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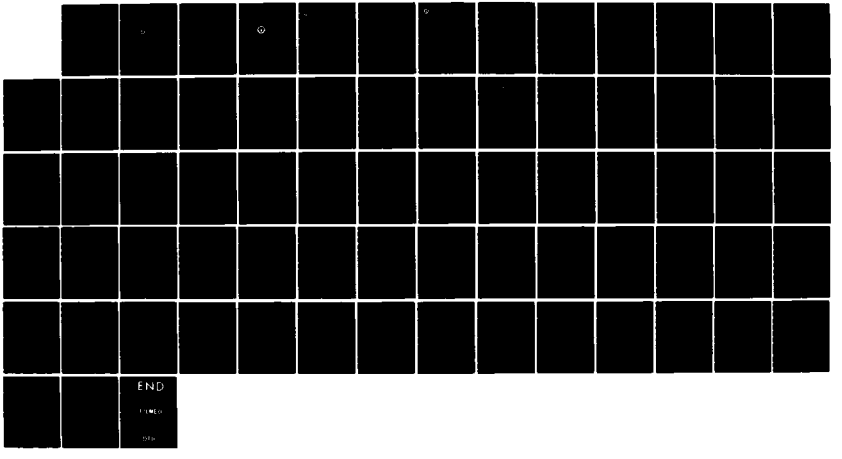

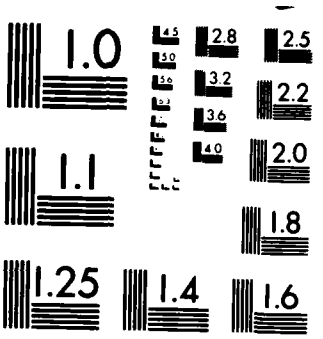

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IMPROVED DEFENSE THROUGH EQUIPMENT UPGRADES:

THE U.S. AND ITS SECURITY PARTNERS

Final Report
of the
1984 Defense Science Board
Summer Study on
Upgrading Current Inventory Equipment

November 1984

1984 DEFENSE SCIENCE BOARD SUMMER STUDY ON UPGRADING CURRENT INVENTORY EQUIPMENT

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DEFENSE SCIENCE BOARD

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

21 February 1985

MEMORANDUM FOR THE SECRETARY OF DEFENSE

THROUGH THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

SUBJECT: Report of Defense Science Board Summer Study on Upgrading Current Inventory Equipment - ACTION MEMORANDUM

I am pleased to forward the report of the 1984 Defense Science Board Summer Study on Upgrading Current Inventory Equipment. This study, which was Chaired by Donald B. Rice, examined the process by which the combat performance of fielded weapon systems could be improved through the addition, modification, or substitution of important subsystems such as sensors, fire control units, and munitions.

The upgrade process for equipments of U.S. forces is in fairly good shape. Yet current trends in threats, weapon costs, and technology indicate a need for greater emphasis on upgrades in the future. The report's recommendations aim at adjusting DoD procedures and incentives to focus greater attention on upgrades in the U.S. force modernization planning process. Specific suggestions are made to strengthen and extend Service planning by mission area and equipment class, to modify subsystem development practices, and to strengthen OSD oversight of force modernization plans and programs. The DSB recommends that USDRE be responsible for increasing the emphasis on upgrade of U.S. equipments.

The process by which the United States assists in the upgrading of equipment in foreign inventories is in considerably worse condition. As the report makes clear, this area demands "significant changes in U.S. policy, procedures, and, most important, culture." There is an abundance of "upgradable" equipment in the active inventories of nations with whom we share important security interests, but the U.S. lacks an aggressive, systematic program to promote and facilitate upgrades for Security Partners. The panel's several recommendations are designed to overcome this deficiency. A high level focal point is needed in the DoD and the U.S. government, and we recommend that USDP be given this role.

The DSB report has helped focus attention on a critical set of issues that must be addressed as we and our security partners carry out force modernization plans. Attention to this problem must be sustained at the highest levels and matched with concerted efforts to assure that the promise embodied in the recommendations of the report are fully realized. I recommend you read the Executive Summary and the proposed implementation plan, and sign the attached memorandum requesting the Under Secretary of Defense for Policy take the responsibility for implementing the portion of the upgrade program relating to Security Partners.

Charles A. Fowler

Charles A. Fowler
Chairman

Attachment:
As Stated

DEFENSE SCIENCE BOARD

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

31 January 1985

Dr. Charles Fowler
Chairman
Defense Science Board
The Pentagon, Room 3D1034
Washington, DC 20301

Dear Mr. Chairman:

Enclosed with this letter is the final report of the Defense Science Board Summer Study on Upgrading Current Inventory Equipment. It expands on the information contained in the preliminary draft circulated in August, provides additional background data, and incorporates the suggestions made by the many reviewers from within and outside government. We have made a special effort to clarify our earlier observations and recommendations concerning legal issues affecting U.S. funding of equipment upgrades for our security partners.

Our recommendations aim at strengthening the process by which upgrades to existing equipment are conceived, considered, and carried out. With effective monitoring and follow-up attention, we believe they hold the promise of significantly improving U.S. defense capabilities and those of our security partners.

I want to make special mention of the outstanding contributions of each member of the Summer Study panel, its working group and special consultants, and the very fine assistance provided by the military services and various elements of the Office of the Secretary of Defense during our investigation. Your assistance and encouragement are especially appreciated.

While the entire panel has approved this report, and many others have helped with its preparation, the Summer Study Chairman bears principal responsibility for its content.

Sincerely,

Donald B Rice

Donald B. Rice
Summer Study Chairman

DBR:mc

Enclosure

IMPLEMENTATION PLAN

A. UPGRADE PROCESS FOR U.S. EQUIPMENT

1. *Recommendation:* Services should conduct modernization planning (based on projected requirements) by entire equipment categories. Focus should be on associated missions, useful system life, relevant technology trends. Plans should include not only modernization initiatives in the form of new system development and procurement, if any, but also alternative upgrades of fielded equipment so that tradeoffs are clear. OSD and the services should continue their efforts to operationalize mission area planning and link it with equipment-class planning activities.

   Action:

   - PA&E, with USDRE, ASD/MIL, ASD/C, and ASD/RA participation, initiate review of current analytic methods for both mission area and equipment class planning and identify necessary areas of improvement.
   - Upon completion of this work, USDRE, with OJCS participation, provide guidance to the services.

2. *Recommendation:* Services should routinely fund at least one major upgrade program aimed at increased combat capability in parallel and in competition with each major new system development.

   Action:

   - USDRE provide additional guidance to services.

3. *Recommendation:* OSD should consider adding a DSARC IV milestone during a system's operational life to review, among other things, upgrade opportunities.

   Action:

   - DEPSECDEF or USDRE should initiate study to define and evaluate DSARC IV options. Issues should include number, timing, and scope of possible reviews.

4. *Recommendation:* Services should encourage and apply more widely several design practices that facilitate upgrades (including standardized interfaces, technical standards, maximum use of component and subsystem building blocks and common parts) and should include upgradability in source selection criteria.

   Action:

   - USDRE provide guidance to services and request services to report on relevant initiatives underway and planned.

5. *Recommendation:* Services should provide subsystem suppliers with more information on future requirements.

   Action:

   - USDRE and DARPA should provide guidance to the services on how to expand dissemination of future technology requirements of classified programs to subsystem suppliers.

6. *Recommendation:* OSD should establish a review process for assessing the services' modernization plans, with additional emphasis on the role of upgrades.

   Action:

   - DEPSECDEF should charge Defense Resources Board with review of services' force modernization plans by equipment category.

7. *Recommendation:* OSD should track incidence and frequency of upgrade initiatives to determine whether the institutionalized consideration of upgrade alternatives and necessary increase in upgrade programs do in fact occur.

   Action:

   - USDRE establish tracking mechanism.

B. UPGRADE PROCESS FOR SECURITY PARTNERS' INVENTORIES

1. *Recommendation:* Codify U.S. policies and responsibilities by (a) refining Defense Guidance and NATO Ministerial Guidance and institutionalizing regional and mission area analyses, and (b) seeking congressional language supportive of security partner upgrades.

   Action:

   - SECDEF instruct USDP, USDRE, CJCS to develop appropriate changes in Defense Guidance and NATO Ministerial Guidance; DEPSECDEF provide overall management of efforts to clarify U.S. policies and responsibilities.
   - SECDEF seek statutory authorizing language that establishes authority for U.S. development of security partner upgrade packages;
   - ASD/C and PA&E provide analytic and program/budget support.

2. *Recommendation:* Encourage security partner interest in equipment upgrades.

   Action:

   - USDRE and PA&E, working with services, devise procedures for compiling and listing desired upgrades for security partners;

- USDRE propose NATO office for transfers and upgrades of equipment designed by NATO nations and initiate assessment of increased use of NATO labs for testing upgrades;
- USDP initiate and chair regional/country force modernization analyses (with participation by USDRE(IP&T), DSAA, PA&E, OJCS, CINC staffs, and ASD/MIL) as preparation for joint U.S.-security partner modernization planning (Turkey, Greece, and South Korea could be early trial cases);
- USDRE and USDP, with OJCS participation, study ways of relaxing restrictions on third-country sales between security partners.

3. *Recommendation:* Increase emphasis on security partner equipment upgrades in U.S. planning process.

   Action:
   - OJCS direct CINCs to add annex on required host/allied nation support (to include upgrade needs) to contingency plans;
   - SECDEF instruct JCS to add CINCs' FMS objectives to Joint Strategic Planning Document;
   - USDRE add section on security partner upgrade opportunities to annual SECDEF and USDRE posture statements;
   - USDRE and PA&E add section on security partner upgrade opportunities to annual NATO issue paper;
   - ASD/MIL add analysis of security partner upgrade opportunities to annual readiness report to Congress;
   - USDP propose to NATO Military Committee that upgrade issues be included in NATO force goals process;
   - DEPSECDEF instruct OJCS to track security partners' force modernization plans and inventory composition characteristics.

4. *Recommendation:* Stimulate Service DT&E funding for upgrade ideas.

   Action:
   - USDRE study options for increased testing and evaluation of industry proposals;
   - ASD/RA study and recommend means of increasing reserve forces' involvement in testing upgrades for security partner equipment;
   - SECDEF instruct DCAA and services to regard R&D for security partner upgrades as reimbursable IR&D;
   - DSAA take steps to add "upgrade proofing" (see p. 28) to list of authorized uses of Special Defense Acquisition Fund;
   - DEPSECDEF direct USDP and OSD/GC to study possibility of changing law to raise FMS surcharge to fund upgrade DT&E;

- DEPSECDEF provide guidance to all services on following precedent and extending Army's "Meyer initiatives" (see p. 23).

5. *Recommendation:* Develop methodology and associated data bases for identifying high leverage upgrade opportunities for security partners

   Action:

   - PA&E, together with OJCS, the services, and OUSDRE prepare and carry out plans for methodology and data base development.

6. *Recommendation:* OSD should track incidence of upgrade initiatives undertaken by U.S. security partners—with attention to role played by U.S. services—to determine whether the necessary increase in upgrade programs does in fact occur.

   Action:

   - USDRE, with USDP and DSAA participation, establish tracking mechanism.

EXECUTIVE SUMMARY

Continuing increases in the enemy threat have maintained pressure on the United States to improve our own weapons inventory. But the growth of weapon system costs, coupled with defense budget limitations, makes it difficult to achieve the necessary improvements by acquiring new weapons systems. As a consequence, upgrading equipment must play an increasingly important role in U.S. force modernization. Upgrading—substituting or adding subsystems on an existing platform—has the additional advantage of providing a mechanism for rapidly introducing technological advances into the operational inventory. However, an effective upgrade process requires an effective subsystem development process that facilitates upgrading.

The United States shares security interests and maintains some kind of security cooperation with a wide range of nations who differ by the nature of the relationship to the United States, by the level of their defense capabilities, and by the size and composition of the military inventory. The factors that dictate increased U.S. attention to upgrades apply even more strongly to most of these countries, many of whom are even more severely resource constrained than the United States. By pursuing an aggressive upgrade program to increase the military capability of these nations, the United States decreases the chances of having to commit U.S. forces in regional conflicts.

Concern about the adequacy of the upgrade process for both the United States and for its security partners prompted a Defense Science Board Summer Study on Upgrading Current Inventory Equipment. The study addressed a broad range of issues, but focused on two basic questions:

- How adequate are the current approaches to creating and maintaining upgrade options?
- How effective are existing concepts and procedures for coordinating the force modernization decisions of the United States and its security partners?

In general, the study panel found that the upgrade process for U.S. equipment is working but needs improvement; however, the upgrade process for U.S. security partners needs significant modification.

IMPROVING THE UPGRADE PROCESS FOR U.S. EQUIPMENT

Findings

We draw three major conclusions from our analysis of the upgrade process for U. S. equipment:

(1) There is no need for substantial changes in institutions or procedures to achieve an appropriate emphasis on weapon system upgrades.
(2) However, all the services will have to place increased emphasis on upgrading in the coming years.
(3) The services are unlikely to assign a sufficiently high priority to upgrading without the concerted efforts of their senior leaders and of the highest levels in OSD and the JCS.

Although the basic upgrade process for U.S. equipment is working, it could be improved in the following areas:

- Services seem reluctant to pursue major upgrades for the same mission area or equipment class in which they are seeking a new system development.
- The best upgrade programs are part of a comprehensive modernization plan for an entire equipment category, including upgrades and new starts. These plans could be improved by a mission-oriented perspective.
- Upgrading could be facilitated if the original design provided for later modification, and if upgrading became the focus of the subsystem design process.
- Particularly promising areas for upgrading efforts are electronics and armaments; the former offers rapid technology advances, the latter provides the opportunity for modular improvements.

Recommendations

We recommend the following changes in procedures and incentives in order to strengthen the role of upgrades in the modernization process.

(1) Modernization planning should focus on complete equipment categories rather than on individual systems. To achieve this goal, OSD should help the services to develop better methods for conducting mission area planning.
(2) The modernization plans should include both warfighting and life-cycle cost criteria and should encompass both new systems and upgrades.
(3) The services should fund upgrade programs in parallel with new system developments in order to maximize the benefits of contractor competition. Parallel upgrade programs should be pursued by all new DSARC programs.
(4) Upgradability should be a required design goal of all systems and subsystems and should influence selection of contractors.
(5) The services should modify the development process for key subsystems and related design practices to capture more fully the opportunities for upgrades and to take advantage of rapid rates of technological change at the subsystem level. Selected organizations to foster subsystem development should be established within the services' development commands.

(6) OSD should consider adding a DSARC IV milestone to review upgrade opportunities and should use the Defense Resources Board to review and approve the more comprehensive force modernization plans called for in (1) and (2) above.

IMPROVING THE EQUIPMENT UPGRADE PROCESS FOR SECURITY PARTNERS

Findings

The Board found strong evidence to support an aggressive U.S. program to promote equipment upgrades for U.S. security partners. These nations have abundant upgradable equipment in their inventories, and there is a substantial overlap with the inventory of U.S. reserve forces. However, the services have shown little interest in upgrading equipment once it leaves the active inventory, and there is no locus of responsibility at the top levels of DoD for planning this kind of security assistance based on its potential for enhancing coalition warfighting capabilities.

At the most general level, we found that DoD has not assigned appropriate importance to upgrading the inventory of U.S. security partners.

