suggestion that the Army work toward demonstrating the capability to accommodate technically diverse AFV modules into a family of common chassis prior to committing to a long developmental process.

Based upon this initiative, TRADOC, AMC, and AFVTF representatives met in May 1988, to identify candidate AFV vehicles to undergo a DEM/VAL phase then stop before FSD. This would determine the development and integration risks involved with technologies related to these systems. The vehicles tentatively chosen for these demonstrations were based on selection criteria proposed by TRADOC. The criteria indicated that the vehicles should display maximum divergence in mission requirements, integration, technology, and producability challenges. This would include systems with new, untried and untested battlefield capabilities, but need not necessarily be systems included in previous Package I prioritization efforts or the Tech Base.
[Ref. 44] Based on these criteria, new candidate systems were identified (Table VIII).

Table VIII - DEM/VAL Candidate Systems [Ref. 45]

HEAVY PROTECTION CHASSIS	MEDIUM PROTECTION CHASSIS
CMV	FARV-A&F
LOS-AT	RAMS
AFAS-C	NLOSS-AD/AT
FIFV	FC2V
FACS	NBCRS

AMC concurred with this list but indicated that the separate DEM/VAL phase without a subsequent FSD phase was not realistic from a cost, scheduling and marketing perspective. Nevertheless, AMC urged that the Package I systems be identified and scheduled for development as quickly as possible with the DEM/VAL candidates being drawn from them. The TRADOC initiative had effectively reintroduced the original Phase I process of using requirements-based priorities rather than vehicle-based priorities as the best method for determining AFV Package I. This constituted a second attempt to begin the managerial evolution of the AFV concept. AFVTF fully supported the reintroduction of this design method.

2. TRADOC Prioritization Guidelines

After TRADOC's first attempt to arrive at a satisfactory Package I, the AFVTF vehicle prioritization guidelines were redefined to recognize the way that the new heavy force vehicles were to be developed. This required that the package stress commonality, modularity, growth potential, and maximize economies of scale. Additionally, the first package vehicles must reduce the O&S burden, reduce logistics and maintenance requirements, and improve vehicle reliability and maintainability (RAM). [Ref. 46]

The establishment of these guidelines led to a specific list of principles to guide selection of

Package I candidate systems. The selection guidelines were based on:

1) the ability of current systems to perform their battlefield mission,

2) the projected date when the threat would affect current system capabilities,

3) expected system obsolescence of current systems,

4) the availability of overmatching capabilities through leap-ahead technologies, and

5) the delaying of system introduction to capitalize on emerging leap-ahead technical capabilities.

New vehicles were planned to be introduced only if compatible with existing force capabilities or until other essential vehicles were concurrently produced to provide that capability. Only vehicle packages that provided significant warfighting enhancements would be chosen. [Ref. 47]

3. Package I and II Systems Requirements

Using the new guidelines, the next step in the TRADOC process was to determine near, mid, and long-term requirements related to each identified AFV mission. During this process, the ability of current, upgraded, or replacement system to meet the requirement in terms of mobility, survivability, lethality, and other similar performance factors was a prime consideration. Issues also developed involving the funding and scheduling of projected improvements or replacement systems resulting in a "neck-

down" (Figure 14) process. The most urgently needed systems were packaged into two groups (Table IX).

Although it was not originally considered for Package I, the FACS (a tank-like vehicle) was targeted as the primary (lead) AFV system due to the complexity and criticality of its chassis design to other heavy vehicles. The ongoing M1 Abrams tank, Block modernization program had expected to integrate electrothermal or electromagnetic weapon systems into the M1A3 (or M1 Block III) tank. With these weapons, the M1 series of upgrades had been considered sufficient to meet the threat. When it was subsequently determined that these weapon system technologies would not be available to meet threat-driven timelines, FACS was placed into package I. Another consideration was that both the future Block III tank and the FACS were each based on designs that were significantly different from the original M1 design, essentially completely new vehicles. As procurement of three (the M1A2, M1A3 and FACS), distinct tanks was unaffordable and would detract from the desired commonality, a determination was made to combine Block III and FACS requirements. This vehicle became commonly referred to as the Block III.

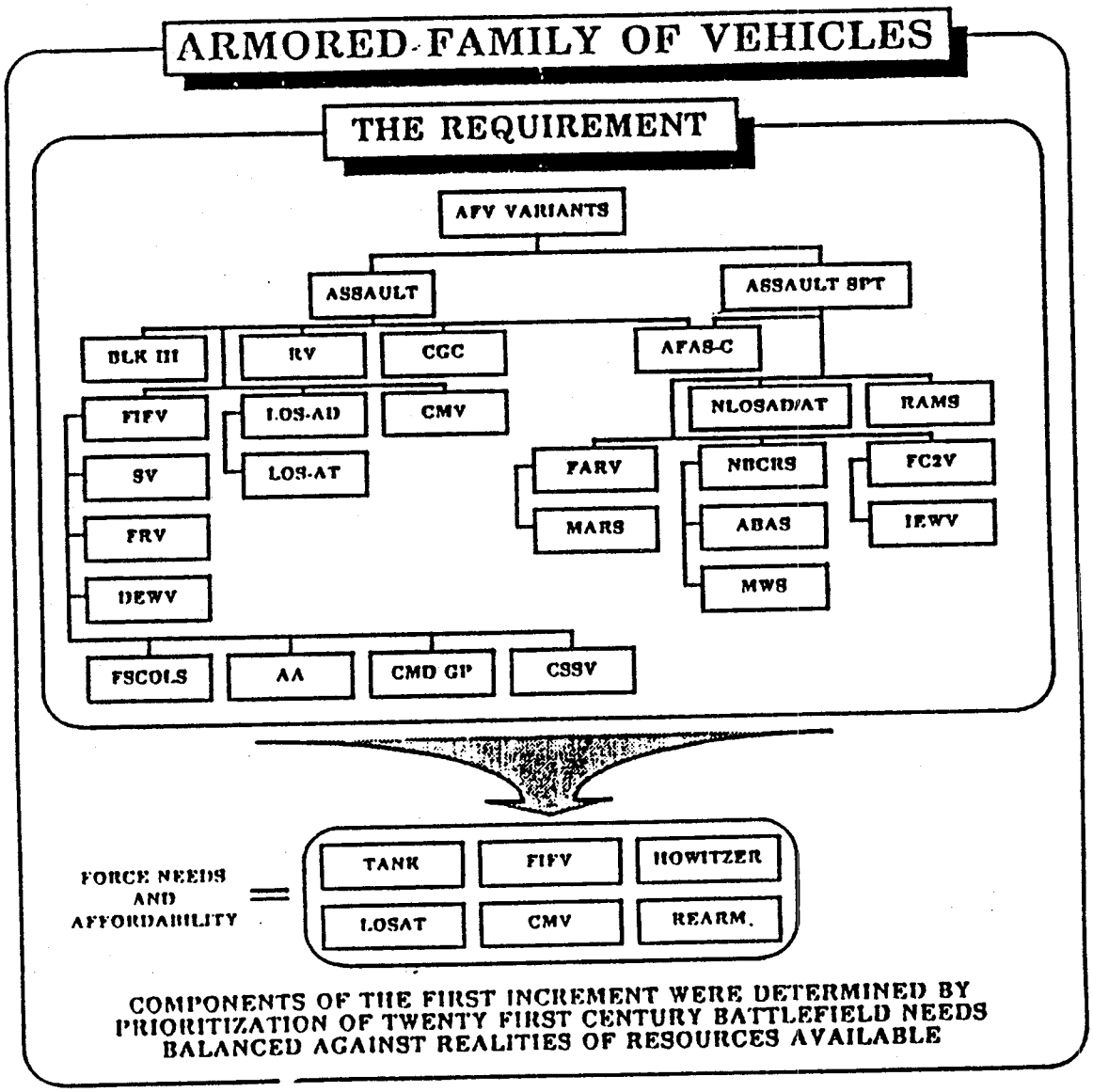


Figure 14. System "Neck-down" Process

Table IX - Priority Package I and II Systems [Ref. 48]	
Package I	Package II
FACS	AFAS-C
FIFV	FS/COLS
LOS-AT	SV
FC2V	MEV
CMV	
FARV-A&F	
MARS	

The priority Package I and II vehicles, along with the selection criteria, supporting rationale, guiding principles, and TRADOC recommends, were briefed during the summer of 1988. The package II systems were not expected to be developed immediately but were to be fielded as soon as resources and schedules permitted. Subsequent review of this listing raised calls for the inclusion of several other vehicles, most notably, of the AFAS-C system. Since the current howitzer improvement program (HIP) was not focused on correcting major chassis mobility and reliability deficiencies, the AFAS-C was added to Package I. The inclusion of AFAS-C, however, remained a contentious issue for months.

In June 1988, collaboration between the AFVTF/A3STF became the basis for development of an integrated Army modernization strategy and specified near, mid, and long-term armored vehicle requirements. This set the stage for the final AFV prioritization review in August 1988.

4. Armor/Anti-Armor Special Task Force (1988-1989)

The Armor/Anti-Armor (A3) Special Task Force (A3STF) was chartered by the CSA, in June 1988. Unlike the AFVTF's long-term focus, the independent A3 study effort was responsible for assessing the Army's current combat vehicle and weapon system deficiencies and for developing a comprehensive near and mid-term modernization plan for armored and anti-armor weapon systems.

A3STF research, identifying what was termed an armor/anti-armor crisis, declared that the appearance of reactive armor on Soviet tanks and armored personnel carriers would offset the qualitative advantages of U.S. armored systems and further change the balance of ground combat power in favor of the Threat. The A3STF had examined a number of solutions to their problems but experienced difficulty in determining effective solutions. After initial discussions with AFVTF regarding the Phase II disciplined evolution requirements for upgrading current or developing mid-term systems, the two groups began to jointly seek mutually acceptable solutions. Through collaborative

efforts, the two task forces were able to develop solutions that satisfied the requirements of their independent task force charters. A3STF assisted in defining AFVTF's near and mid-term solutions while two of the AFV vehicles resolved an A3 force requirement.

5. Armored Family of Vehicles Development Concept

Throughout the summer of 1988, AFVTF maintained its support of the traditional development cycle. ARSTAF's continued objections, however, finally led AFVTF to conclude that the AFV concept would not be assigned program status unless they dropped their objections. In August 1988, bowing to ARSTAF pressure, AFVTF revised the AFV development concept allowing Package I vehicles to proceed through FSD according to their individual merits after a successful joint Milestone I decision. This was known as the Option II timeline Strategy (Figure 15) and the breakthrough permitted the AFV concept to meet budget requirements more easily.

The AFVTF briefing chart (Figure 16), initially designed to illustrate AFV development concept, shows the conceptual overview of the program to date. Beginning on the left of the chart, AFV started with a set of requirements and technologies. During Phase I, the initial concepts were brought through a Milestone 0 decision (August 1986). Following the milestone, operational requirements were formulated for the proposed 28 vehicle

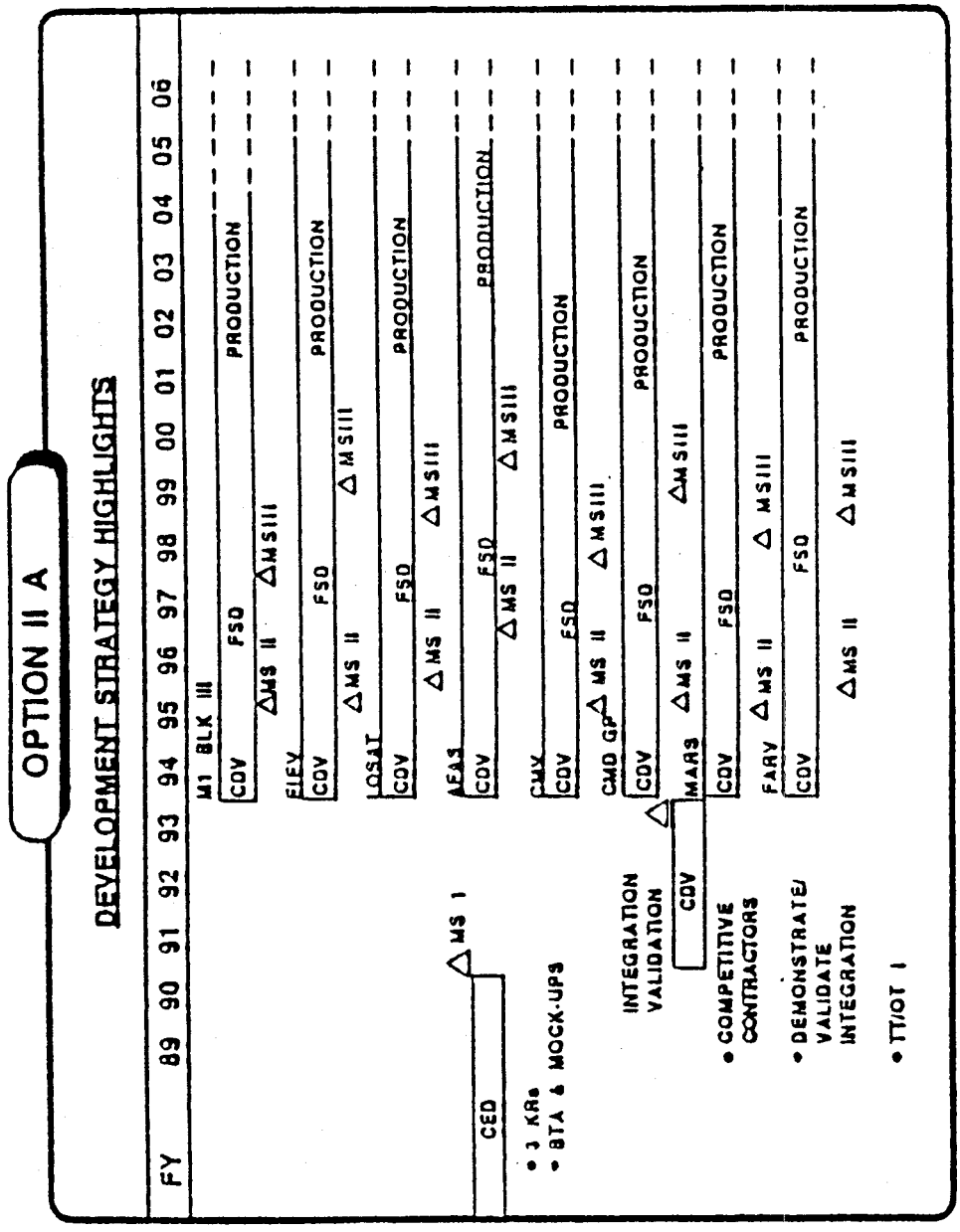


Figure 15. Option II, Design and Development Timeline

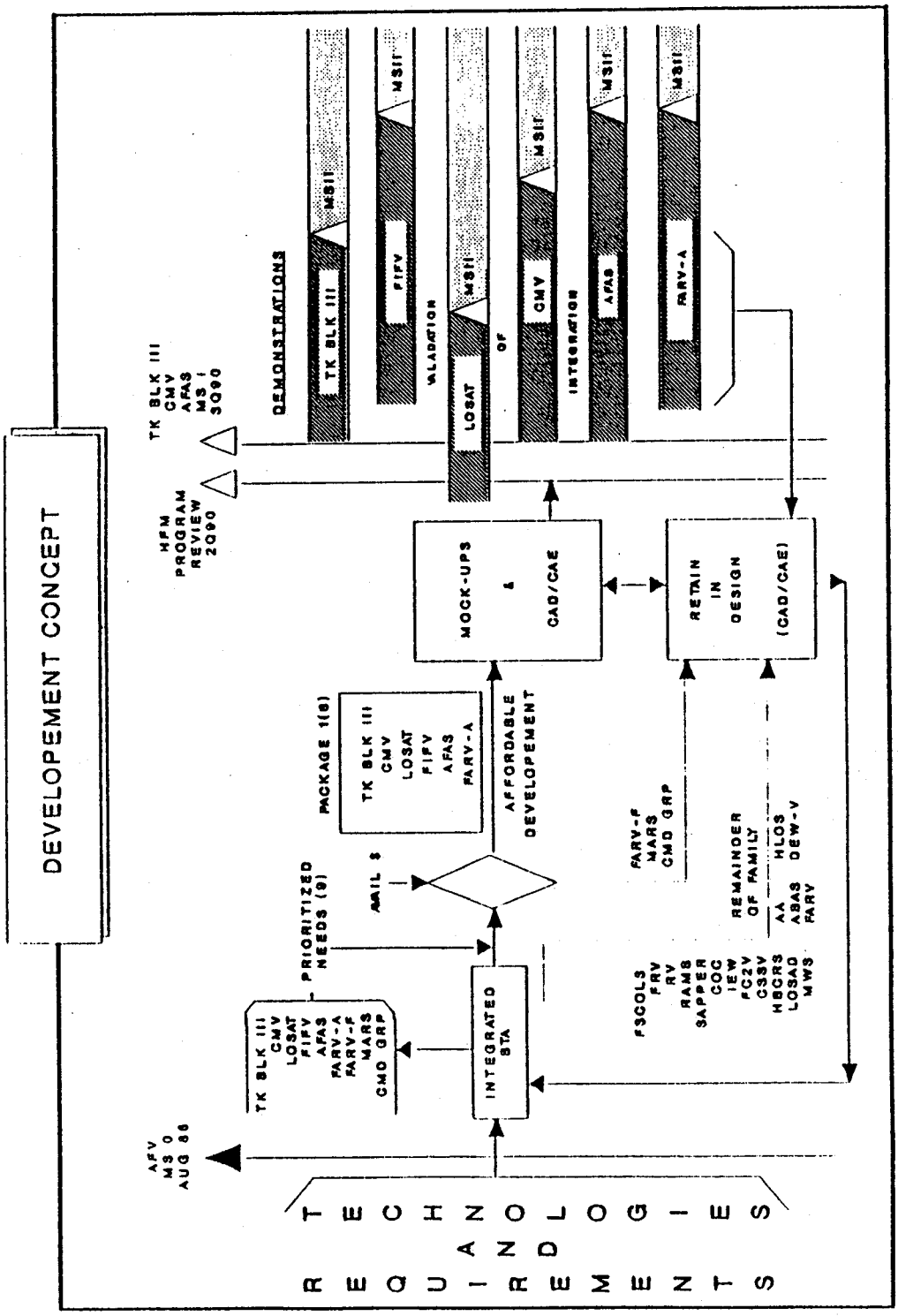


Figure 16. Family Development Concept

family based on commonality and modularity. The system concepts consisted of replacements for existing armored vehicles or substitutions for mission functions normally preformed by trucks and involved concepts for new vehicles.

To arrive at Package I, AFVTF and TRADOC had performed extensive prioritization efforts through the integrated BTA studies. Funding realities finally forced the task force to pick six AFV's to be developed first. Next, following a successful Milestone I decision, Package I systems would progress to advanced development, moving through the individual development phases at their own speed based on their developmental success. Milestone II and progress beyond were to be conducted according to the individual success of the systems. The only joint family decision was to occur at Milestone I.

All systems not within the first package remained in computer-aided design (CAD)/computer-aided manufacturing (CAM) allowing the second and third priority vehicles to be rapidly pulled from the computer data base and proceed from CE/D to a shortened, advanced DEM/VAL phase. This was possible due to the availability of a mature chassis on which integration has already been demonstrated; more simple systems would go directly to FSD [Ref. 49].

The key to the entire development effort involved two factors. These were:

1) the successful demonstration that a single, multi-use chassis was achievable without excessive compromise and

2) the successful integration of multiple types of mission modules onto a the common chassis. The Army was convinced that both factors were readily achievable [Ref. 50].

d. Requirements Review Council (August 1988) and Concurrent Activities

The August 1988, RRC meeting focused the previous attempts to prioritize Package I, define the scope of AFV, and formulate a workable system development concept. During this meeting, the RRC officially approved the M1 BLOCK III and FACS merger, added AFAS-C to the Priority I vehicles, and evaluated the Package I proposals. The TRADOC Package I systems were slightly altered and internally prioritized (Table X).

Table X - RRC System Priorities [Ref. 51]

Package I
FACS, CMV, LOS-AT, FIFV, FARV-A, AFAS-C, MEV, FC2V

Additionally it was determined that a long-term program executive officer (PEO) management structure would be instituted with the concurrent phase-out of AFV task force. This allowed AFV to be developed and managed as a program rather than a concept. The three industry teams were also to be focused on package I and an overall heavy force strategy (similar to that of the light helicopter -

experimental (LHX) program) would be developed for AFV. [Ref. 52]

1. A3STF Tank Review Program

A tank review program conducted under A3STF auspices during August 1988, convinced the CSA to approve the M1A2 (Block II) Abrams program in addition to the approval given at the August RRC meeting for the Block III/FACS merger. The M1A2 had favorable support in Congress and was subsequently considered as a mid-term system in the AFV disciplined evolution strategy. These programs were scheduled to coincide with the fielding of the expected Soviet FST II and III tanks, however, later funding problems over the affordability of near, mid and long-term systems forced the CSA to make a decision between future modernization or near and mid-term up-grades.

2. Advanced Technology Transition Demonstrators

As individual vehicle efforts began competing for the same resources, merging the AFV common chassis, M1 Block III, HIP/AFAS-C program, and other ongoing efforts and AFV systems became necessary. A coordinated effort was needed to consolidate all the resources for these requirements. This consolidation evolved over time into the HFM strategy and a fully integrated HFM Package I. The AFV (HFM) Package I was based on the projected development cycles of the various systems. Development of the lead system, the Block III tank, was reinforced by the M1A2/3

technology demonstrators already undergoing CE/D testing. The Advanced Technology Transition Demonstrator (ATTD), a TACOM initiative, had been designed to accelerate the tank production development cycle to meet threat driven, FUE dates and achieve cost reductions. The ATTD was intended to demonstrate integration and interaction of advanced technologies, focus development of related Tech Base components, and define and correct system compatibility problems. [Ref. 53]

An importance element of the ATTDs research program was its plan to by-pass the standard DEM/VAL approach in favor of a transition approach that would take it from CE/D to FSD, using the ATTD experiments in place of DEM/VAL. ATTDs had been approved and encouraged by Congress as well as OSD and the Army believed that acceptable levels of system maturity and integration confidence could be achieved with an ATTD based component maturation with a minimum of developmental risks. AFVTF's concession to use ATTDs in the development cycle led the ARSTAF to fully support the AFV concept and finally authorize conversion of AFV from concept to a program.

The M1A2/3 heavy chassis, already in CE/D, provided the other heavy systems with a ready-made ATTD and was subsequently used as the basis for the common heavy protection level chassis. The draft development plan was then expanded to include integration of a medium protection

chassis. To complete the plan, other mission module designs had to be considered in relation to the chassis design thus representing the full AFV Package I array. Due to schedule, resource, and technology limitations, mission modules requiring medium chassis were to be situated on interim M2/MLRS chassis until a new state-of-art, medium chassis was developed.

3. Package I Development Cycle

A proposed AFV Package I was eventually depicted in a AFVTF concept briefing chart (Figure 17). It illustrated many of AFV's unique concepts in addition to its diverse mission requirements. The concepts included integration of mission modules with the common chassis, a balance between commonality and performance achievable by the first six vehicles, and significant cost reductions achievable by non-redundant concurrent developmental/ operational (DT/OT) testing of the chassis. [Ref. 54]

Based on the proposed development cycle, the DEM/VAL phase was eliminated for the six tentative Package I vehicles and use of the ATTD approach was planned for the development of the FACS, AFAS-C, FARV-A, LOS-AT, and eventually the CMV and FIFV. Since the FARV-A supported AFAS-C on the battlefield, the two were to undergo simultaneous development, being produced on a one-for-one basis.

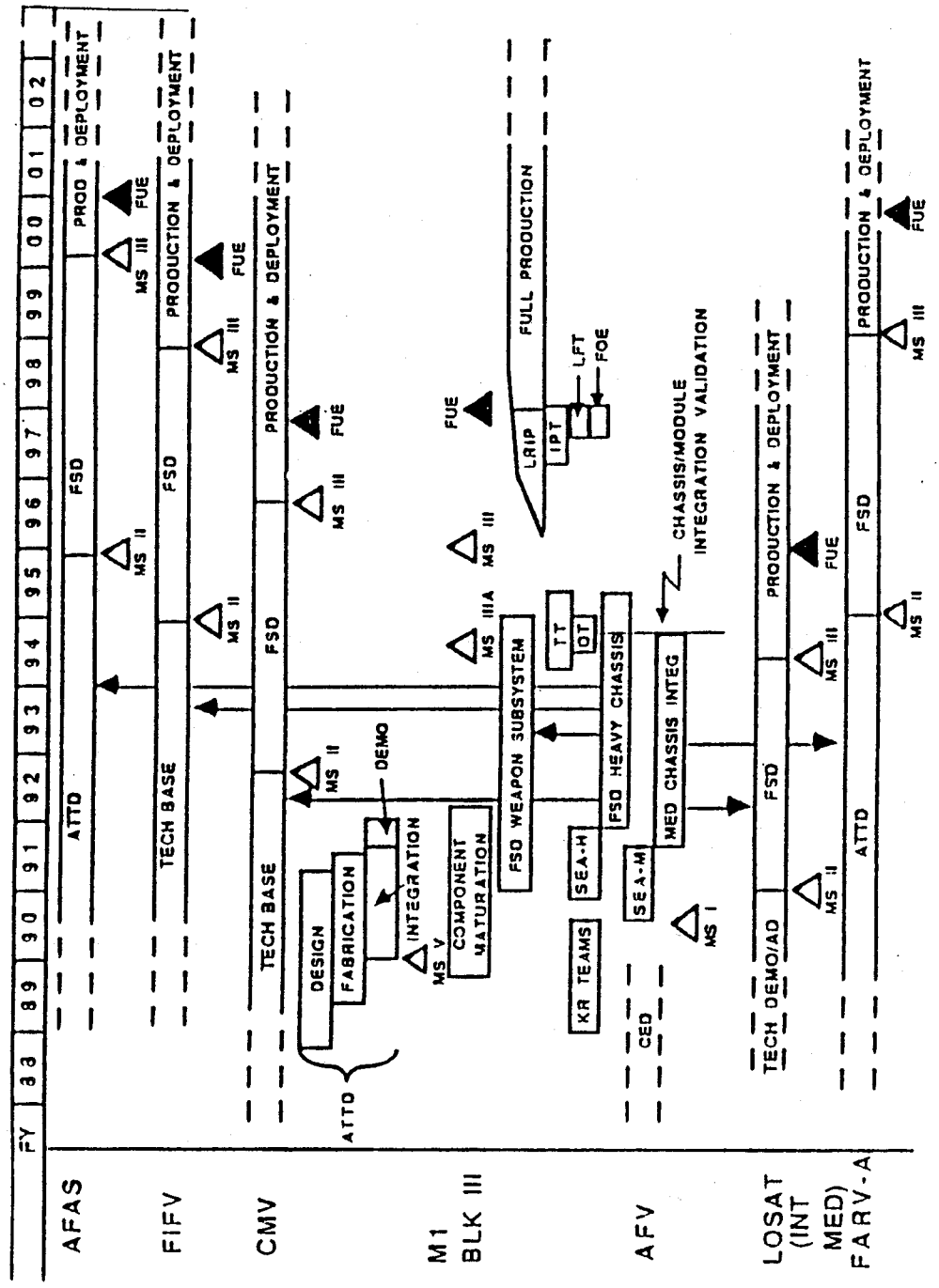


Figure 17. Initial Package I and Design and Development Scheme

From February to April 1988, the AFVTF saw two of its key positions overturned. Concurrent development of individual systems after Milestone I was changed to separate individual system development and use of ATTDS replaced the recommended DEM/VAL approach. In preparation for the September 1988 RCC meeting, AFVTF fought hard for preservation of the concept of total system integration, a key element of the AFV concept. This idea survived the weeks leading up to the RRC meeting and remained a foundation of the family concept along with the foundations of commonality and modularity.

e. Requirements Review Council (September 1988) and Concurrent Activities

The September 1988 RRC meeting focused upon program management and resource issues to support and field AFV Package I. The conceptual AFVTF transition plan and schedule was presented during the meeting. The plan suggested using the newly mandated PEO position to handle the more unique elements of AFV system acquisition while the traditional program managers were employed to handle vehicle specific development organizations. Specific recommendations were to:

1) approve the proposed AFV Package I,

2) use the Option II timeline development cycle,

3) award FY89-FY98 design contracts to the three industry teams with the focus modified to package I, and

4) establish the new PEO.

