THE DEPARTMENT OF DEFENSE

THE FY 1979 DEPARTMENT OF DEFENSE PROGRAM FOR RESEARCH, DEVELOPMENT, AND ACQUISITION

STATEMENT BY
THE HONORABLE
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UNDER SECRETARY
OF DEFENSE, RESEARCH,
AND ENGINEERING
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THE FY 1979 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 Congress of the United States

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THE FY 1979 DEPARTMENT OF DEFENSE PROGRAM FOR

RESEARCH, DEVELOPMENT, AND ACQUISITION

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I. OVERVIEW OF DEFENSE ACQUISITION

"Our principal long-term problem continues to be the Soviet Union. Whether we like it or not, the Soviet leadership seems intent on challenging us to a major military competition...Whatever the motive behind it, the challenge is serious. We must not underestimate it."

Secretary of Defense Harold Brown

"The center of gravity in the competition between the two (world-opposed) systems is now to be found precisely in (the field of science and technology),...making the further intensive development of the latest scientific-technical achievements not only the central economic but also a critical political task, (and giving) to questions of scientific-technical progress...decisive significance."

L. I. Brezhnev

Mr. Chairman and Members of the Committee,

This is an important occasion for me from both a personal and professional viewpoint.

This is my first report to the Congress, and therefore it is my initial opportunity to discuss in detail with you my views on the objectives, rationale and key thrusts of the DoD's research and acquisition program for FY 1979 and beyond. I sincerely appreciate this opportunity and look forward to receiving the benefit of your perspectives and assessments.

It is also the first report of the newly created Under Secretary of Defense for Research and Engineering. The expanded functions and responsibilities which I hold as the incumbent of this position directly reflect several important changes which the Carter Administration has instituted in tackling long-standing problems of the Department's research and acquisition programs. I believe the Congress understands the rationale for these changes; indeed, the Congress has actively encouraged and supported them for some time. Nevertheless, this report will describe what we in the Department expect them to accomplish and why the continued support of the Congress is essential if their payoff is ultimately to be achieved.

A. AN INVESTMENT STRATEGY

As a lead to this Statement, I have quoted Secretary of Defense Brown's views that the Soviet Union--"Whether we like it or not"--is conducting an intense competition with the U.S. to achieve superior military power. One measure of this competition is given in the recent assessment by the Central Intelligence Agency which indicates that the Soviet Union's equivalent defense spending (the CIA measures equivalent defense spending by the comparable expense it would have taken the U.S. to accomplish the same result) has steadily increased at a rate of 3 percent per year or more for the last decade while the defense spending of the United States has declined each year in real terms. As a result, Soviet expenditures exceeded that of the U.S. by 1970 and today exceed ours by about 40 percent. The cumulative effect of this imbalance has led to an observable disparity in our comparative research and development efforts, in the production rates of military equipment, and in the quantities of material deployed. The Soviet Union is producing major items of equipment--tanks, armored personnel carriers, tactical aircraft, and ICBM's--at a rate which exceeds ours by several times; they have deployed about twice the quantity of modern equipment as we have; and in their strategic forces, they have in the last five years gone from a position of marked inferiority to one of essential equivalence, and they show no signs of stopping. Their large investment in research and development apparently has the objective of overcoming our present lead in defense technology.

The defense budget proposed for FY 1979 and planned for the next five years is intended to stop this relative decline by providing for an approximate real growth of 3 percent per year. However, even if these budget growths are achieved, we only will be maintaining the present level of disparity. However, I believe it is possible for us to effectively compete, even in the face of this disadvantage, by employing an investment strategy that exploits some of the fundamental advantages we have over the Soviet Union. These fundamental advantages are our Allies, our Industrial Base, and our Technology.

The NATO alliance embodies the greatest economic strength in the world. The aggregation of the Gross National Product of our countries exceeds that of the Warsaw Pact countries by almost three to one. Other allies of the United States, notably Japan, Australia, and New Zealand, tip the balance even more in our favor. Defense expenditures of the other NATO countries, for example, approximately equal the present disparity in defense spending between the U.S. and the Soviet Union. If the NATO defense spending could be done in an efficient and mutually supportive manner, NATO would be competing on nearly equal expenditure terms with the Warsaw Pact nations. However, there is significant redundancy in our collective R&D programs, and very often four or five nations will produce the same type of equipment, so that none of them get the cost benefits of large production runs. The Soviet Union effectively dominates the materiel acquisition programs of the Pact, thereby avoiding those problems.