- The U.S. planning, programming, and budget process devotes little systematic attention to how upgrades could increase the contribution of security partners to mutual defense needs.
- There is limited funding for upgrades to systems not in the U.S. active inventory, and little attention to those upgradable systems that are common to the inventories of both our security partners and our reserve forces.

In addition to DoD's general inattention to fostering coalition warfighting capability, serious flaws in U.S. security planning hinder greater emphasis on security partner upgrades:

- Responsibility and authority for strategy, funding, and implementation are not well-matched.
- Foreign military sales are not driven by U.S. or by coalition military mission requirements.
- Annual need assessments do not emphasize upgrades or mission area priorities.
- Initiatives and priorities are too often left to the State Department.
- Supporting analysis is seldom sought.
- U.S. does not use analyses or incentives to encourage security partner upgrades in areas of mutual benefit.
- FMS credits/Military Assistance Program grants discourage procurement of upgrades outside of the United States.
- Security assistance programs are not regularly linked with bilateral and multilateral military development undertakings.

- Special Defense Acquisition Fund, used to acquire stockage in anticipation of foreign sales, is limited in scope. It does not currently include development money for upgrades, and it can only be applied to items absorbable by U.S. forces.

The legal issues surrounding potential funding sources for developing and testing upgrades for security partners are not well understood.

- There is no *express* legal prohibition that would prevent the normal authorization and appropriation process from approving the use of RDT&E funds for upgrades intended for adoption solely by our security partners.
- Authorized programs to development improvements for U.S.-owned equipment (for either the active or reserve inventory) do not require additional authorization for application to security partner equipment.
- There is no express legal prohibition against contractors using their Independent Research and Development funds for this purpose.

Recommendations

The analysis suggests six basic ways in which the United States should improve the process by which it plans and implements upgrades for its security partners.

(1) Codify U.S. policies and responsibilities to stress the contributions of security partners to our collective and mutual security interests. To achieve this goal, and to promote U.S. attention to upgrades, DoD should improve regional and mission analyses to highlight the modernization needs of coalition forces, and upgrade opportunities for our security partners.
(2) Stimulate security partners' interest in improving force capability through upgrades. Ways to achieve this goal include more joint U.S.-security partner analyses of security needs, modernization requirements, and upgrade options; and offering tangible offsets for preferred upgrades.
(3) Focus the U.S. planning process on security partner upgrades. This entails including information about security partner upgrade needs and opportunities in the relevant plans and in high level reports, issue papers, and guidance documents. The services should be tasked to collect the data required to conduct multilateral force modernization planning.
(4) Stimulate DT&E funding for security partner upgrades. Steps include encouraging private industry to risk capital, correcting misperceptions about the requirements for funding security partner upgrades, asking Congress to add "upgrade proofing" as an approved use of SDAF money, creating a new direct and foreign military sales recoupment kitty, directing the Air Force and the Navy to follow the Army's lead in initiating improve-

ments that will be applied to various security partner equipment, and encouraging the formation of producer and user consortia.
(5) Develop better methods and data for systematically identifying promising upgrade opportunities.
(6) Renew commitment at highest levels of DoD to coalition warfare and attendant changes in defense planning, and monitor and enforce follow-up actions.

As important as these policy and procedure changes are, this is a situation that also requires a *change in culture.* There must be a strong renewed commitment to coalition warfare and attendant changes in defense planning and leadership embodying that commitment. The commitment must be made by the senior leadership of the Defense Department, and the monitoring and enforcement of follow-up actions must be relentless. Any lesser level of commitment is unlikely to overturn the long-term neglect and bureaucratic inertia in this area.

CONTENTS

FIGURES

TABLES

I. INTRODUCTION

This Report summarizes the findings and recommendations of the 1984 Defense Science Board Summer Study on Upgrading Current Inventory Equipment. (For a list of panel members and other key study participants, see the inside front cover.) The study's central concern was the process by which the performance of fielded weapon systems can be improved through the addition, modification, or substitution of such important subsystems as sensors, fire control units, and munitions. The study Terms of Reference (see Appendix A) called for attention to both U.S. and "Allied" inventories. However, as explained in Section III, the panel broadened the investigation to cover other nations that are not formal Allies, yet share important security interests with the United States.

The range of issues addressed was quite broad. The principal ones involved the adequacy of (1) current approaches to creating and maintaining upgrade options and (2) existing concepts, methods, and procedures for evaluating options and coordinating force modernization decisions of the United States and its security partners. The recommendations emphasize ideas for strengthening the *process* by which upgrades are conceived, considered, and carried out, but attention is also given to identifying classes of attractive current upgrade opportunities.

The panel drew heavily on the military services, elements of the Office of the Secretary of Defense and other national defense agencies, and private defense contractors for data, historical material, current program descriptions, and substantive insights. Appendix B contains a listing of the briefings given during the study; substantial additional assistance was provided in less formal ways.

This Report is divided into two parts. Section II examines the upgrade process for U.S. equipment. The assessment is a positive one: the process is in fairly good shape, although there are several areas where improvement is needed. Section III covers the process by which the United States assists in the upgrading of equipment in friendly foreign inventories. This process is *not* in good shape; it requires significant changes in U.S. policy, procedures, and, most important, culture.

II. IMPROVING THE UPGRADE PROCESS FOR U.S. EQUIPMENT

BACKGROUND

The concern over the adequacy of U.S. force modernization planning and practice in general, and the upgrade process in particular, has its roots in both funding constraints and in recent changes in the enemy threat. Qualitative improvements and numerical increases in the equipment inventories and combat forces of the Soviet Union and other potential adversaries have maintained the pressure to continually improve our own weapons inventory.

Achieving the necessary improvements through the acquisition of new weapon systems is increasingly difficult. The intergenerational increase in weapon system unit cost is generally thought to be equivalent to about five percent per year above inflation. Operations and maintenance costs are rising at a rate of about four to seven percent a year above inflation. Because future defense budget growth is unlikely to accommodate these increases, we can expect increasing pressures to limit the number of new program starts, reduce new equipment procurement quantities, and retain existing equipment in active inventories for ever-longer periods of time.

One implication is that even as far into the future as the year 2000 a very large percentage of U.S. equipment inventories will be composed of platforms now in production or currently in the field (see Figures 1 and 2, as well as Appendix C). As a consequence many major equipment inventories will experience a steady aging during the remainder of the century, as illustrated in Figures 3 and 4 (see also Appendix D). *These trends are such that an increasing share of the necessary force modernization of the future must occur through the upgrading of equipment already in inventory or already committed to production.*

The plans of the military services do in some respects reflect this situation. For example, there are very few new program starts slated for the rest of the century. However, there are other indications that these trends may not be fully appreciated. In fact, some of these indications suggest a systemic bias against upgrades created by the combined actions of the various actors in the defense resource allocation process. Consider, for example, the Navy's experience with its helicopter and fighter, attack, and anti-submarine warfare aircraft inventories: each of the almost 40 models fielded since the early 1950s have for various reasons been retained in active service longer than planned (Figure 5). In some cases, the actual length of service has been over twenty years longer than originally intended.[1] Because impending

[1]Many of the models represented on this chart are still in the Navy's active inventory and thus could be shown with arrows pointing right; their service life might well be extended even further. There is every reason to believe that this picture reflects the experience of the other services, too.

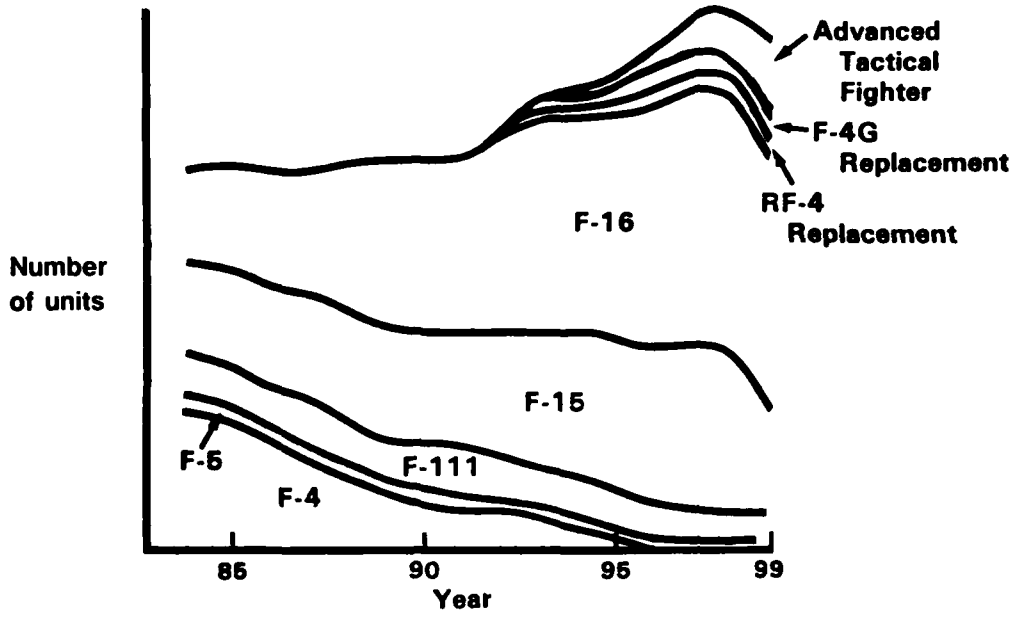

Fig. 1—Projected composition of USAF fighter inventory

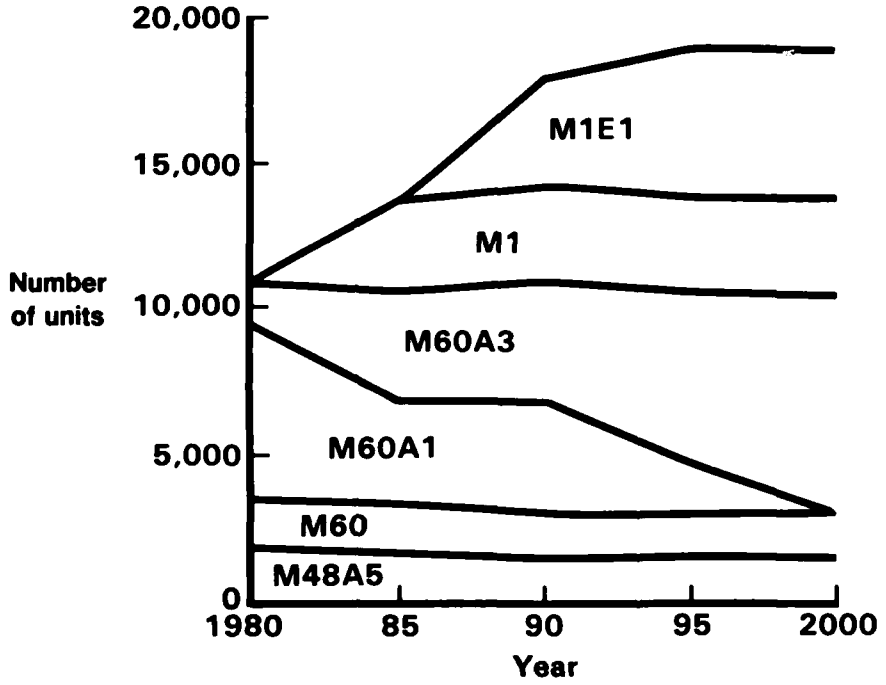

Fig. 2—Projected composition of U.S. Army tank inventory

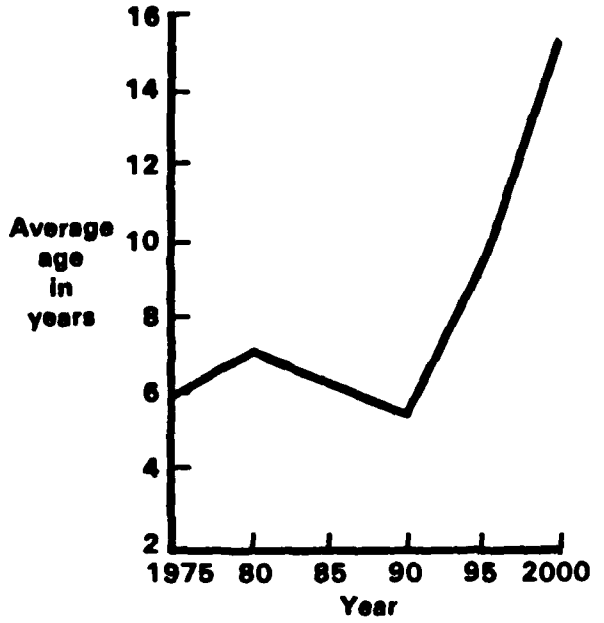

Fig. 3—Projected average age of U.S. Army tank inventory

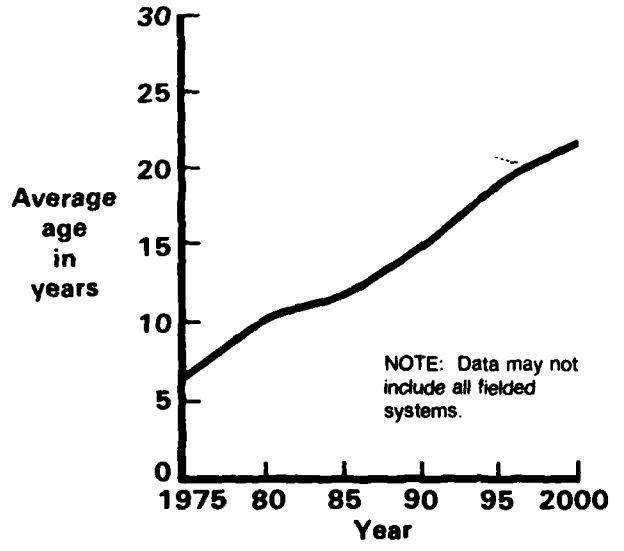

Fig. 4—Projected average age of U.S. Army armored personnel vehicle inventory

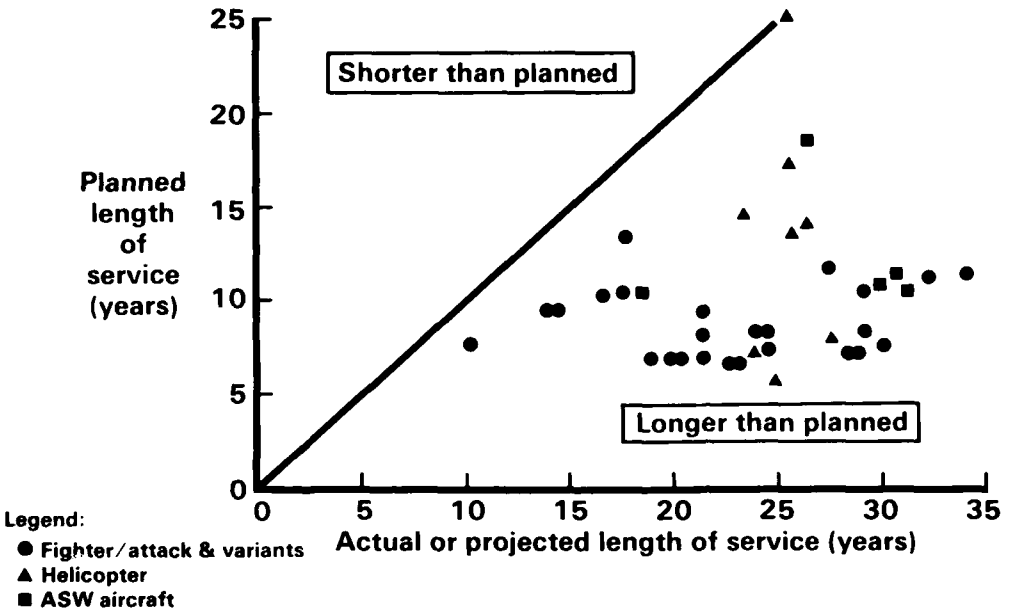

Fig. 5—Planned vs. actual time in service, U.S. Navy aircraft

retirement is one explicit reason offered by the services for ceasing to upgrade equipment, inevitable and repeated underestimates of service lifetimes might very well foreclose consideration and thwart pursuit of necessary upgrade options.

