THE DEPARTMENT OF DEFENSE

THE FY 1980 DEPARTMENT OF DEFENSE PROGRAM FOR RESEARCH, DEVELOPMENT AND ACQUISITION

Statement By
The Honorable William J. Perry,
Under Secretary of Defense,
Research and Engineering
to the 96th Congress,
First Session

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STATEMENT
BY
THE HONORABLE WILLIAM J. PERRY
UNDER SECRETARY OF
DEFENSE, RESEARCH AND ENGINEERING
TO THE CONGRESS OF THE UNITED STATES

96th CONGRESS, FIRST SESSION

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RESEARCH, DEVELOPMENT AND ACQUISITION

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I

I. OVERVIEW

A. OUR INVESTMENT STRATEGY

The basic objective of our defense Research, Development and Acquisition (RD&A) program is to provide our armed forces with weapons which give them the unambiguous strength necessary to deter war. Our research program should be managed creatively to insure that we retain our technology lead and preclude technological surprise; our acquisition program should be managed efficiently so that we procure adequate quantities of needed weapons at the lowest life cycle cost.

We are being confronted with a significant challenge by the Soviet Union, making these objectives difficult to achieve. Last year I reported that the continuation of current trends in the U.S./USSR military technology and acquisition balance could result in significant Soviet military advantages in the next few years. My present assessment of the balance and of the near-term trend has not changed appreciably. By all accepted measures of growth, the Soviet military investment effort continues to increase steadily, resulting in both improved R&D capabilities and the deployment of improved weapon systems. During the past year, for example, estimated Soviet investments were about 75 percent greater in dollar value than the corresponding RD&A program in the United States--that is the nature of the challenge.

We are not without strengths of our own, however, in meeting this challenge. We have the greatest technological capability and the strongest industrial base in the world. And we have Allies who, in aggregate, have an equivalent technological and industrial capability.

In my Posture Statement for FY 1979, I described an investment strategy for our Research, Development and Acquisition program that was designed to meet the challenges I have described by exploiting our principal strengths. This investment strategy has three components:

- o Selective concentration on those technologies which have the greatest potential of multiplying the effectiveness of our forces,

- o More effective exploitation of our industrial base, and

- o Increased cooperation with our Allies in the development and procurement of weapons.

After more than a year of applying this investment strategy, I still believe that it is the proper basis for planning our RD&A programs. But it is not without problems. I will devote the major part of this year's overview to the management issues in implementing this strategy, including:

- o The barriers to success; that is, the problems we have in implementing this strategy;

- o The management techniques we are employing to overcome these barriers; and

- o The real progress that has been made to date and what progress we may realistically expect in FY 1980.

Finally, I will conclude my overview by highlighting the major programs which comprise the $49 billion RD&A program we are requesting for FY 1980. This highlight will be organized into the broad mission areas of our Defense program, listing the program deficiencies we see in each of these mission areas and outlining the major programs we are proposing to correct these deficiencies.

B. OUR CHALLENGE

In Section II of my Posture Statement I give a detailed description of the net balance between the Soviet Union and the United States in presently deployed equipment, equipment in production, systems under development, and the technology base.

Here I will highlight three major points of concern:

- The Soviet Union is out-producing us by more than 2 to 1 in most categories of military equipment.
- The Soviet Union is now deploying equipment which in most cases matches our deployed equipment in quality.
- The Soviet Union is investing twice as much as we are in their military technology base program, leading to a real risk of technological surprise.

1. Production Balance

The Central Intelligence Agency (CIA) estimates that the Soviet Union's overall defense expenditures exceed those of the U.S. by 25 to 45 percent, while that portion of defense concerned with the research, development and acquisition of weapon systems is about 75 percent greater, since the Soviets devote a much smaller portion of their defense budget to salaries and pensions for military personnel. I recognize that there is a real uncertainty in our estimates of Soviet defense expenditures, yet the firm evidence we have on the actual hardware being built and deployed strongly supports these estimates. In the last five years, for example, they have produced 10,000 tanks to our 3,600, over 1,000 ICBM's to our 280*, about 50 submarines to our 12, and 3,000 tactical aircraft to our 1,400. These are not isolated examples; their

*We had, of course, just finished a major production program in ICBMs. The point here, however, is the impressive momentum in their production base during this period.

modernization program includes virtually every category of weapon system, including those in which our lead was undisputed a few years ago.

2. Quality Balance

The Soviets traditionally have had more equipment deployed than the U.S., but we have offset this with qualitative superiority. The new generation of Soviet equipment now being deployed incorporates major improvements in quality, particularly in the introduction of precision guidance. Three examples are of particular concern:

a. The Soviets began MIRVing their ICBM's a few years ago and will have 5,000 warheads in their ICBM forces by the early to mid-1980's. This past year they have conducted tests of a new guidance system which we believe will give them improved guidance accuracies in their deployed forces. The combination of accurate guidance with a large number of warheads gives their ICBM force a counterforce capability that will be capable of destroying most of our ICBM silos with a relatively small fraction of their ICBM's.

b. The Soviets have had a large tactical air arm for many years, but one which, because of its limited range and payload capabilities, had little more than a defensive capability. In the past few years they have been modernizing this force with FLOGGERS and FENCERS, increasing the striking range and air intercept capability, so that by the early 1980's they will have deployed in Europe a tactical air force fully capable of offensive air operations against NATO.

c. While the strategic forces of the Soviet Union have had more delivery vehicles and nuclear yield than the U.S., we have had substantially more warheads because of the MIRV's in our SLBM force. This past year the Soviets began deploying the SS-N-18, a missile capable of carrying three MIRVs, in their SLBM force. If they deploy the MIRVed version of the SS-N-18 on all of their DELTA submarines, they will match us in the number of strategic warheads by the mid-80's, while maintaining their lead in delivery vehicles and nuclear yield.

3. Technological Balance

At the core of our technological strength is the Science and Technology program, in which we develop and demonstrate new technology before we commit it to a specific weapon system development. We have maintained a substantial technological lead over the Soviets through our defense Science and Technology program and through the Independent Research and Development (IR&D) programs conducted by our industry. While it is difficult to get precise information about the Soviet Union's Science and Technology program, we know that their leadership gives it a very high priority, and I estimate that it is about twice the size of our own program. However, the Soviets have no equivalent to our IR&D or commercially sponsored R&D, so it has been difficult to draw firm conclusions about the effect of this spending disparity. Recently, though, their concentration in defense technology is beginning to produce tangible results--a highly accurate ICBM guidance system, a look-down/shoot-down interceptor, an improved anti-satellite system (ASAT), an advanced submarine and a new family of high-speed computers.

In addition, the Soviets are concentrating on several unconventional technologies--high energy lasers, charged particle beams and surface effect vehicles, for example. In particular, in the high energy laser field, they may be beginning the development of specific weapon systems. We, on the other hand, have decided to keep our high-energy laser program in the technology base for the next few years. We believe that we understand the technical issues basic to translating high energy laser technology into weapon systems, that our decision is correct, and that the Soviets may be moving prematurely to weapon systems. However, we will be conducting a very careful review of our program this year, as well as watching Soviet progress with great interest in a continuing re-evaluation of this decision.

A key objective of our Science and Technology program is to prevent technological surprise; that is, to insure that the Soviets do not achieve a militarily significant break-through in a new weapon system before we do, and we have felt comfortable with our ability to do so in the past. However, because of the intensive Soviet commitment to defense technology and the secrecy with which they cloak their activities, it will be much more difficult to achieve that objective in the future than it has been in the past. The significant increase requested for our Science and Technology program is aimed at overcoming this emerging problem.

C. OUR BARRIERS

I have observed that, as a nation, we have great strengths on which to draw in building our defense and that our investment strategy should exploit these strengths, particularly our <u>technology</u>, our <u>industrial base</u> and our <u>Allies</u>. However, in applying this strategy, we should recognize the formidable obstacles we must overcome. I will first describe these obstacles, then describe our management initiatives to overcome these barriers or at least to mitigate their effects.

1. Barriers to Applying Technology

a. Technology as a Cost Problem

As our systems have become more technically sophisticated these past two decades, so also have they become more expensive. Figure I-1 presents the procurement cost of fighter airplanes since WW II. Much of the growth, of course, is the result of inflation. However, normalizing the same data to constant 1978 dollars to correct for inflation, there still is an average increase of about nine percent per year over this thirty year period. This real cost increase reflects the increase in complexity--and capability--of these aircraft. These cost increases force us to buy fewer units, which increases unit costs even more. And we already face quantitative disadvantages that are so great that we cannot expect performance advantages to totally compensate.

It is interesting to compare these results with the cost of passenger cars, illustrated in Figure I-2. The increased costs here also are attributable to both inflation and to increases in capability and complexity, so the phenomenon is not unique to defense. Neither is it inevitable. Figure I-3 illustrates the cost trend of scientific calculators for the last two decades. Here the same technology that led to an increase in performance also facilitated a significant decrease in price, even in inflated dollars. This, of course, is an example which we seek to emulate in Defense, and the next section

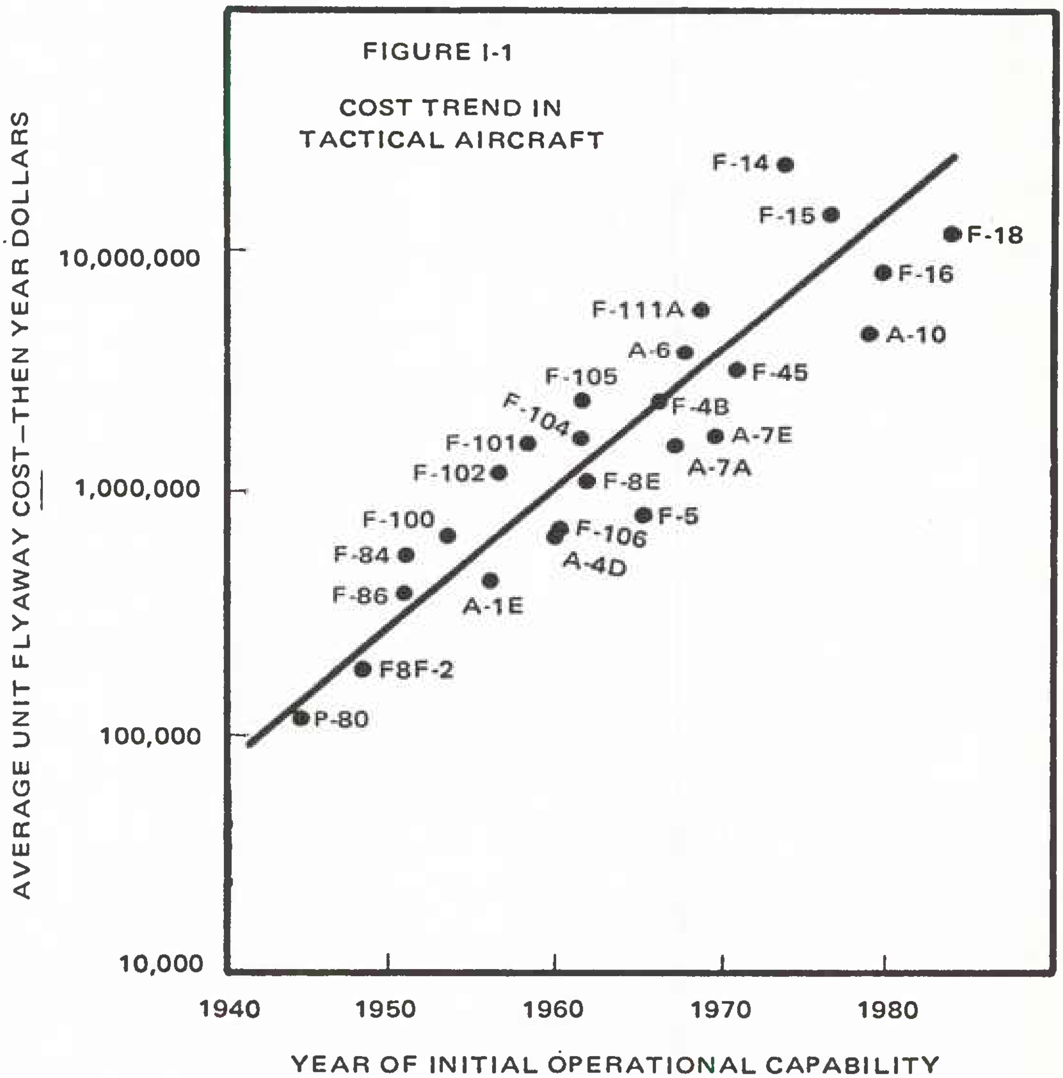
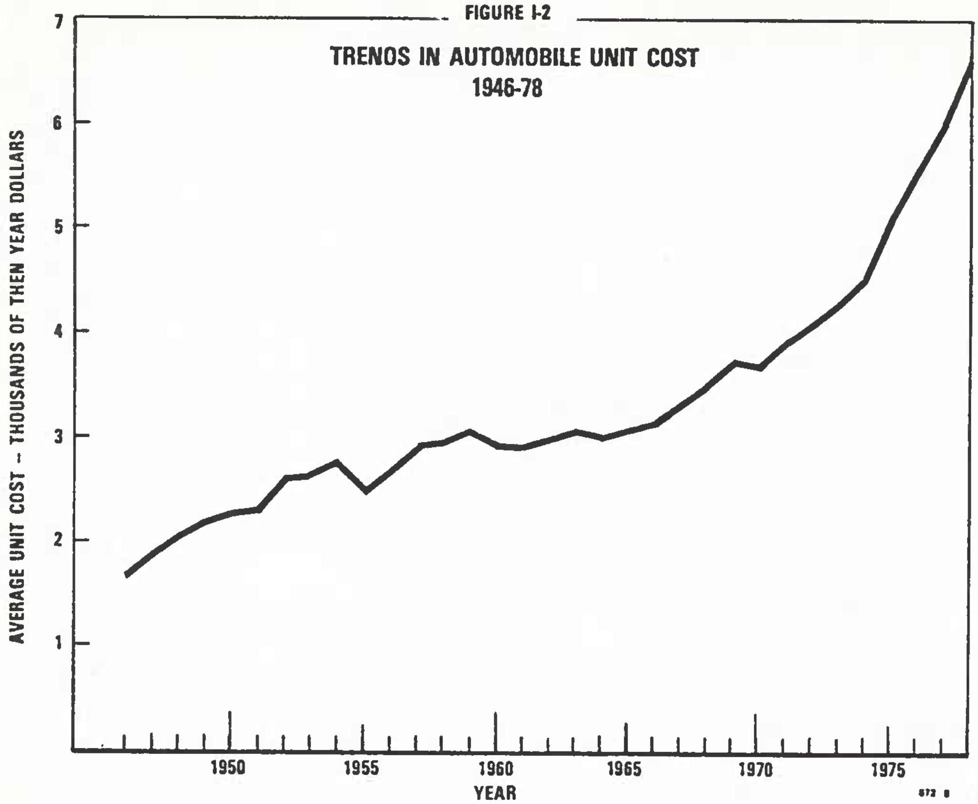


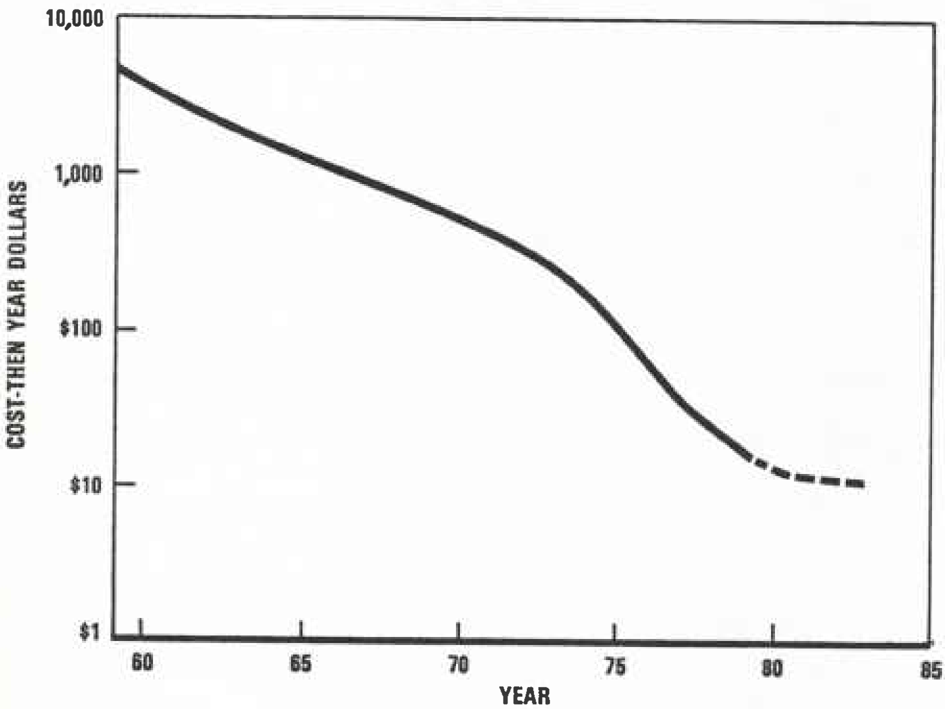
FIGURE I-1
COST TREND IN
TACTICAL AIRCRAFT
AVERAGE UNIT FLYAWAY COST—THEN YEAR DOLLARS
10,000,000
1,000,000
100,000
10,000
1940
1950
1960
1970
1980
YEAR OF INITIAL OPERATIONAL CAPABILITY
F-14
F-15
F-18
F-16
F-111A
A-10
A-6
F-45
F-105
F-104
F-4B
F-101
A-7E
F-102
A-7A
F-8E
F-100
F-5
F-106
F-84
A-4D
F-86
A-1E
F8F-2
P-80

FIGURE I-2



COST TREND OF SCIENTIFIC CALCULATORS IN THEN YEAR DOLLARS

FIGURE I-3



(investment strategy) will describe how we plan to reverse the trend of increasing acquisition cost to defense equipment by: (1) improved procurement techniques which emphasize greater use of competition and of commercial components; (2) application of technology explicitly for cost reduction; and (3) extending the life and capability of existing systems.

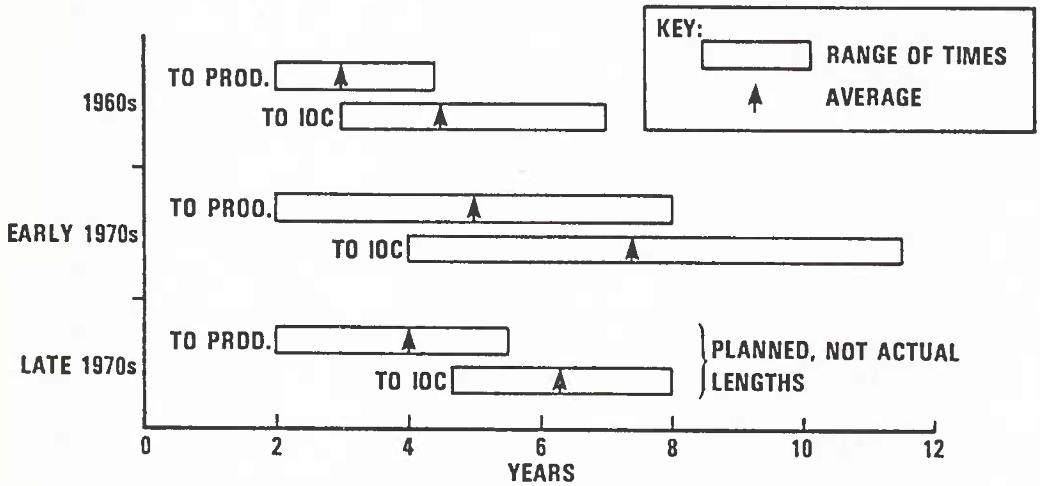
b. Technology as a Schedule Problem

Concomitant with the increasing sophistication and cost of military equipment in the past few decades, there has been an increase in acquisition time. Figure 1-4 illustrates the time from beginning of full-scale development to Initial Operational Capability (IOC) for several different kinds of weapon systems. It indicates that the time increased from about 4½ years in the 1960's to over 7 years in the 1970's. Typical on-going programs are scheduled to achieve IOC in 6-7 years after the start of full-scale development, but programs in the early 1970's were also scheduled to achieve IOC in 6-7 years. The consequences are two-fold: first, there is an increase in total acquisition cost; second, the delay in IOC means that by the time the equipment gets in the field it embodies technology that often is more than ten years old--so we can lose in our fielded equipment the technology lead we enjoy in our laboratories.

These long acquisition times are not inevitable and, in fact, are not experienced in the commercial airline industry which is comprised of many of the same companies that supply our military systems. Figure 1-5 illuminates the problem. It gives the time from

Figure I-4

LENGTHENING TIME FROM FULL SCALE DEVELOPMENT TO DEPLOYMENT

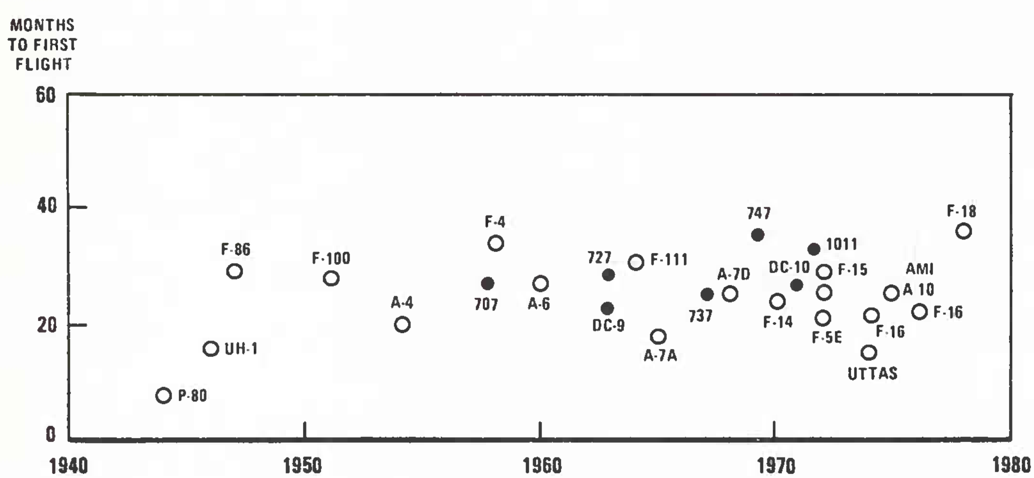


TIME FROM START OF FULL SCALE DEVELOPMENT TO ENTERING PRODUCTION AND TO IOC

DATA INCLUDES DEVELOPMENT OF MOST FIGHTERS, HELICOPTERS

FIGURE I-5

TIME FROM FULL SCALE DEVELOPMENT CONTRACT AWARD TO FIRST FLIGHT



full-scale development contract award to first flight for major military and commercial aircraft since the beginning of WW II. Surprisingly, the time has not increased at all during that period--we are developing military airplanes today as fast as we did in the 40's and 50's, even though the aircraft are much more complex. Also surprising is that the development time for military aircraft is no longer than for commercial aircraft.

The delays we are experiencing in the fielding of new equipment occur primarily during the test phase and the production phase. Our testing has delayed the acquisition process because we generally do our development, testing and production in sequence, whereas commercial practice is to overlap testing with both development and production. Our production gets delayed because we often "stretch out" a production program to reduce the budget drain that year. That not only delays the date by which operational capability is achieved, but it also increases unit cost as a result of inefficient production rates. This latter problem is pervasive in defense acquisition and requires determined action both by the DoD and the Congress to correct. The former problem must be approached carefully, because misapplication of concurrency (to programs with high technical risk, for example) can result in higher life cycle costs from fielding equipment difficult to operate and maintain. I will, in Section D, describe management actions we are taking to reduce delays in the acquisition process.

c. <u>Technology as a Two-Edged Sword</u>

The development of precision-guided weapons by the United States in the late 1960's was the most significant application of technology to modern warfare since the development of radar (excluding nuclear weapons). Precision-guided weapons result from the application of microminiature electronics to devices which detect and track targets and guide weapons to a direct hit (or a hit within the lethal radius of the warhead). This allows for much more effective weapons (with smaller warheads) and greatly reduces the logistics problems attendant to supplying vast quantities of ammunition of barrage-type firings. These weapons make high value targets such as ICBM's, bombers, carriers, and tanks much more vulnerable to destruction and will force a revolutionary change in force mix and tactics as they become more prevalent.

We have a substantial lead in the technology critical to precision-guided weapons, and since we give this technology highest priority in our R&D program, we expect that lead to continue. Nevertheless, the Soviet Union is working hard on this technology. We are beginning to see significant progress in weapons now under test, and we expect to see precision-guided weapons entering Soviet forces in quantity in the early 1980's. Even these first generation weapons will present us with a significant problem. Our response to this emerging problem will be three-fold: we will strive to keep one generation ahead of the Soviets in these weapons; we will pursue a vigorous countermeasure program; and we will evolve different force mixes and tactics with a strong emphasis on mobility and stealth features. These responses will be described in some detail in Section D.

d. Technology as a Problem for the User

In an age of technological explosion, where new weapons can become obsolete before they are fielded, we see a dangerous communication gap developing between the developer of equipment and the user. This leads to systems being fielded that are largely "technology driven" and are poorly suited to the operational need, because the user did not know how to state his need in terms of the available technology. Even when a technology program anticipates a need and supplies the user with equipment well suited to his mission, our technology may be rendered inefficient because the user does not understand its potential well enough to develop appropriate tactics and doctrine. At the beginning of WW II, the French Army had perhaps the most effective tank in the world; the German Army, however, had developed the Blitzkrieg tactics which effectively exploited the tank, and they won that tank war. We must insure that our tactics are capable of exploiting the full potential of our weapons.

We are also concerned with balancing the need for high performance on the one hand with the capability to maintain required readiness levels. Too often our R&D programs have applied technology to enhance performance without adequate consideration of its impact on the user, in terms of support costs and the number of skill levels of our military personnel. The results have been visible in a number of operating weapons with low readiness and needs for expensive retrofits and modifications. Consequently, there is a need to make readiness objectives and skilled manpower constraints major design objectives along with technical performance.

I will describe in Section D our management initiatives for improving communication between the technologist and the user in the application of technology to warfare, and for reducing life cycle costs of equipment.

2. Barriers to Using Industry More Efficiently

The United States has the most powerful industrial base in the world. This is the foundation on which we build our weapons development and acquisition program. But we have not realized the full potential of our industry for two reasons:

- o We have overmanaged industry, thereby reducing its efficiency to less than it achieves on commercial programs; and

- o Industry has not been sufficiently responsive to the unique needs of the Defense Department.

a. Overmanagement of Industry

I believe that industry generally does not produce as efficiently for the defense market as it does for the commercial market. Some of this cost difference results from our imposition of military specifications; some results from the increased overhead required to deal with government regulations and procedures; and some results from the stifling of management incentives to decrease cost.

The tendency to impose government regulation and procedures and, more generally, to oversee company management functions, is a defensive measure which developed as a response to poor performance by some contractors on programs critical to national security. I believe this response generally has been counterproductive and, in fact, perpetuates the very problem it was intended to solve--poor company management. We must turn the management of industry back to company management and then hold them responsible for contract performance. In most cases this will result in more effective management and certainly in reduced overhead for both the company and the government. The key to achieving this result, while still protecting our vital national interests, is to extend the use of the competitive process. By conducting competitive development programs we insure that the most creative engineering teams and management are assigned to defense programs without our intervention, and we have two (or more) technical concepts to select from. By extending competition into production we can let the competitive process, rather than government inspectors, drive production efficiencies. I will describe in Section D the management initiatives we are taking to apply these principles to defense procurement.

b. Lack of Industry Responsiveness to Unique Defense Needs

A primary tool for maintaining effective competition in the defense industry is the Independent Research and Development (IR&D) program. This program amounts to about one billion dollars annually, a portion of which is accepted by the government as allowable expenses on defense contracts. The IR&D program is structured by the companies themselves to advance technology in ways they believe will strengthen their ability to compete. Competition is the key to efficiency in the development and production of high technology systems; the IR&D program, therefore, is a crucial investment in maintaining effective competition, thereby increasing acquisition efficiency, and in sharpening the responsiveness of industry to Defense needs. Where the IR&D program is not applicable, we find industry generally not responsive to Defense needs. The semiconductor industry, for example, is geared primarily to commercial sales--only seven percent of integrated circuit sales are Defense-related, and most of the semiconductor companies, while having substantial company-sponsored R&D, generally have relatively small IR&D programs. Therefore, although semiconductor technology is crucial to maintaining our military technological advantage, we have little influence on the direction of this technology. In fact, we find it of critical importance to change that direction as the industry moves to the next generation of miniaturization--from large-scale integration (LSI) to very large-scale integration (VLSI). Thus, in the absence of IR&D programs within these companies, we are initiating a major program of funded R&D to expedite the development of high speed VLSI technology. This program is described in some detail in Section D.

3. Barriers to a More Effective Alliance

In 1978 the United States spent $12 billion for defense R&D and our NATO allies spent another $4 to $5 billion, a total of $16 billion to $17 billion. But the net effect of this combined R&D spending was much less, because of significant overlap and redundancy among the national programs. The Alliance is developing three different main battle tanks, four different fighter aircraft and three different air defense guns. This not only entails duplicative funding of R&D, but leads to high unit costs because of the inefficiency of three or four production lines.

A key objective of our investment strategy is to achieve significant increases in cooperation in the development and production of NATO armaments so we can increase the efficiency of our procurement and the effectiveness of the equipment deployed with NATO forces. The barriers to achieving this improved efficiency are formidable.

NATO is an alliance of fifteen independent nations, and it is inherently difficult for any one of them to subordinate its sovereign rights for the benefit of all. Each of the nations has its own laws and regulations for the procurement of defense equipment, and these laws generally are designed to protect perceived national interests. In this regard, there are two principal barriers to improved cooperation:

- o The European NATO countries have built up their defense industries this past decade and some are fearful that cooperation with the U.S. may threaten these industries.

- o Legislation in the U.S., designed to protect U.S. industry from foreign competition, inhibits the formulation of cooperative programs.

a. European Barriers to Cooperation

During the fifties and sixties, most of the major defense equipment in NATO was developed and built in the U.S. However, with the growth of European industrial strength during the past decade, a strong European defense industry has emerged. It now has the capability to develop and produce nearly every type of weapon system; it has developed a significant sales base outside of NATO, and it provides jobs that have become important to the European economy (for example, in 1977 the defense industry employed 200,000 workers in the Federal Republic of Germany, 275,000 in France and 300,000 in the United Kingdom). Because of the growing economic importance of the defense industry to their economy, the Europeans have formed an organization, known as the Independent European Program Group (IEPG). Its objective is to strengthen their defense industry by forming European coalitions to develop and produce armaments, and by presenting a united front in dealing with the United States and Canada on armament development and production. The IEPG could become a barrier to cooperation if its emphasis were put on increasing arms sales through cartelization. However, I believe it can become instead an instrument through which we and our allies can develop programs of cooperation which benefit the entire alliance. To that end, a Trans-Atlantic Dialogue has been established between the Armament Directors of the IEPG and the Armament Directors of the U.S. and Canada. Our contribution to the Trans-Atlantic Dialogue has been a proposal for a Triad of programs for armament cooperation, as described in some detail in Section D. The initial response of the Europeans to this proposal has been quite positive, and I am encouraged to believe that we will be able to work together for the common benefit.

b. American Barriers to Cooperation

In addition to European barriers to cooperative programs, we have some of our own. U.S. industry is apprehensive that cooperative programs may somehow reduce their sales and therefore seeks to preserve the status quo, even though the actions they fear have already been taken by the Europeans and have led to dramatically decreased European dependence on the U.S. defense industry. I believe that the vitality of our defense industry is fundamental to a strong defense posture, and that our proposed cooperative programs are consistent with the continuing strength of our defense industry. Hence, I have discussed our proposals in some detail with industry groups and have modified these proposals based on their recommendations. We have established a Defense Science

Board Task Force to facilitate an exchange of views between the Department and industry. As industry has become more familiar with--and has had an opportunity to influence--our plans, they have also become more supportive and are preparing for the multinational teaming that will characterize many of our defense programs in the future.

Some of the barriers to cooperative programs are legislative in nature; accordingly, we have submitted two specific requests for legislative relief--HR 12837 and HR 11607. HR 11607 is necessary to facilitate the interchange of essential logistical support between national forces either stationed in NATO countries or deployed in NATO exercises. It will not apply to major end items. HR 12837 will facilitate agreements and contracts with friendly foreign governments and international organizations for the purchase of supplies and services in furtherance of interoperability. It will also assist in programs for cooperation in development and production of defense materials.

D. OUR MANAGEMENT INITIATIVES

I have already noted that our investment strategy has three components:

- o Selective concentration on those technologies which are "force multipliers".
- o More effective exploitation of our industrial base.
- o Significantly increased cooperation with our Allies in the development and acquisition of weapons.

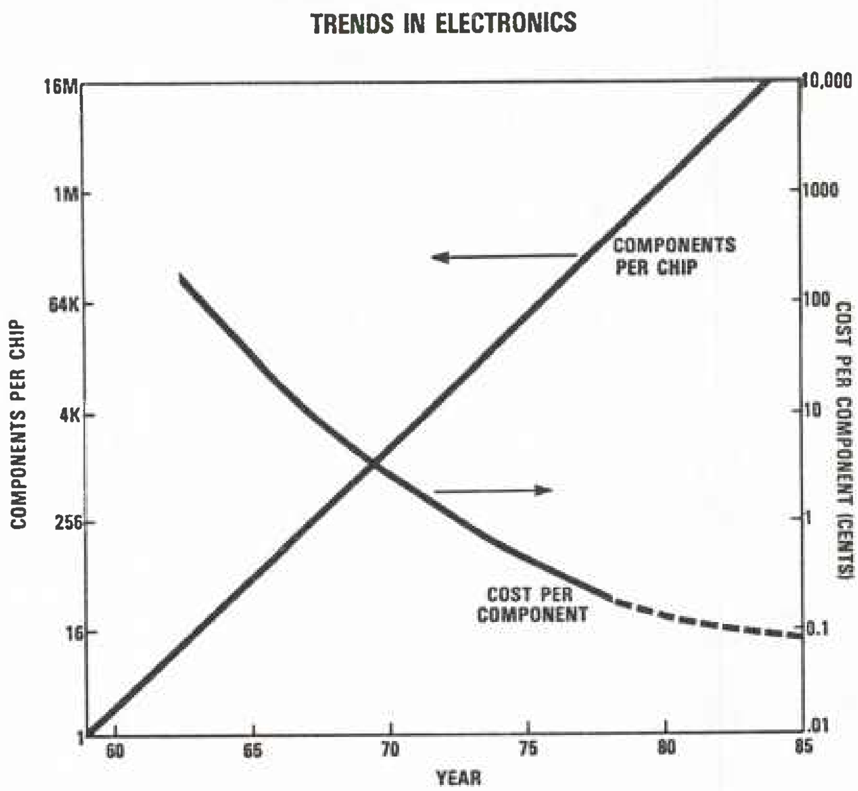
In the previous section I noted the formidable barriers to implementing this Strategy. In this section I will describe the specific management initiatives we have underway to achieve the benefits of our strategy in the face of those barriers.

1. Extend Application of Competition

The U.S. semiconductor industry is perhaps the most efficient industry in the world. This phenomenom of our free enterprise system thrives on two ingredients: large doses of high technology and intense competition. As a result, it is one of the few industries that has succeeded in reversing the upward spiral of costs. Two products of this industry are well known: the hand-held calculator which, at a price of ten dollars, exceeds the performance and reliability of the electro-mechanical calculator which ten years ago sold for nearly a thousand dollars; and the electronic wristwatch which, at a price of ten dollars, exceeds the accuracy, versatility and reliability of mechanical watches which ten years ago sold for more than a hundred dollars. The basic development that underlies these products is known as LSI (large-scale integration). LSI technology involves depositing thousands of electronic components on a single chip less than an inch square. The intense competition in this industry has forced technology in the direction of more and more components on each chip which has resulted in less and less cost per component. The net result is indicated in Figure I-6, which shows the increase in components and the decrease in cost per component in the last ten years. This has allowed significant increases in performance at the same time that costs were being reduced by a factor of ten or even a hundred.

This dramatic development has two important effects on Defense acquisition. First, we are making use of integrated circuits and thereby benefitting directly from the increased performance and decreased cost.

Figure I-6



Second, we see a product development example which has features worthy of emulation. In particular, we will seek to emulate this industry's use of competition as a force to drive costs down. We will not, of course, be able to achieve identical results, because we typically are producing quantities in the thousands instead of in the millions. Nevertheless, there are significant cost benefits to be gained by introducing more competition into defense acquisition, and we intend to do just that.

In FY 1978, 17 percent of our acquisition programs were sole source awards that followed after competition. That is, we conducted a competitive development program, selected the winner and thereafter awarded all subsequent contracts sole source to that winner. The advantage of this approach is obvious--we do not have to pay for two continuing development programs, nor do we have to pay for establishing two production facilities. The disadvantage is well recorded in our acquisition history--it promotes contractor "buy-ins" with subsequent cost overruns from which the government has no satisfactory means of extraction short of program cancellation. We have tried to get around this problem by more careful cost reviews and contractor supervision which has added to both contractor and government overhead. I believe that in many acquisitions a preferred alternative will be to pay the extra cost for continuing the competition through the entire development cycle and, in some cases, on into production.

We are beginning to apply this management principle to an increasing number of programs. In the air-launched cruise missile (ALCM) program, we continued competition into engineering development (the competition "fly off" will be in 1979) and plan to continue competition into production (with a dual production procurement), since we expect to build more than 3,000 ALCM's. We have already begun dual source production on cruise missile engines and inertial guidance systems. We are producing the Navy's new frigates (FFG-7 Class) at three shipyards, which will be reduced to the two best in FY 1980 or FY 1981 and eventually to the one best. We plan to procure COPPERHEAD and STINGER in a dual production mode. If we can get our Allies to join us in dual production, whether of a U.S. or European system, it will further broaden competition.

It is worth noting that while we expect this increase in competition will result in significant cost benefits in the long-term, there will be no near term cost reduction; in fact, there is an investment cost in getting such a program started--but we expect a healthy return on this investment. There also will be an indirect cost benefit to both industry and the government. When we have the protection of cost competition, we can reduce the level of contract supervision, cost auditing, and form-filling, thereby allowing both the contractor and government overhead to be reduced.

2. Use Technology to Reduce Manufacturing Costs

We think of technology as a tool for improving performance, but as the semiconductor industry has shown, it can also be a tool for reducing cost. In our FY 1980 program we place a major emphasis on technologies which can lead to cost reduction. One example is our VHSIC (very high speed integrated circuits) initiative, in which we plan to invest about $200 million over the next six years to direct the next generation of integrated circuit technology to unique Defense applications. This program, which is one of our top priority Science and Technology programs, will lead to very significant cost reduction by decreasing component cost and by greatly reducing assembly costs of electronic equipment. Examples of a different type are found in our Manufacturing Technology program, which is funded at $164 million in

FY 1980, a 23 percent real growth over FY 1979. This program is directed specifically at the advancement of manufacturing processes that will allow production of equipment (e.g., jet engines, missile castings, helicopter blades) more efficiently, thereby reducing costs in quantity production. One example is the development of lightweight composite materials for aircraft and missiles. These materials reduce weight (thereby increasing performance) and manufacturing cost. Another example is the development of "near-net shape" fabrication techniques (using a hot isostatic process) which allows the pressing of engine chassis, for example, to a nearly final form, thereby reducing time and wasted material in the manufacturing process. Especially noteworthy is our program to develop new techniques for computer-aided manufacturing (CAM). The CAM program uses the very technology which is leading to more complex weapon systems to reduce the cost of manufacturing these systems.

3. Extend the Life and Capability of Existing Systems

Our technology allows us to build the best missiles and the best aircraft in the world today--and the most expensive. This puts us in the position of having to fight out-numbered in men and materiel. Up to a point, superior performance is an offset to this quantitative disadvantage. Lanchester's theory of warfare derived simplified relations between quantity and quality in warfare. Basically these relations predict that force effectiveness increases as the square of the quantity of units and linearly with the quality of the units. That is, if you are out-numbered 2 to 1, your force must be four times more effective in order to break even; if you are out-numbered 3 to 1, your force must be nine times as effective.* Our forces in NATO are typically out-numbered 2 or 3 to 1 in tanks, armored vehicles and guns, so it is unreasonable to expect the quality of our forces to totally offset such a large disadvantage.

Therefore, we have focused our attention on additional ways of dealing with the problem of fighting out-numbered. One promising approach is to extend the life and capability of existing systems. The ALCM program is a prime example. The B-52 might have ended its useful life in the mid-80's because of its declining ability to penetrate the growing strength of the Soviet Air Defense complex. However, as a carrier of cruise missiles, it should have a useful life well into the 90's, since it will not have to penetrate this vast air defense complex in order to accomplish its mission. The cruise missile (ALCM or its successors), because of its very low radar signature, will be able to effectively penetrate Soviet Air Defenses for the indefinite future.

Another life extension program is the A3 modification to the M60 tank. This modification gives the M60 a night vision and fire control system equivalent to that developed for the XM-1, thereby extending its useful life into the late 80's, by which time we will have the XM-1 force deployed.

A final example is the AMRAAM (Advanced Medium-Range Air-to-Air Missile) missile which is a lightweight, radar-controlled,

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*These numbers are strictly applicable to only a very special form of combat; they are, however, indicative of trends even in more complex forms of warfare.

air-to-air missile and one of our highest priority FY 1980 developments. This missile, when used to weaponize our fighter aircraft, will provide even our lower cost fighters such as the F-16, with the ability to effectively engage any fighter in the world, even when out-numbered 2 or 3 to 1, because of its "fire-and-soon-forget", multiple target engagement capability.

4. Introduce More Flexibility in Program Management

To realize the full benefit of our technological superiority, we must get technology out of our labs and into the field more rapidly. We have evolved, during the past two decades, a highly stereotyped system of acquisition that basically was conceived in reaction to our failures--that is, our well-publicized cost and schedule overruns. As a consequence, our acquisition process is cautious, slow and expensive. It now takes us 12 years or more for development, production and deployment of a typical system, so that our lead in technology is lost by the time the equipment is deployed.

I believe that we have overreacted to our earlier acquisition problems and must find some way of reducing acquisition time, at least in those programs in which technology is crucial to equalizing the quantitative disadvantages we face. We have underway a pilot program in which we select a number of high priority programs* to receive expedited acquisition treatment. These programs include:

*Several of these programs were accelerated at the urging of Congress, which, for a number of years, has expressed concern at the bureaucratic nature of our acquisition process.

- o DIVAD (Division Air Defense Gun) and GSRS (a tactical multiple launch rocket system)--We have compressed the Advanced Development and Engineering Development phases into one 27-month "hands-off" competitive development, thereby cutting acquisition time by two years.

- o ALCM (Air-Launched Cruise Missile)--We have started the production program on the ALCM missile while the development competition is still underway. This allows full-scale production to start as soon as the competition is complete, thereby cutting acquisition time by one year.

- o Assault Breaker (Precision-Guided Munitions for engaging entire companies of tanks)--We are compressing the Technology phase and Advanced Development phase into a single, expedited demonstration program under DARPA management, thereby reducing acquisition time by two years.

- o F-16 aircraft and XM-1 tank--We are conducting development tests and operational tests (DT III and OT III) concurrently with the low rate initial production run. This will take very careful management attention, but will allow us to get these important programs deployed two years sooner than a standard sequential program.

We are particularly concerned that concurrency not be applied in such a way that new equipment has performance and support problems when it reaches the field. We hope to avoid, for example, the problems that have been encountered on the S-3 and F-14 programs, by introducing in the DIVAD program an "equipment maturing" phase upon completing development.

5. <u>Develop Technology and Tactics to Counter Precision-Guided Weapons</u>

As I stated in the section on "Barriers", Precision-Guided Weapons are a two-edged sword. While we maintain a commanding lead over the Soviet Union in this field, they will be introducing large quantities of precision-guided weapons in their forces in the early 1980's. Even though these weapons will generally be a generation behind weapons entering U.S. forces at that time, they will pose a formidable threat to our forces, particularly our large, high-value targets such as ICBM's, bombers, aircraft carriers and tanks. Our response will be to keep one generation ahead of the Soviets in these weapons, to conduct a vigorous countermeasure program, and to increase the emphasis on mobility, stealth, and low-value weapons in our forces. Our countermeasure program is receiving greatly increased emphasis in the FY 1980 program, and I expect that it will continue to grow in the early 1980's. Here I will describe some of the major changes we are making in our major weapon programs to introduce mobility and stealth to respond to the growing threat of Soviet precision-guided weapons.

a. ICBM's

The Soviet Union has developed greatly improved guidance systems for their SS-18 and SS-19 ICBM's. These systems demonstrate accuracies less than the lethal radius of the SS-18 and SS-19 MIRVed warheads, even against very hard targets like ICBM silos. Therefore, when large numbers of these guidance systems are introduced into their ICBM forces, our silos will no longer protect our ICBM force and no feasible improvement in hardening will restore their ability to survive a mass attack of SS-18's or SS-19's. More generally, it is clear that fixed, hardened bases for any high-value target will not be a viable option in the 1980's. We have studied a variety of options for rebasing our ICBM force to allow it to survive an attack by SS-18's or SS-19's.

One of the primary candidates achieves survivability through a stealthy deployment--we would build a large number of silos and move the missiles from silo to silo in a covert manner. With a constraint on the total number of re-entry vehicles, the Soviet Union could not target all of the silos, and they would not know which silos have the missiles, because of the covert movement. Another primary candidate achieves survivability through mobility--we would put our ICBM's in airplanes and launch the airplanes (but not the missiles) on strategic alert or tactical warning, or on the failure of our warning system. We expect to select a new survivable basing system for our ICBM's in 1979, and the proposed FY 1980 program includes funding for full-scale development of the selected system.

b. Strategic Bombers

Our bomber force, even though stationed at fixed airbases, achieves survivability by escaping these bases on warning of attack (our ICBM's cannot escape unless the attack assessment is certain, because, unlike the bombers, they cannot be recalled if the attack assessment proves to be in error). This bomber base escape will become more difficult in the future as the Soviet Union builds up its SLBM force, because a depressed trajectory SLBM launched from U.S. coastal waters can arrive at some of our SAC airfields before most of the airplanes can take off. We are exploring solutions to this problem which involve making a faster attack assessment and achieving faster aircraft launch.

An additional problem is the introduction of precision-guided weapons in the Soviet Strategic Air Defense complex. We plan to achieve penetration by flying the bombers close to the earth, which would give the ground defensive systems a very small operating radius and would render the airborne interceptors ineffective, because their airborne radars could not pick out the bombers from the background of ground clutter. During the past two years the Soviets have been testing a "look-down/shoot-down" radar and a missile which is capable of engaging low-altitude bombers and fighters. When this system becomes deployed in quantity our bombers will have a much more difficult task penetrating. Our solution to this problem is to introduce cruise missiles into the force. This allows the bombers to operate in a stand-off mode with cruise missiles penetrating the defenses. The cruise missile presents such a small radar target that the "look-down/shoot-down" radar now being tested will not be able to track it at operationally useful ranges. Also, the Air Defense system will have to engage thousands of cruise missiles instead of hundreds of bombers. This approach typifies two distinct, generic solutions to the problem of precision-guided weapons: move to very small (stealthy) weapon systems which nullify the tracking circuits of the precision-guided systems, and move to lower-value weapons which can saturate the defense complex.

c. <u>SLBM's</u>

Our SLBM force enjoys a high degree of survivability, even against precision-guided weapons, because of its mobility and its stealthy nature. It cannot be targeted at a fixed location, and it is very difficult to detect and track. We believe that this force will be essentially invulnerable to an effective attack for the next decade.

Beyond that, it is very difficult to forecast, but we know that the Soviets are working very hard on ASW (Anti-Submarine Warfare), and we also know that the problem of detecting and tracking submarines, while very difficult and expensive, is by no means infeasible. Therefore, we plan to introduce even more mobility and stealth into our SLBM forces. Our new TRIDENT submarine, the first of which will begin sea trials in 1980, is considerably quieter than previous nuclear submarines, thereby making detection and tracking of it more difficult. Our new TRIDENT missile, which will achieve IOC in 1979, will have more than twice the range of the POSEIDON it will replace. With longer range missiles, the submarine can increase its survivability and mobility--in fact, its patrol area will be more than tripled by the increase in missile range.

d. Theater Nuclear Missiles

We are presently developing two new missiles as candidates for modernization of our theater nuclear forces. GLCM is a ground-based version of the cruise missile, and PERSHING II is a modern, longer-range version of the PERSHING I ballistic missile. In both cases we are introducing mobility and stealth into their design and operational concepts. They will be designed to have off-road mobility, so that on strategic alert they can be dispersed from their main operating base and deployed on trails in the woods, with frequent relocations to maintain stealth.

e. Surface Ships

The advent of precision-guided weapons that are capable of direct hits on surface ships from stand-off ranges greatly complicates the task of defending these ships and raises questions about the optimum design of surface ships and the appropriate mix of naval forces. Submarines, if designed with acoustic quieting, will gain a high degree of survivability, since the ocean shields them from visual and radar observation; naval aircraft--when airborne--gain a high degree of survivability (unless seeking an engagement) by their mobility relative to a ship.

However, surface ships are susceptible to long-range observation by radars on aircraft and satellites. A ship can attempt electronic countermeasures against these surveillance systems, but this makes it more susceptible to ELINT surveillance so it has to devote an increasing portion of its fighting capability to defending itself. As a result, the balance is shifting in favor of the air attacker armed with precision-guided missiles. Giving the ship more mobility, that is, making it faster, is useful against the submarine threat but is not particularly effective against the air threat. Therefore, our principal thrusts are: (1) to introduce more stealth in surface ships (through emission control, deceptive countermeasures, and ship design); (2) to introduce improved protection, both active and passive, against air attack; and (3) to gradually evolve a shipbuilding program with a greater emphasis on smaller, cheaper ships (in larger quantities).

f. Tanks

The effectiveness of our own anti-tank systems, particularly those now in test, indicate that tanks will have a more difficult time surviving on the battlefield in the 1980's than ever before--the technological balance is shifting in favor of the anti-tank systems. Tanks, however, will still play a paramount role in tactical warfare for the foreseeable future. Therefore, we need to give U.S. forces a continuing technological advantage in both tank and anti-tank weapons. We are dealing with tank vulnerability in four ways: (1) increasing the effectiveness of the armor--the XM-1 armor will defeat all presently deployed ground or helicopter based anti-tank weapons and we are working to further improve tank armor to meet future threats; (2) increasing tank mobility--the XM-1 will be able to move much faster over more difficult terrain than either the M-60 or, we believe, any existing Soviet tank; (3) giving tanks some stealth capability by allowing them to operate effectively in night and poor weather, when many anti-tank systems will not be able to detect and track them; and (4) giving our tanks a precision-guided large caliber (120mm) gun so that they can achieve a high probability of disabling their targets on the first round, and minimize the time they are exposed to counterfire.

Finally, in our mix of tank and anti-tank forces, we are emphasizing anti-tank systems. The Soviets have more than 40,000 tanks to our 10,000. Our strategy is to deal with the disparity by a modest increase in quantity--deploying 7,000 of the very effective XM-1 tanks in the late 1980's--and a <u>substantial</u> increase in both the quantity and quality of anti-tank weapons throughout the 1980's.