The proposed schedule recommended conducting transition from January 1988 to April 1989 at which time the PEO would assume full operational control. [Ref. 55]

The RRC was concerned over the proposed schedule, the new statutory acquisition requirements, and the need to gain the support of the new Army Acquisition Executive (AAE). These concerns prevented the immediate approval of the AFVTF recommendations. Objections were also voiced over awarding industry contracts prior to adequately preparing OSD and Congress. Nevertheless, the CSA directed only minor changes to the proposed Package I (Table XI).

Table XI - CSA, Package I Vehicles [Ref. 56]

HEAVY PROTECTION CHASSIS	MEDIUM PROTECTION CHASSIS
FACS	LOS-AT
AFAS-C	FARV-A
CMV	
FIFV	

Additionally, the PEO management proposal was approved. The CSA directed that an updated AFV development plan and a public affairs strategy and a plan for gaining OSD and Congressional support had to be defined in detail would have to be ready by late September 1988. [Ref. 57]

Following the RRC meeting, POM and funding actions were permanently shifted from AFVTF to the new

ASARDA office in preparation for upcoming budget deliberations. An intense and detailed budget review (known as the "Midnight Drills") ensued to quickly develop the funding profiles for AFV Package I, refocus the industry teams and the Tech Base, and prepare Package I for inclusion into the FY90-FY91 budget and FY90-FY94 POM.

f. Armored Family of Vehicles Transition to the Heavy Force Modernization Program

During this period, the final conversion of AFV Package I into a component part of the HFM strategy took place. This involved attempts to structure the RD&A effort and the production/deployment plan with individual vehicles that could be supported by available funds. This effort cemented the linkage between Package I and ALB-F and established the Army fielding policy of deploying AFV to the "first-to-fight" forces (Figure 18 & 19). This move to clearly define the Army's AFV strategy provided the justification for the program's name change from the AFV package I to the HFM strategy and HFM package I. The change decision was partially based on the previous success of name changes in the earlier aviation modernization plans. [Ref. 58]

The HFM strategy entailed modernizing and fielding new AFV vehicles for the first to fight forces. Their equipment would be up-graded and then be redistributed to the follow-on units. This strategy established a continuous, disciplined modernization approach, rather than

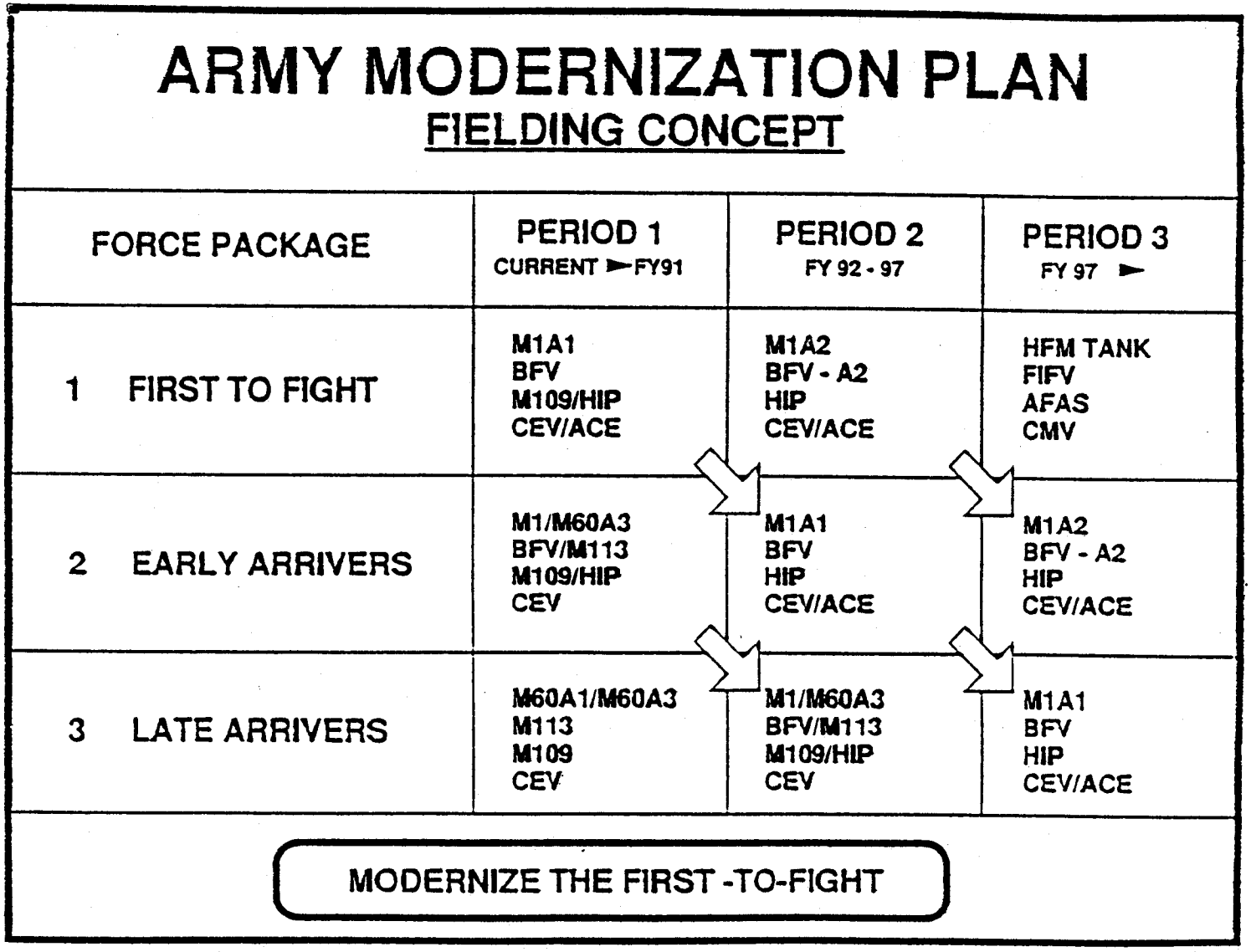


Figure 18. Family Fielding Concept

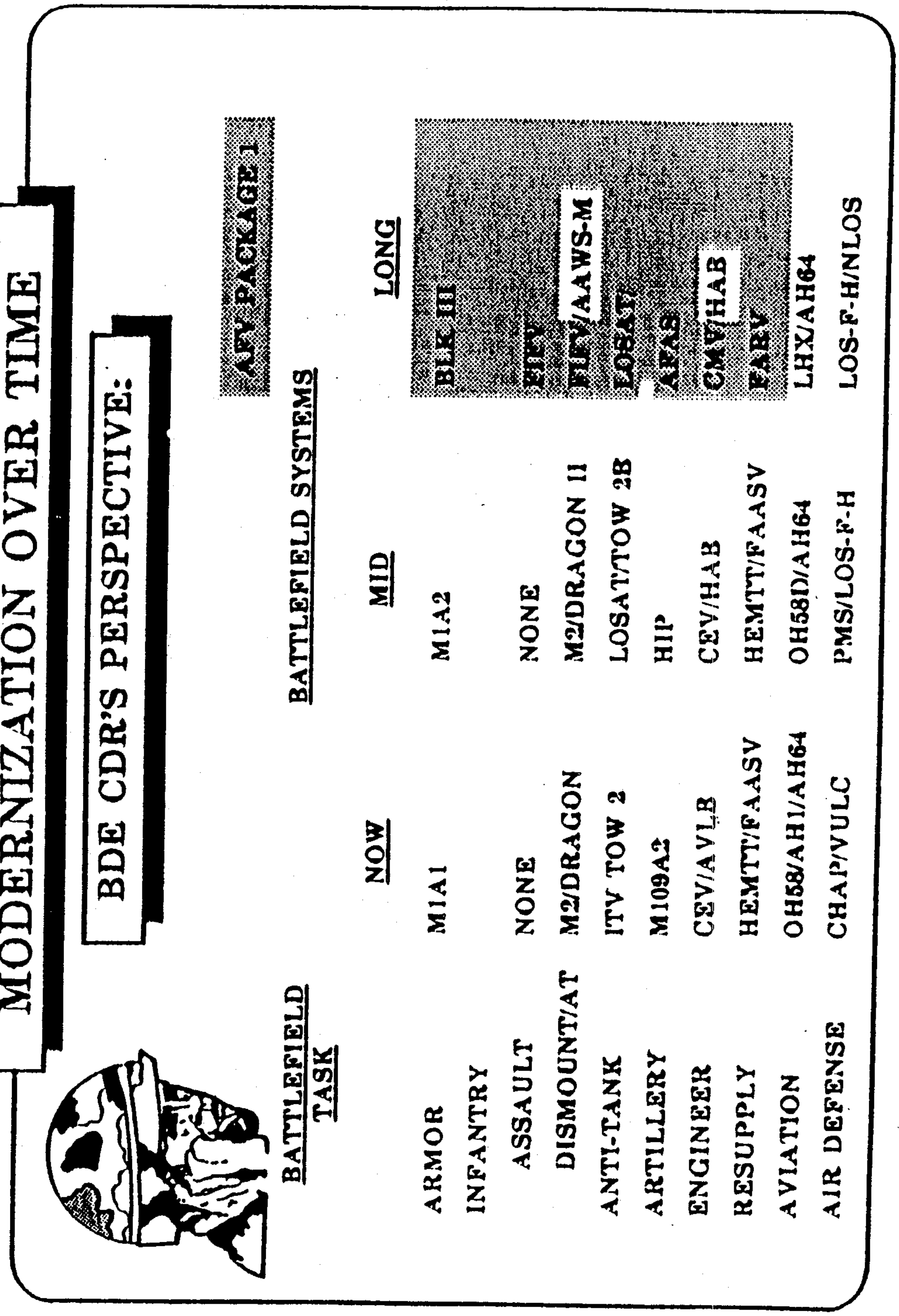


Figure 19. Discipline Evolution - Brigade Commander's Perspective

an individual near, mid, and long-term fielding approach. This resulted in projected early cost savings based on the reduced, initial purchase of AFV vehicles. [Ref. 59]

g. Armored Family of Vehicles, Decision Review

In late September, the CSA held an AFV decision review to present the revised AFV strategy. It resulted in the CSA's final decision on AFV strategy, composition, and transition details. The CSA directed that Package I remain as specified in early September and directed that AFV be made an integral part of the Total Army Force Modernization Plan. The development and acquisition of the Package I fleet was expected to provide similar, although reduced, cost, schedule, and performance benefits as those originally envisioned. Nevertheless, Package I was expected to fully achieve its planned synergistic operational effectiveness. The AFV strategy the emerged from the Phase I and II efforts:

1) provided a substantial increase in warfighting capability within the current resource constraints,

2) integrated force enhancement characteristics as required by ALB-F,

3) facilitated future force modernization,

4) improved the ability to conduct high tempo operations on the 21st century battlefield, and

5) expanded close combat operational capabilities.

Additionally, the strategy:

1) allowed AFV to be fielded inside the Soviet modernization cycle,

2) addressed the most urgent force requirements in the current fleet while allowing for P3I improvements,

3) minimized fielding turbulence due to the HI/LO mix strategy, and

4) established a future heavy protection level baseline and provide an interim solution for medium systems. [Ref. 60]

This review marked the end of AFVTF Phase II. The CSA's final AFV decision was based on a complex, comprehensive formulation process and represented a consensus of support by Army leaders, ARSTAF, and the MACOMs. The new AFV/HFM strategy continued to be reviewed and refined in terms of affordability, emerging requirements, and OSD and Congressional acceptance. Nevertheless, it had been made a key component of the Total Army Modernization Plan and was staunchly defended in all future budget negotiations. The scope of the AFV/HFM strategy was reflected by a chart showing a synopsis of the development concept and depicted the essence of the September 1988, Package I decision (Figure 20).

h. Conventional Systems Committee Briefing

With required funding streams identified, ARSTAF briefed the Conventional Systems Committee (CSC), in October 1988, on the AFV strategy. By canceling selected programs and altering the funding of others, AFV was briefed as a "no-cost" program requiring only that funds be shifted in

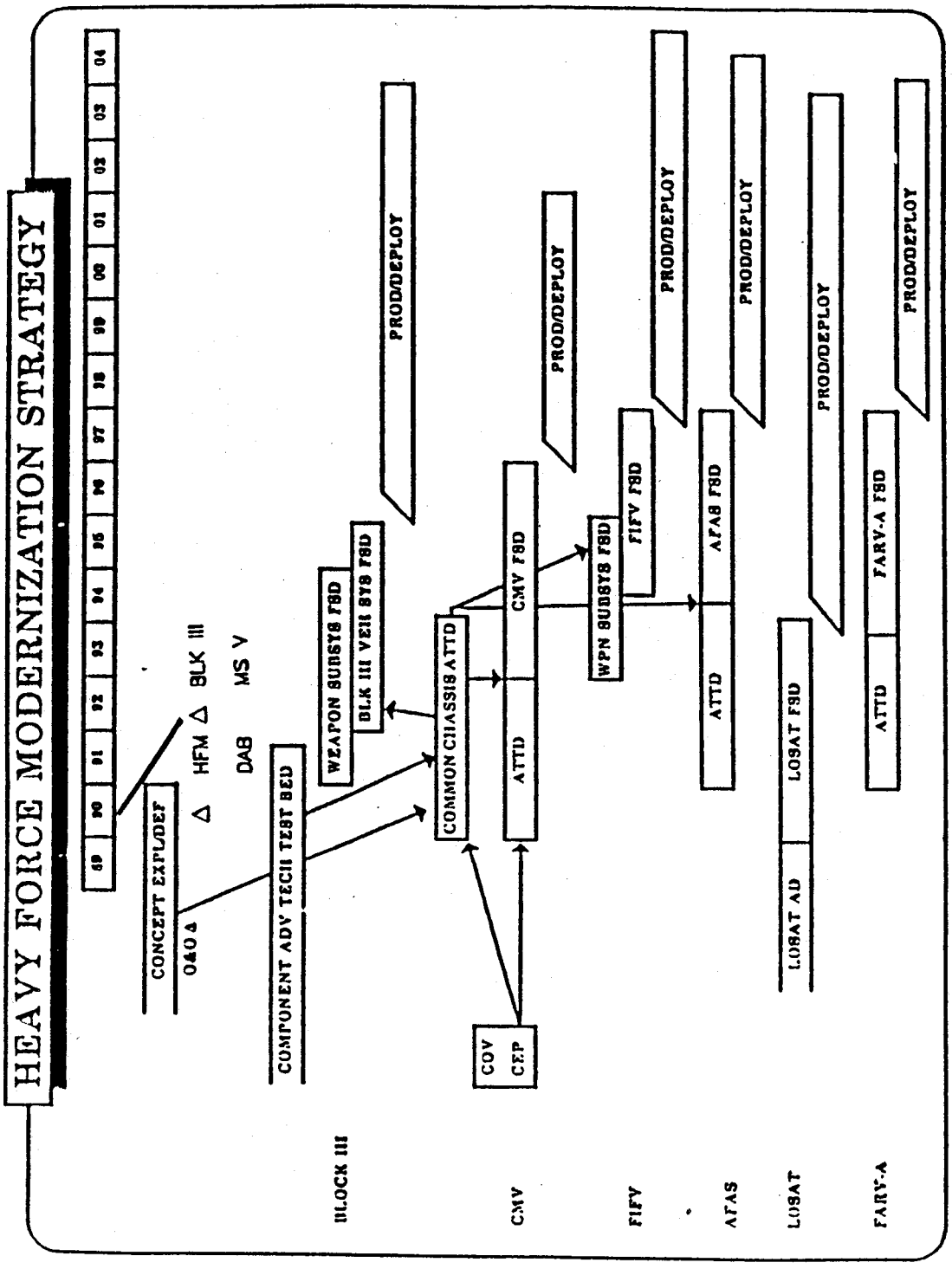


Figure 20. Integrated Package I, Design and Development Strategy

various RD&A programs. The information paper, explaining program funding proposals, subsequently became the underlying draft program strategy document and in March 1989, the document was approved as the HFM program acquisition strategy.

C. EVOLUTION OF THE HEAVY FORCE MODERNIZATION PROGRAM (1989) AND ARMORED SYSTEMS MODERNIZATION ACQUISITION PROGRAM (1990-1991)

The second segment of the ASM historical summary continues with a review of the HFM Program and ASM Acquisition Program efforts. The AFV concept as structured in August 1988, represented a fundamental change in the way that the Army would conduct future medium and high intensity operations and eventually became a cornerstone of the total Army modernization efforts. Unlike the AFVTF experience, however, after the AFV concept transitioned to the HFM program, it became an increasing target for critics and their program challenges. In a 1990 attempt to quell mounting criticisms by Congress and OSD, the program was transformed virtually overnight into the ASM acquisition program and given a broader scope.

ASM struggled for the next two years against environmental factors and circumstances to maintain the program baseline that the Army had based the future of its heavy armored forces on. Increasingly, program concessions began to dilute the innovative and unique elements of the program. Toward the latter part of 1991, the Army and PEO-

ASM were compelled to undertake major restructuring of the program in order to keep it alive. (Table XII).

Table XII - Event Timeline Continued

- APR 1989 - AFVTF disbanded and PEO-HFM assumes HFM opcon;
- MAY 1989 - OSD program milestone and ATTD challenge;
- JAN 1990 - Operation Just Cause after-action report;
- FEB 1990 - HFM converted to ASM;
- MAR 1990 - CSC pre-DAB meeting;
- APR 1990 - DAB ASM review;
- JUN 1990 - ASM Milestone I and Block III DAB postponed;
- AUG 1990 - ASM Milestone I and Block III DAB, program receives approval;
- NOV 1990 - Tier II armor procurement study;
- OCT 1990 - AAE policy change;
- NOV 1990 - Congress places temporary halt on LOS-AT;
- DEC 1990 - AVTA and TCM receive common chassis contract;
- MAR 1991 - Contract protest filled by GMC;
- APR 1991 - Desert Storm after-action report;
- JUN 1991 - GMC protest overturned;
- JUL 1991 - GAO ASM investigation conducted;
- AUG 1991 - Congress encourages ASM program reassessment;
- OCT 1991 - Army proposes ASM restructure plan, denied by OSD;
- DEC 1991 - Army proposes 2nd restructuring plan, denied by OSD;
- JAN 1992 - ASM undergoes major restructuring.

1. Threat Assessment and Trends, 1989 - 1990

Despite indications of the Soviet and Warsaw Pact decline in 1989 and 1990, intelligence appraisals continued to predict rapid erosion of Allied technological superiority and warned of a continued Soviet conventional threat. In late 1989, political and economic signs pointed to the severe stresses within the Communist Bloc, however, intelligence assessments indicated that glastnost and

> ...perestroika [were] not inconsistent with improved Soviet combat readiness....[and that] ...a smaller Soviet Army offer[ed] advantages to the threat [Ref. 61].

Projections also indicated that

> Soviet modernization will continue....with increased R&D expenditures....[and]...that the threat is not likely to diminish....in fact, it is likely to increase [Ref. 62].

Mirroring intelligence reports, the final A3STF report concluded that the U.S. was in danger of falling behind the Soviets and that the Army was "...behind, must catch-up, get ahead, and stay ahead [Ref. 63]".

The conclusions of the 1988 DSB's similarly maintained that the U.S. must counter and overmatch the Soviet armor/anti-armor threat and reaffirmed earlier recommendations that a family of close combat vehicles, based on a future tank, was essential. The DSB urged the Army to speed-up advanced technology transition through the use of ATTDs as a method of regaining ground over the Soviets. Speculation indicated that Soviet military

downsizing could result in improved combat readiness as land force modernization appeared to be the Soviet's top priority. These indicators showed that Soviet armored system modifications would continue and R&D expenditures would increase. It was thought that with additional R&D, a smaller Soviet Army would become more technologically advanced at reduced cost while still retaining its numerical superiority. Finally, reports theorized that the new reactive armor packages on Soviet tanks and the projected fielding of two new tanks before the year 2000, had changed the land force balance of power. This caused Army leaders to determined there was no need to reexamine or reassess the requirement for HFM. [Ref. 64]

2. Heavy Force Modernization Transition and Program Development (1989)

Transition of AFV to HFM was conducted over a four month period, from January through April 1989. During this period, AFVTF continued to manage daily operations while the HFM program office was established and gradually assumed operational control. Existing AFV plans, schedules and documentation (Figure 21) were reformatted to the new HFM focus while program analysis efforts began to concentrate on HFM Package I. New goals, objectives, and strategies were developed to support the program's narrower scope, focusing upon the HFM (AFV) Package I vehicles. A concerted effort to gain OSD and Congressional support also began. HFM came

HFM DOCUMENTATION REQUIREMENTS

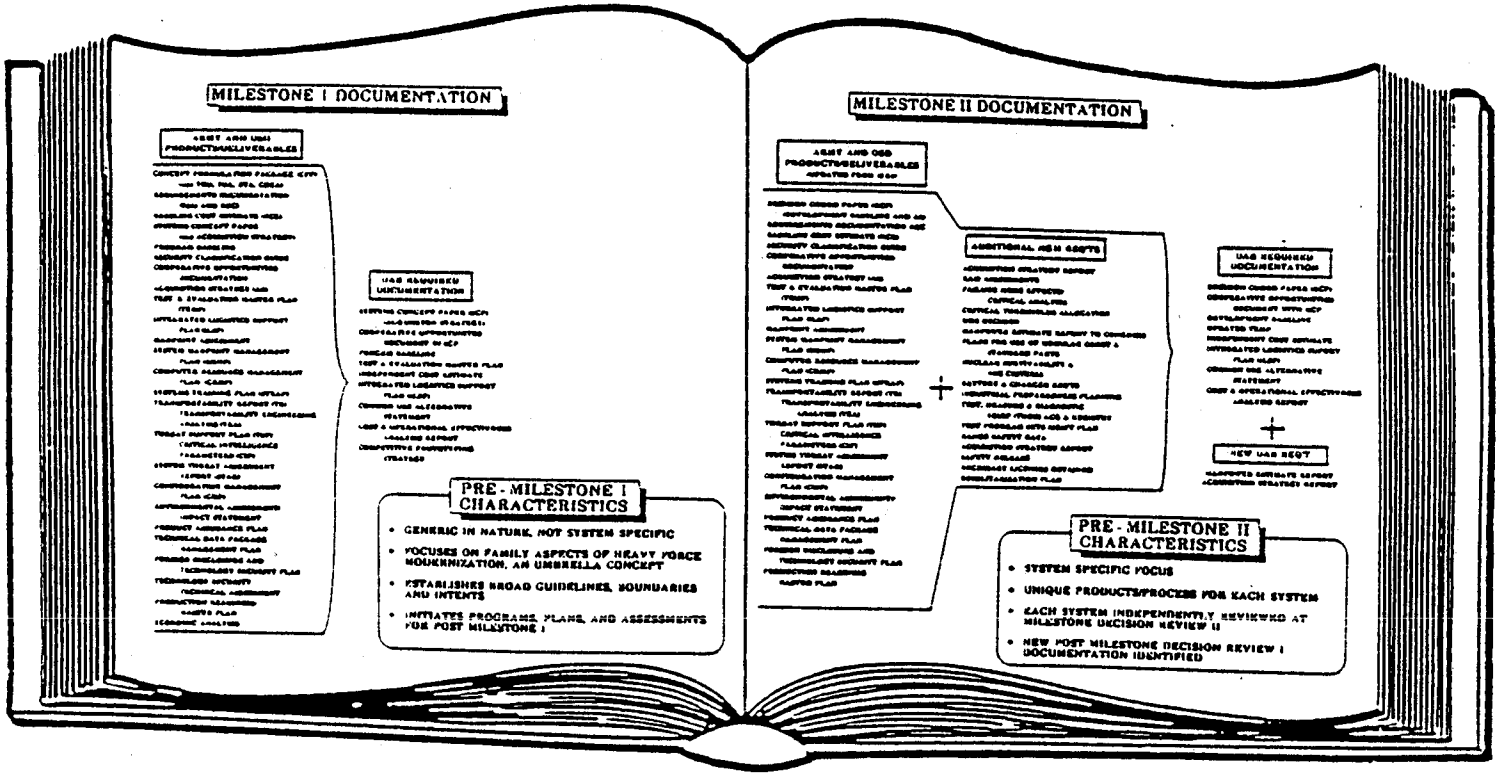


Figure 21. Documentation Requirements

to symbolize the Army's "blueprint" for armored systems modernization. After receiving program approval, HFM was tentatively scheduled for a DAB Milestone I decision review in March 1990. All efforts were concentrated upon passing this landmark.

a. Armored Family of Vehicles/Heavy Force Modernization Transition

Transition to the HFM program involved the establishment of a new management team and program organization to guide ASM through the development, production, and fielding process. Transition was carefully orchestrated to ensure an uncomplicated conversion and safeguard efforts completed to date. Transition principles were enacted to ensure that continuity of intent and effort was maintained. PEO-HFM was established to be a stable, unambiguous, timely, and responsible program organization making maximum use of experienced AFV personnel within its organizational structure. Significant efforts were also made to ensure that continuous industry involvement was maintained throughout transition. [Ref. 65]

b. Initial Program Criticism

As HFM became an officially sanctioned program and transition started, critics began to challenge the program. Army leaders and PEO-HFM received mixed signals regarding support for the program based upon the threat estimates but offset by a declining defense budget. The Army remained confident that the program would be approved

and fully funded, however, evidence pointed toward an increasingly volatile acquisition environment.