In order to take real advantage of the resources of the Alliance, we must embark on a major new program of cooperation with our allies in the development and production of our weapon systems. This will involve the selective sharing of technology so that weapons developed by allies have the benefit of each other's research and developments; it will involve cooperative research and development programs; and it will involve much more extensive coproduction and buying of each other's equipment. We believe we can get greatly improved efficiency through this improved cooperation, while maintaining an equitable balance in the economic benefits that accrue to each country.

We must also achieve much more efficient use of our own industrial base. In segments of our industry critical to defense, the Department of Defense is no longer the dominant customer. In 1965, for example, defense represented more than half of the market for integrated circuits; today we represent only 7 percent of that market. This means that without expenditure of defense R&D we can get the benefits of the extensive R&D done primarily to satisfy commercial markets, and this is a significant advantage we have over the Soviet Union. However, those benefits will not come automatically; we must devise our R&D programs so that they fill the gaps to the R&D being done to satisfy commercial requirements and not duplicate it. We must be willing to modify selectively our specifications so that we can use commercial components to a much greater extent, and we must improve our acquisition policies to make the Government a "better customer". The plans for accomplishing these changes are described in later sections, but basically they involve creating a competitive environment at all stages of our procurement and then getting the Government out of the way so that our free enterprise system can work for us to achieve market-driven efficiencies.

Finally, we must put a greater emphasis on our strongest advantage over the Soviet Union--our technology. Chairman Brezhnev has put it aptly in the quotation given at the beginning of this section. He argues that scientific and technological progress will have "decisive significance" in the competition with the Western World. I agree with him; and I believe that we can win that competition, but we cannot afford to do everything we are capable of doing. Therefore, we must determine which specific technologies can give us the greatest leverage in our force modernization and then put the major emphasis on those specific technologies. This will require us to be extremely selective, cutting out programs with marginal returns and putting major resources on programs that have the potential of significantly multiplying the effectiveness of our forces. In succeeding sections, we describe these programs in some detail. Here I would only highlight what I perceive as our single greatest potential for force multiplication--precision guided weapons.

Precision guided weapons, I believe, have the potential of revolutionizing warfare. More importantly, if we effectively exploit the lead we have in this field, we can greatly enhance our ability to deter war without having to compete tank for tank, missile for missile with the Soviet Union. We will effectively shift the competition to a technological area where we have a fundamental long-term advantage.

Precision guided weapon systems involve three separate technologies: target sensors, precision guidance and warheads. We are making truly significant advances in all three of these technologies. The major thrust in our sensor technology is to develop sensors that can "see" targets on the battlefield day or night, and in all-weather. Our developments in FLIR (Forward Looking Infrared night vision devices) and radars that "take a picture" of a ground scene are typical.

There are two major thrusts in our precision guidance technology. We are going into production with advanced systems for artillery shells, rockets and bombs, thereby converting these barrage type weapons into highly accurate weapons for attacking point targets. At the same time we are developing their successors--precision guidance systems which can operate in a "fire-and-forget" mode. This technology will receive very high emphasis in our R&D programs, while we are producing the laser guided systems.

Finally, we are making major advances in the development of improved conventional munitions. We are developing highly efficient kinetic energy penetrators for attacking super-tough armor, and we are developing cluster munitions, which dispense, in a controlled manner, a large number of bomblets from a single warhead to greatly increase the area of effectiveness of the warhead.

In sum, the objective of our precision guided weapon systems is to give us the following capabilities: to be able to see all high value targets on the battlefield at any time; to be able to make a direct hit on any target we can see, and to be able to destroy any target we can hit. We are converging very rapidly on these objectives. We are developing tactical systems--bombs and missiles--to help offset the numerical superiority we face today in NATO. We are developing strategic systems--the cruise missile--to help maintain our position of strategic equivalence in the next decade. Taken in aggregate, precision guided systems can make a significant contribution to our ability to deter war. They exploit technologies in which the U.S. leads the world; they are "force multipliers"--that is, they produce a greatly increased force effectiveness with a moderate investment; and they make maximum use of equipment--artillery pieces and tactical aircraft--already deployed.

Having described an area in which our technological lead can be used to overcome quantitative deficiencies, I have to point out that our Science and Technology Program has suffered serious erosion compared with our position 10 or 15 years ago. Because the keystone of our investment strategy is to build on our technological lead it is vital that we continue to increase our expenditure for basic technology. Accordingly, we are requesting a 7 percent real increase in the Science and Technology Program in FY 1979. This increase is consistent with the President's recently stated policy for strengthening the U.S. science and technology posture.