There are many other examples of how we can deal with the increasing vulnerability of our major weapons systems to precision-guided weapons. However, the actions that I have described serve to illustrate our strategy. Precision-guided weapons are perhaps the only truly revolutionary weapon development since World War II. Their impact on warfare, however, will evolve over the next decade as they are introduced in quantity (into both our forces and into Soviet forces) and as they improve in quality. During that period we will be evolving a counter strategy which involves changing our force mix to put greater emphasis on precision-guided weapons. At the same time we will be increasing the mobility and stealth of those major systems that are prime targets for precision-guided weapons, and we will be developing countermeasures to mitigate their effectiveness.

6. Build Bridges Between Users and Technologists

We live in an era of unprecedented technology expansion which allows the development of revolutionary new weapon systems. Since we cannot afford to develop and build everything our technology permits, we must be selective, and this selectivity should be guided by those applications of technology which are "force multipliers" (applications which allow for significant increases in military effectiveness or significant decreases in equipment cost or manpower requirements). Intelligent selectivity requires a "shotgun marriage" between the technologist and the user. New technical concepts are developed in our Science and Technology program which is "technology driven"; that is, it is structured by our technologists to advance technology. Our management problem is to determine when to "promote" a concept from the Science and Technology base into a structured development program leading to production and operational use. Understanding the issues involved in whether or when to make this "promotion" requires bridging the communication gap between the technologist and the user. We are dealing with this problem by greatly increasing the emphasis on Technology Demonstration programs both in the Services and in DARPA. In these programs we select a promising technology, build a demonstration system and operate it in the field to expose it to users, demonstrate its capabilities and reveal its conceptual weaknesses. These demonstrations can be done quickly and relatively cheaply, because the equipment does not have to meet military specifications. Such demonstrations are proving invaluable in introducing the user to the potential of new technology and introducing the technologist to the operational problems faced by the user. Because of the importance I place on achieving these objectives, I have requested a 17 percent increase in our Technology Demonstration program in FY 1980. Programs of particular interest are BETA (Battlefield Exploitation and Target Acquisition), which demonstrates the value of fusing different sources of intelligence data in a tactical environment, and Assault Breaker, which applies precision-guided munitions technology to attacking large formations of tanks in rear echelons.

Bringing together the technologist and the operational user in the field will not only lead to equipment designs which are better suited to the users needs, but will stimulate the earlier development of tactics and doctrine necessary to effectively exploit this new technology in combat operations.

7. Direct Commercial Technology to Defense Needs

Between our funded Science and Technology program and the contractors' Independent R&D program, we have an outstanding ability to direct technology resident in the defense industry to high priority defense programs. However, we have little ability to influence those companies whose sales are predominantly commercial. This is a serious limitation in the case of the semiconductor industry, whose products play a crucial role in nearly all of our advanced weapon systems. Therefore, we have initiated a new technology program intended to direct the next generation of large-scale integrated circuits to those characteristics most significant to Defense applications.

This initiative, called the VHSIC (very high speed integrated circuits) program, will require expenditures of $31 million in FY 1980, and involve a total program cost of about $200 million over six years. While this is a substantial investment for a technology base program, we expect this investment to stimulate at least an equal amount in industry. The semiconductor industry is very competitive and attuned to large R&D investments in new technology. In 1978, for example, they invested over $300 million in R&D on new products and improved technology. Our goal is to get the full benefit of our investment plus the added benefit of influencing the direction of a substantial amount of company R&D.

The technical objective of our VHSIC program is to develop chips that have more than ten times the density and 100 times the speed of current chips and are capable of meeting military specifications of ruggedness and reliability. Basically, we are developing "computers-on-a chip", or high speed microprocessors, that will perform advanced signal processing and the rapid computation required for our "smart weapons". We will concentrate on those chips which will be critical components in our next generation of weapons--precision-guided munitions, air-to-air missiles, cruise missiles, ICBM's, night vision devices, torpedoes, and ASW processors, for example. This program will insure that the U.S. maintain a commanding lead in semiconductor technology and that this technology will achieve its full potential in our next full generation of weapons systems.

8. Develop a Framework for Improved Cooperation with Allies

In Section C, I described the urgent requirement for cooperation in the NATO-wide development and procurement of arms. I also described the formidable barriers to achieving this cooperation. In order to overcome these barriers, we have proposed a triad of cooperative programs: General Memoranda of Understanding (MOUs) in reciprocal purchasing; Dual Production in NATO countries; and the Family of Weapons.

a. General MOU's

The purpose of the general MOU's is to facilitate competition by NATO's defense industry in the defense market of each NATO country. These MOU's waive various "Buy National" restrictions on a reciprocal basis. We have already negotiated such MOU's with the U.K., Canada, Germany, Norway, the Netherlands, and Italy. It is too early to forecast the precise benefits which will result from these MOU's. Nevertheless, initial results are encouraging, and I believe that this approach is valid for the whole alliance. We have invited NATO countries who have not yet done so to enter into such agreements with the U.S.

b. Dual Production Programs

Dual production is the second leg of the cooperative triad. When one nation has completed development of a system which is useful to the alliance, that nation should make its system available for production by other countries or consortia of countries. This will eliminate unnecessary duplication in R&D, while avoiding the trade and labor imbalance that would result from exclusive development and sales. We are already engaged in such dual production arrangements on the French/German developed ROLAND. The Germans will produce the MODFLIR night vision device and have formed a consortium to produce the AIM-9L air-to-air missile, and we have offered the COPPERHEAD laser-guided artillery projectile, and the STINGER shoulder-launched surface-to-air missile to European consortia. We will offer others, and we will consider reciprocal offers of NATO countries to the U.S. These dual production programs can lead to the near-term introduction of the latest technology in NATO's deployed forces at the lowest practical cost.

c. Family of Weapons

The Family of Weapons is the third leg of our cooperative triad. Here the principal objective is to obtain greater efficiency by reducing needless duplication in our development programs. We want the $12 billion we spend for R&D and the $4 to $5 billion our allies spend to yield $16 to $17 billion worth of combined results. Our approach is to examine the weapons which member nations plan to develop in the next few years and aggregate these weapons by mission area. When we find two or three that perform similar missions, we will agree to divide the responsibility, with one party developing a long-range version, the other a short-range version, for example. We would anticipate such divisions to be made among the U.S. and Canada on the one hand and European consortia on the other. Each nation would fund the program for which it is responsible. When the development is completed, the developing nation would make available to the other participants a data package for production. Exchange of production data packages would be on a reciprocal basis to include all programs in the family.

As a result of discussions with our Allies and an industrial dialogue initiated in the recent Defense Science Board Summer Study, we have modified this Family of Weapons proposal somewhat. When the U.S. has the lead, we will designate a portion of the development to be available to European industry. The European consortium, in turn, will designate a corresponding portion of their development to U.S. industry. The purpose of this modification is to encourage trans-Atlantic industrial teaming, to provide the best available technology and to facilitate the information exchange that will be needed for the dual production that will follow. On all programs for which we are responsible for development and production, we will select the U.S. prime contractors, subcontractors, and European subcontractors on a competitive basis to insure the best technology and lowest cost in the resulting system. We have not yet negotiated specific Family of Weapons agreements, but are exploring as families: Anti-Tank Guided Missiles, Air-to-Surface Weapons, Ship-to-Ship Missiles and Air-to-Air Missiles.

There are important details to be worked out before we can begin development under the Family of Weapons concept. However, I believe that the mechanics of how to implement the families concept can be worked out, provided all have the desire and determination to do so.

Consider, for example, efforts related to a potential family of air-to-air missiles. There is a joint Air Force and Navy program underway to develop an Advanced Medium-Range Air-to-Air Missile (AMRAAM) which will be a replacement for the AIM-7 SPARROW. The program has recently completed selection of two contractors who will proceed into a competitive validation phase.

The operational characteristics of the missile being developed were derived from an Air Force/Navy Joint System Operational Requirements document which has been substantiated by a Mission Element Need Statement (MENS), both of which include the F-14, F-15, F-16 and F-18, and we are working with our European Allies to be sure unique European requirements are considered. To promote interoperability, we have requested design packages on European aircraft (MRCA and Mirage 2000) so the validation phase contractors will have the data required for this task.

We have proposed to our allies that the U.S. AMRAAM become the NATO standard for the medium-range missile. In turn, our European partners would develop the next generation short-range missile as the NATO standard. We also agreed that it would be desirable to have a portion of the AMRAAM development carried out in Europe and a portion of the short-range missile development carried out in the United States. We will encourage the AMRAAM contractors to use European subcontractors to bring the best alliance technology to bear on missile development, and we expect similar participation of U.S. industry in the European program. We have initiated action to schedule two technical interchange meetings to discuss air-to-air missile requirements, European short-range missile technology and AMRAAM technology. Present planning envisions one production line for AMRAAM in the United States as well as one in Europe to encourage procurement of a large NATO inventory of this advanced weapon. Also, we would plan to produce, in the United States, our inventory requirements for the European-developed short-range missile.

d. Effectiveness and Efficiency Through Armament Cooperation

The ultimate objective of armament cooperation is improved combat force effectiveness. So the first test of a candidate program is whether that program will improve the overall effectiveness of alliance forces. Improving the effectiveness of U.S. forces alone is not sufficient. We will be dependent upon the combat effectiveness of the forces on our flanks, and the criterion for force effectiveness must reflect this reality. The importance of our allies is underscored by the fact that U.S. forces today constitute only 20 to 25 percent of NATO's conventionally armed forces in Europe.

A related criterion is efficiency. A cooperative program should not be considered unless we can reasonably expect it to result in improved exploitation of alliance defense resources. We have not taken full advantage of the total economic and technological resources of the NATO countries, and we will be looking to future cooperative programs to do so.

Efficiency should not be judged solely in terms of an individual weapons system or subsystem. Our judgment should be made on the basis of the improvement offered by the combination of programs in a cooperative agreement. If the program as a whole will improve efficiency and effectiveness, it should be considered favorably.

e. Competition

I have already pointed out that in our national program of armaments development and production competition is vital to maintaining efficiency. I know of no better mechanism to control costs and stimulate peak performance. Our proposed framework for cooperative programs is entirely consistent with maintaining a competitive environment in development and production on all U.S.-managed acquisition programs. Moreover, it is a framework which can actually increase competition throughout the Alliance.

Our actions to establish General MOU's will open up defense markets to competition, removing on a reciprocal basis the barriers resulting from "Buy National" restrictions. Dual production programs provide competitive alternatives to national programs which are often constrained to national markets and associated small-scale inefficient production. Our proposed Family of Weapons includes a mechanism for cross-participation by the partners in development of a family, allowing competition to work in creating the best team. The family approach also provides production data packages, improving the potential for competition in production.

E. OUR PROGRAM

The Defense budget requests $13.5 billion for RDT&E and $35.4 billion for procurement of weapon systems and other materiel and supplies. The allocation of RDT&E and procurement resources is provided in Tables I-1 and I-2. Highlights of the program are summarized in the following sections and described in detail in Sections V through IX of the Posture Statement.

1. The Science and Technology Program

The DoD Science and Technology (S&T) Program is made up of the Technology Base, Advanced Technology Developments and the Manufacturing Technology Program. Our funding request provides real growth of ten percent in Research and five percent in Exploratory Development efforts sponsored by the Services; it also provides for a 17 percent real increase in the Advanced Technology Developments. Primary efforts are being focused on a set of high-leverage technologies such as:

- Precision-Guided Munitions Technology--The DoD precision-guided munitions (PGM) S&T effort will capitalize on advances made in micro-electronics and signal processing. Payoffs include adverse weather and long-range engagement PGM capabilities as well as improved short-range capabilities.

- Directed Energy Technology--We will concentrate our efforts on identifying the scientific and engineering uncertainties associated with laser and particle beam technology, the means for their resolution, and on determining the feasibility and utility of directed energy weapons for the 1980-1990 environment.

- Very High Speed Integrated Circuits (VHSIC)--The VHSIC program is designed to expedite innovation in an area essential to DoD's mission, but an area where DoD and commercial consumer needs are diverging. The goal is to achieve major advances in an accelerated time frame in IC technology, including an order of magnitude reduction in size, weight, power consumption and failure rates and a hundred-fold increase in processing capacity. ICs with these capabilities will allow important and significant advances in cruise missiles, satellites, avionics, radar, undersea surveillance, electronic warfare, communications and intelligence systems.

- Advanced Composite Materials--Efforts are directed at development of materials that can be used to improve survivability and accuracy of advanced re-entry vehicles under adverse conditions, and to improve the structural performance of a wide variety of military systems.

- Manufacturing Technology--The program develops techniques to reduce the cost of production of the entire spectrum of commodities purchased by DoD. Illustrative examples include programs in composite materials fabrication, advanced inspection methods, and improved technology for ammunition production.

2. Strategic Programs

We will continue to rely on a TRIAD of offensive forces to ensure that the U.S. maintains a position of essential equivalence. However, we are concerned about the increasing vulnerability and age of these forces, and our key programs are aimed at easing these concerns. We are in the midst of an intensive study on the best way to enhance the survivability of our ICBM forces, and we expect to make a decision on this issue in FY 1979. In FY 1980, we expect to be in full-scale development of a new missile (M-X) and an associated basing system. The SLBM force continues to be our most survivable TRIAD element, and our current actions are designed to provide even greater assurance of its enduring survivability. Introduction of the longer range TRIDENT I missile, to be backfitted into POSEIDON submarines and later deployed on TRIDENT submarines, will allow our submarines to operate in larger ocean areas, making them harder to find and thereby more survivable. When the quieter TRIDENT submarines are introduced, they will be even harder to find. Development of the TRIDENT II missiles will lead to increased accuracy and throwweight. The air-breathing leg of the TRIAD will rely heavily on the air-launched cruise missile (ALCM)/B-52 combination. ALCM activity will include a fly-off between two candidate missiles leading to a production decision in February 1980.

Our defensive programs are oriented primarily toward Ballistic Missile Defense (BMD) technology development and improvement of our ability to detect and characterize air and missile attacks on the CONUS. Our BMD technology efforts can provide us with an option to deploy a BMD system in the future should we deem it necessary. Air defense will continue to rely on a variety of dedicated active and Air National Guard squadrons, augmented with additional tactical fighters as needed. Programs for warning and detection include improvements to our satellite early warning system and a variety of ground-based radars such as the BMEWS, PARCS, PAVE PAWS, and DEW radars.

Our main concern with strategic control programs is to ensure that we have an adequate, survivable means for controlling our strategic forces; our long-term goal is to make our C^3 capability as survivable as our SLBM force. One of the main thrusts is to ensure that the National Military Command System can provide reliable and responsive support through the attack phase of a general nuclear war and into the post-attack period. Key efforts include development of the E-4B Advanced Airborne Command Post; upgrade and expansion of the TACAMO aircraft fleet for future control of the TRIDENT and POSEIDON submarines in both the Pacific and Atlantic Oceans; and improvements to the AFSATCOM system to ensure worldwide communications to our nuclear forces.

3. Tactical Programs

In view of the destabilizing effect that the increasing capability of Warsaw Pact forces has had on the military balance, U.S. and NATO tactical forces capabilities need to be upgraded. Maximum use will be made of technological superiority and creativity to develop weapon systems able to defeat larger numbers of enemy systems. Reduction in costs for acquisition, operation and maintenance will be achieved by life extension programs and by cooperative programs with our allies.

The modernization of theater nuclear warfare systems includes the 8-inch artillery rounds, a new warhead for the LANCE missile, PERSHING II ballistic missile, the Ground-Launched Cruise Missile, and development concepts for a theater long-range mobile ballistic missile. These efforts include enhancement of system survivability and security.

Land Warfare capabilities are being improved on a broad front. Combat-zone programs such as the SOTAS, TPQ-36 and TPQ-37 radars and the Miniature Remotely Piloted Vehicle, together with longer-range theater surveillance and reconnaissance efforts will provide the battlefield commander with timely and accurate information on the deployment of opposing forces. Close combat systems, such as the XM-1 tank, Infantry Fighting Vehicle/Cavalry Fighting Vehicle, improved Light Anti-Tank Weapon and improved TOW anti-tank missile system will provide a combined arms force better equipped to defeat a numerically superior armored force. Fire support systems, such as the Advanced Attack Helicopter armed with the HELLFIRE anti-tank missile, the COPPERHEAD laser-guided projectile and the General Support Rocket System, are complementary weapons that in combination will improve our ability to counter and defeat massed armor attacks. The new family of complementary air defense systems, PATRIOT, ROLAND and STINGER missiles and the Division Air Defense Gun (DIVAD), provide the necessary modernization to counter the significantly expanded air threat to our ground forces. Development of a more mobile assault vehicle will improve our amphibious assault capability.

Naval Warfare capabilities will be enhanced by programs such as the LAMPS MK-111 helicopter, the P-3 modernization and its eventual follow-on maritime Patrol Aircraft, and an advanced aircraft carrier. Improvements to the MK-48 torpedo, development of an Advanced Lightweight Torpedo, and development of underwater towed arrays should provide a better capability to cope with the projected increased submarine threat to our sea lines of communication. The surface threat requires that we proceed with programs such as Over-the-Horizon (OTH) Targeting, and the TOMAHAWK, HARPOON and PENGUIN missiles for long-, medium- and short-range application. Improved fleet air defense will be provided by development of systems such as AEGIS and improved standard missiles and deployment of the PHALANX gun system and Improved Point Defense Missile System. Mine Warfare advancements will be provided by such programs as the MH-53E helicopter for minesweeping and the CAPTOR, Intermediate Water Depth and QUICKSTRIKE mines for deep, intermediate and shallow-depth mining, respectively.

In Air Warfare, continued procurement of the F-14, F-15, F-16 and F/A-18 will ensure that we maintain our current advantage in air superiority capabilities, particularly when development of a new Advanced Medium-Range Air-to-Air Missile and improvements to today's SIDEWINDER are also completed. Continued procurement of the A-10, F-16 and F/A-18 and a variety of systems such as Assault Breaker, Wide Area Anti-Armor Munitions, Imaging Infrared MAVERICK and Air-to-Ground Stand-Off Missiles will improve our ability to support our ground forces in coping with the projected armored threat. Full-scale development of the High Speed Anti-Radiation Missile and advanced development of a short-range Advanced Defense Suppression Missile will provide increased survivability of our aircraft in a difficult air defense environment.

Our mobility forces will be enhanced through a variety of rotary and fixed-wing programs, as well as improvements to our sealift capability. Procurement of the CH-53E and BLACKHAWK modernization of the CH-47 and replacement of our present combat rescue helicopter should significantly enhance the maintainability, reliability and survivability of our helicopter forces, while modification of the C-5A wing, lengthening the C-141 and emphasizing the very efficient CRAF modification program will go a long way toward alleviating our strategic airlift shortfalls. Sealift improvements are being made in the areas of off-shore bulk fuel transfer, underway replenishment and container off-loading and transfer.

Theater and tactical C^3I programs are aimed at improving interoperability between the Services and with the general purpose forces of our allies, as well as providing needed mobility features. Greater attention is also being focused on protection of our systems from hostile counter-C^3 efforts. Improved theater command and control will be provided by development of a deployable crisis management capability. The control of Naval forces will be enhanced by improved integration and automation of Navy command and control facilities. Improvements in theater and tactical data communications will result from the development of the Joint Tactical Information Distribution System (JTIDS); from programs directed at providing accurate, timely and common perception of the combat situation; and from efforts to overcome the shortcomings to today's friend-or-foe identification systems. Continued deployment of the AWACS, modernization of the EP-3E, and improvements in intelligence support to NATO are intended to enhance our theater surveillance and reconnaissance capabilities, while tactical capabilities will benefit from initiation of the TR-1, development of improved airborne radars, acquisition of complementary ground-based and airborne SIGINT sensors, development of the Precision Location Strike System (PLSS), and evaluation of automated sensor information fusion centers that provide improved near-real-time location and identification of land targets and dissemination of targeting data. Communication systems with greater reliability and survivability will permit us to make better use of forces; specific programs include the Ground Mobile Force Satellite Communications, Joint-Tactical Communications (TRI-TAC) and Combat Net Radio. Special attention is being focused on upgrading our electronic warfare capabilities, including self-protection systems against Soviet air defense systems and command, control and communication jammers.

4. Defense-Wide Support Programs

Defense-wide C^3I programs are designed to enhance U.S. operations worldwide by developing systems that provide a tie between decision-making elements and operating elements in support of both strategic and general purpose forces. Improvements are being made to our intelligence capabilities in areas such as the Consolidated Cryptologic Program, the General Defense Intelligence Program, Indications and Warning Intelligence, and particularly in the use of national and tactical intelligence assets in support of tactical forces. Navigation and position-fixing capabilities will be substantially enhanced by continuing development of the NAVSTAR Global Positioning System and user equipment. Greater communications capacity, reliability and survivability will be provided by development of a follow-on satellite for the Defense Satellite Communications Systems and by other communications efforts, such as the AUTOSEVOCOM II and Digital European Backbone. Opportunities for cost-savings are being enhanced by sharing of satellite communications and consolidation of facilities.

Other key defense-wide support activities include test and evaluation and space and orbital support. The test and evaluation program continues to emphasize the improvement of reliability and reduction of the vulnerability of our weapon systems. Space and orbital support activity continues to center around the Space Shuttle. We are continuing development of the Inertial Upper Stage to deliver DoD and other shuttle user spacecraft to the required orbits, and we are providing a shuttle launch and landing capability at Vandenberg Air Force Base.

Table I-1

R&D/FUNOING BY MAJOR MISSION AREA
($ Millions)

	FY 79 (FY 79 $)		FY 79 (FY 80 $)		FY 80 (FY 80 $)		% Real Increase
S&T Program	2540		2700		2948		9.2
Defense Research		477		507		573	13.0
Exploratory Development		1550		1648		1739	5.5
Adv. Tech. Developments		513		545		636	17.0
Strategic Warfare	2383		2533		2411		-4.8
Strategic Offense		1701		1808		1589	-12.0
Strategic Defense		408		434		446	2.8
Strategic Control		274		291		375	29.0
Tactical Warfare	5310		5644		5251		-7.0
Land Warfare		1163		1236		1023	-17.0
Air Warfare		1427		1517		1294	-15.0
Naval Warfare		1473		1566		1556	0.6
Combat Support		1248		1327		1378	3.8
Includes Mobility, Logistics, Tactical C^3, CB Defense, Electronic Warfare, etc.							
Oefense-Wide C^3I	672		714		910		27.0
CDIP		424		451		658	46.0
Global Comm.		248		264		252	-5.0
Defense-Wide Management & Support	1868		1986		2016		1.5
Technical Integration		115		122		129	5.7
Test & Evaluation Support		1001		1064		1064	0.0
Int'l Cooperative R&D		11		12		14	17.0
Management Support		376		400		399	-0.3
Oefense-Wide Mission Support		366		389		410	5.4
Includes Space, Weather Support, etc.							
TOTAL	12774		13578		13536		-0.3

Table I-2

PROCUREMENT BY DEFENSE PROGRAM CATEGORY
($ Millions)

	FY 79 (FY 79 $)	FY 79 (FY 80 $)	FY 80 (FY 80 $)	% Real Increase
Strategic Forces	2,995	3,160	4,914	56.0
General Purpose Forces	22,141	23,363	23,624	1.1
Intelligence and Communications	3,015	3,181	3,357	5.5
Airlift/Sealift	389	410	402	-2.0
Guard/Reserve Forces	1,448	1,528	1,276	-16.0
Central Supply/ Maintenance	927	978	1,013	3.6
Training, Medical, Other Personnel Activities	452	477	503	5.5
Administration and Associated Activities	48	51	63	24.0
Support to Other Nations	85	90	250	180.0
TOTAL	31,500	33,238	35,402	6.5

II

II. NET BALANCE--MILITARY EQUIPMENT AND TECHNOLOGY

A. INTRODUCTION

Our military posture is dependent upon the calibre of our military personnel, our allies, and the military equipment provided through our program of Research, Development, and Acquisition (RD&A). Our people and our allies are a great source of strength in any comparison with the Soviet Union and the Warsaw Pact. Our FY 1980 program of RD&A has been tailored to exploit these strengths as well as the relative weaknesses of the USSR. We have emphasized development and production, jointly with our allies, of weapons systems which will significantly improve the military effectiveness of our forces and the forces of NATO.

But the Soviet military investment effort continues to increase steadily and to pay off in both improved R&D capabilities and the deployment of improved weapon systems. During the past year, for example, the Soviets have demonstrated significant new capabilities in areas where the US has been clearly superior, including a look-down/shoot-down interceptor; improved ICBM accuracy; and high-speed computers. In addition, the level of Soviet military production continues to permit both increases in the inventories of most weapons and the rapid modernization of their forces in almost every mission area. The continuity and stability of this large and growing Soviet military investment program will present a growing challenge in the near term.

I believe that the near-term RD&A balance will continue to move toward the Soviet's favor. This is so for two reasons:

- First, the CIA estimates that in the immediate future the Soviets will continue the steady increase (in real terms) in their total defense spending and military investment--even in an environment of a diminishing rate of overall economic growth and successful conclusion of a strategic arms control agreement. Therefore, the momentum of the Soviet military buildup appears unlikely to diminish in the next few years.

- Second, those initiatives we have taken, both unilaterally and cooperatively with our allies, to redress the adverse trends will not pay off immediately. Until they do so, the relative imbalance of military investments and production accumulated during the past decade will continue to generate advantages in deployed weapons and equipment to the Soviet Union.

The assessment which follows compares US and Soviet military RD&A, considering defense investment, the acquisition process for major weapon systems, the balance of equipment--deployed, in production, and under development--and the status of underlying military technology.

B. DEFENSE EXPENDITURES AND INVESTMENT

US estimates of the resources expended for Soviet military forces are discussed in detail in the Annual Report of the Secretary of Defense. The estimated dollar value of Soviet total defense expenditures exceeds our own by 25 to 45 percent. And that lead is expected to persist, even with a three percent annual growth rate in US defense expenditures.

Within the defense budget, a key indicator of future military capability is defense related investment, which includes expenditures for RD&A of military systems and construction of military facilities. During the past four years, the dollar value of Soviet investment in defense has been about 75 percent greater than corresponding US defense investment. See Figure II-1.

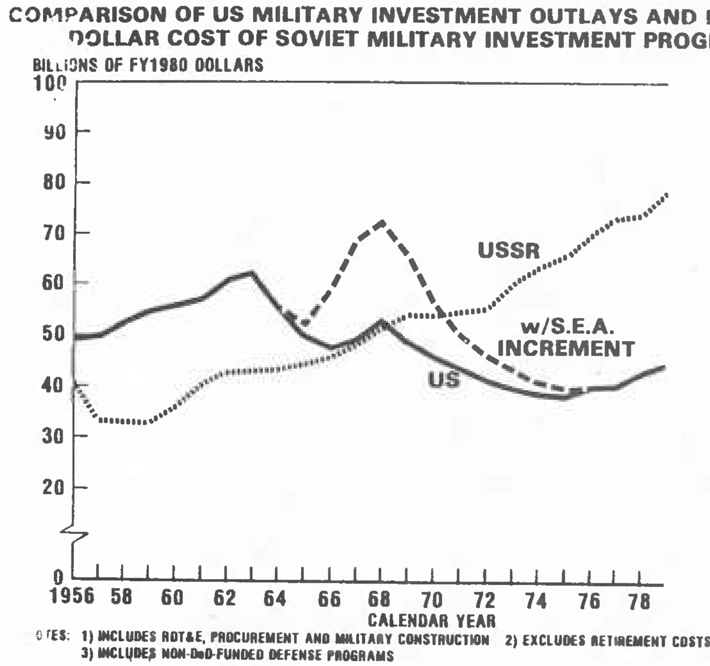

Figure II-1

Another important factor in the military investment balance is the relative contribution made by NATO and the Warsaw Pact. Recently, total NATO defense expenditures slightly exceeded those of the Pact. However, the Soviet-dominated Pact allocates its comparable total defense resources quite differently than NATO. The USSR devotes approximately 50 percent of its defense budget to investment, including about 20 percent for RDT&E; NATO percentages are far lower. As a result, total Pact investment expenditures for military R&D, procurement, and military construction exceeded those of NATO by about 20 percent for the past three years. Moreover, the USSR reserves to itself almost all military R&D and generally requires its allies to standardize mostly on Soviet designs.

C. WEAPONS ACQUISITION PROCESS

The Soviet weapons acquisition process is more highly structured than our own, with high level, centralized decision making and control and a character of immutability. Approvals for the formal development phases of major systems are obtained only after review at the highest levels of government.

Nine industrial ministries are the prime performers of defense related research, development, test, and production. Each ministry is responsible for the development of specific military products. The focal points for all design and development activities within each ministry are the design bureaus. They are essentially the prime systems managers and are supported by both production plants and research institutes. In many cases, the design bureaus are headed by prominent, long-tenured designers.

Key personnel involved in the development and production of Soviet weapons tend to retain tenure for the duration of more than one complete system acqusition cycle. And total employment at design bureaus and major series production plants appears to remain relatively constant or grow steadily, independent of the start or completion of major programs. Stability throughout this system creates momentum by providing a base of experienced design, developmental and managerial personnel, and a continuous stream of weapon system options. It also facilitates long-range planning and the application of resources to attain long-range goals.

The Soviet R&D process also leads to conservatism in design goals, recognizing the importance of meeting schedules approved at the highest levels of government, and the opportunity to provide subsequent performance improvements given the stability and availability of design and production personnel.

This process is consistent with volume production of evolutionary weapons which are characterized by relatively modest performance improvements. Difficult and high risk developments are generally attacked by allowing for long-term, step-by-step solutions to problems and by proceeding with parallel development as illustrated by the Soviet ICBM programs.

My overall assessment of the Soviet military acquisition process is that it has been extraordinarily successful in producing large quantities of steadily improving weapon systems. There are several features of Soviet weapons acquisition from which we can profit.*

- Emphasis on meeting weapons deployment schedules, even at the cost of fielding a system whose performance goals cannot be realized initially.

- The deliberate use of progressive modification programs as a means of incorporating into deployed weapon systems sub-system improvements made possible by later developments.

But the Soviet RD&A process is relatively inflexible, as the established priorities and procedures become so entrenched that participants tend to be discouraged from attempting new approaches or innovations, regardless of their merit. The incentives favor avoiding risky new approaches.

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*These features have been used in major US weapons systems programs, in particular POLARIS and MINUTEMAN I, both of which achieved early IOC and were improved by later modifications.

In contrast, the US weapons acquisition system is conditioned to accept and encourage new approaches. The majority of design and development is performed by contractors in a competitive environment, not by government design bureaus. Given appropriate incentives, our industrial base can respond rapidly to changing military demands. Competition and relatively open debate throughout the entire US acquisition cycle encourage identification and development of the best ideas and end products. The result is a tendency to innovate and press for optimum performance, sometimes at the expense of program cost and schedule.

Continuity of the US development team depends upon the particular program--it is not inherent in the system. Design team continuity was achieved in our SLBM program for a period of more than 20 years as a result of successive awards to the same prime contractor. Similar continuity in design and development of ICBMs was maintained via systems engineering and integration contractors. But there have been striking discontinuities associated with tactical missiles, SAMs, and ABM systems because of variations in perceived need and the large contractor base competing for these programs.

In summary, the Soviet system has the advantages associated with structural continuity--principally the ability to produce evolutionary systems in large numbers. But rigidity and procedural limitations greatly reduce efficiency and incentives to innovate. The US system has the advantages that come with flexibility, openness, and competition--advantages in innovation, technical excellence, and the exploitation of the new and revolutionary.

D. BALANCE OF MILITARY EQUIPMENT

1. Strategic

During the past decade, the estimated dollar value of Soviet strategic force expenditures has been approximately two and one half times that of the US, and during the past four years nearly triple that of the US.

a. Deployed Equipment

US and Soviet strategic systems deployed as of January 1, 1979, are shown in Table II-1. Soviet ICBMs include about 300 SS-17 and SS-19 launchers in converted SS-11 silos. And there are nearly 200 SS-18 launchers deployed in converted SS-9 silos. These ICBMs can carry either single, high-yield warheads or MIRVs. The US ICBM force includes 54 TITAN IIs and 450 MINUTEMAN IIs (each with one warhead) and 550 MIRVed MINUTEMAN IIIs (with up to three RVs per missile).

Our SLBM force includes 41 submarines. Ten carry a total of 160 POLARIS A-3 missiles equipped with three MRVs. The remaining 31 carry a total of 496 POSEIDON MIRVed missiles, each with up to 14 MIRVs.

The Soviets have deployed 950 modern SLBMs. The DELTA I and DELTA II submarines are equipped with the SS-N-8, a single warhead missile. At least one of the YANKEE-class submarines has been backfitted with SS-NX-17 missiles, providing greater accuracy and range than the SS-N-6 which it replaced. The Soviets have begun to deploy the MIRVed SS-N-18 missile in the DELTA III. The SS-N-18 includes MIRVed versions with a range of about 7500 km. Both the

Table II-1

Deployed Strategic Systems (1 January 1979)

SYSTEM	QUANTITY US	QUANTITY USSR	QUALITY (ONE-ON-ONE)
Offensive			
Operational ICBM Launchers[1,2]	1054	1400	USSR superior in hard target lethality, reload
Operational SLBM Launchers[1,3]	656	950	US leads in MIRV, accuracy, and launch platform quality. USSR leads in range, yield.
Operational Long Range Bombers[4,5]	348	150	US leads.
Force Loadings[6] Weapons	9200	5000	USSR leads in yield.
Defensive[7]			
Air Defense Surveillance Radars	59	7000	USSR superior.
Interceptors[8]	309	2500	US superior.
SAM Launchers	0	10,000[9]	USSR superior--no effective US network deployed.
ABM Defense Launchers	0	64	USSR superior--no effective US system deployed.

1. Includes on-line missile launchers as well as those in overhaul, repair, conversion, and modernization.
2. Does not include test and training launchers, but does include launchers at test sites that are thought to be part of the operational force.
3. Includes launchers on all nuclear-powered submarines and, for the Soviets, operational launchers for modern SLBMs on G-class diesel submarines--older SLBMs are not accountable under SALT.
4. Excludes, for the US: 3 B-1 prototypes and 68 FB-111s; for the USSR: BACKFIRE.
5. Includes deployed, strike-configured aircraft only.
6. Total force loadings reflect those independently targetable weapons associated with the total operational ICBMs, SLBMs, and long-range bombers.
7. Excludes radars and launchers at test sites or outside CONUS.
8. These numbers represent Total Active Inventory (TAI).
9. These launchers accommodate about 12 thousand SAM interceptors. Some of the launchers have multiple rails.

SS-N-8 and the SS-N-18 would permit the Soviets to hit targets in the US from patrol areas in the Barents Sea.

The air-breathing leg of our strategic TRIAD includes B-52 long-range bombers, FB-111 medium bombers, and KC-135 tankers. Presently deployed Soviet long-range bombers include the BEAR and BISON, both introduced in the mid-1950s. BACKFIRES are now deployed with Soviet Long Range Air Forces, probably in support of peripheral attack missions.

Our dedicated continental air defenses include manned interceptors augmented by Tactical Air Command F-15 and F-4 aircraft. Warning of attacks from air-breathing systems will come from the Distant Early Warning (DEW) and the Pinetree Lines and from CONUS-based radars. Since the Joint Surveillance System is designed for air sovereignty control at low cost and is non-survivable, crisis Air Defense depends upon the E-3A AWACS. A total of 34 AWACS are tentatively planned for operation, with six currently earmarked for North American employment in peacetime and further augmentation in a crisis.

Surveillance and early warning of missile attacks will continue to be based on satellite-based infrared detection, the Ballistic Missile Early Warning System (BMEWS), the Perimeter Acquisition Radar Attack Characterization System (PARCS) and the PAVE PAWS and FPS-85 anti-SLBM phased array radars. We have dismantled our ABM site in North Dakota.

Soviet anti-bomber defenses include about 2500 manned interceptors and 10,000 SAM launchers. Their ABM defenses include 64 GALOSH missile launchers. The Soviets also have an operational ASAT system.

b. Production and System Development

Since 1968, the end of a period of high US activity, the Soviets have produced more than twice as many ICBMs as the US and 40 percent more SLBMs. Deployment of the SS-17, SS-18, and SS-19 ICBMs is continuing at the combined rate of about 125 missiles per year. We estimate that modifications to the SS-19 and the SS-18 will result in a significant CEP improvement by the early 1980s.

We will be improving our MINUTEMAN force by refitting some of the MINUTEMAN IIIs with MARK 12A warheads which, in conjunction with NS-20 guidance improvements, will improve MINUTEMAN hard target capability. We anticipate that the first TRIDENT submarine, equipped with 24 TRIDENT I (C-4) MIRVed missiles, will complete construction in FY 1981, and we will be backfitting C-4 missiles into POSEIDON submarines. A summary of R&D in support of future strategic offensive systems is provided in Table II-2.

Soviet R&D in strategic defense includes a significant effort to counter bombers and cruise missiles penetrating at low altitudes. The Soviets have not yet developed a look-down radar comparable to AWACS, and such an aircraft is unlikely to become operational, even in small numbers, before 1982. They are developing a modified FOXBAT with a look-down/shoot-down capability against bombers and fighters. This system could begin to enter the force in 1981. In addition, the SA-X-10 surface-to-air missile is currently under development and is expected to be operational in the near future.

Table II-2
Comparison of Key Strategic Offensive R&D Programs

SYSTEM	USSR R&D PROGRAMS	US R&D PROGRAMS
ICBM	SS-17 MOD SS-18 MOD SS-19 MOD	MM Improvements
	Fifth Generation ICBMs (Four Missiles)	MX
SSBN/ SLBM	Typhoon SSBN Large SLBM (Typhoon)	TRIDENT I TRIDENT II TRIDENT Sub
Bombers	Long Range	B-52 Improvements
Cruise Missiles	(1)	ALCM

1. We have not yet identified a Soviet cruise missile program comparable to the Air Launched Cruise Missile (ALCM).

US R&D in strategic defense includes programs in support of improved bomber warning and improved tactical warning and assessment of ballistic missile attack. We are improving the reliability and capability of the Ballistic Missile Early Warning System (BMEWS) and plan to complete deployment of two coastal-based SLBM warning radars (PAVE PAWS) in FY 1980. We are developing evolutionary improvements to present satellite-based infrared detection sensors along with R&D in support of a new generation of spaceborne missile surveillance sensors.

Both the US and the USSR maintain active R&D programs in support of Ballistic Missile Defense (BMD). The US BMD R&D program includes a broad-based advanced technology program to maintain our technology lead over the Soviet Union and a systems technology program to hedge against future capabilities and uncertainties.

Having already tested an orbital anti-satellite (ASAT) system, the Soviets are working on other technology programs that appear to be ASAT related. While we have stated our preference for an adequately verifiable ban on ASAT systems and begun active discussions with the Soviets on this subject, we are continuing with programs to protect our satellite systems. We are continuing R&D on an orbital ASAT system and will continue to investigate advanced concepts such as high energy lasers.

2. <u>Theatre Nuclear Forces</u>

a. <u>Deployed Equipment</u>

Of the nuclear weapons allocated to tactical use, about 7000 offensive warheads are in or near the European theatre. We estimate that a larger number of Soviet warheads are committed to the Warsaw Pact.

The NATO nations have deployed multi-purpose weapon systems in the interest of efficiency and in concert with future uncertainties about the nature of a European conflict.

The Soviet Union has placed high priority on large theatre nuclear force levels. But recent emphasis on qualitative improvements is apparent in Soviet ballistic missiles now deployed in support of the Warsaw Pact.

NATO theatre nuclear delivery systems include tactical aircraft, medium bombers, short range surface-to-surface missile (SSM) launchers (e.g., PERSHING, LANCE, HONEST JOHN, PLUTON), French IRBM launchers, SLBM launchers (US, UK, France), and nuclear artillery. Warsaw Pact forces include both Soviet and non-Soviet Warsaw Pact (NSWP) delivery systems. The ground forces of all NSWP countries possess weapons with nuclear delivery capability. However, all nuclear warheads appear to be under Soviet control. The Warsaw Pact nuclear-capable systems include Frontal Aviation tactical aircraft, medium bombers, short-range missile launchers (SCUD, FROG), IR/MRBMs (SS-4, SS-5, SS-20), and artillery tubes projected by DIA to have a nuclear capability.

b. Production and System Development

Tactical nuclear missiles produced in quantity in NATO and the Warsaw Pact during the past five years are listed in Table II-3.

Table II-3
Tactical Nuclear Missiles
(Produced in Quantity Since 1974)

NATO/US	WARSAW PACT/USSR
PERSHING	FROG 7
LANCE	SS-12
PLUTON	SS-21
	SS-22

Research and development in support of future theatre nuclear systems/components is summarized in Table II-4.

3. Ground and Tactical Air Forces

a. Deployed Equipment

Deployed equipment in support of NATO and Warsaw Pact forces is compared in Table II-5. Although many of the Warsaw Pact systems are outperformed by their NATO counterparts--in particular, combat aircraft--there is a significant Warsaw Pact edge in the quantities of most deployed equipment.

Table II-4

Theatre Nuclear Systems - Key Development Programs

SYSTEM/COMPONENT	US	USSR
Short-Range/ Battlefield	Nuclear Munitions (155mm and 8 inch)	Nuclear Munitions
	Improved LANCE Warhead	Mod or Follow-on to SCUD, SS-21, and SS-22
Intermediate and Long-Range Systems	PERSHING II[1]	SS-20 Follow-on
	Medium Range Ballistic Missile[1]	
	Ground Launched Cruise Missile[1] (GLCM)	Cruise Missiles
	Sea Launched Cruise Missile (SLCM)[1]	
	Nuclear Capable Aircraft[1] F-16 F-18	Nuclear Capable Aircraft
	Air Launched Cruise Missile[1,2] (ALCM)	

1. An appropriate mix of future US systems is expected to be drawn from among these ongoing R&D programs.
2. Though currently considered a strategic system, the ALCM could have a variety of applications in either a short or long range version.

Table II-5

NATO Deployed Forces--Land and Tactical Air

	APPROXIMATE FORCE SIZE RATIO[1] (NATO AND WARSAW PACT)	QUALITY
Tanks	1:2	NATO leads in lethality and envelope.
Armored Personnel Carriers	1:2	Warsaw Pact leads.
Anti-Tank Missile Launchers	2:1	NATO leads, but losing edge.
Artillery Tubes and Rocket Launchers	1:2	Equal--USSR leads in diversity; US leads in lethality.
Combat Aircraft (including air defense aircraft)[2]	1:1	US leads.

1. Includes France and US and allied reserve component equipment.

2. Also includes naval aircraft and combat-capable trainers in combat units.

b. Production and System Development

Although many Soviet systems are outperformed individually by US systems, the clear Soviet advantage in weapon production has allowed introduction of emerging technology into the force faster than in the US.

Despite their demonstrated ability to develop and produce high technology weapons systems when they are assigned a high priority, the Soviets continue to experience difficulties in mass production and maintenance of certain high technology tactical systems. Soviet aircraft are overweight by US standards, with limited avionics sophistication. Only recently has the Soviet Union fielded proximity fuzes with field artillery, and they appear to lag behind the West in precision-guided munitions.

Systems currently under development are compared in Table II-6.

Table II-6

Ground and Tactical Air
Key Development Programs

SYSTEM	US PROGRAM	USSR PROGRAM
Tank	XM-1	T-80
SAMs	ROLAND PATRIOT	 SA-X-11
Helicopters	AAH CH-47 MOD	Hind Follow-on Heavy Lift
Attack/ Fighters	F/A-18 F-16 Enhanced Tactical Fighter	Ground Support Air Superiority Advanced VSTOL

4. General Purpose Naval Forces

a. Deployed Equipment

The total number and displacement of major general purpose naval ship forces is compared in Figure II-2.

GENERAL PURPOSE NAVAL FORCES OF NATO AND THE WARSAW PACT

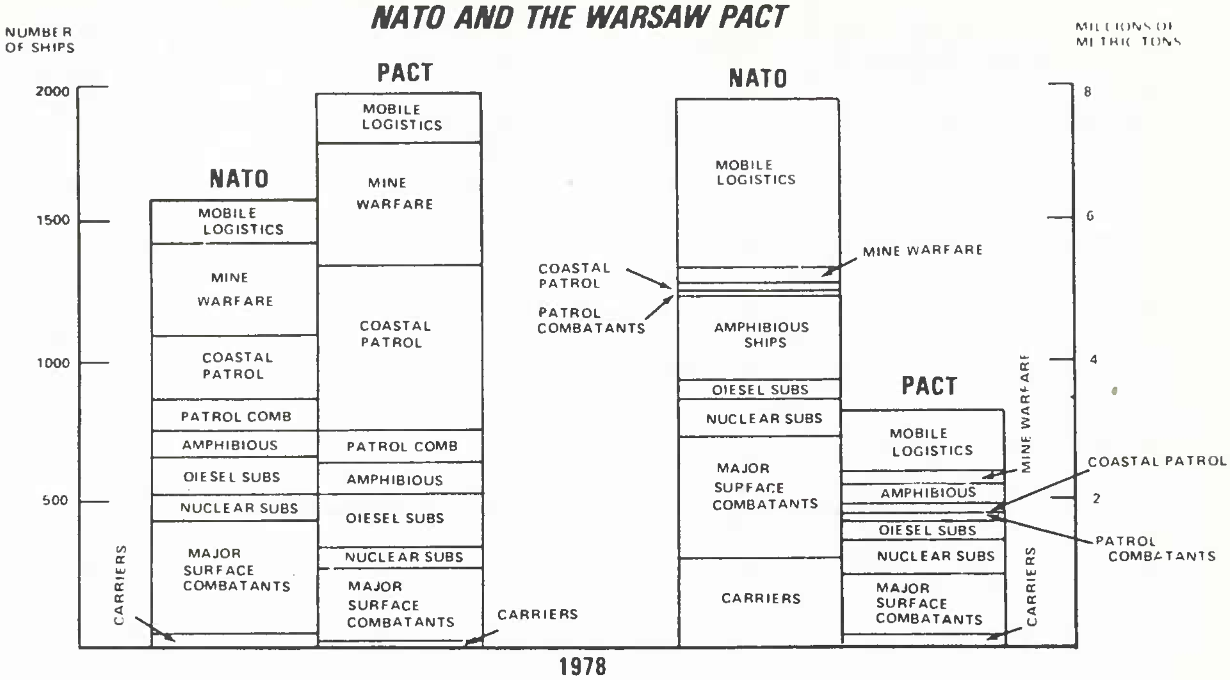


Figure II-2

A qualitative comparison of naval forces is provided in Table II-7.

Table II-7
Qualitative Comparison of Deployed
General Purpose Naval Systems

DEPLOYED SYSTEM	US SUPERIOR	US-USSR EQUAL	USSR SUPERIOR	COMMENTS
SSNs	X			USSR advantage in maximum speed
Anti-Submarine Warfare	X			Major efforts underway in both US and USSR
Land-Based Naval Air			X	
Sea-Based Air	X			USSR developing in this area
Surface Combatants		X		
Cruise Missile		X		
Mine Warfare			X	CAPTOR technology superior to USSR deployed technology

The Soviets have acquired strong capabilities against aircraft carriers operating within strike range of the USSR and diversified their inventory of anti-ship missiles on nuclear-powered submarines and surface combatants. More recently, Soviet helicopter and VTOL carriers have also been produced. These are principally armed for ASW and anti-ship missions, but the VTOL aircraft provide some power projection capability as well.

b. Production and System Development

A major part of Soviet investment has been focused on ships and naval aircraft associated with open ocean ASW and open ocean anti-ship operations. The Soviets have an extensive ASW R&D program devoted both to acoustical and non-acoustical detection sensors. The development of submarine detection systems depends on advanced signal processing techniques, a critical technology area in which the Soviets are very active.

E. MILITARY TECHNOLOGY

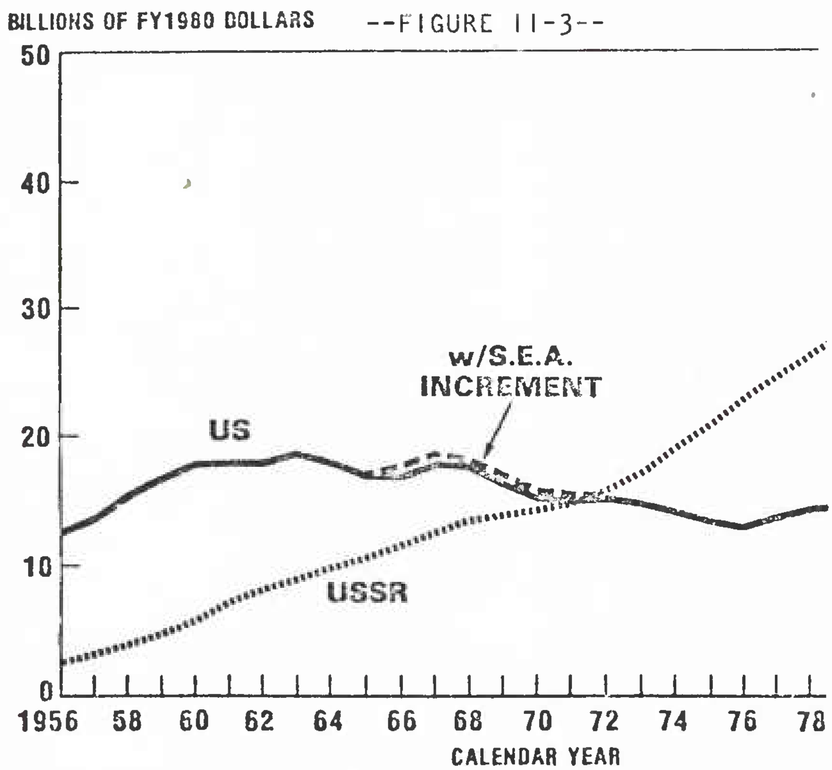
Our traditional approach to offsetting Soviet quantitative superiority in weaponry has been to field more technologically advanced systems. To do this, we have relied on our superior R&D base and our advantage in development of new, revolutionary systems. There is little doubt that our technology is still superior to that of the Soviets in most areas, although that superiority continues to be eroded by the larger Soviet investments. But it is increasingly uncertain whether our technology will produce sufficient military advantage to fully offset our deployed numerical inferiority.

The Soviets clearly have singled out science and technology for special emphasis in their pursuit of military excellence. They acknowledge that our overall lead in science and technology is our greatest competitive asset, and they are determined to eliminate it.

As reflected in Figure II-3, the growth in the dollar cost of Soviet military RDT&E activities has been remarkably steady and substantial for more than two decades. Military R&D cost estimating is uncertain, but the spending trends are alarming. Rapid growth in Soviet expenditures has resulted in a Soviet R&D program that has exceeded our own since 1972 and is now about 75 percent larger in equivalent dollar costs. The difference in the size of the two military RDT&E programs is projected to increase both in absolute and in relative terms, for at least the next five years.

COMPARISON OF US MILITARY RDT&E OUTLAYS AND ESTIMATED DOLLAR COST OF SOVIET MILITARY RDT&E PROGRAMS

--FIGURE II-3--



NOTE: INCLUDES NON-DoD-FUNDED DEFENSE PROGRAMS

Table II-8 compares the status of some important underlying technologies. These lists do not show the fragile nature of technology; e.g., the rate of technological progress over time or the military effectiveness of a particular deployed technology over time. I note that the US lead in most of the technologies listed in Table II-8 has been narrowed in the past few years. As Soviet R&D investments and technological competence continue to increase, they will provide new opportunities for catching and surpassing the US in technology.