PEO-HFM attempted to satisfy OSD and Congressional concerns by strict adherence to their guidance for new-start programs. The PEO attempted to focus the efforts of the Tech Base on HFM, accelerating transitions from Tech research and design to development. Additionally, HFM attempted to resolve the problem of declining defense dollars through the use of shared technology and proclaiming the cost reductions inherent in commonality and modularity aspects of HFM.

PEO-HFM was the first major Army acquisition program to be conducted under the new streamlined program management structure (e.g. Defense Acquisition Executive (DAE), Army Acquisition Executive (AAE), PEO, and program manager (PM)) and was structured accordingly to meet the new statutory guidelines. Through active consideration of common use solutions and development of a tailored acquisition process, PEO-HFM's compliance with new statutory and regulatory procurement guidelines convinced Army leaders that they had taken the proper steps to ensure that the program would be safe from serious challenges.

c. Internal Acquisition Environment

Criticism of the program remained a problem for HFM. An Army assessment of the internal acquisition environment during the fall of 1989, exhibited the depth of

concern and skepticism over HFM within the acquisition decision chain. Congress believed that HFM was overly ambitious, conceptually flawed, unaffordable, and "would die of its own weight". Congress also noted that the program was additionally complicated by the fact that a light tank program was not an HFM component. OSD expressed similar concerns implying that the program was ill defined, too expensive, had an unrealistic timeline, competed with many other major Army programs, and was the carrier of all program "diseases". Even elements from within the Army believed that HFM lacked a compelling case for procurement and recommended a reduction in scope. Comments from the Army acquisition and combat development communities suggested that concern over HFM funding would increase. Army support for current armored system modifications, competing mid-term programs, and the long-term HFM over-complicated the acquisition arena. Finally, it was thought that there was no sense of urgency to define, combine, or prioritize HFM systems and subsystems. [Ref. 66]

The overall perception was that AFV was inexecutable and lacked the support and commitment required to procure systems. While significant difficulties were experienced in attempting to overcoming these impressions, the Army continued to develop the HFM strategy and plan. Responding to mounting criticism in March, 1989, the CSA stated that

> ...there should be no question as to our purpose. The Heavy Force Modernization Plan is a blueprint for disciplined evolution of the total Army heavy force into the 21st century. [Ref. 67]

d. Acquisition Strategy

The HFM strategy was divided into two principal components, acquisition and contracting. HFM Package I was based on a unique developmental approach conceived to shorten development timelines, exploit related technology initiatives, and reduce risk and duplication through learning curves (Figure 22). This was to be successfully accomplished through maturation and integration of HFM components and systems in Component, Advanced Technology Test Bed (CATTB) programs and by the use of ATTDs. The CATTB and ATTDs were expected to produce the confidence needed and sufficiently reduce the risks to proceed directly to FSD without the resulting time and expense of a required DEM/VAL phase. DSB recommendations and OSD and Congressional initiatives seemed to bear out this plan citing the belief that Tech Base technology transfer would be increased by use of ATTDs prior to FSD. The use of a contracted HFM systems integrator, managing the programs systems engineering analysis (SEA), was also planned to aid the PEO through commonality integration and configuration management issues. [Ref. 68]

The second component of the strategy involved contracting and competition. This element was based on

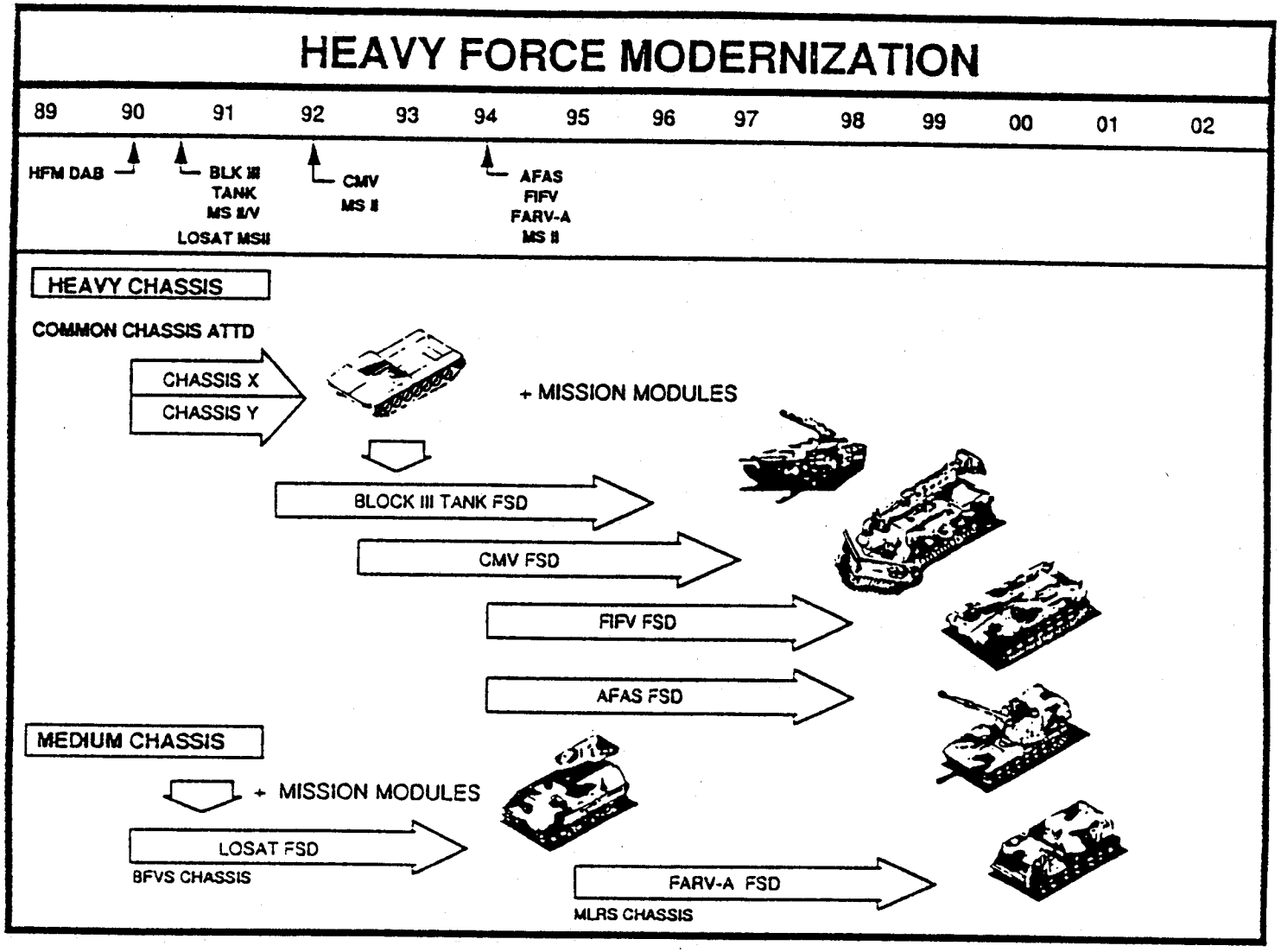


Figure 22. Package I FSD Timeline

performance solicitations that fostered innovation, trade-off optimization and cost efficiency, avoided "how-to" criteria, and encouraged development of a broad industrial base through heavy industry involvement and competition. [Ref. 69]

The HFM program objectives were designed in consideration of the decreasing defense budget but remained primarily focused on the Soviet threat. Program objectives stated that the priority of effort was to satisfy immediate operational needs with the new systems being fielded within threat-driven, time constraints and to fully support the emerging ALB-F doctrine. Nevertheless, all systems were expected to remain within affordability limits and new-starts would be minimized.

HFM Program risk was to be minimized by designing systems for optimum commonality and modularity. The HFM advanced development phase would use the CATTBs and component ATTDs to achieve system/component maturation. The tailored, abbreviated development cycle consisted of:

1) a standard CE/D phase,
2) an advanced development phase characterized by the use of ATTDs, CATTBs, and SEA to ensure component and technology maturation and integration,
3) a transitional FSD phase, and
4) a production and deployment phase.

The Package I systems were planned to achieve a joint package Milestone I decision first then the individual

systems would be developed on separate timelines. The non-priority family vehicles would remain in CAD/CAM with selection of future systems for development based on warfighting needs and available resources. Risk was to be further reduced through contracting for the program's systems engineering effort. [Ref. 70]

The systems integration and SEA effort was to be administered by a contractor. The contractor was to provide the PEO with engineering and technical experience in the areas of chassis and mission module commonality, simulations and modeling, and milestone documentation and production assistance. Finally, maximum competition would be encouraged between contractors with statements of work (SOW) indicating "what not how" to the contractors.

e. Army Modernization Principles

The Army established a foundation for the HFM Program by defining a series of force modernization principles tailored for HFM but applicable to total force modernization. Program actions and decisions were then justified on the basis of these principles and they remained a basis for the program through its subsequent transition to the ASM Acquisition Program (Table XIII).

Table XIII - Army Modernization Principles [Ref. 71]

- Support Army warfighting requirements;
- Ensure level funding (prevent funding bow-waves);
- Provide most modern equipment to first to fight forces;
- Field modernized equipment faster than the threat;
- Modernize by force packages;
- Retain a system of systems approach;
- Allow ease of system upgrades;
- Preserve lethality and survivability;
- Control the age of vehicle fleets;
- Control O&S expenses;
- Focus and harness the Tech Base;
- Minimize training turbulence;
- Maintain a balanced force perspective;
- Continuous modernization based on a HI/LO force mix;
- Purchase current production systems to meet immediate readiness requirements;
- Maintain the industrial base for mobilization.

f. Heavy Force Modernization Plan

The new Army modernization principles, in turn, provided the basis for the Heavy Force Modernization Plan. This plan mandated that HFM adhere to a set of specific developmental guidelines. Supported by the Army modernization principles and heavy force modernization plan, the HFM acquisition strategy for the six priority HFM

Package I vehicles was approved by the Secretary of the Army in March 1989 (Table XIV).

Table XIV - Heavy Force Modernization Guidelines [Ref. 72]

- Modernize systems to meet ALB-F operational requirements;
- Design/field a heavy force vehicle family that enhances total force capabilities and reduces the logistics burden;
- Build an affordable force without placing battlefield lethality or survivability at risk;
- Modernize the total force by thirds;
- Modernize forces from a current start-point (disciplined evolution);
- Buy current and mid-term production systems (e.g. M1A1, M1A2 Abrams tanks) to meet readiness requirements;
- Modernize to meet the threat based on safety, efficiency, and economic considerations;
- Maximize commonality and modularity to enhance capabilities and reduce costs;
- Eliminate competing technologies and eliminate systems with limited potential early;
- Design for P3I;
- Match vehicle protection and mobility levels;
- Field systems inside of the Soviet modernization cycle;
- Field vehicles by Force packages and in unit sets with priority to first to fight units.

g. Heavy Force System Advantages

In order to gain the support of HFM opponents, system advantages were then compared and contrasted with those of current operational systems to

3) provide a test and evaluation (T&E) interface between industry and government developed subsystems, and

4) verify technologies to allow the government to make informed purchases.

HFM components such as fire control systems, track & suspension systems, vehicle countermeasures, vetronics, armor, and propulsion systems were proposed for maturation on the CATTB. [Ref. 74]

The two different types of ATTDs (Common Chassis Advanced Technology Transition Demonstrator (CCATTD) and Mission Module Advanced Technology Transition Demonstrators (MMATTD)) were planned for use in the development and maturation of systems, subsystems, and components. The ATTDs were to be developed by industry as integration and test platforms designed to determine the optimal chassis, common components, weapon systems and subsystems. CCATTD/MMATTDs were intended to foster competitive demonstrations of HFM chassis prototypes and integration of weapon systems or system peculiar subsystems on the surrogate test chassis (mission module integration) mission module prototypes. Planned HFM ATTD chassis demonstrators were an M155 HIP surrogate for AFAS-C, an MLRS surrogate for FARV-A, an M2 surrogate for FIFV, and an M1A1 surrogate for CMV testing. The Block III would use the ATTD common, heavy chassis previously developed for the M1A3 program. [Ref. 75]

i. Suspension of Program Operations

In May 1989, OSD temporarily suspended the further conduct of the HFM operations. OSD expressed concerns over allowing HFM, in its current configuration, to proceed toward the HFM Milestone I DAB review, tentatively scheduled for March 1990. OSD believed that while a Milestone 0 decision had been reached for the earlier AFV studies, no Milestone 0 decision had, in fact, been reached on HFM. On the assumption that a HFM Milestone 0 notionally occurred, OSD stated that it was no longer receptive to HFM Package I as it had been structured. In OSD's interpretation, since HFM had evolved into a concept quite different from that of the AFV concept, the AFV Milestone was no longer valid. To resolve this dilemma, OSD stated that each vehicle needed to go through an individual Milestone I review rather than the joint Package I review that had become a part of the HFM development cycle. [Ref. 76]

Additional OSD and Congressional complaints cited that the program development cycle was not well thought out. OSD indicated that ATTDs were not sufficient to adequately reduce the development and integration risks for HFM systems to by-pass the DEM/VAL phase and enter FSD. Congress was becoming increasingly worried that large amounts of funds would be expended on FSD before a satisfactory product materialized. Finally, the T&E

community was also troubled by the ATTDs issue. They claimed they would be unable to conduct sufficient testing on the limited number of ATTD systems that would be developed prior to FSD. These concerns forced the Army leadership and PEO-HFM to reassess key elements of the HFM program and acquisition strategy. [Ref. 77]

j. Changing Environment; Operation Just Cause Influences

During the fall of 1989, the Eastern Europeans in large numbers were demanding an end to communist rule. Many of these governments subsequently fell under the popular will of the people. In the Soviet Union, glastnost and perestroika had brought about a new openness and decades old Cold War tensions with the U.S. began to ease. In the U.S., concerns over the spiraling National debt and a mounting budget deficit resulted in calls for reductions in defense spending and further demands to divert defense dollars into social programs.

Rapidly changing international and domestic events pointed to a quickly changing acquisition environment. The activities and actions of Congressional appropriations and armed service committees resulted in a dichotomy of views over support for Army modernization and procurement programs. Calls for procurement reform had become a popular political issue as a Democratic Congress sought to make an issue out of military spending.

Two significant events occurred in December 1989. Contracts for CE/D studies were finally awarded to the three industry teams in early December when Congress approved HFM line items within the budget. In late December, the U.S. military forces conducted a contingency force operation in Panama (Operation Just Cause). After-action reports from this operation indicated that the M551 Sheridan Reconnaissance vehicle, a Vietnam era light tank employed with the contingency forces, lacked the ability to adequately support Army combat elements. This news brought an instant reaction from Congress who noted that an Army replacement for the M551 had been in CE/D for over 12 years. Based on the M551 deficiencies, the success of the Marine LAV (light armored vehicle) program, and the fact that a light tank was not addressed in the HFM strategy, Congress threatened to withhold funding until the Army included a light tank requirement in the HFM program.

Bowing to OSD and Congressional pressure, the Army began addressing the problems of the milestone achievement, the abbreviated development cycle, and the light tank requirement and the realization that significant global and domestic changes were beginning to occur.

3. Armored Systems Modernization Acquisition Program, Transition and Development (1990-December 1991)

In January 1990, responding to changing geopolitical and economic conditions, HFM was redesignated the Armored Systems Modernization Acquisition Program. The ASM Program

was expanded to encompass a comprehensive plan that focused upon the total armored force rather than only upon heavy and medium forces (Figures 23, 24, & 25).

Despite this shift in emphasis, the Army maintained that the Package I systems remained a necessity. The nature of the acquisition environment, during this particular period, was such that the Army was forced to repeatedly make program alterations and justify its existence. Finally, in the wake of significant environmental factors such as the national deficit, Operation Desert Storm, the dissolution of the Soviet Union, and Congressional and OSD pressure, ASM was finally totally restructured.

a. Modernization Strategy Revision

In January 1990, FY90 funding for HFM (ASM) was withheld by Congress to deal with initial Army reluctance to include a light tank in the program. Subsequent Army review of the HFM strategy concluded that it must yield to Congressional and OSD concerns over the reduction in the Soviet threat and the performance of the M551. As a result, a light tank requirement was added and the program was refocused towards a regional threat. The Armored Gun System (AGS), a non-developmental (NDI) item separate from HFM Package I, was planned as a near term solution to the needs of U.S. contingency forces. The possibility of having to

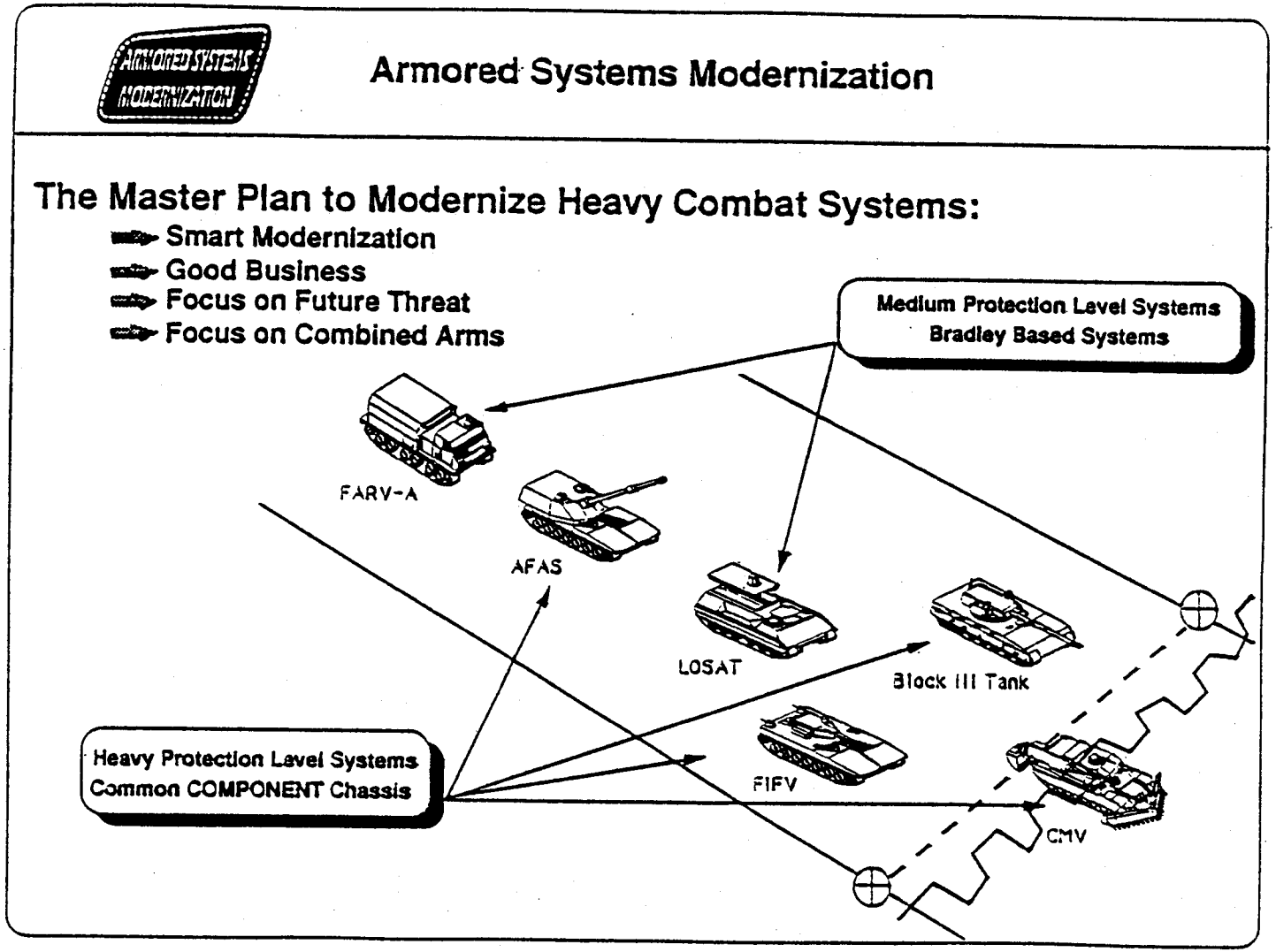


Figure 23. Modernization "Blueprint"

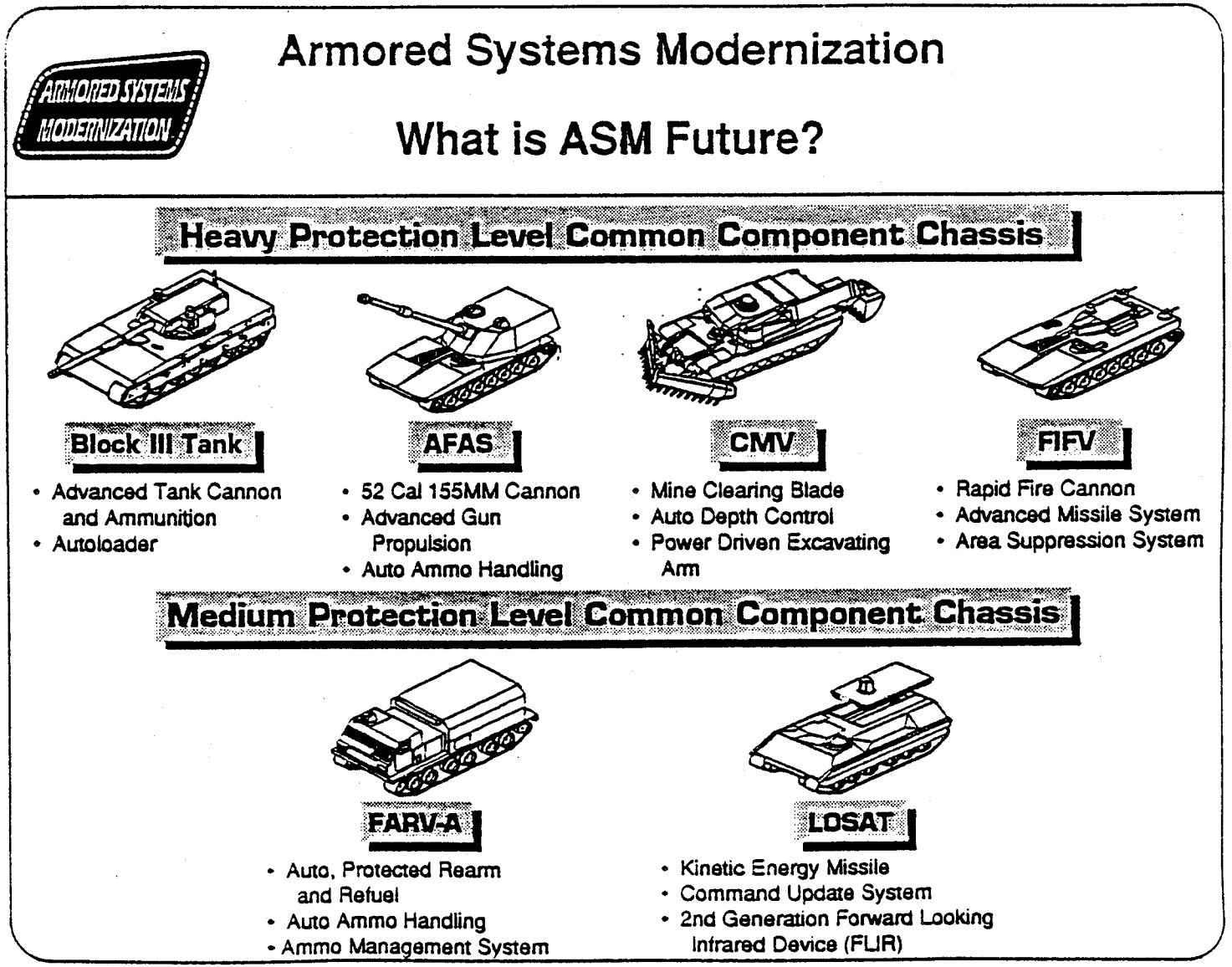


Figure 24. Package I Characteristics

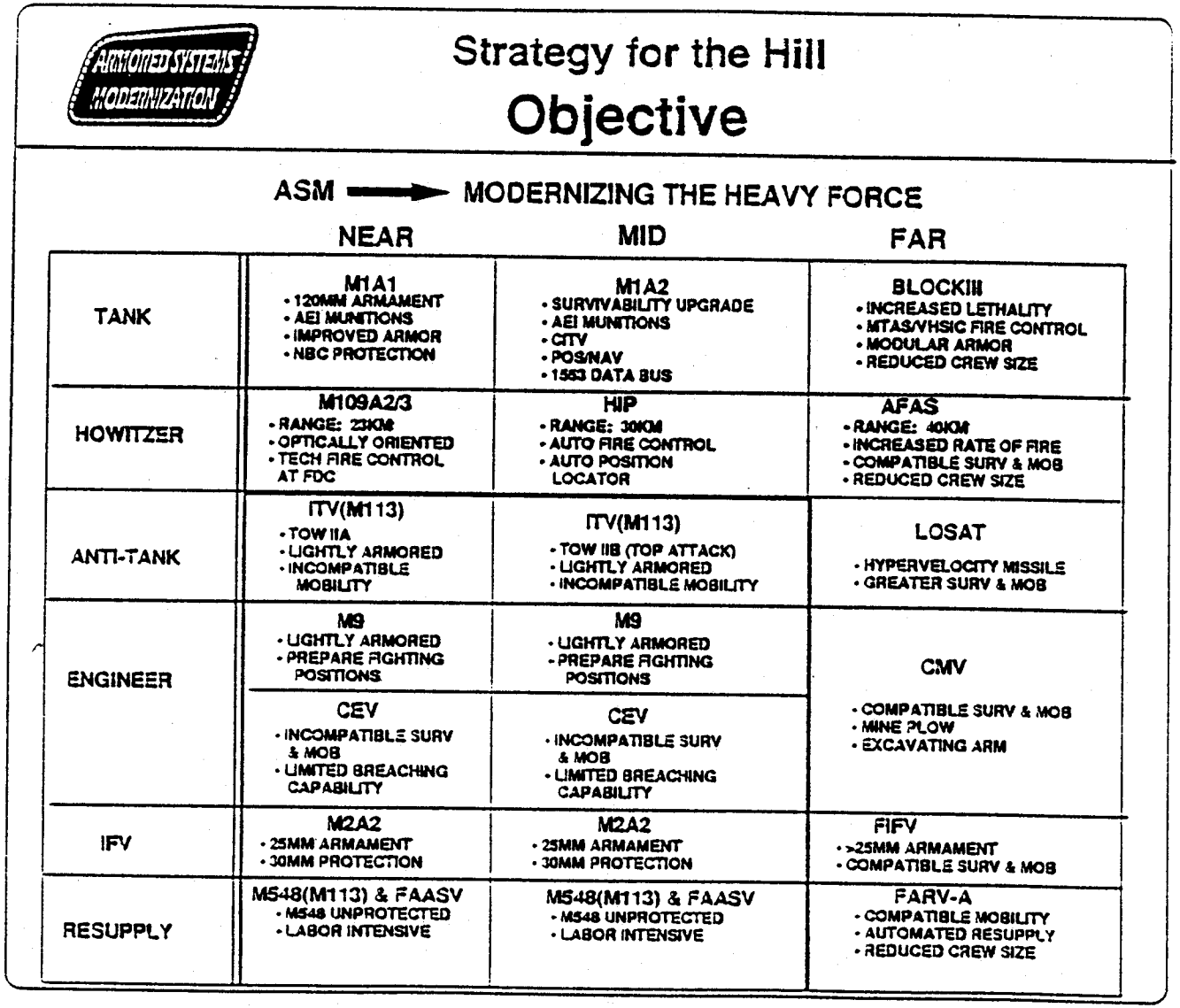


Figure 25. System Comparisons with Near, Mid, Long-Term Systems

include other light systems in addition to the HFM Package I systems, however, prompted HFM to evolve into a comprehensive modernization approach for both heavy and light armored forces. No longer exclusively a heavy force effort, the new modernization strategy was changed to the ASM Acquisition Program (Figure 26).