B. ORGANIZATIONAL CHANGES

Several organizational realignments reflect our approach to the management of an integrated defense research, development and acquisition effort, and, in my view, offer fresh opportunities for improving the effectiveness of that effort.

The DoD Reorganization Bill, PL 95-140, established an Under Secretary of Defense for Research and Engineering to be the primary advisor and staff assistant to the Secretary of Defense on research, engineering, and acquisition of weapon systems and communications, command, control and intelligence resources.

We have combined the functions and responsibilities of Communications, Command and Control and Intelligence under one Assistant Secretary of Defense, my Principal Deputy to ensure that the interdependence of technologies and systems inherent in these missions is reflected throughout our R&D and procurement process.

The Office of Assistant to the Secretary for Atomic Energy and the Defense Nuclear Agency have been placed under the Under Secretary of

Defense for Research and Engineering to consolidate the management of defense nuclear R&D and acquisition (in association with the Department of Energy).

Although the Director of Defense Test and Evaluation is responsible for coordinating all test and evaluation matters, I have delegated principal staff responsibility for operational testing to the Assistant Secretary of Defense (Program Analysis and Evaluation). This change will provide an independent analytical evaluation and is designed to place increased emphasis on the role of operational testing.

Finally, all acquisition policy functions, including contract policy, industrial resources and preparedness, production management, standardization, and other contractual areas have been combined in one office under me. In addition, each of my Deputy Under Secretaries has been made responsible for production and life-cycle considerations, as well as R&D, for the programs under his cognizance. These two changes--consolidation of acquisition policy and extension of the Deputy Under Secretaries' responsibilities--aim at integrating the management and business-related disciplines essential to the acquisition process with the entire R&D and production cycle.

This reorganization and realignment has one major objective: to apply a broad and comprehensive management approach to all major system program activities, with emphasis on developing and producing military capabilities effectively and at the lowest possible cost. I ask that you view these changes from the perspective of improving our policy making and management review processes. They are not attempts to usurp or to undermine the policy initiatives, execution authority and responsibilities of the Military Departments and Defense Agencies. On the contrary, the Military Departments and Defense Agencies are essential elements of the team approach to management that we have instituted. I will rely heavily on them to make our acquisition strategy work, and I intent to delegate as much responsibility as possible to them at all stages of the cycle.

The organizational structure and policy process we have established are of no value unless they contribute to improving both the use we make of our resources and the output of our R&D and acquisition programs. I expect them to contribute in the following ways:

- They will provide an institutional framework which encourages all participants in the policy process to view major programs from a broad, comprehensive perspective, including consideration of our allies, instead of a compartmentalized and parochial view.

- They will integrate the major functions and responsibilities of the R&D and acquisition process, enabling us to construct a life-cycle acquisition strategy for each major program, to assign clear responsibility for executing that strategy, and to tie more closely together the policy-maker and those who implement his policy.

- They will enable us to carry out more effectively the principal recommendations of the Commission on Government Procurement as set forth in OMB Circular A-109 and reflected in the revised DoD Directives 5000.1 and 5000.2, which cover the entire major system acquisition process. The steps we have taken to implement these recommendations are discussed more fully in the next section.

C. ACQUISITION MANAGEMENT

In January 1977 DoD's primary directives on the acquisition process, DoDD 5000.1, "Major System Acquisition" and DoDD 5000.2, "Major System Acquisition Process" were revised and reissued to reflect the recommendations of the Commission on Government Procurement as incorporated by the Office of Federal Procurement Policy (OFPP) in OMB Circular A-109.

Also in response to Circular A-109, the Secretary of Defense has appointed me the Defense Acquisition Executive. In this role and also as the permanent Chairman of the Defense System Acquisition Review Council (DSARC), I will provide a balanced assessment of each program at the major decision milestones, with the objective of developing a set of program options for the Secretary of Defense and avoiding unacceptable compromises that often result from strong opposing functional and user interests.

A key thrust of the revised directives (DoDD 5000.1 and 5000.2) is that particular attention is given to restructuring the first phase or "front end" of the acquisition process. Programs will start when the Secretary of Defense approves a Service document termed "Mission Element Need Statement" (MENS), which states a mission deficiency or need in operational terms rather than system characteristics and performance. This MENS will form the basis for a mission-based request to industry, government laboratories and universities for alternative solutions, thus providing wide latitude in conceptual approaches to meet mission needs.