One of the most significant observations from this assessment is that while the Soviets lead in none of the basic technologies in Table II-8, they lead in the technology level of quite a few deployed weapon systems. This suggests the need to improve our exploitation of basic US technology as we translate it into deployed military capability.

Table II-8

RELATIVE US/USSR STANDING IN THE TWENTY MOST IMPORTANT BASIC TECHNOLOGY AREAS

BASIC TECHNOLOGIES*	US SUPERIOR	US-USSR EQUAL	USSR SUPERIOR
1. Aerodynamics/Fluid Dynamics		X	
2. Communications	X		
3. Computers and Software	X		
4. Countermeasures		?	
5. Electrical Power Generation Technology		X	
6. Electronic Materials and Integrated Circuit Manufacture	X		
7. Electro-optical Sensors (including IR)	X →		
8. Guidance and Navigation	X →		
9. High Energy Laser Technology		?	
10. Hydro-acoustic Technology	X		
11. Intelligence Sensors	X		
12. Manufacturing Technology	X →		
13. Materials (Lightweight and High Strength)	X		
14. Non-acoustic Submarine Detection		?	
15. Nuclear Warhead Technology		X	
16. Particle Beam Technology		?	
17. Precision Optics	X		
18. Propulsion (Aerospace) Technology	X →		
19. Radar Sensors		X	
20. Signal Processing	X →		

*Criteria for Selection of Basic Technologies Most Important to Future Military Capabilities

1. The list in aggregate was selected with the objective of providing a valid basis for comparing overall US and USSR basic technology. The technologies were specifically not chosen to compare technology level in currently deployed military systems. The list is in alphabetical order.
2. The list was limited to twenty items so that it would be a manageable size for assessment purposes.
3. The technologies selected had the potential for significantly changing the military balance in the next ten to twenty years. The technologies are not static; they are improving or have the potential for significant improvements.
4. The arrows denote that the relative technology level is changing significantly in the direction indicated.

III

III. ACQUISITION MANAGEMENT

To help offset the Soviet achievements of the last decade, we and our allies must do a better job of capitalizing on our technological advantages. Simply stated, we must get superior equipment to our forces in sufficient quantities, get it there sooner, and at an affordable cost. This is a particularly difficult task because of the complexity of modern weapons and rising expenditures for personnel. These factors have caused our Defense systems to become increasingly more expensive to procure, operate, and support. Since 1950, the production cost of a new system has grown at a rate of 4.5 times per decade relative to the cost of the system it replaced. Another disturbing factor is the time it usually takes us to design, develop, produce and field new weapon systems. We must improve the efficiency of the acquisition management process within DoD to achieve the goals stated above. A number of initiatives are underway to this end which can be separated into four general categories: (1) increased use of competition; (2) better control of the program selection process; (3) improved program management policies; and (4) reducing the complexity of the overall acquisition process. We will pursue the cooperative efforts described in Chapter IV in a manner consistent with these initiatives.

A. USE OF COMPETITION

One of our major advantages over the Soviets is the capability for our industry to respond to a competitive challenge. There is ample evidence, both in the defense and commercial markets, to show that industry can achieve significant cost and schedule savings when faced with competition. Unfortunately, we have not benefited from this strength to the extent that we should have--rather, in defense acquisition we have tended toward less competition, especially in the later stages of a weapon's life cycle. It is my goal to reverse this trend and make more effective use of competition throughout the life of a weapon system. To this end numerous initiatives have been undertaken and more will follow--a few are described below.

- Increased use of competitive procurements at the front-end of the acquisition cycle. Encouraging contractors to provide their best ideas early in order to remain in the competition and providing continuous and sufficient funding during these early phases will provide the dual benefits of expanded options for DoD and improved contractor performance. This competition among the best ideas will continue as long as feasible through the development and production of weapons.

- To achieve competition in the later stages we intend to use a "leader/follower" production concept where there will be a sharing of the production effort on long production run programs. One such application is the Cruise Missile program where the winning competitor is given sufficient incentives to develop a second source for the final product. Competition will be maintained as the subsequent production sharing will be based on the relative performance of the two sources. The leader/follower concept has been applied to the engine and guidance components and is planned for the airframe as well.

- Over the past two years the Department has evaluated a 4-step method of competitively selecting sources and negotiating R&D contracts. The 4-steps involve evaluating technical proposals; evaluating cost/price proposals; establishing a common cut-off date for receiving final revisions to proposals; determining the competitive range, selecting the successful contractor, and negotiating a definitive contract. Discussions between the Government and offerors are limited to clarification of the proposals thus reducing the possibility of technical leveling. This should ensure that the final source selection will be from among offerors who initially submit their best technical proposals. This process will also discourage "buy-ins" and government cost/price auctioning. Instructions regarding the use of the 4-step source selection method were incorporated in the Defense Acquisition Regulation (DAR) in October 1978.

B. PROGRAM SELECTION AND PRIORITIES

The methods by which programs are initiated, prioritized and reviewed are critical to the entire process. Inadequate attention to these early decisions has been a major factor contributing to problems in later stages of the acquisition cycle. Some of the efforts of the past year which will continue are described in the following paragraphs:

1. <u>Validation of Mission Needs</u>

In the past it has been possible to start major acquisition programs without sufficient high-level visibility to the specific need and its relationship to overall mission objectives. Often this visibility was first achieved only when these projects reached a stage where significant funding was required, perhaps of such a level to qualify as a major acquisition program. When this occurred a lengthy debate usually ensued involving top management in the Services and OSD and often the Congress as well. The net result has been that programs with a valid need and priority have suffered delays and attendant cost growth while disagreements are settled. Also, many programs whose need and priority do not have a sound basis continue to be funded simply due to momentum or the efforts of advocates.

The time to debate the need and priority is before major funding commitments are made and a cadre of advocates develop. In order to move toward this method of operation we have concentrated efforts in two areas. First we are developing new guidance for the preparation and processing of the Mission Element Need Statement (MENS) to clarify and simplify the process. Beginning with next year's program development, we will require that all new major system starts for the next fiscal year be identified in the Program Objective Memorandum (POM). This action will highlight new major system acquisition programs for review as the Defense Program is being reviewed by the components and by the Office of the Secretary of Defense. It will also improve the tie between the Defense System Acquisition Review Council (DSARC) process with the Programming, Planning and Budgeting System (PPBS) by having a common review before new major system acquisition programs are initiated. Subsequently, when the Amended Program Decision Memorandum (ADPM) establishes the five year program, the need for major new starts which are included will automatically have been established. In the future, we expect to have approved statements of need for these new starts when the budget is submitted.

Second, we are developing a revised mission structure for grouping, categorizing and coordinating research, development, and acquisition activities. The goal is to provide a common mission framework for the assessment of equipment deficiencies. This approach will highlight needs and allow us to set more effective priorities and eliminate duplications. Program initiations will naturally result from Mission Area Analysis (MAA) performed by the Services. The MAA will provide a continuous evaluation of changes in the threat, mission capabilities, and operating concepts, thus providing a prioritized set of deficiencies.

A common set of mission areas should aid our decision process in at least three ways:

- Provide a summary of the complete set of deficiencies related to a mission area, together with the programs and investments for corrective action;
- Highlight areas of duplication between Services early in the R&D cycle; and
- Establish a framework for the analysis of RD&A expenditures based on the relative priority/value of conducting certain missions as opposed to others.

2. Long-Range Investment Planning

Financial constraints facing the Department of Defense require that acquisition decisions correlate closely with long-term policy and strategic objectives, and that overlap and duplication be eliminated from the weapon system acquisition process of the Military Services to the greatest extent possible. In order to improve the efficiency of the acquisition process in this respect, we are developing Department-wide consolidated (as opposed to Service-unique) investment strategies oriented toward future technological military environments, as defined within closely related areas of military activities, or "mission areas"; such as strategic warfare or theater nuclear warfare.

A Theater Nuclear Warfare Coordinating Group has been established on a pilot basis to develop a long-range strategy which coordinates the wide variety of weapon systems required by all of the Military Services in the Theater Nuclear Warfare mission area. By projecting the costs of various alternative weapon acquisitions over a ten or fifteen year period, and relating these projections to long-range policy and strategic goals, substantial improvement is anticipated in the return realized from Defense dollars invested in theater nuclear warfare weapons. As progress is made in the pilot mission area, this planning technique will be applied to other mission area categories.

Implementation of this concept will be a complex process because of the nature and structure of the Defense Programming and Budgeting System. There are two basic problems. First, the POM and budget are necessarily constructed within the framework of a much shorter term than the ten to fifteen year planning span involved in long-term investment planning. Second, the budget is currently comprised of different programs and appropriations spread among the three Military Departments rather than being oriented toward mission areas. In part, these problems will be overcome by the common mission structure referred to earlier.

3. Responsiveness to Needs of the Unified and Specified Commanders

For the past two years, the Commanders of the Unified and Specified Commands have provided their personal development and acquisition concerns directly to the Secretary of Defense. These concerns stem from their perceived operational deficiencies in capability to accomplish assigned missions. The following comments summarize the results of a comparison of the current RD&A program with the needs of the Commanders of the Unified and Specified Commands.

a. Areas of Common Concern

In general, user concerns address a broad spectrum of mission areas. We did not rank-order the specific user concerns, because they are all sufficiently important to warrant attention. Rather, our emphasis has been to identify those areas of common concern to two or more users, as well as those specific needs that will not likely be satisfied without specific action on our part.

All the users expressed a similar need for more reliable, survivable, secure C^3 capabilities. This observation reinforces our own judgments that there are significant C^3 problems to be corrected and that a significant portion of our acquisition resources should be committed to the task. Another common need is for improved reconnaissance and surveillance capabilities, including the need for timely intelligence data processing, dissemination and display. A third common need is for improved fighter aircraft capabilities, particularly for all-weather operation and longer-range kill capabilities (both air-to-air and air-to-ground). Other areas of similar needs include better Nuclear, Biological and Chemical (NBC) warning/survivability and Chemical Warfare (CW) retaliation, strategic and tactical air defense, logistics/airlift and Anti-Submarine Warfare (ASW) systems.

Some examples of programs which are designed to satisfy a few of the more common needs are provided in Table III-1.

b. Areas of Further Evaluation and Action

Specific needs that require further evaluation and action are listed in Table III-2. Some of these needs will be difficult to meet because of technology deficiencies; others are undergoing policy reviews.

Table III-1

REPRESENTATIVE PROGRAMS DESIGNED TO MEET A FEW OF THE COMMON NEEDS

NEED	REPRESENTATIVE PROGRAMS
Better Strategic C^3 Including Surveillance and Warning	Improvements to Ballistc Missile Early Warning System SIBM Radar Warning System Missile Surveillance Technology Warning Information Correlation Satellite System Survivability Integrated Operational NUDETS Detection System Atomic Energy Detection System Spacetrack Improvement NAVSPASUR Improvement Space Surveillance Technology WWMCCS Architecture/Secure Voice COMSEC Improvements AFSATCOM Advanced Airborne Command Post GRYPHON/HYDRUS for SSBN Communications PARCS Range Extension
Better Tactical C^3I, Including Surveillance and Reconnaissance	Submarine/Acoustic Communications Fleet Tactical Communications Equipment JTIDS Tactical Surveillance/Reconnaissance Programs TRI-TAC DCS Long Haul Communications COMSEC Improvements TR-1 Squadron SOTAS BETA Tactical Exploitation of National Capabilities (TENCAP) JINTACCS Airborne Command Posts Quick Strike Reconnaissance System

Table III-1
(Continued)

REPRESENTATIVE PROGRAMS DESIGNED TO MEET A FEW OF THE COMMON NEEDS

NEED	REPRESENTATIVE PROGRAMS
Improved Fighter Aircraft Capabilities	Advanced Medium-Range Air-to-Air Missile Combat Aircraft Technology Night Attack Program AIM-7F Improved Monopulse Air-to-Ground Stand-Off Weapons Wide Area Anti-Armor Munition Airborne Self-Protection Jammer Defense Suppression Missiles/Systems
NBC Survivability	Procurement of Protective Equipment Better Training

Table III-2

ITEMS FOR EVALUATION/ACTION

- Survivable C^3 in trans/post attack
- Sensors for jungle surveillance/reconnaissance
- Improved tactical compasses
- Underwater sensors for mine countermeasures
- Runway repair/ordnance disposal improvements
- Stabilized fuel additives
- Implement better tactical weather support
- Chemical warfare retaliation
- Performance monitoring capability for military systems
- Better energy conservation/alternate fuel sources
- Better reliability/maintainability of armor/anti-armor systems
- Interoperable, survivable, tactical C^3
- New test ranges
- Dedicated space defense C^2 system
- Reusable aerodynamic space vehicle
- Long-range transport for outsize cargo
- Self-contained navigation system for airlift
- Damage assessment of OTH target areas

Still others can be met if specific operational concepts and requirements can be defined or if relative priorities are modified so that additional funds can be allocated. We plan to continue this review and increase the emphasis on comparing our RD&A plans with stated user needs.

C. PROGRAM MANAGEMENT ISSUES

Given that major programs are initiated with a sound basis of need and priority, our next task is to ensure that these programs have an equally sound basis of program management. In this regard, in addition to the need for increased competition which I have already mentioned, two other areas stand out and will continue to receive management attention in the coming year. First is the issue of acquisition strategy--early planning is essential to successful program execution. The second area is related to the above and is the issue of affordability--we should not begin programs that we cannot afford to produce, deploy and support. A review of our activities in these areas follows.

1. Acquisition Strategy

Each major program has its own unique features which dictate that an acquisition strategy be "tailored" for it. Such factors as the number of alternative solutions to be explored, the degree of competition to be achieved, and the relative roles of government laboratories and industry must be based on the nature of the problem, not on a blanket rule. The nature of the mission deficiency, when it must be corrected, and the technology required to correct the deficiency must be paramount considerations. However, since we must be careful not to foreclose options prematurely we must be sure that proper attention is given to a plan for evaluation of alternative design concepts. Also, production management, and operating and system support considerations must be reviewed during the early stages of development. One of the alternative concepts to be considered is the modification of existing systems as an alternative to new systems development in the interest of reduced cost and schedule risks.

One other issue to be addressed in an acquisition strategy is the degree of concurrency to be used. Because of the potential for shortening the acquisition cycle, we plan greater use of concurrent development and test activities when the technological risks warrant it--particularly when competing concepts are being developed in parallel. For example, on the Division Air Defense (DIVAD) gun program, concurrency will result in a full-scale development phase that is at least a year, and possibly two years, shorter than what we would normally expect. This compressed schedule entails program risk; we are reducing this risk by funding two contractors in a "hands-off" competitive development. We expect to use the same technique on other developments in FY 1980.

2. Affordability

Earlier consideration of system affordability on the basis of life cycle costs is also a major goal. We are developing an affordability policy for major defense systems which will ascertain and maintain our financial capability to support both acquisition and deployment of these weapons within the constraints of our foreseeable budgets in the years ahead. This, in turn, will assume that we procure our equipments at economical production rates and avoid the waste that is incurred when we must terminate or stretch out programs that do not fit within one or more fiscal appropriations.

At program initiation we will assess what we can spend to satisfy a military need by considering it in context with other elements of the same mission area and constructing a composite program within a projected mission budget. The affordability of each program, on the basis of life cycle costs, will be examined subsequently at program milestones so that selected program alternatives fall within established limits of affordability. The relative allocation of resources to the various defense missions will continue to depend on changing priorities, and will be decided in the PPBS process. This concept will reconcile the MENS/ DSARC and PPBS processes so that the two management mechanisms complement each other and programmatic and budgetary decisions are not made in isolation or conflict.

In line with the affordability issue, we plan to consolidate similar program activities to reduce undesirable duplication, such as Air Force/Navy air-to-air and air-to-ground weapons and Air Force/Navy self-protection systems.

Greater emphasis on acquisition schedules based on operational needs rather than technological opportunities should also contribute to a more affordable program. The MENS will indicate when a new capability is needed, and the level of technology incorporated in the solution will depend on the need date and the technological opportunities available.

D. ACQUISITION POLICY INITIATIVES

Coupled with efforts to structure the front-end of the acquisition cycle and improve the execution phases are a series of initiatives to simplify the overall process. They include reducing the processes complexity, eliminating unnecessary controls and specifications, and clarifying the intent of our policies. Basically our objective is to make the process work for us rather than provide a set of barriers to the acquisition community. A few of these initiatives are highlighted in the following paragraphs to provide an idea of the thrust of our efforts.

1. Reduction and Simplification of Regulations and Specifications

We are rewriting, with the assistance of the General Services Administration, entire sections of the Defense Acquisition Regulation (DAR) and the Federal Procurement Regulations (FPR). At the completion of this work in 1979, we will have a simplified acquisition regulation, known as the Federal Acquisition Regulation, applicable to all Federal Agencies. This work will reduce the size of the DAR by at least 50 percent. In addition, we have two other initiatives which will consolidate DoD directives and instructions relating to acquisition into a cohesive Defense Acquisition Regulatory System (DARS) and which will eliminate unnecessary specifications. We have already eliminated over 1000 specifications in this latter effort. In summary, we have undertaken significant programs which we believe will simplify the regulatory process for acquisition.

2. Productivity and Responsiveness of the Industrial Base

We are continuing to place prime emphasis on new initiatives to spur more innovation in the industrial base to improve productivity, reduce costs and make the base more responsive to our peacetime and emergency needs.

- In the government-owned sector of the base, we are continuing our efforts to reduce government-ownership of plant and equpment and to place maximum reliance on the privately-owned sector for defense production. Currently negotiations are in process to sell seven government-owned plants to the using contractors. The minimum essential government-owned base will be modernized to improve its readiness capability. Our Energy Conservation and Management (ECAM) program is directed toward the conservation of energy resources in government-owned plants and the program cost savings to be achieved through more efficient energy use. Our goal is a 20 percent reduction in energy use by CY 1985. We are seeking out those incentives which will promote private sector innovation in Defense programs to help regain our technological superiority and, at the same time, provide concomitant benefits to the commercial market. We are requesting continued funding support of our Manufacturing Productivity programs to infuse new and improved technologies throughout the base.

- To assure the continued responsiveness of the industrial base to meet our peacetime and emergency demands, we are sharpening our cognizance over international and domestic issues which could impact adversely upon the defense capabilities of the base. Chief among our concerns are the present indications of skilled manpower shortages, the potential impacts of proposed environmental and safety restrictions upon the base, the phenomenon of "diminishing manufacturing sources", the stability of foreign suppliers of those critical materials required in defense production, and the impacts of international trade case determinations.

- To encourage contractors to invest in cost reducing assets for DoD programs we have revised our profit policy to provide increased profit levels in capital intensive contracts. As a further inducement to contractors to acquire such productivity enhancing equipment, a policy has been promulgated which provides that an investment clause may be included in certain types of DoD contracts. Under this clause, if the contract or program is terminated, the Government will "buy-back" specifically identified items of industrial plant equipment at the then current depreciated value.

- We are continuing our efforts to find the least cost approach to an adequate preparedness posture by pre-stocking critical long-leadtime components, subassemblies, and upgraded material forms to reduce production leadtimes and provide trade-off alternatives to high cost investments in complete weapons systems in our war reserve. To assure the availability of sufficient production capability to meet our emergency demands, we are incorporating "surge" planning requirements into our major acquisition programs. Resolution of deficiencies in the base will be pursued through the authorities in Titles I and III of the Defense Production Act and other appropriate preparedness measures.

3. Small/Minority and Labor Surplus Business

There are two main thrusts of our efforts:

- o We are placing much greater emphasis on breaking out the components of major weapons systems for unrestricted competition to provide increased opportunity for small business, minority business, and labor surplus area firms to become major contributors to the Defense segment of the industrial base.
- o Concurrent with this effort, our acquisition activities will be setting aside for small business, requirements for which there are at least three small firms on the activity's bidder's mailing list.

4. Shipbuilding Claims

With the successful negotiation of the bulk of remaining shipbuilding claims by the Secretary of the Navy, we are looking forward to a period of improved business relationships with the shipbuilding industry. Through a program of new initiatives, we hope to be able to rebuild the viability and responsiveness of this critical sector of the industrial base. Having mutually agreed that past difficulties were contributed to by both the Government and the industry, both parties have consented to a fresh approach to future program requirements. For all future requirements, program risks will be more adequately isolated and defined, agreement will be reached on the sharing of the risks, and both parties will agree to objectively address and resolve problems as they arise. This approach should contribute significantly to precluding a reoccurrence of previous impasses.

5. Independent Research and Development (IR&D)

In the area of IR&D, I intend to continue encouraging greater emphasis on the research end of the spectrum as compared with the development side. IR&D is, of course, industry's program, not government's. Each contractor selects his own projects, choosing those he thinks will maintain and improve his technical competence and his competitive position. The projects are directed to problems with potentially high payoff and they generally attract the highest quality corporate staff. IR&D is, in fact, an integral part of the overall defense technology base and we look to it as a major factor in helping this country maintain its position of technological leadership.

There are a number of areas which we think may prove of great significance in the next decade or sooner. One such area is Very High Speed Integrated (VHSI) Circuits. Exploring the potential of VHSI can be an expensive undertaking but the possible payoff, militarily and in industrial technology in general, is vast. The work performed by industry in these areas provides a double advantage. Not only do we have the benefit of industry expertise, but the costs of IR&D projects do not fall completely on the Government. Much of these costs are absorbed by the contractor and his other customers. We welcome industry's attention, through the IR&D program, to promising technologies like VHSI. We believe that swift and significant advances can be made in explorations of this type through the interaction of our best laboratory people and industry scientists and engineers.

6. Other Activities

- We are modifying our directives which implement OMB Circular A-109 on major system acquisition, to place additional emphasis on retaining the flexibility inherent in that policy and to clarify the policy. We do not want to make the acquisition process a "fill in the blanks" process, rather, the process must recognize that unique features exist in every program and proper treatment of these features often spells the difference between success and failure. These directives are expected to be reissued early in CY 1979.

- Adoption of non-government standards is accelerating. A less than optimum reliance on total resources of the US standardization system can cause excessive costs in defining those products and services for which a non-government standard document exists. Since non-government groups have become more receptive to including Defense needs in their documents, increased reliance is placed upon them. Approximately 1,800 private sector standards have been formally accepted by the Department of Defense in lieu of "military" standards, resulting in overall efficiencies through better use of proven commercial/industrial practices.

- A new policy on the acquisition and distribution of commercial products (ADCP) has been adopted to increase Government acquisition efficiencies and reduce paperwork. Test buys are being conducted in the high inflation areas of subsistence, clothing and textiles, and medical supplies. A DoD Directive on ADCP has been issued. Revisions to the Defense Acquisition Regulation are currently being considered. Wider use of commercial products will avoid development cost and Government specification drafting. Use of commercial channels for distribution will minimize Government transportation and stocking cost.

- A new policy has been issued whch is aimed at reducing direct government surveillance in those contractors' plants which product high quality products. The new directive places greater responsibility on Program Managers to insure adequate consideration of product quality through design reviews and independent quality assessments at appropriate acquisition milestones; it also strengthens the contractors' role in assuring the quality of his product.

- Classic realiability and maintainability (R&M) programs drive acquisition cost and schedule, but they do not sufficiently improve the readiness or reduce the ownership cost of deployed systems. Therefore we have initiated a major reorientation in our approach to this subject. The first DoD Directive on R&M is now in final coordination. It emphasizes early investment to avoid subsequent costs and to help ensure that R&M deficiencies are corrected before deployment. Separate requirements are to be established for the system R&M characteristics directly related to operational readiness, mission success, maintenance manning and logistics support cost. The acquisition community will be held more responsible for meeting those requirements during the deployment phase. With full implementation of the new approach, we expect to see a marked improvement in operational cost-effectiveness for each increment of cost and schedule investment in reliability and maintainability.

- More attention is being placed on material standardization of components/parts so as to insure improved interoperability and cross service supply among Allied forces. The "top down" approach to standardization of systems is not the only approach. Current efforts are taking a "bottom-up" look at systems and equipment to insure maximum standardization and interchangeability of lower assemblies, components, parts and materials. The US recently assumed chairmanship of a NATO group formed to accelerate standardization of Assemblies, Components, Spare Parts and Materials. This group is developing standards governing engineering practices such as drawing and configuration management practices as well as product standards. Our objective is to facilitate interchange of data and to promote interchangeability of components.

- We are striving to improve our contract administration effectiveness and efficiency by developing better organizational arrangements for managing the approximately 25,000 people who perform this function. Each one of the Military Departments as well as the Defense Contract Administration Service maintain contract administration organizations responsible for representing the Defense Department at contractor plants. Although our policies require that only one organization (i.e. one of the Services or the Defense Contract Administration Service) shall represent us at each contractor plant, we are having problems maintaining consistent contract administration policies and practices. The quality of our work force varies considerably among the various contract administration groups, and there are several other difficulties which we can best attack through organizational improvements. We are considering increased centralization of the contract administration function. An analysis is being performed with the Services to examine all potential alternatives. In any case, we have a clear picture of our objectives and we intend to make initial plans for achieving them in early 1979. We expect to make a final decision on our reorganization by July 1979.

IV

IV. INTERNATIONAL INITIATIVES

A. INTRODUCTION

In my overview in Section 1 I described an investment strategy for defense R&D and acquisition which had as one of its major components achieving much greater armaments cooperation with our NATO and other Allies. I see this as indispensable to the common defense. While such cooperation has always been given lip service in NATO, and there have been some solid accomplishments, for the most part such pledges have been honored more in the breach than the observance. However, as I pointed out in Section 1, the steady increase in Soviet military R&D and procurement outlays, which now far outstrip our own, give us no real alternative to wiser utilization of the combined resources of the Western powers if we are to preserve credible deterrence and defense in the 1980s. We and our Allies must squeeze full collective value out of our respective R&D and procurement, and avoid wasteful overlap and duplication, if we are to keep abreast of massive Soviet spending at a cost politically acceptable to our free societies.

As NATO's leading power, the U.S. must give as well as get, in order to promote this more rational utilization of scarce defense resources. The European demand for more of a "two-way street" in reciprocal defense purchases reflects Western Europe's increasing unhappiness with past U.S. domination of the defense R&D process and equipment market. In consequence, our Allies are increasingly designing and producing their own equipment, a sharp departure from the situation in the 1950s and early 1960s. Unless the U.S. provides positive leadership in establishing cooperative armament programs, this trend will likely continue--both reducing our European exports and preventing essential interoperability.

These concepts provided the rationale behind President Carter's initiatives for greater Alliance Cooperation at the May 1977 NATO Summit, and the May 1978 Summit agreement on a bold Long Term Defense Program. They are the source of my direction from the Secretary of Defense, and they are something I deeply believe to be essential to adequate U.S. defense at a politically acceptable cost. Alone, we cannot meet the challenge posed by massive Soviet and Warsaw Pact military investment outlays without unreasonably high U.S. expenditures. Further, the European nations have the technological capability and political needs to develop and produce modern weapons and will do so independently--but wastefully--if joint solutions are not found.

Hence the primary thrust of our international programs is the enhancement of the overall military capabilities of the NATO alliance to counter the continued growth of the Warsaw Pact forces. The basic objectives of our program are:

- Reduction of duplicative NATO research and development for more effective and efficient use of collective resources.
- Promotion of fuller industrial collaboration in military equipment to achieve economies of scale and reduce unit costs.

- Enhancement of NATO military strength by procuring more and better military equipment because of the effectiveness in R&D and procurement resulting from cooperation.

- Enhancement of NATO military strength through increased interoperability and standardization of Allied military equipment.

These objectives will not be easy to achieve. They require major changes from nationally-focused armaments planning, development and acquisition to a multinational perspective. Given deep seated national vested interests and all the other obstacles entailed, this transition will only take place gradually over time. But this is all the more reason for accelerating our efforts to rationalize NATO defense R&D and procurement to meet the Warsaw Pact challenge.

Therefore, we have launched a triad of initiatives: First, a series of general Memoranda of Understanding (MOUs) in arms development and procurement; Second, dual production of existing systems on both sides of the Atlantic; and Third, we have adopted a Family of Weapons concept which I will discuss in more detail later. In aggregate, these actions can help insure that NATO forces are equal to the challenge of Warsaw Pact forces. Moreover, I am confident that they will not impair the overall competitive position of our defense industry or undermine our technological positions.

The purpose of the general MOUs is to open up the defense market of each country to international competition and facilitate industrial cooperation among the defense industries of participating nations. We have negotiated such MOUs with the U.K., Canada, Germany, Norway, the Netherlands and Italy. We have invited other allies to enter into such agreements with the U.S.

Dual production is the second leg of the cooperative triad. When one nation has developed a system which meets the needs of other nations of the Alliance, the developing nation could make its system available for production by other countries. Straight sale of the main systems and spares to another country facilitates operational capability but may seriously impact the in-country employment profile of the receiving country. Dual production alleviates this problem and can lead to the near-term introduction of weapons with the latest technology in NATO's deployed forces without duplicative research and development cost.

The Family of Weapons concept is the third leg of our cooperative triad. We want the $12 billion we spend and the $4 to $5 billion our allies spend on R&D to yield $16-17 billion in results. Our approach is to examine mission areas to find operational requirements which can only be satisfied by more than one of a "Family of Weapons." When the mission needs of the U.S. and at least one European country coincide both in time and required capability, the U.S. would develop one of the required weapon systems while a European country or consortium would develop the complementary weapon system. The fully developed systems would then be made available to allies for purchase or co-production. Cost savings would be realized in development because of the elimination of redundant programs. As part of this concept, the defense industries of the cooperating countries would participate in the development program of the other to make certain that the best technology was available and that the operational and technological requirements of all countries are satisfied. It is important to stress that for U.S. developed systems the U.S. prime contractors, subcontractors and European subcontractors will be chosen on a competitive basis to insure the lowest cost and there will be early participation by industry with a minimum of government involvement in licensing and industrial teaming negotiations.

We believe that the cooperative programs which we recommend will not lead to the loss of jobs within the U.S. industrial base. Indeed, this danger is much more real if we do not improve cooperation and thus further encourage the "Buy European" approach which has been developing in Europe.

Finally, in order to further our objectives we need an effective technology transfer policy. Such policy must be uniformly applied in both export case decisions (FMS, Munitions, U.S. Exports and COCOM) and in the multiple government-to-government channels for cooperation in science and technology with our Allies. Two points should be made with regard to our overall international strategy; First, we should consider technology transfer not only in terms of the risk of compromise and threat to our competitive position but also in terms of the risk to NATO effectiveness if our policies are too restrictive. In the interest of common defense we want our Allies to have equipment comparable to ours. Only in this way can they adequately meet their share of the common defense burden. Second, technology transfer is also a two-way street--we stand to gain by capitalizing on our Allies' technological and industrial strengths.

B. PROGRESS TOWARD ARMS COOPERATION

1. Key Cooperative Programs

Table IV-1 at the end of this chapter presents a comprehensive summary of programs and activities underway that demonstrate progress toward the objective of improving cooperation in arms development and production. While many of these projects will take time to reach fruition, they represent a notable increase in allied efforts to cooperate in concrete ways. We are making a good beginning, some of the highlights of which I will discuss below.

NATO Airborne Early Warning and Control (AEW&C) Program

This program includes planned acquisition and operation of 18 E-3A aircraft (in a standard configuration with U.S. AWACS aircraft); modifications to make 52 ground sites interoperable with the AWACS aircraft; and refurbishment of a main operating base and other support facilities. U.S. participation in this program will be in two capacities, first as agent for NATO's acquisition of the E-3As and second as purchaser and user of the system. The U.S. Air Force as agent will work with the NATO AEW&C

Program Management Organization to procure the 18 AWACS aircraft. As a member of NATO, the U.S. will also participate in both the management and operation of the NATO Airborne Early Warning and Control System.

The multinational NATO AWACS program will be the largest, single commonly-funded project ever undertaken by the Alliance. In taking this crucial step to counter the Warsaw Pact low-level air threat, NATO has demonstrated its military and political solidarity. NATO Defense Ministers formally approved the NATO AEW&C program during their 5-6 December 1978 Defense Planning Committee (DPC) meeting in Brussels.

120mm Tank Gun

The German 120mm smoothbore gun system was selected for future incorporation on the XM-1 as a result of a U.S. evaluation of the FRG and U.K. 120mm tank main armament systems. It consists of a 120mm smoothbore cannon of German design using a fin-stablized family of ammunition composed of kinetic energy and high explosive service rounds and two companion training rounds. A DSARC production decision is now anticipated in September 1982, and the first production delivery of a XM-1 tank equipped with the 120mm gun is currently planned in late FY 84.

The U.S. is negotiating a licensing agreement with the German producer and an addendum to the December 1974 US/FRG MOU for tank harmonization with the FRG for U.S. production of their gun system.

It is also anticipated that the U.S. and the FRG will participate in a cooperative effort to develop modern-technology 120mm ammunition. Configuration management working groups have been established to assure the maximum degree of standardization and interoperability. The approved FY 1979 funding level for this program is $35.6M.

General Support Rocket System (GSRS)

The General Support Rocket System (GSRS) is a multiple-launch rocket system designed to deliver a large volume of firepower in a short period of time against critical, time-sensitive, area-type targets, particularly during surge periods when the rate of targets acquired exceeds available cannon weapons fire support. This system is following an accelerated acquisition cycle with DSARC III scheduled in May 1980. Currently, the U.S., France, the FRG and the U.K. are negotiating an MOU for a cooperative development program for a Multiple Launch Rocket System (MLRS), scheduled to be signed in Spring 1979. If signed, all four countries will adopt a standardized MLRS, which will be the GSRS. Italy has also expressed interest in the system. The Army FY 80 budget submission included the funds necessary to start Low Rate Initial Production beginning in FY 80.

Advanced Medium-Range Air-to-Air Missile (AMRAAM)

AMRAAM is an all-weather, all-aspect, radar missile capable of engaging numerically superior aircraft forces before they close to within visual range. This missile will have the capability for multiple launches at beyond visual ranges and become autonomous soon after launch to permit the launch aircraft to maneuver and/or engage more targets quickly. It will be compatible with the F-14, F-15, F-16 and F-18 aircraft as well as applicable Air Defense and Air Superiority NATO interceptor aircraft of the late 1980s. The AMRAAM program has passed DSARC I for initiation of the competitive prototype phase with deliveries anticipated in the mid 1980s. Missile development is in response to a Joint Service Operational Requirement (JSOR) and a Mission Element Need Statement (MENS) and is consistent with NATO requirements being formulated in NAFAG Subgroup 13. All five of the participating contractors have contracted NATO industry for potential technical support. Initial exchange of aircraft/missile interface data requirements has occurred with the U.K. In consonance with on-going efforts for agreement on a NATO family of air-to-air missiles, the AMRAAM program has initiated planning for early NATO industry participation in full-scale development leading to U.S./NATO co-production. AMRAAM is fully funded for the prototype phase leading to Milestone/DSARC II.

2. Long Term Defense Program (LTDP) Implementation

The LTDP adopted by heads of the North Atlantic Alliance governments in May 1978 recognized at the highest political level the need for the Alliance to intensify a collective cooperative effort in defense preparedness in order to counter the Warsaw Pact buildup. Although much of the LTDP is focused on upgrading Alliance readiness, quicker reinforcement and better logistics cooperation, it also calls for cooperative development of numerous defense systems. The triad of cooperative activities which we have begun will greatly facilitate their successful completion. In turn, the impetus and common context provided by the LTDP will also increase our chances for success in other cooperative projects.

3. Periodic Armaments Planning System (PAPS)

Substantial progress has been made over the past year toward the development of a framework for a NATO armament planning system. Creation of an institutionalized process for planning and programming key NATO research, development and procurement actions is fundamental to more efficient resource allocations within the Alliance.

During the past year, the recommended framework was developed under the direction of the Conference of National Armaments Directors (CNAD). The framework gives due recognition to the sovereignty of nations in equipment decisions by using the basic existing Alliance structure without radical change. Initial efforts focused on the development of mission needs and the early phases of the life cycle of a weapon system at the time when arms cooperation among partners can be most effectively achieved. By Spring 1979 we expect to have a detailed plan for trial implementation of these early phases.

C. CONGRESSIONAL/INDUSTRY ROLE

Our initiatives for defense cooperation are very complex efforts in which the partnership participation of Congress and U.S. industry is a prerequisite to success. Hence during the past year we have tried hard to further a better understanding of our goals in Congress and with U.S. industry. For example, the extensive hearings of the HASC Subcommittee on Standardization, Interoperability and Readiness provided an excellent forum for fully describing the scope and thrust of our efforts. They also gave us an opportunity to better understand Congressional concerns about some of the aspects of RSI, particularly as related to the Family of Weapons concept and to the issue of technology transfer.

I would strongly reiterate the need for Congressional support of our legislative proposals that would permit the Secretary of Defense to waive certain restrictive statutory provisions when they impede our entering into desirable agreements or contracts with allied governments and international organizations. Clearly, such agreements or contracts involve considerations of sovereignty and national foreign relations policy which are not present in purchases by the Department of Defense from private commercial parties. DoD legislative proposal 96-4 would facilitate the entering into mutual logistics support agreements with NATO governments and organizations covering such things as rations, billeting, transportation, fuel, medical supplies, ammunition, base operations support, storage facilities, and training ranges. It would not cover the purchase of major equipment. DoD legislative proposal 96-5 would facilitate our acquisition of property and services in furtherance of cooperation arrangements in the interest of NATO standardization and interoperability.

We have actively solicited the advice and assistance of U.S. industry in several industry-DoD meetings specifically organized for this purpose. The Defense Science Board Summer Study on RSI provided us with both a constructive critique of our approach and a specific set of recommendations for action many of which are now being implemented. One example of the implementation actions is the DSB-sponsored study group that will address the practical aspects of the Family of Weapons concept as applied to air-to-air and Anti-Tank Guided Weapons.

The issue of intellectual property rights is a potential stumbling block to RSI and co-production programs. Contractors are concerned that their proprietary data may be disclosed to foreign competition against their will and without their full compensation. A committee of the Conference of National Armaments Directors (CNAD), referred to as AC/94, was tasked a year ago to study and identify the obstacles to cooperative programs in this area, and to recommend solutions. Since then, AC/94 has presented to the CNAD a set of principles, and specific guidelines for implementing them. Essentially the guidelines provide that

Governments must lay early groundwork in R&D contracts to facilitate the licensing of resulting systems and encourage other NATO partners to standardize on them. The CNAD accepted the principles and guidelines provisionally, and on condition that industry be fully consulted. A concerted effort has since been made to inform industry, both at home and abroad, and to solicit support. A special delegation of the NATO Industry Advisory Group appears to be on the verge of agreement on the final principles and guidelines. This should clear the way for final CNAD approval, and full implementation throughout the Alliance.

D. NON-NATO INITIATIVES

Middle East. Defense cooperation with allied and friendly Middle-East nations is primarily accomplished through security assistance sales and commercial munitions licensing procedures.

Northern Pacific. The focus of Defense R&D cooperation in the Northern Pacific region is primarily with Japan and the Republic of Korea.

With regard to Japan, this key ally is beginning to strengthen its defense forces and defense industry. Exploratory discussions of cooperative development/production/system interoperability have been initiated whereby both the U.S. and Japan will seek ways to selectively improve defense cooperation on a mutually beneficial basis. Working level discussions commenced in November 1978 in preparation for R&D policy level meetings in the Spring 1979.

E. PRIORITY EMPHASES FOR 1979 AND BEYOND

In the coming year, I will emphasize effective implementation of the triad measures with our NATO Allies as a means to improve the use not only of U.S. resources, but those of our Allies as well, in our common defense. Implementation of the General MOUs is well underway. I would expect to see significantly greater transatlantic procurements building over the next couple of years mirroring our experience with the U.K. since that MOU was signed in 1975.

We will offer additional U.S.-developed systems for production in Europe where this would advance the military effectiveness and promote efficient resource usage in the Alliance and will consider European-developed systems for our production.

Implementation of one or two programs in the Family of Weapons will be a high priority during 1979. Because of the enormity of simultaneously satisfying multinational requirements, schedules, industrial interests, economic factors, foreign policy, etc. the long term future of the Family of Weapons concept will depend heavily on whether our initial efforts in 1979 are successful.

I have given priority budget emphasis to those acquisition Programs most needed for improved capability in NATO, particularly where other Allies are also relying on the program for their defense, and I am giving priority management attention to the successful execution of these programs.

KEY NATO PROGRAMS

PROGRAM	ALLIES	DESCRIPTION	RSI GOALS AND ACHIEVEMENTS
ARMY ROLAND	FR FRG Norway	Short range air defense system, developed by FR/FRG, which is intended to protect the Corps and Division areas.	o FRG/FR/US established Joint Control Comm to insure max standardization o 90% of field-replaceable sub assemblies interchangeable.
COPPERHEAD	UK FRG IT	155mm cannon launched projectile, developed by the US, which gives ARTY systems capability to engage stationary and moving armored targets with direct fire.	o Interoperability with non-US artillery systems o MOU with UK signed June 78 (FMS, or coproduction at UK's option) o Possible collaboration with FRG and IT
MOD FLIR	FRG	Family of forward looking IR common modules (MOD FLIR) developed by US for use in target acquisition and fire control systems, e.g., TOW Night Sight (AN/TAS-4) and Tank Thermal Sight (AN/VSG-4).	o MOU with FRG signed April 78 (FMS and coproduction) o Same modules used in Navy and AF airborne FLIR's o Possible employment by many Allies
MAIN BATTLE TANKS	FRG UK Netherlands	US/FRG MOU for harmonization of Main Battle Tanks (XM-1, Leopard II, etc.) was initiated in Dec 74, Addendum added in July 76, and amended in Jan 77 to include standardization of key tank components.	o NATO harmonization/standardization of Main Battle Tanks o Fuel and organizational level metric fasteners have been standardized. o US plans to adapt the FRG 120mm gun to the XM-1 o Initiatives in achieving a common sprocket interface design may result in near-term track interoperability.
PATRIOT	Netherlands Belgium Denmark Greece FRG FR	Surface-to-air, medium and high altitude, air defense system designed to counter the field Army air defense threat of the 1980's and 1990's.	o NATO RSI of air defense systems o MOU signed, Oct 78, by Netherlands, Belgium, Denmark, Greece, and US to determine preferred European option to acquire PATRIOT o MOU signed 15 Jan 79 by France and 17 Jan 79 by FRG

Table IV-1

Table IV-1 (Continued)

KEY NATO PROGRAMS

PROGRAM	ALLIES	DESCRIPTION	RSI GOALS AND ACHIEVEMENTS
ARMY (Cont'd) STINGER	FRG Italy Norway Netherlands	Advanced man-portable air defense system (MANPAOS), which is the follow-on of the REOEYE system. It uses a passive IR homing guidance system which operates independently after initial arming and launching by the operator. Target engagement will be possible regardless of engagement aspect. STINGER and Swedish RBS-70 (3 man team) are the leading contenders for future NATO MANPAOS weapons.	o NATO RSI of short range air defense (SHORAD) systems. o Approved for production 1977--expected to be produced for NATO use. o STINGER requirements discussed in NAAG Panel V, Land Based Air Oefense Weapons. Formal briefing by US Reps scheduled for Spring 79 meeting.
GSRS/MLRS	FRG FR UK Italy	General Support Rocket System (GSRS/ Multiple Launch Rocket System (MLRS) designed to deliver large volume of ordnance in a short period of time against critical, time sensitive, area-type targets.	o NATO RSI of general support systems o US, FRG, FR, and UK are negotiating an MOU for cooperative development program for MLRS.
ASH	FRG FR UK Italy	Advanced Scout Helicopter (ASH) is a day-night/adverse weather, combat survivable aerial scout system designed to provide surveillance, security, target acquisition, and laser designation functions for precision guided munitions.	o NATO RSI for helicopters. o ASH requirement briefed to NATO Panel X (Tactical Air Mobility). o In interests of NATO RSI, US offer being made to NATO nations for possible production programs. o Italy has expressed interest in commonality between ASH and their AGUSTA A-129 "Mongoose" helicopter.
ATGM	All NATO Nations	Anti Tank Guided Munitions (ATGM) Improvements formerly Advanced Heavy Anti-Tank Missile System (AHAMS) will provide evaluation of critical components for Army's next generation infantry heavy anti-tank weapon to replace improved TOW in all configurations (ground, vehicle and helicopter modes). Evaluation will include	o NATO RSI of anti-armor systems. o NATO has agreed to being cooperative anti-armor system program family package.

KEY NATO PROGRAMS

PROGRAM	ALLIES	DESCRIPTION	RSI GOALS AND ACHIEVEMENTS
ATGM (Cont'd)		components for improved capabilities against projected threat armor and operation in sophisticated counter-measures and battlefield obscurants environment.	
NAVY NATO ASSM	UK	US Navy's NATO Anti-Surface Ship Missile (ASSM II) is a second generation system, similar to HARPOON in size and range, but will be able to accept varying modules within its configuration to meet different NATO nations require-ments	o NATO RSI of anti-surface ship missile o NATO Project Group 16 of Naval Arm-aments Group working on coop devel-opment of second generation anti-surface ship missile.
NATO SEA GNAT	All NATO Nations	Ship-launched decoy system to protect against air and sea launched anti-ship missiles	o Goal - provide NATO with standardized decoy system with resultant economies in development costs as well as potential savings in procurement and logistics costs. o Coop R&D effort, sponsored by NATO Naval Armaments Group, under MOU signed in 1976. o NATO SEA GNAT project established in 1977 by consortium of NATO nations.
Mid-Course Guidance System	FRG	Anti-Ship Missile Defense system, which has capability of rotating.	o NATO RSI of anti-ship missile defense systems. o MOU between US and FRG for Mid-course Guidance demonstration program proposed under Weaponizing Prototypes using guidance from rotating and utilizing self defense VELARC (vertically luanched) missile

KEY NATO PROGRAMS

PROGRAM	ALLIES	DESCRIPTION	RSI GOALS AND ACHIEVEMENTS
NAVY (Cont'd) IRST	Canada Denmark FRG FR UK Netherlands Norway	Ship board IR Search and Track System (IRST). Joint US/Canada three-phased program, under MOU, signed in 1976. Phase I - demonstration of feasibility to form basis for providing operational capability, Phase II - T&E. Phase III - procurement.	o NATO RSI of electro-optical devices. o NATO Project Group to consider coop development and production of IRST. o Strong possibility that other NATO nations will participate in IRST development and procurement phases.
P-3 ORION	Canada Netherlands Norway	Maritime patrol aircraft with missile for surveillance, location and attack operations against submarines and surface ships.	o NATO RSI of anti-submarine systems. o Studies results indicate that P-3 is one of NATO's most effective and economical anti-submarine systems.
HARPOON	FRG UK Netherlands Denmark Turkey	Anti-Surface ship missile which would be luanched from ship, submarine, aircraft, or shore.	o NATO RSI of anti-surface ship systems. o Currently in use by Netherlands, Denmark and Turkey. o UK and FRG will take deliveries on their purchases starting in CY 1980.
PENGUIN II	Norway Greece	Norwegian PENGUIN MK 2 system provides combatant craft and patrol boats with means to launch surface-to-surface anti-shipping missiles against surface vessels.	o NATO RSI of anti-surface ship systems. o US Navy negotiated MOU with Royal Norwegian Navy (RNON) on test and evaluation project to adapt PENGUIN MK 2 to US Navy combatant craft. o PENGUIN MK 1 was developed in 1962-1970 by RNON, with US Navy participation.
NATO SEASPARROW	FRG Italy Belgium Denmark Netherlands	Point defense missile system, which includes fire control radar, launcher and a variation of the SEASPARROW missile intended to provide point defense to various classes of ships.	o NATO RSI of naval point defense systems. o MOU, signed in 1977 with US, FRG, Italy, Belgium, Denmark and Netherlands to form consortium to produce NATO SEASPARROW. o As of Nov 78, US ships and NATO Consortium ships have installed NATO SEASPARROW.

Table IV-1 (Continued)

KEY NATO PROGRAMS

PROGRAM	ALLIES	DESCRIPTION	RSI GOALS AND ACHIEVEMENTS
NAVY (Cont'd) SONOBUOYS	FRG FR UK Canada	US Navy participation in NATO Sonobuoy (aircraft launched submarine acquisition system that deploys a sonic listening device which transmits signals to the aircraft) Interoperability Demonstration hosted by the French Navy in France on 4-6 Oct 78. Demonstration included: sonobuoy handling; sonobuoy launching from aircraft; and VHF data link between sonobuoys and aircraft with simultaneous monitoring by shore based facility.	o Interoperability of sonobuoys and launching mechanisms in ASW/maritime patrol aircraft employed by NATO nations. o Demonstration proved NATO has attained high degree of interoperability of sonobuoys. o Systems included were: Nation / Aircraft / Sonobuoy US / S-3A, P-3B, P-3C / AN/SSQ-41A, 41B, 36, 57A FR / ATLANTIC / DSTV-4L UK / NIMROD / Type 30068 FRG / / AN/SSQ-41A (HERMES) Canada / ARGUS / AN/SSQ-517B
ERMISS	FRG FR UK Netherlands	U.S. Navy participating in NATO project to develop explosive resistant multi-influence sweep system (ERMISS) specially designed "guinea pig" ships to counter the pressure influence sea mine and withstand repeated explosions of such mines beneath the ERMISS.	o MOU signed in Sep 78, with FRG, FR, UK and Netherlands, which covers the initial 2-3 years of the ERMISS development. The MOU goal is to proceed with construction of two prototype ships. Actual contruction expected to proceed under subsequent MOU. Each nation will contribute approximately $160K (US) to cover project's work during period of current MOU.
AIM-9L	FRG UK Italy Norway	IR air-to-air missile to be employed on numerous NATO aircraft, including the F-16 and MRCA.	o NATO RSI of air-to-air missiles o MOU, signed in Oct 77, with FRG to lead European consortium to co-produce the AIM-9L missile in Europe. UK, Italy and Norway are participating. FRG now arranging for manufacture of specific parts by each country.