Official ASM policy statements indicated that "ASM is not just a name change but a plan to respond to the changing world situation.

> ...[the] Soviets will remain the most capable competitor for the foreseeable future but the Army must field capabilities that can defeat other threats around the world. ASM provides the near term solution for contingency forces and will continue to preserve the Army investment for the future. [Ref. 78]

ASM was revised to also consider and provide improvements to both near and mid-term systems. In the long-term, the ASM Acquisition Program continued to primarily concentrate on the future modernization of U.S. armored systems. ASM retained the basic HFM advantages, justification, and built upon the foundation of the earlier HFM principles and plan. The conversion to ASM began in January and was completed by late February 1990. The Army intended to elaborate on the specific program changes during the scheduled April 1990 DAB.

b. OSD Technology Demonstrator Controversy

Based on the disagreement regarding ATTDs and the milestone issues it had raised in the fall of 1989, OSD refused to allow HFM to meet the DAB for its critical

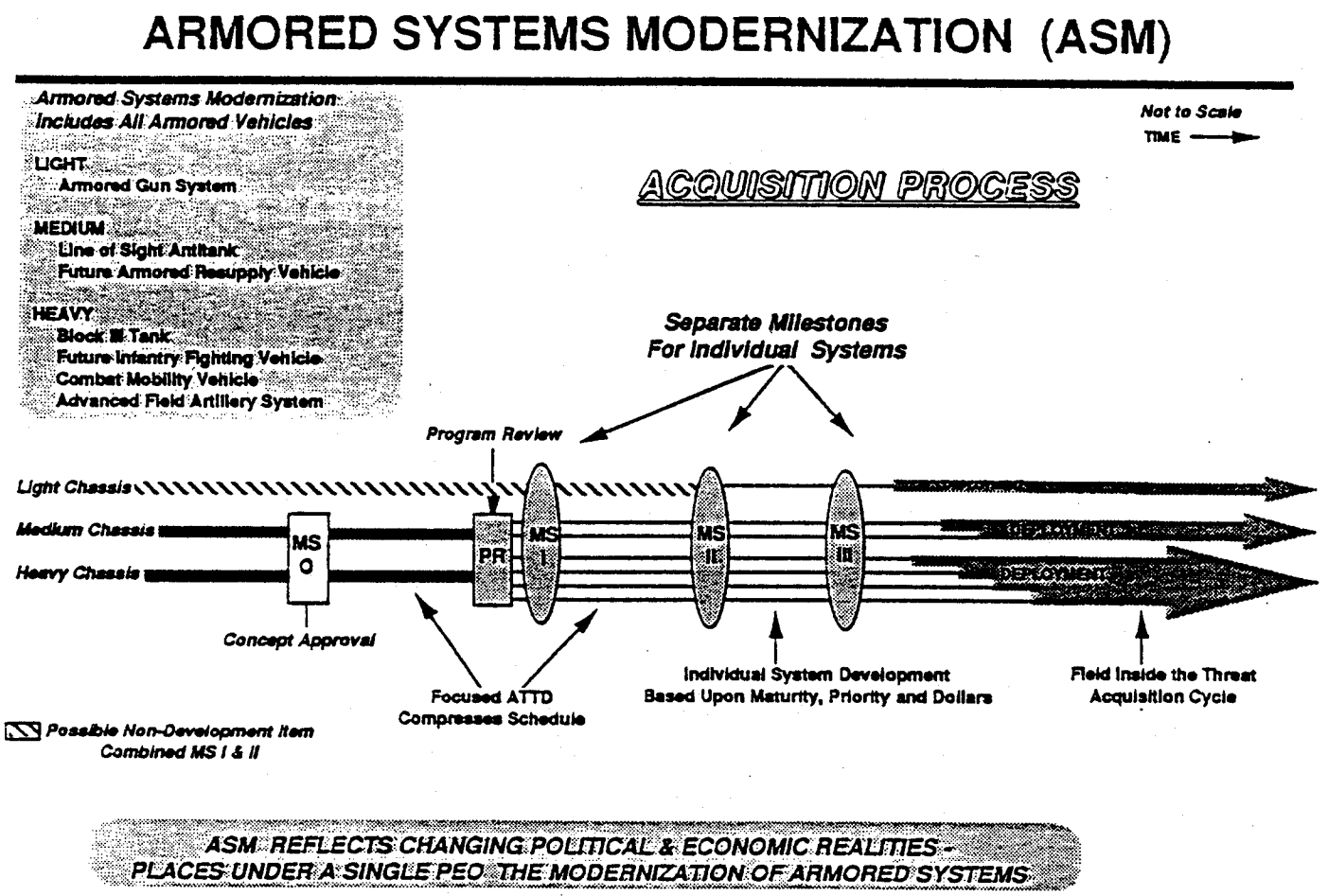


Figure 26. Armored Systems Modernization Acquisition Process

Milestone I review. OSD and Congressional expressed concern over the perceived risks in developing the new Package I systems and the possibility of wasting diminishing defense dollars on a failed abbreviated acquisition strategy. OSD additionally charged that the Army improperly substituted the ATTDs in lieu of the traditional DEM/VAL prototypes which had been originally budgeted for.

Nevertheless, the Army made a strong case for their development strategy stating that it had been properly formulated to reduce the acquisition cycle. Further, risk was being properly managed through the incorporation of tailored acquisition methodologies originally advocated by Congress and OSD. The Army felt its strategy of pre-FSD risk-reducing, proof of principle (POP) demonstrations, conducted in an operational environment rather than a laboratory, would demonstrate the potential for new or enhanced system capabilities. The strategy would also improve the cost effectiveness of system development, and reduce the required technological lead-time (Figure 27).

The Army stated that it had complied with DOD directives to incorporate tailored acquisition approaches in new system development and minimize the time taken to satisfy development requirements without inducing unacceptable risk (Figure 28). The Packard Commission was noted as having encouraged that system and subsystem prototyping use a streamlined acquisition process before

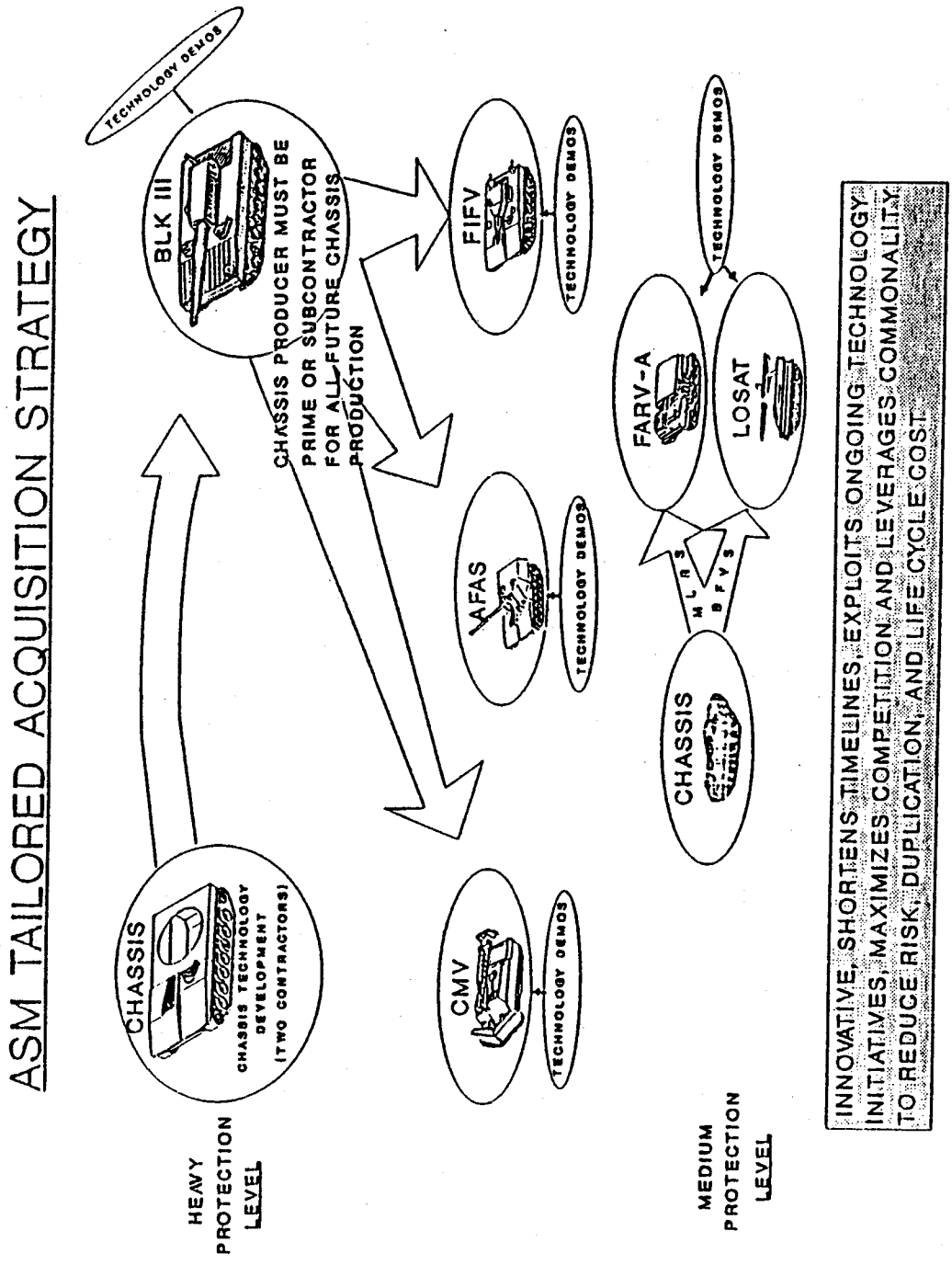


Figure 27. Tailored Acquisition Strategy

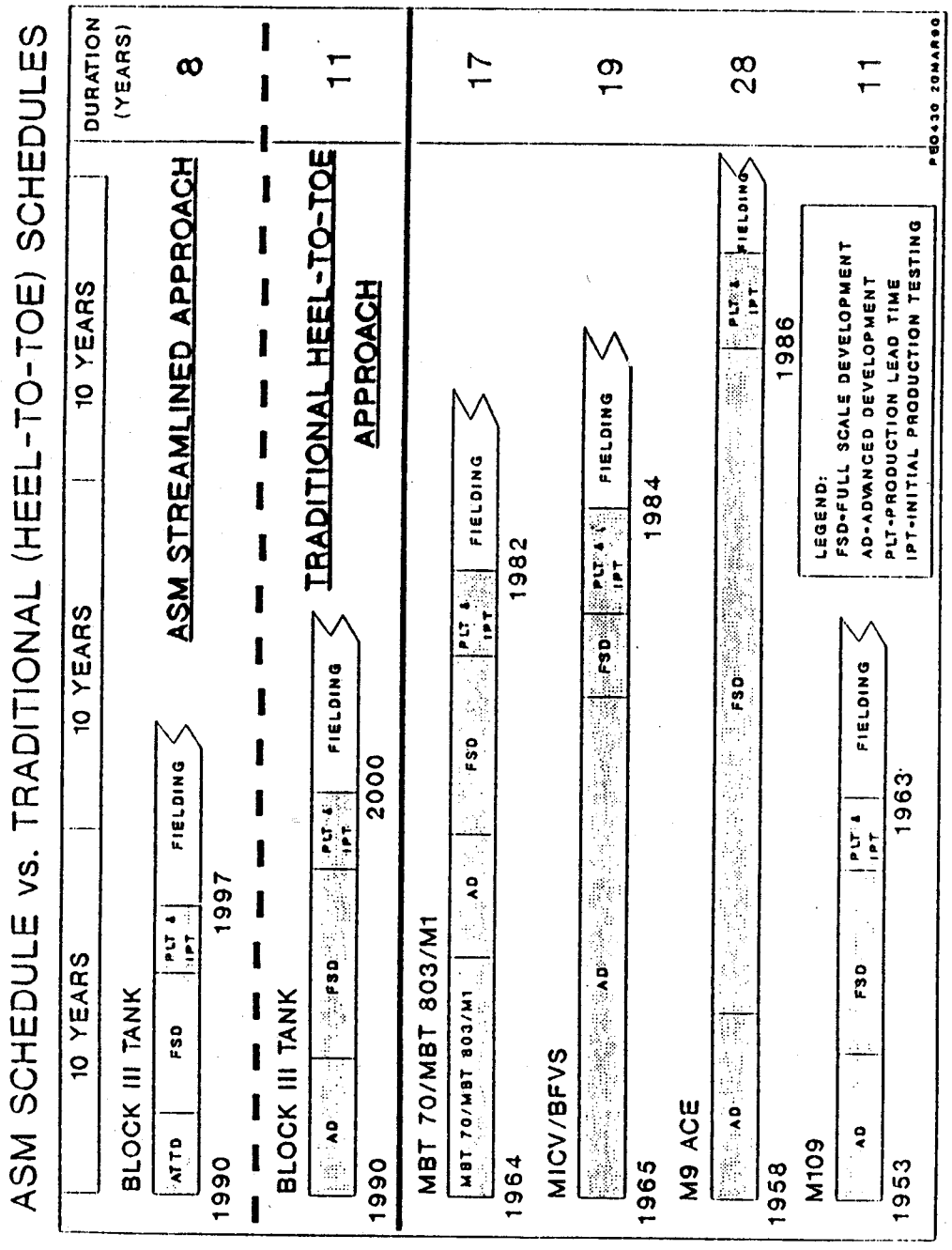


Figure 28. Comparison of Traditional versus Streamlined Development Process

proceeding with FSD. The 1987 DSB study recommendations on the Tech Base were also cited, indicating that ATTDs were a logical extension of Packard Commissions recommendations on prototyping and that pre-FSD system development should be managed less rigidly and in a more streamlined manner than current prototyping processes. The Army had also made a substantial investment, at the urging of OSD and Congress, to achieve capabilities in modeling, simulation, and CAD as a method to further reduce risk. Finally, the Army indicated that ATTDs were not prohibited by law, directive, or regulation and "...common sense [does not] dictate such a restricted policy" [Ref. 79].

The Army concluded that if DEM/VAL prototypes were mandated, the ASM schedule would have to be "slipped" an estimated two(+) years. That would significantly add to the low cost of the overall program, a major advantage of the ASM program. The Army indicated that its plan assumed success but was flexible. If ATTDs failed to demonstrate the proper performance, options included:

1) the ATTDs could then be modified to focus on the deficient areas,

2) the duration of the demonstrations could be extended,

3) additional demonstrations could be implemented, or

4) a full scale DEM/VAL prototype phase could be added. [Ref. 80]

Despite arguments that use of the CATTB, CCATTD, and MMATTD would keep risk to acceptable levels, the proposed, Army development plan continued to remain a contentious issue. OSD eventually directed that each system would undergo separate milestone reviews before proceeding to FSD. This was a change from the AFV Option II, Milestone 1 development plan, virtually back to the original timeline determined at the outset of AFVTF Phase II.

c. Conventional System Committee Recommendations

In March 1990, the CSC conducted a review of the foundation of the ASM effort, the common chassis program. The Army was increasing concerned over the effects that withheld program funds were having upon program cost and schedule. The lack of funds had delayed award of the common chassis contract and without relief, would eventually force PEO-ASM to cease operations.

The CSC, however, raised its own concerns over the Army's justification for the ASM in light of the rapidly changing Soviet threat and the need to counter new, less dangerous regional threats. Other issues included CSC concern over program affordability in light of the decreasing Army budget and that a common chassis ATTD might constrain development of the four heavy variants, not allowing designers to take full advantage of future technologies. As a result, the Army was directed to review the ASM plan and the risks associated with by-passing the

use of DEM/VAL prototypes. The Army stated that "prototyping will lay-away the tank industrial base for two years [Ref. 81]".

The CSC rescheduled the March DAB until their concerns were sufficiently addressed by the Army. The delay forced the Army to once again postpone RFPs for industry team ATTDs contracts and "...[sent] the wrong signal to industry and Congress." It was feared that these signals might encourage Congress to "...take program dollars as a peace dividend", and raised the possibility that future common chassis delays would create program instability, increase cost, and place the Army in position of forced cancellation of future modernization plans. [Ref. 82]

d. Follow-up Conventional Systems Committee Review

A subsequent decision by the CSC, in a late March follow-up meeting, determined that the common chassis development contract would not be economically viable unless at least two of the Package I weapon systems passed Milestone I. Citing the withheld common chassis contracts and the still unanswered question regarding the determination of the ASM DEM/VAL phase, the CSC declared that common chassis contract funds would not be released until at least the first system passed a Milestone I review. The Block III tank had been scheduled for review in June 1990.

ASM procurement affordability was another unresolved CSC issue. To determine the proper course of action, CSC developed four possible options for the continuation of the ASM Acquisition Program. These ranged from restructuring ASM to comply with the CSC specified DEM/VAL requirements to simply keeping ASM in the Tech Base. None of these options, however, favored Army plans to proceed according to their originally structured strategy.

e. Defense Acquisition Board Review (April 1990)

In April 1990 DAB, the Army asked the DAB to approve the original ASM common chassis development concept and to fund the stalled contracts for chassis development and component maturation. Despite disagreements between the CSC and Army, CSC supported the ASM concept, based on the capstone COEA and EA, and recommended approval of the program. The DAB, consequently, approved the ASM concept, supported the common chassis approach, and released the withheld FY 90 funds with the understanding that no DEM/VAL contracts be would be awarded prior to the June Block III Milestone I.

In preparation for the June 1990 DAB, a detailed discussion of the pros and cons of technology demonstrators versus full system prototypes was directed including the latest threat assessments and a review of the current armor/anti-armor systems under development.

f. Defense Acquisition Board Postponement (June 1990)

In June 1990, the Block III DAB was postponed until August. The decision to delay the milestone review resulted when the DAE determined in a DAB pre-brief that OSD did not have sufficient data to refute the Army ATTD position. The DAE also expressed dissatisfaction with the Army's ATTD position and decided not to make a favorable decision. A subsequent meeting with the DAE, AAE, and PEO-ASM, elicited a positive response to the Army ATTD position (Figure 29), but a final decision was postponed until risks could be fully assessed. This reassessment effort required at least two months to conduct. Consequently, the ASM development timeline was again set back. This slippage in the program prevented the release of funds for common chassis contract award. The DOD enforced ASM schedule delay sent the wrong signals to Congress and industry. This resulted in backlogs within the AFAS-C and CMV programs and placed ASM at risk by making it a target for FY90 - FY92 funding delays and reductions. [Ref. 83]

Meanwhile, Congress admonished the Army for failing to properly reevaluate the decreasing threat and for using the Block III as the lead ASM system. The Army maintained that reduced funding was driving the order of ASM development and production. Further, the tank required development first due to its technical challenges and stringent operational requirements. The LOS-AT, however,

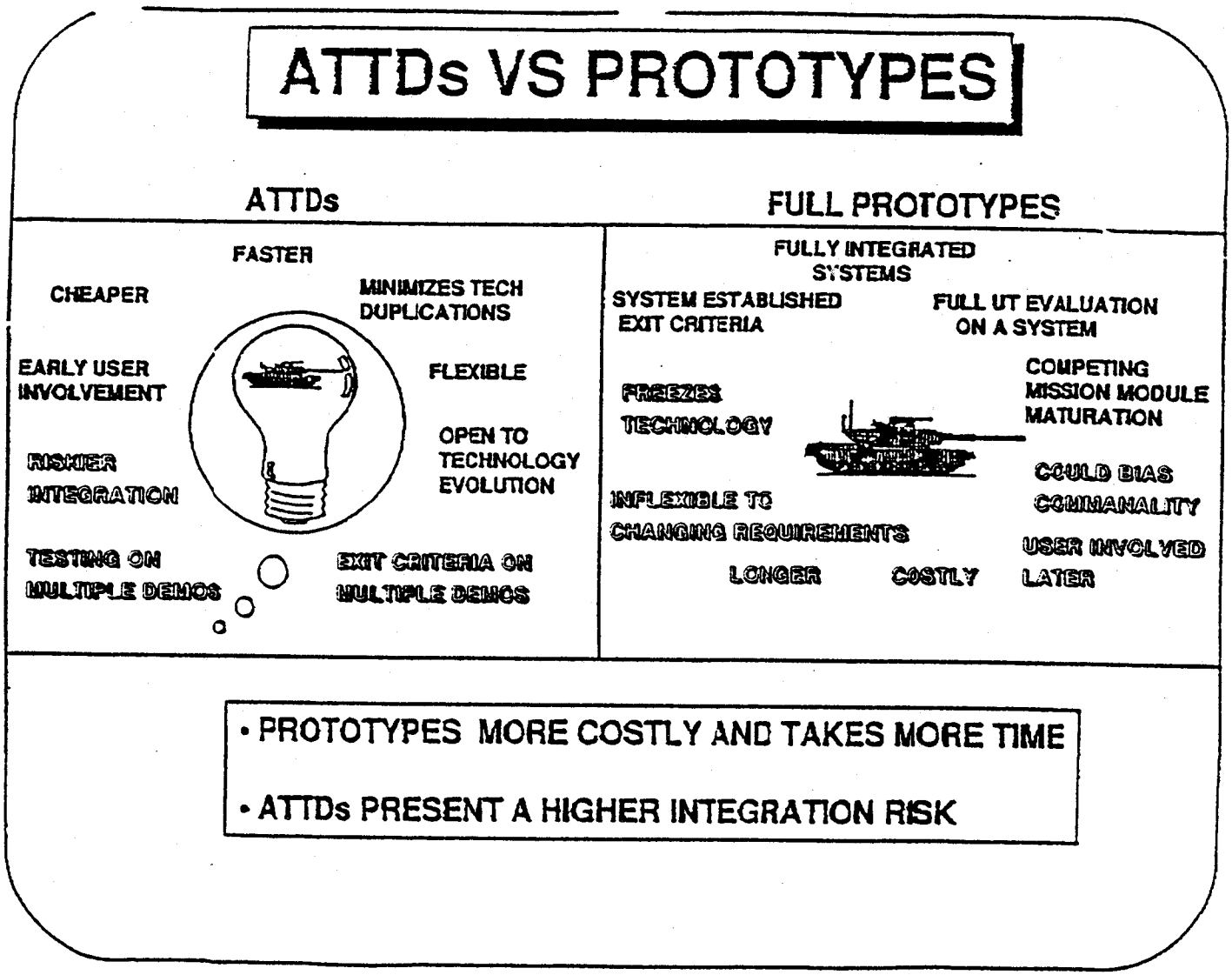


Figure 29. ATTD's Versus Prototype Development Process

would actually be produced first due to its more advanced mission module development and the use of an interim chassis.

g. Defense Acquisition Board (August 1990)

The DAB met to review the Block III Milestone I in August 1990. At this meeting, the threat-based justification for ASM was validated. The intelligence community had verified ASM's System Threat Analysis Report (STAR) in February 1990. In August, they signed a joint intelligence memorandum indicating that the Soviets, despite reduced forces, still retained significant military capabilities. It was determined that this capability along with the increasing proliferation of Soviet and Western technology and weaponry throughout the world, necessitated continued modernization.

In another critical area, unmoved by Army arguments regarding ATTDs, the CSC recommended that the program proceed with a standard DEM/VAL phase and require the use of system prototypes. The DAB agreed and mandated that the ASM system development strategy be based on competitive common chassis fabrication followed by integration of the tank mission module and chassis through laboratory (rather than operational) efforts. Upon completion of testing, the chassis would then be down-selected to a single contractor who then would build, for government validation, a full advanced development prototype

(ADP) tank prior to FSD [Ref. 84] (Figures 30 & 31).