Regardless of whether upgrades have or have not been underemphasized in the past, it is certain that the emphasis on them must increase in the future. This is apparent from the summary of projected inventory composition and aging trends, and new start plans, for 15 equipment classes shown in Table 1. (That summary is drawn from the services' Extended Planning Annexes, which means the assumptions about the timing and production rates of future new systems are probably optimistic. If so, the importance of upgrades in our force modernization activities over the next two decades will be even greater.)

Upgrades are an attractive means of both countering improvements in enemy capabilities and expanding capabilities for new missions. Part of the reason lies in the fact that most of the important warfighting capabilities needed for future conflicts are ones in which subsystems—as opposed to their platforms—play a dominant role. These capabilities include, but are not limited to, 24-hour and all-weather operations, standoff engagement, effective acquisition and coverage of proliferated targets, precision weapons delivery and increased lethality, and the

Table 1

SUMMARY OF PROJECTED INVENTORY COMPOSITION AND AGING TRENDS

	New Starts	Implications of New Starts for Inventory Composition	Average Equipment Age
U.S. NAVY			
Attack aircraft	ATA—late 80s	ATA~30% of 2000 inventory	Growing slowly until early 90s, then slight decline
Fighter/strike aircraft		—	Declining slightly until early 90s, then growing
Helicopters	JVX—late 80s	JVX~30% of 2000 inventory	Growing until early 90s, slight decline, then slow growth in late 90s
Patrol aircraft	VSX—mid 90s	VSX~15% of 2000 inventory	Growing until early 90s, then slight decline
Submarines	SSN-21—mid 90s	[No data]	[No data]
USAF			
Fighters	ATF—mid 80s	ATF~15% of 2000 inventory	Stable until end of century, then growing
Bombers	(Data not useful because ATB excluded)		
Tankers	None	—	Modest growth through rest of century
Cargo aircraft	C-17—mid 80s	C-17s~30% of 2000 inventory	
U.S. ARMY			
Tanks	None	—	Declining until 1990, then sharp increase
APCs	None	—	Growing for rest of century
Attack helicopters	None	—	Growing, especially after 1990
Air defense systems	None	—	Fire units: growing for rest of century; missiles: declining
Shoulder-fired air defense systems	None	—	Growing until 1985; then declining until 1995; growing thereafter
Scout/utility helicopters	LHX—late 80s JVX—late 80s	[No data]	[No data]

growing importance of electronic combat. At the same time, the rates of technological advance and performance improvements at the subsystem level are very high. Night-sights, laser rangers, smart bombs and rounds, advanced armor, special coatings and paints, and digital flight and engine controls are a few illustrations.

Thus upgrading—substituting or adding subsystems on an existing platform—can be a cost-effective way of rapidly introducing technological advances with important warfighting implications into the operational inventory. It can enable a service to take quick advantage of an advance in a particular subsystem technology without having to wait for a comparable advance in enough other subsystems to warrant a whole new platform. Often, a new subsystem can add new capabilities to more than one platform type.

An aggressive and effective upgrade process is not possible, however, without a strong and productive subsystem development process. That process must stimulate and nurture development efforts aimed at forestalling equipment wear-out and reducing operating and support costs, as well as at increasing a system's functional performance. It must emphasize platform life extension as well as increased system combat effectiveness. Moreover, it is especially important for such a process to routinely produce subsystems that can be easily added to more than one platform and which are themselves amenable to subsequent upgrading.

FINDINGS AND CONCLUSIONS

OSD has recognized the importance of upgrades and has provided some guidance and direction. Upgrading fielded weapon systems is by no means a new concept. The strategy is embodied in the original 1981 Acquisition Improvement Program Initiatives (commonly known as the Carlucci Initiatives), which emphasized "pre-planned product improvement," or P^3I, as a means of "reducing unit costs and decreasing acquisition time,"[2] and in the principal regulation governing the defense acquisition process, DODI 5000.2.

Each military service has aggressive and numerous upgrade programs. Simply put, every major weapon system operated by the services has been upgraded, many of them extensively and repeatedly. The service efforts go by different names, but they are similar in intent and conduct. Some examples: the Army's PIP (Product Improvement Program), the Navy's SLEP (Service Life Extension Program) and CILOPS (Conversion in Lieu of Production), and the Air Force's MSIP (Multi-Stage Improvement Programs). Each, of course, has large equipment modification programs at its organic depot facilities and under contract with private industry. Moreover, there are upgrades underway

[2]See Memorandum from Frank C. Carlucci, Deputy Secretary of Defense, to Secretaries of the Military Departments, et al., "Improving the Acquisition Process Through Pre-Planned Product Improvements, 6 July 1981; Frederick Biery and Mark Lorell, "Preplanned Product Improvement and Other Modification Strategies: Lessons from Past Aircraft Modification Programs," The Rand Corporation, N-1794-AF, December 1981.

for every conceivable purpose, including survivability, supportability, lethality, interoperability, reduced operating and support cost, improved functional performance, and extended service life. A long but still only partial list of current upgrade programs or proposals under active consideration is shown in Table 2.

Nonetheless, services are sometimes reluctant to pursue major upgrades and new system developments concurrently. Although hard to document, the services seem to be reluctant to undertake major upgrades for the same mission area or equipment class when they are already promoting a new system development. The Navy and Air Force decision not to upgrade the AIM-7 Sparrow (which is being replaced by the in-development Advanced Medium Range Air-to-Air Missile—AMRAAM) is a frequently cited example. This reluctance is generally attributed by service officials to the difficulty of persuading the Congress to fund such concurrent efforts. However, the Congress would not generally oppose such a dual-track approach, especially if it results from a comprehensive assessment of mission area needs, a subject addressed below. This reluctance is probably an intraservice phenomenon.[3] Nevertheless, there are several examples of parallel upgrade and new system programs in each service:

Army
- PIVAD (Product-Improved Vulcan Air Defense gun) vs. DIVAD (Division Air Defense System, the Sgt. York)
- 105 mm ammunition upgrades vs. 120 mm gun for tanks

Navy
- Upgrades to Seasparrow and Close-in Weapon Systems vs. Rolling Airframe Missile
- SSN-688 nuclear attack submarine upgrade vs. SSN-21

Air Force
- Boosted GBUs (Glide Bomb Units) upgrade vs. TACMS (Tactical Missile Systems)
- B-52 and FB-111 modernization vs. B-1B and Advanced Technology Bomber

Among the best upgrade programs are those that are part of a planned approach aimed at modernizing an entire equipment category, including upgrades and new starts, rather than at single systems. Three examples of this style of more comprehensive modernization planning are the Air Force's Fighter Roadmap, the Navy's attack submarine program, and the Army's aviation program. Each developed an overall

[3]In fact, the second year-end report of the Acquisition Improvement Program noted that, "DoD, and especially industry, generally prefer selection of new high-technology systems of great capability as opposed to modest improvements in existing systems, or new systems of more limited capability that can be upgraded later." See Attachment A to Memorandum from Paul Thayer to Secretaries of the Military Departments, et al., "Guidance on the Acquisition Improvement Program (AIP)," 8 June 1983.

Table 2

SELECTED UPGRADES UNDERWAY OR UNDER CONSIDERATION

NAVY	AIR FORCE	ARMY
• SUBACS A (Submarine Advanced Combat System) Acoustic Processing	• F-4 Avionics, engine signature, etc.	• Stinger Night capability
• SUBACS B Communications	• A-10 Navigation, communications, AIM-9, LANTIRN	• M113 APC Power train, spall liners, fuel tank armor
• MK 48 ADCAP Acoustics, homing performance	• F-15 AMRAAM, communications, range, payload, etc.	• M110 Howitzer Turret protection, NBC protection
• P-3 update Sensors, displays, processing	• F-16 Sensors, navigation, AMRAAM, etc.	• UH-1 Composite rotor blade
• S-3 Sensors, communications, defensive systems, etc.	• F-111 Armament, avionics modernization	• HAWK Visual tracking
• SURTASS (Surveillance Towed Array Sonar System) Signal processing	• A-7 Armament, avionics, chaff/flares	• Chaparral Night capability
• OV-10D Night attack capability	• AIM-7 Range, clutter rejection, ECCM, etc.	• M60 tank Engine improvements, armor, laser range-finder thermal sights, etc.
• AH-1T Hellfire	• Tactical Munitions Dispenser Submunitions (mines, bomblets, area munitions), fuzing, etc.	• 105mm Tank Gun Increased tube length, new rounds
• AV-8B Night attack capability	• Anti-Jam Communications HAVE QUICK, JTIDS, Enhanced JTIDS	• Vulcan Fire control improvement
• AN/SPN-46 Radar Reliability upgrades, range and tracking performance	• DEWLINE/North Warning System Reliability, detection/tracking, etc.	• M109 Howitzer Fire control, automotive enhancements, new rounds
• AN/AYK-14 Computational speed	• B-52 ALCM/ACM, Harpoon, defensive systems, etc.	• OH-58A Navigation, communication, target acquisition
• AEGIS Power supply, reliability	• GATOR air-delivered mine Compatible with all USAF ground attack aircraft	• UH-60 Defensive systems
• F-14 Engine, avionics, etc.		• TOW Subcaliber and full caliber warhead
• F-18 Communications, navigation, etc.		
• Standard Missile family Sensors, warhead, etc.		

rationale for a mix of new development, modification, and product improvement programs. Even these types of planning activities could be improved, however, by a more thorough consideration and incorporation of relevant technology trends and by adoption of a more mission-oriented perspective that would allow trade-offs with other equipment types that contribute to the same mission as the subject class of equipment.

Upgrading is easier if the original system (and subsystem) design provided for subsequent modifications. Planning for subsequent upgrades during the design process can pay large dividends, even though the foresight this might entail may not always be easy or obvious. The Navy's Standard Missile program and its upcoming SSN-21 attack submarine program are excellent examples of this design philosophy and approach (as were the earlier DD-963 and F-4 programs). The SSN-21 design emphasizes reserve space, weight, and power; the Standard Missile has stressed design modularity.

Improving the subsystem design and development process would facilitate upgrading. Given the trends discussed earlier, the changing demands of modern warfare, and the rapid pace of technology, changes to the subsystem development process are indicated. Technology research efforts (funded largely by 6.2 exploratory development and 6.3A engineering development moneys and subcontractor IR&D) would benefit greatly from the more directed and discrete focus provided by the upgrade approach. As subsystem development is currently practiced, it is mostly directed towards application in new weapon system development, largely because new subsystems have been "easier" to fit into systems that are still in development. Whether justifiable or not, older systems are often seen as resistant to accepting new components that they were not originally designed to accommodate. However, there is now ample evidence that this need not be the case. Indeed, quite the opposite could easily be argued. Finally, such a design philosophy that emphasizes upgrades would further encourage the modest progress made recently towards increased standardization, building blocks, and system modularity, on both an intra- and interservice basis.

Electronics and armaments offer particularly attractive upgrade opportunities. The first offers rapid technology advances into an expanding sphere of applications. The second area—encompassing missiles and munitions—is by all accounts an area requiring substantial increased emphasis especially because of the opportunity to make modular improvements.

We draw three major conclusions from our study of the U.S. upgrade process. First, there is no evidence of a widespread or systematic neglect of upgrading, and, therefore, no need for sweeping, pervasive changes in institutions or procedures to achieve the proper emphasis on weapon system upgrades. Second, although it is difficult

to extract distinct problems from the identifiable trends, the emphasis placed on upgrades in the force modernization of all the services will almost certainly have to increase in the coming years.[4] Third, in spite of the likely benefits, the services' priorities on upgrades will probably not rise to the necessary level without concerted efforts by their senior leadership and that of OSD and the JCS.

RECOMMENDATIONS

The recommendations in this section are intended to help assure that the added emphasis on upgrades actually occurs. They therefore focus on ways to assure that more and better upgrade options are generated, that they receive more and better consideration and evaluation in the various force modernization planning and requirements activities. The recommendations are directed at changing internal procedures and incentives to accomplish the objective of placing greater reliance on upgrades in the force modernization process.

The services should conduct modernization planning by entire equipment categories rather than by individual systems. Fighter aircraft, helicopters, and attack submarines have already been mentioned as good examples of this approach; it should be applied to other types of systems, too, such as air defense systems, surface escorts, antisubmarine warfare systems, and tracked combat vehicles. This process should necessarily encompass an analysis of capability shortfalls and enhancement options for the entire equipment category—with explicit consideration being given to its associated missions, its predicted useful system lifespans, and the relevant subsystem and component technology trends. (Even the fine examples mentioned above generally took insufficient account of a wide-enough set of technology trends[5] and did not examine in concert the contribution by different equipment types to the same mission.)

Equipment-class planning is well-within the state-of-the-art. However, unless the equipment class happens to represent almost the only means by which a particular *mission* could be accomplished, the activity falls short of developing the combat mission orientation that is ultimately needed for effective force modernization planning and management. The services, with OSD leadership and assistance, should develop and apply better methods for conducting true mission area planning exercises. This will necessitate greater cross-service involvement than is called for by equipment-class planning (although that occasionally requires subsequent cross-service programs, usually at the subsystem level).

[4]It should be noted that this area is plagued with a serious paucity of data that makes it impossible to ascertain with precision either how much and what kind of upgrading is actually taking place or how much is enough.

[5]The Air Force has supplemented its acquisition roadmaps with subsystem (e.g., avionics) "master plans." However, there is much room for improving the integration of these efforts.

Whether the planning centers on an equipment class or a mission area, it should focus on tradeoffs based on realistic projections of resource availability and improved estimates of the systems' predicted warfighting capabilities. This requires that the analytic methods used emphasize *both* warfighting and life-cycle costs, criteria that have not been fully incorporated and integrated in past analyses. In addition, the resulting modernization plan should produce a comprehensive, coordinated blueprint that includes new system developments and procurements, if any, and upgrades for the existing equipment in the fielded inventory.

The purpose here is not only to promote better modernization plans but also to eliminate any residual fears that pursuing a dual track strategy of new platform developments and old platform upgrades in parallel is undesirable and should be discouraged. If one can extrapolate from the congressional reception given to the equipment class modernization plans already prepared, planning of this type is likely to be persuasive when asking the Congress to fund appropriate parallel or concurrent upgrade and new development programs.

The services should fund upgrade programs aimed at increased combat capability in parallel with new system developments. This promises to be a more efficient means of fostering desirable contractor rivalry and competition for some situations than dual production sources, for example when the quantities to be procured are relatively limited and thus do not justify investments in two production facilities. Naturally, this tactic would also serve as a welcome hedge against technical and programmatic risk. Such a blend of efforts provides the added flexibility necessary for carrying out a High/Low mix strategy and responding to sudden "environmental" changes, such as changes in the budget topline that can occur with shifts in the national economic conditions or in national or international political conditions. In other words, many of the benefits that are correctly attributed to increased contractor competition would be better achieved by having the competition for the new system come instead from an aggressive upgrade program.