Table IV-1 (Continued)

Table IV-1 (Continued)

KEY NATO PROGRAMS

PROGRAM	ALLIES	DESCRIPTION	RSI GOALS AND ACHIEVEMENTS
AIR FORCE F-16	Belgium Denmark Netherlands Norway	F-16 Multinational Fighter Aircraft Program is a joint development/production effort between the US and European Participating Governments (EPG's).	o NATO RSI of Fighter Aircraft. o MOU between US and EPG's was signed in June 1975. o Letters of Offer and Acceptance totalling over $2.6B signed in May 77 for purchase of 348 EPG F-16 aircraft and associated support.
NAVSTAR	FRG FR UK Canada Belgium Denmark Norway Netherlands Italy	NAVSTAR Global Positioning System (GPS) is a satellite-based, universal positioning and navigation system. It was designed by the US to provide precise position information and time for accurate world-wide weapons delivery and reduce proliferation of navigation aids.	o Provide continuous world-wide, all-weather positioning system for NATO use. o MOU, signed in Apr 78, with nine Allies for NATO participation in NAVSTAR GPS. MOU created a NATO team located at the NAVSTAR Joint Program Office (JPO) LA, AFS Calif. o CNAD and the Tri-Service Group on Comm and Eleectr Equip (TSGCEE) created the NATO GPS Group (PG-1 under AC 302).
ATLIS II	FR	USAF has proposed joining the French ATLIS II pod development program to satisfy requirements for a near term, day, laser target designator for use by single-seat aircraft, such as the F-16.	o NATO RSI of laser target designators for aircraft. o Informal negotiations resulted in draft MOU for US to acquire 2 prototype pods for engineering and flight T&E in FY's 79 and 80. o ATLIS II, with US/FR interest now and possible UK participation later, could become part of the NATO family of air-to-ground systems.
JP-233	UK	UK developed airfield attack system consisting of area denial and cratering submunitions for low-level high speed deliveries. The US has no capability to accomplish this task with current conventional munitions at the extremely low altitudes necessary to minimize losses to our attack aircraft.	o Standardize upon single interoperable munition for airfield attack. o In interests of NATO RSI and the "two way street," the UK offered JP-233 to the US for coop development

KEY NATO PROGRAMS

PROGRAM	ALLIES	DESCRIPTION	RSI GOALS AND ACHIEVEMENTS
AIR FORCE (Cont'd) STREBO	Several NATO Nations	FRG's STREBO anti-armor seek cluster munitions. US now has program to test several STREBO submunitions and the complete MW-1 system on the A-10 aircraft. Since STREBO in early development (now in AD), US decision to test prototype submunitions to determine potential operational utility. STREBO dispenser redesign needed for USAF strike aircraft and tactics.	o NATO RSI of anti-armor munitions. o STREBO BL-755 is in inventory of several NATO nations.
AWACS	Several NATO Nations	E-3A Airborne Warning and Control Systems (AWACS) combines sophisticated radar with advanced data processing and commo systems in a modified Boeing 707 aircraft to provide mobile, survivable, jam resistant, wide area all altitude air surveillance command control.	o NATO RSI of AEW systems. o In 1975, NATO judged AWACS superior to other AEW candidates. o In 1977, UK began development of their own AEW aircraft (NIMROD). o MOU was approved for our participation and funds for our share of program will be sought in early 1979.
HARASSMENT DRONE	Several NATO Nations	FRG developed HD is a low radar cross-section, expendable vehicle designed to harass the enemy's threat radars by delivering a warhead to damage the equipment. It is a one way vehicle to eliminate post launch C2, recovery and refurbishing problems. Preprogrammed flight profiles eliminate enemy intrusion and takeover.	o NATO RSI of harassment drones/EW systems. o NATO Long-Term Defense Program (LTDP) as the #3 priority program for improving the air EW capability of NATO in the 1980's.
AMRAAM	All NATO Nations	Advanced Medium Range Air-to-Air Missile (AMRAAM) is an all weather, all aspect, radar missile capable of engaging numerically superior aircraft forces before they close to visual range. It will have compatibility for multiple	o For NATO family of air-to-air missiles AMRAAM program initiated planning for early NATO industry participation in full scale development, leading to US/NATO coproduction. o All five US aerospace contractors,

Table IV-1 (Continued)

KEY NATO PROGRAMS

PROGRAM	ALLIES	DESCRIPTION	RSI GOALS AND ACHIEVEMENTS
AMRAAM (Cont'd)		launches at beyond visual ranges and becomes autonomous soon after launch to permit the launch aircraft to maneuver and/or engage more targets quickly. It is being developed to replace the SPARROW AIM-7F missile.	competing in the Concept Definition (CD) Phase, have contacted NATO industry for technical support (one, Ford Aerospace, has three NATO subcontractors for seeker, fuze and warhead). The UK, Italy and FR currently have a BVR missile capability. o AMRAAM NATO RSI plan has been developed. o Analyses indicated that USAFE fighter aircraft and EPG F-16's with AMRAAM's will have NATO capability. o AMRAAM will be compatible with F-14, F-15, F-16 and F-18 aircraft, as well as applicable Air Defense and Air Superiority NATO interceptor aircraft of the late 1980's.
AMMO COMMONALITY 155mm AMMO	UK FRG Italy	155mm weapons and ammo standardization with participating NATO nations.	o 155mm ammo RSI within NATO. o MOU with UK, FRG, Italy signed in 1969, revised in 1978. Revision requires participating nations to develop only 155mm ammo that meets criteria in MOU and that ammo and howitzer development conform to ballistic parameters in MOU.
120mm(Tank Gun)	FRG UK	US/UK/FRG program conducted for standardization of tank main armament systems.	o Tank Gun ammo S/I within NATO. o FRG 120mm smoothbore gun selected for XM-1 as result of tests of US's 105mm, UK's 120mm rifled bore and FRG's 120mm, all firing improved ammo. o Configuration management working groups established for max S/I for NATO use.

Table IV-1 (Continued)

KEY NATO PROGRAMS

PROGRAM	ALLIES	DESCRIPTION	RSI GOALS AND ACHIEVEMENTS
20-40mm	UK FRG FR	Standardized families of ammo between 20-40mm calibers.	o Goal-that within 15-20 years NATO nations will have no calibers between 20-40mm which are not interoperable. o Ad Hoc Group of tech members of US/UK/FRG/FR has worked toward agreement on standard families of ammo between 20-40mm calibers.
NATO Small Arms Ammo	Belgium Canada Denmark FR FRG UK Greece Netherlands Norway Luxembourg	NATO program for standardized interoperable small arms ammo within NATO.	o NATO S/I of small arms ammo. o MOU between eleven NATO nations for T&E and selection of second NATO standard of small arms ammo, as well as NATO infantry weapon. o NATO standard 7.62mm ammo will continue as NATO cartridge for use in heavy weapons, such as crew served machine guns.
Communications and Identification			
Identification (IFF) Systems	All NATO Nations	Systems capable of positive and reliable identification of friends or foes (IFF) is problem common to all weapon systems, especially those engaging targets beyond visual range. US participating in NATO-wide architecture and development of NATO Future Identification System (FIS) that will overcome short comings of current Mark XII IFF, which is early 60's design.	o Achieve NATO IFF interoperability. o NATO operational commanders emphasis on IFF system to preclude self-inflicted losses, as demonstrated during 1973 Middle-East War. o STANAG for signal architecture of NATO FIS has been drafted by TSGCEE Sub-Group 6. If systems proposed could provide NATO with significant improvements over MARK XII, Mode 4 within next seven years, it will be difficult to justify a NATO investment for Mode 4 equipment. Conversely, if proposed FIS system

KEY NATO PROGRAMS

PROGRAM	ALLIES	DESCRIPTION	RSI GOALS AND ACHIEVEMENTS
Identification (IFF) Systems (Cont'd)			requires lengthy development program, prior to T&E, then earliest possible NATO implementation of Mode 4 appears warranted.
Tactical Area Communications	All NATO Nations	During past several years, NATO nations agreed to device allowing limited degree of interoperability among tac area commo systems. Since this is hardly adequate, a major effort is currently being made to improve interoperability.	o Goal - NATO nations expected to field completely interoperable tac area commo equipment. o During interim period, NATO nations striving for improved interoperability between existing and new systems.
Combat Net Radio	All NATO Nations	US has proposed, under auspices of the TSGCEE, NATO nations study, define and agree to NATO ECCM technical interoperability standards for VHF tactical single channel combat net radios (CNR) for post 1985 time frame.	o NATO interoperability of all combat net radio equipment. o US offered NATO nations participation in US funded SINCGARS V ECCM development and testing to provide them with threat, R&D and test data produced as well as insuring NATO interoperability. o NATO Ministers agreed that all new combat net radio equipment introduced after 1985 would be designed to common specs, or common standards.
SATCOM	UK	Satellite Communications (SATCOM) sharing between US, UK and NATO SATCOM assets to enhance NATO interoperability.	o Goal - Completely interoperable NATO Satellite Commo systems and ground terminals. o US and UK have made use of NATO satellites 111A in the Atlantic area and NATO 111B in East Pacific. o US has used UK SKYNET satellite to provide communications for special users.

Table IV-1 (Continued)

Table IV-1 (Continued)

KEY NATO PROGRAMS

PROGRAM	ALLIES	DESCRIPTION	RSI GOALS AND ACHIEVEMENTS
JTIDS	UK FR FRG	Joint Tactical Information Distribution System (JTIDS), in joint development by US, will provide means of interconnecting and facilitating real time, jam resistant, secure exchange of combat critical communications between tactical force elements.	o Goal - provide jam resistant communications systems interoperability with NATO. o MOU with UK, signed in Dec 78. o US-FR tech exchanges held to achieve interoperability between JTIDS and French developed system. o As NATO nations adopt JTIDS, or introduce JTIDS compatible equipments, significant improvements in interoperability between tactical elements NATO forces will be achieved.

V

V. THE SCIENCE AND TECHNOLOGY PROGRAM

A. INTRODUCTION

The DoD Science and Technology (S&T) Program is made up of the Technology Base, Advanced Technology Developments and the Manufacturing Technology Program. In terms of budget categories:

- o The Technology Base consists of Research (6.1) and Exploratory Development (6.2) efforts;
- o The Advanced Technology Developments (ATDs) are funded under category 6.3A, which is approximately 20 percent of the Advanced Development (6.3) budget category, and
- o Manufacturing Technology is funded primarily from the procurement appropriation, Industrial Preparedness (7.8), although some 6.3A funding is provided.

Associated activities of the DoD S&T Program include the control of exports of U.S. technology and cooperative R&D activities with the NATO Alliance and other Allies. These are also described in this chapter.

B. OBJECTIVES

The DoD S&T Program is the very foundation of our national security. It is the basic building block which structures our future military systems.

The continuing overall objective of the DoD S&T Program, along with its accompanying program for the control of exports of U.S. technology is to:

> Maintain the level of technological supremacy which enables the United States to develop, acquire and maintain the military capabilities needed for national security.

In FY 1980, four specific goals have been highlighted in the DoD S&T Program; namely:

1. Ten percent real growth in Services-sponsored Research (6.1)

During the FY 1965-1975 period, the overall research budget was eroded by over 50 percent in purchasing power, while funding for contractual research decreased by an even larger percentage. FY 1976 budget guidance to the Military Departments called for a 10 percent per year real growth in Research (6.1) for 5 years to reverse this dangerous decline. Although Congress and the Services supported real growth over the last three years, when we consider the sharp declines in FY 1975 and FY 1976, the average real growth from FY 1975-1979 has been only about one percent per year. Because we have yet to achieve the desired real growth rate, the Secretary of Defense reaffirmed the earlier decision, and we have budgeted at 10 percent real growth in the DoD Research category for FY 1980.

We have identified science/engineering areas of critical significance to DoD to apply such additional scientific resources. The FY 1980 funding increase will be applied, for example, to new materials and better characterization of existing materials, emergent combat environments, determination of fundamental physical limits, microelectronics and improved survivability. Description of these programs is given in Section E.

2. Five percent real growth in Services-sponsored Exploratory Development (6.2)

Exploratory Development feeds on the output of the Research effort. The cumulative decrease of 50 percent over 10 years in DoD Research resulted in a decline in the number of opportunities for

Exploratory Development over the same 10 years. The planned increase of five percent real growth will be used to increase the innovation, flexibility and responsiveness of the Exploratory Development effort. Partly this will be accomplished by increasing participation in the program by industry and universities thereby increasing sources of possible innovation. New efforts to be started or continued in FY 1980 include the Very High Speed Integrated Circuit Program which will speed the industrial innovation process so that needed technology will be available to DoD three to five years earlier than otherwise anticipated; seekers for missiles which will be increasingly insensitive to weather and clutter; improved displays for night vision devices; and, identification of low vulnerability explosives and propellants which are unlikely to detonate accidentally or as a result of enemy fire.

3. Expedite a selected set of technologies which have real promise for introducing "revolutionary" advances into our military forces such as:

- o Precision guided munitions (PGM),
- o Very high speed integrated circuits (VHSIC),
- o Directed energy technology,
- o Low vulnerability munitions,
- o Advanced composite materials, and
- o Manufacturing technology.

These technologies show promise for development in areas where we are in direct and serious competition with the Soviet Union. Some of them are key to maintaining what we believe is our present technological lead which we must protect with these aggressive, well-focused development efforts. In other instances such as in directed energy technology, our efforts are directed to determining technical feasibility and preventing technological surprise rather than protecting a lead. In all cases the potential exists in the areas cited above for introducing revolutionary advances. PGMs offer the opportunity to counter the Soviet armor advantage over NATO with air- or ground-delivered warheads able to attack second echelon armor before it can be deployed at the battle front. Low vulnerability munitions will increase battlefield survivability of armor and aircraft and permit more expeditious storage and transport in populated areas such as Europe. Finally, advanced composite materials will permit development of more survivable reentry vehicles and increase performance for such items as mines and torpedoes, portable bridging components and helicopter transmission housings.

4. <u>Emphasis on Advanced Technology Developments (6.3A) which draw projects of high promise from Exploratory Development and shorten the time required to deliver weapons using advanced technology to forces in the field</u>

Identification of program elements/projects for inclusion as Advanced Technology Developments (6.3A) increased in FY 1978. They were identified as an essential step in the continuous process from Exploratory Development to the fielding of weapons in an operational environment. They provide the most cost-effective means for demonstrating the effectiveness of devices, components and products against pre-established technological criteria. The FY 1980 efforts emphasize high energy lasers, jet engines, flight vehicle technology, avionics, guidance and control for PGMs, electro-optical warfare, training simulators and computer software.

C. THE FY 1980 REQUEST

The FY 1980 budget request assures real growth in the DoD S&T Program and provides the necessary resources that can lead to revolutionary advances in our military equipment and support an adequate technology infrastructure essential to achieve the incremental improvements needed by our future combat and support posture. The FY 1980 request provides for 10 percent real growth in Research and 5 percent real growth in Exploratory Development. The request also provides for 17 percent real increase in the Advanced Technology Development Program which consists of over 80 individual programs that are justified on their individual merits in the context of the broader technological objectives they support. Details of the request for the Services, DARPA and DNA are as follows:

Science and Technology Program Request
(Dollars in Millions)

Program Category	FY 1979	FY 1980
Research (6.1)	477	573
Exploratory Development (6.2)	1,551	1,739
Advanced Technology Developments (6.3A)	513	636
Manufacturing Technology*	120	158
Total	2,661	3,106

*Primarily procurement funds.

D. MANAGEMENT OF THE DOD S&T PROGRAM

1. The In-House Laboratories

We must maintain and strengthen the capabilities of our in-house laboratories because they have a major role in developing new technology, in providing technical advice to the systems acquisition process and in testing components and subsystems. They also maintain the corporate technology "memory" and provide quick response to problems that arise in field operations.

Institutional barriers often inhibit the laboratory director's ability to do his job. In July 1978, we convened a two-day meeting of the DoD Laboratory Technical Directors to assess several aspects of this problem and to make recommendations for improvements. We are now following through on recommendations resulting from that conference, as well as Congressional suggestions, with an intensive program aimed at defining and assessing institutional barriers to efficient laboratory management which will lead to corrective fiscal, personnel and organizational measures.

2. Joint Service Efforts

Many technical areas within the DoD S&T Program are of interest to two or more of the Services. Effective coordination of efforts in these areas of mutual interest is jointly effected by the Services in several ways. As an example, the Army, Navy and Air Force jointly fund high leverage contractual efforts in jet engine technology. Joint funding provides a means to pursue mutually required programs and provides joint planning and evaluation of results. It also permits each Service to adapt the technology to its individual needs. Such cooperation is also used in ramjet and rocket propulsion and in certain aspects of materials development efforts. Another technique, which is used in the chemical defense area, is to designate a single Service as the lead Service for Research and Exploratory Development. Each Service participates in the planning for this work and adapts the developed technology to its own requirements. We find that joint programs provide an effective means of coordination and permit broader views to be considered in the planning process with the end result of conserving our scarce resources.

3. Technology Export

National policy, as implemented by the Departments of State, Commerce, Energy and Treasury, encourages international commerce. Similar encouragement is endorsed by the DoD, but we must also be alert and selective in approving the export of critical technologies which are key to our military strength.

We have made measureable and useful progress in the past year in introducing new practices for the control of technology. This progress is exemplified by:

- An intensive effort to carry out DoD's responsibilities in the 1978 COCOM List Review,
- The initial implementation of a new approach to technology export which embodies the "critical technology" concept as its dominant feature,
- Better interaction between DoD and industry in the development of new and improved technology export procedures, and
- The review of unusually significant and complex technology export cases.

4. Industrial Innovation

Industrial innovation plays a key role in maintaining the military technological lead on which our national security depends.

Any shift to other countries in the industrial innovation balance, which is still slightly tilted in favor of the U.S., will not only affect the domestic R&D capacity available to the Department, but will cause serious strains in our military technological lead. We plan a sustained effort to expand our S&T Program and are prepared to move boldly to accelerate application of innovative technologies such as VHSIC, manufacturing technology and others which can significantly improve military effectiveness.

A key element in planning the Defense posture is the assessment of emergent and existing technology, both foreign and domestic with the objective of determining the potential for improving U.S. military capability. DoD, along with CIA and OSTP, sponsored a landmark conference in April 1978 to identify technology trends through the remainder of this century. The preliminary results from the conference are being evaluated by the Services and intelligence community for application to the S&T Program.

President Carter has directed a Domestic Policy Review of Industrial Innovation, recognizing the fact that the Federal Government can significantly influence both the ability and the motivation for individual firms to innovate. I believe this review offers a unique opportunity to improve the climate for innovation in America. DoD is an active participant in the review.

5. Independent Research and Development (IR&D)

The Defense IR&D investment is a major contributor to our ability to meet the pressing challenge of the Soviets as they accelerate their rate of technological advance. Our IR&D program brings to bear on defense problems the best of industry's independent innovative creativity. I intend to couple DoD's and industry's IR&D investment with the directed products of our DoD S&T Program so as to achieve an enhanced capability to match our adversaries' quantitative superiority with a technological superiority. I will be giving IR&D management my personal attention to ensure that we pursue vigorously those IR&D policies and procedures that will allow DoD to benefit from our superbly competent and motivated domestic industry.

6. Cooperation with Allied Countries in the S&T Program

Cooperation with allies is a vital part of the DoD S&T Program. The U.S. R&D budget can be effectively augmented by our Allies if we can minimize duplication and take full advantage of the technical strengths of each country. The DoD policy is to:

> "...support the transfer of critical technologies to countries with which the U.S. has a major security interest, where such transfers can (1) strengthen collective security, (2) contribute to the goals of weapons standardization and interoperability and (3) maximize the effective return on collective NATO investment in R&D."

We will continue to work through well established vehicles such as The Technical Cooperation Program and the NATO Defense Research Group to expedite the flow of technology between participating countries. But we will also actively seek to involve our Allies more closely to use our collective technology to equalize the Soviet edge in deployed equipment and higher rate of defense spending. We will use our technology both as high leverage devices for specific weapons (e.g. Copperhead, Roland) and to exploit the superior commercial base of the West (e.g. computers, large scale integration).

7. Scientific and Technical Information

The DoD has taken careful note of Congressional interest in the need for an excellent Federal scientific and technical information (STI) program. We recognize the increasing importance of improved scientific and technical information programs as well as the extraordinary proliferation of technical information technology in the handling and dissemination of information. We have initiated action that will assure a high quality DoD STI Program. Among these actions was the establishment of a position within OSD to manage these functions. Other actions over the past year included:

- A careful review of the entire DoD scientific and technical information apparatus, including the Defense Documentation Center,
- The updating of eight major directives involving the DoD scientific and technical information process, and
- A study of a number of data bases that serve DoD and other research and development managers.

As a result of these actions, it is anticipated that our thrusts in the next year will include:

- The establishment of a DoD Council to coordinate the agency's scientific and technical information program, which will be made up of the focal points in the Military Services and Defense Agencies,
- Additional support to DoD R&D managers by the Defense Documentation Center,
- Closer cooperation with other Federal agencies in the sharing of scientific and technical information resources, especially the National Technical Information Service and the Smithsonian Information Exchange, and

- Upgrading Defense Documentation Center services in the acquisition and dissemination of scientific and technical information.

E. PROGRAMS

As cited earlier, one of the key strengths of the DoD S&T Program is that it is responsive to technological innovation rather than operationally perceived requirements. At the same time, the inventive creativity and innovation which it supplies to DoD is properly confined within the bounds of DoD's mission. A key management responsibility is to allocate resources among the technologies comprising the DoD technology infrastructure to match emergent and existing technologies based on DoD's mission needs.

Exemplary of this match is the support provided to DoD's strategic mission by technology programs such as directed energy technology and composite material developments.

Support is provided to DoD's tactical mission by technology programs such as precision guided munitions, low vulnerability munitions, chemical defense technology, night and inclement weather surveillance capability and over-the-horizon (OTH) search, acquisition and target designation.

General support to the DoD mission is provided by technology programs such as research, manufacturing technology, very high speed integrated circuits and training devices and simulators.

In the following paragraphs these programs are described in more detail.

1. <u>Research</u>

The function of research is to probe the limits of knowledge for opportunities in advancing fundamental military capabilities. Areas of basic significance to the DoD which require emphasis in FY 1980 are listed with examples.

a. New Materials and Better Characterization of Existing Materials

- Investigate anomalous optical properties of metals.
- Characterize the mechanism of fracture of metallic alloys.
- Synthesize new or improved superconducting materials.

b. Emergent Combat Environments

- Improve remote sensing of the atmosphere.
- Study three dimensional time varying ocean behavior.
- Determine aerodynamic limitations for low speed aircraft.
- Determine hydrodynamic limitations for ocean vessels.

c. Determination of Fundamental Physical Limits

- Determination of the limits of high pressure that can be generated and reliably measured.
- Utilize the availability of the space shuttle to develop deep space instrumentation and monitor phenomena of importance to DoD.

d. Microelectronics

- Develop understanding of the physics, electronics and behavior of ultra-small electronic devices (20 to 1000 Angstroms).
- Perform fundamental research in advanced signal processing.

e. Alien Environments

- Investigate factors that lead to deterioration of materials under extremely high temperatures.

- Investigate shock interactions with materials and their behavior under severe loading conditions and impact by high velocity penetrators.

f. Individual Survivability

- Investigate new techniques for remote detection of biological warfare agents.
- Investigate advanced g-protection for enhanced air crew capability and safety in repetitive high-intensity maneuvering acceleration.

2. Very High Speed Integrated Circuits (VHSIC)

A major new initiative was started in FY 1979 on integrated circuits (ICs) following nearly a year of careful planning. The program is planned to extend over a six-year period, and the funding is planned to average over $10 million per Service per year, for a total of about $200 million.

Technologically the program will result in ICs featuring submicron sizes. A single new IC will replace 50 or more present ICs. This will provide new and significantly increased capabilities for cruise missile terminal guidance, fire and forget tactical missiles, satellites, avionics, radar, signal intelligence (SIGINT), electronic warfare, communications, command and control systems, etc. Additionally, this will result in major savings in cost, weight, size and power compared to present systems and a ten-fold increase in reliability.

To insure rapid transition to military systems, an interim goal has been established. In FY 1982 ICs with minimum feature sizes of 1.3 microns will be demonstrated. In FY 1983 these ICs will be used to build demonstration units of selected military systems.

The program was initiated for two main reasons. First, we see an increasing divergence between the direction of the IC industry and the needs of the military. Because of the small (less than 10 percent) DoD IC market, we cannot expect industry to focus on real-time, high-speed signal processing and the related high clock rates we need. Also, industry is not developing devices to meet military specifications or partitioning chip sets for signal processing applications, including fault tolerance and built-in test features. Second, although the U.S. still holds a commanding lead in IC technology over the Soviets, particularly in the commercial sector, there is some evidence that this lead is eroding for military ICs.

This is a bold and ambitious program badly needed to meet DoD's present and projected needs. Also, it will help focus U.S. industry on these advanced goals and provide fallout to U.S. industry in meeting commercial overseas competition. Furthermore, it should stimulate innovation in the fabrication, design and utilization of ICs.

3. Manufacturing Technology

The Manufacturing Technology Program (MTP) develops and demonstrates advanced manufacturing techniques to assure the economical production of our weapons systems. While specific projects focus on individual production problems, the MTP addresses improved productivity across the entire spectrum of commodities purchased by DoD. Examples include composite materials fabrication, advanced inspection methods, near net shape fabrication techniques and ammunition production.

Efforts directed at automatically monitoring and controlling the variables of fabricating composite materials components will significantly reduce production costs, improve product quality and increase the reliability of missile and aircraft parts. Efforts are being directed toward automatically detecting anomalies in loaded artillery projectiles, jet engine blades and composite materials components. Applications of near net shape fabrication processes, such as hot isostatic pressing, and new casting techniques are focusing on turbine engine and aircraft structural components. Initiatives are continuing to support the modernization and improvement of the ammunition production processes, reprocessing explosive fines and drill scrap and dry cutting energetic materials.

4. Precision Guided Munitions (PGM)

We will soon have PGM weapons in full service that are highly effective but only in clear weather. To overcome this limitation, major thrusts were initiated in midcourse guidance and control and in autonomous, adverse weather terminal homing. Specific accomplishments in midcourse guidance and control (G&C) involved captive flight testing of a strapdown ring laser gyro (RLG) as a low cost inertial guidance system for missiles. In FY 1979 and FY 1980 the RLG and other proposed low cost inertial guidance candidates will be flight tested. To achieve autonomous terminal homing we have started development of advanced signal processing algorithms and statistical characterization of armor targets in both the infrared (IR) and millimeter wave (MMW) spectra. We have performed captive flight testing of prototype seekers. In FY 1979 and FY 1980 flight testing of competitive IR and MMW seeker candidates will be conducted.

A program in "fire-and-forget" seeker technology is being pursued with emphasis placed on imaging seekers resistant to countermeasures. Recently a Charged Coupled Device (CCD) imaging tracker demonstrated the capability to acquire and lock on to air targets in head-on aspect in the near visible spectrum. In FY 1979 and FY 1980 the development of a CCD array seeker will be pursued, capitalizing on the success of the previous CCD work but extending its capabilities into the infrared spectrum for use in night operations. We will design and fabricate an active RF seeker for use against surface targets. Again advanced signal processing will be the key to the successful demonstration of this new capability. This particular work is expected to provide a truly "all-weather" capability.

To better understand propagation effects in adverse weather, smoke and dust conditions we have formulated a five-year DoD plan for atmospheric transmission research and development. Each Service will concentrate on those areas unique to its mission. The Army is concentrating on the land battlefield environment, studying the detailed interaction of dust and smoke with optical propagation. The Navy is concentrating on the unique problems posed by the marine environment. The Air Force is responsible for the numerical modelling of atmospheric transmission. These programs capitalize upon and extend existing Service capabilities.

5. <u>Night Surveillance Capability</u>

Two major technology advances, the common module Forward-Looking Infrared (FLIR) and the second generation night vision goggles, have progressed into production. Even more advanced night vision goggles will be entering engineering development in FY 1980.

The next major advance will be the development of two dimensional arrays of detectors, called focal plane arrays (FPAs). Their increased total sensitivity will provide three new advantages: first, better utilization of the three to five micron wavelength regime, for example, will provide more than twice the range in humid weather; second, doubling the field of view of present FLIRs; third, staring (nonscanned) sensing device with no moving parts will provide new capabilities for air-to-ground missiles.

In this past year a charge transfer efficiency of 0.9995 was achieved in HgCdTe. A HgCdTe FPA operated with thermoelectric cooling, essential for a rifle sight. A photocathode for image intensifiers was demonstrated to operate at 1.65 microns with a high yield. In FY 1980 FPAs will be incorporated and tested in FLIRs and development of automatic cueing of targets in an infrared scene will begin.

6. <u>Over-the-Horizon (OTH) Search and Target Designation</u>

As enemy firepower increases, it becomes increasingly important to achieve a standoff capability for search, identification and target designation. The Army mini-RPV program demonstrated a significant advance in FY 1977 when an effective landing system for a test vehicle was demonstrated. Mini-RPVs, equipped with a television camera and a laser target designator, are now entering engineering development. In addition, the Air Force is developing new digital radars for satellite applications which will have an unprecedented counter-countermeasure capability by using spread spectrum and adaptive antenna techniques.

7. Low Vulnerability Munitions

A joint DoD/DoE study will complete by March 1979 a careful evaluation of the technical possibilities for developing and applying new explosives and propellants to military weapons which are less susceptible to accidental detonation while maintaining a good destructive potential. Broadly, the preliminary findings of this study are that:

- o Insensitive explosives clearly have a role to play in reducing the vulnerability of some of our weapons and thereby the vulnerability of especially sensitive and important carriers (e.g., Naval ships).
- o Insensitive explosives now available (e.g., triaminotrinitrobenzene, TATB) are adaptable to some of the more specialized weapons applications and can serve an important role there. They are too expensive for general purpose ordnance and too low in performance for applications that are highly performance-dependent.
- o Similar considerations apply to gun propellants.
- o The damage produced by vulnerable missile propellants--on the basis of historical evidence--is very largely from unintended ignition and pressure vessel explosion. Despite major efforts, no progress has been made toward identifying a means for coping with it through propellant reformulation. On the contrary the demand for highest possible propellant performance is leading to acceptance of more rather than less vulnerable propellant materials (e.g., reduced smoke tactical weapons).
- o The Navy has made substantial progress toward reducing hazards of propulsion system explosive burning through modification of case design, material and insulation. At the moment this appears to be the most promising route toward reducing vulnerability to damage from unintended ignition of rocket motors.

A five-year S&T program will be initiated having as its objectives:

- Identifying and characterizing the most rewarding specific applications for insensitive high explosives now available (TATB, nitroguanidine) in current and near term weapons.

- Understanding better the controlling steps in the physics and chemistry of initiation of detonation and finding ways to apply this understanding to desensitize high performance explosives and propellants now available.

- Developing new explosive molecules and new formulations and compositions which are less sensitive but of high energy output.

- Transferring current and new, less sensitive explosives and propellants from laboratory to pilot production scale.

8. Directed Energy Technology

Within the directed energy technology program, there are two basic thrusts--high energy lasers and particle beam technology.

The major thrust in high energy lasers continues to be verification that such weapons will be cost-effective compared with other more conventional means.

In March 1978, the Navy achieved a significant milestone through the shoot-down of TOW missiles by a high energy laser laboratory test bed. Design of a high energy laser test facility at the White Sands Missile Range (WSMR) is nearing completion. In additon, we will use a pulsed electric laser to perform joint Army-Air Force tests at an existing facility at North Oscura Peak on WSMR.

The DARPA high energy laser program continues. Including these DARPA efforts, which are explained in more detail later, we are requesting $211 million for FY 1980 for high energy laser technology, or a 10 percent increase over the $194 million appropriated for FY 1979.

Particle beam technology is in the very early research and exploratory development phases. To provide firm evidence that particle beam weapons are feasible, a major effort is required in accelerator technology. We need accelerators that will provide the high beam powers and currents for definitive experiments in beam propagation. Other efforts are devoted to critical issues in power generation, conditioning and switching; beam interactions with materials and target components; and beam pointing and tracking.

The Chair Heritage program management has been transferred from the Navy to DARPA. In FY 1980 Chair Heritage will continue to emphasize construction of the Advanced Test Accelerator (ATA) at the Lawrence Livermore Laboratory. The large increase in funding requested will allow for purchase or construction of the bulk of the components for this accelerator. The Experimental Test Accelerator beam will be characterized and used in experiments designed to obtain a fundamental understanding of the physics of beam propagation.

The Army in 1980 will complete efforts to demonstrate proof of principle for collective acceleration of a high current proton beam which could lead to very compact beam generators. Tests will be conducted to verify theoretical models and computer codes for design of neutral beam generators for possible exoatmospheric applications.

A total of $29.5 million is being requested; $24.0 million in DARPA research funds, $4.5 million under the Army Ballistic Missile Defense Technology and $1 million in Air Force funds. $17.2 million was appropriated in FY 1979.

9. Composite Material Development

A coordinated Navy and Air Force program in erosion resistant carbon/carbon (C/C) composite materials is directed toward improving the survivability and accuracy of advanced reentry vehicles under the adverse atmospheric conditions caused by severe weather and/or nuclear bursts. The technological goal of this program is to develop, by FY 1982, nose tip and heat sheild materials which in severe weather will maintain the accuracy and survivability now achieved with C/C materials under clear air conditions. One approach entails improvements in the construction and processing of C/C materials and the other seeks to reduce erosion damage by changes in the composition of these composites.

All three Services and DARPA will increase work in FY 1980 on development and application of metal matrix composite materials. These very advanced structural materials show uniquely good promise for:

- o Helicopter Transmission Housing--50 percent reduction in vibration.
- o Portable Bridging Components--increased mobility, reduced weight.
- o Equipment structure for TRIDENT missile--range increase.
- o Mines and Torpedoes--increased depth capability.
- o Tactical Missile Components--hypersonic speed range option.
- o Airframe and Gas Turbine Components--10-20 percent weight reductions.
- o Satellite Components--increase in antennae gain.

To yield composite materials that are stronger and much stiffer than the metals alone, the projected work will develop and evaluate selectively reinforced conventional metals such as aluminum, magnesium, titanium and combinations in preplanned orientations of high strength and stiffness fibers including graphite, silicon carbide and aluminum oxide.

10. Chemical Defense Technology

U.S. forces can only be rated as marginally prepared to survive and operate in a chemical attack. This has been recognized by the DoD and the Congress. However, if our present planned RDT&E and procurement programs continue, an adequate defensive posture should be attained.

Research and development programs have been directed to all critical areas: pyridostigmine prophylaxis should improve treatment of nerve agent casualties; remote detection using new infrared and logic techniques will enhance early warning and detection capabilities; a new universal mask and individual decontamination kit will provide better individual protection; prototype protection for groups and a decontamination apparatus for vehicles is in development; new simulant materials to provide realistic training are being developed; and a new effort directed toward decontamination fluids and dispensing apparatus will allow improved mobility and logistics by facilitating decontamination of sensitive equipment, personnel and large areas. Limited efforts have been maintained in the development of binary munitions; a warhead for the General Support Rocket System and a 155mm projectile to deliver an intermediate volatility nerve agent. Binary munitions, while maintaining a deterrent/retaliatory stockpile, would provide significant safety advantages in manufacturing, storage, surveillance, transportation and disposal operations.

11. Training Devices and Simulation Technology

Technology efforts on training devices and simulation support an annual procurement program of over $500 million. Our objectives are to provide initial and life cycle cost reduction of maintenar : and operational trainers through reduced dependence on expensive operational equipment. This technology also allows us to train when and where we want with increased safety and knowledge of results as experienced with the Simulator for Air to Air Combat, the A-7 Head-Up Display maintenance trainer, the Ground Control Approach operator trainer and the laser engagement simulators.

Our goal is to provide more effective individual and team initial and readiness training by simulating the weapon system and its operational environment. The Services have established cooperative and coordinated programs focusing on visual, maintenance and munitions simulation. For example, the Air Force, Army and Navy are developing complementary technological approaches for simulating very wide field-of-view scenes for aircraft weapons systems simulator' and armored full crew tank simulator (XM-1) using both computer and model board image generation techniques. The Navy has a highly concentrated maintenance training improvement program for aircraft, surface and submarine system hands-on fault isolation and repair. The Army is continuing its efforts to provide full battlefield engagement training using advanced laser and weapons effects techniques to simulate actual weapon employment.

Recent flight simulator evaluations indicate (a) the use of the Navy P-3C aircraft simulator saves enough flight time to amortize the cost of the simulator in two years; and (b) the relative worth (effectiveness/cost) of the modern UH-1 helicopter simulator is about three times that of the simulator it replaced. Similar data are being compiled as battlefield engagement and maintenance training systems undergo operational utilization.

12. <u>The Defense Advanced Research Projects Agency Program</u>

The Defense Advanced Research Projects Agency (DARPA) serves a key role in DoD, vigorously pursuing high-risk and high-payoff technologies that have revolutionary implications for future weapon systems. DARPA's task is to provide "venture capital" for selective fast-moving technologies where exploitation may significantly enhance our defense posture. In addition, DARPA also is engaged in Research and Exploratory Development that (1) supports multi-Service and new mission oriented technologies and (2) permits a rapid examination of new technology approaches to ongoing Service developments.

DARPA's management approach has three elements. First, the program planning is accomplished in a streamlined organization that emphasizes "hands on" management by the technical staff and "flexibility" in program initiation and execution. Second, programs are executed through selected Service R&D laboratories which facilitates program control and coordination, and eases the transfer of technology to the appropriate Service after feasibility, payoff and risks have been determined. Third, DARPA programs are conducted largely through contracts with industrial, university and not-for-profit organizations in the private sector.

a. Program Overview

The following paragraphs highlight DARPA's major thrusts:

- Cruise Missile Technology. The overall objective is to provide options for increasing capabilities of current and next generation cruise missiles (consistent with SALT provisions) by pursuing technologies for (1) designs which will yield greatly improved penetration survivability, and improvement in payload capabilities, (2) guidance techniques which will reduce circular error probabilities to permit the destruction of fixed, high value strategic and theater targets with non-nuclear munitions, (3) to provide reduction in fuel consumption compared to conventional small turbofans and (4) develop an R&D capability for measuring and evaluating target signature effects to resolve long-term cruise missile defense and penetration issues.

- Space Defense. This thrust will develop the high energy laser technologies for space applications. In the past year, effort was concentrated on demonstrating the key technologies required. The feasibility of this approach will be demonstrated. The high efficiency nozzle design has been demonstrated; lightweight, large optics designs and fabrication techniques have been developed and conceptual designs indicate the feasibility of precise beam pointing required for the demonstration.

- Space Surveillance. A technology base for advancing space based infrared sensors is being developed. The optics and focal plane technology base includes the capability to produce cost effective mosaic focal planes. These technologies will provide sensor options to match evolving defensive concepts and threat scenarios. The TEAL RUBY experiment, incorporating first generation advanced focal plane technology, will be launched in 1981 and a second sensor will be launched to demonstrate mission concepts and technologies of the High Altitude, Large Optics (HALO) Program.

- Anti-Submarine Warfare. Under Project SEAGUARD, a towed array surpassed its objective. Advanced signal processing techniques were used. Additionally, there is an ongoing program in non-acoustic ASW.

- Land Combat. With the successful transfer of the Armored Combat Vehicle Technology Program to the Army, DARPA is now developing weapons to engage enemy armored vehicles and aircraft along three major approaches. First, radar technology is being coupled with a 75mm cannon to permit detecting and tracking multiple ground and air targets in all weather conditions. Second, infrared and focal plane array technologies are being applied to projectile guidance to provide true "fire and forget" capability both in a direct fire Tube Launched Guided Projectile and in the indirect fire role. Finally, a program has started which is aimed at destroying point targets to provide an option for a self-propelled howitzer with fire-on-the-move capability.

- Air Vehicles and Weapons. The key rotor and flight control systems of the X-Wing V/STOL flight demonstrator will enter fullscale wind tunnel test this Fiscal Year. The Forward Swept Wing technology demonstrator, with the potential for higher aerodynamic and maneuver performance as well as lower weight and cost, is presently undergoing a series of scale model wind tunnel tests. In the avionics area, both the Low Probability Intercept Radar (LPIR) and Sanctuary Radar programs are developing airborne sensors capable of increased aircraft survivability as well as reducing vulnerability to warning and targeting receivers. The Self-Initiated Anti-Aircraft Missile (SIAM) program has proved to be a successful technology development and plans are to complete analysis and test flights in FY 1980 for Navy submarine application.

- Nuclear Test Verification Technology. The verification research has been reoriented to emphasize the interpretation of the complicated but more easily detectable seismic signals recorded at nearby stations. Research will also cover the design of a center to meet U.S. obligations under a CTBT, new means of source identification and improvements in our capability to estimate the yield of underground explosions.

- Command, Control and Communications. DARPA's efforts aim to enhance the survivability and mobility of computer communications, to create a technological framework for future secure message and information systems and to improve substantially the human interfaces with command and control information, decision and forecasting systems. Experimental demonstrations are planned to allow the research and operational communities, a "try-before-buy" mode of evaluating new operational capabilities. The DARPA/Navy Advanced Command and Control

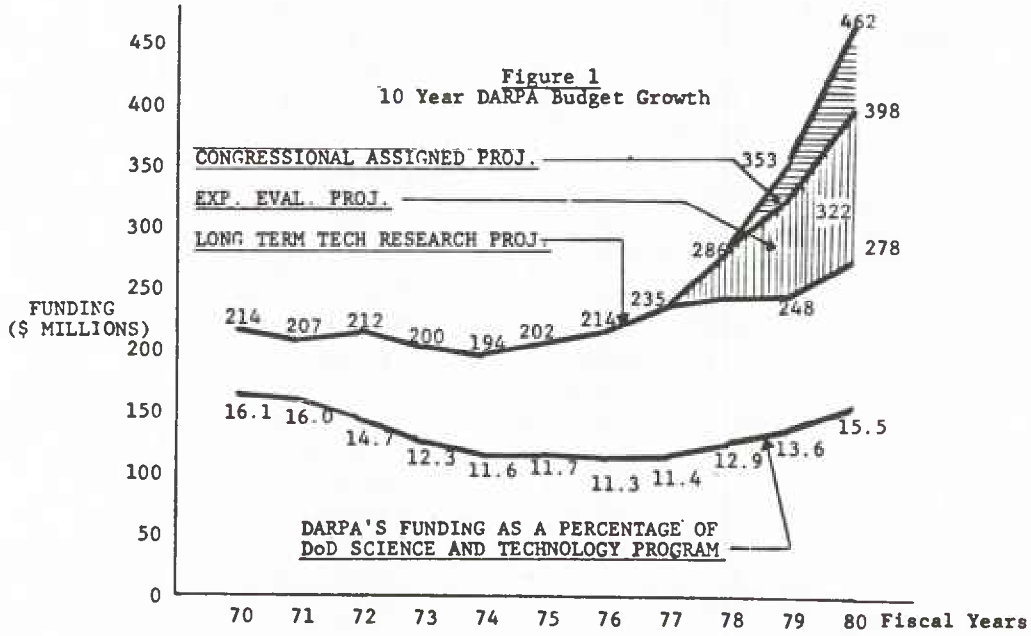
Architectural Testbed and the DARPA/Army Tactical Information Distribution Testbed are primary programs. The Battlefield Exploitation and Target Acquisition program is a DARPA/Army/Air Force effort to develop and test a tactical sensor "fusion" system.

- Charged Particle Beam. Key technical issue for charged particle beam concepts is whether the beam will propagate stably in the atmosphere. Low energy experiments have led to the stable propagation at sub-atmospheric densities. A much higher energy Advanced Test Accelerator is currently under construction.

- Assault Breaker. The Soviet conventional forces in Eastern Europe have undergone significant expansion and improvement during the past decade. The combined Warsaw Pact air and ground forces opposite NATO in Central Europe are capable of executing a minimal warning attack across the inter-German border with a minimum of mobilization. Most assessments of such a confrontation tend to indicate rapid success by the Warsaw Pact. Current Soviet doctrine stresses the offensive and calls for forming their forces in echelons to generate and sustain attack momentum along major axes of advance. The Assault Breaker (AB) program is demonstrating the technology for a standoff weapon system capable of engaging and destroying an attacking force thus negating this most serious Warsaw Pact threat in Central Europe. The system makes use of target acquisition and weapon guidance radar to find and track targets. The radar then guides standoff-launched area weapons, which can engage and destroy the target array. The program is currently competitively developing elements under DARPA direction with a system concept demonstration planned for mid FY 1981. A Steering Group consisting of Army, Air Force and DARPA members is formulating a plan for Service development, as appropriate, following the FY 1981 concept demonstration.

- Technology Initiatives and Seed Efforts. DARPA continues to be a spawning ground for innovative concepts and ideas which can have a major effect on reducing new weapon system costs and enhancing national security. For example, new superalloys have already demonstrated property improvements that could increase the specific thrust of today's turbojet engines by 50 percent by the mid-1980s. Other examples are (1) the use of finely-focused laser, electron and ion beams in the fabrication of reliable, high performance integrated circuits without the use of photomasks or high temperature processing for microelectronic "systems on a chip"; (2) the development of an electromagnetic gun which can propel projectiles in the hypervelocity regime and (3) the development of advanced fighter cockpit avionics based upon the analysis of potentially useful information from the human electroencephalogram and other non-verbal behavior.

b. Program Balance. The requested DARPA budget for FY 1980 is $462 million. This budget is consistent with the size and growth of the overall DoD Science and Technology Program as shown in Figure 1.



The DARPA FY 1980 budget is almost the same percentage of the DoD Science and Technology Program as it was in FY 1970. Over this period, the DARPA budget has grown by only 1.4 percent per year, when inflation is taken into account. Nevertheless, this budget provides for full funding of the two congressionally assigned projects (i.e., Charged Particle Beam and Assault Breaker), fully supports the major program demonstrations in the Experimental Evaluation project and provides a no-growth budget for the remaining long-term technology research projects.

13. Defense Nuclear Agency

The effects of nuclear weapons on military systems are of vital concern to the national security. The Defense Nuclear Agency is the DoD's principal source of nuclear effects knowledge and conducts a comprehensive research program to assess the survivability of our military systems in a hostile nuclear environment, to predict the lethality criteria for confident destruction of enemy assets and to develop technological capabilities that will enhance theater nuclear force effectiveness. The DNA development and test program spans the entire range of DoD nuclear weapons effects interest. Major activities in FY 1980 include:

- Laboratory Radiation Simulators. A major thrust of the DNA program is the development of advanced radiation simulators to lessen our dependence on underground nuclear tests. Two major simulation facilities are planned. In the near term, a Satellite X-Ray Test Facility (SXTF) is being developed in which full-scale satellites will be exposed to threat relatable X-ray pulses in a simulated space environment. All elements of this program are proceeding smoothly toward a planned IOC of FY 1984. In the longer tern, DNA is conducting an aggressive program to develop a laboratory simulation capability for missile and reentry vehicle hardness verification now performed in underground tests. This work takes on an added sense of urgency with the increasing possibility of a Comprehensive Test Ban Treaty in the near future.

- C^3I Nuclear Survivability. Another important DNA effort is the determination of the effects that nuclear weapon detonations have on the endurance of communications, command, control and intelligence (C^3I) functions that would be needed to support a general war. High altitude nuclear explosions are of particular concern because of the potential for widespread damage from the electromagnetic pulse (EMP). DNA has recently concluded field activities of the Assessment of Pacific Communications for Hardening to EMP (APACHE), which included threat level EMP testing of NAVCAMS EASTPAC at Wahiawa, Hawaii. The results indicate that disruptions would occur to CINCPAC's operating forces in the Pacific under certain conditions. The final phase of the program will define a hardening program to CINCPAC for enhancing the survivability of Pacific C^3 in a nuclear environment. Also included in the DNA C^3I nuclear survivability program is an assessment of the disruption to radiocommunication links and optical and infrared sensors produced by the disturbed atmosphere resulting from nuclear detonations. This program has concentrated not only on prediction of the complex nuclear phenomenology, but equally importantly on ways to mitigate signal transmission/reception degradation in a nuclear environment.

- M-X Support. DNA's program in support of M-X has remained flexible and closely coordinated with the Air Force decisions to investigate different, viable, multiple protective structures concepts. In addition to experiments on underground tests, DNA has successfully conducted a series of high explosive tests whose main purpose was to provide data on the airblast and ground shock effects for M-X basing structure designs in a multiburst environment. The effects of nuclear radiation and the EMP from close-in bursts on multiple protective structures are being closely examined to determine their optimal spacing. We are also examining the EMP effects on air mobile systems from nuclear bursts at intermediate ranges.

- Underground Test. The next scheduled underground test (UGT), MINERS IRON, in FY 1980, will provide engineering and design data on materials components and subsystems of the M-X weapon system. In addition, systems components and materials being considered for the Advanced Ballistic Reentry System (ABRV) and the Advanced Maneuvering Reentry Vehicle (AMaRV) will be exposed to threat relatable X-ray fluences. A full-scale satellite, based on the DSCS III design, will be exposed to investigate the impact of System Generated Electromagnetic Pulse. Finally, a series of strategic structures will be subjected to the ground shock environment to extend the data obtained on earlier tests as part of ongoing research on deep underground systems. Preliminary planning is underway for a series of shots, sponsored by DARPA and fielded by DNA, to obtain data on the generation of seismic signals by underground nuclear explosions. These data will be used to verify seismic source calculational methods, improve methods of discriminating between UGTs and earthquakes, and address U.S. capabilities to monitor both the existing Threshold Test Ban Treaty and the Comprehensive Test Ban Treaty now being negotiated.

- Strategic Nuclear Targeting. In FY 1980, DNA is initiating a new program on strategic nuclear implications and assessments. This effort is designed to improve the understanding of the relationship between nuclear weapon effects and strategic nuclear targeting and employment planning, and provide techniques for the optimized application of nuclear weapons to carry out national strategic objectives. These broad objectives are specifically designed to allow for upgrading and implementing guidance cited in National Security Decision Memorandum 242, the Joint Strategic Capabilities Plan (Annex C), the Policy Guidance for the Employment of Nuclear Weapons and succeeding guidance documents as they are issued.

DNA programs on theater nuclear warfare and the survivability and security of theater nuclear forces are discussed in further detail in Chapter VII. The total DNA funding request for FY 1980 is $179 million.

VI

VI. STRATEGIC PROGRAMS

A. INTRODUCTION AND SUMMARY

The principal policy objective underlying the structure of our strategic nuclear forces is deterrence of a nuclear attack on the United States, our allies, or others whose security is important to us. The diverse, militarily effective strategic capabilities of our TRIAD have achieved such deterrence in the past, and continue to do so. We plan to continue to maintain the capability of the TRIAD because separate forces with differing characteristics hedge against breakthroughs in defensive technology and unanticipated failures in any one force component, and they allow exploitation of the complementary features of the different types of forces to achieve high confidence in their employment. By complicating a potential enemy's attack problem, as well as his defensive problem, we gain the high confidence we are looking for. With TRIAD diversity, we could be confident that a large fraction of at least two of the three force elements will survive and be capable of effective retaliation.

In the air breathing element of the TRIAD we are continuing the development of the cruise missile. Its inherent penetration capability is sufficiently encouraging that we are convinced cruise missiles will assure the effectiveness of the strategic bomber force into the future. In addition, cruise missiles provide us with the capability to rapidly expand the air breathing element of our forces should that be required. We plan to deploy a mix of SRAMs, gravity bombs, and cruise missiles on our B-52's to utilize the inherent flexibility of the bombers as long as practical.

The potential vulnerability of our existing silo-based ICBM force continues to be the item of major concern in our strategic forces. We have recognized that these fixed targets would become vulnerable with improving Soviet accuracy. We are now projecting that, by the early-to-mid 1980's, the Soviets could destroy a large percentage of our MINUTEMAN missiles with a relatively small fraction of their ICBM force. Accordingly, rebasing a portion of our ICBM's for survivability will be necessary if we are to continue to benefit from the unique advantages of the ICBM force (a combination of independence from tactical warning, endurance, good C^3, quick response, accuracy, rapid retargeting, and low operating costs). The major rebasing effort to date has been Multiple Protective Structure (MPS) technology (formerly known as Multiple Aimpoint, MAP). We decided, however, not to recommend the immediate initiation of full scale development for this approach because there are several remaining issues. In parallel with attempts to resolve these, we are proceeding with the design of an alternate basing concept--air mobile--and plan to have sufficient data to allow a mid FY 1979 decision and subsequent full scale development of either the MPS or air mobile options.