I believe that formalizing our front-end activities will have the potential to reduce both development costs and schedules. The early validation of mission needs, the competitive development of system concept designs, and the emphasis on extended competition could go a long way toward reducing technical risks, shortening development times, and making our acquisition programs affordable.

We also believe that application of these new policies will help make DoD a "better customer" by debating the need and the attendant constraints and reaching agreement between the Administration and the Congress before acquisition programs are begun, thereby, reducing the probability of program cancellation or significant redirection.

To further expand on the "quality" of DoD as a customer, we intend to see that contractual and business planning aspects are inherent in all program planning. We will require that closer attention be paid in the acquisition strategy to Defense priorities, risks and affordability. Emphasis will be placed on obtaining a healthy level of competition throughout the acquisition phases beginning with solicitations for alternate concepts and extending, where practical, into production. Selection of the appropriate types of contracts and the incorporation of incentive clauses and other provisions will be made commensurate with program experience and risk.

The cost of acquisition and the cost of ownership will be translated into meaningful design to cost and life-cycle cost values in order to evaluate cost on the same level as technical requirements. Military specifications, standards and data requirements will be tailored specifically toward the requirements of the given system. We also have established policy requiring the use of commercial specifications and the incorporation of commercially available components wherever practical.

The requirement that a system demonstrate its technical and operational sufficiency to meet the specified military need remains the keystone of the new acquisition policies. However, we intend to ensure that there is a valid need whenever there is an acquisition program, and that we design to meet the need and no more.

In support of these management initiatives I have directed my staff to examine the spectrum of acquisition policies within the DoD and reorient them or rewrite them such that we can begin managing our research, development, test, evaluation and procurement program more like a business. These efforts are further described in Chapter III of this Statement.

The implementation of such a broad set of new policies is neither automatic nor instantaneous. During this past year there have been many false starts, and we believe there is still a long way to go. Our greatest challenge is to provide unambiguous guidance to the Services regarding implementation. After all, we make policy, but the Service functional and program manager must implement it. We now have, and will continue to have, a concentrated effort by my staff to assure that our initiatives are understood and non-disruptive to current programs. To this end we are consulting closely with the Services to obtain feedback on the impact of these initiatives so that we can "fine tune" them as necessary.

I am also initiating a program to develop a long-range acquisition resources plan. Because of the lead-time phenomenon, our weapons requirements are necessarily based on competitive needs, developed from projected force deficiencies and threats, which will occur 10-20 years in the future. Since projections of the threat 10-20 years in the future are obviously uncertain, we attempt to address these uncertainties by developing hedges--the options produced by our Science and Technology Program are often critical to this effort. Nevertheless, I believe we can do a better job of establishing requirements, of designing our future systems and of exercising selectivity--particularly in the early stages of the R&D process--if we improve our understanding of both U.S. and Soviet R&D and acquisition processes and how they will pay off in terms of future deployed military capabilities. We must also develop better force-on-force analyses to identify both relative strengths and weaknesses, as well as those areas of uncertainty, that could affect future balances and conflict outcomes.

Success in this effort would enable us to select R&D options in the areas of greatest leverage for future military capabilities and to design our equipment to exploit future Soviet weaknesses and our own strengths, while remaining viable despite possible changes in the threat. It would also assist in fine-tuning systems development and procurement to correspond with emerging requirements. These management tools are important to our efforts to improve both selectivity and, ultimately our military capabilities in the field.

D. NATO INITIATIVES

The primary thrust within our international programs continues to be enhancement of the military capabilities of the NATO Alliance through closer, in-depth cooperative efforts. Major new and unprecedented initiatives for comprehensive NATO defense planning and cooperation were launched by the President during 1977. The initiatives provide the basic impetus and guidance to our international programs in 1978.

Basic objectives of our international programs are:

- o Enhancement of NATO military strength through rationalization/standardization/interoperability of Allied military equipment.
- o Reduction of duplicative NATO research and development for more effective and efficient use of collective resources.
- o Promotion of fuller industrial collaboration in military equipment to achieve economies of scale and reduce unit costs.

The growing Warsaw Pact threat, coupled with inflation pressures, makes it even more important to make the best collective use of the considerable funds the Alliance, as a whole, spends on defense.

Standardization/interoperability of military equipment is at the heart of our NATO rationalization effort. Maintenance of NATO deterrent capabilities must be based upon healthy national economies and industries, greater financial commitment to the Alliance by the partners and increased military effectiveness through equipment standardization. These are possible only through more North-American-European industrial collaboration in armaments research, development and procurement.