These upgrade considerations and benefits are important enough to warrant application of this recommendation *to all new DSARC programs unless specifically waived by the Deputy Secretary of Defense.* Forthcoming examples of new programs for which a parallel upgrade effort should be funded in competition include the Light Helicopter-Experimental (LHX), the Joint Vertical Takeoff Aircraft-Experimental (JVX), the C-17 Transport Aircraft, the Air Force's Advanced Tactical Fighter, the Navy's Advanced Tactical Aircraft, and the Advanced Air-to-Surface missile.

Upgradability should be a required system and subsystem design goal and should figure in source selection decisions. This will help encourage vendors to develop and present new subsystems or components on a more continuous, regular basis.

Services should encourage and apply more widely several design practices that facilitate upgrades. The three most promising practices are:

- the use of standardized interfaces,
- the formulation of technical standards,[6] and
- the use of component and subsystem building blocks.[7]

These practices are exemplified by programs in each of the services: the Air Force's standardized Inertial Navigation System program, the Navy's Standard Missile and AN/UYK standard shipboard and airborne mini-computer developments, and the Army's infrared module development efforts.

Services should modify the development process for avionics and other critical electronics-driven subsystems to emulate the successful approach used in Air Force turbine engine developments, the Navy's Standard Missile program, and the Army aircraft engine developments. The way subsystems are developed must be adapted to capture more fully the opportunities for upgrading and to take advantage of rapid rates of technological change at the subsystem level. An approach used by all the services, but not widely, holds substantial promise. It features special development organizations with the charter, authority, and financial resources to provide effective "cradle-to-grave" guidance and management of subsystem development. The organization resembles most closely a system program office that must control sufficient amounts of 6.2 and 6.3A RDT&E money to nurture early technology development and effective maturation of subsystem building blocks.[8] It would fund and manage design, development, prototype demonstration, and test programs. For example, the Deputy for Propulsion in the Air Force Systems Command's Aeronautical Systems Division is responsible for all Air Force acquisition activities for aircraft gas turbine engines and manages both the engine component improvement program and the engine model derivative program.

Untying the development of critical subsystems from the development of a particular platform, and combining this with added emphasis on the design practices described above, will help stimulate the development of more subsystems with broad (multi-platform) applicability.

Selected organizations to foster subsystem development should be established in the services' development commands and empowered as described above.

Services can increase the return on IR&D of subsystem suppliers by providing more information on future requirements and current mission

[6]For information on the status of these efforts, see U.S. House of Representatives, Committee on Government Operations, *Defense Department's Efforts to Standardize Military Avionics Equipment*, 98th Congress, 2nd Session, 9 February 1984.

[7]These are in addition to the deliberate provision of reserve space, weight, and power discussed on page 10.

[8]For a description of why and how such an approach contributes to the timely maturation of critical subsystems, see Michael D. Rich and Stephen M. Drezner, *An Integrated View on Improving Combat Readiness*, The Rand Corporation, N-1797-AF, February 1982, pp. 19–27.

needs. The stepped-up emphasis on subsystem development will require some changes in the flow of information from the services to the subsystem developers themselves. (This change should also occur in instances where R&D is initiated by OSD development organizations, e.g., DARPA.) Not only will more direct channels of communication have to be established but more technical guidance and information of future mission needs based on restricted programs will have to be provided directly to subsystem developers. The establishment of organizations in the service development communities chartered to foster subsystem development will provide a natural mechanism for increased information flow to subsystem suppliers.

OSD should consider adding a DSARC IV milestone during a system's operational life to review, among other things, upgrade opportunities. The last Defense Systems Acquisition Review Council review is now held before the onset of high-rate series production. With the growing incidence and importance of upgrades during a system's period of operational service, it is reasonable to ask whether an additional OSD-level review should be held later in the system life-cycle. Several issues need study and resolution before such a review is institutionalized, including the number, timing, and scope of the reviews. In any event, the services should intensify their current efforts to stimulate and consider upgrade options during the full operational lifetimes of their weapon systems.

OSD should establish a review process for assessing the services' force modernization plans, with additional emphasis on the role of upgrades. In addition to encouraging or requiring the service-level modernization planning by equipment class (and ultimately by mission area) described earlier, OSD should assure that its review of those plans consider whether the role of upgrades in the plans is adequate.[9]

After considering both the Defense Systems Acquisition Review Council and the Defense Resources Board as possible homes for these reviews,[10] we concluded that the DRB's charter to review and approve resource allocation decisions makes it the appropriate choice,[11] especially because the services currently feed their limited equipment-class planning into the Program Objective Memorandum process. This added emphasis could have the additional benefit of helping the DRB achieve its original aim of concentrating on major force capability issues and alternative major investment choices instead of specific programmatic details.

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[9]The several suggestions for increasing the emphasis on upgrades should not be interpreted as also suggesting that every upgrade and modification be surfaced at OSD and congressional levels. There is a large volume of U.S. upgrade activity underway today that proceeds very successfully without surfacing at those levels and this should not change.

[10]A new review panel was also considered, but only briefly. There was no support among the panel members for the creation of yet another OSD-level review board.

[11]The purpose of the DSARC, on the other hand, is to certify the design, schedule, cost, and management integrity of individual programs.

This level of review, tied to resource allocation decisions in the five-year defense program, may be the only chance to overcome a systemic bias against upgrades. This bias can occur when the costs of new systems are underestimated and the level of the budget topline is overestimated, thus leading to overly optimistic estimates of the numbers of new systems to be procured and too-early estimates of retirement dates for existing systems. This, in turn, can incorrectly undercut the apparent value of upgrading the current equipment.

III. IMPROVING THE EQUIPMENT UPGRADE PROCESS FOR SECURITY PARTNERS

BACKGROUND

The funding constraints, enemy threat developments, and other problems that dictate closer U.S. attention to upgrades apply with even greater force to most U.S. Allies and friends. Although the formal Summer Study Terms of Reference directed attention at "Allied" inventories, it soon became clear that limiting the investigation's scope to nations with formal alliances with the United States would be inappropriate. The United States shares security interests and maintains various forms of security cooperation with a diverse collection of foreign countries. As Table 3 shows, these nations differ by the status of their relationships with the United States, as well as by the level of their defense and overall industrial capabilities. Moreover, they vary even further in terms of the composition of their military equipment inventories: Their equipment originates from many different sources, includes both systems that are still in production and some that have gone out of production, and features varying degrees of commonality with the equipment maintained in our own active and reserve inventories.

Table 3

THE VARIETY OF SECURITY PARTNERS

By status	By wealth and military industry
• Formal allies (e.g., Turkey, Korea)	• Industrially advanced (e.g., North & Central NATO, Japan)
• Friendly governments (e.g., Israel, Indonesia, Pakistan)	• Emerging industrial (current & potential arms exporters) (e.g., Korea, Israel, Taiwan)
• Others with specific shared goals (e.g., PRC, Egypt)	• Militarily capable LDCs (overhaul & rebuild capacity) (e.g., Turkey, Egypt)
• Others passively supporting U.S. (e.g., Saudi Arabia)	• Poorer nations (e.g., Somalia, El Salvador, Portugal)
Equipment variety	• U.S. or foreign (UK, French, Soviet, Chinese) • In or out of production • In or out of U.S. active/reserve inventory

The collection of nations that can be regarded as U.S. security partners has a sizable aggregate inventory of potentially upgradable weapon systems. In some cases, like the M47 and M48 tanks and the M113 armored personnel carrier, their aggregate inventories are even larger than our own. By no means comprehensive, Table 4 demonstrates both the magnitude of the potential and the need for U.S. financial and technical leadership to realize it.[1] Although in some instances the size of individual national holdings is probably large enough to warrant unilateral financing and management of an upgrade program (the case of Israel's M113 armored personnel carriers being an example), in most cases individual nations do not own enough units over which to spread the one-time upgrade development costs. Furthermore, most of the nations do not possess the technical resources to initiate and conduct the upgrade development efforts (though some most notably do[2]). However, even some of those who could probably not undertake the

Table 4

ILLUSTRATIVE UPGRADABLE INVENTORIES OF SECURITY PARTNERS

	Tanks		APC	Fixed-Wing Aircraft				Utility Helicopters		
	M60A	M47/48	M113	F-4	F-5	Mirage	MiG-17	UH-10	UH-1B/H	Destroyers
Spain		350/110	500	36	20		67			73
Greece		350/818	832	68	40	36		22		14
Turkey		500/3000	2000	82	54			60		15
Jordan		—/350	850		80	23				
Israel	1010	—/650	4000	131				17		
Egypt	250 (A3)		300			53	50			5
Saudi Arabia	150 (A1)		800		105					
Taiwan		—/310	1100		330				118	24
Philippines			80		22				50	
Singapore			720		27				36	
Pakistan		—/370	500			79				7
South Korea		—/1200	500	70	250				126	11
Japan				173				145		31
Brazil			600		36				25	10
El Salvador			10						19	
Rest of NATO		~600/1300	~1500+	~275		~125				

SOURCE: International Institute for Strategic Studies, *The Military Balance, 1983–1984* (London: International Institute for Strategic Studies, 1983).

[1]Below the threshold of major weapon systems, there is a large amount of other potentially upgradable equipment. For example, there are approximately 30,000 AN/VRC-12 series and about 24,000 AN/PRC-77 series radios in foreign inventories.

[2]Several of many notable examples: Spain's rebuilding of its M48 tanks, South Korea's M113 upgrade program, and Israel's upgrading of both tanks and armored personnel carriers.

upgrade development chore, could in fact perform the actual equipment modification and, as discussed below, such an arrangement is attractive for many reasons.

Like any multinational enterprise, U.S. involvement in the force modernization activities of its security partners will require the acknowledgment and accommodation of the objectives sought by those sovereign nations. A comprehensive compilation of security partner force modernization and defense industrial goals was outside the bounds of this study, but a representative listing was constructed to illustrate the range and composition of such objectives.

We proceed from the general premise that the more capable our security partners, the less likely United States forces will have to be committed in regional conflicts. Stronger security partners also promise stronger and more effective coalitions when the United States finds itself fighting alongside them. Thus, an effective and aggressive program for upgrading the equipment in security partner inventories promises to:

- Increase the capacity for coalition deterrence and defense;
- Raise the nuclear threshhold by improving conventional forces;
- Reduce the need for U.S. combat involvement in security partner defense;
- Improve burden-sharing with wealthy security partner nations;
- Help poorer security partner nations; and
- Improve the production and mobilization base and quick reaction capability of security partner industries.

On the other hand, it is important to recognize that our security partners are sovereign nations with other interests affected by upgrade policies. These include, but of course are not limited to, such things as improving national status, increasing military capabilities, and various economic and industrial goals (relating to employment growth and stability, technology transfer, balance of payments, and so on).

Proposals for upgrades to equipment owned by security partners in the context of these objectives should gain congressional support. Although the Congress is by no means monolithic with respect to these issues, there appears to be substantial support for these objectives, providing certain concerns are addressed. The most prominent concerns involve sensitive technology transfer, our own mobilization base, and the effect on U.S. defense industry revenues and employment.

FINDINGS

Our investigation uncovered a very strong case for a more aggressive U.S. program to promote and facilitate security partner upgrades. Many security partners are more resource-constrained than the United States and thus face even more acutely the same force modernization dilemmas that lead us to recommend more emphasis on upgrades to equipment in U.S. inventories. These foreign nations have abundant

"upgradable" equipment in their active inventories, much of it also operated by United States reserve forces. This inventory commonality is substantial. Table 5 shows the large U.S. reserve forces' holdings of weapon systems that are also possessed in large numbers by U.S. security partners.

Unfortunately, there has been little service interest in upgrading systems once they leave the U.S. active inventory. Making matters worse is a disappointing lack of focus and responsibility for this special type of security assistance at top levels of Department of Defense. This section elaborates on these general findings.

Perceptions of U.S. Security Partners

The interests and perceptions of U.S. security partners could become serious constraints on U.S. choices in fashioning aggressive security partner inventory upgrade programs. Three broad themes emerged from discussions with U.S. officials: First, the acquisition and operation of modern weaponry are sometimes viewed as a status symbol in the international community. (This is often termed a "parade mentality" by observers in industralized nations, but is generally termed a manifestation of "institutional dignity" by scholars specializing in the study of less-industrialized nations.[3]) The second is the importance of the "seal of approval" that comes with active U.S. use of a weapon system. This derives in part from concerns about the logistics support available for upgrades that are not in U.S. inventories. Because it is

Table 5

SELECTED WEAPON SYSTEMS IN U.S. RESERVE FORCES' INVENTORIES

Fixed-Wing Aircraft (Units)		
	Air National Guard	Air Force Reserve
A-7	360	—
C-130	174	140
F-4/RF-4	649	113
Ground Systems and Helicopters (Units)		
	Army National Guard	Army Reserve
M48	~1600	~400
M60	700	—
M113	3000	N/A
M114	800	200
Chapparal	150	
Vulcan	400	
AH-1	120	N/A
UH-1	1200	N/A

[3]See, e.g., Luigi Einaudi, et al., *Arms Transfers to Latin America: Toward a Policy of Mutual Respect*, The Rand Corporation, R-1173-DOS, June 1973.

not always permissible or desirable to adopt or retain a system in our inventory simply to be able to upgrade it in a foreign inventory, it is very important to develop other ways of providing this "seal of approval" and the associated logistics support. Finally, security partner upgrades must be acceptable to politically-dominant groups in their military services; that acceptance is enhanced when the upgrade can be performed locally and involves tangible benefits in the form of employment, new technology, industrial skills, and contributions to the balance of payments.

U.S. Attention to Security Partner Upgrades

On the U.S. side, there is an alarming inattention to the value and mechanics of security partner upgrades. *The inescapable conclusion is that creating and preserving a capability to conduct coalition warfare are not serious Department of Defense goals.*

If one examines the U.S. planning, programming, and budget process, one finds very little systematic focus on the potential contributions of equipment upgrades to enhance the contribution of security partners to coalition defense or self-defense. This is especially true of upgrades that are not applicable to systems in U.S. inventories but nevertheless useful for enhancing a security partners' capacity for self-defense or coalition warfare. This mirrors the relatively low value apparently placed on the importance of strong security partner economies and defense industries as coalition assets.

The Defense Department has tended to leave far too much to the State Department in this arena because the latter by law has primary responsibility for security assistance (of which foreign military sales is one part). As a consequence there has been very limited funding for upgrades to systems outside the U.S. active inventory and very little attention to the commonality among upgradable systems in security partner inventories and those in U.S. reserve inventories. Nor has there been much interest in conceiving, promoting, or facilitating upgrade transactions *among* security partners. Yet the Defense Department, rather than the State Department, has primary responsibility for planning and achieving defense capabilities to support U.S. national security and that of our security partners. Upgrading partner capabilities contributes directly to these ends.

There are some positives, however, in this picture, which can be used to advantage in improving DoD's efforts. Upgrading fielded equipment is an effective way of increasing coalition warfighting capability. Because the Congress continues to be concerned about the ability of security partners to shoulder the burden of defending their own regional interests, more active service support of such programs will probably be well-received by the Congress. Once such endeavors are underway there is every indication that the services will be effective implementors, especially if the arrangement does not involve U.S. retention of unwanted systems, and does not divert significant financial and management resources from mainstream programs.