The SLBM force continues to be our most survivable TRIAD element and our current actions are designed to provide even greater assurance of its enduring survivability. This will be accomplished through introduction of the longer range TRIDENT I missile to be backfitted into POSEIDON submarines and deployed in the new quieter TRIDENT submarines.

We continue to rely primarily on strategic offensive forces to achieve strategic objectives. Our air defense forces are modest and we have chosen to dismantle our only ABM defenses, which in any event are severely restricted by treaty.

The Soviets currently have an operational capability to attack some U. S. satellites. The United States possesses no such capability. Since we are becoming increasingly dependent on space assets for command and control, navigation, and critical surveillance, we are concerned about a Soviet capability to interfere with our satellites. We cannot accept this asymmetry and the President has directed two efforts to work towards its elimination. First, a vigorous program is underway to seek means of protecting our satellites and to develop the capability to attack enemy satellites. Second, the U. S. is holding ASAT arms control talks with the Soviets which could lead to negotiations on bilateral curbing of anti-satellite capabilities. We believe that such an agreement would be in the overall national security interests of both nations.

B. OFFENSIVE SYSTEMS

Our FY 1980 program for strategic offensive forces is structured to assure that we maintain essential equivalence with the Soviet Union to deny them the opportunity to gain political or military advantage from their strategic forces. The principal efforts included in this program are full scale development of the M-X missile and an associated survivable basing system, continued full scale development and production of cruise missiles, continued production of TRIDENT submarines, and continued production with initial deployment of the TRIDENT I missile.

1. Land Based Intercontinental Ballistic Missiles

The major thrust of our FY 1980 strategic effort will be directed toward the development of a survivable ICBM in order to reduce the adverse effects of projected MINUTEMAN vulnerability on our TRIAD capabilities. There are two types of adverse effects we would suffer by allowing our ICBM force to become ineffective, thereby moving to a DYAD. The first is the loss of specific characteristics; this influences what we will or will not be able to do with our forces. The second is a loss in diversity, which influences our confidence in being able to effectively utilize our forces in the face of new and unexpected Soviet developments or of unforeseen occurrences.

Some of the more important ICBM characteristics we value are as follows: Independence from Tactical Warning (this means we can ride out an attack and are not forced into a position of having a "hair trigger" response); Endurance (so we are able to maintain capability after an initial exchange for an appropriate period of time); Good C^3 (by this it is meant that we have communication and data links that are survivable, have the appropriate capacity, and are redundant); Quick Response (not only in the sense of flight time, but equally importantly, in the sense of rapid communications with the force and getting it to respond promptly); Rapid Retargeting (so that we have flexibility); Accuracy (so that our targeting capabilities can be matched to a variety of desired SIOP execution options); Low Operating Costs.

The benefits of having diversity appear in three ways. First, we are protected from major breakthroughs by the Soviets (e.g., solving the ASW problem or deploying a very effective air defense). Secondly, we are protected against failures on our own part such as equipment problems, unsuspected vulnerabilities, and shortcomings in our ability to plan scenarios in detail. Thirdly, we use diversity to complicate the enemy's planning and resource allocations.

Thus, by modernizing the ICBM leg of our TRIAD, we maintain important military characteristics and are well hedged against unanticipated developments by the Soviets and unknown inadequacies of our forces.

The ICBM programs we are proposing in FY 1980 are aimed at improving survivability to preserve our TRIAD as well as increasing capability. These programs consist of the M-X system, which will result in long term survivability starting in the mid-1980's, and upgrade of the MINUTEMAN III to effect higher yield and better control for the near to mid term.

a. M-X Basing
(RDT&E: $229.0 Million)

The M-X Basing system is at the heart of plans for enduring ICBM survivability. A promising technical solution is the Multiple Protective Structure (MPS) system (formerly MAP) which would be composed of many vertical shelters for each missile. Missile mass simulators could be emplaced in those shelters not containing missiles. Transposition of the missiles and their simulators at appropriate intervals by transporter/emplacer vehicles would deny the enemy knowledge of the location of the missiles and thus force him to target all of the shelters.

A point of concern in this MPS approach is provision of the ability to verify with confidence the numbers of missiles on each side by National Technical Means. This problem is being addressed. On the basis of overall attractive features of the MPS we intend to continue its development at a pace consistent with the missile development, while refining the verification solutions so that a full scale development decision can be made in FY 1979, if appropriate.

Additionally, we are proceeding with the study of an air mobile option. The most promising of the air mobile options uses STOL aircraft which, under high alert conditions, could be operated out of hundreds or thousands of small airfields. This concept envisions the use of AMST-derivatives to escape from an SLBM attack directed against the main airbases (North-Central CONUS) and capitalizes on the existing large number of short runways at airfields throughout the country (civil as well as military). The aircraft would flush to these bases upon attack of the main bases and subsequently move base-to-base to deny the Soviets knowledge of their location and to provide a means to achieve endurance. As a result, there are a very large number of possible missile locations--as in MPS. The missile would be designed for air-launching.

b. M-X Missile

(RDT&E; $441.0 Million)

The missile selection for use in M-X is more straightforward than the basing. We are preserving the option for the development of a missile having two stages applicable to TRIDENT II use as that system matures. This approach allows for some financial savings, while insuring a near-optimum carriage of RV's with high accuracy.

c. MINUTEMAN Improvements

(RDT&E: $30.3 Million, Procurement: $129.4 Million)

We are continuing improvements in the MINUTEMAN force by increasing the yield on MINUTEMAN III and by installing a better command and control capability. The yield of the MINUTEMAN III reentry vehicle/warhead (Mk-12) is being increased in order to provide improved missile effectiveness. The new warhead (Mk-12A) is well along in its development stage.

The present MINUTEMAN force can be launched on command from Airborne Launch Control Centers (ALCC's); however, their alert status is unknown to the ALCC in the absence of communications from the ground Launch Control Centers. Moreover, they cannot be retargeted from the ALCC. We plan to give the ALCC capabilities to determine missile status and to retarget missiles.

2. Sea Launched Ballistic Missiles

Deployed at sea the SLBM force currently is essentially invulnerable to preemptive strike by opposing forces. SLBM weapons can therefore be launched in response to a nuclear attack on the United States or can be withheld by the National Command Authorities with confidence that they will be available when needed.

However, this invulnerability may not be absolute nor last indefinitely. We have postulated technologies which, if deployed in large quantities, could put a portion of the existing SLBM force at risk. We don't believe the Soviets are as advanced in these ASW technologies and, in any event, such a deployment would be very expensive and observable (so we would have sufficient warning). Nevertheless, because of these postulated ASW improvements, we believe it is important to continue those improvements in our SLBM forces which make the ASW task more difficult.

a. TRIDENT Program

(RDT&E: $164.8 Million, Procurement: $1884.1 Million)

The TRIDENT program will help insure the continuing invulnerability of the SLBM force. The TRIDENT ship design results from a very deliberate effort to reduce the acoustic observables of a sea-based system while increasing its operating range and area. The selection of the TRIDENT design was made only after carefully considering those characteristics that contribute to the survivability of the SLBM force and reduce the acquisition and life cycle cost of the system. The principal survivability characteristic is its ability to remain at sea, submerged and undetected. Every effort has been made to increase the time the system will remain at sea both by increasing the time at sea between upkeeps and overhauls as well as decreasing the planned overhaul period. Other features are reduction of self noise and improved defensive systems. An important addition will be the improved strategic weapon system that will decrease the dependency of the system on outside electronic navigational aids and therefore the necessity for exposing the submarine to collect position information.

The TRIDENT SSBN missile launch tubes will accept the TRIDENT II missile, with its potential for improved accuracy and greater range/payload combination. This missile is currently in the concept definition phase. In the meantime, the initial TRIDENT SSBN's will be deployed with the TRIDENT I missile. The improved range capability of the TRIDENT I missile will permit employment of the TRIDENT system in the northern Pacific Ocean and throughout the Atlantic Ocean.

The TRIDENT I missile, constrained in size for deployment on POSEIDON submarines, will permit us to upgrade the POSEIDON force in the near term and therefore mitigate the impact of our pending withdrawal from the advanced deployment site at Rota and delays in the TRIDENT submarine building program. The TRIDENT I missile test program will be completed this year. Initial deployment of the TRIDENT I missile on a backfitted POSEIDON submarine is currently scheduled to occur in October 1979 with subsequent deployment on the first TRIDENT submarine scheduled to occur in August 1981.

The FY 1980 program will continue the procurement of TRIDENT submarines and TRIDENT I missiles, the concept definition phase for the TRIDENT II missile, and the advanced development of the Mk-500 Evader which could be required as an option to guard against the contingency of a major upgrade of the Soviet ABM system.

b. SSBN Survival

The principal effort for assuring the continuing survivability of the force is the SSBN Security Technology program. The objective of this program is to determine the limits of performance of hypothesized ASW techniques based on SSBN signatures and operational characteristics. Both acoustic and non-acoustic techniques are assessed in analyses, laboratory experiments, and at-sea experiments utilizing SSBN's. Changes to SSBN operational practices have occurred as a result of findings in this program. It is not an academic exercise.

One of the major events of FY 1980 will be the first at-sea trial of a long towed array to assess the noise background in the mid to high frequency band. This experiment will build on the DARPA experiment in FY 1978 and will make use of one of the highest gain arrays ever attempted at these frequencies. The experiment promises to add considerably to our knowledge of the structure of background noise.

Among the tools used by the SSBN commanders to avoid detection is the ship's sonar. The sonar enables the commander to detect the presence of other ships and alerts him to take appropriate action. We have a Sonar Evaluation Program which evaluates the actual operational use of the sonars on the POLARIS and POSEIDON boats. By this means, the performance of these critical systems is kept at the highest levels.

Finally, we are taking steps for the future to make the TRIDENT submarine secure from detection. We have made major efforts to reduce its acoustic signature far below that of the POLARIS/POSEIDON force. We are also determining how we might do the same for other signatures.

c. SSBN-X

(RDT&E: $10.0 Million)

We are undertaking conceptual design of SSBN alternatives which might provide systems of lower costs but with the capabilities and survivability required in our sea-based deterrent force. This effort includes feasibility studies of conventional and non-conventional alternatives.

3. Air Breathing Forces

We continue to advocate the concept of a mixed force of manned bombers and cruise missiles for the air breathing TRIAD element. A mixed force is much more stressing to the defense in that the preferable responses to bombers and cruise missiles are quite different. For example, a potential threat to penetrating bomber forces is the use of AWACS-type surveillance aircraft and look-down shoot-down (LD/SD) fighters. In this situation the cruise missile offers the opportunity for saturating the defense, requiring the defensive systems to have much greater detection sensitivity and to be deployed by the thousands instead of the hundreds.

a. Air Launchd Cruise Missile (ALCM)
(RDT&E: $100.0 Million, Procurement: $364.4 Million)

By the mid-1980's the ALCM/B-52 weapon system will constitute the primary force in the bomber element of the Strategic TRIAD, providing an accurate, long range weapon; increased targeting and routing flexibility; and reduced B-52 exposure to present and postulated air defense systems. The ALCM can also dilute area defense system effectiveness by saturating the system with numerous penetrating vehicles.

To insure that the best possible missile is developed for the ALCM mission, the AGM-86B (the Boeing ALCM design) and the AGM-109 (the General Dynamics ALCM design) have been placed in parallel competitive development. This competition was initiated in February 1978. Contracts have been awarded to both Boeing and General Dynamics for the delivery of ten and seven flight test missiles, respectively. The contract provides for the missile airframes and the integration of the engines and the guidance units into the airframes. The engines and guidance units are being procured under separate contracts and provided to both missile system contractors. Ten flights of each missile design are planned during the June-November 1979 time period. Source selection will be completed in early 1980 to support a DSARC Milestone III in February 1980. Substantial efforts are also underway to develop TERCOM mapping and mission planning capabilities to support cruise missile deployment.

We conducted a series of survivability tests in 1978 to determine the effectiveness of the cruise missile in penetrating present and future Soviet air defenses. These tests demonstrate that the present design defeats the present generation of Soviet air defense systems. They also indicated the characteristics required of an air defense system that could effectively defend against a mass cruise missile attack. Survivability testing will continue to insure that there are no unsuspected vulnerabilities or weaknesses which can be exploited by an opponent. These tests have been and will continue to be the basis for improvements to the weapons now in development and for possible follow-on weapons.

On-going technology efforts already show promise for additional improvements in cruise missile range and survivability beyond those that can be accommodated by modifying the existing cruise missile designs. The Advanced Technology Cruise Missile (ATCM) program provides for the investigation of technology that could lead to a follow-on cruise missile with improved propulsion, signature reduction, and avionics in the late 1980's.

The cost and development span of all our first generation cruise missile programs are being carefully controlled by use of common management, testing, and components wherever possible. The result has been a highly successful and closely integrated development effort. However, elimination of duplicate effort among the programs has also made these programs mutually dependent to a very high degree. Details of the Ground Launched Cruise Missile (GLCM) and Sea Launched Cruise Missile (SLCM) programs can be found in Chapter VII (Tactical Programs).

b. <u>Bomber Forces</u>

In order to enhance the capability of our current bomber force we will assess upgrading the B-52 defensive electronic countermeasures (ECM) by applying advanced techniques similar to those developed for the B-1 system. This will enable us to better cope with the threat posed by AWACS-type aircraft and LD/SD fighters as well as surface-to-air missile systems (SAM's). We also intend to continue B-1 R&D and will place emphasis on defensive avionics and electromagnetic pulse (EMP) testing. Under this program we will complete the advanced ECM development, carrying it through testing, and determine the success of our EMP protection efforts. Additionally, we plan concept definition for the next generation penetrating bomber. Such a bomber concept would involve advanced technology to optimize penetration.

(1) <u>B-52 Squadrons</u>

<u>(RDT&E: $136.2 Million, Procurement: $562.9 Million)</u>

This program provides for upgrading the B-52 so that it can effectively perform its roles as a standoff cruise missile launcher and a penetrator. The largest effort is for improving the offensive avionics which will improve weapon system delivery performance, reduce support costs, and provide an interface to cruise missiles and SRAM. The first aircraft is to be modified in early 1981 and modification of the first squadron is to be completed in late 1982. Also included in this effort is the analysis of B-52 nuclear hardness, and the evaluation of B-52 life. We plan to continue upgrade of the existing B-52 electronic warfare (EW) suite to maintain effectiveness against current and near term predicted threats. The question of whether to initiate installation and flight test of the B-1 ALQ-161 EW system in the B-52 to satisfy longer term EW self-protection is being studied. In addition, the Electronically Agile Radar has been incorporated into this line as a part of the Phase II modification to the bomb navigation system.

(2) <u>Bomber Penetration Evaluation (Previously B-1)</u>

<u>(RDT&E: $54.9 Million)</u>

Two important phases of the B-1 R&D program remain: completion of the ECM development and testing, and evaluation of the EMP efforts. Completion of the ECM system and testing on aircraft Number 4 will continue in FY 1980. This testing will serve to evaluate the effectiveness of a modern computer-aided ECM system. Following the ECM evaluation, EMP testing will be conducted to demonstrate our ability to design systems to withstand the anticipated nuclear levels that may be encountered.

(3) New Manned Bomber
(RDT&E: $5 Million)

In order to maintain our options for the air breathing element of the TRIAD we plan concept development for the next generation penetrating bomber. This bomber might be an unconventional design to significantly enhance penetrativity against the evolving threat. We visualize this approach as a high risk technology program which could lead to a new aircraft operational in the 1990's as the B-52's wear out. Thus, for FY 1980, we will initiate detailed studies and laboratory efforts of feasibility prior to the commitment of substantial development funding. Desired characteristics of a new bomber are high prelaunch survivability, reduced tanker dependence, and low life cycle cost.

(4) Strategic Bomber Enhancement
(RDT&E: $12.8 Million)

The primary objective of this effort is to achieve and sustain a technological base that will reduce component and subsystem lead-time and provide the technical confidence required to support decisions to enter full-scale development. It is a broad-based research and development program that provides for concept formulation, technology demonstration, and advanced development in such areas as lethal bomber defense weapons, advanced aircraft and cruise missile technologies, new avionics technologies, and new weapon concepts.

(5) Advanced Strategic Air Launched Missile (ASALM) (RDT&E: $25.0 Million)

ASALM is a supersonic missile with long range air-to-air and air-to-ground capabilities. It will fill the need for a strategic bomber/cruise missile carrier defense against a Soviet Union AWACS (SUAWACS) and, as a follow-on to SRAM, will provide a capability against hardened, defended targets. The ASALM program is a competitive subsystem development and demonstration effort leading to full scale development in FY 1983. The Propulsion Technology Validation (PTV) flight tests, which will begin in 1979, will be continued in FY 1980. Emphasis will be placed on subsystem development and testing of the air-to-air and air-to-ground guidance, the propulsion system, and techniques to reduce detectability.

(6) KC-135 Squadrons (RDT&E: $11.0 Million)

This program's main objective is the development of improved air refueling systems and equipment for use with the tanker force. The demands for aerial refueling support are increasing which require advances to increase the utility of our current KC-135 tanker force. Therefore we are continuing the engineering necessary for reengining the KC-135. This reengining would increase the fuel off-load capability, reduce the environmental impact of operations, and permit safer operations from shorter, hence more numerous, airfields. Coincident with reengining we are developing an advanced refueling boom for greater flow rates and winglets for increased operating efficiency and improved range.

c. Cruise Missile Carrier Aircraft (CMCA) (RDT&E: $30.0 Million)

The CMCA program provides an option to respond rapidly to a potential Soviet build-up in strategic forces. The development of a cruise missile carrier based on a current generation military or civilian aircraft design provides an early alternative if current forces cannot carry sufficient cruise missiles to meet projected requirements. The advanced design and development testing of two candidate aircraft, which will commence in FY 1979, will be completed in FY 1980. Our FY 1980 efforts also include the initial planning for a possible flight demonstration, by both candidate aircraft, in FY 1981 in order to provide solutions and risk reduction alternatives for critical areas identified during the system requirements definition phase. This schedule will support the option for the initiation of full scale development in late FY 1981.

4. Advanced Ballistic Reentry Systems (ABRES) (RDT&E: $105.3 Million)

The Air Force managed ABRES program is the principal DoD focus for advanced reentry technology. We look to ABRES to provide a national center of expertise in reentry technology and concepts in order to develop and maintain the technology base; evaluate new concepts;

and support the SALT, intelligence, and ballistic missile defense communities. Of greater importance, we now expect ABRES to generate options for the near future; preprototypes giving system designers the capability to penetrate enemy defenses, more effective subsystems which permit more efficient Reentry Vehicle (RV) designs, and proven materials and designs for RV's which can better survive hostile environments. Current emphasis on penetration aid preprototypes is needed to prepare for near term responses to Soviet activity in ABM systems. This is a possibility for the mid-1980's, and it is important for ABRES to prepare the groundwork for a rapid response to Soviet actions should it prove necessary.

In FY 1979, ABRES will complete the Advanced Ballistic Reentry Vehicle (ABRV). This RV preprototype is not only a candidate design for M-X and TRIDENT II but also a testbed for new technology. FY 1979 will also see the first flight of the Advanced Maneuvering Reentry Vehicle (AMaRV).

In FY 1980, major emphasis will be given to penetration aids for the Mk-500 (the maneuvering RV for the Trident I missile) and development of an advanced arming and fuzing system having the property of full resistance to enemy countermeasures.

C. DEFENSIVE SYSTEMS

The basic elements of strategic defense consists of the surveillance and warning systems to detect and characterize hostile actions by strategic aircraft, missiles, or spacecraft, and the defensive weapons to counter these forces. As a consequence of the long-standing U.S. posture that places the burden for deterrence on our strategic offensive forces, only limited resources are being placed on developing defensive weapon systems. Nevertheless, we maintain a meaningful level of activity in this area to provide future options for defense should the need arise, and to be capable of effecitvely performing the surveillance and warning functions so that we can react to an attack in a timely fashion should deterrence fail. Moreover, it is important that we keep technologically abreast of the Soviets, who have a very active program of strategic defense, to assure that we will not be surprised and be without an adequate response.

Our warning programs are designed to improve our ability to detect and determine the character of a Soviet attack so that we can enforce our options for strategic response such as launching our bomber forces. As a potential response to the Soviet threat to MINUTEMAN, our ballistic missile defense (BMD) research and development program could provide us the option to deploy a BMD system in the future should it be desirable to do so. In response to the Soviet anti-satellite interceptor, which I discussed earlier, we are developing technologies to make our satellites more survivable and have also initiated the development of an anti-satellite intercept system.

1. Warning

The survivability of the B-52 strategic bomber force and of our time-sensitive command elements such as the airborne command post depends on the performance and reliability of our early warning systems. Further, the increasing vulnerability of our MINUTEMAN force and the need for timely information regarding the nature of an ICBM attack to support future strategic options makes detailed attack characterization information imperative. Accordingly, we are proceeding with a modernization program to upgrade the Ballistic Missile Early Warning System (BMEWS); modify the software for the PAR Attack Characterization System (PARCS); and develop technology to provide improved attack assessment capability.

a. Bomber Warning
(RDT&E: $27.0 Million)

Our bomber warning systems are required to provide surveillance of bomber approaches to the U. S. to prevent enemy bombers or airborne reconnaissance vehicles from having unchallenged access to U. S. airspace and to provide adequate tactical warning of bomber attack. The objectives of our programs for bomber warning are to improve our existing capability against modern threats and to reduce the cost of facility operation and support.

Long-range early warning of bomber attacks from northern approaches to North America is provided by the Distant Early Warning (DEW) Line. The DEW Line was designed to provide warning of medium and high altitude bomber attacks; hence, it has gaps in the coverage at low altitudes. In addition, the equipment is becoming expensive to maintain because of its age. Several alternative approaches are being explored to improve the low altitude performance and to reduce operating costs. In FY 1980 we plan to initiate prototype development of a ground-based sensor to replace the present DEW radars.

To improve the capability of one of our warning systems and substantially reduce its operating costs, we have initiated the development of a minimally-manned, long-range radar for the Alaskan Air Command (AAC). The approach reduces the amount of equipment at each of the present 13 AAC radar stations and substantially reduces the number of personnel required at each site. Competitive contracts for the radar prototype design have been awarded. In FY 1980 a single prototype will be completed and tests and evaluation of the equipment will begin.

The most promising near term technique for providing long range, all altitude aircraft coverage of the coastal approaches to North America is the application of an Over-the-Horizon Backscatter (OTH-B) radar. The technical feasibility program we are pursuing will assess the ability of an OTH-B radar system to establish and maintain tracks on aircraft in the high traffic North American air traffic corridors and to assess the adverse effects of the auroral phenomena at the northern latitudes. If the technical feasibility is proven, an OTH-B radar installed on the East and West coasts could provide coverage that is contiguous with the AAC and DEW systems, thereby giving complete aircraft surveillance from all northern and coastal approaches. The construction of the experimental site in Maine is nearly complete and the technical feasibility experiments are to be undertaken in 1980.

Technology and concepts for space-based detection and tracking of a bomber threat are being developed to establish the viability of this potential alternative to ground-based radar. Space-based radar and infrared sensing concepts, being pursued by DARPA and the Air Force, offer the potential of increased warning time and reduced vulnerability. The TEAL RUBY space experiment, scheduled for 1981 launch, will provide proof-of-concept for space-based infrared bomber warning.

b. Missile Warning

(RDT&E: $89.0 Million, Procurement: $144.4 Million)

While our extensive early warning network is adequate today we have serious concerns regarding its reliability and performance during the next decade. Our current warning capabilities have served us well in assuring the launch survivability of the strategic bomber. We now face the immediate task of enhancing the survivability of our MINUTEMAN force.

Our approach to reliable warning has been to depend primarily on our satellite early warning system for immediate alert in case of a ballistic missile attack on CONUS, while ground-based radars such as BMEWS, PARCS, and PAVE PAWS provide corroborative data increasing the confidence of the warning information. Our satellite system consists of three satellites deployed in geostationary orbit over the Eastern and Western Hemispheres to cover Soviet ICBM and SLBM launch areas. While the system has performed admirably, it is nevertheless fragile. We are therefore proceeding with development of mobile truck-mounted terminals easily proliferated and indistinguishable from other Service vans. The current sensor evolutionary development (SED) program will provide a general upgrade of satellite system software, on-board data processing, and sensor improvements thereby increasing its raid and warning performance.

The ground-based radar program includes the development of two PAVE PAWS SLBM phased-array radars; one at Otis AFB, Massachusetts to be operational this year; and the other at Beale AFB, California to be complete a year later. A BMEWS modernization program which will involve the replacement, or extensive upgrading, of the radars is being planned for an IOC during 1983-1984. The PARCS radar at Grand Forks, North Dakota, provides the only detailed attack characterization capability we have against an ICBM attack on CONUS. Without the improved software, approved in the FY 1978 Budget Supplemental and to be continued into FY 1980, we would not have additional decision time required to support new strategic options until the upgraded BMEWS becomes operational.

A significant effort this fiscal year is the exploitation of mosaic focal plane technology for a possible operational prototype for a follow-on satellite system. It would not only provide more reliable early warning but, unlike the current system, it could be less vulnerable than BMEWS. This effort, carried under the Missile Surveillance Technology Program, places the Air Force mosaic sensor technology program (MSP) on a track directed at flight demonstration of a scalable operational prototype, with residual operational capabilities after controlled initial experiments over CONUS.

DARPA is pursuing alternative technologies for mosaic sensors oriented toward several surveillance missions, including missile surveillance. A flight experiment to demonstrate these technologies is contemplated. This demonstration will provide the technical/operational confidence required to make critical decisions on new space surveillance missions, including air vehicle and theater surveillance.

2. Ballistic Missile Defense

The Ballistic Missile Defense (BMD) program seeks to provide and maintain options for defense, maintain our lead in BMD technology, and encourage continued Soviet participation in strategic arms limitation efforts. By developing a broad technological base in BMD we attempt to avoid any destabilizing technological surprise that might result from a Soviet lead. In addition, the BMD program provides valuable assistance in the evaluation of the U. S. strategic offensive forces and the assessment of Soviet BMD activity.

Our BMD program, which is conducted within the constraints of the ABM Treaty, has been focused on the timely resolution of the key technical issues associated with concepts and technologies that offer the most promise for the defense of our land-based missile forces in the 1980's. A number of potentially effective approaches to missile defense have been identified. We will continue to test the feasibility of the Layered Defense System (LDS), which employs an exoatmospheric, homing, non-nuclear interceptor as a overlay to a conventional terminal defense system. We are also addressing key issues regarding low altitude defense systems that could be rapidly deployed. For the longer term, we have initiated a technology program that could lead to an interceptor with the capability to perform non-nuclear intercepts within the atmosphere.

a. <u>Ballistic Missile Defense Systems Technology (RDT&E: $114.8 Million)</u>

The most technologically challenging problems in the development of a BMD system are the integration and coordination of the many complex components. The Systems Technology Program (STP) addresses these issues by validating the performance of new concepts and technologies in a system context. This effort improves our capability to develop future BMD systems and preserves a minimum capability to initiate design and development of a system if required.

A major milestone was achieved during the past year when the Systems Technology Radar (STR) at Kwajalein became operational and tracked several ballistic missile payloads of opportunity. This radar represents a major advancement in BMD radars over earlier versions such as those used in the SAFEGUARD system. It is capable of generating more useful and flexible waveforms for BMD application, has demonstrated unmanned operation, and requires much less equipment. The STR could be employed as the underlay radar in the LDS or as a stand alone terminal defense system. The STR at Kwajalein will be used to gather additional target signature data against both targets of opportunity and dedicated targets.

A key component of the LDS is the non-nuclear exoatmospheric interceptor. Although the benefits of this type of interceptor are great, we have not yet demonstrated that it is feasible. A program to demonstrate the capability to destroy a reentry vehicle outside the atmosphere with a non-nuclear interceptor using a long-wave infrared

(LWIR) homing sensor was initiated last year. This program, the Homing Overlay Experiment (HOE), is a major new thrust in the STP. During FY 1980 the equipment will be designed and various components tested in preparation for the first flight test.

b. Ballistic Missile Defense Advanced Technology (RDT&E: $113.7 Million)

This program emphasizes the development and application of new technologies to reduce BMD costs, provide for more rapid deployment, and improve BMD performance. Major efforts are directed toward the development of conventional components such as radars, data processors, and interceptors; more advanced components such as mosaic optical sensors, laser radars, and high energy beam devices; and the technology associated with BMD functions such as discrimination, tracking, guidance, and fuzing.

A technologically challenging component of the LDS is a forward acquisition missile-borne long-wave infrared probe that would perform the functions of attack assessment and battle management. The definition of this component, which will require the integration of several subsystems each utilizing advanced techniques, will be undertaken. This effort, which was initiated last year, will be increased in FY 1980 and will be supported by data gathered on a series of missile-borne infrared sensor flights at Kwajalein. This probe development will also be of general utility to our warning system development efforts. Another major effort in FY 1980 will be the development of the technologies required to support the interception of reentry vehicles in the atmosphere with non-nuclear warheads. Finally, an Advanced Digital Signal Processor (ADSP) will be completed for follow-on testing and installation in the STR. This processor will increase both the capability and flexibility of the STR waveforms making it more useful as an experimental facility.

3. Air Defense

(RDT&E: $8.6 Million, Procurement: $69.6 Million)

The emphasis on North American Air Defense continues to be to perform airspace surveillance and maintain airspace sovereignty in peacetime. In this regard, it is our objective to provide sufficient dedicated CONUS Air Defense forces to prevent unchallenged access to our airspace and to augment these forces in time of crisis with tactical forces to defend against limited bomber attacks.

Our force of interceptors dedicated to North American Air Defense is operated from active and Air National Guard squadrons and maintains a peacetime alert at 26 sites around the CONUS periphery. This force would be augmented in a crisis, with additional Air Force, Navy, and Marine general purpose interceptors. The augmentation force will include some of the F-15's already procured or programmed for our tactical forces, thereby providing a limited number of newer, more capable interceptors without the high cost of adding dedicated aircraft to the air defense force. Finally, the interceptor forces are supplemented by Army operated NIKE-Hercules and HAWK surface-to-air missile (SAM) batteries located in Alaska and Florida.

The current North American Air Defense surveillance and control system is the aging SAGE/BUIC system which is costly to maintain because of large manpower requirements. To provide peacetime air surveillance and control at reduced cost and to provide an interface and transition to the E-3A (AWACS) for operations in time of crisis, we have initiated the implementation of the Joint Surveillance System (JSS). This system will collect aircraft returns from many available ground radars and process the data in Region Operations Control Centers (ROCC's). A total of seven ROCC's are to be procured: four are to be installed in CONUS, one in Alaska, and two will be procured by Canada. Each ROCC in CONUS will process data from a network of FAA and USAF radars located on the periphery of the U. S. This will permit phasing out a large number of existing USAF SAGE radars with a resultant savings in excess of $100 million per year in operations and support costs. The bulk of the procurement will be accomplished in FY 1980 and the first ROCC will be operational in late FY 1981.

4. Space Defense

Currently, U. S. space systems provide support through communications, ballistic missile early warning, navigation, treaty monitoring, nuclear detection and monitoring, and weather reporting. Many of the functions provided by space systems are unique in that the support cannot be efficiently provided by ground-based or air-borne systems. As a consequence, the U. S. has become increasingly dependent on space systems for the effective use of our military forces.

The Soviets have developed and tested an anti-satellite (ASAT) interceptor that, we believe, has an operational capability against our satellites. The U. S., however, does not currently have an ASAT system, and an asymmetry exists. The President desires to achieve a comprehensive and verifiable ban on ASAT systems, and we hope that negotiations on ASAT limitations lead to strong symmetric controls. In the meantime, however, we have placed emphasis on our research and development activities to increase our survivability against attacks should they occur, and to be able to destroy Soviet satellites if necessary.

a. Space Surveillance
(RDT&E: $42.1 Million)

The U. S. space surveillance network, known as the Space Detection and Tracking System (SPADATS), consists primarily of ground-based radar sensors. We are improving on and deploying additional ground-based sensors for near-term improvements and, for the far-term, we are pursuing those R&D efforts necessary for a space-based system. In order that we may detect and more readily monitor satellites, we are procuring a global five-site Ground-Based Electro-Optical Deep Space Surveillance (GEODSS) system. This system, when fully operational, will permit observation of satellites when lighting and weather conditions are favorable. Since there are fundamental disadvantages of ground-based sensors for accomplishing the space surveillance missions, I believe that the long-term approach for responsive surveillance up to geosynchronous altitude is the use of space-borne LWIR sensors. We are conducting research and development on the critical technologies, such as the LWIR sensor and the cryogenic cooler, for such an approach and will launch an experimental satellite to demonstrate the feasibility of this concept. Additionally, the DARPA surveillance technology program encompasses spaceborne detection and tracking of satellites.

b. Satellite System Survivability

(RDT&E: $30.0 Million)

Some techniques available for enhancing satellite system survivability include proliferating the number of satellites that perform a given mission, designing satellites so that they are not easily observed and placing them in orbits beyond sensor surveillance range, hardening satellites against laser radiation, and employing decoys to deceive or a maneuver capability to evade an attacking interceptor. These are some of the concepts and technologies that are being pursued within our survivability program. These approaches to survivability make use of technologies that are close at hand. For potential solutions to these problems that use more futuristic technology, we look to DARPA development programs.

D. STRATEGIC C^3I

1. Strategic Requirements and Initiatives

Deterrence is strengthened if our opponents know that we can detect, assess, and react appropriately to an attack. Our tactical warning systems should therefore be able to detect attacks in progress and provide unambiguous, reliable, and timely information for the National Command Authorities (NCA) to select the appropriate response. These capabilities require survivability, endurability, and reconstitutability of our assets.

To ensure communications connectivity during a nuclear attack, survivable, jam-resistant, and secure means of passing Emergency Action Messages (EAMs) and other orders to and from the NCA to the strategic forces are needed. Provisions should therefore be made to provide our bomber, missile, and SSBN forces with two-way communications, in support of strategic policy and the need to efficiently manage the Secure Reserve Force.

2. Strategic Command and Control

a. E-4B AABNCP

The E-4B AABNCP is one of the best near-term prospects for achieving survivability of the key elements of command and control. Fixed command posts, even if hardened, are vulnerable to a concentrated nuclear attack. The E-4B AABNCP is a survivable emergency extension of the ground command centers and provides a higher confidence in our ability to manage the Single Integrated Operational Plan (SIOP) forces in a nuclear war.

Communications for the E-4B aircraft include SHF and UHF airborne satellite communications terminals, a high-powered LF-VLF terminal, and improved communications processing, and will not be operationally limited to air-to-air or air-to-ground line-of-sight communications. These systems have anti-jam features and will support operations in a nuclear environment over extended ranges. The improvements, when installed in the full complement of six E-4B aircraft, will also permit a substantial reduction in currently operational CINCSAC airborne radio relay and auxiliary command post assets.

The results of extensive evaluations of the E-4B test bed aircraft will form the basis for the final E-4B configuration. Retrofit of the three current E-4A NEACP to the E-4B configuration is scheduled to be completed in FY 1984. Procurement of two new E-4B aircraft is planned during FY 1983 and 1984, leading to FOC of the six-aircraft fleet in FY 1987.

b. TACAMO

TACAMO is our principal survivable link to the fleet ballistic missile submarines. Currently, a TACAMO aircraft is airborne at all times to insure that EAMs can be transmitted to the Atlantic SSBN force. Deployment of TRIDENT submarines to the Pacific Ocean will require a survivable means for relaying EAMs in the Pacific in that timeframe. However, the present fleet of twelve aircraft will not support a full airborne posture in both areas. This fleet is moreover reaching the end of its service life.

We are taking several actions to achieve a survivable airborne relay capability in both the Atlantic and Pacific. Beginning in FY 1980, we plan to purchase four new aircraft. These, plus replacements programmed for subsequent procurement, will enable us to build up the TACAMO fleet to the needed strength.

3. Strategic Surveillance and Warning

Besides the missile surveillance and warning systems described earlier in this chapter, real-time assessment of a nuclear attack anywhere in the world will be provided by the Integrated Operational NUDETS Detection System (IONDS). The IONDS concept, which involves deployment of bhangmeters as secondary payloads on NAVSTAR Global Positioning System (GPS) satellites to detect explosions from low-yield warheads to multimegation strategic weapons. IONDS will furnish notification to the NCA of the use of nuclear weapons, provide information via the World-Wide Military Command and Control System (WWMCCS) for estimation of strike damage and indirect assessment of residual capability, and contribute to nuclear test-ban treaty monitoring.

IONDS development is in phase with the GPS program and should be included in a forthcoming procurement of six additional GPS spacecraft to achieve an uninterrupted deployment schedule leading to a final configuration of 24 IONDS-equipped GPS satellites by about 1986. While the Air Force awaits a Phase II DSARC decision concerning secondary GPS payloads in mid-1979, we must prepare now for a go-ahead in FY 1980. We are requesting $11.9 million for this purpose.

4. Strategic Communications

a. The Strategic Satellite System (SSS)

The Air Force Satellite Communications System (AFSATCOM) is designed to provide essential worldwide communications to strategic nuclear forces. The ground segment consists primarily of terminals on B-52 and FB-111 bombers, EC/RC-135's ground and airborne command posts, TACAMO aircraft and ICBM launch control centers. The terminals are now in full production and installation is expected to proceed rapidly in FY 1979 and 1980. The space segment consists of several components. One component is now operational and includes transponders on FLTSAT and Satellite Data System (SDS) satellites. The next component will consist of improved SDS satellites and single-channel transponders on DSCS and possibly GPS satellites. Alternative configurations for the third component, the Strategic Satellite System, are now being considered. The budget request currently includes $51.4 million for research and development in support of the SSS program.

b. SAC Digital Network (SACDIN)

SACDIN is a hierarchical communications network capable of conveying two-way, hard-copy, secure command and control data and messages between CINCSAC and his SIOP Executing Force Commanders for control and direction of the SAC Forces. It will replace the existing SAC Data Transmission Subsystem (DTS) and will be the means for entry, transmission and distribution of all SAC command and control messages. SACDIN will utilize AUTODIN II, a DCS common-user network, as the primary transmission segment thus eliminating the need for dedicated

"SAC only" transmission and switching systems. The SACDIN budget request for FY 1980 if $18.0 million in research and development.

c. Extremely Low Frequency (ELF) Communications Program

Survivability of the Navy's SSBN force is acquired through its ability to remain undetected for long periods of time. In order to be capable of executing a nuclear strike order from the NCA the SSBNs must be constantly capable of receiving such an order. However, present capabilities for continuous communications reception constrains the ability of the SSBNs to remain undetected because the current systems require operation with an antenna on or near the surface. Further, the effectiveness of the Navy's attack submarines (SSNs) is in part determined by their capability to operate both deeply submerged and at high speed. Current communication to SSNs is severely limited in this operational posture.

The ELF Communications Program is directed toward development of a highly reliable link from CONUS to submarines. ELF was selected because, at such frequencies, signals will penetrate hundreds of feet of seawater and are more resistant to jamming and adverse nuclear effects on propagation than currently used frequencies. ELF propagation characteristics can provide nearly global communications and free our submarines from the requirement to remain near the surface and permit them to operate at higher speed. The ELF Communications Program provides a hedge against a Soviet breakthrough in submarine detection based on exploitation of near-surface observables that result from the constrained SSBN and SSN operational procedures.

Receipt of a system configuration and site decision in early FY 1979 will allow attainment of an IOC during the FY 1984 time frame.

d. Jam-Resistant Secure Communications

The Jam-Resistant Secure Communications Program will combine small satellite communications terminals, developed for tactical forces, with anti-jam modulation equipment, developed for the Defense Satellite Communications System, to provide jam-resistant links directly to command centers to major commands, deployable command and control facilities and other selected critical nodes. In FY 1980, we will commence initial procurement of terminal sets to accompany deployable command and control facilities, described in Chapter VII. In future years we will procure fixed command center terminals, and possibly terminals at the sites of ICBM/SLBM warning sensors.

VII

VII. TACTICAL PROGRAMS

A. INTRODUCTION

The Secretary of Defense, in his Annual Report, discusses our needs for tactical general purpose forces and our present capabilities. As he makes clear, the most exacting test of our tactical forces is their ability to deter Warsaw Pact aggression in Europe and, if deterrence should fail, to throw back attacking forces.

In looking at Soviet forces, at their development focus, at their exercises, and at their own published material, we can discern some critical characteristics of the threat against which we must prepare. On the land in one scenario they would attempt:

- Thorough preparation, covert to the extent possible, including identification and location of all our forces and fixed sites as well as attempts to conceal the massing of Warsaw Pact forces.

- Massive, coordinated strikes with artillery, missiles, and air forces with the objective to knock out our forces before they can reach defensive posture, destroy air bases and logistics facilities, and demoralize us. These strikes would be unlikely to employ nuclear weapons, unless they believed NATO had used, or was about to use, such weapons. Their initial use of chemical weapons cannot be ruled out.

- Massed surprise attacks by ground maneuver forces enjoying heavy localized numerical superiority with the objectives to crush, disperse, or break through our defensive forces.

- A coordinated, concerted effort to disrupt our surveillance and communications through jamming and physical attack.

- Employment of a dense, multilayered air defense system designed to prevent our air forces from attacking invading forces and targets behind the forward edge of the battle area (FEBA).

Our research, development, and acquisition program for land and air tactical forces has been carefully structured and integrated to maintain and improve our ability to defend against such an attack in the face of improvements in Soviet and Warsaw Pact capabilities.

Major program emphasis is being placed in the following areas:

- o Systems to give our commanders the maximum possible tactical warning.

- o Systems which integrate inputs from a wide variety of redundant, survivable sensors to provide information on enemy force movements and permit rapid, accurate acquisition of critical targets.

- o Multilayered, survivable counterair systems to blunt initial Warsaw Pact strikes.

- o Systems to jam and destroy the sensor and communications systems upon which Warsaw Pact commanders must depend to coordinate their attacks.

- o Highly mobile, fast-reaction systems able to destroy or disable armored combat vehicles in massive numbers and neutralize Warsaw Pact firepower.

- o Long-range "smart" systems to destroy reinforcements and critical supplies before they can reach the battle area.

- o Modernized armored combat vehicles and fire support systems that would permit stabilization of the "meeting engagement" with the enemy massed armored forces.

Soviet naval and peripheral forces could also pose serious tactical threats in such a conflict, including:

- o Massive air and submarine attacks against our naval striking forces to prevent them from reinforcing NATO's maritime flanks. While these attacks would probably be made using conventional weapons, since Soviet naval platforms carry dual-capable systems, attacks with nuclear weapons are not precluded.

- o Attempts to impede or cut off the flow of supplies and reinforcements to Europe through air and submarine attacks on shipping, as well as attacks on vital terminal facilities.

- o Support and extension of the seaward flanks of the Warsaw Pact armies by naval striking forces.

- o Diversionary and opportunistic thrusts at important targets outside the European theater.

To ensure that we can continue to contain these threats, our program of naval tactical development and acquisition focuses on:

- o Multilayered systems to detect and attack Soviet naval air, submarine, and surface forces all along the routes they must traverse to reach our ships.

- o Strike systems to permit us to neutralize, destroy, or seize key Soviet naval bases and facilities.

- o Systems to confuse and blind the Soviet ocean surveillance and command/control capabilities.

Elsewhere in this report I describe the general objectives and management principles which apply to all our programs. Three which are especially important for tactical warfare programs are:

- o Rationalization, standardization, and interoperability (RSI), both within our own forces and between them and the forces of our allies.

- o Reduction in manpower requirements for operation and maintenance.

- o Reduction in costs for acquisition, operation, and support of our systems.

The sections which follow give more specific information on how we are pursuing the goals I have outlined here.

B. THEATER NUCLEAR FORCES (TNF)

1. Theater Nuclear Land Forces

a. Strategy

Theater Nuclear Forces (TNF) complement and provide a link between conventional and strategic nuclear forces. TNF are ntended to help deter and, if deterrence fails, to blunt theater nuclear attacks. TNF also contribute to the conventional defense by placing Soviet forces at risk if they mass in sufficient strength to defeat NATO conventional forces. Thus, they provide the capability to compel dispersal of enemy forces, to attack selected military, political, and economic targets throughout the theater, to demonstrate to the enemy that the risks inherent in continued aggression far outweigh any possible benefits to him and that no decisive advantage could be gained by the first use of nuclear weapons.

Modernization of our theater nuclear forces is under way to:

- Increase the long range capability of our systems.
- Improve the survivability of TNF under nuclear or non-nuclear attack through greater mobility, increased hardness, and dispersal. Such survival may be required for relatively extended periods of conventional fighting.
- Upgrade communications, command and control (C^3) systems to maintain responsiveness of TNF to military and political authorities.
- Provide enhanced peacetime security for nuclear weapons against the spectrum of threats including terrorists, enemy agents and special forces.

b. Issues

Options for modernization of theater nuclear forces are currently under consideration by both the United States and with our NATO allies. Theater nuclear weapons are primarily deployed in Europe as a deterrent and for defense of the NATO alliance. It is important, therefore, for the NATO countries to share the risk, responsibility and cost of the theater nuclear programs and plans for both general nuclear response as well as for limited nuclear use. This not only demonstrates the solidarity of the Alliance but also enhances the credibility and affordability of the overall NATO deterrent to the Warsaw Pact. A credible posture comes from force mixes and dispersal of theater nuclear weapons which can survive an attack and retaliate with a wide range of options. Issues under consideration include:

- What is the most cost-effective program for overall theater nuclear force modernization? What is the right mix of short, medium, and long-range systems, survivability, C^3 and target acquisition capabilities, within the overall context of strategic and conventional force improvements?

- What should be the pace and scope of long-range TNF modernization programs considering arms control objectives and initiatives?

- What is the correct allocation of resources among long-range TNF system modernization, conventional force improvements, and other TNF improvement options?

- What should be the NATO maritime nuclear force posture?

c. Key Programs

(1) Short Range/Battlefield Systems (up to 200 km Range)

Battlefield Support Systems provide the options and capabilities for nuclear strike near the forward edge of the battle area. These systems need: (a) higher survivability, (b) improved accuracy and appropriate yields to reduce collateral damage, and (c) responsiveness to military and political authorities.

Our current capability includes cannon munitions (8-inch and 155mm rounds), LANCE surface-to-surface missiles (which have replaced HONEST JOHN and SERGEANT in U.S. units) and tactical aircraft capable of delivering nuclear bombs. Several of these older systems have major deficiencies which are being improved.

(a) <u>155mm Artillery Projectiles</u>

The new 155mm artillery projectile, in engineering development, has features that provide needed improvements as follows:

- o Survivability by its improved range. The artillery system may be located further back from the enemy and is thus less detectable.
- o Flexibility and effectiveness of response.
- o Advanced denial and disablement features which enhance safety, security, and command and control.

(b) <u>8-Inch Artillery Projectile</u>

The new 8-inch artillery projectile, presently in the final stages of development, will provide improvements comparable to those for the 155mm projectile. Enhanced radiation features can be incorporated should the President decide to deploy this capability.

(c) <u>Nuclear LANCE</u>

Nuclear LANCE deployment for U.S. forces has been completed and is continuing on schedule for other NATO forces. An improved warhead in production will provide adequate target coverage with less collateral damage than the current warhead. Enhanced radiation features can be incorporated should the President decide to deploy this capability.

The FY 1980 budget request for Short Range/Battlefield Systems includes $27.9 million in development for nuclear artillery munitions and $29.3 million in procurement. $4.1 million in procurement is requested for modification of LANCE to accommodate the improved warhead.

(2) Intermediate and Long-Range Systems (200 km & Greater)

Intermediate and long-range TNF are planned for use in selected employment options or as part of a general nuclear response. These systems are primarily intended for attack of fixed targets, although, there are a number of important transient targets such as Warsaw Pact staging and assembly areas that could be targets.

NATO's present capability for intermediate and long-range nuclear strikes to carry out NATO's Selective and General Nuclear Response is provided by land and carrier-based tactical aircraft (F-111, VULCAN, F-4, F-104, F-100, JAGUAR, A-6, A-7 and BUCCANEER), and the PERSHING Ia surface-to-surface ballistic missile. Strategic forces including POSEIDON and the United Kingdom POLARIS submarine-launched ballistic missiles, can also be used against theater targets of interest to NATO; however, these systems are primarily dedicated to General Nuclear Response missions.

(a) PERSHING Ia

The PERSHING Ia system is a ground mobile ballistic missile deployed in Germany with the U.S. Army and the

Federal Republic of Germany (FRG). Each year, approximately 13 missiles are returned to the U.S. and fired for training purposes. The FY 1980 budget request includes $70.6 million for procurement to increase the PERSHING Ia inventory.

(b) PERSHING II

The new PERSHING II system will be developed and deployed in the same manner by the Army as the presently fielded PERSHING Ia. It will make use of the present erector launcher equipment. Ground support equipment will be upgraded to improve command and control and to reduce manpower requirements. Range of the PERSHING II will be increased over that of the PERSHING Ia. A new re-entry vehicle, demonstrated in the PERSHING II advanced development program, will incorporate precision terminal guidance system and an earth penetrator warhead option. PERSHING II will have the following additional advantages over the PERSHING Ia:

- Lower operating and support costs.
- Improved employment flexibility because of lower warhead yields and the earth penetrator option.
- Considerable reduction in collateral damage due to the combination of precision terminal guidance and lower warhead yields.
- Enhanced safety and security because of modern permissive action link (PAL) and the use of insensitive high explosives.

The PERSHING II program has been approved for full scale engineering development following a DSARC II in December 1978. $144.8 million is included in the FY 1980 R&D budget request for this effort.

(c) <u>Ground-Launched Cruise Missile (GLCM)</u>

The GLCM could be used for selective release or general nuclear release options against fixed targets such as lines of communications, logistics facilities, airfields, command posts and stationary tactical targets such as staging and assembly areas. GLCM, presently in engineering development, will be deployed in a ground mobile mode in order to achieve pre-launch survivability. The basic advantageous features of the GLCM include its small radar cross section, very low altitude defense avoidance flight profile, high accuracy at long ranges, and all-weather capability. $44.1 million is requested in FY 1980 for engineering development and $25.0 million for procurement to support this IOC.

(d) <u>Medium Range Ballistic Missile (MRBM)</u>

The MRBM is a new lightweight ballistic missile concept for which $4.0 million is requested in the FY 1980 R&D budget to continue competitive concept development and mission area analysis to determine the feasibility and need for an MRBM for possible deployment in NATO. The concept is a lightweight missile that could offer high mobility (ground mobile, air mobile, or possibly both), quick reaction and high pre-launch survivability and security. This system would exploit fully the new possibilities and the latest technology for flexible transport, highly dispersed storage, high readiness and security against misuse, terrorist or other attack, and violent accidents. Based upon the results of these studies and consultations with our NATO Allies, a decision will be made in FY 1981 as to whether or not this system will proceed into advanced development. This decision will consider potential deployment of GLCM, SLCM, PERSHING II and MRBM individually or an appropriate mix of these systems to achieve the most cost-effective theater nuclear long-range missile force.

2. Naval Systems

Sea-Launched Cruise Missile (SLCM)

The SLCM program includes land-attack (nuclear) and anti-ship (conventional) weapons systems sized to fit submarine torpedo tubes and capable of being launched from either submarines or surface ships against both land and ship targets. $103.4 million is requested in the FY 1980 budget for the continuing engineering development of these systems. The land attack SLCM (TOMAHAWK) employed on submarines and surface ships could provide a world-wide theater nuclear capability with high survivability to all threats including sabotage and capture, in a conventional conflict.