Standardization calls for identical equipment for as many Allies as possible. It is a long term goal which will be achieved incrementally as older weapon systems are replaced. For many systems, Alliance-wide uniformity is impractical; there will normally be several generations of a particular type of weapon in the field at the same time--even in U.S. forces.

Interoperability, a major step toward standardization, does not require that NATO Allies standardize on one weapons system in order to meet a particular military need. However, interoperability does require that our systems have certain characteristics in common--such as compatible communications gear or common tank gun ammunition--in order to facilitate mutual Allied support.

The U.S. has always been looked to by the Allies to take the lead in NATO, because we are the largest partner. I believe that we are again assuming leadership through a number of significant new initiatives, presented by the President and the Secretary this past year, that will guide our collective efforts in the coming years.

It is imperative that defense equipment design and procurement be more of a two-way street than it has in the past, to overcome European suspicions that standardization and interoperability really mean "Buy American" in our eyes. Therefore, we must "give" more in the sense of buying some European systems and loosening some restraints on technology sharing and licensing. We expect, however, to gain far more in terms of the total strength of the Alliance. Achieving all this must be a joint endeavor of the Congress and the Administration--as well as our Allies. Our policy remains the NATO strategy of deterrence and collective defense, and if deterrence fails, forward defense and flexible response. We are thus committed to effective participation in Alliance defense, doing our part as our Allies do theirs. Our effort is both a catalyst and a companion piece to theirs; the net result is greater security at a lesser cost to all.

The continuing economic health and innovative vitality of our high technology industry is crucial to achieving NATO modernization at a minimum cost. We must recognize that these factors depend largely on the viability of those companies in commercial markets over which we in defense have no control, but from which we are beneficiaries. Thus, NATO's ability to compete with Warsaw Pact nations in force modernization is linked in part to the commercial vitality of our technology companies.

Chapter IV provides a detailed review of our current and planned international programs and activities.

E. MAJOR FY 1979 R&D AND PROCUREMENT THRUSTS

Our budget and programs focus on meeting critical deficiencies in our deployed capabilities, strengthening the technology base, and applying our resources more effectively. The following programs are of particular importance.

1. Strategic Programs

We request $2.2 billion in RDT&E to continue development programs and $4.1 billion for procurement programs which will maintain the effectiveness of each leg of the TRIAD of strategic retaliatory forces, demonstrate options for future force improvements, and strive for leadership in the technology of defensive systems.

a. Strategic Offensive Systems

The ability of our strategic offensive forces to retaliate with high levels of assurance is being threatened by the combination of Soviet quantitative advantages in offensive and defensive capabilities and rapidly evolving improvements in their systems performance. Of particular concern is the increasing vulnerability of our fixed-based ICBMs, which remain a vital element of our retaliatory capability. In this regard, we will continue advanced development of the M-X missile, including a thorough examination of alternative basing modes which offer improved survivability through concealment and mobility. The $158 million requested will enable us to develop the system technologies necessary to reach an IOC in the mid-1980s.

We propose to upgrade the effectiveness of our SLBM force by continuing the development and procurement of the TRIDENT Weapon System ($2.8 billion, including the TRIDENT I and II missiles and the TRIDENT submarine) to replace our aging POSEIDON force. We will also be developing several options to improve the survivability and effectiveness of our SLBM force.

We propose to improve the air-breathing element of our TRIAD by continuing development and initiating procurement of the Air-Launched Cruise Missile ($413 million requested), and by improving the penetration capability of our B-52 force. We intend to test our cruise missiles in an aggressive defensive environment to determine any vulnerabilities or weaknesses. Source selection for the Air-Launched Cruise Missile will be completed by January 1980. The B-1 development program will continue, as a hedge, with completion and testing of the fourth prototype aircraft ($106 million requested).

Finally, we request $205 million to support development of a number of technology base options for maintaining the effectiveness and survivability of our strategic offensive forces as future threats emerge. These efforts include Advanced Ballistic Re-entry Systems, the SSBN Security Technology Program, Advanced Strategic Air-Launched Missile and Strategic Bomber Enhancement, including consideration of a possible future advanced bomber.

b. Strategic Defensive Systems

The objectives of our program are to maintain leadership in the technologies of defensive systems and reduce the risk of technological surprise; to develop options for future defensive systems, including protection for satellite and command and control systems; and to develop an effective surveillance and warning network against aircraft, missiles and spacecraft.

We are requesting $228 million for research and development in ballistic missile defense technologies--a level equal to our FY 1978 program in real terms. I believe this is a minimum level of effort in view of the large and aggressive Soviet development and test program.