Current U.S. Security Assistance Planning

Below the level of general attention to coalition warfighting capability, there are serious flaws in the U.S. security assistance planning that impede the necessary greater emphasis on security partner upgrades:

- Responsibility and authority for strategy, funding, and implementation are not well-matched.
- Foreign Military Sales are not driven by U.S. or coalition military mission requirements.
- Annual need assessments do not emphasize upgrades or mission area priorities.
- Initiatives and priorities are too often left to the State Department.
- Supporting analysis is seldom sought.
- U.S. does not press upgrades on security partners through analyses or incentives.
- FMS credits/Military Assistance Program grants discourage procurement of upgrades outside of the United States.
- No regular linkage with bilateral and multilateral military development undertakings to guide or inform security assistance programs.
- Special Defense Acquisition Fund (for stockage in anticipation of foreign sales) limited in scope.
  - —Have not included development money for upgrades.
  - —Limited to items absorbable by U.S. forces.

These points can also be used to conceptualize the elements of a more comprehensive and rational security assistance planning process. Unfortunately, most of these elements are missing today.

Because U.S. security assistance and FMS programs operate reactively to country requests and focus on individual sales cases, the larger picture of coalition warfighting capability is severely underemphasized in security assistance planning. There is very little analysis conducted to identify the potential military value of upgrades to foreign-operated systems; therefore little is available to guide assessments of technical and force modernization issues confronting potential recipients of security assistance. For example, State Department guidance to the country teams that prepare the Annual Integrated Assessments of Security Assistance (AIASAs) does not even address mission area priorities. Nor does it emphasize equipment upgrades. There is no DoD baseline capability assessment that might support such priorities. The OJCS does prepare an analytical input, the Joint Security Assistance Memorandum Supporting Analysis (JSAMSA), but it is generally too late to be effective and in any event lacks the necessary detail for force modernization planning. There are other related OSD analyses (the Security Assistance Defense Analysis Papers, or SADAPs, for instance) but they are generally illustrative in nature. Instead, the security assistance program tends to operate as catalog marketeers for new, U.S.-manufactured items. Responsibility and authority for determining what combination

of U.S. and security partner capabilities would be preferred—in a coalition warfare context—are diffuse or simply unassigned.

One mechanism that has promise—with the enactment of appropriate legislation—for increasing the incidence of security partner upgrades is the Special Defense Acquisition Fund (SDAF). The SDAF was established by the International Security and Development Cooperation Act of 1981.[4] It is a revolving fund for financing the acquisition of defense articles and service in anticipation of subsequent sales to foreign nations.[5] The language authorizing the Fund was enacted to prevent depleting DoD inventories for foreign military sales.

The Fund cannot be used for research and development activities as its statutory authorizing language is currently written. Recently there was sentiment in the House Foreign Affairs Committee to explicitly forbid such use. Although expanded SDAF authority and moneys might be sought for developing upgrade kits for foreign-owned systems, the requirement that the item involved be absorbable by U.S. forces should the anticipated transfer not occur might be troublesome. This is another reason for paying more attention to the overlap between upgradable systems operated by security partners and those in U.S. reserve inventories.[6]

Legal Considerations Affecting DT&E Funding for Security Partner Upgrades[7]

The legal issues surrounding potential funding sources for developing and testing security partner upgrades are not well-understood within the R&D community. For example, the notion that there is an *express* legal prohibition that precludes the normal authorization and appropriation process from approving the use of RDT&E funds for upgrades intended for adoption solely by our security partners is not accurate. The law (31 U.S.C. §1301(a)) does require that appropriated money be used solely for the purposes for which it was appropriated, which means that such upgrade programs must be subjected to the

[4]Section 803, Public Law 97-113, 22 U.S.C. 2795.

[5]A profile of the Fund's evolution (in millions of dollars):

Fiscal Year	Cumulative Authorized Capitalization	Cumulative Receipts	Turn-back	Cumulative Obligational Authority
1982	300	204	0	125
1983	600	654	54	250
1984	900	860	0	475
1985	900	1120	220	800

[6]There are other legal restrictions that work against security partner upgrades. For example, countries can use FMS credits or MAP grants to "buy" upgrades from the United States. However, they cannot use these credits "offshore" in their own country without a rare special exception being granted.

[7]The panel is indebted to the following people for their assistance in the preparation of this subsection: Dennis H. Trosch, Assistant General Counsel (Logistics), Office, Secretary of Defense; Edward J. Kortz, Deputy Command Counsel, Army Materiel Command; and Stephen A. Whitlock, Office of the General Counsel, Department of the Air Force.

standard defense authorization and appropriation process. That is, a service must include a request for authorizing statutory language and for funds to support design, development, or testing of an upgrade package for security partner equipment in the RDT&E program it submits for congressional authorization. If such language and funding approvals were obtained, 31 U.S.C. §1301(a) would no longer be a problem and no other contrary statutory provision would have to be separately addressed.

Authorized programs to develop improvements for U.S.-owned equipment (in either the active or reserve inventories) do not require *additional* authorization because the upgrade of security partner equipment is also anticipated. That is, once a program has been authorized for the U.S. requirement, the potential benefit of the upgrade development to security partner equipment is incidental. The U.S. Army has initiated such a program, known commonly as the "Meyer Initiatives," consisting of several inexpensive but high-leverage improvements that will be applied to various security partner equipment:

- Add-on armor
- Recoilless rifle ammunition
- 40 mm air defense gun ammunition
- Night-vision enhancements
- 81 mm mortar shells
- 4.2 mm mortar shells
- 105 mm howitzer ammunition

The RDT&E funding profile begins with $2 million in FY 1984 and totals more than $210 million over the next several years:

Fiscal Year	Funding for "Meyer Initiatives" ($ millions)
1984	2.0
1985	30.8
1986	28.6
1987	51.6
1988	48.7
1989	48.1

Furthermore, there appears to be no express prohibition on the use of the Independent Research and Development (IR&D) funds of defense contractors for this purpose. Nevertheless, DCAA reviews of private contractor IR&D programs have tended *not* to approve such expenditures, which has had the effect of discouraging some investment in this type of activity. These administrative restrictions should be substantially relaxed, a suggestion reflected in our recommendations in the next subsection.

In sum, there could be several legally permissible funding sources for accomplishing the necessary DT&E and subsequent equipment modification. These include the ones discussed above (statutory

authorization permitting the use of appropriated funds and administratively approved IR&D resources), as well as funds from the recipient security partners themselves, either on an individual or a consortium basis; FMS funds; and "pre-" and "post-sales" funds (as in the case of many F-5 transactions). Counterpart funds could be an attractive way to involve even those nations in need of upgrade assistance but lacking the foreign exchange to finance the programs. With appropriate legislative authority, the United States could accept payment in local currency and then use that currency to purchase local goods and services required by on-site U.S. military forces. Moreover, a promising variety of third-country funding prospects exists. These might involve such nations as Japan, Saudi Arabia, and the Federal Republic of Germany, for example, and merit serious additional exploration.

How Large Should the U.S. Security Partner Upgrade Program Be?

The Summer Study could not answer this question during its limited investigation. It is clear, however, that it is possible to accomplish *something significant in this area with only a very modest investment.* Table 6 collects several illustrations of possible upgrade packages, together with estimates of their one-time development costs (exclusive of installation or modification costs). A vigorous, effective, influential, and constructive program seems possible if $100–200 million were invested annually for several years.

Table 6

ILLUSTRATIVE POTENTIAL UPGRADE PACKAGES

	Estimated DT&E Cost ($ millions)
Aircraft systems	
30 mm gun pod system (aircraft structural modification; flight test)	10
Head-up display (cockpit and avionics modification; flight test)	40–60
Maverick missile (cockpit and avionics modification; flight test)[a]	60–80
Ground warfare systems	
Vulcan air defense system (forward-looking infrared equipment; ammunition; communications; target acquisition; laser ranging)	20–30
Add-on armor for M47, M48, M60 tanks	5
Survivability improvements for M48 and M60 tanks (climatic vest system, spall/radiation liners)	7

SOURCE: Office, Director of Program Analysis and Evaluation, OSD; U.S. Army.

[a]Cost for new applications should be even lower than shown because the capability has already been installed in Saudi F-5Es.

RECOMMENDATIONS

The business of how the United States plans and conducts security partner upgrades needs serious and wide-ranging improvements. The recommendations that follow address several important needs, including the crystallization and codification of U.S. policies and responsibilities; the stimulation of security partner attention and interest; the sharpening of U.S. planning activities; the generation of DT&E funding; and the identification of lucrative upgrade opportunities.

As important as these policy and procedure changes are, this is a situation that also requires a *change in culture*. There must be a strong renewed commitment to coalition warfare and attendant changes in defense planning and leadership embodying that commitment. The commitment must be made by the senior leadership of the Defense Department and the monitoring and enforcement of follow-up actions must be relentless. Any lesser level of commitment is unlikely to overturn the long-term neglect and bureaucratic inertia in this area.

Codify U.S. policies and responsibilities. The commitment to coalition warfare, the role that security assistance can and should play in strengthening coalition warfighting capabilities, and the role that upgrades can and should play in modernizing the arsenals of U.S. security partners are all seriously underemphasized in formal U.S. defense policy and guidance. The various elements of top-level defense guidance emanating from the Office of the Secretary of Defense, the Organization of the Joint Chiefs of Staff, and the Military Departments, should all be refined to stress the existing and potential contributions of security partners to our collective and mutual security interests. This should be matched by efforts to expand NATO ministerial guidance to encourage serious consideration of upgrades as an attractive means of force modernization. To support that effort and promote more U.S. attention to the development of upgrade packages, regional and mission analyses at various levels of DoD planning should be improved so that they more systematically and comprehensively highlight for the PPBS and DRB process both (1) coalition force deficiencies and modernization needs and (2) security partner upgrade opportunities. This emphasis and perspective should be infused as well into relevant interagency processes.

This may well be a situation in which the Defense Department should seek congressional language supportive of security partner upgrades (and authorizing language necessary to permit a more active U.S. role in bringing them about). The rationale for such language would be based on the importance of coalition warfare in raising the nuclear threshold, improving security burden-sharing, and enhancing security partner self-defense and defense of compatible regional security interests. (There needs in addition to be attendant increased attention to congressional concerns about technology transfer and trade balance issues that would be amplified by an increased incidence of U.S.-led security partner upgrades.)

The Secretary of Defense should assign responsibilities to implement these recommendations to Under Secretaries for Policy and Research & Engineering and the Chairman, JCS, and should put the Deputy Secretary in overall charge of the continuing efforts required.

The U.S. defense and security assistance community should encourage security-partner interest in upgrades. There needs to be much more effort devoted to stimulating security partner interest in identifying, evaluating, and implementing opportunities for achieving significant force capability improvements through equipment upgrades. This involves enhancing the perceived military worth of equipment upgrades. Although some of this message has been transmitted in NATO and other international forums, strengthening it in military-to-military channels of communications is an important next step. This should begin with concerted attempts to reverse the "hand-me-down" impression that tends to accompany many upgrade proposals. One way of clarifying the military value of upgrades is to encourage more *joint* U.S.-security partner analyses of country and regional security needs, force modernization requirements, and upgrade options.

Another is to offer tangible offsets for preferred upgrade initiatives. An actual increase in security partner upgrades probably requires a renewed and demonstrable U.S. commitment to a two-way street of defense purchases (of both R&D services and manufactured end-items). This could well mean that we will have to buy some upgrades—for the equipment that both our security partners and our own reserve forces operate, for example—that we promote mainly for security partner adoption and which security partners may themselves develop or apply.[8] Emphasizing the potential role that security partners' own defense industries could play in wider and more active upgrade programs will also require that we relax current restrictions on sales of U.S.-developed equipment between security partners.

As indicated earlier, one possible barrier to stepped-up upgrade activity is the concern for adequate "certification" of upgraded systems. We urge that a NATO office be established for transfers and upgrades of U.S. and non-U.S. weaponry for use both within and beyond NATO. This office should be charged with promoting and assisting in the overall coordination of multinational force modernization programs (especially upgrades). Whether or not such responsibility is drawn together at the NATO level, the United States should encourage NATO labs and other R&D resources to assume a greater role in the testing and certification of upgrade packages.

The Defense Department should focus the U.S. planning process on security partner upgrades. Several steps should be taken to elevate the

[8]There are, of course, several noteworthy examples of U.S. adoption of foreign-developed upgrades to U.S.-designed equipment. Three involving upgrades devised by Israel: the F-4E's leading edge slats, the integrated head-up display and weapons delivery system in the Marine Corps' A-4N, and the F-15's conformal fuel tanks. The latter concept originated with McDonnell Douglas, but the idea was developed in Israel.

importance of and sharpen the focus on security upgrades in various U.S. defense planning activities. Adopting these steps will accomplish much of the required change in culture called for earlier. For example:

- A host or allied nation support annex, including upgrade needs, should be a regular part of CINC contingency plans;
- The Joint Strategic Planning Document should contain CINC foreign military sales objectives;
- Security partner upgrade needs and opportunities should be included in the annual reports of the Secretary and the Under Secretary for Research & Engineering; annual readiness reports to Congress; the annual NATO issues paper; and the related DoD guidance documents.

In the case of NATO, there is no need for a major new process to achieve the necessary stepped-up emphasis on upgrades. Adding the issue to the ongoing NATO force goals and Conference of National Armaments Directors priorities process are essential steps, however.

There has recently been an increase in the amount, complexity, and quality of regional and country analyses of warfighting and industrial capabilities, both at the State Department and within the Defense Department. In the Pentagon, useful analyses are being conducted in several places, including OUSD/P, OUSD/RE, and OSD/PAE. These efforts should be strengthened, circulated more widely within the defense community, and, most important, integrated; they are today largely unconnected.

Our investigation was repeatedly plagued by the poor state of data bases on foreign inventories, and especially modernization plans and industrial capabilities. Improved information is a key requirement of an improved multilateral force modernization planning process and a necessary prerequisite to a greater U.S. leadership role in facilitating security partner upgrades. The Services should be tasked to track life-of-type in security partner inventories and to compile up-to-date information on foreign upgrade programs.

The Defense Department should stimulate DT&E funding for security partner upgrades. As indicated earlier, there are several possible sources of funds for developing upgrade packages. Only a few of them need be fully tapped because the amount of money needed to make a considerable difference is not very great.

The following steps should be taken:

- Encourage private industry to risk capital by
  — Listing desired upgrades
  — Testing prototype upgrades developed by industry for foreign sale
  — Including IR&D programs for security partner upgrade packages in "allowable" contractor costs.

The Defense Department should aggressively expand the use of the reserve forces as testbeds for upgrade development ideas, in part

because of the considerable overlap in security partner and reserve force inventories. With regard to IR&D and bid and proposal funds, the guidance given to those who provide the technical and fiscal reviews of those programs should be changed so that industry investigation of upgrades for security partner inventories becomes recognized as a legitimate objective.

- Correct misperceptions about service and congressional actions necessary to permit the funding of security partner upgrade initiatives.
- Ask the Congress to add "upgrade proofing" as an approved use of SDAF money.

"Upgrade proofing" refers to the collection of certification activities that are necessary and desirable to encourage greater security partner acceptance of upgrades that do not figure prominently in U.S. active force modernization. The emphasis would be on test, evaluation, and certification, rather than on research and development per se.

- Create a new direct and foreign military sales recoupment kitty by adding an additional fraction of a percentage point to the sales price surcharge.
- Direct the Air Force and Navy to follow the lead of the Army's "Meyer Initiatives."
- Encourage the formation of regional upgrade producer and user consortia, NATO infrastructure funds, and counterpart funds.