The first launches of TOMAHAWK missiles from submerged submarines were conducted in 1978. While there have been some problems encountered with pyrotechnic system contamination, they are not expected to significantly delay the development program.

The FY 1980 program will consist of ship technical evaluations and completing delivery of the OPEVAL missiles. OPEVAL will be completed for the submarine launch in FY 1981 and surface ship launch in FY 1982.

3. Theater Nuclear Forces Survivability and Security ($TNFS^2$) Program

The DoD $TNFS^2$ program formally started in FY 1979 with the objective of a systematic evaluation of TNF vulnerabilities and the identification of technological solutions to reduce the security and survivability shortcomings. With FY 1978 reprogrammed funds, the program was defined, critical survivability and security deficiencies were identified and tests, exercises and analyses of proposed solutions were planned. Assessments of C^3 survivability and security are under way.

Testing of survivability and security solutions presently under way includes:

- a flexible protective armored blanket for protection of nuclear warheads from small arms fire.

- a DoE Safe-Secure Trailer (SST) for the storage of relatively small (in terms of size and numbers) nuclear weapons on the territory of NATO member nations.

Tests will be expanded later this year (FY 1979) to include a container utilizing SST principles for use on 1½ ton Army trailers to transport TNF projectiles. These tests will be further expanded in FY 1980 and will encompass TNF elements in both CONUS and Europe. Data from these tests, demonstrations and evaluations will provide a basis for the applications of these solutions to be implemented for our TNF systems including artillery, LANCE, GLCM, PERSHING II, MRBM and storage facilities including Automated Deterrent Systems, and Security manpower effectiveness. A total of $48.3 million is requested in the FY 1980 R&D budget for these survivability and security efforts which have applicability to strategic systems as well as our theater nuclear systems.

C. LAND WARFARE

1. Introduction

Land Warfare encompasses all conventional weapon programs for either the field Army or the Marine Corps. The area of major emphasis by U.S. and NATO is to maintain balance with Warsaw Pact in order to offset their greater quantity and rapidly growing quality.

Our main FY 1980 thrusts are as follows:

- Battlefield Surveillance--improve surveillance and real-time target acquisition beyond ground line-of-sight.

- Close Combat--improve our antitank capability both qualitatively and quantitatively to counter the imbalance in armor forces favoring the Warsaw Pact, not by attempting to match the Soviets tank for tank, but by an approach where several complementary antiarmor weapons are integrated into the total force structure.

- Fire Support--improve our ability to mass firepower at the point the enemy chooses for his attack. Improve our counterbattery fire capability through extended range and terminal guidance.

- Field Army Air Defense--improve our short-range all-weather weapons, both guns and missiles. Deploy man-portable systems that are more countermeasure resistant and develop improvements to existing as well as new high-altitude systems.

- Landmine Warfare--deploy an effective family of mines capable of implantation by artillery, helicopter, fixed-wing aircraft and ground means and to enhance our ability to rapidly clear enemy minefields.

- Chemical Biological Defense/Chemical Warfare--provide better environmental and CW protective equipment. Maintain a CW capability to deter the use of chemicals against the U.S. and the capability to warn and protect U.S. forces in the event of CW attack.

The following subsections describe mission area objectives, major programs, and other significant efforts in land warfare.

2. Battlefield Surveillance

a. Strategy

Improvements in the quality and quantity of weapons and operational tactics have emphasized the need to detect, localize and classify large volumes of enemy target data on a timely basis to support target engagements and friendly maneuvers. Battlefield Surveillance Mission Area programs are structured to provide timely and accurate data to the battlefield commander engaged with the enemy. The data supports effective utilization of combat resources on a 24-hour day basis and under adverse weather, countermeasure, and battlefield conditions.

These programs are coordinated with Tactical Reconnaissance Surveillance and Target Acquisition programs (described in Section G.3 of this chapter) to assure a comprehensive framework of complementary, interoperable and survivable assets, and to prevent redundancies.

Targeting data are time perishable in dynamic combat environments. Battlefield sensor systems are interfaced with the Battlefield Exploitation and Target Acquisition (BETA) for near real-time fusion and dissemination of targeting data, with the Tactical Operations System (TOS) for real-time battlefield needs and with the Tactical Fire Direction Center (TACFIRE) for targeting of artillery assets. Both the TOS and TACFIRE programs have representatives on the SOTAS source selection evaluation board (SSEB) to assure compatibility of these systems. Interfaces between the Stand-Off Target Acquisition System (SOTAS) and the Short Range Air Defense System

(SHORADS) are being evaluated to provide SOTAS detections of low flying aircraft for cueing purposes to SHORADS.

b. Issues

Issues of note to battlefield surveillance are:

- o Sensors and communication systems for successful operation in countermeasure environments.
- o Survivability of systems on the battlefield.
- o Standardization and interoperability of system with NATO Allies.

c. Key Programs

Major programs in the battlefield surveillance mission area are described below:

(1) Standoff Target Acquisition System (SOTAS)

SOTAS is an Army program to develop an airborne target acquisition system that will provide a new capability to detect and locate moving targets, during day and night, and under most weather conditions. Information will be displayed in near real-time at ground stations with sufficient accuracy for strike by Army ground and Air Force support weapon systems.

SOTAS is a division-level asset consisting of helicopter-borne radars; one primary ground station at the division tactical operations center (DTOC); one or more secondary ground stations (division artillery - one, alternative DTOC - one, three-brigade headquarters - one each); and a data link/positioning system. One helicopter can cover the division's area of interest; four helicopters per division allow continuous coverage during periods of sustained combat. The targeting data from SOTAS will also be fed to the BETA fusion center and combined with GUARDRAIL V, FIREFINDER, UPD-4, RIVET JOINT, COMPASS EARS, TEREC, and the Navy's EP-3E data. The SOTAS program was approved for engineering development by the DSARC in August 1978. Competitive source selection is in progress and will be completed in the Spring of 1979. The FY 1980 program is funded at $66.5 million.

(2) REMBASS

REMBASS consists of sensors utilizing magnetic, seismic, acoustic, infrared and pressure phenomena that may be hand emplaced, delivered by aircraft or by artillery, data links to transmit sensor data to monitor stations, repeaters to automatically relay data link information where line-of-sight is not feasible, hand-held monitoring sets and a suitcase size monitoring set. Records of sensor reports in time-ordered sequence will be made for analysis and estimates of target location, speed, direction of travel, convoy size, and classification as to tracked, wheeled, or personnel.

The REMBASS data link will be compatible with the Remote Area Weather Station (RAWS) system and the Base Installation Security System (BISS).

REMBASS is in the second year of a three-year development program. The FY 80 funding request is $2.0 million.

(3) Remotely Piloted Vehicle (RPV)

Miniature RPV operations will fill requirements for unmanned aerial target acquisition, target designation and location, laser designation for laser seeking weapons such as COPPERHEAD and HELLFIRE, conventional artillery adjustments and battlefield reconnaissance. The advanced development system consisted of an air vehicle, truck-mounted catapult launcher and vertical net recovery system, data link/air vehicle tracking system that will be common with the SOTAS data link in future systems, and a ground control station that contains sensor controls and displays and air vehicle controls and displays. The initial sensor package will consist of a gimballed TV and laser ranger/designator for daylight operations. An interchangeable sensor package with FLIR for night operations is in advanced development. A request for competitive proposals for development of the RPV system was released 21 December 1978. RDT&E funding of $49.4 million is requested for FY 1980.

(4) Advanced Scout Helicopter

The objective of this program is to meet the Army's stated aerial scout requirement for an improved system to conduct reconnaissance, security and target acquisition and designation missions.

The Army is presently conducting an extensive COEA study, to be completed by August 1979, to evaluate a wide range of alternatives and options to meet the aerial scout requirement. Included are alternative sensor systems such as SOTAS and RPV and their command and control to include BETA. Alternative helicopter options for the ASH include modification or adaptation of existing military or commercial designs, both U.S. and European; and utilization of the AAH as a scout. Although a new helicopter development program is an alternative included in the study, it no longer appears to be a feasible option in light of other defense needs and an already constrained budget. For FY 1980, $12.5 million have been requested for the initial year development effort to modify or otherwise adapt an already existing system to the ASH requirement.

2. Close Combat

a. Strategy

The major goal in Close Combat is acquisition of significantly improved weapons for armored and infantry units for use in direct engagements with the enemy. We must develop a combined arms force capable of successfully engaging a numerically superior armored force. We accomplish this by overcoming larger forces with higher quality weapons that have greater accuracy, greater lethality, and better protection than those of our potential adversary. However, we must not allow our drive for higher quality in our weapons to increase our costs to the point where we create an even worse quantity ratio.

b. Issues

Our major issue in close combat is to find the most cost and performance effective mix of tanks, infantry fighting vehicles, antitank missiles, antitank rockets and guns that we can afford in the necessary numbers to meet a presently numerically superior threat.

c. Key Programs

(1) XM1 Tank and Main Gun

Developing a modern, affordable replacement for the obsolescent M48A5 and M60 tanks is one of our highest priority Land Warfare development objectives. The XM1 program involves a total development cost of about $600 million over an eight-year period. In FY 1980, we will procure 352 units. XM1 objectives relative to its predecessors are: greatly improved battlefield survivability, mobility, firepower, reliability, availability, and maintainability, in a tank that can be produced in quantity within the original average unit hardware cost goal of $507 thousand (FY 1972 dollars). Inflation may bring that unit cost to over $1.4 million during the period of procurement in the 1980s. We are requesting $31.6 million for RDT&E and $666.0 million for procurement in FY 1980, including $70.7 million for advance procurement and $18.4 million for training equipment.

On 31 January 1978, the Army, with our concurrence, reported to the Congress that they had selected the Federal Republic of Germany's 120mm smoothbore gun system design as the future main armament system for the XM1 tank. This selection will provide the U.S. with increased capability against long term armor threats as well as enhance interoperability of the next generation of tank guns within NATO. We are requesting $51.9 million for RDT&E and $15.0 million for procurement in FY 1980 for the gun and ammunition and the integration into the XM1.

(2) Infantry Fighting Vehicle/Cavalry Fighting Vehicle (IFV/CFV)

The IFV/CFV, formerly MICV, will provide the mechanized infantry forces with an armored squad carrier that has significantly increased firepower, mobility, and protection compared to the present M-113. The tank can only realize its full combat potential when properly supported by mechanized infantry units. The IFV provides an effective companion vehicle for the XM-1 tank, and significantly enhances projected anti-armor exchange ratios. The IFV will replace the M-113 armored personnel carrier in selected mechanized infantry units in the European theater. For operations in a nuclear, bacteriological, chemical (NBC) environment, the IFV/CFV will require ventilated facepiece and protective clothing for the crew and individual masks and protective clothing for the remainder of the squad. CFV version of the IFV will be issued to cavalry units for armored reconnaissance scout roles. Both vehicles will mount an automatic 25mm cannon and a TOW weapon system. Recent accomplishments are the selection of an externally powered 25mm automatic cannon following a competitive side-by-side test and initiation of prototype qualification tests. Procurement will be initiated in FY 1980 with a buy of 208 vehicles with funding of $170.4 million. The IFV/CFV program will finish its operational test and evaluation in FY 1980. R&D FY 1980 funding is $33.3 million.

(3) Improved Light Antitank Weapon

The Improved Light Antitank Weapon (VIPER) is a low-cost (approximately $200 per unit), lightweight, short-range, shoulder-fired antitank weapon to replace the M72A2 LAW, which is deficient in range, accuracy and lethality. Planned for use as a general assault weapon against bunkers and pillbox-type targets, and as a last-ditch defense against surging armor, VIPER is a high priority U.S. Army program. Development of the VIPER will be finished in FY 1980. FY 1980 funds request for R&D is $3.0 million and for procurement is $33.5 million for 91,000 VIPERS.

(4) TOW

TOW is the main infantry antitank guided weapon of the U.S. Army. The growth in armor protection and ability to work in obscurants of the threat Warsaw Pact tanks has made it necessary to implement a significant product improvement program to retrofit existing TOW stocks. The improvements will be in the warhead and the tracking beacon. This program was initiated in FY 1979. These improvements will provide the capability to defeat the current threat and improve performance in obscurants. However, the TOW retrofit is not expected to provide the required capability against the T-80 and electro-optical countermeasures. This R&D effort in FY 1980 is funded at $26.2 million. Additionally, an antitank guided missile improvement program will be launched in FY 1979 to correct the remaining TOW deficiencies with an improvement or replacement. This effort will investigate alternative guidance concepts to include ground-launched HELLFIRE for development of a follow-on to TOW and HOT. It is hoped that this effort will be a cooperative RSI program with our allies. FY 1980 R&D funding is $12.0 million. TOW procurement funding for FY 1980 is $58.0 million for 12,800 units.

4. Fire Support

a. Strategy

Although the antiarmor capability of our armored, mechanized, and infantry divisions is being significantly improved by the addition of TOW and DRAGON, these systems will be subjected to intense enemy artillery fire. Since the attacker can mass his forces at points of his choice, the normal distribution of antitank weapons within Army units will not provide sufficient antiarmor weapons to counter massed attacks. Therefore, the antiarmor capability of the close combat forces must be augmented by the fire support arms, artillery and attack helicopters, as well as close air support aircraft which can mass the bulk of their firepower in a timely manner at the critical points along the front. U.S. technological superiority in precision guided weapons is being exploited to provide our fire support arms with a significantly improved capability to attack Soviet armor.

b. Issues

Our shortcomings in this area deal primarily with the ability to counter and defeat massed armor attacks during all battle conditions whether it be night or day. We need the ability to destroy enemy armor at higher rates and with significantly lower ammunition expenditures; to concentrate massed firepower at critical points where breakthroughs are occurring or are threatened; and the ability to locate and fire on targets during poor visibility and at night with low vulnerability to enemy counterfire.

c. Key Programs

(1) YAH-64 Advanced Attack Helicopter

The YAH-64 is a twin engine (1560 SHP T-700 engines) helicopter with four-bladed, fully articulated main and tail rotors, and three point gear with the pilot in the rear of a tandem cockpit. It is designed as a stable, manned aerial weapon vehicle optimized for destruction of armored vehicles but will defeat a wide range of targets and provide direct aerial fires as an element of the ground combat units. Armament systems are the HELLFIRE laser-seeking anti-armor missile system, 30mm automatic gun that will use improved ammunition similar to and interoperable with NATO ADEN and DEFA ammunition, and 2.75" rockets. The target acquisition and designation system (TADS) for employment of the weapon systems consists of an infrared imaging system for night operations, a direct view optics system, a TV system and a laser designator/range finder. A separate pilot's night vision system (PNVS) is included for night flight operations. Two prototype helicopters are being modified to incorporate configuration changes and to install fire control systems. Flight testing will begin in FY 1979 for flying qualities evaluations, for armament and fire control system surveys, and initial HELLFIRE missile firings. Three new YAH-64 aircraft are in fabrication. The FY 1980 R&D request is $176.2 million.

(2) HELLFIRE

In March 1976 the DSARC approved full-scale engineering development of the HELLFIRE Modular Missile for use on the AAH. Relative to the COBRA/TOW, HELLFIRE will significantly enhance the effectiveness and survivability of the AAH. The 7-inch HELLFIRE warhead will have a high level of effectiveness against present and near-term future types of armor. Because of its modular design, the basic HELLFIRE missile will be able to accept a variety of terminal homing seekers (laser, TV, IR, RF or dual mode RF/IR). Based on technical and cost considerations, a low-cost laser seeker has been selected for system qualification. This alternative seeker has been judged superior to the tri-Service laser seeker by the Army for short-range and multiple missile launch conditions.

The first guided flight of a HELLFIRE from a COBRA helicopter took place on 21 October 1978 and it scored a direct hit on a target designated by a ground laser designator. Full-scale development of an imaging infrared seeker will start in FY 1980 to provide HELLFIRE with true "launch and leave" capability. The Army has been directed to pursue a parallel seeker development approach. Designs of focal plane array technology as a prime effort, and current generation imaging seeker technology as backup will be evaluated. A final selection will be made in FY 1981. R&D funding of $58.0 million for a laser HELLFIRE and $15.0 million for an IIR seeker is requested for FY 1980. No procurement funding is requested.

(3) COPPERHEAD

The COPPERHEAD laser guided projectile will give artillery a significant anti-armor capability using existing howitzers and personnel. The 155mm COPPERHEAD entered full-scale engineering development in July 1975. Flight testing of the engineering development round began in March 1977. Since then a total of 48 rounds have been fired. During the Systems Qualification Phase that started on 15 September 1978, the system has experienced a high degree of success using the latest design for guidance components. Engineering development is scheduled for completion in October 1979. For FY 1980 $7.1 million is requested for R&D and $66.3 million for procurement.

Congress has directed that IOCs for both COPPERHEAD and the Navy 5-inch Guided Projectile be achieved by 1 July 1981, and that maximum component commonality be achieved between these two rounds. In order to achieve an early IOC, the Army was designated lead Service for the development of all semiactive laser cannon-launched guided projectiles. By directing the COPPERHEAD contractor to develop the 5" guided projectile, savings will result from common production facilities and joint procurement. We could not achieve maximum component commonality because of the different development schedules. Commonality within NATO has been a key goal within this program, and we have negotiations under way that could result in utilization of the system by at least ten NATO countries for employment in their 155mm weapons.

(4) General Support Rocket System (GSRS)

GSRS is a promising way to enhance our fire support capability for counterbattery and air defense suppression especially during surge conditions. The system will have provisions for operating in an NBC environment.

The initial GSRS payload will consist of submunitions optimized for the counterfire and air defense suppression missions, but the system will have the growth potential to incorporate both mines and terminal homing submunitions as alternate warheads.

This program will ultimately involve the US, FRG, FR and UK in a joint development effort if the Memorandum of Understanding (MOU) being negotiated is finalized as planned in April 1979. The MOU will reflect the intent of the signatories to establish an agreement on the design, development and production of a Multiple Launch Rocket System (MLRS) which satisfies the agreed upon tactical requirements of all four nations. The FY 1980 R&D request is $72.3 million, with $61.9 million for procurement.

(5) Assault Breaker

The Assault Breaker concept has been developed by DARPA. The system concept was described in Chapter V as part of the DARPA program. After the system concept is demonstrated, the Army will complete the development of a weapon system. We are requesting $9.2 million in FY 1980 for the Army to pursue a competitive booster program for Assault Breaker and to perform program planning.

5. Field Army Air Defense

a. Strategy

The field Army must have adequate air defense to ensure that the air threat does not destroy significant quantities of critical assets or seriously limit the maneuverability of friendly forces. A family of air defense weapons is required to counter the threat including: low-altitude short-range weapons for self- and point-defense; larger more complex and costly surface-to-air missiles systems for providing area coverage at medium and high altitudes; and manned interceptors/air superiority aircraft (discussed under section D of this Chapter) to defend the air space and to counter massed air attacks in a complementary role to the ground-based air defense systems.

b. Issues

The air threat continues to increase at a rapid pace especially in terms of improved ground attack aircraft and weapons.

This threat improvement represents a major shift in tactical employment of aircraft. We continue to improve fielded systems and have embarked on a major modernization program aimed at replacing or complementing all currently deployed systems. Current critical Field Army air defense issues are: should there be a mix of PATRIOT and Improved HAWK or should PATRIOT replace all Improved HAWKs?; and should ROLAND replace Improved CHAPARRAL in the division or should Improved CHAPARRAL be upgraded further? These issues and others will be resolved in FY 1979 and will impact the FY 1981 budget submission but not this FY 1980 budget submission.

c. Key Programs

(1) Medium/High Altitude Air Defense

(a) PATRIOT

The PATRIOT is planned to replace the NIKE HERCULES and Improved HAWK, providing greatly increased electronic counter-countermeasures and simultaneous engagement capability. A production contract award is planned for April 1980.

To date, a total of 39 guided flight tests have been conducted. During 1978, the PATRIOT test program conducted 15 firings. Tests involved engagements in the presence of a chaff environment. A flight of several drones permitted the system to successfully exercise its multiple simultaneous engagement capability. $128.7 million is requested for R&D and $426.0 million for procurement in FY 1980.

During the last year, the NATO PATRIOT Project Group formulated a Memorandum of Understanding for those nations interested in replacing NIKE HERCULES with PATRIOT. The draft MOU was signed in November and a Multi-National Management Group is being formed to plan and evaluate the various acquisition options for the NATO nations.

(b) Improved HAWK

While PATRIOT is planned eventually to replace Improved HAWK, there will be significant HAWK quantities in the inventory into the late 1980's. Continuation of development of the emission control product improvement for the pulse acquisition radar and development of missile ECM modifications will increase the system capability against countermeasures. $10.1 million is requested for R&D in FY 1980.

(2) Short-Range Air Defense

(a) US ROLAND

US ROLAND is an all-weather system to replace the fair-weather/daylight CHAPARRAL system in the Corps and rear areas. This program is an outstanding example of the NATO Allies and US two-way street concept working, and involves the transfer of a foreign design weapon system to the US for production. The design has been transferred and units produced in the US. Production facilitization was initiated in FY 1978 in preparation for hardware procurement in FY 1979, with the procurement decision (DSARC) to be made in May 1979. The cooperative flight test program of about 107 missiles, 60 of which were produced in the US, has been successful and is essentially complete. The FY 1980 program funding required is $11.3 million for R&D, $283.3 million for procurement and $13.6 million for initial spares.

(b) Division Air Defense Gun

The Division Air Defense Gun development will fulfill the need for organic ground-based air defense to accompany and protect armor and mechanized units in combat. Our deployed systems, VULCAN and CHAPARRAL, are extremely limited in this role by their lack of armor protection, limited range and effectiveness, and fair-weather/daylight capability only. The Army has completed an extensive cost and operational effectiveness analysis which considered alternatives for fulfilling the role. Alternatives included VULCAN, ROLAND, and a generic air defense gun (DIVAD). The DIVAD was found to be the preferred system. In January 1978, two contracts were awarded for an accelerated 29-month competitive prototype engineering development program. The program is a government "hands off" intense development program at fixed price resulting in a shoot-off leading to an initial production decision. The "hands off" development is working effectively and the development schedule, cost and performances are being achieved. For FY 1980 $25.7 million is requested for R&D.

6. Amphibious Assault and Special Warfare

a. Strategy

Amphibious assault is one of the basic modes of naval force projection, but is basically a land combat mission.

Amphibious assaults may be mounted to: open a major land campaign; effect an envelopment in the course of an ongoing land campaign; seize an island or other base to support a naval or air campaign; or provide a diversion. Our strategy is to develop amphibious systems which have increased capability to move our forces more swiftly and efficiently in a campaign. The Marine Corps future landing force concept requires increased tactical mobility to project direct fire weapon systems rapidly ashore in sufficient numbers to support the landing force.

b. <u>Issues</u>

The main issues include:

- o Requirement to increase speed and survivability of landing craft in order to provide enhanced operational capability.
- o Need for fire support in light of our decline in gun support assets.
- o Need for enhanced mine clearing capability.
- o Present lack of effective weapon system capability beyond line-of-sight range.

c. <u>Key Program</u>

<u>Landing Vehicle Assault (LVA)</u>

The LVA is a highly mobile amphibious landing vehicle, designed to replace the LVTP7 in the mission of transporting and supporting Marine Corps assault forces during amphibious assault and subsequent operations ashore. Funding of $17.8 million is requested in FY 1980 to initiate advanced development and to continue advanced development of the rotary combustion engine.

7. Logistics and General Combat Support

a. Strategy

This mission area includes numerous small programs designed to meet the objective of providing responsive support to our operating forces. Active efforts include development of such items as relocatable hangers, Tactical Rigid Wall Shelters, fuel and container handling systems, aircraft maintenance and servicing equipment, and engineer and construction equipment.

b. Issues

This mission area encompasses a number of logistically critical items. Insufficient emphasis in this area could lead to disastrous results in the logistical aspects of conflict. We lack sufficient and efficient POL distribution and storage in forward areas, current bridging is too heavy, labor intensive and requires too much time for emplacement and vehicle support costs are becoming prohibitive.

c. Key Programs

FY 1980 R&D funding for this area totals $40 million. A sampling of some key programs follows:

(1) Combat Support Equipment

This program encompasses combat engineer equipment such as a family of bridging, container distribution equipment which includes logistics over the shore missions, POL distribution systems, tactical rigid wall shelters and Army development of camouflage, simulation and decoy systems which will be capable of defeating the surveillance threat of visual, thermal, radar and other sensors and Combat Medical Material.

(2) Armored Combat Support Vehicle Family

This program will initiate development of the basic IFV/CFV chassis derivative vehicles. In addition to the General Support Rocket System derivative, four more derivative vehicles will be developed. They are: A vehicle to rearm tanks under fire, a high payload armored carrier to resupply self-propelled artillery, a maintenance assist vehicle and a medical evacuation vehicle. Additionally, a POL refuel vehicle will be investigated.

(3) High Mobility Weapons Carrier

This program will initiate development of a highly mobile armored vehicle to replace the jeep presently used to transport the TOW weapons systems. This system will replace the two jeeps and trailer presently needed to support one TOW system and provide a significantly greater degree of protection and mobility.

(4) Other Operational Equipment (Ground Support Equipment)

Current methods of developing new weapons systems do not promote multi-system usage or standardization of support equipment. This project was established in FY 1978 in response to concern over support equipment cost. Multi-system application was investigated for: Hydraulic Manifold System, On-Aircraft Testing

Techniques, Magnetic Compass Calibration Test Set, Antenna Near Field Test System and Automated Data Retrieval System.

(5) A/C Handling and Servicing Equipment

This project develops advanced aviation support equipment for Naval and Marine Corps weapon systems with emphasis on multipurpose/system application. In FY 1979 21 prototypes of an Aircraft Weapons Loader and a Hydraulic Components Test Stand were developed for test and evaluation. In FY 1980 Engineering development of seven support equipment items is planned as well as full-scale development of three new items.

8. Physical Security Equipment

a. Strategy

Develop a standardized, fully integrated, interior and exterior system capability for the protection of critical DoD security equipment and facilities, with emphasis on nuclear and chemical weapon storage sites. The objectives are to provide a limited system level capability for high priority application by FY 1982 with a total interim system capability by FY 1984. To achieve these goals, $43.9 million in RDT&E funds is being requested in FY 1980 to support Army (interior systems), Air Force (exterior systems), and Navy (anticompromise destruct and shipboard security) development programs.

b. Issues

Although duplication of effort may appear to be a problem, unnecessary duplicative development of security equipment within DoD is avoided by assigning specific areas of development to each military branch. To effect maximum utilization and benefit from these development programs, the DoD is keeping other federal agencies apprised of its progress and is participating in some cooperative efforts with the Department of Energy (DoE), US Customs Service, the Immigration and Naturalization Service, and the Nuclear Regulatory Commission and is looking into the applicability of this equipment to securing the rear areas of the Field Army.

9. Chemical Warfare and Chemical/Biological Defense

a. Strategy

The US national policy on chemical warfare (CW) is no first-use of lethal or incapacitating chemicals, the maintenance of a CW capability to deter the use of chemicals against US or Allied Forces, and the capability to warn and protect US forces and retaliate should deterrence fail. The objective of US policy is to negotiate a comprehensive treaty to ban chemical weapons.

b. Issues

(1) US forces can only be rated as marginally prepared to survive and operate in a chemical attack. This has been recognized by the DoD and the Congress and an intensive effort to equip all forces with an acceptable minimum level of protective equipment has been launched.

(2) The second issue is that our retaliatory stockpile has deteriorated to less than prudent level. The principal deficiencies are the number of usable munitions and the mix of

artillery and aerial systems. There is a serious lack of modern air deliverable munitions to provide full tactical support and about half of the current stockpile consists of mustard agent which is less effective than nerve agents.

(3) Another deficiency is the lack of an adequate training program to utilize available equipment. Training requires a realistic scenario and the use of simulant agent materials and "hands-on" use of unit and individual warning and protective equipment.

c. Key Programs

All issues are being addressed in both the science and technology programs and in the engineering development and procurement programs. The key defensive programs include completion in FY 1979 of Engineering Development on the SM-29 protective mask, Engineering Development of modular collective protection equipment for Improved HAWK and PATRIOT, a complete chemical agent/equipment field training set, Advanced Development on a remote chemical sensing alarm, and Advanced Development on a personal decontamination system. Advanced Development will begin on a lethal binary warhead for the General Support Rocket System, and Engineering Development will be completed on the 8-inch Binary VX projectile to provide significant safety advantage in retaliatory, storage, transportation, and disposal operations. The management of the program has been centralized in the Army with a Joint Agreement among the three Military Departments which requires the development of joint requirements documents where possible. Already the ionization detector and alarm and the personal mask are being developed to meet such joint requirements. It is anticipated this will lead to improved interoperability, not only among US forces but Allied Forces as well through the NATO Long-Term Defense Program and NATO Panel VII. FY 1980 R&D funding for this area is $69.7 million and procurement is $149.1 million.

D. AIR WARFARE

1. Introduction

Air Warfare covers the mission areas of Air Superiority, Interdiction and Defense Suppression. The primary goal of our Air Warfare programs is to increase the effectiveness of our tactical air forces in countering Warsaw Pact forces, in defending our naval forces and in projecting sea-based air power ashore.

2. Air Superiority

a. Strategy

The mission of our fighter aircraft, with their air-to-air missiles, is to maintain air superiority in the forward battle area and significantly assist in defense of our high value targets against high as well as low flying attacking enemy aircraft. New U.S. and NATO fighter aircraft remain technologically superior to Russian and Warsaw Pact aircraft although the Soviets have introduced significantly more capable aircraft while retaining large numbers in the force. The Soviets are also emphasizing aircraft with a surface attack capability in addition to air-to-air capability. Allied weapon systems must counter with technology, innovation and superior pilot training in order to obtain high kill ratios. Lookdown/shoot-down capability is required, and efforts are continuing to improve our ability in this area.

b. Issues

(1) In lieu of full scale development of a new engine specifically for the F-14, should the DoD undertake a limited engine development and test program for an alternate fighter engine which

could be used in the F-14 and/or F-16 if the on-going Component Improvement Programs (CIP) for the TF-30 and F-100 engines fail to correct present problems?

One of the problems concerning us at the present time is the reliability and availability of our fighter aircraft caused by durability and high maintenance requirements of their engines. This problem has been recognized for some time and engine component improvement programs are under way to correct known deficiencies. In addition, Congress has directed that $41 million, previously authorized and appropriated for re-engining the F-14, be used to fund a joint Air Force/Navy program for competitive development of an engine which could be used in the F-14, F-16, or other aircraft. The approach that we are taking to solve this problem is to initiate a limited development and flight demonstration program of the General Electric F-101X engine while at the same time continuing the improvements on the TF-30 (F-14) and F-100 (F-15 & F-16) engines at a high level of effort. This will result in a high degree of competition between the TF-30, F-100 and F-101X engines and enhances competition for future fighter engines. The limited development and demonstration program will be initiated in FY 1979 with part, or all, of the $41 million appropriated by Congress and result in flight demonstrations in both the F-14 and F-16 aircraft in approximately 30 months. An additional $16 million is requested in the FY 1980 budget in the Air Force Engine Model Derivative program to continue this effort. Completion of the flight demonstration milestone will permit a decision to be made as to the need for full scale development based on flight test results and the status of the current efforts to correct problems in the TF-30 and F-100 engines.

(2) To be consistent with advanced procurement funding provided by Congress in FY 1979, should the Department of the Navy procurement of tactical aircraft be increased to 30 (vice 15) F-18s and 36 (vice 24) F-14s in 1980? Procurement of enough tactical aircraft to maintain a modern force is a continuing concern of the Department of Defense. This issue was considered in detail during the formulation of the FY 1980 budget request. However, the high unit cost of Navy tactical fighter aircraft and priorities for other needed systems necessarily limited the number of aircraft that we could afford. Procurement of the F/A-18 at a high production rate will reverse the trend toward increasing unit costs and allow us to buy more aircraft in future years. Since the F/A-18 is just entering production, we believe it prudent to build up at a low rate until development testing is substantially complete. Status of these programs and funding are discussed further under major program highlights.

(3) The operational utility of beyond visual range (BVR) air-to-air missiles can depend critically on the ability of the aircrew to identify potential targets as friend or foe. Also, there may be tactics which enemy aircraft could employ to minimize the effectiveness of BVR missiles launched against multiple aircraft. The Air Force is planning a joint operational utility evaluation using analysis, simulation and flight test to assess the sensitivity of future medium range missiles to variations in IFF and tactics.

A new medium range air-to-air missile is being developed with an active radar seeker and inertial midcourse guidance so one aircraft can launch missiles against more than one enemy aircraft on the initial pass. The modifications to aircraft avionics to best utilize this capability have not been determined. One objective of the operational utility evaluation mentioned above will be to determine the effectiveness of the aircraft/missile system with various modifications to aircraft avionics.

c. Major Program Highlights

Some major program highlights are as follows:

(1) F-16 Multimission Fighter

This general purpose tactical fighter retains superior air-to-air capabilities in the close-in air combat arena utilizing the AIM-9L SIDEWINDER and 20mm cannon. It has a multimode radar with the capability to acquire fixed surface targets in all weather as well as high and low flying aircraft. The F-16 does not carry the AIM-7 SPARROW missile but beyond-visual-range capability is planned with the introduction of the Advanced Medium Range Air-to-Air Missile (AMRAAM) in FY 1986. The first production aircraft was delivered in August 1978. Activation of the first U.S. Air Force F-16 unit occurred in January 1979. Also, in January, the first European production F-16 was accepted by the Belgian Air Force. During FY 1980, the F-16 production rate will reach the planned U.S. production rate of 15 aircraft per month and European assembly lines will be producing at the rate of 6 per month. Future flight tests include additional weapon certification and continued systems integration tests. Development and test of a dual element fuel pump will provide added single engine safety. The F-16 provides the USAF and the NATO European Participating Group with a standard, lower cost but effective means of modernizing and expanding the tactical fighter force. The FY 1980 funding request includes $27.8 million in development and $1,671.8 million for procurement of 175 aircraft.

(2) F-15 Fighter

The F-15 is a high performance, highly maneuverable fighter equipped with a long-range lookdown radar and a balanced mix of air-to-air weapons (AIM-7, AIM-9, 20mm) for use in close-in and medium range all-weather combat. It will also be AMRAAM capable. It is designed specifically to gain and maintain air superiority and significantly upgrades USAF tactical forces. Procurement funding of the authorized 729 aircraft will be complete in 1982. The force will include 325 F-15 C/D models which will incorporate a programmable signal processor (PSP) and other improvements (PEP 2000). The PSP provides the capability to reprogram the radar via software changes and permits improved ECCM performance, higher resolution and the introduction of air-to-ground radar modes. PEP-2000 provides 2,000 pounds additional fuel, provisions for conformal fuel tanks and increases maximum take-off weight by 12,000 pounds. The development program includes test and qualification of the software for the PSP. $500 thousand is requested in the FY 1980 budget for on-going program management and support along with procurement of 60 aircraft at a cost of $989.0 million.

(3) F/A-18 Naval Strike Fighter

Full scale development (FSD) of the F/A-18 began in early 1976. First flight was in November 1978. Eleven FSD aircraft will be delivered during FY 1979. The common F/A-18 configuration will provide operational flexibility and decrease life cycle costs. In the fighter role, the primary mission is fighter escort with a secondary mission of fleet air defense. It replaces the F-4 in the Navy and Marine Corps and will carry a full complement of air-to-air weapons including AIM-7, AIM-9, 20mm gun and (when developed) AMRAAM. In the attack role, it will replace the A-7s in the mid-1980s. Future high rate production should provide needed and affordable modernization of Navy and Marine tactical air forces. The major concerns in the development program include weight growth and cost growth in both development and production costs which we are monitoring closely. DSARC IIIA, for low rate production, is scheduled for March 1980. IOC for the first Marine Squadron is in early 1983. The FY 1980 budget request for development is $310.8 million and for procurement of 15 aircraft is $726.8 million.

(4) F-14 Fleet Air Defense Fighter

The F-14 is the primary fleet air defense fighter for the Navy which will carry a balanced mix of air-to-air weapons including AIM-54, AIM-7, AIM-9, and the 20mm gun. We are continuing to correct TF-30 engine deficiencies and develop fixes to increase its reliability and durability. $30.9 million in the engine component improvement program is included in the FY 1980 budget request for this purpose. Development of a digital programmable signal processor similar to that going in the F-15 aircraft is planned along with incorporation of non-cooperative target recognition and identification techniques. The FY 1980 budget request includes $27.7 million for these avionics improvements and $638.4 million for procurement of 24 aircraft.

(5) Beyond Visual Range Missiles

Our current BVR air-to-air missiles are the AIM-7 SPARROW and the AIM-54 PHOENIX. The PHOENIX is a long range missile optimized for the fleet air defense mission. The Navy's F-14 with AWG-9 fire control system can launch multiple PHOENIX missiles at multiple targets at ranges of more than 60 miles. PHOENIX should continue to fulfill this need for several more years until the Soviet Union develops electronic countermeasures capable of degrading the PHOENIX radar guidance systems. The AIM-54C is being developed to meet the projected threat and to replace analog circuitry utilizing obsolete components with modern digital processing incorporating current technology components.

The medium range AIM-7F model SPARROW, now in production, provides greater range and speed than the earlier AIM-7E. The AIM-7M, in development, utilizes a monopulse seeker and provides improved performance in clutter. The AIM-7M will enter production in FY 80 with all production shifting from AIM-7F to AIM-7M in FY 1981.

The AIMVAL/ACEVAL operational tests indicate that our effectiveness in air combat would be much improved if we could launch multiple missiles at multiple targets. We are taking advantage of advanced technology to develop this capability as well as improved range, lower susceptibility to ECM, lighter weight and higher speed in the AMRAAM program. The AMRAAM program has completed concept definition. Two of the five contractors are now being chosen to proceed into the validation phase.

Development of AMRAAM and an Advanced Short Range Air-to-Air Missile (ASRAAM) may become a cooperative NATO program. We have agreed in principle with Germany, France, and the United Kingdom that the U.S. will develop AMRAAM and our European Allies will develop ASRAAM. The required system characteristics for both systems will be agreed to by the Four Powers. This "family of weapons" concept of development is intended to take advantage of the best technology throughout NATO and to balance the development costs on each side of the Atlantic. That is, the United States would expend approximately the same amount of funds for AMRAAM as the Europeans would spend for ASRAAM. Additionally, there should be the same balance in the technological level of the development work performed. If there should be an increase in AMRAAM funding requirements due to the added complexity of NATO cooperation, the increase would be more than offset by the savings obtained by European ASRAAM development. Total funding requested for BVR missiles for FY 1980 is $103.9 million R&D and $208.5 million for procurement.

(6) Within Visual Range (WVR) Missiles

The ASRAAM program is in its very earliest stages and the missile is not likely to be in our forces for some time to come. In the meantime, we are producing the AIM-9L SIDEWINDER. This WVR missile uses a sensitive infrared seeker that permits attack from virtually all aspects, and we learned from the AIMVAL/ACEVAL tests that having all aspect capability causes drastic changes in the nature of air combat. We have included $8.5 million for development of improvements to the AIM-9L in FY 1980, but no funds are requested for ASRAAM. We are requesting $108.1 million for procurement of the AIM-9L.

3. Interdiction

a. Strategy

Air interdiction must be effective before and during a Warsaw Pact armored breakthrough attempt. The attack would involve several divisions supported by tactical air. Development efforts to counter this formidable ground threat include ground-based and airborne air defenses and enhancement of our effectiveness for close air support and for destruction of key installations and second echelon forces. Through quick annihilation of key targets and reinforcements, NATO can blunt a Pact offensive thrust. Our strike aircraft must be able to survive enemy air defenses and destroy targets at a fast rate.

b. Major Program Highlights

(1) Low Altitude Airfield Attack System (LAAAS)

We have initiated a joint U.S./UK engineering development program for the JP-233 LAAAS. The system is designed for delivery by the UK Tornado and the U.S. F-111E. Full scale development started in November 1977. Detailed specifications have been prepared, dispenser designs selected, and prototype submunitions tested.

The FY 1980 request for JP-233 is $25.3 million to fund engineering development and testing.

(2) Close Air Support Weapon System

MAVERICK is an air-to-surface missile designed to destroy enemy armor or other small, hard tactical targets. MAVERICK development has resulted in a "family" of terminal guidance sensors. A television guided weapon has been deployed with the tactical air forces. Full scale development of an imaging infrared (IIR) seeker for MAVERICK is continuing. Improvements, recently defined for the target tracker, will increase the probability of maintaining lock-on throughout the missile flight. The Navy has chosen a slightly modified IIR MAVERICK to fill its at-sea IR attack weapon requirements in lieu of a new weapon development. The Air Force has no present plans for a laser guided MAVERICK, but the Marine Corps is interested and may conduct a limited operational evaluation in CY 1979 or 1980. Total funding requested for the MAVERICK program in FY 1980 is $54.0 million for engineering development.

(3) Advanced Attack Weapons

We have begun the development of a family of area munitions, dispensers, warheads and guidance systems in the Advanced Attack Weapons program. A MENS for the Wide Area Anti-Armor Munitions (WAAM) program has been prepared and should be approved soon. The various WAAM munitions are designed for area attack. There were previously four concepts in development: the Anti-Armor Cluster Munition (ACM), the Extended Range Anti-Tank Mine (ERAM), the CYCLOPS, a terminally guided weapon and the WASP Mini-Missile. Due to funding limitations, the Air Force is deferring CYCLOPS. ACM will move into full scale development in FY 1980. Validation of ERAM and WASP concepts will continue in FY 1981. Only the most promising concepts will be carried through development and deployment. An Executive Committee, chaired by USDR&E, has been formed to assure strong central management of DoD's terminally guided submunition (TGSM) programs. These programs include WAAM, ASSAULT BREAKER, (described in Chapter V as part of the DARPA program), and the TGSMs being developed for possible use in the General Support Rocket System. The committee reviews these programs to improve management efficiency, eliminate unwarranted duplication, and insure that an appropriate degree of competition is maintained. Funding for the WAAM program for advanced development and testing is $35.8 million. Engineering development funding for ACM is $20.6 million.

(4) Air-to-Ground Standoff Missile

The goal of this program is to provide the Navy with a reasonable cost, survivable weapon with which to attack high value, heavily defended land and sea targets. The Navy and the Air Force are developing joint requirements and are evaluating existing cruise missiles, variants of existing cruise missiles, and missiles powered by supersonic integral rocket ramjets. A MENS is being validated for this standoff weapon. We recognize an urgent need for our Navy and Air Force to be able to standoff and attack key targets. By taking advantage of mature propulsion and guidance technologies, the joint Navy/Air Force program may achieve an early operational capability; however, these design choices have not yet been made. The

FY 1980 funding requested for development of the joint Air-to-Ground Standoff Missile is $15.8 million.

(5) A-10 Squadrons

Operational employment of the A-10 Close Air Support (CAS) aircraft is proceeding satisfactorily. IOC was achieved in October 1977 and the first squadron of A-10 aircraft successfully passed their Operational Readiness inspection in January 1978. In April 1978, during a two-week exercise, the Air Force evaluated its "Forward Operating-Rearward Based" concept for NATO/USAFE operations. For three days, 18 aircraft surged at wartime sortie rates and flew 324 missions. This resulted in an average of 6 missions per aircraft per day versus a routine operation of 1.2 and demonstrated the weapon system's exceptional surge capability. Three squadrons of A-10s are now activated in the U.S. and initial activation of a USAFE wing in the United Kingdom began in January 1979.

Efforts are continuing to improve the A-10's attack capability as well as its combat survivability. In the near term, during FY 1980, we will complete RDT&E efforts to incorporate an inertial navigation system for enhanced low level navigation. We are also incorporating an updated radar warning receiver and an internal chaff/flare system for enhanced survivability. The FY 1980 budget request includes $17.8 million for development and $886.1 million for procurement of 144 A-10 aircraft.

(6) Night Attack Program

The Night Attack Program objective is to conduct feasibility flight demonstrations of concepts and hardware which will improve the precision night attack capability of our existing fighter aircraft. The increasing threat will require air-to-surface capable aircraft in the projected force to operate at night with multiple target kills per sortie to achieve mission objectives. Mission area analysis conducted since 1977 has highlighted the night attack limitations of existing equipment.

The Fiscal Year 1979 Congressional deletion of the 10.0 million dollars in the Night Attack Program has resulted in a major restructuring. Currently, the Night Attack Program is the sole Air Force program with the objective of improving the precision night attack capability of existing USAF fighter aircraft. The program has consolidated several independent but related analyses, simulation, and proposed feasibility flight demonstration efforts to eliminate actual and potential duplication of effort within the Air Force and between the Services. Existing hardware will be used to fulfill this requirement.

The $12.8 million Fiscal Year 1980 request for the Night Attack Program includes four tasks. Funding of $2.0 million will be used for a flight feasibility demonstration of a terrain following radar for the F-16 and F-4E PAVE TACK aircraft. Funding of $1.1 million will be used for the millimeter wave fire control technology flight demonstration on an F-4 test bed aircraft. Further, $9.7 million will be used for precision attack enhancement in the A-10 and F-16.

4. Defense Suppression

a. Strategy

The primary threat to aircraft engaged in tactical air operations is an integrated network of sea and land-based, radar-directed air defense artillery (ADA), surface-to-air missiles (SAMs) and interceptors. The Warsaw Pact has numerous types of highly mobile, widely distributed and overlapping SAM systems. They operate in close cooperation with early warning radars and threaten the survival and reduce the effectiveness of our tactical air forces. At sea, tactical operations face similar ship-based, radar-controlled air defense systems, which may be grouped in supportive formations and integrated with land-based elements. Observed trends suggest that enemy defenses will continue to gain increased capability, while aircraft performance remains relatively fixed. Electromagnetic signal density and complexity over the battlefield is increasing the technical challenge in developing effective countermeasures. In broadest terms, such countermeasures take two basic forms: lethal (such as self-homing or guided missiles and bombs) and non-lethal (electronic warfare). To achieve an effective defense suppression, we are pursuing an aggressive program of system and engagement analysis, equipment/concept testing and hardware development leading to an appropriate mix of lethal and non-lethal systems.

b. Issues

The range of the High Speed Anti-Radiation Missile (HARM), now in full scale development, provides a standoff mechanism for lethal suppression of acquisition radars, allowing tactical air to penetrate to ranges where fire control radars are operative. However, a companion defense suppression missile, provided in quantity to penetrating aircraft, is required to provide an affordable means for suppression of shorter range fire control radars and mobile radar directed air defense threats. A MENS will be initiated in FY 1979 which establishes the tactical relationships between the two anti-radiation weapons.

c. Major Program Highlights

(1) High Speed Anti-Radiation Missile (HARM)

HARM is an air-launched guided missile which can suppress or destroy the radars of enemy surface-to-air missile systems and air defense artillery. HARM will be able to attack radars which are beyond the capability of either SHRIKE or Standard Anti-Radiation Missiles. It is a joint U.S. Navy/Air Force program intended to be used with the A-7, F/A-18, and F-4G WILD WEASEL aircraft. The program has incorporated improvements in airframe maneuverability. Engineering design is almost complete and fabrication of development test articles has started. The first missile flight is scheduled for early CY 1979. We are requesting $43.8 million in FY 1980 for the continued development of this program and $54.8 million for the procurement of 80 missiles.

(2) Advanced Defense Suppression Weapon

The self-protection weapon, now in the conceptual stage, is a small, short range, quick reaction, anti-shutdown missile to be carried by strike aircraft. We are requesting $3.0 million for concept definition in FY 1980 for this program.

(3) Non-Lethal Systems

Non-lethal systems are discussed in Section G.7 of this chapter.

E. SEA CONTROL

1. Introduction

Sea Control programs are oriented toward maintenance and improvement of capabilities essential to free use of the seas. Principal needs in Sea Control are to:

- Protect the sea lines of communication linking us to the territory of allies threatened by external aggression.
- Protect merchant ships carrying US foreign trade and support our allies in protecting their own trade.
- Protect our own territory and to assist our allies in protecting their territory from attack by hostile maritime forces.
- Protect our maritime strategic deterrent forces.

Sea Control forces include not only those which defend shipping against direct threats, but those sea-based air and amphibious assault forces which can strike at threats before they can reach the sea lanes.

Major deficiencies and risks related to the potential future threat are:

a. Anti-Submarine Warfare. The effectiveness of US ASW systems could be reduced if Soviet submarines are quieted. Disabling critical undersea surveillance systems could reduce our ASW effectiveness in early stages of war.

b. Anti-Air Warfare. The long-range air threats to ships is increasing, impelling us to improve our shipboard and airborne anti-air capabilities. Effectiveness will be very sensitive to changes and improvements in the threat.

Non-Soviet air and missile threats are becoming a significant problem.

c. Anti-Surface Ship Warfare. Inadequacies continue in our capability as the non-Soviet missile-armed surface forces become widespread.

d. Mine Warfare. Improvements to mine countermeasure capability are essential to contain the threat posed by the large Soviet stock of mines, many of which are technically sophisticated.

The development and acquisition program in Sea Control is tailored to concentrate on rectifying these major deficiencies while devoting adequate attention to other less immediate problems.

2. Multimission Naval Systems

a. Strategy

This area includes weapon systems and their subcomponents that are capable of performing multiple missions or being employed in ships or aircraft that are designated for one or more missions. The development of multimission naval systems influences developmental efforts for combat subsystems included in other Sea Control mission areas. Current research and development programs are pursuing a variety of improvements to ships and aircraft.

b. Issues

(1) Surface Effect Ship (SES) - DoD recommended termination of the program in FY 1979. Is the SES cost effective for the mission(s) for which it is being considered?

If not, should the program be continued beyond FY 1979? This issue is discussed below.

(2) Submarines - High cost of SSNs. Can we build smaller, less costly submarines? Programs to investigate this are discussed below.

(3) Aircraft carrier - What kind of carrier should we build to meet our needs? The decision is a CVV as discussed below.

c. Key Programs

(1) LAMPS MK III

The LAMPS MK III ASW helicopter program will provide the essential ASW capability for the FFG-7 class frigates and the DD-963 class destroyers and restore to our ASW ships the advantage in speed and weapons-reach against Soviet nuclear attack submarines.

Following FY 1979 debates and congressional guidance, cost reduction steps totalling $400 million have been identified. Prototype helicopter system deliveries and testing will commence early in FY 1980. FY 1980 funding of $178.8 million for RDT&E is requested for system integration, testing, and demonstration of prototypes.

(2) V/STOL

The Navy is continuing a systematic and complete investigation of alternatives for new design, follow-on aircraft for the present force. Two study efforts are under way to investigate alternatives for future sea-based aircraft. The CNO Sea-Based Air Master Study Plan is investigating four possible alternatives for future sea-based aircraft to determine which will be the most cost-effective. Systems under review are conventional Takeoff and Landing (CTOL), Short Takeoff and Landing (STOL), Short Takeoff, Vertical Landing (STOVL), and the V/STOL concept. Concurrently, Naval Air Systems Command is funding industry to analyze V/STOL operational concepts and program approaches for future V/STOL aircraft weapons systems. The Navy expects to use the results of these study and technology efforts during the fall of 1979 in a DSARC program review. In the meantime, the Navy is pursuing a technology development program to provide advances in propulsion, avionics, and structural aircraft technology to reduce weight and improve performance. The FY 1980 budget request includes $16.8 million to continue this effort.