With this stipulation, Milestone I was approved for Block III and entry of ASM Package I into DEM/VAL was approved, contingent upon the Army's accomplishment of several actions prior to the scheduled September 1990, armored vehicle DAB. The Army was directed to develop a plan to mitigate the risk of the "down-select to one prototype" strategy and the Cost Analysis Improvement Group (CAIG) was to review Army cost estimates for the new approach in light of growing questions over ASM affordability. [Ref. 85]

This constituted the overall Milestone I review of the ASM program. Revision of the ASM development strategy had forced the Army to contend with developmental prototypes but the scope of prototype use was limited. This compromise, in an attempt to satisfy both parties, reduced the total time and funding required. Nevertheless, separate prototyping and component integration for Block III was required before moving into FSD. This delayed the IOC date almost two years, from early 2001 to late 2002. With purchase contracts for M1 tanks nearing completion and the decision to not buy (to ensure ASM funding) large numbers of the M1A2, the postponement created a gap in Army tank production. Consequently, DOD wanted to start the upgrade program in FY94, but FY96 was the optimum year for ASM. It

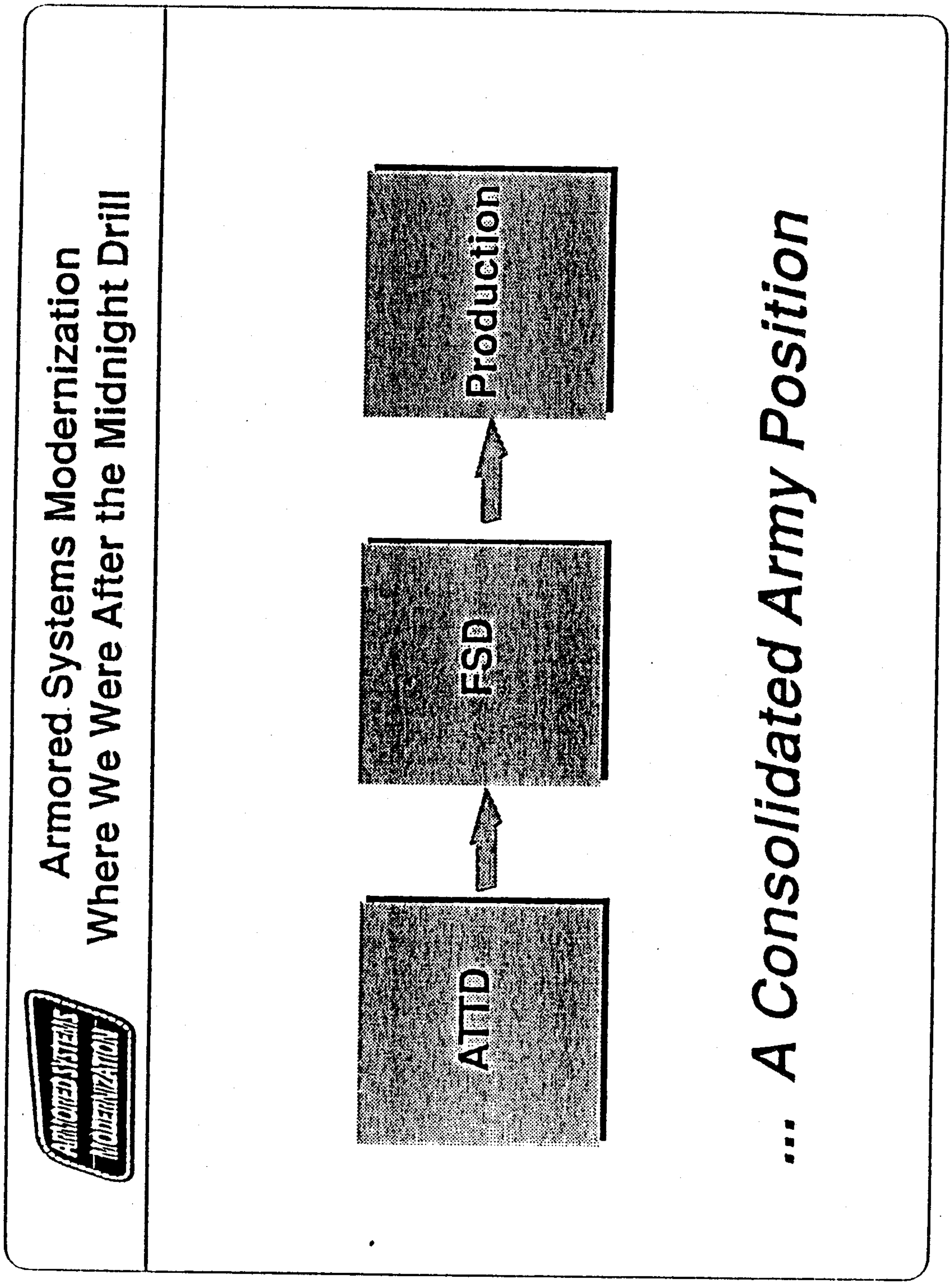


Figure 30. Army Acquisition Strategy

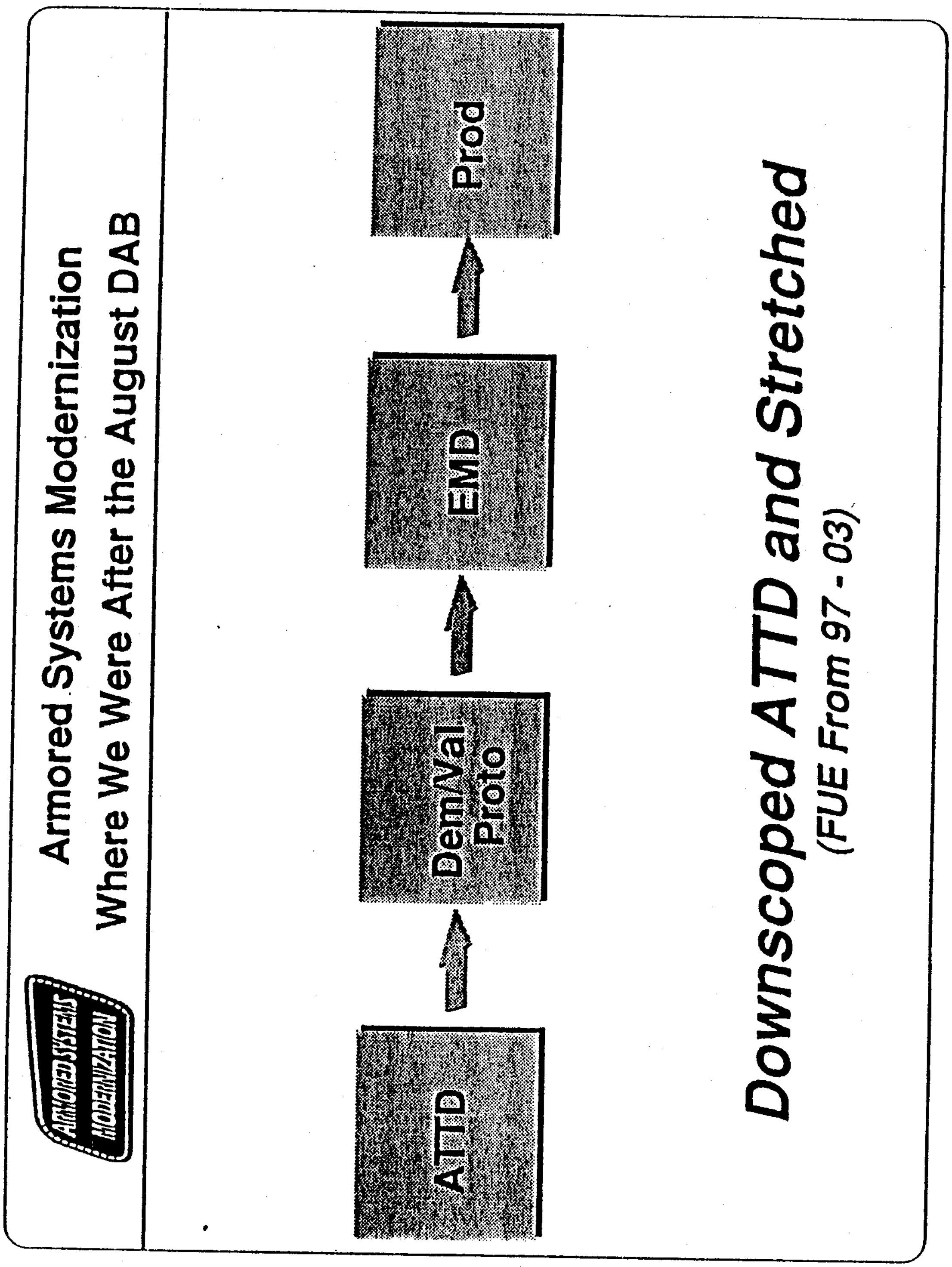


Figure 31. OSD Directed Acquisition Strategy

was becoming increasingly difficult, due to constant schedule changes, to make future scheduling and funding fit the planned ASM production schedule. [Ref. 86]

h. Congressional Concerns

In September 1990, Congress and OSD expressed concern over the order in which systems would be produced and the cost and number of vehicles. The Army was troubled by the August DAB decision requiring a pre-FSD tank prototype. Reorganization of the ASM development strategy required the Army to develop four heavy vehicle prototypes. Block III fielding delays were projected to exceed four years.

The Army still considered all systems to be high priority and Block III remained the lead ASM system. Congress, however, indicated that it wanted to see AFAS-C fielding accelerated based on the current U.S. artillery deficiencies as being experienced in the HIP program. The Army maintained that its vehicle priorities reflected warfighting requirements stating that Block III was the most urgent system from a development point of view. Further, the Block III common chassis had to be designed and developed from the beginning to accommodate the tanks more stringent operational requirements and ultimately supported all heavy vehicles. In an attempt to satisfy Congress, AFAS-C development was accelerated to the second priority position but the Army kept the tank as the priority system.

No other reassessment of ASM was conducted, however, the Army indicated that it may alter ASM in the future based on changing priorities and available funding based on Army budget.

i. Tier II Armored Systems Review

Tier II was an independent study jointly conducted by OSD and the Army to review AGS system procurement, the viability of a Bradley procurement "stretch", M1 conversion to M1A2 specifications, and the overall affordability of ASM Program. Conducted to support the November 1990 DAB, the results of the review achieved OSD concurrence for the purchase of 300 AGS systems to replace the 70 aging M551 systems. Support was also given for the Bradley purchase due to its chassis use in future systems. [Ref. 87]

It was also determined that conversion of the M1 to M1A2 provided the highest increase in fleet effectiveness at the lowest cost. As a result, M1 upgrades were considered able to fill the projected four year gap between the planned shutdown of the M1A2 production lines and start-up of Block III production, thus preserving the tank industrial base. The Army, however, had determined that it would sacrifice M1A2 buys to keep dwindling procurement funds for the purchase of ASMs. Army leaders had made a conscious decision to forego near and mid-term systems, due

to the reduced threat, in order to pay for future ASM systems. [Ref. 88]

The M1 up-grade program caused great concern within the Army as projected costs for the program ran over the estimated budget. To effectively conduct the M1 up-grades program, the Army would have to reduce other priority programs, including ASM. ASM was additionally funded through the POM but cost analysis showed that ASM portion of budget would increase significantly after FY97. Budget problems would be further exacerbated by the any future funding reductions.

j. Threat Assessment, Late 1990

Results of threat assessments began to show the extent of changes in projected U.S. threats. The National Military Strategy (NMS) had began to refocus attention away from the global Soviet threat to a more regionally-based threat. While the Soviets were expected to remain the most militarily capable threat to the U.S. for the next 20 years, U.S. strategic interests were considered more likely to be threatened by events in other regions. Intelligence sources stated that "Political instability and economic duress were expected to pose the greatest challenges to U.S. defense and the potential for U.S. intervention is [now] global in scope and runs the gamut from high to low intensity combat. [Additionally], ...the advancement and proliferation of western and Soviet technology,....as other nations are being

equipped with new and modern weapons purchased from world wide suppliers,....combined with the aspirations of regional power by many nations, present an array of increasingly sophisticated threats" [Ref. 89] (Figure 32).

It was not until mid-1991 that the Army finally acknowledged the full impact of global threat changes. This persistent adherence to the conviction that the Soviets remained a significant threat, in the face of seemingly contradictory evidence, caused the Army to lose credibility at a time when it could least afford to do so.

k. Army Acquisition Executive Policy Change

In October 1990, the AAE presented an address that significantly changed the Army's acquisition policy. This change in policy placed Army civilian acquisition managers and military combat developers and operational planners at odds. At a time when the program was under severe attack by critics, this change seriously disrupted the "one voice" policy and Army resolve to develop and procure ASM Package I vehicles.

The AAE reviewed the current Army acquisition climate. It showed:

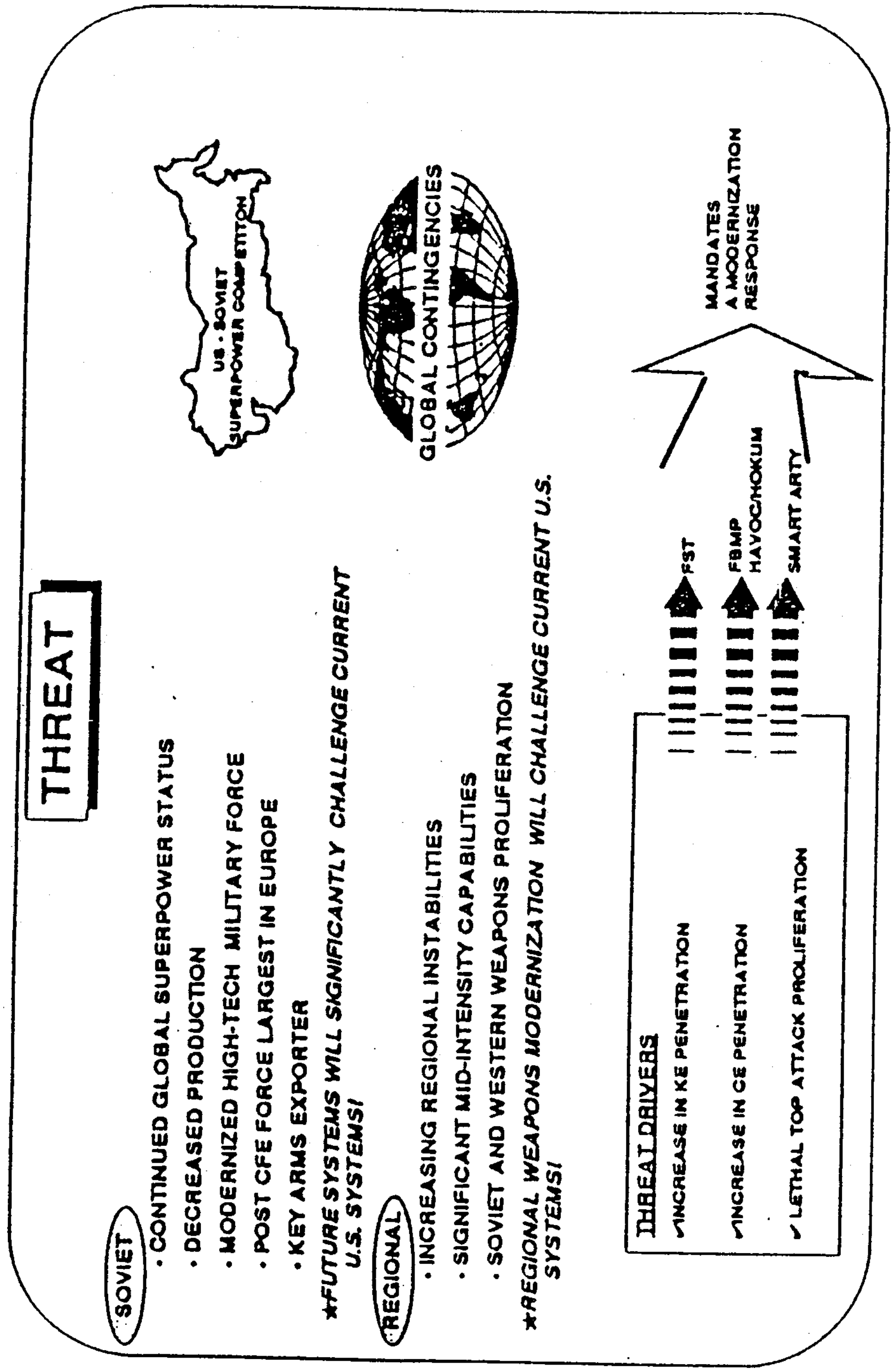


Figure 32. Changing Threat Environment

1) the conclusion of the "big five" system (the M1 and Bradley armored vehicles, the Apache and Black-Hawk helicopters, and the Patriot missile system) buys,

2) a total Army acquisition budget (R&D plus procurement) decline of 46% since 1985 (in real purchasing terms),

3) only three Army programs in the DOD top 20 programs, all in the last five, with none scheduled for FY91 (Figure 33), and

4) Army procurement spending cuts of 64%, since 1985. Of the three services, the Army received only 13 cents of every procurement dollar). [Ref. 90]

The AAE made two major assumptions in his address:

1) the Army needed to sustainment the industrial base and

2) that future ASM, procurement timelines would not be supported based on major changes in international and domestic events. Based on these assumptions, the reasons for the Army procurement dilemma were blamed on cuts in the Army acquisition budget by double the amount of DOD total obligational authority (TOA) reductions from FY90-FY93. [Ref. 91]

The AAE indicated that OSD's unwillingness to approve systems and the decline in R&D funds were due to an inadequate Army modernization budget that was being increasingly constrained by other Army priorities. Also, OSD's risk adverse attitude and its search for "loose" funds constrained the Army R&D budget. OSD had, in effect, become a bigger challenge for program approval than Congress. OSD was "looking for money and will not allow new programs into development [Ref. 92]." OSD alternatives to

TOP 20 DoD HARDWARE PROGRAMS

PROGRAM	FY91
1 B-2 (USAF)	5536
2. SDI (DOD-WIDE)	4471
3. DDG (USN)	3681
4. SSN-21 (USN)	3669
5. F-16D (USAF)	2973
6. M-X RAIL (USAF)	2836
7. C-17 (USAF)	2700
8. F/A-18 (USN)	2123
9. F-15E (USAF)	1845
10. TRIDENT II (USN)	1746
11. TRIDENT SUB (USN)	1453
12. F14A/D (USN)	1118
13. LHD-1 (USN)	971
14. AMRAAM (USAF)	915
15. PATRIOT (USA)	909
16. TOMAHAWK (USN)	863
17. M-1 TANK (USA)	838
18. ATF (USAF)	769
19. BRADLEY (USA)	695
20. STAND. MISSILE (USN)	658

FY 92

?

The Army probably will have no programs in the FY92 DoD Top 20 list.

FUNDING BASED ON REQUESTED RDTE, PROC, & MILCON FY 91 $M

Figure 33. DOD Top 20 Acquisition Programs

production, such as technology "roll-over" and "lay-away", were designed to keep systems in the Tech Base, restricting new production. Consequently, a new modernization strategy was recommended to take those problems into account. [Ref. 93]

OSD trends, at this time, were noted as:

1) reducing funding levels,
2) requiring additional justification documentation,
3) adding program content through prototype and stretch programs and risk reduction,
4) conducting affordability analyses, and
5) by emphasizing strategic over conventional programs. Army procurement was also being constrained by Congress which was looking for funds and trying to protect current production. "...they don't like us terminating Blackhawks and M1s...." [Ref. 94].

Congressional trends included reducing funding levels, stretching long-term procurement through roll-over and layaway techniques, and protecting the industrial base through increases to current production. With Congress reluctant to support new-starts, it was felt they would do what was necessary to push current system production into the future. As a result of these trends (Figure 34), the Army 1980's production-based acquisition system was on the verge of becoming a 1990's research-only based acquisition system. [Ref. 95]

The AAE concluded that if the Army maintained its course, current production would continue to be canceled,

future systems would be delayed, and the industrial base would shrink through non-use. Speaking specifically of the industrial base, it was indicated that without an armored system upgrade program, the tank industrial base would erode significantly prior to Block III. This would result in the break-up of design teams, specialized vendors would leave the business, and restarting a dormant industrial base would require 48 months to achieve current capacity and 60 months for surge capacity. Finally, The AAE noted that, at current rate of decline, the RD&A budget would eventually exceed the procurement budget and continue to decline in the out-years (Figure 35). [Ref. 96]

The AAE's recommendation was to rethink the Army modernization strategy based on the recent threat reductions. Additionally, a strategy of protecting near and mid-term systems, rather than focusing on ASM, should be developed as continued procurement of current systems might provide the only opportunity for future modernization. Finally, the industrial base could disappear if near/mid-term production was stopped. As a result, the AAE recommended three criteria for support of any future production/modernization. These criteria were to become the basis for the current Army acquisition policy (Table XVI).

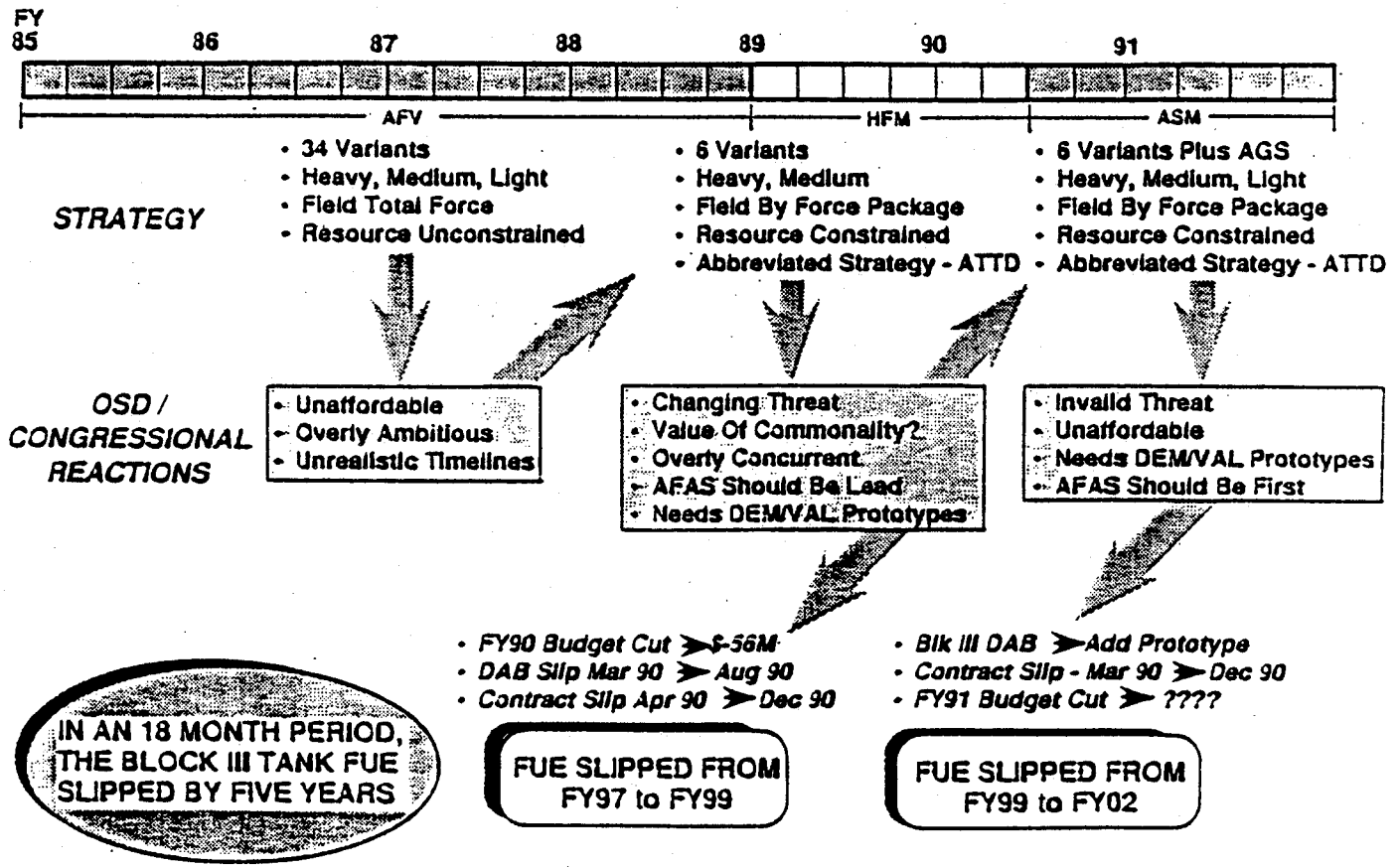


Figure 34. Program Evolution Through October 1990.

PROCUREMENT HISTORY

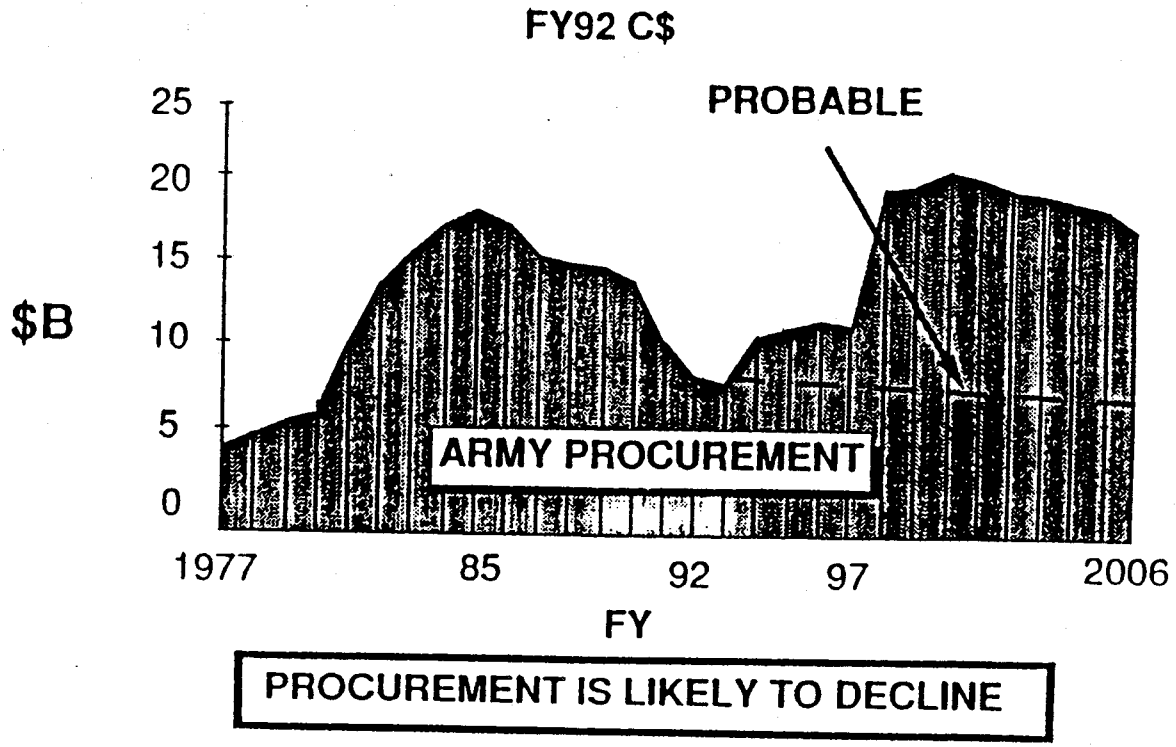


Figure 35. Decline in Army R & D Funding

Table XVI - Army Acquisition Policy

New Army systems must:

- Provide significant improvement in warfighting capability or the new program must meet a critical operational need;
- Support programs that Army can get through the acquisition process without major problems (industry can deliver, the acquisition structure can manage, and meet cost, schedule, perform, testing, and fielding criteria);
- Be approvable by OSD and Congress. [Ref. 97]

Based on executability and approvability criteria, Army leaders were encouraged to fight for additional Army acquisition funding and earmark these funds to R&D. "At the present funding levels the Army is out of major acquisition program business and simply not serious about modernization. [Ref. 98]" The AAE also encouraged Army leaders to reexamine their focus on only new, major long-term systems, stating "...[we] can't put all our eggs into the long term [ASM] basket.... [Ref. 99]".

The AAE cited ASM as an example of a potentially flawed strategy and program. ASM had been given approval but then subsequently had run into Block III capability questions, industrial base concerns, affordability issues, and dubious need based on the reduced threat. Concluding his address, the AAE commented on the 13 year ROC formulation process for a light tank, indicating that the Army had a tendency to look for "perfect solutions".

Advocating a reconsideration of the M1 upgrade program, the AAE stated that Congress was "...begging Army to build upgraded M1's...." and that in the future, "...[the Army] may have to scale back its ambitions somewhat." [Ref. 100]

l. Temporary Congressional Restriction of LOS-AT

In November 1990, Congress mandated restrictive legislation that linked the LOS-AT system to a classified "black" program. Based on the restriction, the Army experienced a five month moratorium on program spending. The five month delay added a large additional sum to overall program development costs. The AAE complained that the program was "...[being] held hostage, not delayed by technical problems but by restrictive language." [Ref. 101] LOS-AT and the classified program were not related but lawmakers thought the only way to ensure Army compliance with their ASM related concerns was to hold-up the top-priority LOS-AT. This tactic was expected to be increasingly used by Congress to ensure compliance with their directives.

m. Common Chassis Contract Dispute

Despite the restriction on LOS-AT, Congress finally released funds so that the Army could continue with common chassis development. In December 1990, based on the revie of the proposals submitted by the three industry teams, development contracts were awarded for competitive

development of the common, heavy protection level chassis to AVTA and TCM. GMC did not receive a contract and subsequently filed a formal protest with the GAO in March 1991, arguing that it submitted the low bid while meeting all technical parameters. Program chassis development activity was suspended on the common chassis until the protest was overturned in June 1991.

n. Renewed Congressional Concerns

For the first several months of 1991, the Army continued to extol ASM as a counter to Soviet modernization. As it became clear that the Soviets were slowing weapons production and becoming more involved in internal political changes, the Army began to adopt elements of the AAE's acquisition policy criteria. The Army attempted to format ASM to meet the executability and approvability parameters of the policy and subsequently declared the program to be sound, based by achievable technologies, and supported by an executable strategy.