Develop better methods (and data) for systematically identifying high-level upgrade opportunities. The data and analytic techniques for identifying and evaluating promising upgrade possibilities are sorely deficient. This panel asked OSD/PAE to develop an example of the type of analysis that can pinpoint such opportunities. The example and the results of the analysis are summarized in Table 7.

Table 7

ILLUSTRATIVE EXAMPLE OF A HIGH-LEVERAGE UPGRADE OPPORTUNITY

- Current system: M48A1
- Upgrade to M48A5 configuration by adding:
  - 105 mm gun for higher lethality
  - New fire control system for higher lethality
  - Diesel engine for longer cruise range and reduced vulnerability
  - Israeli hatch on the commander's cupola for reduced vulnerability
- Resulting tank comparable in effectiveness to M60A3
- Cost effectiveness ratio: 3 to 1
- FY 1985 cost
  M48A5 kit: $0.43 million
  M60A3: $1.23 million

SOURCE: Office, Director of Program Analysis and Evaluation, OSD.

Systematic identification of high-leverage upgrade opportunities depends in part on better data and development of methodology that provides realistic assessment of the military capabilities enhanced by the upgrade. Thus, a full assessment of attractive upgrade opportunities was beyond the scope of this summer study. The Secretary should task the Director of PA&E to lead the needed efforts in this area. This analysis should be deepened and broadened and conducted more regularly at all levels. If the needed analyses were completed, they could be expected to identify a menu of attractive upgrade programs similar to the broad (but still not comprehensive) one in Table 8, which lists numbers of upgradable systems and some of the subsystems that offer increased capabilities.

Table 8

SUMMARY OF MAJOR EQUIPMENT UPGRADE OPPORTUNITIES
(Numbers in security partner inventories; not ranked by priority)

Ground Forces (armor, gun, engine, fire control, munitions, security)	
• 10,000 M41/M47/M48 tanks	• 900 M42 AAA guns
• 15,000 M113 APCs	• 600 helicopters
• 7,500 105/155 towed & SP artillery	• 300 Hawk batteries
• 7,000 90/106mm recoilless rifles	• 50,000 field radios
TACAIR Forces (ECM, IFF, fire control, munitions, radar, engines, etc.)	
• 1,700 F-5s	• 1,200 F-4s
• 1,500 Mirage fighters	• 400 A-4s
• 1,200 F-104s	• 600 MiGs
Naval Forces (towed arrays/ASROC; Seasparrow/Seacat/Phalanx; Harpoon/Exocet/76mm OTO Melara gun; torpedoes) (U.S. made/other)	
• 90/20 WWII destroyers	• 100/140 minesweepers
• 150/900 patrol craft	• 30/150 submarines

Appendix A

STUDY TERMS OF REFERENCE

THE UNDER SECRETARY OF DEFENSE

WASHINGTON D.C. 20301

RESEARCH AND
ENGINEERING
(DSB)

8 JUN 1984

MEMORANDUM FOR CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Defense Science Board (DSB) Summer Study on Upgrading Current Inventory Equipment

You are requested to undertake a Summer Study to determine what needs to be done to successfully employ available technology to rapidly upgrade existing U.S. and Allied equipment and munitions that are in inventory in substantial quantity.

Programs designed to upgrade equipment in U.S. and Allied inventories by improving performance of key subsystems, such as sensors, fire control units, or munitions, offer a potential means to rapidly increase force effectiveness with only moderate R&D and procurement costs and limited technological risk. Such programs would complement the development and production of new weapon systems. The Preplanned Product Improvement Program (P^3I), addresses part of this opportunity and we wish to build on it.

This Summer Study should examine U.S. and Allied R&D and Procurement procedures for upgrading equipment inventories and make recommendations on how OSD, JCS and the Services might make them more effective. The study scope should include but not be limited to the following:

(1) Defining various approaches to creating and maintaining options for upgrading equipment, identifying factors that must be considered in assessing and selecting options, and recommending, if needed, areas for improvement.

(2) Identifying some particularly attractive weapon upgrades that could be undertaken now.

(3) Identifying weapon system design, development and program management strategies that would stimulate the development and application of subsystem upgrades and maximize future opportunities for upgrading equipment.

(4) Developing concepts and methods for evaluating performance, cost, schedules and other critical factors in potential upgrade programs and outlining procedures for coordinating development and budget decision processes so that both U.S. and Allied force modernization interests are well served.

In examining options for upgrading U.S.-developed systems in Allied inventories, the study will consider the ability of the Allied country to use its own resources and manufacturing capabilities. The study should also consider logistic implications of weapons upgrade.

I am personally sponsoring this Summer Study. Dr. Donald B. Rice, President, The Rand Corporation, has agreed to serve as Chairman. Col. Joseph Briggs, USA, Military Assistant, DSB, will be the Executive Secretary. It is not anticipated that your inquiry will need to go into any "particular matters" within the meaning of Section 208 of Title 18, United States Code.

James P. Wade Jr.

James P. Wade, Jr.
Acting

Appendix B

BRIEFINGS PRESENTED TO SUMMER STUDY PANEL

Agenda

First Meeting
1984 Defense Science Board Summer Study
on
UPGRADING CURRENT INVENTORY EQUIPMENT

Tuesday, 22 May 1984
The Pentagon

Morning Session (0900-1200) - Room 5D1021

0900 - 1000	Welcome, Discussion of TOR & Proposed Study Outline - Dr. Rice
1000 - 1100	OSD/PA&E Presentation on Significant Force Capability Improvements Through Upgrades - Mr. Roll, Principal Deputy
1100 - 1200	Navy Presentation on Management and Decision Processes for Upgrades - VADM Baciocco, Dir of Navy RDT&E
1200 - 1245	Panel Discussion

Afternoon Session (1300-1630) - Room 4E1037

1300 - 1400	Army Presentation on Management and Decision Processes for Upgrades - MGEN Kenyon, ADCS for RD&A
1400 - 1500	OUSDRE Presentation on Management and Decision Processes for Upgrades - Mr. Kopcsak, TWP Mr. Cittadino, C^3I
1500 - 1600	Air Force Presentation on Management and Decision Processes for Upgrades - MGEN Lamberson, ADCS for R&D
1600 - 1630	Review, Comments & Closing Remarks
1630	ADJOURN

Joseph Briggs
Colonel, U.S. Army
Executive Secretary

6/8/84

Agenda

Second Meeting
1984 Defense Science Board Summer Study
on
UPGRADING CURRENT INVENTORY EQUIPMENT

11-12 June 1984
The Pentagon

Monday, 11 June 1984 (Room 1E-801, #7)

0900-1000	Panel Plenary Session - Dr. Rice
1000-1130	Army Presentation on Previous Upgrade Programs Versus New System Options - Mr. Fred Pradko, TACOM, and Col Don Williamson, ASCOM
1130-1245	Army Presentation on Upgrades to U.S.-Designed Equipment in Allied Inventories - LTC Banks, DAM-PPM-T
1245-1300	Break/Preparation for Working Lunch - Dr. Rice
1300-1430	Lunch & Air Force Presentation on Previous Upgrade Programs Versus New System Options - Col R. Bedarf, RDQT
1430-1545	Air Force Presentation on Upgrades to U.S.-Designed Equipment in Allied Inventories - Col R. Bedarf, RDQT
1545-1630	Panel Discussion - Dr. Rice
1630	Adjourn

Tuesday, 12 June 1984 (Room 3C-200)

0845-1015	Navy Presentation on Previous Upgrade Programs Versus New System Options - CPT Blose, PM, AIM-7 (Nav Air) and CPT Kiel, PM, P-3 (Nav Air)
1015-1120	Navy Presentation on Upgrades to U.S.-Designed Equipment in Allied Inventories - Mr. Jim White, Foreign Sales Office (OP-63)
1130-1230	Comments from PDUSDRE - Dr. Wade * (Rm 3E1014)
1230-1245	Break/Preparation for Working Lunch - Dr. Rice
1245-1345	Lunch & Presentation on the Evolution of the P-3 - Mr. Lloyd Graham, Lockheed
1345-1445	Presentation on the Evolution of the F-5 - Dr. Welko Gasich, Northrop
1445-1530	General Discussion
1530	Adjourn

* Task Force Members Only

COL JOSEPH BRIGGS, USA
Executive Secretary

23 July 1984
1600

AGENDA

DSB 1984 Summer Study Panel

on

UPGRADING CURRENT INVENTORY EQUIPMENT

Monday - 23 July 1984

0845-1035 - DSB Plenary Session
1035-1050 - Introductory Remarks - Dr. Rice
1050-1125 - Report from Working Group Background Research
  - Mr. Michael Rich
1130-1215 - Dr. Delauer's Meeting with Panel
1215-1315 - LUNCH
1315-1515 - Soviet Upgrade Practices
  - Mr. Bill Holder, FTD, Wright Patterson AFB
  - Dr. Arthur Alexander, Rand Corporation
1530-1630 - DARPA - Army Equipment Upgrade
  - Col. Rene' Larriva, USMC
1630-1730 - Executive Session
  - Dr. Donald Rice

Tuesday, 24 July 1984

0830-0845 - Planning and Implementing of Allied Upgrade Programs: Overview
  - Mr. Michael Leonard, OSD/PA&E
  - Ambassador Robert Komer, Rand Corporation
0845-1200 - Planning and Implementing Allied Upgrade Programs (Cont.): U.S. Security Assistance Planning
  - Mr. Henry H. Gaffney, DSAA
  - Mr. Paul Kosky, OJCS
1200-1300 - LUNCH
1300-1700 - Allied Process and Perspectives (Country Material) Acquisition Systems & Security Assistance Case Histories):
  - Lt. Col. Elmo Phillips, AF/XOXXM - Thailand
  - Lt. Col. John Sandrock, AF/XOXXM - Pakistan
  - Col. Chuck Marshall, DALO-SAA - ROK
  - Col. Chuck Marshall, DALO-SAA - Turkey
  - Lt. Col. Marshall Michel, J-5, OJCS - Israel

Wednesday - 25 July 1984

0830-1100 - Congressional Perspectives on Equipment Upgrades
  - Mr. John Ford, AVCO & Mr. George Reidel, ITT
1100-1200 - NATO Forces Goals and Performance Measures
  - Mr. Richard Kugler, OSD/PA&E
1200-1300 - LUNCH
1300-1415 - Potential Modification Opportunities & Data Requirements
  - Mr. Robert Schneider, OSD/PA&E

AGENDA (Cont.)

UPGRADING CURRENT INVENTORY EQUIPMENT

Wednesday - 25 July 1984 (Cont.)

1415-1530 - Israel Upgrade Program
- General Puvia Margalit/Israel Ordnance Corp.

1530-1730 - Subsystems Building Blocks: Contrasting USAF Practices (Avionics and Engines)
- Col. Howard Bethel, USAF, ASD/YZ

Thursday - 26 July 1984

0830-1000 - Subsystem Building Blocks (Continued) Industry Perspectives
- Mr. Charles Barron, General Electric

1000-1100 - Navy Presentation
- Capt. Dave Boslaugh, Hq. NAVMAT

1100-1200 - Army Presentation
- Mr. Jean Lambert, DELNVOS

1200-1300 - LUNCH

1300-1430 - Planning for Upgraded to U.S. Equipment (Examples) of Mission Area Force Modernization) Tactical Fighter Roadmap
- BGen Jimmie Adams, USAF, AF/RDQ

1430-1530 - Navy Presentation: Nuclear Powered Submarines
- Capt. Robertson, USN

1530-1700 - Executive Session
- Dr. Donald Rice

Friday - 27 July 1984

0830-1000 - Planning for Upgrades to U.S. Equipment (Cont.) Army Presentation
- Major Jerry Harper, USA, TRADOC

1000-1100 - Case Studies of Imminent Upgrade Opportunities Army Presentation: HAWK Program
- Mr. Bennie Pinckley, DRCTM-HA

1100-1200 - Navy Presentation: Standard Missile Family

1200-1300 - LUNCH

1300-1430 - Air Force Presentation: B-52
- MGen James McCarthy, USAF, (SAC/XP)

1430-1700 - Executive Session

Monday - 30 July 1984

0830-1000 - Menu for Future: U.S. Upgrade Opportunities
- LtGen Robert Moore, USA, DRCDRA
- BGen John Loh, USAF, TAC
- RADM John Parker, USN, OP-098B

1000-1130 - Modernizing with Munitions: Missed Opportunities and Future Chances
- Mr. James Digby, Rand Corporation

1130-1300 - LUNCH

1300-1400 - Summary of Army Science Board Study on Upgrades
- Dr. John Moore, Northrop Corporation

1400-1700 - Executive Session
- Dr. Donald Rice

AGENDA (Continued)

DSB 1984 Summer Study Panel

on

UPGRADING CURRENT INVENTORY EQUIPMENT

Tuesday - 31 July 1984

0830-1200 - Executive Session and Briefing/Report Preparation
1200-1300 - LUNCH
1300-1700 - Executive Session and Briefing/Report Preparation

Wednesday - 1 August 1984

0830-1200 - Executive Session and Briefing/Report Preparation
1200-1300 - LUNCH
1300-1700 - Briefing Dry-Run to DSB

Thursday - 2 August 1984

0830-1200 - Briefing and Report Completion
1200-1300 - LUNCH
1300-1700 - Briefing and Report Completion