We cannot afford to lose our present advantage in the concepts, technologies and innovative approaches to ballistic missile defenses, for such a loss would eliminate our ability to develop hedges against unexpected Soviet developments that could alter the future strategic balance. We must also maintain a capability to assess and respond appropriately to Soviet programs in this area.

We request $128 million to continue development of our surveillance and warning capabilities (CONUS OTH-B radar, the JSS system and DEW line and BMEWS upgrade), and to investigate space-based detection systems.

Our request of $128 million for space defense R&D focuses on improving our ability to locate, track and identify objects in space; enhancing the survivability of our satellite systems; and developing an anti-satellite capability. Since our military space systems play an important role in a wide range of mission areas, providing appropriate levels of survivability is essential. The Soviet development of an anti-satellite (ASAT) system has emphasized this need. Growing Soviet capabilities to use satellites for military and intelligence support has created a need to provide the option for a U.S. ASAT capability. In addition, a U.S. ASAT capability could act as a deterrent to Soviet use of their ASAT.

2. Tactical Programs

Rough parity at the strategic and theater nuclear levels heightens the continued importance of maintaining substantial conventional forces as a requisite to deterring conventional conflict and to raising the nuclear threshold. Our major focus is on Europe, where we and our NATO Allies are faced with Pact quantitative superiority in most categories of weapons and a Soviet modernization program which challenges the performance advantages we still possess. I believe we have no more important requirement than to act now with our NATO partners to make those improvements in the Alliance's capabilities necessary to retain key force balances in both the near and far term. Our FY 1979 budget request of $5.1 billion for RDT&E and $23.5 billion for procurement of tactical warfare weapon systems therefore focuses on:

- o Improving the initial combat capabilities of deployed NATO forward defense forces;
- o Increasing the Allies' ability to field reinforcements at the right time and place to stop a Pact attack; and
- o Developing and deploying modern, affordable and interoperable or common weapons and supporting systems that will counter the Pact's numerical superiority by retaining or restoring our qualitative advantage and exploiting the potential of new technologies to multiply our force effectiveness.

The program we have designed is predicated on two major principles. First, the conventional balance is measured in terms of deployed capabilities; therefore, we are emphasizing development and acquisition of systems that can be fielded rapidly and in sufficient numbers. Second, NATO must respond collectively to the multiple challenges which face us; therefore, we are emphasizing a number of cooperative programs which cut across several mission areas. These are described later in my Statement.

The Soviet Union has long maintained substantial nuclear forces directed against Europe and is modernizing those forces at a rapid pace. Soviet doctrine, training and deployments emphasize the importance of theater nuclear weapons in a European conflict. Because of the vital role our theater nuclear forces play in deterring both nuclear and conventional conflict, it is imperative that we take steps now to improve their effectiveness in pace with the growing threat. Thus, in addition to our program to modernize battlefield weapons, we are continuing the development of ground-launched and sea-launched cruise missiles. The FY 1979 budget request provides for programs to satisfy the most critical near-term requirement of increasing the survivability and security of our nuclear weapon storage facilities, particularly those sites overseas. It also supports a comprehensive assessment of theater nuclear force modernization requirements for the longer term.

3. Command, Control, Communications and Intelligence (C^3I)

We request $1.1 billion for RDT&E and $3.1 billion in procurement in FY 1979 for programs to improve our Defense-wide surveillance, warning, force control and intelligence capabilities. Our major goals are to enhance the combat effectiveness of our forces and to reduce costs and increase the efficiency of C^3I activities.

We have designed our program to exploit the close interrelationship which exists among the C^3I functions. All involve accumulating, processing and disseminating information. The consolidation of responsibilities for C^3I systems which I described earlier in this

Statement is an important first step in increasing the leverage which an effectively coordinated C^3I posture can provide to our force capabilities. The second step is to apply our technological strengths to correct key deficiencies in our current C^3I systems.

The major areas of concern addressed by our budget program are the survivability of our global and battlefield communications assets, the capability of our warning sensors to deal with increasingly sophisticated offensive threats, our communications links with our fleet ballistic missile forces, the vulnerability of our tactical C^3, and a lack of interoperability among NATO and U.S. command and control systems. Our major programs to meet these deficiencies are discussed in Chapter VII of this report.

4. The Science and Technology Program

The Science and Technology Program is the source of the innovative concepts and developments which are the foundation of our future weapon systems and of our continued leadership across a broad spectrum of critical military technologies. The program employs the scientific and engineering resources of defense and other government laboratories, industry and the academic community.