Nevertheless, Congress still was not satisfied with Block III's developmental lead despite the movement of AFAS-C into the second position. In response, Congress mandated that AFAS-C be placed into a separate funding account and cut overall ASM program funding by over six percent from the Army's original funding request. The system priority disputes began to threaten the long-term economic and operational advantages of vehicle commonality.

In an attempt to support the Army's position on ASM, the AAE told Congress that the next generation of U.S. Armored systems must not only be able to defeat the best future Soviet systems but defeat top-of-the-line western technology as well. The AAE warned that large cuts in army procurement accounts coupled with anticipated delays in the Block III program would put the Army's ability to build tanks in jeopardy. By this time, Block III slippage and Army curtailment of M1 procurement had resulted in an almost 10 year gap in major tank production; this was expected to have a significant impact on the U.S. tank-building industrial base. [Ref. 102]

Congress, citing the reduced Soviet threat and intelligence report that the Soviets had slipped the schedules for their FST series tanks, indicated that the Army argument for ASM was no longer credible.

o. Operation Desert Storm Influences

After-action reports of Operation Desert Shield/ Desert Storm equipment performance provided Congress with renewed impetus to challenge the ASM program. A number of system shortcomings during the war motivated Congress to direct that the Army take specific action to correct these system deficiencies. Many of the mandated "fixes" were of a near/mid-term nature and cut into funding being shielded for the future ASM program.

Two of the war's "stars" also received Congressional attention. The often maligned M1/M1A1 Abrams tank and the Bradley infantry fighting vehicle preformed much better than expected; high operational rates and action against Iraqi, top-line Soviet equipment raised additional questions about the need for Block III and the FIFV. The performance of these systems provided Congress with the rationale needed to further demand current production be continued and up-grades efforts be undertaken.

p. General Accounting Office Report

In July 1991, the GAO was directed by Congress to report upon the justification, affordability, and priorities of the ASM Acquisition Program. The report concluded that the program was questionable for several reasons. It admonished the Army for not reassessing the changes to the Soviet threat and restructure ASM in light of the new regional threats. It also indicated that it would require a significantly greater outlay than was expected to be available at the time when production would begin. A $39 Billion shortfall in weapons funding during peak ASM production in 1998-2008 was projected (Figure 36). Anticipated declining budgets and competing programs also served to further constrain available funds. Current artillery systems were deemed as being unable to meet the current threat, however, the Block III still maintained the lead position in the developmental schedule rather than the

AFAS-C. Finally, it was noted that the M1 series could be upgraded to meet any potentially envisioned threat based upon current technology and was more cost effective than the Block III. [Ref. 103]

q. Diminishing Congressional Support

By August 1991, the ASM debate had grown substantially. Nevertheless, both the House and Senate Armed Services Committees (HASC/SASC) declared their continued support for the programs commitment to technical superiority and actually increased funding. The SASC, however, voted to slow development of ASM. Conversely, HASC stated five major concerns and reservations to the program as structured. These included:

1) the lack of a credible threat,

2) the unclear assignment of system armor protection levels (AFAS-C was heavy chassis-based while LOS-AT, which was thought to be a close combat system, was light chassis-based),

3) the disproportionate emphasis on Block III when the perception was that artillery systems were needed,

4) the lack of an Army industrial base investment strategy (linkage of ASM with current systems to preserve the industrial base,

5) and the long development schedules of systems that Congress felt were simpler to produce.

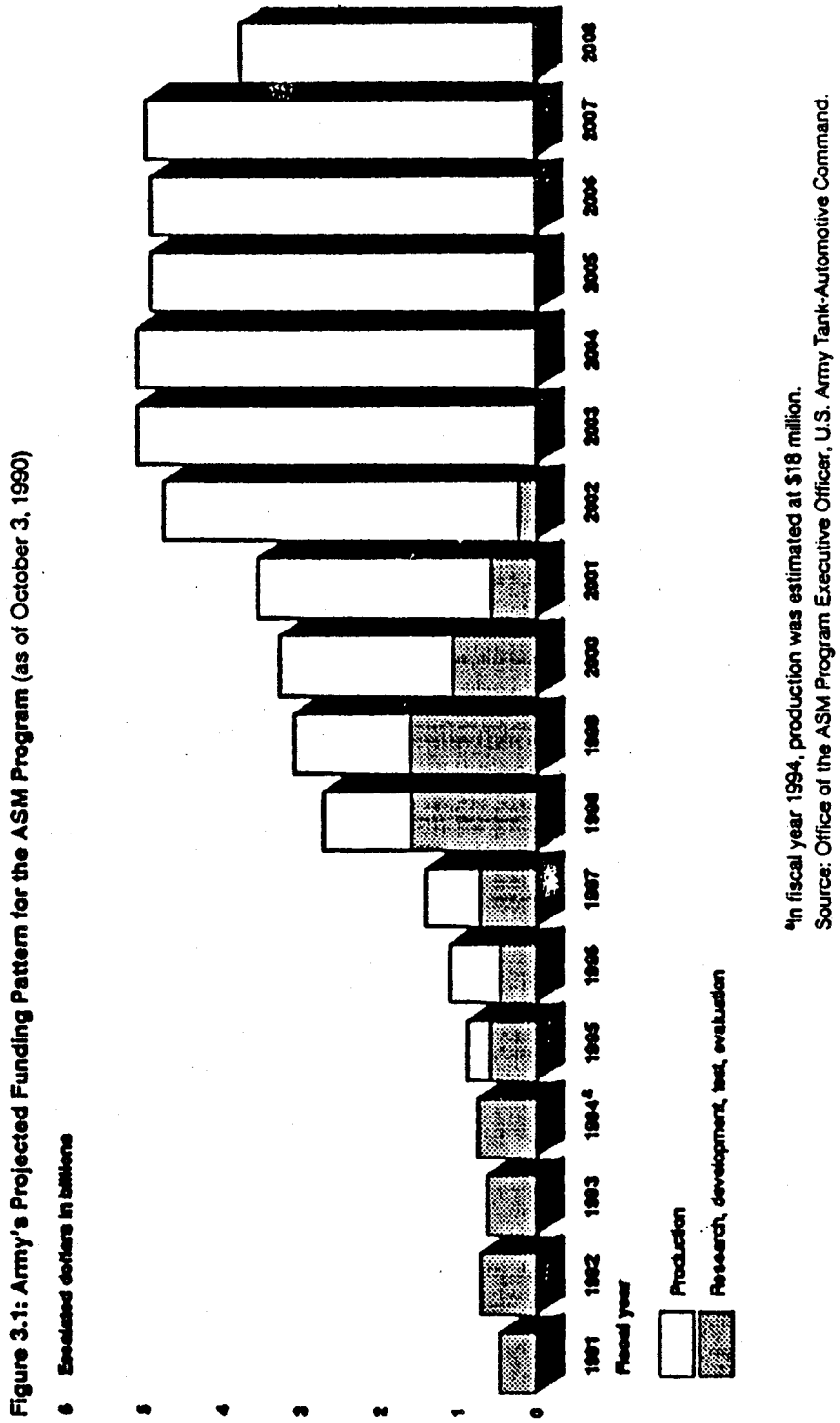


Figure 36. GAO Projected ASM Funding Requirements

Congress also indicated its dissatisfaction with the Army for apparent "foot dragging" on both the AFAS-C and AGS portion of the ASM effort. As a result of these concerns, Congress directed the Army to reassess ASM. [Ref. 104]

r. Proposed Restructuring Plan

In October 1991, the Army informed Congress that it intended to restructure ASM to align itself with Congressional directives to delay Block III and accelerate development of AFAS-C and to match its procurement plans with projected reductions in funds. Additionally, the Army sought to complete the ASM restructuring plans prior to being brought before the "DOD budget cutters", the Defense Planning Resource Board (DPRB).

The internal disagreement between Army military material developers and operational managers (DCSOPS) and civilian acquisition planners (ASARDA) over the disconnect between ASM and the AAE's acquisition policy erupted, eventually reaching to the highest levels of the Army bureaucracy. DCSOPS insisted that the Army should forfeit current system upgrades to save ASM funds. ASARDA argued that ASM was not justified according to the threat and that funds should be used to upgrade existing weapons and support the Army industrial base. This internal argument, while conducted, behind the scenes, did not escape the attention of OSD nor Congress.

Stating that it welcomed Congressional suggestions to conduct a new assessment of the threat and develop a modernization plan that linked ASM with M1 and Bradley upgrades, the Army, nevertheless, was unwilling to ask OSD for additional procurement funds. This was largely due to the potential interservice fight that it could have provoked. Despite the fact that there was probably not enough funding in the out-year budgets to upgrade M1s, even with sacrificing Block III to pay for it, the Army did not cancel Block III but instead realigned ASM Program priorities.

It appeared that ASM was caught in a "program death spiral". Decreasing system quantities and spiraling costs would be labeled inefficient by OSD, and thus become a prime candidate for the budget-cutters "axe". Privately, one Army source exclaimed,

> ...we are trying to keep ASM on track with arguments that do not meet the light of day. We really need to reexamine what we have on the drawing board...[because] ...the credibility of the Army is on the line. [Ref. 105]

s. Program Realignment Alternatives

A second set of so called "midnight drills" began in October. The Army, responding to calls for cancellation of ASM, undertook a plan to refocus the ASM strategy and preserve its battlefield capabilities while shaping a new, more acceptable modernization program. The

alternative program strategy chosen by the Army detailed that:

1) the Block III would be delayed until new capabilities and technologies produced a technologically superior tank, justified by the threat,

2) the AFAS-C and the FARV-A would be accelerated using funds earmarked for Block III,

3) the current CCATTD effort would be modified in FY92 from development of a tank chassis to development of a common chassis with emphasis on component commonality for AFAS-C and FARV-A (in an effort to preserve the original AFV tenants of commonality and modularity),

4) key ASM system Tech efforts would be continued,

5) the LOS-AT would be continued, and

6) the development of a command and control (C2) vehicle based on the Congressional set of Desert Storm system initiatives would be initiated. [Ref. 106]

Nevertheless, the Army declared that they

> ...remain committed to the full ASM program over time and across the full range of armored systems capabilities because it is the best approach to ensure technical overmatch on future battlefields. Along with the Comanche [(a helicopter mod program also under fire)], ASM is the Army's highest priority modernization program. [Ref. 107]

t. Block III/M1 Upgrade Dilemma

By this point, the AAE's modernization principles had gained significant support within the Army acquisition community. A variety of acquisition experts indicated that the Army should follow the policy. Support for that line of thought was at the center of the Congressional controversy over DA pursuit of the ASM Block III tank rather than upgrading M1 tanks. Many argued that

the Army did not have the funds nor the threat to justify a new tank at this point in time.

The Army, aware of the diminishing support for ASM, undertook another attempt to restructure the program (Figures 37 & 38). Development of the Block III was deferred, but only small steps were taken toward the Congressionally mandated M1 upgrades. Meanwhile, the disagreements between DCSOPS and ASARDA increased. ASARDA argued that from a political and budgetary point of view, it was better to upgrade near-term systems using the declining procurement dollars than chance losing future funds altogether. ASARDA stated that new systems should be fielded when the threat dictates, money was available, and politics were favorable. Conversely, DCSOPS felt that since it could not "have it both ways", it would rather procure the future ASM systems.

To resolve this issue, the Army began a series of high level reviews to reassess ASM restructuring efforts. The primary question needing resolution was the dilemma over whether to use Block III development funds to finance the near-term M1 upgrades, as based on a tank retrofit program frugally funded by Congress in the FY92 budget. If that was

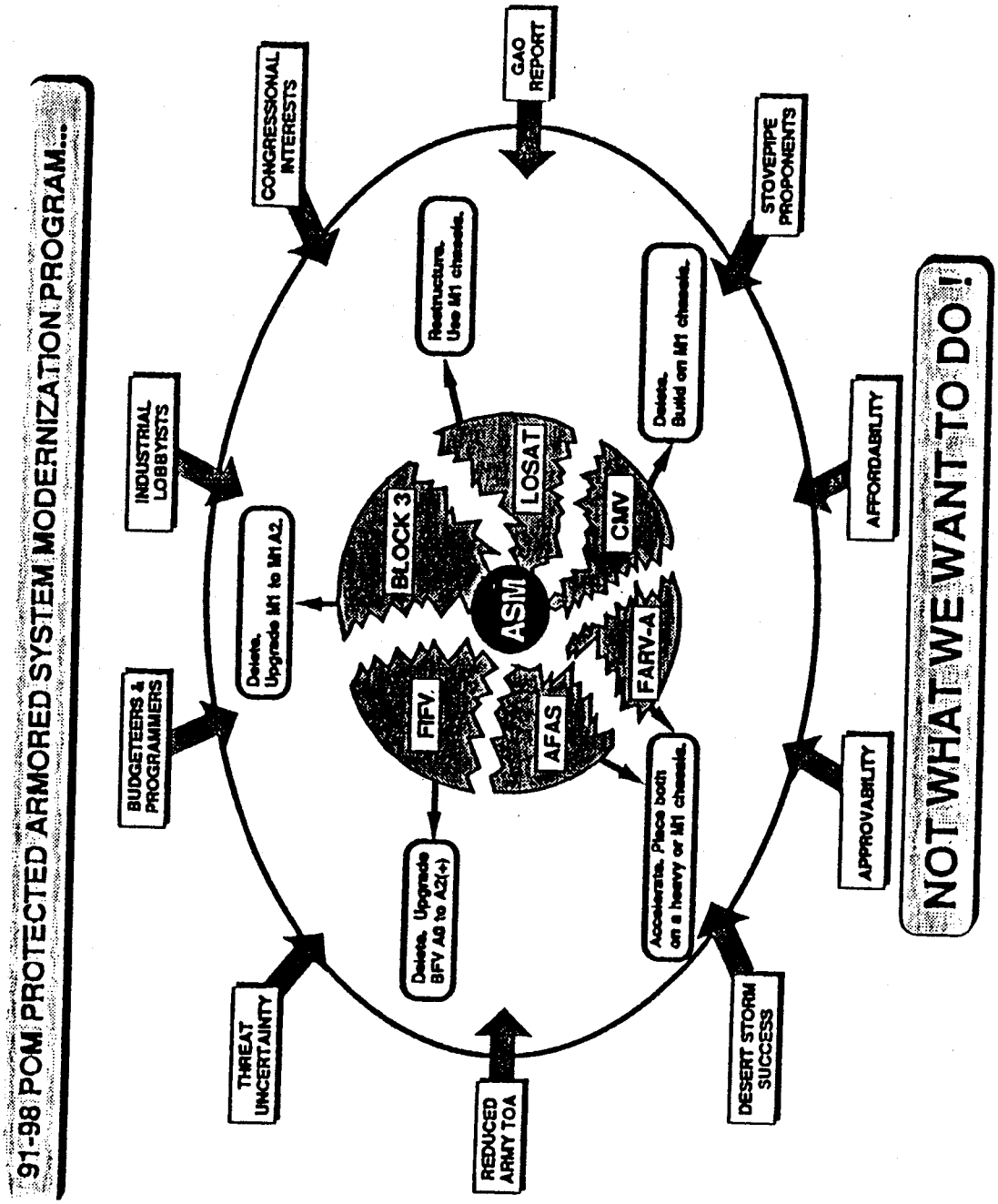


Figure 37. Acquisition Related Environmental Influences

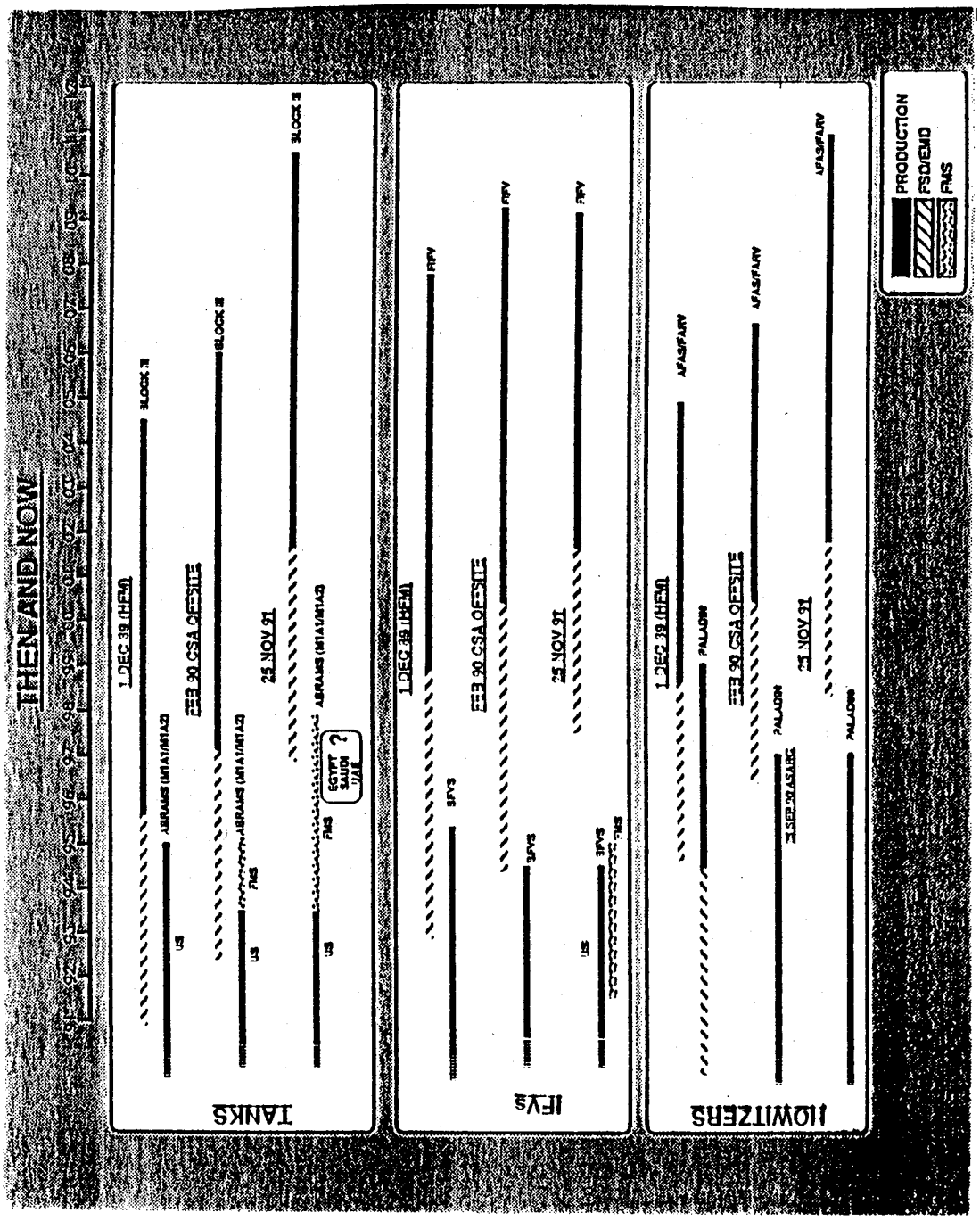


Figure 38. Program Schedule "Slippage"

done, the Block III would essentially never be built. The gradual demise of tank industrial base had added additional urgency to the question.

> As development of Block III has slipped, the production gap between the last M1A2 and a future tank have widened. ...without Block III, [however] there was no longer a tank plant layaway, it was tank plant closure [Ref. 108] (Figure 39).

It was thought that a failure to come to a consensus might also jeopardize the tentative M1A2 foreign military sales (FMS) to Saudi Arabia, once again, further damaging the tank industrial base.

u. Second Proposed Restructuring Plan

OSD had rejected the initial ASM restructuring plan because it failed to implement the Congressional mandate to modernize the M1 with out-year funds additionally, the Army had yet to sufficiently address serious funding shortfalls.

By December 1991, the prospect of a near-term Soviet threat had greatly diminished and the pace of Soviet conventional force modernization had also drastically slowed. The Army budget decline increased due to Congressionally mandated, military down-sizing, which forced a complete reassessment of the Total Army Modernization Plan. Additionally, Congress had again raised the industrial base issue and was pushing for upgrades and system "fixes" for specific armored systems based on Desert Storm shortcomings.

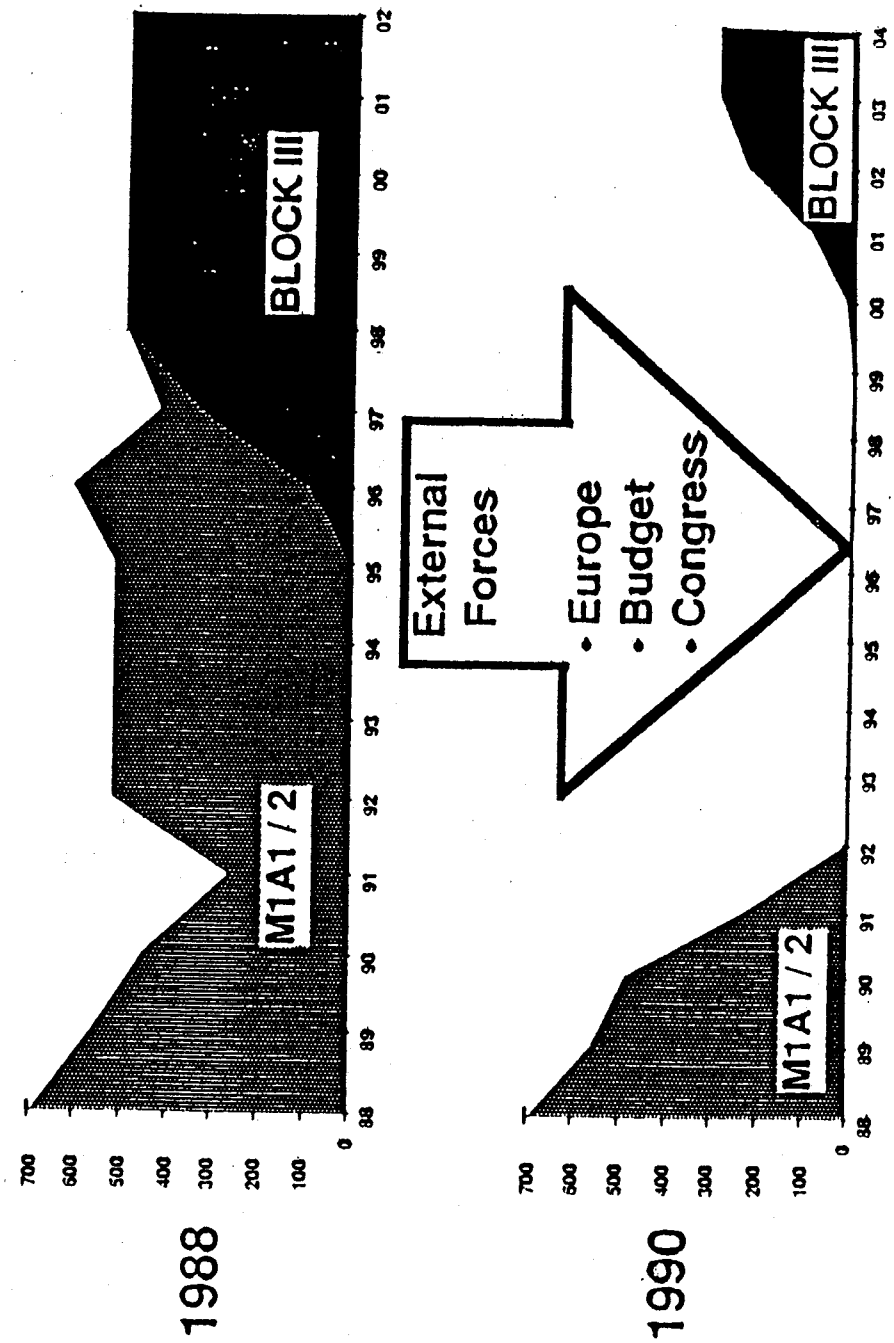


Figure 39. Projected Shutdown of Tank Industrial Base

The Army's analysis and review of the ASM strategy and the AAE acquisition policies produced a decision in early December. The new proposal deferred further development of Block III, FIFV, and the CMV but maintained their key related, advanced technology components in the Tech Base for continued development. AFAS-C and FARV-A would become the lead systems and be based on common components. AGS funding would also be realigned to reflect the new schedule. Additionally, development and procurement of LOS-AT was slipped while four Congressional, Desert Storm initiatives would be implemented including:

1) a C2 vehicle based on an M2 chassis,
2) an improved recovery vehicle,
3) engineer bridging and breaching vehicles based on an M1 chassis, and
4) limited M1 upgrades and M1A2 production based on funds allocated by Congress in the FY91 and FY92 budgets. [Ref. 109]

Upon submission of the new strategy, the Army stated that

> ...the restructured program provided near and mid-term improvements in warfighting needs, while providing a potent antitank system (LOS-AT) and an overmatching artillery piece for the post-2000 force. At the same time, a future bridge for other members of the close combat family is maintained through retention of the common component concept and a robust Tech Base effort. The Army remains strongly committed to the concept of the ASM as a goal. [Ref. 110]

With that effort, the ASM Program awaited OSD and Congressional approval of the initiative. In early 1992,

the Army proposal was denied and the ASM program was completely restructured.

III. ARMORED SYSTEMS MODERNIZATION PROGRAM'S ACQUISITION ENVIRONMENT INFLUENCES

A. GENERAL

The ASM historical summary detailed the significant characteristics of the ASM Program evolution. A review of the summary unveils a succession of environmental factors that negatively impacted upon the program. These environmental factors, over the course of ASM's conceptual and programmatic life, prompted a series of responses and from Congress, OSD, and the Army itself. The actions of these parties resulted in extensive revisions, modifications, and alterations to ASM strategy and program planning. The root causes of these actions have been examined and a summary of the environmental influences are presented below.

B. THE ENVIRONMENT AND FORCES FOR CHANGE

1. Environmental Influences on Organizations

An understanding of what an environment and environmental change mean and how they relate to acquisition programs is important. Environment refers to the forces, events, circumstances, and institutions that exist outside of an organization, but nevertheless, affect its performance. Forces within the environment play a principal role in shaping organizational decisions and actions.

Environmental factors may be separated into external (general) or internal (specific) categories.