(3) Surface Effect Ship (SES)

After a thorough examination of all the issues involved, the Navy recommended against continuing with development of the 3000 ton SES test ship in this budget. The Navy's analysis showed that the payoff from this program was distant and very uncertain, and that SESs of the type being developed were unlikely to have a significant impact on our naval posture. After conducting my own review, I concurred in the Navy's recommendation. We plan to request that the balance of the funds appropriated in FY 1979 be used to pursue vigorous development of technology and system concepts leading to an advanced ship program which will achieve some of the performance advantages of the SES without suffering its penalties in payload, cost, and fuel consumption.

(4) Maritime Patrol Aircraft (MPA)

The MPA program seeks to define a successor to the P-3C and to develop a cost-effective land-based supplement to our sea-based, anti-ship and anti-air forces. The MPA will be designed to counter the projected threats in the 1990s. A variety of competitive system concepts, including modifications to existing aircraft, are under investigation. These investigations will continue in FY 1980, for which $4.0 million in funds is requested.

(5) P-3 Modernization

This important new start for FY 1980 will enable us to derive the maximum benefit from the service life extension of the P-3 aircraft from 20 to 28 years by bringing some of its integral subsystems up to date in performance capability, e.g., ESM system, communication suite, and advanced acoustic and non-acoustic processing. FY 1980 funding of $30.6 million is requested for RDT&E to initiate hardware and software integration.

(6) Submarines

Submarine alternatives studies are examining SSN new construction options which would be available in the FY 1983 timeframe. The SSN chosen will be a follow-on to the SSN-688 class. Further, studies and R&D is on-going to determine technology that holds promise, in the 1990s, of a capable attack submarine that we can afford to build in the numbers required to maintain desired force levels. FY 1980 funding of $10 million for RDT&E is requested to pursue these studies and for concept formulation.

(7) Advanced Aircraft Carrier (CVV)

The CVV will replace the carrier MIDWAY, which is due for inactivation in the mid1980s. Currently in preliminary design stage, the CVV is a conventionally powered aircraft carrier of approximately 60,000 tons full load displacement. Since the CVV will be initially required to support all current conventional takeoff and landing aircraft (CTOL) in the Navy's air wing, it will be equipped with catapults and arresting gear. In the future, it will be able to accommodate high performance V/STOL aircraft. The CVV as now envisioned will have survivability features incorporated in its design which will make it less vulnerable to weapons effects than existing carriers; i.e., both CV and CVN. Preliminary design is projected for completion in May 1979 and contract design by May 1980. In FY 1980, $6.9 million has been requested in RDT&E to complete contract design and $1,617 million for procurement.

The CVV will provide a carrier of high capability while saving significant cost over its operating life as compared to a full-size carrier. Although the initial cost savings for construction of the CVV vice a CV of the

KENNEDY Class (CV-67) is not great; i.e., CVV $1.62 billion vice CV $1.77 billion, there is a significant savings in life cycle cost. The life cycle cost for a modified CV-67 is estimated at $19.7 billion; $14.5 billion for a CVV. These costs include air wings of 105 aircraft for a CV and 73 aircraft for the CVV, so the reduction in life cycle cost is accompanied by a reduction in capability (operational aircraft). With the design of the CVV, we will begin to reverse the trend toward larger, more expensive ships.

3. <u>Undersea Surveillance and Anti-Submarine Warfare</u>

a. <u>Strategy</u>

Undersea surveillance provides information on the locations of potentially hostile submarines. Anti-Submarine Warfare (ASW) protects US forces so that they can perform their missions and assures that sea transport suffers minimal losses from submarine attack. Surveillance emphasis in FY 1980 will be placed on providing rapid detection and localization information to tactical ASW commanders through the implementation of an Integrated Undersea Surveillance System (IUSS).

ASW efforts during FY 1980 will continue to be directed toward development of in-depth area, barrier, and local defense capability which will complement our undersea surveillance and command and control systems. Our area and barrier detection capability is being improved with a sonobuoy development program, the priorities of which have been realigned consistent with current threat predictions. Near-term emphasis is being placed on a more sensitive line array buoy and on improved buoy-to-platform communications. The P-3 modernization and S-3 weapons systems improvement programs will provide the platform communications and processing capability to work with the buoys in area, barrier, and carrier task force operations. Both vehicle programs will upgrade passive self-defense capability and non-acoustic detection. The requirement for local ASW will be met by a combination of extended-range helicopters (LAMPS MK III) and the long range detection afforded by AN/SQR-19 Tactical Towed Array Sonar. The Advanced Lightweight Torpedo program will provide an appropriate weapon for these platforms after the mid 1980s. Submarines as ASW weapons are being strengthened through continued emphasis of quieting, improved sonar array detection and localization, a new ASW standoff weapon development to match detection and targeting range, and a small new effort to investigate submarine air defense.

b. Issues

What mix of systems under development potentially offers the best available cost effectiveness? Studies such as force mix and the on-going Sea War 85 seek insight into this question.

c. Key Programs

(1) Surveillance Towed Array Sensor System (SURTASS)

Some problems have been discovered during development testing and are being corrected. This will require increased RDT&E funding through FY 1983. For FY 1980, funding of $11.8 million RDT&E is requested to implement and test these corrections. In procurement, $12.2 million is requested for a trainer and for electronics for the two shore sites and $154 million is requested for five tow ships and their arrays.

(2) Tactical Towed Array Sonar (TACTAS)

The AN/SQR-19 development contract was terminated in FY 1978 because of cost growth and schedule slips in the electronics subsystem. These were due principally to high technical risks associated with the multiprocessor. A new management team has been assigned and the program has been restructured to use the standard ASW acoustic signal processor. The array and handling system developments are proceeding on schedule. Present efforts are focused on award of a new contract for completion of system development and on examination of backfit application of the AN/SQR-19 to the FFG-7, DD-963 and DDG-47 ship classes. FY 1980 funding of $27.8 million in RDT&E is requested to conduct subsystem qualification tests, software development, and at-sea development tests of the array.

(3) MK 48 Torpedo Additional Capability

In order to effectively counter the threat projected for the 1980s, the MK 48 will be given improved acoustic performance, better counter-countermeasure effectiveness, increased warhead stand-off distance, and a close-in attack capability. FY 1980 funding of $28.2M in RDT&E is requested to go into contract for torpedo alteration kits to be tested.

(4) Advanced Lightweight Torpedo (ALWT)

The ALWT is being developed to replace the MK 46 and will provide a superior air and surface launched counter to the projected submarine threat, which will operate deeper, faster, and quieter and will employ sophisticated countermeasures. In FY 1980, $60.1 million in RDT&E is requested to continue two prime contracts in advanced development.

4. Ocean Surveillance and Anti-Surface Ship Warfare

a. Strategy

The goal of Ocean Surveillance and Targeting programs is to acquire, correlate and provide timely and accurate surveillance data to naval tactical commanders and the National Command Authorities in a form suitable for tactical exploitation. Effort in this area over the past year demonstrated a decrease in targeting time and target location error. Work is continuing to further reduce these factors. Anti-Surface Warfare uses the surveillance and targeting information to destroy and neutralize detected targets, whether they are enemy surface combatants, merchant ships, or their operating bases. Tomahawk development and Harpoon improvements are the major efforts in FY 1980.

b. Issues

The ability to detect and discriminate targets at long ranges and the accuracy and timeliness of such information to support missile performance are of considerable concern.

Programs to resolve these issues are described below.

c. Key Programs

(1) Over-The-Horizon (OTH) Targeting

Navy OTH freeplay exercises conducted in both the Mediterranean and Pacific fleets have demonstrated a capability to target anti-ship cruise missiles using shipboard sensors. Furthermore, in structured (i.e., non-freeplay) exercises, the fleet has demonstrated the potential to use various kinds of off-hull support such as aircraft, RDF, etc., for long-range simulated anti-ship cruise missile launches. In FY 1980, funding of $20.3 million in RDT&E is requested to support Tomahawk targeting demonstrations, the validation and demonstration of an advanced development model, and initiation of engineering development.

(2) Anti-Ship Tomahawk Cruise Missile

The anti-ship variant of the Tomahawk is an offensive weapon capable of deployment from submarines and surface ships. Consideration is being given to adapting it for air launch as well. Primary emphasis during FY 1980 will be on system testing to validate performance. In FY 1980, $103.4 million in RDT&E is requested to complete ship launch technical evaluation, for both the land attack (nuclear) and ship attack versions, submarine launched operational evaluation, and to start ship launched operational evaluation.

(3) Harpoon

Harpoon is a ship, air, and submarine launched all-weather 60 nmi anti-ship cruise missile for the US, NATO, and other allied countries. Infrared seeker development, funded under a weapon prototyping program, appears promising for use with Harpoon. During FY 1980 work will continue on improvements necessary to improve Harpoon effectiveness including a new passive imaging infrared seeker. In FY 1980, $8.0 million has been requested in RDT&E to pursue these efforts.

(4) PENGUIN

PENGUIN is a Norwegian, inertially guided, passive infrared terminal homing, anti-shipping missile. PENGUIN is suitably sized for missile patrol boat applications and will complement the Harpoon missile engagement envelope. In FY 1980, $9.3 million is requested to procure a PENGUIN system, install it on a patrol boat, and initiate testing.

(5) Surface Gunnery

Work in this area will continue on the 5-inch guided projectile program and with improved sensors to support surface gunnery. In FY 1980, RDT&E funding of $20.6 million is requested for the fabrication and testing of 5-inch guided projectiles and $10.9 million for engineering development models of the Seafire electro-optic fire control system.

5. Anti-Air Warfare (AAW)

a. Strategy

Defense of the surface fleet against air attack is based upon the defense-in-depth concept. Under this concept, attacking aircraft and anti-ship missiles will first be engaged at longer ranges by fighter aircraft and long-range area defense SAMs. These weapons systems will reduce the number of attackers to a level which can be countered successfully by the ship's shorter range self-defense systems. Current R&D programs in this area primarily are directed toward improving the range and effectiveness of shipboard missile systems and providing more integrated ship defense systems for the future Fleet.

b. Issues

Which of several systems under development should be used to improve shipboard area and point defense systems and to enhance long range defense? How best can we coordinate air and surface AAW systems? Programs to resolve these issues are described below.

c. Key Programs

(1) Aegis and CSEDS

Aegis is an integrated AAW system designed for fast reaction, high tracking and engagement capacity, and has improved missile guidance. Design modifications for the Aegis system, based on experience gained from the sea trials, will be tested at the land based Combat Systems Engineering Development Site (CSEDS). The initial installation of Aegis will be on the DDG-47. For FY 1980, RDT&E funding of $25.3 million support Aegis developmental testing in NORTON SOUND and $44.8 million is for the integration and testing of the ship tactical computer at the CSED site. Procurement funding of $820.2 million is requested for the second ship of the DDG-47 class of Aegis destroyers.

(2) Standard Missiles

The Standard Missile (SM-1) will be given improved propulsion. A follow-on missile, the SM-2, will incorporate many additional features to increase the weapon system effectiveness. It will be used on Aegis equipped ships. A system for the vertical launching of the Standard Missile is in development and promises to reduce costs, decrease reaction time, and increase the number of platforms on which the Standard Missiles could be installed. In FY 1980, funding requested is $97.8 million in RDT&E to improve and test the SM-2 missile, produce the SM-1 missile modifications for operational evaluation, and develop a vertical launcher, and $183.6 million in procurement to buy 480 SM-1 (medium range), 30 SM-2 (medium range), and 55 SM-2 (extended range) missiles.

(3) Self-Defense Weapon Systems

The short range air defense requirements for surface ships will be met by the PHALANX (Close-In Weapon System) gun system and the Improved Point Defense (IPD) Missile System. Both systems will enter the fleet operationally in 1979. PHALANX is a high-rate-of-fire 20mm gun with a self-contained closed-loop search and track radar mounted in a single above-deck structure. The IPD system uses the NATO Sea Sparrow missile. These systems will be installed on the FFG-7, DDG-47, DD-963, and certain CGN Class ships as well as selected auxiliaries. In FY 1980, funding of $4.2 million is requested for RDT&E and $133.2 million in weapons procurement to buy 61 PHALANX units for backfit onto active fleet ships and $35.1 million in SCN funding to procure 11 sets for new construction ships.

A cooperative effort with West Germany and Denmark is underway to develop the Rolling Airframe Missile (RAM), a lightweight, low cost, ship defense missile system as a complement to NATO Sea Sparrow. The $19.1 million requested in FY 1980 represents the US portion of the engineering development costs.

(4) Self-Defense EW

As a complement to hard-kill AAW weapons, the future fleet will place increasing emphasis on "soft kill" or electronic warfare. In FY 1980, $18.9 million is requested in RDT&E to continue engineering development of EW systems.

(5) Shipboard Surveillance Radars

Improvement of the shipboard radars in support of Fleet air defense will continue in two broad areas - upgrading near term Fleet radar capability, and developing future radars. Improvements to existing radars will emphasize automatic target detection and tracking techniques plus reliability and maintainability. The Shipboard Surveillance Radar Systems (SSURADS) program addresses the radar need for the Fleet in the heavy threat environment postulated for the 1990s and will preclude technical obsolescence in radars. In FY 1980, $26.8 million is requested in RDT&E to continue the implementation of AN/SYS-1 Integrated Automated Detection and Track System on CG and CV platforms and to complete concept studies on SSURADS.

(6) Command and Control

The defense-in-depth concept requires effective coordination of sensors and weapons on both ship and air platforms. The Navy is participating with the other Services in developing the requisite systems, an example of which is Joint Tactical Information Distribution System (JTIDS). These developments are discussed in the section on Theater and Tactical C^3I.

6. Naval Mine Warfare

a. Strategy

The naval mine is a highly cost effective weapon for anti-submarine warfare. Due to the restricted Soviet geographic access to the open ocean, the mine is an effective anti-surface ship weapon as well. The Soviets have long recognized the utility of mines and have developed large mine stockpiles. Our mine warfare program will be closely coordinated with our NATO allies to achieve the Long Term Defense Program (LTDP) objective.

The US Navy does not now have an adequate anti-mining capability, either qualitatively or quantitatively. In order to counter the threat in shallow water, we are developing new and improved helicopter mine sweeping equipment for quick, independent, reactive operations. The Soviet deep water mine threat will be countered by new hunting and sweeping systems being developed for a new mine countermeasures ship. These systems will reach the fleet in the mid-80s.

b. Issues

Production cost growth has occurred in CAPTOR as a result of a need to improve reliability of the system. Production is being maintained at a low level until sufficient testing has been completed to demonstrate a satisfactory level of performance and reliability. Testing other than long term reliability was completed in November with promising results not yet fully analyzed. In FY 1980, $61.7 million in procurement is requested to buy 260 CAPTOR mines.

c. Key Programs

(1) Quickstrike

The Quickstrike family of mines provides an improved shallow water mining and a submarine launched standoff mining capability. These mines are primarily conversions of existing bombs and torpedoes. In FY 1980, $9.5 million is requested in RDT&E to continue development of the Mk 64 mine using the Mk 84 bomb, and $5.4 in procurement for the first of the Quickstrike mines.

(2) Intermediate Water Depth (IWD) Mine

The IWD mine is a dual purpose (anti-submarine and anti-ship) weapon which will cover a range of water depths. This program has been restructured from the Propelled Ascent Mine (PRAM) program because the PRAM development was considered to be too risky. In accordance with OMB Circular A-109, during FY 1980, two advanced development contractors will be selected from the six contractors selected for concept evaluation in FY 1979.

(3) MH-53E Mine Countermeasure Helicopter

The CH-53E is the largest helicopter in the Free World. Now in production for the Marine Corps as the CH-53E, the mine countermeasures version (MH-53E) will meet the airborne mine countermeasures (AMCM) requirements. Its longer time on station compared to the current RH-53D and around the clock operations will result in higher operational productivity because a greater portion of each mission flight will be devoted to AMCM operations. The higher utilization of the MH-53E will result in fewer aircraft required to meet the Navy program requirements. In FY 1980, $12 million in RDT&E is requested for the conversion of test units from the CH to MH configurations.

F. MOBILITY

1. Introduction

Mobility forces enable us to deploy our general purpose forces rapidly to overseas theaters, to increase their flexibility when deployed, to provide for their logistic support, and to re-supply our Allies. Strategic mobility forces operate over inter-continental ranges, transporting units and supplies from the United States to overseas areas or between two operational theaters. Tactical mobility forces are used on short range missions, usually within an operational theater, to improve force and logistic flexi-bility.

2. Air Mobility

a. Strategy

Air mobility encompasses both strategic and tactical airlift mission objectives. Our strategic airlift force will be sized to meet our needs in (1) non-NATO contingencies, (2) inter-theater moves in a global conflict, or (3) reinforcement of NATO's Central Region, whichever generates the highest demands. Strategic airlift forces for support of non-NATO contingencies should be designed to be independent of overseas bases and logistic support to the maximum extent possible. For the tactical airlift forces, we are currently evaluating a set of options for tactical airlift modernization.

b. Issue

The primary issue in the Air Mobility program centers about the fact that the tactical intra-theater fixed-wing transport fleet is aging and that programmed service life attrition will require modernization of that fleet in the mid-to-late 1980s. Connected with this is the Army stated requirement for the intra-theater tactical airlift of heavy combat unit (outsize) equipment such as tanks and self-propelled artillery.

OSD has recently completed a comprehensive study of the various alternatives to tactical airlift modernization. The AMST was shown to be cost effective, given the requirement to move outsize equipment. However, we did not assess the current need for tactical airlift as pressing as other tactical force modernization needs and are not requesting funding for the engineering development phase. We are, however, considering an AMST-type aircraft with STOL and wide-body characteristics as a potential candidate for other mission requirements which include strategic airlift augmentation, cruise missile carrier and airborne M-X carrier. Studies to evaluate an AMST or AMST-variant in these roles have been recently initiated and results will be available by early Spring. Development of other mission requirements for an AMST-type aircraft could well alter the affordability issue surrounding tactical airlift and change our assessment of the AMST in that role. For FY 1980, $5.0 million is requested for continued RDT&E efforts on Tactical Airlift Modernization. Dependent upon the results of the present study efforts, it is planned to develop and evaluate a set of options for an AMST or AMST variant that could be utilized in both Strategic and Tactical mission applications.

c. Key Programs

(1) Helicopter Programs

(a) BLACKHAWK

The UH-60A helicopter (BLACKHAWK) is being procured by the Army to replace the aging UH-1 series in the air assault, air cavalry and aeromedical missions. With major design emphasis on reliability, maintainability and survivability, the BLACKHAWK is expected to provide dramatic savings in the areas of operational support and life cycle costs. Final flight testing is nearly complete and the first production BLACKHAWK was delivered to the U.S. Army in October 1978. For FY 1980, $380.2 million is requested for continued production.

(b) CH-47 Modernization

This program is aimed at improving reliability, maintainability, and safety, while extending the life of the Army's medium-lift helicopters an additional 20 years. The present CH-47 fleet of A, B, and C airframes will be overhauled and seven new systems incorporated: (a) fiberglass rotor blades, (b) transmission and drive system, (c) modularized hydraulic system, (d) auxiliary power unit, (e) electrical system, (f) advanced flight control system, and (g) multi-cargo hook load suspension system. In FY 1980, delivery of three prototypes will be made to the Army for the design validation flight testing. For FY 1980, $23.3 million is requested for R&D and $27.4 million for long lead production items.

(c) Combat Rescue Replacement Helicopter

This is a new program with the objective of replacing the aging H-3 combat rescue helicopter with a modified version of the Army BLACKHAWK/Navy LAMPS or other suitable airframe. Use of Army or Navy developed airframes will significantly enhance standardization and minimize acquisition costs. In FY 1980, concept studies defining alternative solutions to the requirement will be conducted.

(d) CH-53E Super Stallion

The CH-53E, with a lift capability of over 16 tons, is being procured by the Navy and Marine Corps for heavy helicopter logistics missions. Developmental and flight test efforts are nearly complete and delivery of the first production aircraft is scheduled for June 1980. For FY 1980, $190.0 million is requested for continued production.

(2) Fixed Wing Aircraft Programs

(a) C-5A Wing Modification

The Air Force has determined that the fatigue life of the C-5A wing is inadequate and will result in a projected aircraft life of about 8,000 flight hours. To achieve the required aircraft life of 30,000 flight hours, modification and strengthening of the wing are required. Fabrication of fatigue and flight test modification kits was continued during CY 1978. Full scale production of the kits will begin in FY 1980, with installation beginning in FY 1982 and completion scheduled for CY 1987. For FY 1980, $12.7 million is requested to continue R&D efforts and $78.6 million is requested for initial fabrication of modification kits.

(b) C-141 Stretch Modification

The objective of this program is to increase this aircraft's ability to move oversize cargo by up to 30% and to decrease reliance on foreign bases. This is being accomplished by lengthening the C-141 fuselage by 23.3 feet and by installing an aerial refueling system. These capability increases are accomplished with no increase in peacetime operating costs. The first modified C-141 will be delivered to the Air Force in early FY 1980. By the end of FY 1980, 50 modified aircraft will have been delivered. For FY 1980, $130.4 million is requested for the fabrication and installation of modification kits.

(c) Civil Reserve Air Fleet (CRAF) Modification

The basis of the CRAF program is to modify new production L-1011, DC-10 and 747 aircraft to a passenger/cargo convertible capability. Previous plans proposed modification of existing wide-bodied aircraft; however, with the airlines now beginning to order significant numbers of new aircraft, the program has been re-oriented to the more cost-effective solution of incorporating the required modifications during production. The first modified aircraft will be delivered during FY 1979. During FY 1980, nine additional aircraft will be modified. For FY 1980, $73.6 million is requested.

3. Sea Mobility

a. Strategy

Forces for the defense of the sea lanes are sized to engage in a world-wide war at sea with the Soviet Union concurrent with a NATO war since that contingency would pose the greatest threat to the sea lanes and cause the maximum flow of essential shipping. To keep these forces operating efficiently, Underway Replenishment (UNREP) ships resupply forces at sea in forward areas with fuel, munitions, provisions and spare parts. A wartime objective of sea lane defense forces is to ensure the delivery of seaborne material to the U.S. and its Allies with an acceptable loss rate. Current R&D efforts are aimed at improving underway replenishment equipment and providing a means to transfer cargo and petroleum products ashore under adverse conditions. There are no current substantive issues in this area.

b. Key Programs

(1) Underway Replenishment System

Develops a standard underway replenishment equipment for future new ships with FY 1980 R&D funding of $1.8 million.

(2) Offshore Bulk Fuel Transfer

Develops a system to transfer POL from deep draft commercial and MSC tankers in support of amphibious forces ashore with FY 1980 R&D funding of $3.2 million.

(3) Container Offloading and Transfer System

Develops hardware such as cranes, causeways, etc., to facilitate the unloading of intermodal commercial ships (containerships, roll-on/roll-off (RO/RO) and barges) with FY 1980 R&D funding of $5.4 million.

G. THEATER AND TACTICAL C^3I

1. Requirements

Theater C^3I programs are akin to strategic C^3I efforts, in that survivability of essential command and control functions is crucial, but must also provide capabilities for participation in multinational defense efforts in support of alliance commitments, and coordinated management of multi-Service operations.

Tactical C^3I programs must facilitate interoperability between the Services and with the general purpose forces of our allies, as well as providing required mobility features. Moreover, such systems are typically procured in large numbers and can impose substantial burdens for maintenance and logistics support. Special emphasis should therefore be placed on achieving greater utility at lower cost.

Both theater and tactical programs need to protect essential command and control functions from hostile counter-C^3 efforts. Our systems should therefore be resistant to attempts by potential adversaries to exploit critical communications links, and to disrupt command and control processes by jamming and deception.

The Soviet Union and its Warsaw Pact allies are making significant advances in military surveillance, communications, and command and control, with the prospect of substantial improvements in Pact capabilities for precise and timely force management. We plan to expand our counter-C^3 initiatives to offset these advances.

2. Theater Command and Control

Current systems which support rapid control of escalating crises are deficient. Reaction capabilities under the control of the Joint Chiefs of Staff (JCS) are aging and do not include essential communications capabilities. The ability of overseas commands to provide early on-scene assessments to theater headquarters and the Washington area is unacceptably limited. The Department of Defense has, over the past several years, undertaken several improvement efforts: The WWMCCS Airborne Command Center (ABCC) and Rapid Reaction Deployable C^3 (R^2DC^3) capability; U.S. Readiness Command's requirement for an upgrade to the Joint Airborne Joint Command Post, nicknamed FORWARD TALK; the upgrade program for the JCS Element, and air-transportable Joint Task Force (JTF) capability; and the Airborne Command Control Communications capability, primarily for airborne control of tactical air forces.

Recognizing the similarity of requirements for these separate programs, DoD is generating a single program to consolidate efforts to upgrade and improve deployable crisis management facilities and communications. The two WWMCCS efforts (ABCC and R^2DC^3) have been combined into a single program, the Joint Crisis Management Capability (JCMC), which will replace present and future joint programs. Individual Service programs aimed at the same objectives or which can contribute to crisis management and control will interact and be compatible with and effectively enhance the JCMC. The reconstituted program will satisfy the various stated requirements for rapidly deployable crisis/JTF-oriented capabilities to extend the WWMCCS temporarily beyond its normal day-to-day limits.

The capability to be provided is separable into four modules:

- A minimum communications package, transportable by many means, to provide secure communications in small crisis situations.

- A rapidly responsive airborne capability to relay crisis situation-assessment communications between the crisis scene and appropriate area and national authorities.

- An air and ground transportable system which can provide C^3 for a moderate-size joint (air, ground and/or naval) force on the crisis scene while either airborne or on the ground. Operational capability on the ground is expected to be greater than while airborne.

- An air and ground transportable system which augments the C^3I capability of a large crisis management force such as a large JTF and assures JTF responsiveness to the NCA.

The program will be conducted by the Services, with strong WWMCC System Engineer, JCS, and OASD(C^3I) involvement. We are requesting $ 8 million in FY 1980 for JCMC.

3. Theater Surveillance and Reconnaissance

a. E-3A Airborne Warning and Control System (AWACS)

The E-3A (AWACS) is now operational in the Air Force and into its initial deployment. The long-range look-down radar surveillance and tracking capabilities of the E-3A provide a significant upgrade in our tactical air defense operations. There are, however, several high-priority evolutionary improvements to the radar and the overall system command and control capability that we believe will significantly enhance the long-term effectiveness of the system. Funding in the amount of $74.2 million is requested for development and testing of these improvements in FY 1980.

b. Surveillance Towed Array Sensor System (SURTASS)

SURTASS is a mobile undersea surveillance system, optimized for long-range detection and classification of submarines. The primary mission objective is to provide timely submarine surveillance information to at-sea tactical forces. SURTASS will function primarily as an adjunct to the fixed, bottom-mounted Sound Surveillance System (SOSUS). Correlation of fixed system and mobile system contacts will be facilitated by a central processing concept. We are requesting $194.0 million for SURTASS in FY 1980.

c. EP-3E

The Navy has operated twelve EP-3 land-based multisensor-equipped aircraft in direct support of fleet operations. A program for "off-the-shelf" upgrade of the mission equipment was begun in 1978. This is a long overdue modernization to improve sensor capacity, and $6.4 million is requested to support this effort in FY 1980.

d. Intelligence Support to NATO

Intelligence information is the basis for many of the key decisions made by NATO, and we are emphasizing improvements to NATO intelligence. These improvements range from enhancement of combat-level information support to strengthening NATO headquarters warning and reaction capability. Improved U.S. warning reports to SHAPE are being developed along with upgrades in analysis and dissemination assets of Allied Command Europe. At the NATO Major Subordinate Command (MSC) and Principal Subordinate Command (PSC) headquarters, special cells to receive national intelligence information are being tested and developed. A major study on policy revisions necessary to open up the flow of theater-level intelligence is currently being performed, and the conclusion should be a set of specific policy changes to improve the flow of U.S. intelligence into NATO.

4. Tactical Command and Control

a. Joint Tactical Information Distribution System (JTIDS)

The JTIDS is a major joint Service development program to provide jam-resistant, secure, integrated communications, position-fixing, and identification capabilities to tactical forces. It will be the primary tactical data distribution system for passing critical real-time information to large numbers and types of force elements. Joint agency electromagnetic compatibility tests have verified compatibility of JTIDS with other systems in the same frequency band. National frequency allocation is now in final stages of approval.

Three classes of terminal equipment are being developed:

- Class 1 for large aircraft, such as AWACS, and surface ships;
- Class 2 for other space-constrained aircraft and surface vehicles;
- Class 3 for man-pack and missile applications.

The Class 1 engineering development models of the JTIDS terminals for the E-3A (AWACS) successfully passed their tests and initial production funding of $76.3 million is proposed in FY 1980. This equipment will be operational in the E-3A in the early 1980's. The adaptable surface interface terminal development is progressing well, and we plan to initiate engineering development of the Class 2 terminals for fighter aircraft in mid-1979. Recent decisions on technology to be used for the Class 2 terminal development have provided a strong foundation for all future JTIDS development. The Class 3 terminals are still in the study phase at this time.

We have offered JTIDS to other NATO nations. This area of cooperation with our allies is a key to achieving real-time effective interoperability among all NATO forces.

b. Joint Interoperability of Tactical Command and Control Systems (JINTACCS)

The JINTACCS program is to test and demonstrate the operational effectiveness of interacting service tactical command and control systems in joint operations. At the request of the Congress, the program was reorganized in 1977-1978 to provide a more responsive management structure and to accelerate the program schedule. The overall schedule has been reduced by approximately two years. In addition, JINTACCS has been designated as the U.S. agent responsible for achieving interoperability of NATO tactical data systems. The Army is the Executive Agency for JINTACCS, but all Services are active participants. The total requested for JINTACCS in FY 1980 is $42.9 million, which includes $2.0 million to initiate NATO efforts.

c. Tactical C^2 and Battlefield Systems Integration

Increased lethality, mobility and range of modern weapons have put added stress upon our ability to detect, locate, and react to the enemy. We have thus intensified efforts to provide systems which will provide an accurate, timely and common perception of the combat situation. There are several related efforts under way in this area.

- The Army's Tactical Operations Systems program will apply improved ADP and display technology to provide Division and Corps commanders with a system responsive to real-time battlefield needs. Funding of $51.5 million in FY 1980 is requested for testing the system and to procure an additional system for early fielding to Europe.

- $20.6 million is requested in FY 1980 for integration of Army Tactical Data Systems, to reduce automated systems costs through development and adaptation of common standardized ADP equipment and higher-order programming languages for multi-system requirements.

- Work will continue on the improvement and automation of the Air Force Tactical Air Control System. We are requesting $40.9 million in FY 1980 to undertake various improvements, investigations to alternative configurations, and to continue development of the TACS System Trainer and Exercise Module.

- We are requesting $8.7 million for the Air Force Tactical Air Intelligence System Activities program in FY 1980. $5.0 million of this total will support the BETA project (discussed below) and system integration of various tactical intelligence processing systems and to initiate a new classified project. The USAFE Command and Control System project will continue to work on improvements on the Operational Application of Special Intelligence System (OASIS) through the generation of additional computer programs. Our request for FY 1980 is $5.9 million for OASIS.

d. Identification

Positive and reliable identification of friends and foes (IFF) is a capability required by all of our tactical weapon control systems, especially those which can engage targets beyond visual range. The United States is continuing to participate in the formulation of a NATO-wide architecture and development of a future identification system that will overcome shortcomings of the present MARK XII IFF system, which is an early 1960s design. The NATO activity envisions a secure, jam-resistant capability for positive identification of foes. Distribution of identification data will be by a multi-function data distribution system to be used throughout NATO. Other high-priority interrogation-reply developments are planned, leading to NATO wide interoperability in accordance with a recently agreed NATO technical characteristic. Total research and development funding proposed for IFF in FY 1980 for all the Services is $25 million.

5. Tactical Reconnaissance, Surveillance, and Target Acquisition

During the past year, the Army and Air Force conducted a joint review of tactical reconnaissance, surveillance, and target acquisition (RS&TA) capabilities and shortfalls for coordinated air and land battle support. This effort, together with a number of other analyses, has led to identification of deficiencies and redundancies in the RS&TA mission area and has initiated reconciliation of several new starts on on-going programs against a comprehensive framework of complementary, interoperable and survivable assets. In addition, a GAO report on tactical intelligence assets, published in the spring of 1978, identified the shortage of modern assets in the field. We have therefore placed increased emphasis during the past year on early deployment of those on-going programs which fit the architectural framework.

a. TR-1/COMPASS QUASAR

We have ascertained that a high-altitude, high-endurance aircraft equipped with multiple sensors is needed for stand-off surveillance into the second echelon of opposing forces. In addition to facilitating timely allocation of defensive units, such a capability can be used to cue shorter-range surveillance sensors, and will thereby enable more efficient use of such assets in direct-support target acquisition functions. Our new initiative in this regard, started in FY 1979, is the TR-1, a tactical reconnaissance variant of the strategic reconnaissance U-2R aircraft, capable of long loiter, stand-off surveillance from altitudes above 60,000 feet. Equipped with a high-capacity data link and advanced sensors, the TR-1 and associated ground processing facilities, including COMPASS QUASAR (formerly the Transportable Ground Intercept Facility) will provide all-hours, all-weather battlefield surveillance into the second echelon of opposing forces with real-time reporting to both Army and Air Force commanders. We are requesting $82.2 million in FY 1980 in support of the TR-1/COMPASS QUASAR programs, of which $38.0 million will be to initiate airframe production and procure two BIG WING trainers.

b. Airborne Reconnaissance Radar Programs

As explained in last year's report, the UPD-X and ASARS synthetic aperture radar developments have been combined and are now under contract. In the interim, we are improving the existing UPD-4, employed on Air Force RF-4C and Marine Corps RF-4E aircraft, and the

APS-94F, for the Army OV-1 aircraft, side-looking airborne radars to extend range and, most importantly, to improve ECCM performance. The FY 1980 request in support of these efforts is $42.5 million.

c. Airborne Surveillance Radars--SOTAS and PAVE MOVER

A third initiative comprises programs to provide all-weather stand-off moving target indication (MTI) radar surveillance capable of performing in a heavy jamming environment.

The Stand-Off Target Acquisition and Strike System (SOTAS) is a helicopter-borne MTI radar providing close-in surveillance to support battle management and artillery targeting. The operational utility of SOTAS was successfully demonstrated during REFORGER-76, -77, and -78, and the program entered Engineering Development following a DSARC II decision in August 1978. FY 1980 funding requested for SOTAS is $66.5 million.

For the longer term, PAVE MOVER, formerly the low visibility moving-target acquisition/strike program, will provide a wide-area surveillance, detection, and strike capability. The system is designed for low probability of intercept by enemy ELINT sensors, and will provide real-time weapons guidance data and cueing to other sensors. PAVE MOVER is a joint effort of the Air Force and DARPA.

d. Ground-Based SIGINT Sensors

Procurement of TEAMPACK and TRAILBLAZER assets for Army forward-area deployment is proceeding according to plan. We are requesting $28 million for FY 1980 in support of these programs.

The larger systems for Corps commander support, AGTELIS and TACELIS, completed Engineering Development in 1978 and will enter developmental and operational testing in 1979. We will be closely reviewing the test results to insure that these larger systems meet the interoperability and survivability requirements of the overall architectural framework.

e. Airborne SIGINT Sensors

Production of TEREC II systems for the RF-4C aircraft is underway with the objective of augmenting the three equipments now in service with USAFE as soon as possible. Delivery of improved GUARDRAIL systems to operational units began in the fall of 1978. An initiative to upgrade GUARDRAIL to be interoperable with TR-1 sensor capabilities has begun.

f. Precision Location Strike System (PLSS)

Development of PLSS continues leading to a Critical Design Review in early 1979. PLSS is being designed to provide tactical forces with an all-weather, stand-off precision location and strike system capable of attacks against tactical targets (e.g., command posts, and radar facilities) located in the PLSS electronic grid. PLSS can locate both fixed, non-emitting targets and radar and radio emitters. We are requesting $24.9 million for PLSS in FY 1980.

g. Battlefield Exploitation and Target Acquisition (BETA)

Project BETA is a joint Army and Air Force program to implement a mobile test-bed to evaluate the ability of automated sensor information fusion centers to improve the process of near-real-time location and identification of land targets and dissemination of targeting data. The BETA facilities will be located at Army Corps and Division operations centers and at the Air Force Tactical Air Control Center. The BETA test-bed elements will be interoperable and will exchange data in near-real-time. BETA will provide integrated targeting information, alternative portrayals of the battlefield situation, and facilitate battlefield sensor management. NATO-based demonstration and evaluation is scheduled for 1980 and will include processed sensor reports from GUARDRAIL V, SOTAS, FIREFINDER, UPD-4, RIVET JOINT, COMPASS EARS, TEREC, and the Navy's EP-3E.

The Navy and Marine Corps have recently become active participants in the program. Following an examination of those missions which require support for land-based targeting, a determination will be made as to the timing and extent of their participation in the NATO demonstration and evaluation. A funding level of $12.8 million is proposed for BETA in FY 1980, exclusive of resources needed for Navy and Marine Corps participation. Reprogramming will be required to support the Navy and Marine Corps efforts when a program to meet their requirements has been defined.

6. Tactical Communications

a. Ground Mobile Forces (GMF) Satellite Communications

The GMF Program is to provide Ultra High Frequency (UHF) and Super High Frequency (SHF) tactical satellite communication terminals, multiplex anti-jam control modems and ancillary equipments for the Army, Air Force and the Marine Corps. While each Service is responsible for funds to meet their specific requirements, the Army as the GMF executive agent will procure all ground terminals.

GMF terminals will provide the tactical forces with reliable communication links that are independent of terrestrial networks and the physical conditions of the terrain where operations are being supported. The terminals are all highly transportable, allowing quick set-up and tear-down when an operational unit is relocated. One equipment, the PSC-1 manpack unit, can be alerted to the immediate need to communicate with its base station while on the move. Communication satellites to support the GMF terminals are the DSCS (SHF), FLTSATCOM (UHF), SDS (UHF) and the follow-on leased communication satellite (UHF), presently under Navy contract.

Major GMF procurement activities include:

- A multi-year contract for 200 MSC-64 terminals. FY 1980 request for these terminals is $27.2 million; FY 1981 funding of $21.9 million will be required to complete the procurement.

- TSC-86 and TSC-94 terminals for the Air Force, starting in FY 1981.

- MSC-85 and MSC-93 terminals for the Army, beginning in FY 1979 at a cost of $28.5 million. Follow-on funding for these terminals is in FY 1981 and beyond because of the time lag between contract award and first terminal delivery.

- 100 PSC-1 manpack terminals in FY 1979 at a cost of $5.3 million, with a follow-on buy anticipated for FY 1981.

- The MSC-65 terminal, beginning in FY 1981, for support of U.S. tactical forces.

The SHF terminals being procured will be equipped with anti-jam modems to provide continued communications capability in severe jamming environments. The MSC-64 terminals will also provide a degree of anti-jam protection. Incorporation of anti-jam features in the PSC-1 and MSC-65 terminals is currently precluded by availability of appropriate channels in the space segment. Such features can be added, however, if and when the appropriate space segment link capacity become available.

b. <u>The Joint Multichannel Trunking and Switching System (JMTSS)</u>

The JMTSS provides multi-Service common-user capabilities for a theater of operations. It will:

- Provide capabilities to extend, supplement or restore the Defense Communications System, including joint common user or shared-use telecommunications support, in a wartime environment.

- Support the objectives of the WWMCCS, by providing improved reliability, survivability, security, interoperability, and cost effectiveness.

- Reduce dependence on incompatible and duplicative systems.

Key JMTSS requirements are for general-purpose multichannel communications for rear-area Army and Air Force elements supporting combat forces in the forward areas. These requirements area currently being reviewed for JCS validation and determination of resource shortfalls.

c. <u>The Joint Tactical Communications Program (TRI-TAC)</u>

TRI-TAC is an all-Service program to acquire interoperable, standardized, multichannel, switched communications systems. TRI-TAC is, in effect, a system of systems and has constituted a formidable technological challenge because the TRI-TAC program is not simply a modernization of tactical communication capabilities. The TRI-TAC architecture takes advantage of U.S. and Allied investments in existing tactical communication equipment while facilitating the introduction of more capable systems. TRI-TAC will provide much needed overall communications security, and the new systems will be highly reliable and rapidly deployable.

Equipments being developed under the TRI-TAC program include a family of large and small message and circuit switches, communications security equipment, systems control facilities, multiplex and transmission equipment, terminal devices, and hardware to interface with mobile radios. The use of automatic switching and control will provide for rapid and timely transmission of messages, data and voice communications. The design also provides for interfaces with other existing and planned U.S. and allied communication systems.

FY 1980 represents a key turning point in the TRI-TAC program. Developments which have been assigned to individual Services are well underway with the large switches undergoing joint initial operational testing. We are requesting $189 million for TRI-TAC in FY 1980, which includes funds for initial procurement of the large switches. Full-scale procurement activities will commence in FY 1981 and peak in FY 1983 and FY 1984.

d. Combat Net Radio

Command and control of tactical forces is exercised primarily through the use of combat net radios (CNR). The Army, as lead Service, is developing, for the use of all Services, a secure, jam-resistant CNR, including manpack, vehicular and airborne versions. The program, in the advanced development phase, is called the Single Channel Ground and Airborne Radio Subsystem (SINCGARS-V). We have offered NATO nations the opportunity to participate in the SINCGARS-V program through membership in the Interface Control and Test Integration Working Groups as a step toward improved interoperability.

During the next few years we will continue procurement and installation of modern voice security devices for operation with existing tactical HF, VHF, and UHF radios.

7. Electronic Warfare (EW) and Counter-C^3

EW systems provide needed means for offsetting technological advances in the deployed weapons of opposing force, whether they be intended for use against ground, air, or naval targets. In the absence of electronic and other countermeasures against such weapons, we would face the risk of having to deal, solely by active defense, with enemy firepower of increased range, accuracy, and therefore lethality. EW can operate in several ways to reduce the effectiveness of such weapons, and thereby helps restore and balance against numercially superior forces.

Concurrently, major advances are being made in Warsaw Pact capabilities for more timely and precise force management through the introduction and deployment of modern communications technology, more sophisticated surveillance and reconnaissance sensors, and automated aids to command decision-making. These advances span the entire spectrum of land, air, and naval warfare, and enhance the threat posed by already large forces. One of our major thrusts in FY 1980 is therefore to improve our means to exploit and jam hostile communications and command and control systems, with the objective of substantially degrading enemy force management capabilities in the event of hostilities.

We have consolidated these related activities into a single mission area to facilitate coordination among Service and Agency activities--to insure that important capability gaps are addressed, and that complementarity and compatibility of the several programs are achieved with minimal duplication of effort.

a. Self-Protection and Self-Defense EW

The FY 1980 budget request provides for several projects in this area, including:

- o Development of an Advanced Self-Protection Jammer system for use in fighter aircraft to reduce the effectiveness of air-launched and surface-to-air weapons. The Navy and Air Force have signed an MOU for a collaborative program; we are requesting $32.7 million--$24.2 million for the Navy and $8.5 million for the Air Force--in support of this effort in FY 1980.

- o Development of scaled-down versions of Navy and Air Force EW systems for use in Army attack and scout helicopters and reconnaissance and target acquisition. We are requesting $9.9 million in FY 1980 in support of this effort to enhance the survivability of Army airborne assets in the forward combat zone.

- o Development of added capabilities for the AN/SLQ-32 shipboard EW system, to improve defenses against newer anti-ship missiles. $5.3 million is requested in FY

1980 in support of this project to enhance the survivability of naval units against concerted missile attacks.

b. <u>Counter-C^3</u>

Major Counter-C^3 efforts in FY 1980 include:

- o Continuation of work on the Air Force COMPASS CALL jamming system. The FY 1980 request for support of this project is $11 million.

- o Acquisition of Army communications countermeasures equipment mounted in tracked vehicles and expendable artillery-delivered jammers for disrupting enemy communications in the forward combat zone. $10.9 million is requested for support of these projects in FY 1980.

- o Navy cover-and-deception efforts. We are requesting $7.9 million for this area in FY 1980.

VIII

VIII. DEFENSE-WIDE COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE (C^3I)

A. C^3I REQUIREMENTS

Our C^3I systems must support the command function at all echelons--the National Command Authorities (NCA) and the Joint Chiefs of Staff on a worldwide basis; the Unified and Specified Commands in their areas of responsibility; and the individual unit commands, operating separately or together. These systems should have flexibility to cope with evolving threats and be consistent with planned force composition and employment. C^3I systems must facilitate conduct of U.S. joint operations worldwide and combined operations with Allied forces in Europe, Asia, and over the sea lines of communications. More specifically, the following are key requirements for defense-wide C^3 systems:

- Worldwide jam-resistant communications are needed to link decision-makers in CONUS with commanders overseas. Jam-resistant communications are also needed to support tactical users and designated nuclear-capable forces. We intend to improve our posture in this area and, where necessary, to deploy systems resistant to nuclear effects.

- U.S. military forces throughout the world need secure voice, digital data, and teletype services to support general C^3 functions. Present facilities of the Defense Communications Systems (DCS) include obsolete equipment and contain single-node vulnerabilities. Upgrades are needed to enhance survivability in wartime, to accommodate future digital circuit requirements, to reduce operation and maintenance costs, and to improve interoperability with our allies.

- It is National policy to protect U.S. government telecommunications which carry traffic essential to our national security. We are preparing a plan for protecting CONUS links and for development and implementation of a future global secure voice switched network.

- o Accurate, secure, jam-resistant, all-weather/all hours navigation and position-fixing is needed to provide a common grid for precise worldwide control of forces.

Defense intelligence has been directed to work toward the fulfillment of four major objectives:

- o Support operational commanders, by providing intelligence support for military operations during peacetime, crisis and throughout the spectrum of military conflict.

- o Provide indications and warning, by providing for timely acquisition and dissemination of critical intelligence information concerning capabilities and preparation for attack by hostile powers on the U.S. or its Allies and concerning situations affecting the national interest.

- o Support national-level intelligence needs, by providing intelligence to the NCA for policy and planning and fulfillment of requirements of the Director of Central Intelligence for national foreign intelligence.

- o Support Departmental requirements, by providing intelligence required to promote readiness, develop U.S. weapon systems and policy, and arm and structure the combat forces of the U.S.

In support of the above objectives, we need to improve the intelligence infrastructure--the organization and operation of facilities and resources comprising the Defense intelligence systems. Some areas requiring improvement are:

- o Wartime survivability of intelligence assets.

- o Interoperability of intelligence assets with our C^3 structure--needed to insure that intelligence can be provided in a timely manner to commanders and decision-makers.

- o Mapping, charting, and geodesy support--vital to improved accuracies for new strategic weapons systems such as the cruise missile.

- o Long-range technical threat projections--in support of weapon system acquisition programs.

- o Capability to monitor enemy activities at night or in bad weather--important for indications and warning, support to combat commanders, and treaty--compliance monitoring.

B. INTELLIGENCE PROGRAMS

1. National Intelligence

National intelligence supports the National Command Authorities and other senior military and civilian policy-makers. It is used by force planners and those who develop weapons systems. The national intelligence effort is organized in the National Foreign Intelligence Program (NFIP), which comprises a significant portion of the intelligence effort of the Departments of Defense, State, Energy, Treasury, as well as the CIA and the counterintelligence efforts of the FBI.

Within the Defense portion of the NFIP, there are four major intelligence programs--the Consolidated Cryptologic Program, General Defense Intelligence Program, and Air Force and Navy Special Activities.

Within the Defense budget are programs integral to the strategic and general purpose forces and which support tactical commanders in the use of their forces. These activities, as a secondary function, also provide intelligence to national-level consumers, as national intelligence programs provide information for military commanders. The two processes are complementary, rather than duplicative.

2. Indications and Warning Intelligence

This area supports national, departmental, and command needs for both strategic and tactical warning of events that affect national security, including warning of attack against the United States and its allies. It includes the worldwide Defense indications network, indications and warning collection by human resources, and operation of certain technical collectors which provide coverage of potential crisis areas.

3. Intelligence Support to Tactical Forces

The DoD has been undertaking a full-scale effort to develop a master plan for coordinated, integrated, and timely acquisition and use of national and tactical intelligence assets in support of tactical forces. This program entails participation by senior OSD officials, the Services, cognizant Defense Agencies, the Unified and Specified Commands, and the Intelligence Community Staff, and deals comprehensively with all aspects of the problem of matching intelligence capabilities and opportunities to commanders' information requirements.

C. POSITION-FIXING AND NAVIGATION

1. Major Programs

Over five years of development and testing have been devoted to the NAVSTAR Global Positioning System (GPS) concept. Concurrently with evaluation of the results of these efforts, we are developing a detailed plan for the orderly phase-in and phase-out of position-fixing and navigation (POS/NAV) systems and equipment. Although NAVSTAR GPS plays a central role in the final mix of POS/NAV systems, we are mindful of the potential impact that implementation of other new systems such as Joint Tactical Information Distribution System (JTIDS), Position Location Reporting System (PLRS), Discrete Address Beacon System (DABS), and the Microwave Landing System (MLS) during the next 10 to 15 years will have on total Defense expenditures and capabilities in this area. Through careful management of the transition from older equipment to the new systems, which capitalize on the rapidly expanding technology base, we plan to effect a substantial reduction in the number of existing POS/NAV systems while significantly increasing our ability to meet emerging military requirements. Further, we are working to improve coordination between DoD and other Federal agencies responsible for providing navigation services, with the ultimate goal of providing a consolidated plan for development, acquisition, and operation of military and civil radio-navigation systems. We are also working closely with our NATO allies to introduce these concepts and to achieve POS/NAV standardization and interoperability.

In FY 1980, we are requesting research and development funding of $230 million, of which $209.3 million is for continuation of full-scale engineering development of NAVSTAR GPS. GPS will provide precise real-time position and velocity data, and time signals, to an unlimited number of users worldwide. Security compromise from intercept of transmitted signals is circumvented, because GPS user equipment operates in a receive-only mode, and the user equipment can be made jam-resistant.

GPS funding is premised on successful completion of the NAVSTAR GPS Concept Validation Program and a positive decision by the Defense Systems Acquisition Review Council early in 1979 to proceed with full-scale development and deployment of the system. A fully operational system is anticipated by the mid-1980's and phase-in for military use is expected to continue through the mid-1990's. During this same period, a general reduction of DoD dependence on existing systems such as TRANSIT, LORAN, OMEGA, TACAN, and VOR-DME is anticipated.

2. Mapping, Charting, and Geodesy (MC&G)

MC&G R&D is conducted by the Defense Mapping Agency to improve terrestrial and space positioning and navigation, using techniques such as satellite-to-satellite tracking, satellite altimetry, very long baseline interferometry, and inertial technology. Other MC&G R&D programs are aimed at achieving improved target positioning and gravity field modelling and directly related to ICBM and SLBM accuracy. Additional areas of MC&G R&D effort include target reference scene preparation for the PERSHING II, and the DARPA cruise missile technology programs. TERCOM matrices are being generated through MC&G R&D for use by cruise missiles and other systems in terrain comparison and correlation navigation concepts. R&D in photo-bathymetry for shoal detection and remote sensing for terrain analysis is conducted to support needs applicable to military geographic intelligence.