Our FY 1979 budget request of $2.6 billion for the Science and Technology Program highlights the following priority areas:

- Continuing real funding growth of 7 percent in Research, 5 percent in Exploratory Development and 16 percent in technology demonstrations in Advanced Development. This growth is essential to maintaining the vitality of our military technology base.

- o Developing more active cooperation between DoD laboratories and their industrial and academic counterparts so as to improve the vitality of the DoD laboratories and to exploit more fully the competences inherent in our civil R&D communities.

- o Identifying those critical technology areas on which we must focus our own R&D resources and whose export to potential adversaries must be more effectively controlled.

- o Increasing the reliability and performance of our electronic and computer systems, which are vital to the retention of our qualitative superiority in many mission areas.

- o Continuing the development and demonstration of a number of technologies which offer the promise of significant payoffs in future systems applications and lower costs. These include developments in electronic warfare, electron devices, aircraft and missile propulsion, guidance and control technology, materials, mobility, oceanography, life support and protective equipment, chemical/biological defense, and training and simulation technology.

I would also note the important role which the Defense Advanced Research Projects Agency (DARPA) plays in our Science and Technology effort. DARPA is charged with the responsibility of exploring those technologies with potentially high payoffs in terms of future mission capabilities. DARPA's current work in space defense and surveillance; cruise missile technologies; anti-submarine warfare; land combat survivability, mobility and firepower; air vehicles and weapons; and C^3 is discussed more fully in Chapter VIII of this report. I believe the DARPA program is critical to the formation of options which can make a real difference in our future military capabilities, and I am requesting

real growth of 11 percent in the FY 1979 DARPA budget to give increased emphasis to this effort.

F. CONCLUSIONS

The FY 1979 research, development and acquisition budget request of $44.4 billion is a large one. But I believe it is a responsible request, and I ask that the Congress support it fully.

- It is responsible, first, because it is necessary to correct critical deficiencies in our deployed capabilities in the near term and to nurture the options which will enable us to respond successfully to the challenges and the opportunities of the 1990s and beyond.

- Second, our request is responsible because it has been based on a realistic appraisal of the current situation and an objective assessment of the major trends shaping the environment we will face in the 1980s and 90s. There are, of course, ambiguities and uncertainties in our assessments--and we will work hard to reduce these in the coming year--but I am satisfied that this budget is grounded on a firm appreciation of where we stand today vis-a-vis our major competitor, where we need to go to strengthen our competitive stance, and what is needed to get there. And the message which comes through clearly from these assessments is that we must improve our deployed capabilities and maintain our technological superiority if we are to confront, successfully, the serious, long-term Soviet challenge.

- Third, this is a responsible budget request because it recognizes explicitly that, while the challenges and opportunities are great, our resources are limited and that we must, therefore, exercise selectivity throughout all phases of the research, development and acquisition cycle. We have been selective, and this budget request has been restrained by several decisions to eliminate programs which do not meet cost or requirements goals, before they proceed too far in the development process.

- Fourth, we have accepted the responsibility of judiciously selecting programs which minimize the cost of obtaining a competitive level of defense capability. Accordingly, we are paying much closer attention to the need for new programs before they are initiated; insisting that programs demonstrate adequate performance before proceeding; emphasizing life-cycle cost as a major criterion of a program's success; integrating R&D and acquisition planning and management through organizational and policy changes; encouraging fuller application of the expertise and resources of the industrial and academic sectors in our R&D and acquisition process; and improving the DoD as a customer--reducing the risks of doing business with Defense--so that we can benefit more effectively from the strengths inherent in our nation's civil technological and industrial base.

- o Fifth, this is a responsible budget request, because it emphasizes that the U.S. cannot, and should not, act in isolation from its NATO partners in responding to the challenge of the Soviet Union and its Warsaw Pact allies. Accordingly, we have included a number of programs which seek to enhance NATO military strength and improve the effective use of collective resources through equipment standardization and interoperability, through the reduction of duplicative NATO R&D, and through fuller industrial collaboration in military production. We believe these cooperative efforts are essential if NATO is to improve its security at a lesser cost to its members.

- o Finally, our program lays the foundation for improvements in our long-range acquisition resource planning. Our activities in this area will depend on improved understanding of both U.S. and Soviet system acquisition processes and the resultant identification of relative strengths and weaknesses, as well as the uncertainties that could affect the future balance.

In summary, our FY 1979 budget request for defense R&D and acquisition is directed at maintaining key military balances upon which successful deterrence rests. It is responsive to the real and growing Soviet challenge to our current overall superiority in military technology.