The external environment refers to everything outside an organization and usually indicates such things as political conditions, economic and technological factors, and the social climate. These are conditions that may affect the organization but in which the initial relevance is not clear. Conversely, the internal environment is directly relevant to the achievement of organizational goals and is comprised of critical components and constituencies that can positively or negatively affect an organization. The specific environment is unique to each organization and usually changes with conditions. The Department of Defense, Defense Systems Management College (DSMC) specifically defines the acquisition environment as being characterized by

> ...innumerable external factors [that] impact on, and help shape, every defense acquisition program, creating an environment that no one person controls. These factors include forces, policies, decisions, regulations, reactions, and emergencies. [Ref. 111]

2. Organizational Responses to Environmental Change

Organizations must remain aware of the potential influences on its general environment and respond to factors that may challenge organizational actions. These environments are difficult to manage since they differ by degree of environmental uncertainty and complexity within an

organization's environment. Many environmental forces are dynamic and create considerable uncertainty for the organization. To the degree that these environmental uncertainties can not be anticipated, they force the organization to respond in ways that it may not prefer. The greater the environmental uncertainty that an organization faces, the more the environment limits the organization's options and freedom to determine its own future. Since uncertainty is a threat to organizational effectiveness, reduction of uncertainty is critical.

Managing environmental uncertainty is a continual process and analyzing the environment that creates it is a critical aspect of that process. Because an organization's environment largely defines the available management options, the successful administration of uncertainty will help align the organization with its environment rather than fight the strong forces of change that are often presented. Consequently, an organization must have an accurate grasp of what is happening within its environment, both general and specific, and maintain an awareness of important trends that might affect its operations. Effective management of the environment entails being able to decipher the contradictions of the acquisition environment and reconcile them effectively into efficient action.

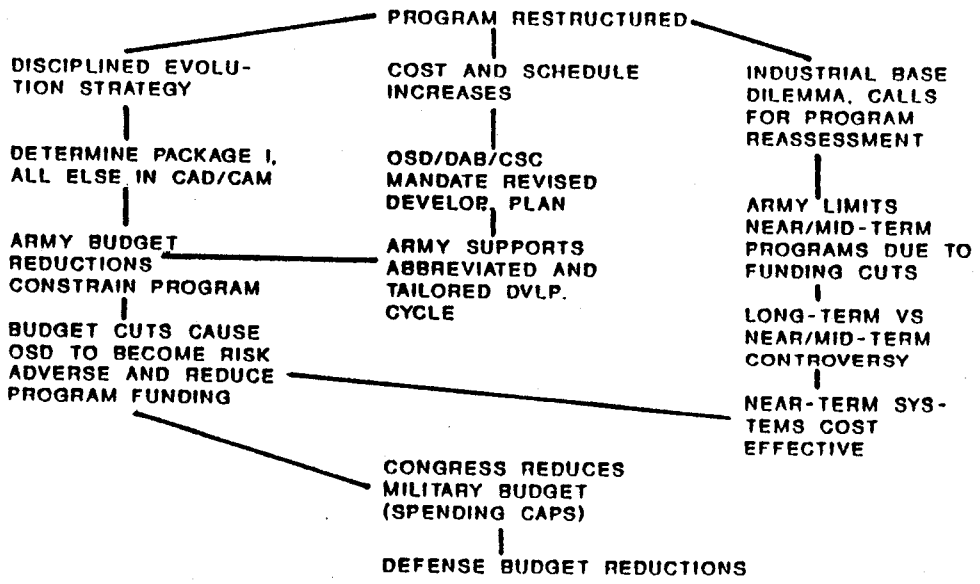
C. ARMORED SYSTEMS MODERNIZATION PROGRAM AND THE ACQUISITION ENVIRONMENT

In order to examine the ASM environment and determine the actions and ensuing reactions that occurred, a set of cause-effect matrices (Figures 40, 41 & 42) were constructed to trace the environmental driving forces. These driving forces have a tendency to direct actions away from a status quo or equilibrium condition. Based on these matrices the external and internal forces that induced ASM changes can be seen. Principally, three external environmental causes were substantially responsible for all resulting program changes. These were budget reductions, the dissolution of the Communist threat and, the operational effectiveness of Army armored vehicle systems during the two most recent U.S. military operations (Operations Just Cause and Desert Storm).

1. Budget Reductions (Figure 40)

The changing nature of the Federal budget became a major driving force behind program changes. Budget reductions, regardless of the cause (e.g. Federal budget deficit, peace-dividend, withheld funds), created a environment where ASM affordability became a prime issue. This resulted in a climate where cost reductions, smaller outlays, budget-cutting, and risk adversity were the norm. Affordability issues encouraged Congress to become involved in the detailed planning and determination of specific

BUDGET REDUCTIONS



BUDGET REDUCTIONS

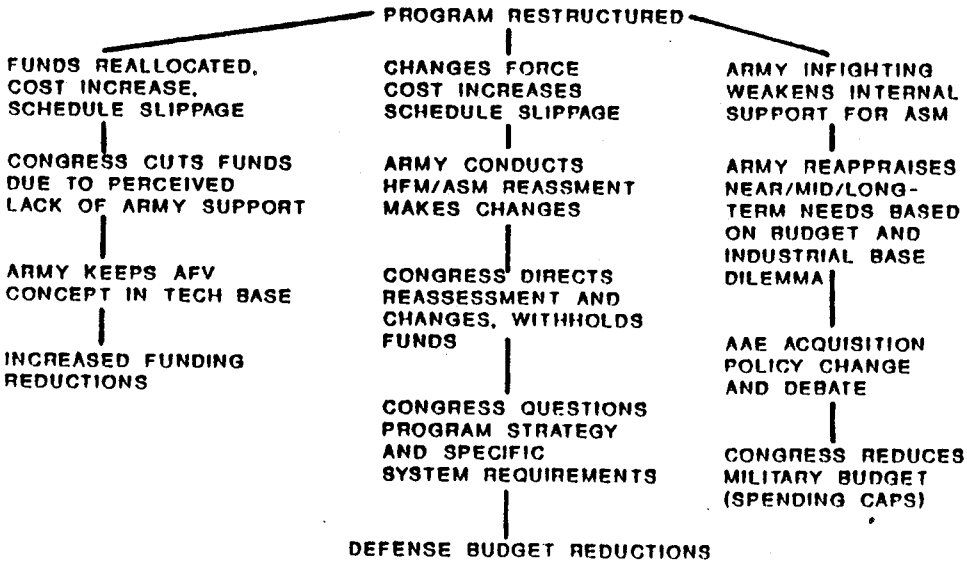


Figure 40. Budget Cause - Effect Matrix

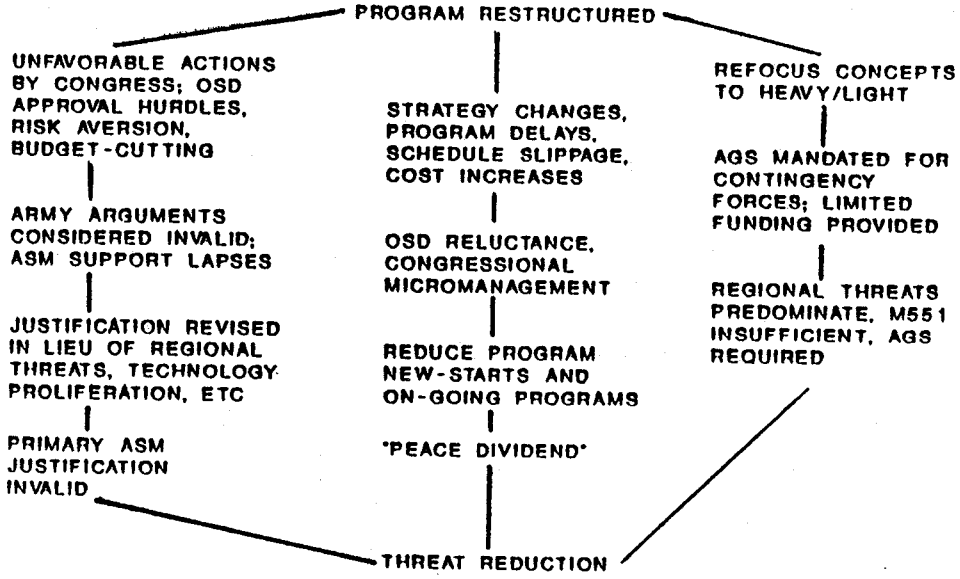
system requirements and capabilities, and thereby directing efforts to reprioritize the systems and review technology considerations.

OSD mirrored the Congressional reactions to defense budget-cutting measures, resulting in similar concerns regarding ASM affordability, excessive expenditures, and potential cost overruns. Consequently, OSD directed reviews of ASM justification, strategies, and plans. OSD's risk adversity slowed critical decision-making which further added to ASM woes through schedule slippage and the resulting cost increases. As a result, budget considerations were at the root of the AAE's acquisition policy. This policy resulted in a subsequent high-level, internal Army debate over the viability of the ASM program and the need to reevaluate Army priorities. This infighting significantly weakened Army resolve to support the program. The cumulative effect of Congressional, OSD, and Army reactions to the influence of an environment replete with on-going budget problems was the eventual restructuring of the ASM program.

2. Dissolution of the Communist Threat (Figure 41)

The dissolution of the Soviet and Warsaw Pact threat precipitated a major change in the acquisition environment, substantially undercutting the rationale for the ASM Program. During the early stages of the program, ASM was primarily justified based upon the perceived threat. With

DISSOLUTION OF THE THREAT



DISSOLUTION OF THE THREAT

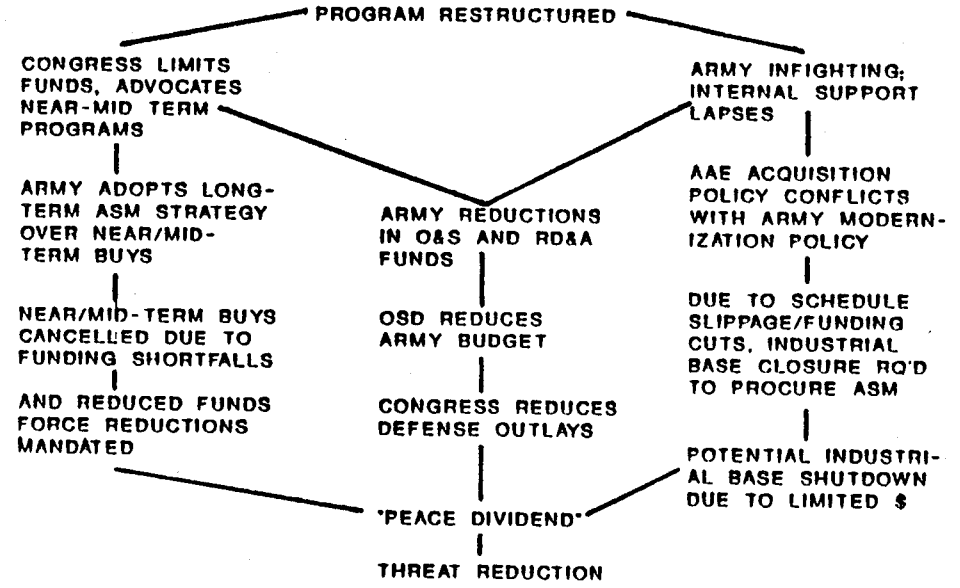


Figure 41. Threat Cause - Effect Matrix

the decline of the Communist threat, the Army had to quickly justify their rationale for supporting the ASM program. Later, the lack of a credible threat allowed a host of other programmatic issues to shift to the forefront, such as the development strategy, system priorities, and increased technological risks.

Defense budgets reductions and reduced need for leading- edge armored systems accelerated program challenges. As a result, support quickly eroded in Congress and OSD for expensive systems designed to counter the dwindling threat of Soviet modernization. After Desert Storm, Congress largely came to the conclusion that current systems were good and that with their help they could make the near and mid-term systems better. Over a period of months, Congress significantly redirected ASM priorities and strategies. OSD, already leery of expensive new systems, became increasingly risk adverse. Based on concern over heightened risk, ASM was reevaluated several times, therefore delaying approval of the Program and subsequently causing schedule slippage and increased costs. Finally, in reaction to the reduced threat, reduced budgets, and the succeeding force draw-down, internal Army support for the ASM program diminished significantly. New issues such as reducing the further loss of Army R&D funds, maintenance of the tank industrial base, and preventing the mortgaging of current system authorizations for an uncertain ASM future,

became primary considerations. Loss of the threat-based justification for the ASM Program forced Congressional, OSD, and internal Army reviews to recommend the complete restructuring of the ASM program.

3. Operations Just Cause and Desert Storm (Figure 42)

Operations Just Cause and Desert Storm also influenced and contributed significantly to ASM Program changes. These combat operations demonstrated the true performance of current armored system. The resulting after-action examinations of their specific strengths and weaknesses increased scrutiny and analysis of ASM related issues.

Current armored vehicle strengths reaffirmed Congressional resolve to mandate continued upgrading and procurement of near and mid-term systems rather than development of the future ASM Program. Current system deficiencies, such as the addition of the AGS system, resulted in Congressionally and OSD directed changes to ASM strategies and plans. As a result of Desert Storm, the Army was instructed to undertake near and mid-term "solutions" to system deficiencies and acquire a new set of armored vehicles based on the current systems that the Army wanted to stop procuring. In both cases, Congressional oversight and OSD guidance resulted in unmanageable demands upon projected program schedules, increased costs, and led to the eventual ASM restructuring effort.

MILITARY OPERATIONS

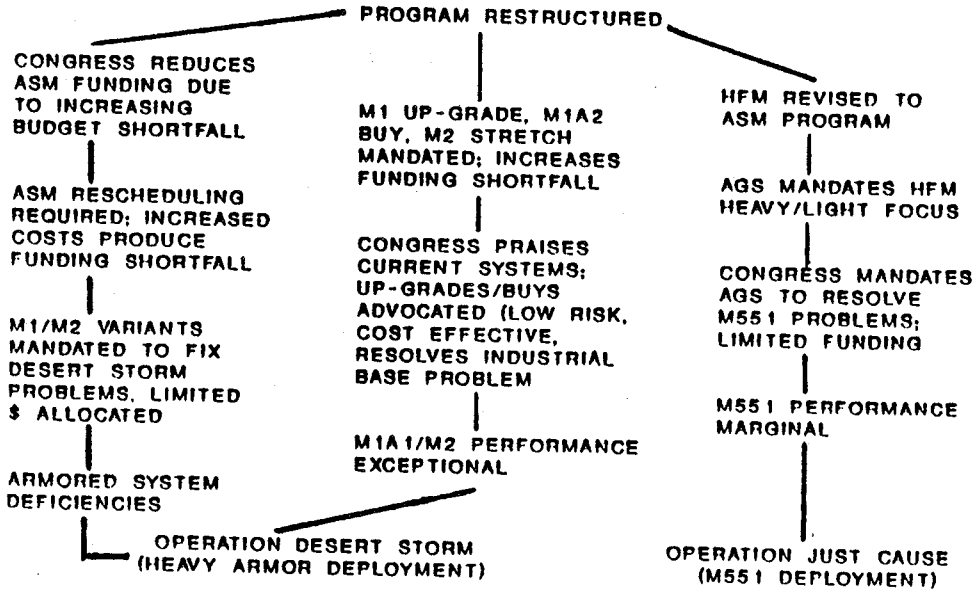


Figure 42. Military Cause - Effect Matrix

IV. LESSONS LEARNED FROM THE ARMORED SYSTEMS MODERNIZATION PROGRAMS'S ACQUISITION ENVIRONMENT

A. GENERAL

The major acquisition related environmental factors discussed in Chapter III had significant influence on the ASM Program. A review and analysis of the cause-effect relationships suggest a series of acquisition management lessons learned. These lessons, however, are not based on hard scientific quantitative data instead, they are based on qualitative insights and deductive reasoning. They are not intended to be all encompassing but rather touch upon the larger issues discovered.

These lessons learned are intended for members of the Army acquisition workforce and are provided as teaching points and for management, administrative, and program planning considerations.

B. LESSONS LEARNED

Over time, ASM depicts a series of circumstances in which the Army lost the ability to fully control its acquisition future at crucial points within a major program. As a result of environmental influence, Army leaders and ASM Program managers were virtually powerless to accomplish initial program objectives and achieve forward momentum. Had the Army been more flexible, proactive, and sought to

transform environmental change into opportunity, disruptive environmental factors may have been moderated resulting in more favorable ASM outcomes.

Although each situation is unique, there are some common criteria. Many factors can help to ensure a successful strategy; large amounts of resources, opposition errors, and effective implementation procedures name a few. Another key factor is to understand the dynamics and complexities of the acquisition environment. Complex strategies, plans, organizational structures, systems and internal/external environments mixed together to influence ASM Program outcomes. These complexities may extend well below the surface and as larger environmental issues are rooted in details and each level can be pulled back to reveal new insights. Effective acquisition strategies can, then, be reduced to specifics. It is within these specific insights that the Army may gain the advantage for dealing, one-on-one with the acquisition environment.

The lessons learned presented here are not meant to suggest that Army strategic management or planning processes and procedures are faulty. Many of the factors that disrupted the ASM program may well have been beyond the Army leaders and program managers ability to resolve satisfactorily. Nevertheless, strategy is a mediating force between the organization and its environment and most of the lessons learned do involve the realm of strategy. The

following insights into the ASM Program provide techniques for managing the future acquisition environment.

1. Comprehensive Threat Assessment

The threat must be viewed in a macro rather than one-dimensional sense. All factors (events, circumstances, capabilities, entities, organizations) that provide the rationale to justify the need for a particular defense system should be verified and validated. Lessons learned are:

- **Lesson Learned #1: <u>Justify Systems According to Requirements and/or Capabilities, Not One-Dimensional Threats.</u>**

  Acquisition programs should not be justified on the basis of one-dimensional threats. New-start programs must describe how they mitigate multiple "threats" (e.g. geo-political relationships, technological change, fiscal projections, national objectives, programmatic risks, temporal considerations) by satisfying a series of requirements and achieving set capabilities.

- **Lesson Learned #2: <u>Conduct Regular Threat Reassessment and Revalidation.</u>**

  Regular internal reviews or "reality checks" of the projected composite threat (additional to such external reports as the STAR) should be conducted to ensure system justifications are closely linked with valid and verifiable threats, requirements, and capabilities.

2. Relations With Congress

The Army must do a better job of articulating to Congress the necessity for its defense systems requirements. Additionally, effective lobbying efforts must be undertaken to gain and maintain needed support. Lessons learned are:

- **Lesson Learned #3: <u>Understand the Nature of the Congress and Congressional Interests.</u>**

  Congress, as a political entity, maintains many different agendas (e.g. home district contractors, constituencies, jobs). An appreciation for the programmatic related concerns of Congressional members (including staffers) must be acquired and satisfactorily addressed well before crucial votes. Effective program lobbying efforts, through the Congressional Liaison Office (CLO) and Office of Legislative Affairs (OLA), can bring dividends.

- **Lesson Learned #4: <u>Abide By Congressional Directives and Mandates.</u>**
  An unwillingness to confront Congressional concerns and follow the mandates of Congress may cause the body to resort to a range of persuasive "devices" (e.g. withholding program funds, increased program scrutiny). The tendency to relegate Congressional directives to restudying issues and conducting analyses, while sometimes necessary, often gives the impression of "foot-dragging" and "stonewalling". Without underestimating the political gamesmanship that is involved in such situations, prompt initial compliance with Congressional directives and mandates often satisfies the immediate interests of those concerned and serves to reduce oversight of particular programs in the future.

3. Relations With OSD

OSD interests often require greater efforts to satisfy than Congressional interests. It is critically important that Army leaders and acquisition managers understand the concerns and appreciate the prevailing political climate within OSD.

- **Lesson Learned #5: <u>Understand OSD's Political Foundations.</u>**
  OSD has a political foundation and consequently often has an agenda that is at odds with the military services. By its nature, OSD is able to react to a changing political and economic climate much faster than the services.

Understanding OSD's linkage to the political process and their ability to rapidly change positions in support of the Executive Branch will afford the Army information necessary to prevent program non-concurrence.

4. Acquisition Guidelines and Policies

Defense acquisition and procurement guidelines and policies are often the product of Congressional and OSD collaboration.

- **Lesson Learned #6: <u>Understand the Underlying Meaning of Acquisition/Procurement Guidelines and Policies.</u>** Statutes, regulations, and guidelines are enacted for a variety of reasons; many embody the prevailing political climate of the time. These guidelines should be thoroughly understood and followed. Be aware, however, that policies can be changed rapidly to suit a new political or economic climate. Therefore, the early identification of new policy trends is imperative.

5. Program Strategies and Management Concerns

These lessons learned were derived from observing the wide range of strategic Army responses to the changing acquisition environment that occurred during the ASM Program.

- **Lesson Learned #7: <u>Plan For Unexpected, Unknown Factors.</u>**
The future is too uncertain to accurately predict, therefore an attempt must be made to evaluate the dynamics and complexities that exist within the prevailing acquisition environment. As a bureaucracy, the Army is often reactive rather than proactive to change. Steps must be taken to monitor and anticipate changing environmental factors and when necessary, be prepared to change program direction. Contingency planning and what-if analyses must be used to mitigate reactive responses to change, thereby allowing Army decision-makers to be proactive in their responses.

- **Lesson Learned #8: Establish Periodic Strategic Reassessment Points.**
  Established periodic reviews should be incorporated to determine if the possibility of strategic environmental shifts or changes are occurring. At the reassessment points, a review of political and economic factors, Congressional and OSD support, the comprehensive threat, and requirements/capabilities should be conducted. This will permit the prevailing acquisition environment to be assessed and allow Army decision-makers to then make timely and prudent adjustments to program baselines.

- **Lesson Learned #9: Ensure Mutually Supportive Acquisition Strategies.**
  Acquisition efforts should be conducted according to an integrated and mutually supportive set of strategies. Just as all Army operations and planning efforts support the goals and objectives of the National Military Strategy, so too should all internal Army plans be mutually supportive. Army Modernization objectives and strategies for system development and procurement must not be at odds with sound Acquisition policies and practices. They must be fully integrated so that one does not undercut the objectives or precepts of another.

- **Lesson Learned #10: Repress Organizational Paradigms.**
  A tendency exists in any organization to view change in terms of specific familiar and routine structures or patterns, thereby causing a narrow focus or "tunnel vision". Unintentional adherence to internal paradigms may cause important considerations and possible solutions to be overlooked. The internal resistance that results from focusing on paradigms limits the possibility of controlling the effects of change and converting environmental changes into opportunities.

- **Lesson Learned #11: Safeguard Key Program Concepts and Ideas.**
  As programs negotiate the acquisition approval chain, a conscious and concerted effort must be made to safeguard the most important conceptual elements and components from being substantially diluted or curtailed during the process. Important concepts and ideas are the product of great time, effort, and analyses. In many cases, these emerging concepts/ideas have survived a process that often nullifies unique

and innovation solutions. The rationale and justifications for these concepts and ideas should not be forgotten, but need to be fully addressed and reviewed when challenged.

- **Lesson Learned #12:** **Focus on Program Ends Rather Than Specific Means.** Army programs are designed and developed to satisfy specific warfighting requirements and capabilities. In pursuit of these objectives, the means for attaining the end result often becomes skewed from planned baselines. Compromising, with regard to program strategies, methodologies, and plans, should be considered an integral component in the achievement of the specified end objectives.

- **Lesson Learned #13:** **Operational Planners and Material Developers Must Comprehend Political and Economic Realities.** Planners and developers often lack understanding of the political and economic compromises and concessions that often must be made to ensure positive program decisions are obtained. A cooperative rather than adversarial relationship must exist between Army the requirements generators and acquisition managers; mutual trust in the specific competencies of each of these groups must be paramount if program consensus is to be reached and maintained.

- **Lesson Learned #14:** **Maintain Program Consensus.** Army leadership welcomes the very important and necessary internal discussions and debates over acquisition strategies, plans, and policies. However, once a consensus is reached, infighting and public disagreement over official Army policy undercuts the consensus, confuses external decision-makers, and make programs into targets for change. All Army components must maintain a consensus ("must speak with one voice") with regards to its acquisition programs until internal Army decision-making bodies deem otherwise.

- **Lesson Learned #15:** **Instruct Acquisition Managers in the Art of Political Compromise.** In addition to a lack of understanding of the political/economic processes that often decide the fate of acquisition programs, a general lack of understanding of negotiation and compromise appears to exist. Rigid adherence to virtually all aspects of a programs objectives, strategy, and plans often ends with detrimental results. Unwillingness to compromise usually results in forced program modifications or changes above and beyond what might have been obtained if negotiation and mutually beneficial compromises were sought. Conversely, compromise, negotiation, and

flexibility allow room for maneuver and often can be orchestrated into a "win-win" situation for all parties involved. An educational program needs to be established to help decision-makers master the art of political compromise. The adroit use of negotiation and compromise will allow Army decision-makers to maintain key elements of its acquisition programs while achieving its end objectives.

V. CONCLUSIONS AND RECOMMENDATIONS

A. GENERAL CONCLUSION

Analyzing the acquisition environment is a critical aspect of the acquisition process. Despite the fact that each environmental condition is often unique, the influence of unknown and unexpected factors can not be left to chance. The environment surrounding the Army acquisition process largely defines the management options in the procurement of new systems. The lessons learned derived from this thesis provide a point of reference and areas for analysis. They provide avenues for evaluation and management of environmental influences and change. Environmental management should be thought of as a continual process and must be a program priority.

Acquisition managers must maintain an in-depth knowledge of what is happening in the environment and become aware of the important trends that might affect Army acquisition programs. Successful achievement of acquisition goals and objectives can be accomplished, if the Army is able to see through the complexities and align itself well with the environment.

B. SUMMARY OF LESSONS LEARNED

A summary of the specific lessons learned from a review of the ASM Program is provided below. Although many

insights stem from traditional management techniques, consideration and adherence to these lessons should assist Army leaders and acquisition managers to better control and responde to the ever changing acquisition environment.

- **Lesson Learned #1: Justify Systems According to Requirements and/or Capabilities, Not One-Dimensional Threats.**
- **Lesson Learned #2: Conduct Regular Threat Reassessment and Revalidation.**
- **Lesson Learned #3: Understand the Nature of the Congress and Congressional Interests.**
- **Lesson Learned #4: Abide By Congressional Directives and Mandates.**
- **Lesson Learned #5: Understand OSD's Political Foundations.**
- **Lesson Learned #6: Understand the Underlying Meaning of Acquisition/Procurement Guidelines and Policies.**
- **Lesson Learned #7: Plan For Unexpected, Unknown Factors.**
- **Lesson Learned #8: Establish Periodic Strategic Reassessment Points.**
- **Lesson Learned #9: Ensure Mutually Supportive Acquisition Strategies.**
- **Lesson Learned #10: Repress Organizational Paradigms.**
- **Lesson Learned #11: Safeguard Key Program Concepts and Ideas.**
- **Lesson Learned #12: Focus on Program Ends Rather Than Specific Means.**
- **Lesson Learned #13: Operational Planners and Material Developers Must Comprehend Political and Economic Realities.**

- **Lesson Learned #14: Maintain Program Consensus.**

- **Lesson Learned #15: Instruct Acquisition Managers in the Art of Political Compromise.**

C. RECOMMENDATIONS

The following recommendations have been derived from the review and analysis of the ASM Program:

1. These lessons learned should be reviewed for application in all current and future Army acquisition programs.

2. Periodic programmatic reassessment of both internal and external environmental factors should be conducted to ensure that the program is aligned with valid justifications and has the support necessary for approval.