Friday - 3 August 1984

0830 - Informal Briefing to USDRE and Guests

Appendix C

SUPPLEMENTAL INVENTORY COMPOSITION PROJECTIONS

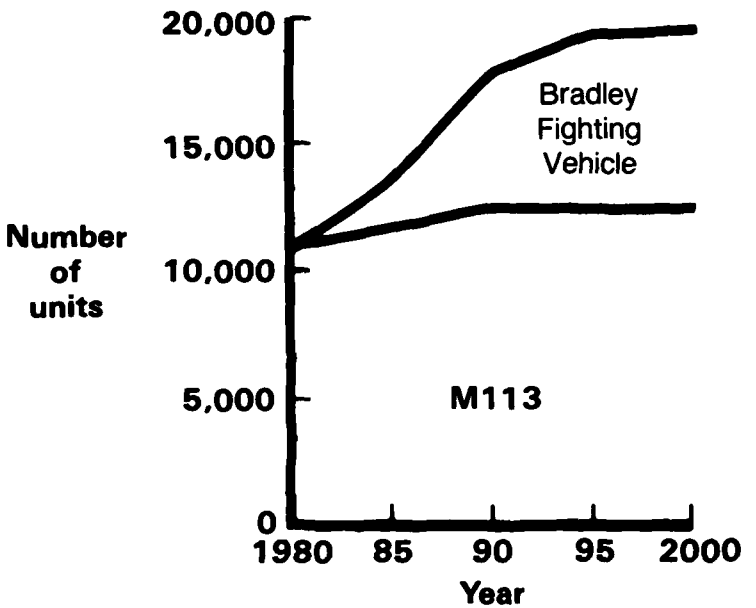

Fig. C.1—Projected composition of U.S. Army armored personnel vehicle inventory

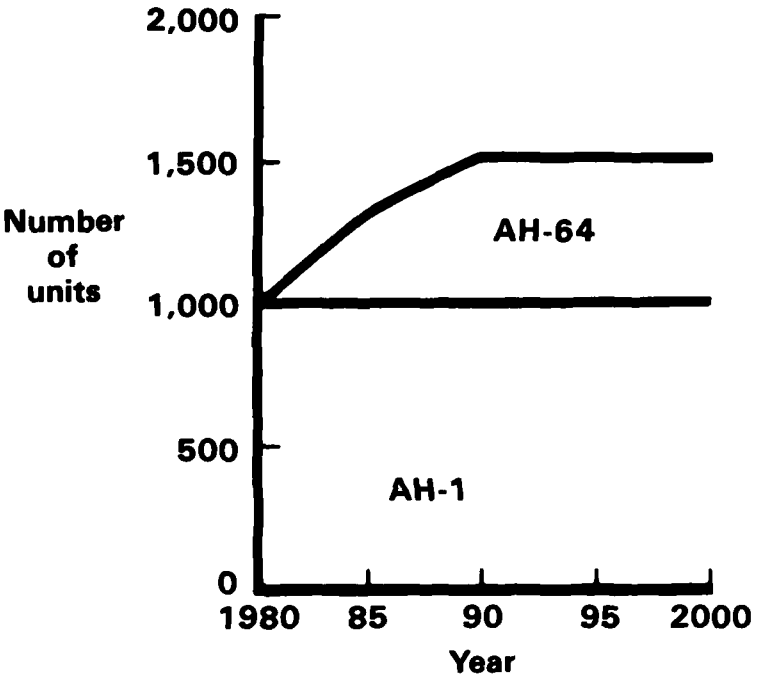

Fig. C.2—Projected composition of U.S. Army attack helicopter inventory

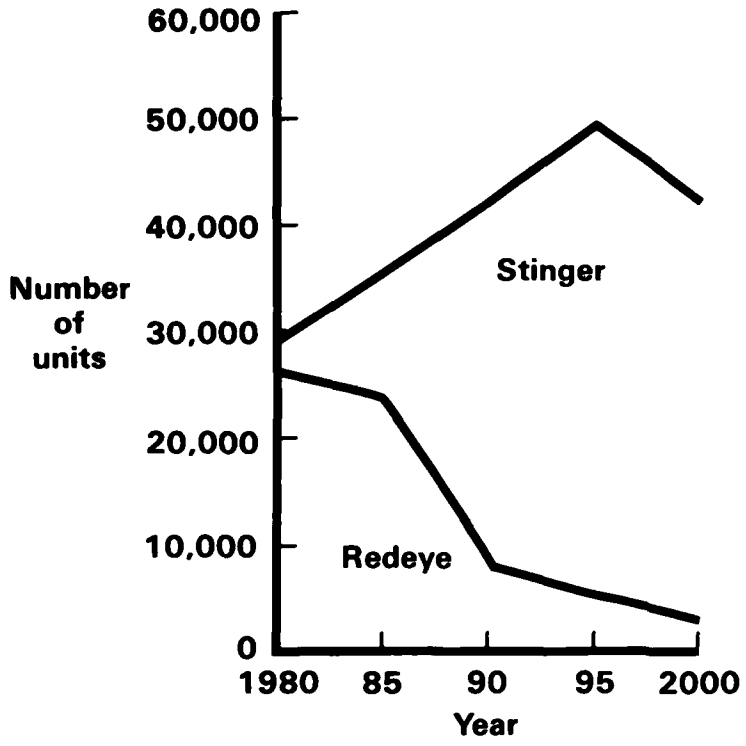

Fig. C.3—Projected composition of U.S. Army shoulder fired air defense system inventory