D. DEFENSE-WIDE COMMUNICATIONS PROGRAMS

1. The Defense Satellite Communications Systems (DSCS)

DSCS, a Super High Frequency (SHF) satellite communications system, is key to linking the NCA and other priority U.S. agencies with forces located overseas. In addition to large fixed terminals, mobile terminals will be available to support WWMCCS requirements and some tactical Service requirements. Two DSCS II satellites were launched successfully in May 1977. Two additional DSCS II satellites were launched in March 1978 but failed to achieve orbit because of a booster malfunction. Two were then successfully launched on 13 December 1978. The space segment now consists of five DSCS II satellites, located over the Atlantic, Western Pacific, Eastern Pacific and Indian Ocean areas. The demand for DSCS capacity, area coverage, and reliability has established the need for a six-satellite space segment comprised of four active satellites and two in-orbit spares. To maintain this system until follow-on DSCS III satellites are available, replenishment satellites will be needed. Four are currently under contract, and two more will be procured in FY 1980, for which we are requesting $59 million.

DSCS III is being developed to provide greater satellite life and a major increase in communications capability over the DSCS II satellites. Two R&D DSCS III Demonstration Flight Satellites are being procured with FY 1978 and 1979 R&D funds and the first is now scheduled to be launched for validation tests in FY 1979. We plan to procure long-lead items for the first increment of DSCS III production satellites in FY 1980, for which we are requesting $20 million.

2. DCS Secure Voice Improvement Program (DCS SVIP)

The DCS SVIP program is aimed at realization of a major upgrade of the global secure voice communications network. The current system cannot accommodate national requirements for secure voice service. Actions are underway to restructure the program to respond to the Congress. We are giving highest priority to planning of improvements to critical links, by means of analog transmission and digital secure voice techniques.

3. <u>AUTODIN I and AUTODIN II</u>

The Automatic Digital Network (AUTODIN) is the principal switched digital communications network for data and narrative communications of the DoD. AUTODIN I has been in operation since the mid-1960's, and will continue to be the primary DoD message switching system until the mid-1980's. AUTODIN II will achieve IOC in late 1979, and provide interactive computer communications support and AUTODIN I connectivity. The initial stage of the AUTODIN II program will provide DoD with the ability to meet the majority of the projected long-haul data communications needs in CONUS. Its rapid response capability will allow us to eliminate a number of dedicated computer networks as we transition to this new common user system. Plans for extending AUTODIN II service overseas are currently under development. We are requesting $9 million in FY 1980 to support AUTODIN II.

4. <u>Digital European Backbone (DEB)</u>

DEB is an ongoing program that will upgrade the majority of the existing DCS European transmission network to all-digital operation. The present system, using analog techniques, is old and costly to maintain, and the links are difficult to secure. The four-stage DEB program will establish a major digital transmission system interconnecting U.S. activities in the United Kingdom, Belgium, Germany, and Italy. All information flowing through this system will be encrypted. Backbone links will be installed in the first three stages and stage IV will interconnect the majority of U.S. bases to the backbone system. The FY 1980 procurement request for DEB is $37.6 million.

5. <u>European Telephone System (ETS)</u>

ETS is the fixed telephone system serving U.S. forces in Europe. Operation and maintenance of the antiquated equipment of ETS is heavily labor intensive and does not provide reliable service or adequate capabilities. Two projects are being implemented to provide a reliable, responsive, and cost-effective system. One project will improve the transmission and cable distribution system; the other will replace telephone switches after fiscal approval is received. We are requesting $18.8 million for ETS procurement and O&M in FY 1980.

6. <u>Consolidation and Automation of DoD Telecommunication Centers</u>

DoD is committed to a program of telecommunication center automation to improve service and to control operation costs and personnel requirements. Near-term improvements are being achieved through application of currently available computer-based systems. Over the longer term, these systems and the procedures and formats which support them will be standardized to realize additional benefits in the form of lower hardware, software, training and logistics costs.

Intra-Service efforts over the past decade have resulted in a 30 percent reduction of existing DoD telecommunications facilities. Subsequently, we have pursued an inter-Service consolidation/automation program focused on areas of major installation concentration. We have also initiated consolidation of centers involving Intelligence and General Service communications. Over 130 centers have been identified where such actions may be feasible. Such consolidation efforts must take mission responsibilities and security criteria into account, however, and the majority of improvements will take place in the 1979-1981 period.

To date we estimate that these efforts have resulted in savings exceeding $200 million and 2,500 personnel. We believe additional savings in excess of 2,000 personnel and $20-30 million per year will be realized when all actions are complete.

7. NATO/U.S. Interoperability and Mutual Efforts

a. Satellite Communications (SATCOM) Sharing

The sharing of United States, United Kingdom, and NATO SATCOM assets have proved to be extremely beneficial. The United States and the United Kingdom have made use of NATO IIIA in the Atlantic area and NATO IIIB in the East Pacific. The United States has also used the UK SKYNET satellite. To continue the shared SATCOM systems, it is imperative that the next generation of United States and NATO SATCOM systems be interoperable. Not only will this provide for contingency operations, but it should also be most economic for both the United States and NATO. Completely interoperable United States and NATO space segments and ground terminals are DoD objectives.

b. Mutual U.S./NATO Support

Communications facilities must be provided for the U.S. Brigades 75/76 that are being stationed in Northern Europe. As part of the rationalization program, the Army and Air Force will make use of existing allied communications, e.g., the UK STARRNET. To avoid building duplicate United States systems, the JCS and DCA are investigating both the continued use, including expansion if necessary, of the UK STARRNET and the use of the NATO Integrated Communications System.

c. Consolidation of U.S. and NATO Communications Facilities

Consolidation of the Supreme Allied Commander, Atlantic (SACLANT) and the U.S. communications centers in the Norfolk area is completed. Planning and programming for automatic interconnection of the U.S. AUTODIN and NATO TARE record traffic systems, and of the U.S. AUTOVON and NATO IVSN switched voice systems will be completed in 1979. U.S. procurement of multiplex equipment for the NATO CIP-67 system will provide links for U.S. transmission requirements in the NATO system at lower cost. These and related projects will provide added reliability and survivability for U.S. and NATO communications. We continue to press for adoption of a NATO policy that will permit automatic interconnection of national and NATO switched communications systems.

8. Communications Security (COMSEC)

a. COMSEC Programs

The DoD Communications Security (COMSEC) program includes all resources devoted to the protection of U.S. Government telecommunications. Our goal is to secure all U.S. Government communications systems which carry traffic of significant intelligence value. This must be done in the face of two major trends in communications. First, the sheer volume of the communications requiring protection grows steadily. Locations requiring COMSEC protection are more and more widely dispersed, and the media required to transmit the traffic are inherently more susceptible to intercept. Continuing COMSEC developments are aimed at increasing the reliability and life expectancy of COMSEC hardware and integrating appropriate COMSEC measures into early development states of new and advanced communications systems.

b. Computer Security

DoD has designed and is implementing two automatic data processing (ADP) concepts with internal integrity mechanisms to allow simultaneous processing of multiple levels of classified information. Detailed design information is being made available to the computer industry to encourage them to build ADP systems with similar integrity mechanisms. We are preparing procedures for evaluation of industry-developed products for use in DoD multilevel secure applications, and expect the effort to result in the widespread availability of secure ADP systems for use in government and the private sector.

IX

IX. OTHER DEFENSE-WIDE MISSION SUPPORT

A. TEST AND EVALUATION SUPPORT

1. Objectives. Our defense systems test and evaluation (T&E) program continues to emphasize the reduction of vulnerability and the improvement of reliability, availability, and maintainability. Through earlier operational testing in the system acquisition process we seek to lessen risks in decision making and assure the highest levels of operational effectiveness and suitability of fielded weapons, while avoiding unwarranted additions to their cost and time to deployment. We will emphasize the use of an improved T&E Master Plan as a tool for better assessment of T&E in relation to the overall progress of weapon systems programs. The Joint Test and Evaluation (JT&E) program, in which the assets of two or more Services interact cooperatively or competitively, will continue to provide useful information on our weapon systems and their use in operational environments. Numerous foreign initiatives in testing of weapons and in test support are being followed.

We will proceed with efforts to improve and modernize the capabilities of the DoD test ranges and centers to keep pace with the increasingly sophisticated requirements of our new weapon systems. These efforts include the development and acquisition of sufficient numbers of realistic targets for use in weapons testing. By careful attention to costs and products, the goal of maximizing the "return on investment" of the T&E process will continue to be pursued.

2. Reorganization. As a part of the continuing effort to achieve more efficient development and acquisition procedures, OSD staff

elements responsible for operational test and evaluation (OT&E) and those responsible for development test and evaluation (DT&E) have been recombined under the Director Defense Test and Evaluation. The decision to consolidate was made after approximately eight months' experience during which the staff responsibilities for monitoring and assessing OT&E were separated from the responsibilities for DT&E.

This separation, implemented concurrently with the FY 1978 reduction in OSD staff, had originally been effected in order to place greater emphasis on OT&E. It was discovered, however, that no significant benefits accrued to counterbalance the loss of efficiency resulting from the split T&E organization working within the limitations of reduced manpower. In particular, the separation resulted in some duplication of effort by T&E personnel, since each staff was required to be familiar with the findings of the other. The new structure will provide for more efficient application of the relatively small numbers of T&E personnel. It will also permit more effective analysis and review of major T&E programs, while maintaining safeguards to continue the independence required for assessment of OT&E. This consolidation acknowledges the complementary nature of the DT&E and OT&E functions, and will allow better management integration of the results of both.

3. <u>Current Programs</u>. Major defense system programs for which significant testing is planned in FY 1980 are shown in Table IX-1 along with the relation of this T&E activity to Defense Systems Acquisition Review Council (DSARC) milestones.

TABLE IX-1

MAJOR DEFENSE PROGRAMS
FY 1980 Test Status

Testing in Preparation for a Milestone II Decision

- SINCGARS
- ELF
- Wide Aperture Sonar
- TRIDENT II Missile
- ASPJ
- ALWT
- AMRAAM
- WAAM
- JTIDS (Class II Terminal)

Testing in Preparation for a Milestone III Decision

- M-X
- PLSS
- NAVSTAR
- SURTASS
- TACTASS
- C-5 Wing Mod
- AAH
- CH-47D
- DSCS III
- F-18
- HARM
- HELLFIRE
- LAMPS
- PATRIOT
- TOS
- GSRS
- 5" Guided Projectile
- Space Shuttle/IUS
- AN/TTC-39
- ALCM
- SLCM
- GLCM
- SOTAS
- IFV/CFV
- PERSHING II
- DIVAD
- AIM-7M
- IIR Maverick
- AIM-9M

Post-Milestone III Testing

- Advanced Tanker Cargo Aircraft
- A-10
- GBU-15
- CAPTOR
- XM-1 Tank
- COPPERHEAD
- CIWS
- F-16
- C-141 Stretch
- SSN-688
- SOSUS Improvement
- AEGIS/CSED
- DDG-47
- US ROLAND
- ASMD-EW
- EF-111 Tactical Jamming System
- JTIDS (Class I Terminal-AWACS)
- AABNCP
- FLTSATCOM

Our T&E program recorded many important achievements in 1978, including the first eight survivability test missions of the cruise missile. These tests were conducted at Nellis AFB, White Sands Missile Range, and Pacific Missile Test Center against realistic representations of threat ground and air defenses. Other cruise missile test events included the first launch from a submerged submarine and demonstrations of terminal guidance accuracies required for airfield runway interdiction with nonnuclear munitions.

Tests conducted on the Eastern Test Range served to prove range-payload performance of the TRIDENT I missile. Various aspects of underground shelter concepts for the M-X missile were tested and evaluated, and M-X inertial guidance system performance was demonstrated.

During the past year the F/A-18 aircraft completed a series of laboratory, wind tunnel, simulation, propulsion and radar tests leading to rollout in September 1978 and first flight in November 1978. The F-404 engine completed preliminary flight rating tests that showed favorable performance and durability results. In addition to the first full-scale development aircraft now flying, another 10 will enter flight testing this year to investigate all critical areas, including flying qualities, propulsion, carrier suitability, avionics, armament, reliability, and maintainability.

The F-16 aircraft will complete the majority of its development testing program this year; no major weapon system deficiencies have been revealed by testing to date. Operational testing will continue, including a planned deployment of three full-scale development F-16's to Norway, Denmark, Germany, and the United Kingdom in early 1979 for the purpose of obtaining a realistic assessment of operational effectiveness and supportability in the European environment for each of the F-16's weapons systems. A second multinational OT&E effort will begin this year in which representatives of NATO member air forces will team to develop common operational tactics. This will insure that the F-16 meets its full potential in support of NATO standardization and interoperability. These tests will begin in Utah and continue in each of the four participating European countries.

Engineering development of the HELLFIRE precision guided anti-tank missile will be completed this year with a production decision scheduled for April 1980. Some 169 laser guided firings are planned for the test program, 107 from a modified AH-1S helicopter and 62 from the Advanced Attack Helicopter (AAH). The tactical flexibility of HELLFIRE will be demonstrated by day and night firings at moving and stationary targets using both methods of launch (direct and indirect), three methods of designation (autonomous, air remote, and ground remote), and three methods of fire (single, rapid, and ripple). In addition to extensive development flight testing, the AAH itself will be subjected to a 110-hour operational flight test program utilizing four flying prototypes prior to the scheduled production decision in FY 1981.

Evaluation of the effectiveness of a weapon system in a realistic environment often requires the use of forces and systems from two or more Services. JT&E activities--tests in which the assets of one or more Services are used along with or in opposition to the assets of another Service--provide a useful tool for evaluating our systems in an operational contest. Past JT&E activities (of which 27 have been initiated since FY 1972) have provided valuable information on such diverse topics as effectiveness of over-the-beach resupply from container ships, effect of the number of participants in close air-to-air fighter aircraft combat, relative effectiveness of selected mixes of air-to-ground electronic warfare systems, and performance of command and control systems used in the conduct of close air support. In FY 1980 ten JT&E's will be ongoing (Table IX-2). The Battlefield Air Space Management Joint Test will be a new start, selected from candidate tests nominated by the Services and the JCS.

Table IX-2
FY 1980 Joint Test and Evaluation Program

Advanced Anti-Armor Combat Vehicle
Aircraft Survivability in Anti-Armor Operations
Battlefield Air Space Management
Counter Command, Control and Communications
Data Link Vulnerability
Electro-Optical Guided Weapons Countermeasures
Electronic Warfare During Close Air Support
Identification of Friend, Foe or Neutral
Laser Guided Weapons in Close Air Support
Tube-Launched Guided Projectile

In the area of foreign T&E initiatives, the US and the United Kingdom have signed an agreement on the mutual acceptance of T&E results on systems which are offered by one country for acquisition by the other. The objective of the agreement is the elimination of unwarranted duplication of testing on systems of mutual interest. This document will become an Annex to the Memorandum of Understanding between the US and UK regarding cooperation in R&E, production, and procurement.

The Four Power governments have agreed to work toward a similar T&E agreement. To that end, representatives of the US, UK, FRG, and France have met to initiate the prerequisite exchange of information on each country's T&E organization and procedures. The extension of an analogous agreement to all of NATO is a desired eventuality.

In the area of test resources we continue to explore mutually beneficial programs with our allies. Examples include assessment of a French target for test range use, provision of range assets for UK and other NATO member fleet exercises, and support of ROK test range and test methodology capability requirements.

In response to Congressional guidance, steps have been taken to consolidate the individual Services' programs for the evaluation of foreign weapons. The selection of candidate foreign systems and the assessment of T&E performed on them is now under the direct cognizance of my staff.

4. Major Range and Test Facility Base. The 23 DoD major ranges and test facilities are managed by the Military Departments with OSD cognizance provided by the Director Defense Test and Evaluation. This collection of facilities constitutes the principal DoD support capability for conduct of test and evaluation. It includes extensive land, airspace, and water areas as well as the people and equipment uniquely suited to the broad range of testing activities.

Newer systems such as the cruise missile tax the current geographic capabilities of our test facilities. We frequently seek and obtain special accommodation with other agencies, most notably the FAA and Department of Interior, for temporary expansion of our test areas to support these programs.

While the requirements for testing areas increase, we are constantly faced with encroachment pressures from outside. At nearly all of our testing locations outside the United States, we are renegotiating lease/use rights. While our continued presence appears assured, the cost of such rights can be high. Domestically, we compete with maritime and off-shore energy interests for our water areas, with municipalities and environmental groups for uses of our land, and with general and commercial aviation interests for our airspace. A disturbing characteristic of this encroachment problem is that we often relinquish some areas to temporarily secure the remainder. The result is a continuing cumulative loss of flexibility in the support of test and evaluation.

In FY 1980 the program of modernization at the test facilities will continue. This program will yield dual benefits in the future. It will significantly improve test support capabilities and data reduction times, and at the same time produce increased efficiencies and reduced labor requirements.

During the period from FY 1976 to FY 1980 there has been no real increase in the funding for the test facilities. During this same period work load has increased over 10% and the modernization program has been sustained. Military and civilian personnel reductions since 1975 have created a severe shortage of manpower to operate the test facilities and directly support the users. The problem is particularly acute at the Army facilities, where test support of major programs such as the AAH, the NAVSTAR-GPS, and the 120 mm XM-1 gun could be affected. Major test programs will continue to receive priority, but when work load substantially exceeds capacity, either test quality suffers or lower priority program testing must be delayed. Program delays usually translate into increased program costs. Additional contracting for services appears to be the long-term solution and we are accelerating efforts in this area.

The second major problem is the backlog of technical equipment rehabilitation and the maintenance and repair of real property. I am particularly concerned over the possible resultant loss of data during critical missions. Beginning in FY 1980, emphasis will be placed on selectively reducing the backlog of equipment rehabilitation projects.

5. Test and Evaluation Return on Investment. Much has been said in the past about the importance of T&E in the system acquisition process. In numerous cases, through testing we have been able to detect problem areas early enough in the development process to avoid the costs of retrofitting had the problem gone unnoticed until the system was placed in operational use. In these cases, a cost avoidance can be quantified and compared with the cost of testing. For example, the Navy FFG-7 Class Combat System test program revealed deficiencies

during OT&E which were corrected prior to production, thereby avoiding substantial retrofit costs. The total direct cost of T&E was estimated at $32 million, which included the development and use of a land-based site to test and evaluate the system prior to construction of the lead ship. During testing it was determined that the FFG-7 Combat System possessed significant limitations in antisubmarine warfare and other areas. Corrective modifications were incorporated and an additional $4.3 million spent in retesting. Retrofit costs of about $60 million were avoided as a result of this testing at the land-based site.

In other cases, T&E served to confirm that the system design was adequate, and thus no cost avoidance or other quantifiable savings were realized. The Army M198 Medium Towed Howitzer is a good example. The direct cost of T&E, including consumed ammunition, exceeded $15 million. All major design requirements were successfully demonstrated.

In all cases, T&E produced a payoff in risk reduction and the discipline added to the design and development process. The knowledge of how well a system meets its engineering specifications and operational requirements provides the information to make an intelligent production decision. The absence of data obviously increases the risk of making an incorrect decision. The prior knowledge that system performance and suitability must be demonstrated through testing strengthens the integrity of the development process.

B. SPACE AND ORBITAL SUPPORT

We are moving toward the transition of all space system payloads from launch on current expendable boosters to launch on the Space Shuttle after the Shuttle becomes operational in 1981. The Air Force program to develop the Inertial Upper Stage (IUS) for use on both the Shuttle and the TITAN III booster during the transition period is progressing satisfactorily. The first phase of the Air Force program to develop the Shuttle launch and landing facilities at Vandenberg Air Force Base (VAFB), consisting of site preparation, begins in early 1979. A minimum number of TITAN III boosters are being procured as a backup for critical launches in the event the Shuttle encounters delays during development or early operational use. Once the Shuttle's full operational capabilities are demonstrated, these boosters will be phased out of the inventory.

Our primary interest lies in the potential benefits offered by the unique capabilities of the manned, reusable Shuttle, and we have undertaken studies that consider how we can use these capabilities to enhance effectiveness of our military space systems. Compared with existing, expendable boosters, the Shuttle will offer increased reliability; increased payload weight and volume capacity; and the capability to recover and refurbish spacecraft for reuse, to conduct on-orbit testing and repair of spacecraft or experiments, and to assemble large structures in space. Coupled with lower projected launch costs, these unique features promise increased effectiveness and economies for our military space operations.

1. IUS

(RDT&E: $57.3 Million, Procurement: $10.0 Million)

The IUS is being developed for use on Shuttle launches to deliver DoD spacecraft to higher orbital altitudes and inclinations than the Shuttle alone provides and will also be used by NASA for synchronous orbit and planetary missions. DoD will also use the highly reliable IUS on the TITAN III to improve mission success and reduce costs during the early Shuttle transition period. FY 1979 funding is being used for the IUS full-scale development which began in April 1978, procurement of IUS ground support equipment and logistics support, and necessary modifications to the Solid Motor Assembly Building at Kennedy Space Center (KSC). In FY 1980 we plan to continue IUS development and integration efforts, and procure IUS airborne and ground support equipment to support the initial flight currently scheduled for late calendar year 1980.

2. Space Shuttle

(RDT&E: $118.2 Million, Procurement: $181.1 Million)

We are providing a Shuttle launch and landing capability at VAFB so that we can continue to support high inclination DoD launches. Launches into sun synchronous, polar, or near polar orbits cannot be conducted from KSC without unacceptable performance loss and over-flight of populated land areas during launch. Since last year we have reoriented our VAFB activities. We now plan to phase our capability to conduct Shuttle operations starting with an initial capability of six launches per year in December 1983 and building toward a final capability to conduct up to 20 evenly spaced launches per year by mid-1985. Our previous plan called for 20 launches per year capability in 1983. This phased approach provides a better opportunity to incorporate, at VAFB, any changes which may be necessary based on early flight experience at KSC; minimizes early year expenditures while satisfying near term requirements; and assures that the VAFB Shuttle facility will be properly sized to meet national needs.

Shuttle weight growth now dictates thrust augmentation to meet long term performance requirements. Thrust augmentation involves adding strap-on solid motors to the basic Shuttle configuration. This impacts the design of the launch pad, launch mount, and solid motor processing and storage facilities at VAFB. We are working closely with NASA to minimize both the schedule and cost risk associated with the recently identified Shuttle configuration change.

FY 1979 funding for VAFB is being used for facilities, equipment and software design, procurement of launch processing and other common support equipment, and launch pad modifications. Site preparations at VAFB are scheduled to begin in early calendar year 1979, with actual launch pad construction beginning around the middle of the year. FY 1980 funding will provide for continued facilities, equipment, and software design; ground support systems integration and initial systems activation effort; plus the continuation of procurement of common and unique equipment. Our MILCON request for VAFB includes the orbiter processing and hypergol maintenance and checkout facilities, utilities, launch pad thrust augmentation provisions, and relocation of existing TITAN solid motor facilities to make room for Shuttle solid motor processing and storage.

Other Shuttle activities include preparations for DoD launches at KSC, payload integration, and mission operations capabilities development, including DoD modifications at Johnson Space Center (JSC). FY 1979 funding supports our transition and operations activities at KSC, and the procurement of security equipment for KSC and DoD peculiar flight planning and control equipment. In FY 1980 we will continue security systems development, airborne and ground support equipment development, software validation and verification, payload interface verification, and the development of flight planning and control capabilities for the IUS. We will also modify the Shuttle flight control facilities at JSC to permit the conduct of secure operations for classified DoD missions.

DoD planning for early Shuttle launches is based on using NASA's JSC for simulation, training, and Shuttle flight control for all DoD missions. Since the JSC facilities, as presently designed, cannot concurrently handle classified and unclassified payload data we have worked closely with NASA to define modifications needed. Very recently a modification approach has been validated which will assure adequate protection of DoD classified data and have a minimum impact on concurrent civil space operations. This approach, called the controlled mode, is now being implemented. Detailed design modifications of the JSC facilities and procurement of essential additional equipment will continue in FY 1980. We will acquire the controlled mode capability at JSC in time to support our first classified payload launch on the Shuttle. Our investment for this purpose will be held to a minimum consistent with our essential security needs and projected classified launches on the Shuttle through the mid-1980's. For the longer term we feel that a dedicated DoD Shuttle flight control facility will be required. We will include this requirement in any new facility which we may consider to improve our satellite control capabilities and enhance the survivability of our space systems.

C. STUDIES AND ANALYSES

We are requesting $164.2 million for Studies and Analyses this year for the Department of Defense. Of this, $29.1 million is for studies in support of decision-makers at all levels of OSD/OJCS.

1. OSD/OJCS Support

Throughout the acquisition process, there are a number of key decision points, and studies are among the inputs that affect these decisions. Figure IX-1 summarizes the interplay of studies with the acquisition process and also identifies the likely principal sponsor of the study involved.

Before we begin an acquisition program, our first task is to establish a need for a new capability. Needs are determined by evaluating the ability of U.S. and Soviet systems to cope with each other--both from a technical one-on-one standpoint and from a force standpoint. We have major on-going studies to assess the net balance which includes the important element of the net technical balance. This is a significant input when we assess the need for a new system. For example, in the ICBM field our studies have indicated that projected improvements in Soviet ICBM's and the number deployed will make our ICBM force vulnerable to attack by the early to mid-1980's. Our national policy of maintaining strategic deterrence with a TRIAD of forces is factored in with the defined deficiency to establish the need to improve our ICBM capability.

The next step is to determine how best to satisfy our need. This demands technical studies to help us select among the possible candidate systems. In the ICBM case, the studies, some of which are still going on, look at the different ways of achieving survivability against the kind of counter-force attack we perceive.

Figure IX-1

OSD/OJCS USE OF STUDIES AND ANALYSES

Stage of Acquisition Process	Type of Study	Study Sponsor
Establishing Need	o Net Balance (Technical and Force Level)	USDR&E, Net Assessment PA&E, OJCS
	o Policy	USDP/PA&E
Concept Definition & Demonstration	o Alternative Designs	USDR&E
	o System Selection	USDR&E
	o Acquisition Management	USDR&E
Full-Scale Development	o Test and Evaluation	DDT&E
	o Force Level Requirements	PA&E/OJCS
Deployment	o Maintenance/Training Techniques	USDR&E, MRA&L
	o Tactics & Doctrine	OJCS

The studies involve examining different parametric designs for the missile and the basing scheme, and they enable us to look at conceivable alternatives. The feasibility of each alternative will be determined on the basis of our present R&D capabilities and the emerging technology trends. The results of that exercise will be a convergence to a preferred system design. At the same time, on the basis of the preferred design systems, we look at the capabilities in industry, in the government and within our allies, as well as the fiscal constraints under which we will be working. These studies help us determine whether the system should be obtained through competition or sole source, whether the contract should be a cost-plus award or a firm or fixed price or an incentive award. Also, we must consider whether we can buy the system or a part of it from existing commercial sources or whether we have to have it developed for us. And finally, the consideration of NATO participation for improved standardization and interoperability, has been given higher attention in our planning process.

As we enter Full-Scale Engineering Development, other studies are used to support system test and evaluation requirements as well as force level requirements. These studies are used to establish system effectiveness and to decide on the number of systems we should procure and deploy.

Finally, as we approach deployment of the new system, other studies are used to determine what changes we need to make to our tactics and doctrine to incorporate this new capability into the forces.

These studies are done under the auspices of the JCS and for the past few years they have had two different studies looking into this area. At the same time, we conduct studies on maintenance and training techniques for the new system, with the goal of reducing operating and support costs.

2. The Overall Studies and Analyses Program

Outside the OSD/OJCS arena, studies play a similar role in the decision-making process. In the Services and in the Defense Agencies, studies may be concerned with plans, policies, programs and operations, and may address such questions as: Is a particular class of system warranted? What kind of system would be best? Which of several specific system alternatives is preferred? How could a system best be used? How many systems should be acquired?

In past years, the Congress has expressed its concern over the difficulty of determining precisely how much is spent overall by the Department of Defense on studies. This is because of the way studies enter the Defense system. Studies are not conducted independent of other activities but are initiated by an office or a command in need of a study to help it reach a decision. Similarly, the total funding devoted to studies, which is substantial (about a quarter of a billion dollars), is expended in a great number of small sums. The small amounts spent for individual studies are among the most highly leveraged investments we make, for they are allocated with great specificity to yield results vital to decisions which themselves affect outlays of huge sums of money. Nevertheless, the decentralized nature of the study effort has made it difficult to find out the total amount being spent on studies as a distinct entity.

The report which we provided to the Congress last March was a major step toward overcoming this problem. It was a first, bringing together the total proposed program for studies by all DoD components: Services, Defense Agencies, OSD/OJCS. A similar report was provided with this year's budget submission.

Another tangible result of our increased emphasis on centralized reporting of the studies program has been the significant increase in the number of on-going studies entered in the Defense Documentation Center (DDC) data bank. There were twice as many entries in October 1978 as there had been in October 1977.

In a series of meetings with the representatives of the various DoD components involved in studies, we are developing a reporting system that should satisfy the legitimate demands for an accounting of how study funds are spent and study programs managed, without micromanaging the studies program itself. We are focusing in particular on the dissemination of study results and the uses to which they are put. We want to ensure that studies are being used, that they are not conducted in isolation from all but the sponsors, or ignored when completed. To this end, we are requiring some additional information to be entered into the DDC Data Bank, providing a post-study audit of specific applications of study results. We are introducing management techniques to enforce the requirement to consult the data bank before starting a new study. This emphasis on greater justification for undertaking studies and on careful post-study audit of use should have a significant impact on the general quality of studies.

APPENDIX

APPENDIX

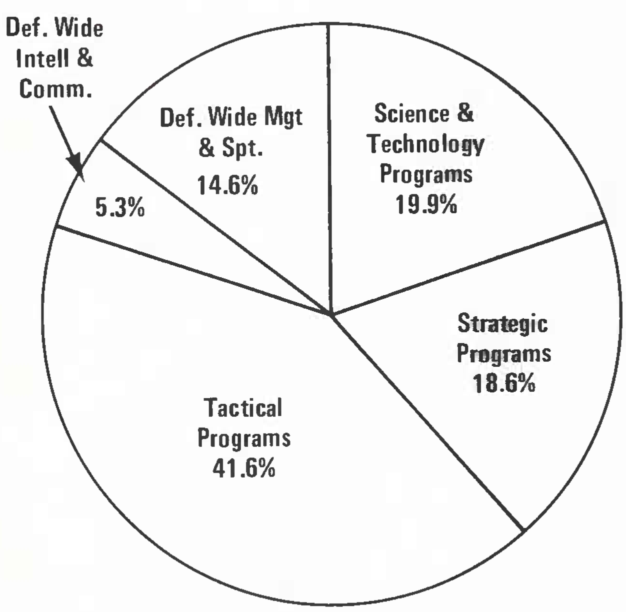
RDT&E BY MISSION CATEGORY

($ MILLIONS)

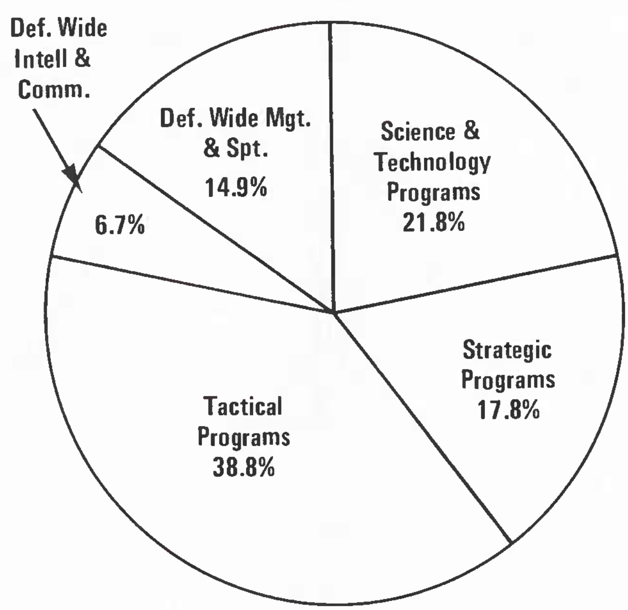
	FY 1978	FY 1979	FY 1980	FY 1981
*Science & Technology Programs	2,279.0	2,540.2	2,948.2	3,302.4
Strategic Programs	2,332.8	2,382.8	2,410.7	3,200.7
Tactical Programs	4,638.9	5,310.5	5,250.6	5,099.2
Defensewide Intelligence & Communications	552.8	672.2	910.5	1,225,8
Defensewide Management & Support	1,670.4	1,868.3	2,016.1	2,234.6
TOTAL RDT&E	11,473.9	12,774.0	13,536.1	15,062.7

*Technology Base and Advanced Technology Demonstrations

FY 1979



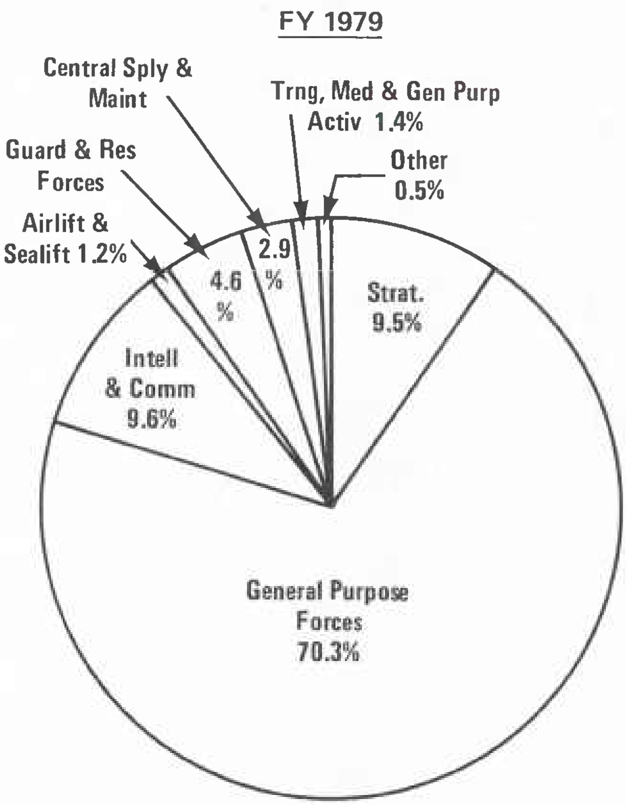
FY 1980

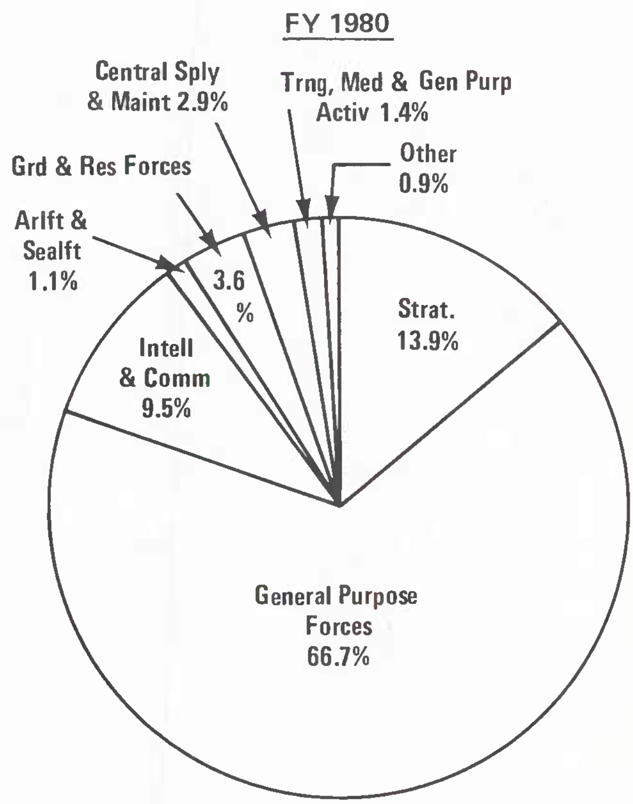


PROCUREMENT BY DEFENSE PROGRAMS

($ MILLIONS)

	FY 1978	FY 1979	FY 1980	FY 1981
Strategic Forces	4,279.7	2,994.6	4,914.0	
General Purpose Forces	19,175.3	22,141.0	23,624.0	
Intelligence & Communications	3,223.6	3,015.5	3,357.6	
Airlift and Sealift	257.2	389.1	402.0	
Guard and Reserve Forces	1,753.6	1,448.0	1,275.6	
Central Supply & Maintenance	1,139.6	926.6	1,012.9	
Training, Medical & Other General Personnel Activities	474.9	452.3	503.0	
Administrative & Assoc Activities	41.9	47.7	62.9	
Support to Other Nations		85.1	250.2	
TOTAL PROCUREMENT	30,345.8	31,499.9	35,402.2	30,354.3



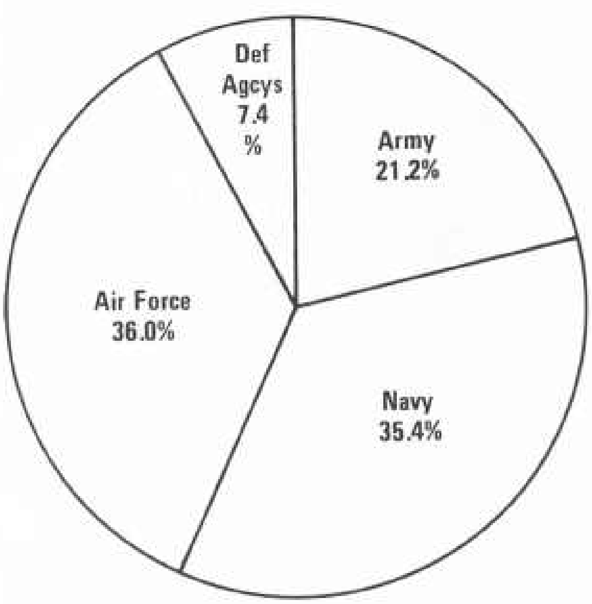


RDT&E BY COMPONENT

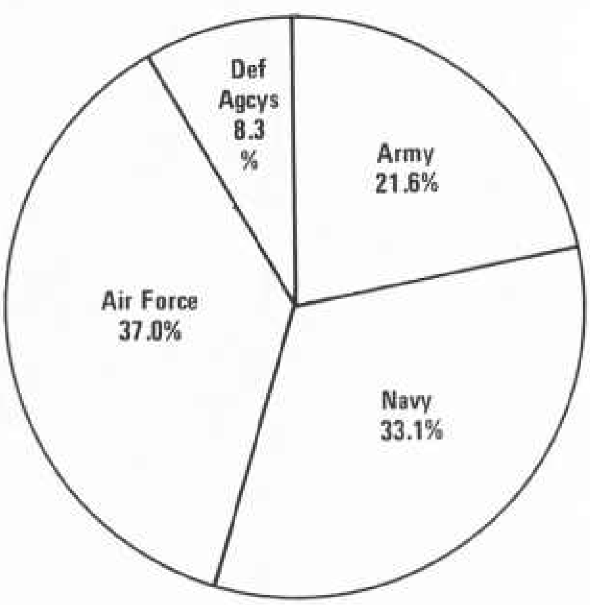
($ MILLIONS)

	FY 1978	FY 1979	FY 1980	FY 1981
ARMY	2,418.3	2,709.5	2,927.0	2,993.2
NAVY	4,054.3	4,521.9	4,484.0	4,562.0
AIR FORCE	4,222.0	4,597.6	5,005.1	6,272.7
DEFENSE AGENCIES	779.3	945.0	1,120.0	1,234.8
TOTAL RDT&E	11,473.9	12,774.0	13,536.1	15,062.7

FY 1979



FY 1980

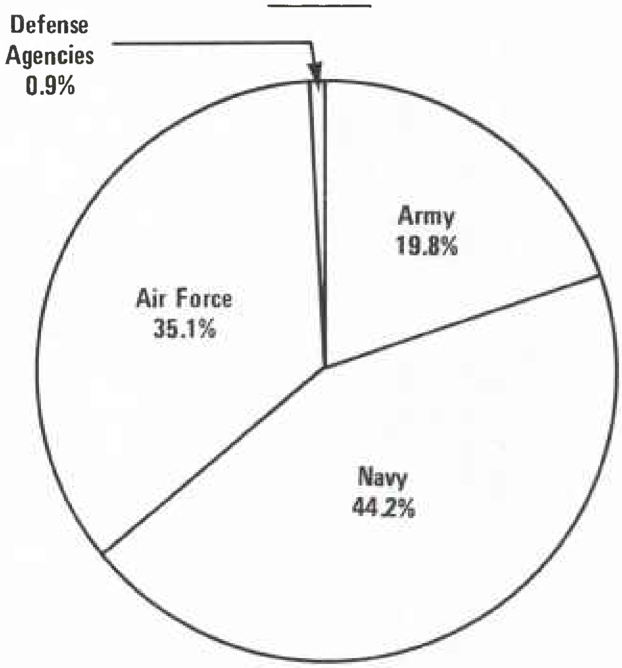


PROCUREMENT BY COMPONENT

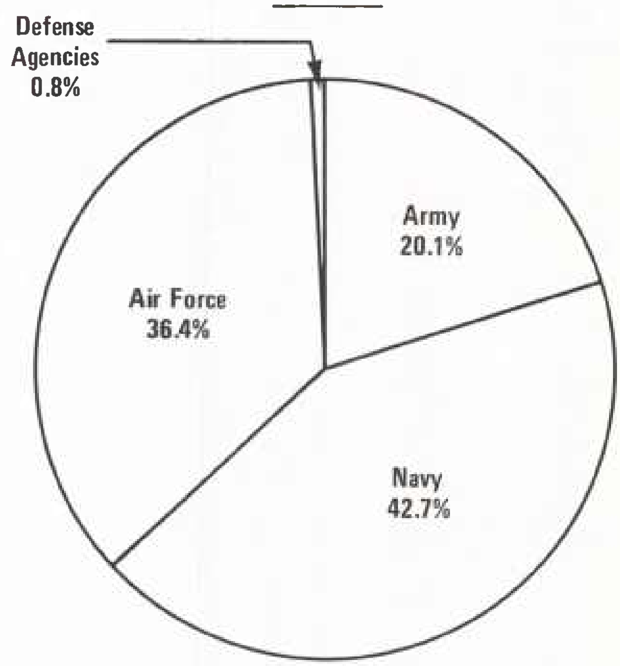
($ MILLIONS)

	FY 1978	FY 1979	FY 1980	FY 1981
ARMY	5,347.3	6,225.8	7,123.4	4,973.5
NAVY	14,233.1	13,936.1	15,093.9	13,597.5
AIR FORCE	10,437.6	11,063.4	12,890.9	11,783.3
DEFENSE AGENCIES	327.8	274.6	294.0	
TOTAL PROCUREMENT	30,345.8	31,499.9	35,402.2	30,354.3

FY 1979



FY 1980

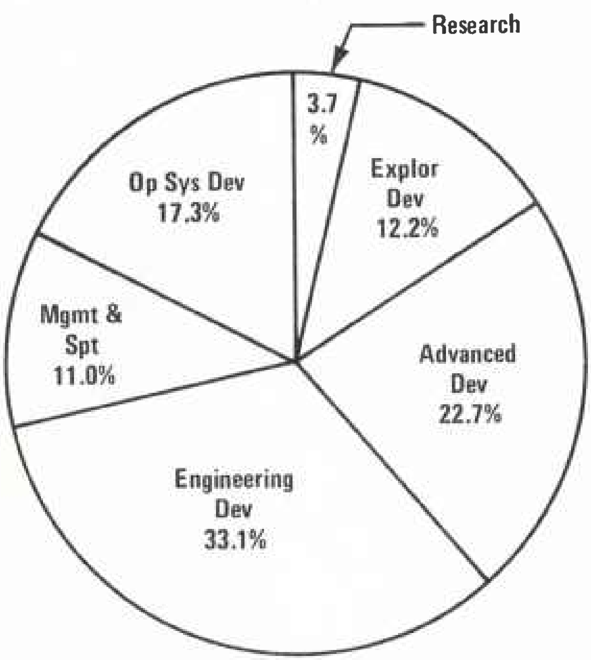


RDT&E BY ACTIVITY TYPE

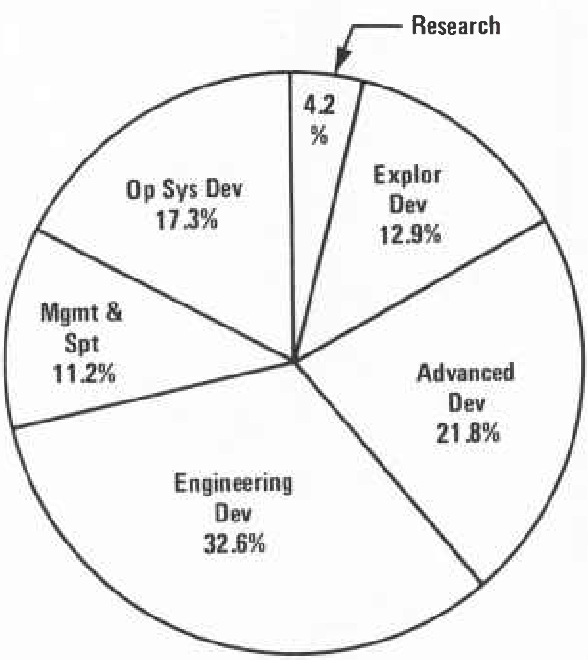
($ MILLIONS)

	FY 1978	FY 1979	FY 1980	FY 1981
Research	416.2	476.6	573.3	643.7
Exploratory Development	1,386.3	1,550.6	1,739.0	1,864.4
Advanced Development	2,223.6	2,898.4	2,951.7	3,793.5
Engineering Development	4,225.7	4,235.8	4,410.7	4,463.9
Management & Support	1,345.7	1,408.5	1,515.2	1,665.5
Operational Systems Develop	1,876.4	2,204.1	2,346.2	2,631.7
TOTAL RDT&E	11,437.9	12,774.0	13,536.1	15,062.7

FY 1979



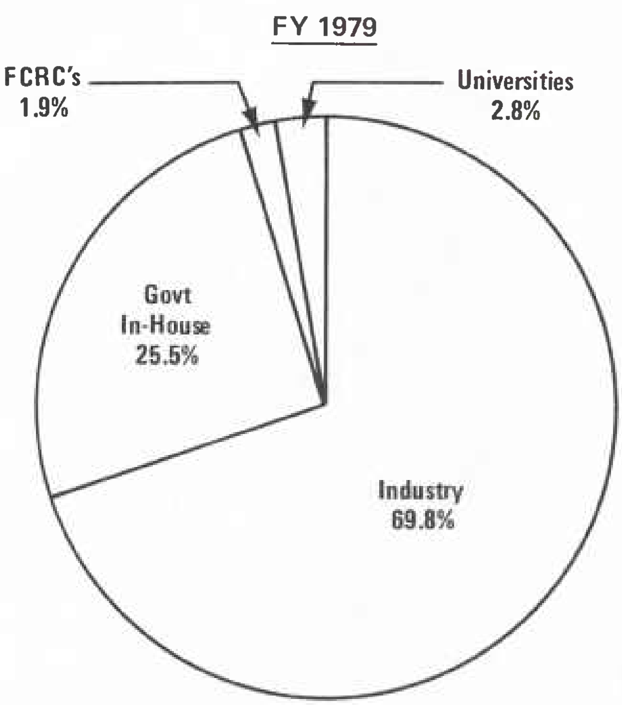
FY 1980

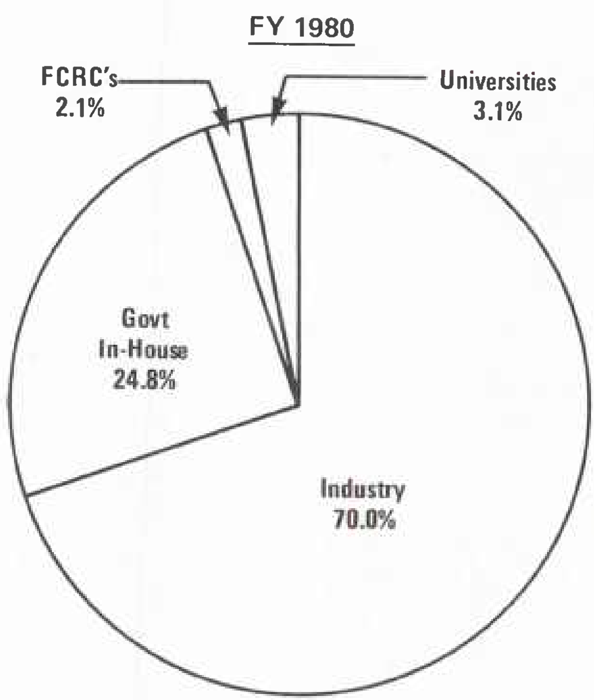


RDT&E BY PERFORMER

($ MILLIONS)

	FY 1978	FY 1979	FY 1980	FY 1981
Industry	7,959.8	8,913.0	9,471.2	10,890.8
Government In-House	2,984.9	3,268.2	3,368.2	3,411.5
Federal Contract Research Centers (FCRC's)	205.9	239.9	281.5	324.7
Universities	323.3	352.9	415.2	435.7
TOTAL RDT&E	11,473.9	12,774.0	13,536.1	15,062.7





PROCUREMENT BY AUTHORIZATION

($ MILLIONS)

	FY 1978	FY 1979	FY 1980	FY 1981
Aircraft				
Aircraft Procurement, Army	658.7	949.7	946.4	1,242.9
Aircraft Procurement, Navy	3,528.9	4,358.7	3,967.9	4,714.1
Aircraft Procurement, AF	6,372.2	7,144.7	7,931.2	9,138.6
Sub-Total Aircraft	10,559.8	12,453.1	12,845.5	15,095.6
Missiles				
Missile Procurement, Army	562.7	764.7	1,250.5	1,481.8
Weapons Procurement, Navy	1,876.6	1,565.5	1,548.3	1,693.3
Missile Procurement, AF	1,797.3	1,513.5	2,288.6	2,644.7
Procurement, Marine Corps	83.2	22.8	20.5	33.5
Sub-Total Missiles	4,319.8	3,866.5	5,107.9	5,853.3
Naval Vessels				
Shipbldg & Conversion, Navy	5,780.0	4,594.3	6,173.8	6,534.9
Tracked Combat Vehicles				
Procurement of Weapons and Tracked Cmbat Vehs, Army	1,342.8	1,402.8	1,692.5	1,818.4
Procurement, Marine Corps	74.2	26.8	13.0	62.9
Sub-Total Trkd Combat Veh	1,417.0	1,429.6	1,705.5	1,881.3
Torpedoes & Related Support Equip.				
Weapons Procurement, Navy	317.0	313.7	267.2	381.9
Other Weapons				
Procurement of Weapons & Trk Combat Vehicles, Army	65.8	108.3	196.4	430.4
Weapons Procurement, Navy	97.2	100.4	158.0	174.3
Procurement, Marine Corps	2.5	27.9	18.7	2.6
Other Procurement, AF	-	0.3	-	-
Sub-Total Other Weapons	165.5	236.9	373.1	607.3
TOTAL PROCUREMENT (Subject to Authorization)	22,559.1	22,894.1	26,473.0	30,354.3
All Other	7,786.7	8,605.8	8,929.2	-
TOTAL PROCUREMENT	30,345.8	31,499.9	35,402.2	30,354.3