3. Acquisition managers should receive instruction in the art of political negotiation and compromise in order to successfully secure essential program objectives.

4. Further study is recommended into other programs for additional insights and lessons learned.

APPENDIX A

ACRONYM LIST

ABBREVIATION	FULL-TITLE
AAE	Army Acquisition Executive
A3	Armor/Anti-Armor
A3STF	Armor/Anti-Armor Task Force
ACVST	Armored Combat Vehicle, Science and Technology
ACVT	Armored Combat Vehicle Technology
ADP	Advanced Development Prototype
AFAS-C	Advanced Field Artillery System - Cannon
AFV	Armored Family of Vehicles
AFVTF	Armored Family of Vehicles Task Force
AGS	Armored Gun System
AIS	Armor Investment Strategy Group
ALB	AirLand Battle
ALB-F	AirLand Battle - Future
ALB-F(H)	AirLand Battle - Future, Heavy
ALB-F(H)SSG	AirLand Battle - Future, Heavy, Special Study Group
AMC	Army Material Command
ARSTAF	Army Staff
ASAP	Army Streamlined Acquisition Process
ASARC	Army Systems Acquisition Review Committee
ASARDA	Assistant Secretary of the Army for Research, Development, and Acquisition
ASM	Armored Systems Modernization
ASV	Armored Security Vehicle
ATPA	Army Tank Program Analysis
ATTD	Advanced Technology Transition Demonstrator
AVTA	Armored Vehicle Technology Associates
AWC	Army War College
BTA	Best Technological Approach
CACDA	Combined Arms Combat Developments Activity
CAD	Computer-Aided Design
CAIG	Cost Accounting Improvement Group
CAM	Computer-Aided Manufacturing
CATTB	Component, Advanced Technology Test Bed
CCATTD	Common Chassis, Advanced Technology Transition Demonstrator
CE/D	Concept Exploration and Development
CEM	Combat Earthmover
CEX	Combat Excavator
CGC	Combat Gap Crosser
CLO	Congressional Liaison Office

CMV	Combat Mobility Vehicle
COEA	Cost and Operational Effectiveness Analysis
CSA	Chief of Staff of the Army
CSC	Conventional Systems Committee
CSSV	Combat Support Smoke Vehicle
DA	Department of the Army
DAB	Defense Acquisition Board
DAE	Defense Acquisition Executive
DCSOPS	Deputy Chief of Staff for Operations
DEM/VAL	Demonstration and Validation
DEW-V	Directed Energy Weapons - Vehicle
DOD	Department of Defense
DPRB	Defense Planning Review Board
DSB	Defense Science Board
DT/OT	Developmental Testing and Operational Testing
EA	Economic Analysis
ETAS	Elevated Target Acquisition System
FACS	Future Armored Combat System
FARV-A	Future Armored Rearm Vehicle - Artillery
FARV-F	Future Armored Refuel Vehicle - Fleet
FIFV	Future Infantry Fighting Vehicle
FC2V	Future Command and Control Vehicle
FCCVS	Future Close Combat Vehicle Study
FMS	Foreign Military Sales
FMSWG	Force Modernization Systems Working Group
FRV	Future Reconnaissance Vehicle
FS/COLS	Fire Support/Combat Observation, Line of Sight
FST	Future Soviet Tank
FUE	First Unit Equipped
FY	Fiscal Year
GAO	General Accounting Office
GMC	General Motors Corporation
GPC	General Purpose Carrier
HASC	House Armed Services Committee
HIC	High Intensity Conflict
HFM	Heavy Force Modernization
IEWV	Intelligence and Electronic Warfare - Vehicle
IOC	Initial Operational Capability
JMNS	Joint Missions Need Statement

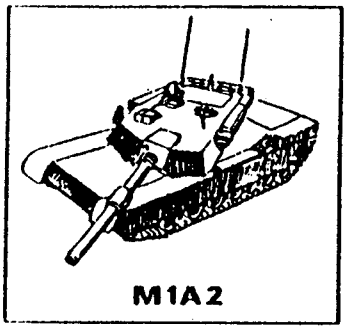
LAV	Light Armored Vehicle
LFACS	Light, Future Armored Combat System
LHX	Light Helicopter, Experimental
LIC	Light Intensity Conflict
LOS-AT (KEM-V)	Line of Sight, Anti-Tank (Kinetic Energy Missile - Vehicle)
LOS-AD	Line of Sight, Air Defense
MACOM	Major Command
MANPRINT	Manpower Personnel Integration
MARS	Maintenance Assistance and Repair System
MEV	Medical Evacuation Vehicle
MIC	Medium Intensity Conflict
MMATTD	Mission Module, Advanced Technology Transition Demonstrator
MWS-V	Mortar Weapons System - Vehicle (Mortar)
NBCRS	Nuclear, Chemical, and Biological Reconnaissance System
NDI	Non-Developmental Item
NMS	National Military Strategy
NLOSS-AT/AD	Non-Line of Sight System - Anti-Tank/Air Defense
OLA	Office of Legislative Affairs
O & O	Operational and Organizational
ORD	Operational Requirements Document
O & S	Operations and Support
OSD	Office of the Secretary of Defense
PEO	Program Executive Officer
PEO-ASM	Program Executive Officer - Armored Systems Modernization
PMP	Platform Modernization Program
POM	Programs Objective Memorandum
POP	Proof of Principle
PM	Program Manager
RAMS	Rocket and Missile System
R&D	Research and Development
RD&A	Research, Development, and Acquisition
RFP	Request for Proposal
ROC	Requirements Operational Capability
RRC	Requirements Review Committee
RV	Recovery Vehicle
SASC	Senate Armed Services Committee
SEA	Systems Engineering Analysis
SSGA	Special Study Group - Armor
SV	Sapper (Engineer) Vehicle

TACOM	Tank and Automotive Command
TARG	Tan Armament Review Group
T&E	Test and Evaluation
TECH	Technology
TOA	Total Obligational Authority
TOE	Table of Equipment
TPIO	Training and Doctrine Command, Program Integration Office
TRADOC	Training and Doctrine Command

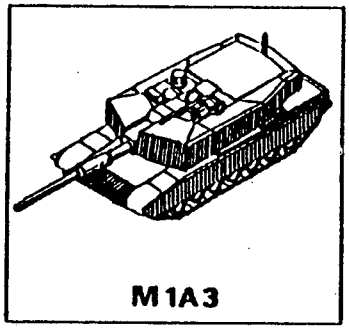
APPENDIX B

AFV/HFM SYSTEM ALTERNATIVES

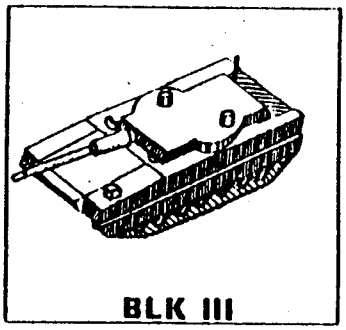
TANK SYSTEM



M1A2



M1A3



BLK III

Chassis		
Abrams	Modified Abrams	HFM Heavy (rear engine)
Turret		
Conventional	Conventional	Unconventional (remote gun)
Engine		
1,500-hp Turbine	1,500-hp PS[1]	1,500-hp APS
Weight		
69.5 tons	75.8 tons	64.9 tons
Crew		
4	3 (Autoloader)	3 (Autoloader)
Embedded tng/tech help		
Limited	Yes	Yes
Armament		
120mm main gun	ATACS[2]	ATACS
50-cal/7.62 MG	50-cal/7.62 MG	7.62mm MG
Fire control		
M1 thermal	Adv tech FLIR[3] (2d generation)	Adv tech FLIR (2d generation)
Laser rangefinder	MMW[4], MTAS[5],	MMW, MTAS,
M1 Day sight	Day/TV	Day/TV
	Laser rangefinder	Laser rangefinder

Figure 5. (U) Tank systems

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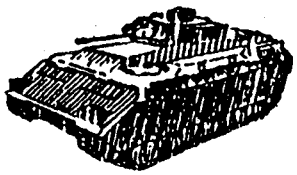
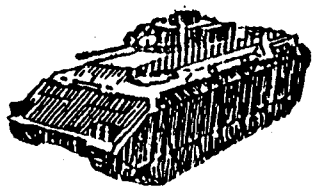
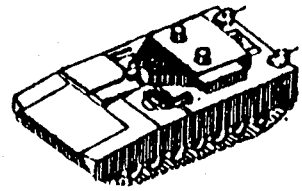
[1]Advanced Propulsion System
[2]Advanced Tank Cannon System
[3]Forward-looking infrared
[4]Millimeter wave
[5]Multiple Target Acquisition System

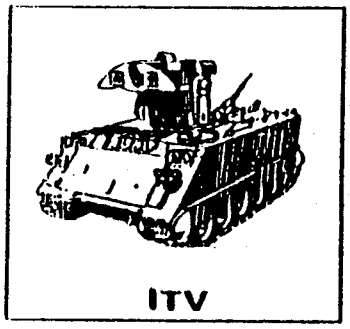
IFV SYSTEMS

M2A2	M2A2(I)	FIFV
		
Chassis M2A2 Bradley	M2A2 Bradley	HFM heavy (front engine)
Turret Conventional	Conventional	Unconventional (external cannon)
Engine 600-hp diesel	500-hp diesel	1,500-hp APS
Weight 33 tons	33 tons	68.7 tons
Crew 3-man crew 6-man dismount element	3-man crew 6-man dismount element	2-man crew 6-man dismount element
Embedded training, technical help No	No	Yes
Armament TOW IIB 25mm auto cannon 7.62mm coax	TOW IIB 25mm auto cannon 7.62mm coax	TOW IIB 45mm auto cannon MK-19 40mm launcher 7.62mm coax
Fire control Direct-view optics TOW day sight TISP FLIR	Direct-view optics TISP[1] FLIR	Adv tech FLIR MMW, Day/TV, MTAS Laser rangefinder

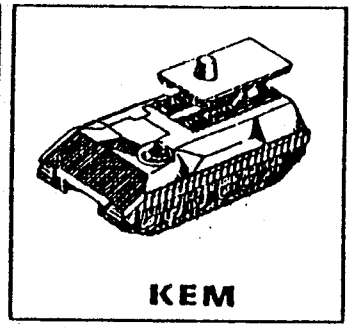
[1]TOW Improved Sight Program

Figure 6. (U) IFV systems

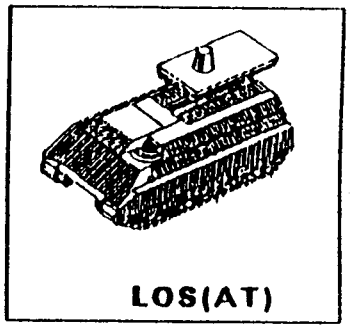
DIRECT FIRE, ANTI-TANK SYSTEMS



ITV



KEM



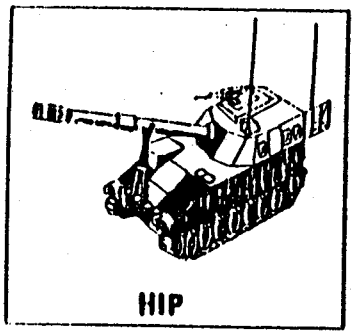
LOS(AT)

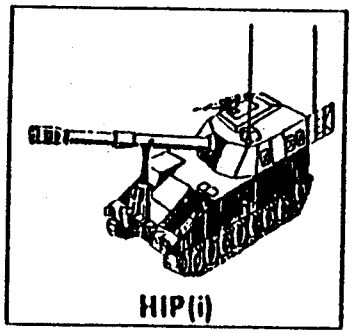
Chassis Modified M113A2	M2A2 Bradley	HFM interim medium
Turret Manned tow launcher	HVM[1] launcher	HVM launcher
Engine 212-hp diesel	600-hp diesel	600-hp diesel
Weight 13.1 tons	28.0 tons	33.0 tons
Crew 4	3	3
Embedded tng No	Yes	Yes
Embedded tech help None	Full up	Full up
Armament TOW IIB 7.62mm MG	HVM 7.62mm MG	HVM 7.62mm MG
Fire control Direct-view optics (TV) TISP FLIR (2d generation)	Direct-view optics (TV) LOS(AT) FLIR (2d generation) unique to missile	Direct-view optics (TV) LOS(AT) FLIR (2d generation) unique to missile

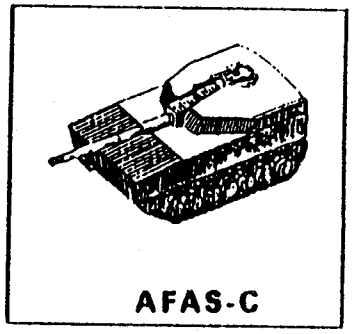
Figure 9. (U) DF-AT systems

[1]Hypervelocity missile

DIRECT SUPPORT, ARTILLERY SYSTEMS

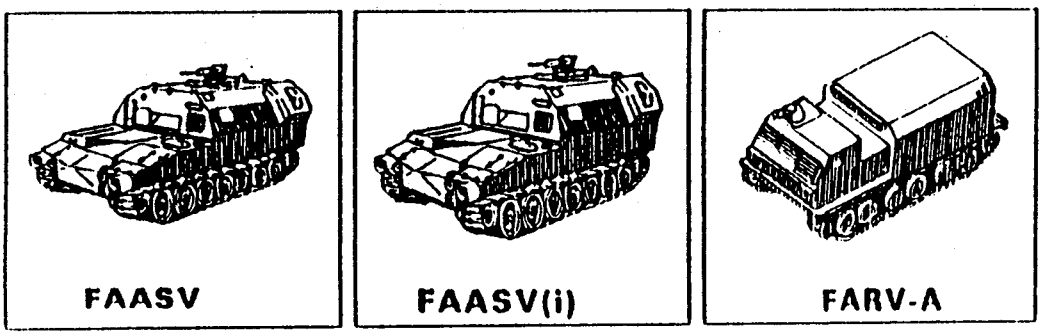






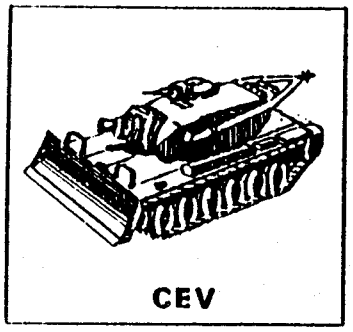
Chassis M109A4/5	M109A4/5	HFM heavy (front engine)
Turret Conventional	Conventional	Modified casemate
Engine 8-cyl diesel	8-cyl diesel	1,500-hp APS
Weight 33 tons	33 tons	62.4 tons
Crew 4	4	4
Embedded tng Some	Some	Yes
Embedded tech help Limited	Limited	Full up
Armament 155mm cannon (39-cal) 50-cal MG	155mm cannon (39-cal) 50-cal MG	155mm cannon (52-cal) Autoloader 7.62mm MG

Figure 7. (U) DS artillery systems

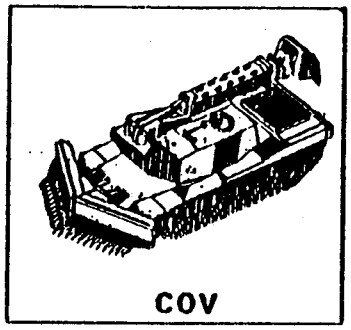


Chassis M981	M981	HFM interim medium
Engine 8-cyl diesel	8-cyl diesel	600-hp diesel
Weight 30 tons	30 tons	28 tons
Crew 5	5	2
Armament 7.62mm MG	7.62mm MG	7.62mm MG
Ammo transfer Manual	Manual	Automatic (robotic)
Embedded tng No	No	No
Embedded tech help Limited	Limited	Limited

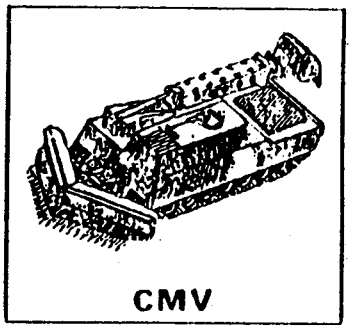
Figure 10. (U) FARV systems



CEV



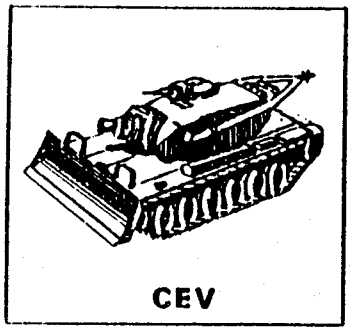
COV



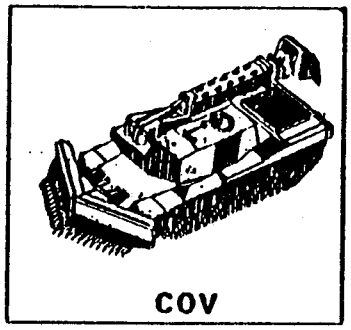
CMV

Chassis		
Modified M60A1	Modified M1A2	HFM heavy (rear engine)
Special Equipment		
Conventional turrent Dozer blade Retractable boom and wench	Mine-clearing blade Mechanical arm (dual controls)	Mine-clearing blade Mechanical arm (dual controls)
Engine		
750-hp diesel	1,500-hp turbine	1,500-hp APS
Weight		
58 tons	70 tons	57 tons
Crew		
4	2	2
Embedded tng		
No	Yes	Yes
Embedded tech help		
No	Full up	Full up
Armament		
165mm demolition gun 50-cal MG	MK-19 grenade launcher 7.62mm MG	MK-19 grenade launcher 7.62mm MG

Figure 8. (U) CEV systems



CEV



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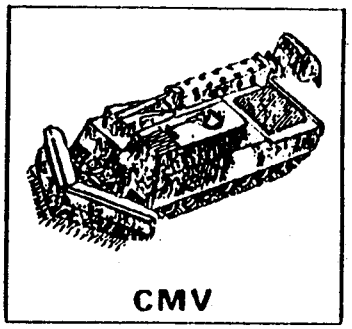


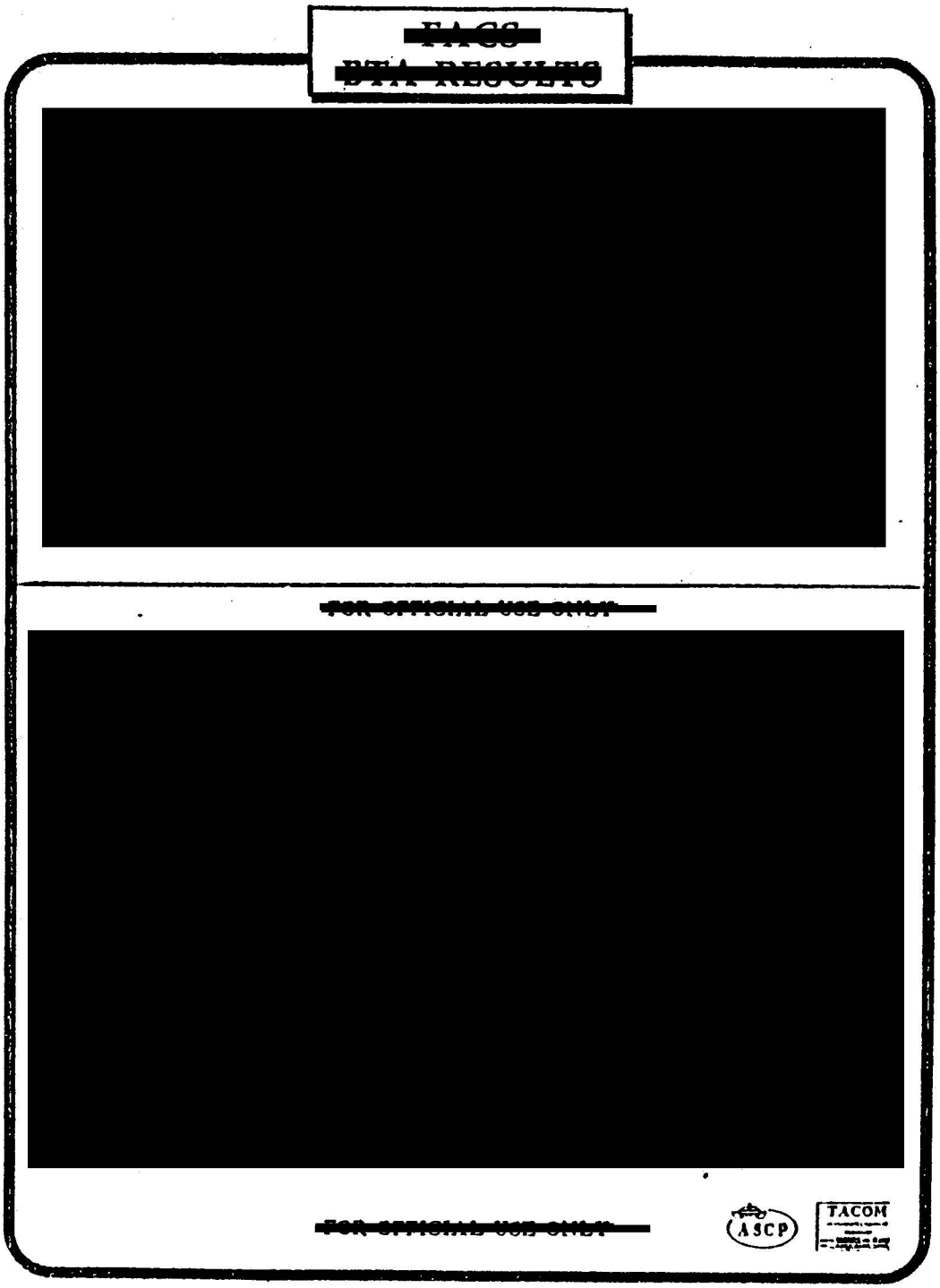
CMV

Chassis		
Modified M60A1	Modified M1A2	HFM heavy (rear engine)
Special Equipment		
Conventional turrent Dozer blade Retractable boom and wench	Mine-clearing blade Mechanical arm (dual controls)	Mine-clearing blade Mechanical arm (dual controls)
Engine		
750-hp diesel	1,500-hp turbine	1,500-hp APS
Weight		
58 tons	70 tons	57 tons
Crew		
4	2	2
Embedded tng		
No	Yes	Yes
Embedded tech help		
No	Full up	Full up
Armament		
165mm demolition gun 50-cal MG	MK-19 grenade launcher 7.62mm MG	MK-19 grenade launcher 7.62mm MG

Figure 8. (U) CEV systems

APPENDIX C

ASM BTA, PACKAGE I


FACS
BTA RESULTS
FOR OFFICIAL USE ONLY
FOR OFFICIAL USE ONLY
ASCP
TACOM

[redacted]
FIFV
PTA RESULTS

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FOR OFFICIAL USE ONLY

[redacted]

FOR OFFICIAL USE ONLY

ASCP

TACOM

LOS-AT BTA RESULTS

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AFAS-C
BTA RESULTS

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ASCP

TACOM

FARV-A
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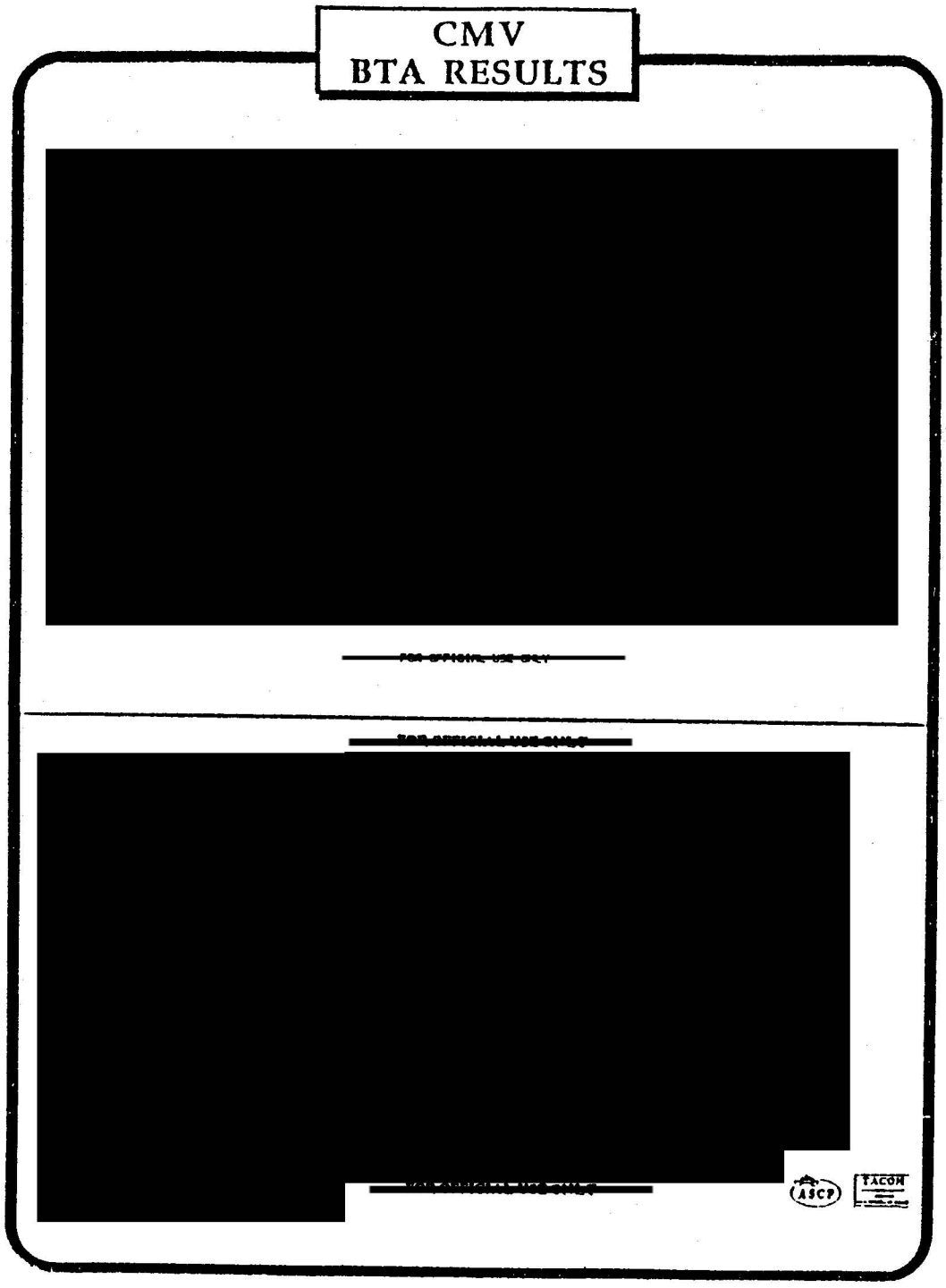
ASCP TACOM

CMV
BTA RESULTS



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