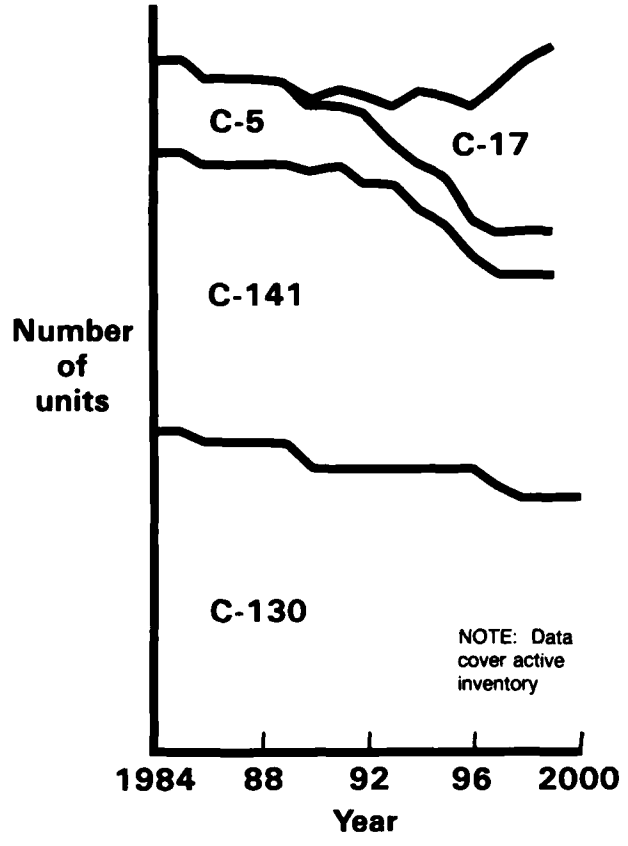

Fig. C.4—Projected composition of USAF cargo aircraft inventory

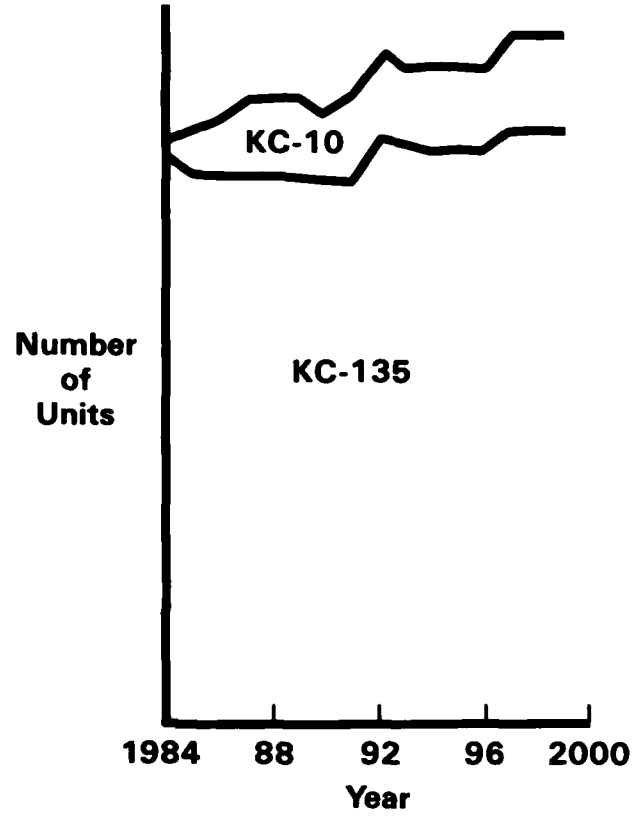

Fig. C.5—Projected composition of USAF tanker inventory

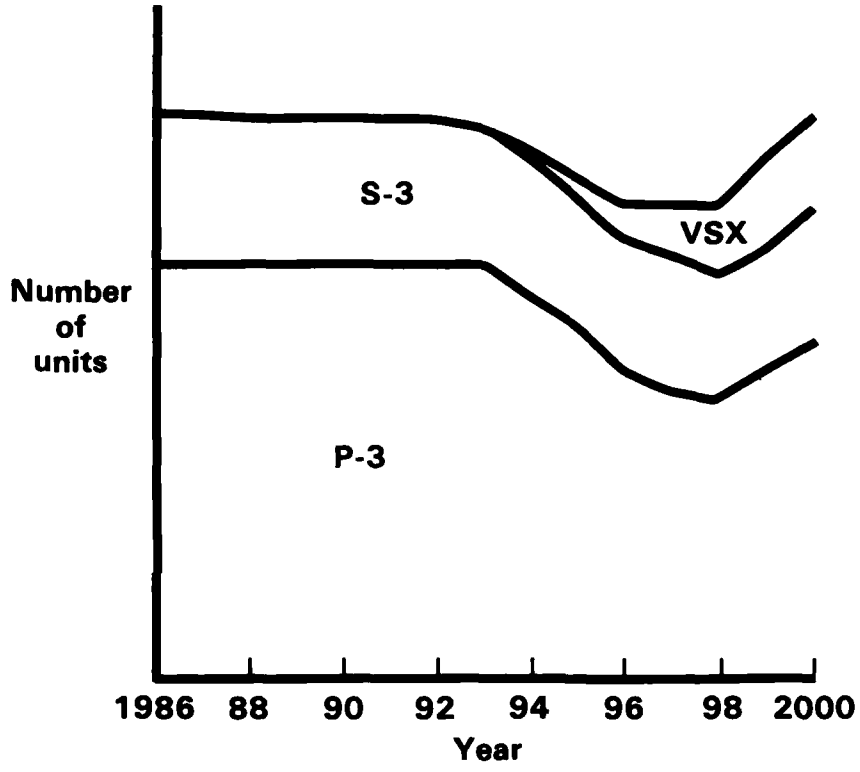

Fig. C.6—Projected composition of U.S. Navy patrol aircraft inventory

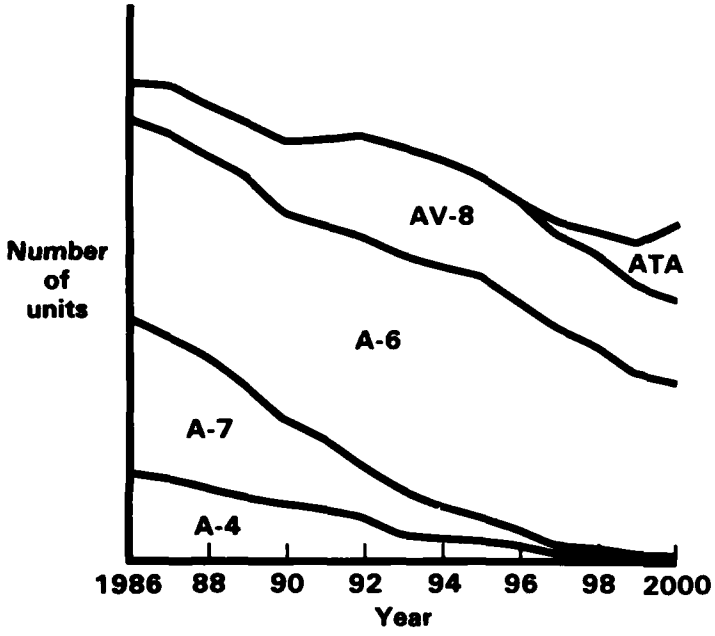

Fig. C.7—Projected composition of U.S. Navy attack/jammer aircraft inventory

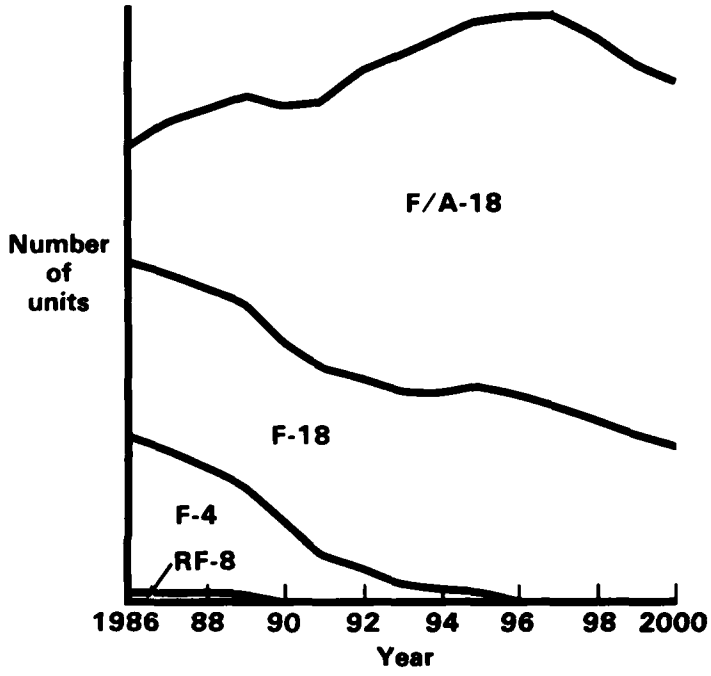

Fig. C.8—Projected composition of U.S. Navy fighter/strike aircraft inventory

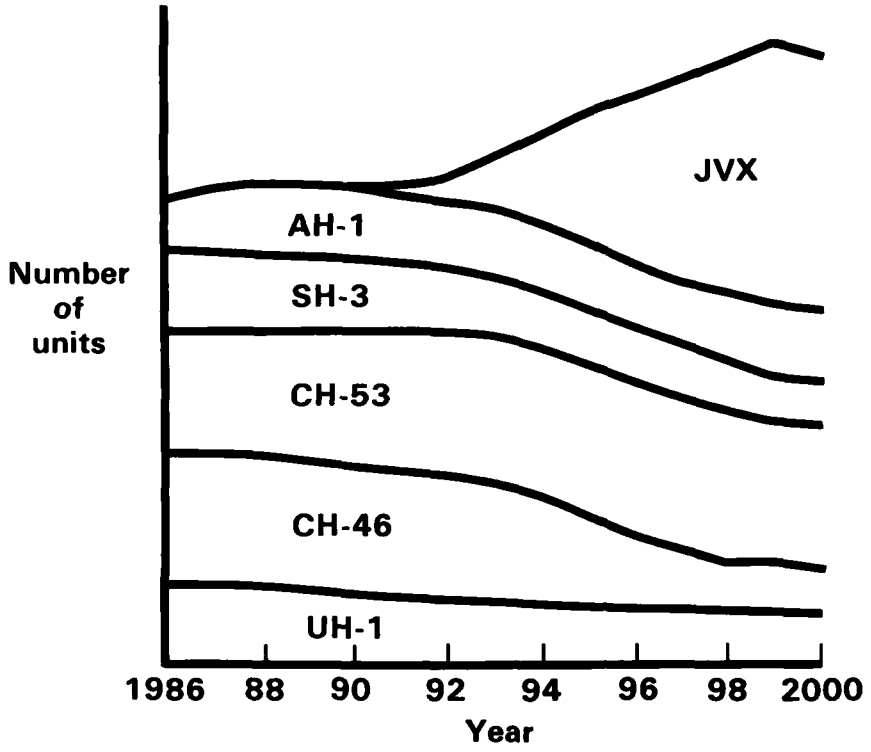

Fig. C.9—Projected composition of U.S. Navy helicopter inventory

Appendix D

SUPPLEMENTAL INVENTORY AGING TRENDS

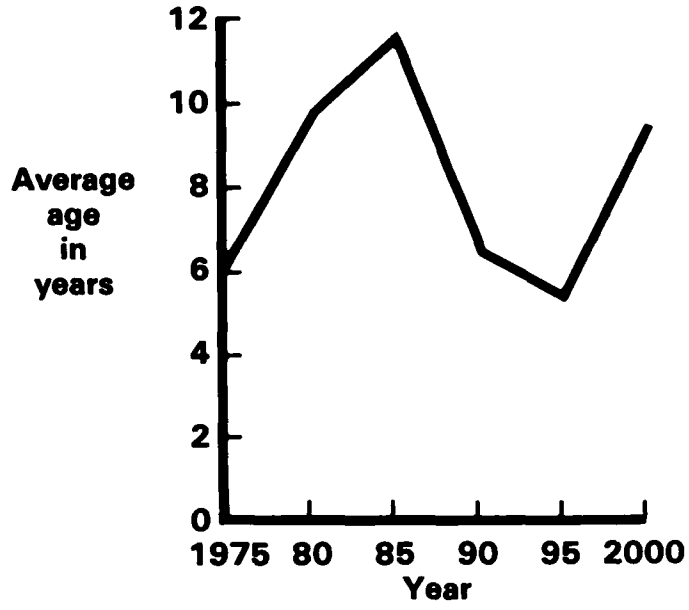

Fig. D.1—Projected average age of U.S. Army shoulder fired air defense systems

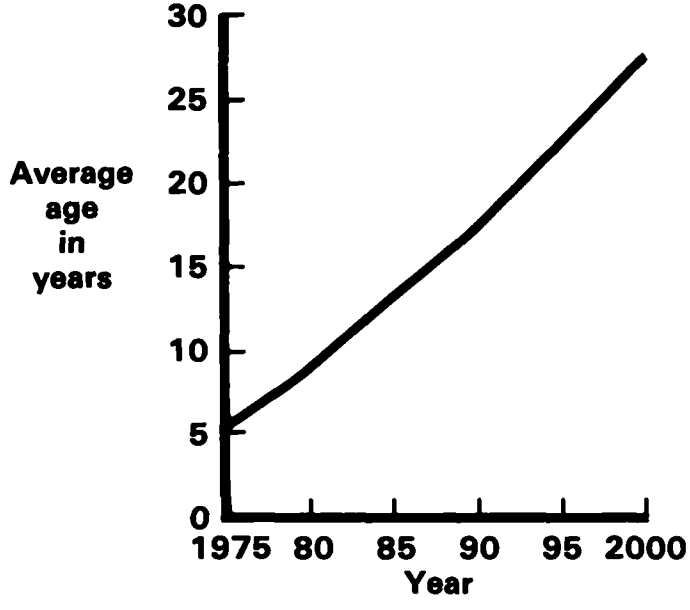

Fig. D.2—Projected average age of U.S. Army air defense fire units

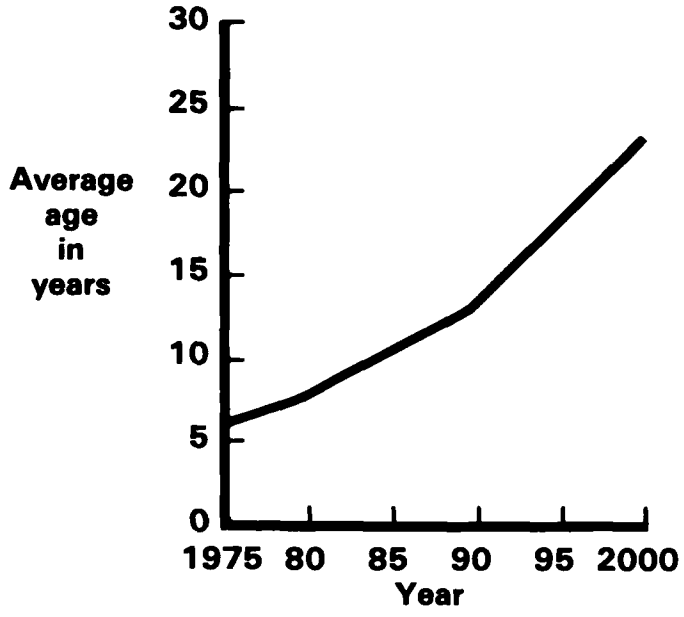

Fig. D.3—Projected average age of U.S. Army attack helicopters

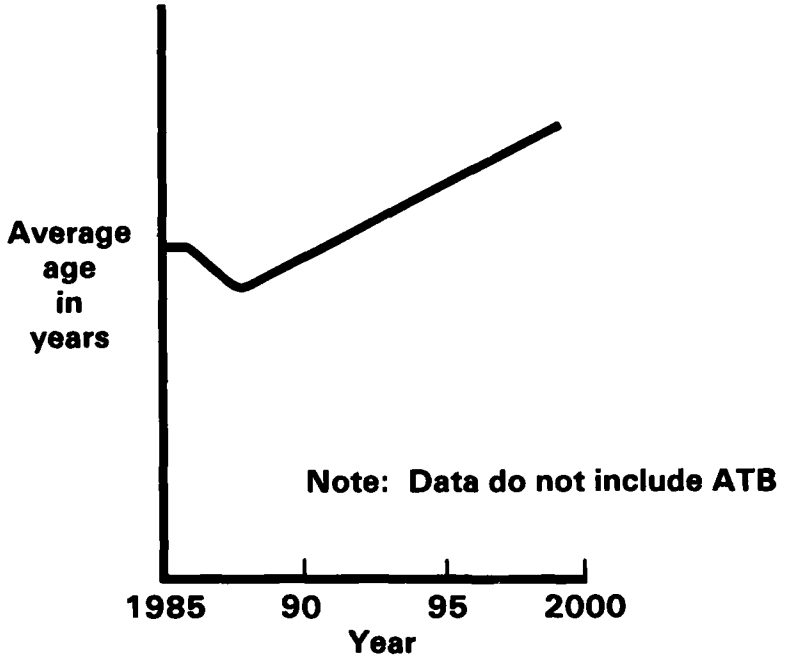

Fig. D.4—Projected average age of USAF bomber inventory

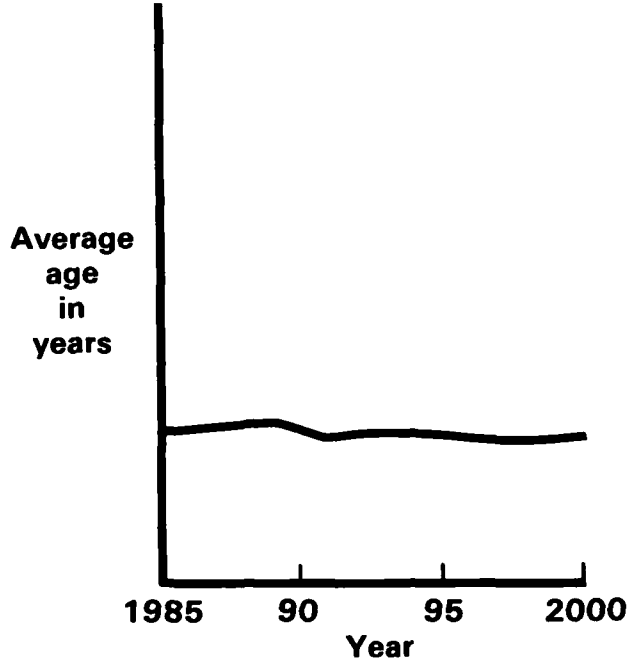

Fig. D.5—Projected average age of USAF fighter/attack aircraft inventory

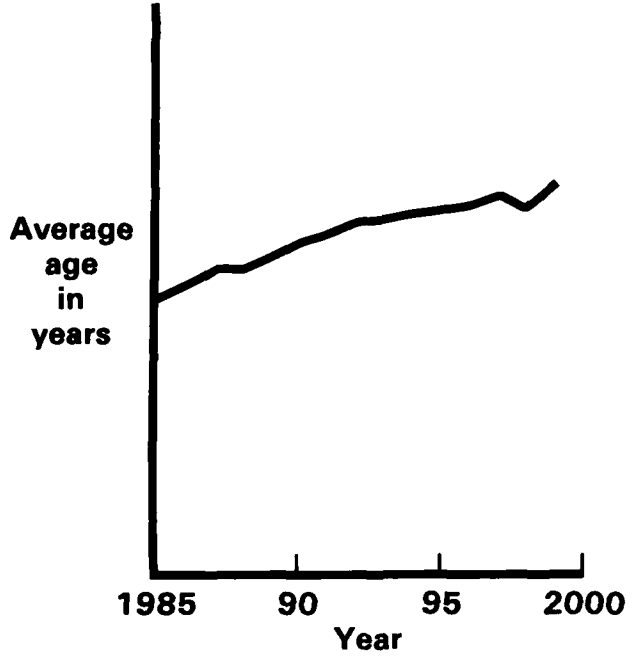

Fig. D.6—Projected average age of USAF cargo aircraft inventory

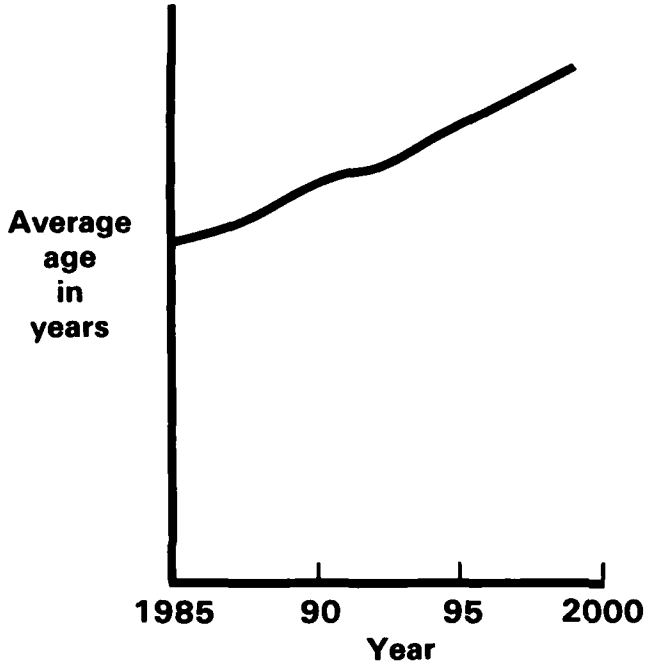

Fig. D.7—Projected average age of USAF tanker inventory

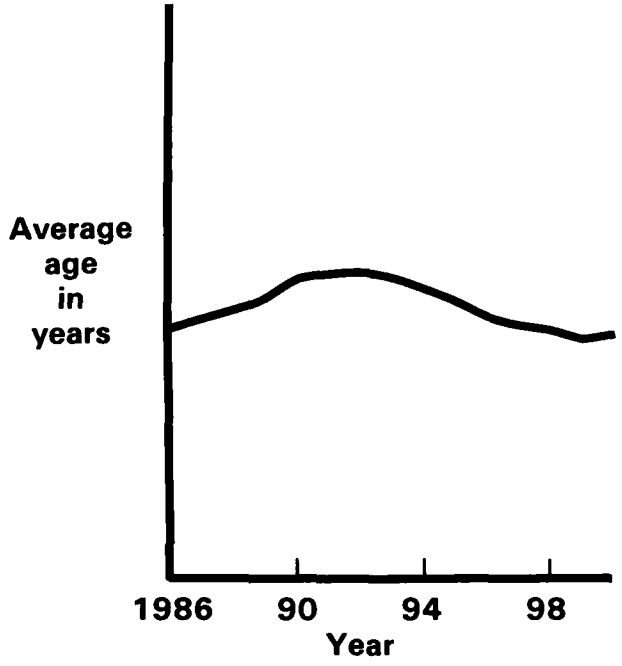

Fig. D.8—Projected average age of U.S. Navy helicopter inventory

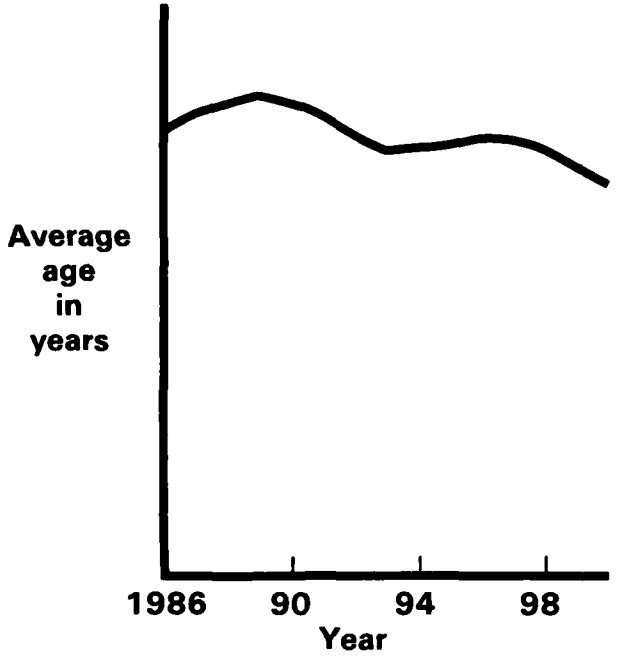

Fig. D.9—Projected average age of U.S. Navy attack/jammer aircraft inventory

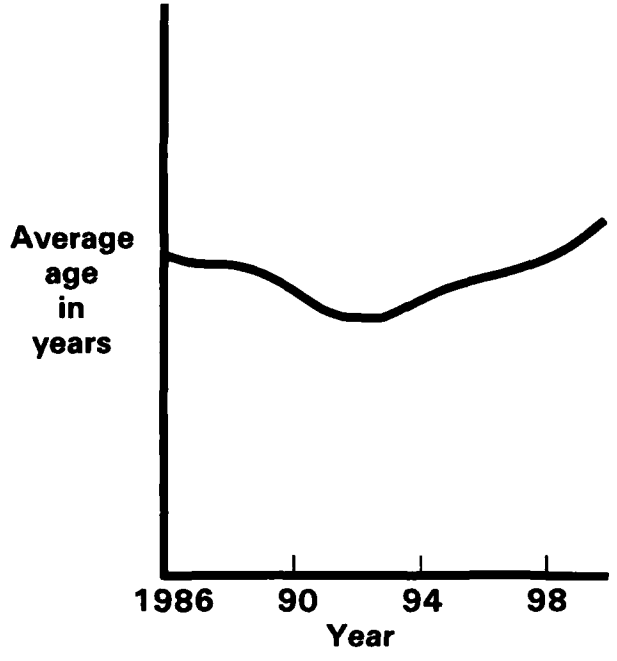

Fig. D.10—Projected average age of U.S. Navy fighter/strike aircraft inventory

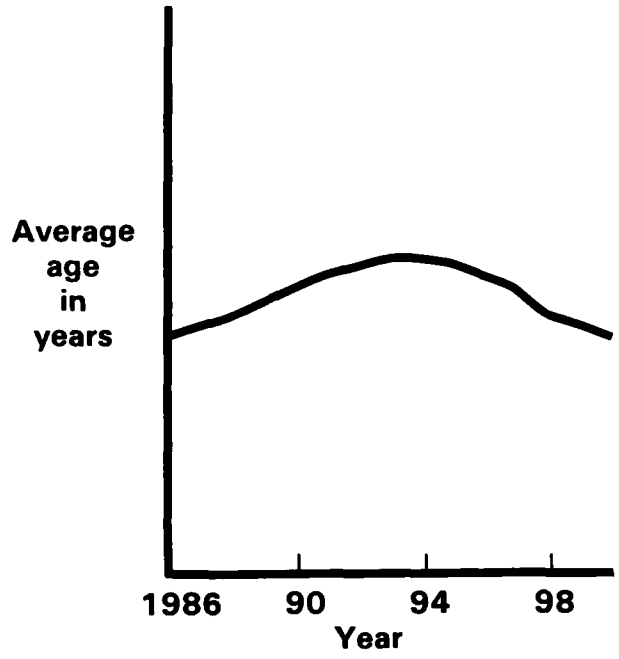

Fig. D.11—Projected average age of U.S. Navy patrol aircraft inventory

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