- o It emphasizes programs that will pay off in deployed weapon systems capable of meeting critical deficiencies in our nuclear and conventional forces in the near term and programs that will provide a broad spectrum of technologies to form the base for systems and options applicable to longer term military needs.

- It emphasizes firm control on costs and lays the foundation for further improvements in the effectiveness and efficiency of our use of scarce resources.
- It emphasizes the importance of retaining and building momentum in our military investment programs.
- it emphasizes maximizing the contributions of the U.S. civil sector and of our Allies.

I believe the funds we are requesting are necessary to assure that our future national security requirements are met. I urge your support.

Thank you.

II. THE TECHNOLOGY AND ACQUISITION BALANCE

"Our principal long-term problem continues to be the Soviet Union. Whether we like it or not, the Soviet leadership seems intent on challenging us to a major military competition...Whatever the motive behind it, the challenge is serious. We must not underestimate it."

Secretary of Defense Harold Brown

A. INTRODUCTION

In each of the past several years, the Department of Defense has reported the following assessments of the military technology and acquisition balance between the U.S. and USSR:

- The Soviet Union has a quantitative advantage in most categories of deployed weapons.
- The U.S. has a qualitative lead in most areas of military technology and in the large majority of deployed weapon systems.
- The Soviets are now reducing the overall U.S. qualitative lead in deployed weapon systems performance.
- Should current relative trends--measured in terms of production and deployment of military equipment--continue, the USSR could achieve significant military advantages in the next few years.

Our most recent assessments of the military technology and acquisition balance reaffirm the validity of these conclusions and the importance of the need for U.S. action. The momentum of the persistent Soviet drive to harness science, technology and industrial power for fulfillment of military requirements continues to increase in comparison with our own. During the 1970s, Soviet defense spending in rubles has grown at a rate of 3 to 5 percent per year, while comparable U.S. spending, in real terms, has been decreasing until last year. Estimated Soviet military investments (procurement, construction and RDT&E) are currently about 75 percent greater than those of the U.S., measured in terms of what it would cost us to duplicate the Soviet effort.

The concentration of the Soviet effort in the military and military industrial sector can be seen in the following comparisons with our own economy. The U.S. GNP is now about twice that of the USSR, and that gap is widening in absolute terms. But ours is largely a consumer and service economy while the primary focus of Soviet economic development has been on capital formation and defense. The U.S. produces many times more consumer goods, while the USSR produces more coal, petroleum, steel, cement, machine tools, railway cars and ships.

Americans and other Westerners are continually impressed by the poor technological performance in the Soviet economy as a whole, and the Soviets themselves have acknowledged their shortcomings. But the weaknesses in the Soviet civil economy have not precluded the achievement of impressive capabilities in the military sector. In fact, the Soviet leadership channels human and material resources on a priority basis into military-related science, technology and industry, which are growing more rapidly than the comparable technological and industrial base in the U.S.

The U.S. program of defense research, development and acquisition which must counter this Soviet effort will be relatively limited in resources and scope. Accordingly, selectivity will become an increasingly important factor in U.S. plans and programs, as will closer collaboration with our allies, particularly our NATO allies. But selectivity in turn requires an improved understanding of the Soviet R&D and procurement efforts; of how and when these will pay off in terms of future war fighting capabilities; of relative military strengths and weaknesses; and of the impact of our own programs on future Soviet developments and deployments. In short, we must improve the base of knowledge on which the selective application of our scarce resources depends. This will be a major focus of our effort to develop a long-term strategy for defense technology and acquisition resources.

We do not minimize the difficulties inherent in this effort. Attempts to make assessments of the quality, level of effort and outputs of Soviet military technology and acquisition programs suffer from significant gaps and ambiguities in our information about current activities. Attempts to formulate and project future Soviet capabilities are even more uncertain.

Nevertheless, we believe our assessments to date have clearly demonstrated the disturbing implications of the Soviet effort for the future military balance. Now we must work to improve these assessments, particularly insofar as they focus on trends and milestones of the Soviet effort, for these are essential to determining the most efficient level and scope of our own programs aimed at competing successfully with the USSR in the long run.

In the following sections, the overall U.S./USSR military technology and acquisition balance is assessed in terms of these components:

- o Priorities and methods.
- o The technology balance--a comparison of the U.S. and Soviet scientific and technological base applicable to military requirements.
- o The acquisition balance--a comparison of weapon system production rates and the technological quality of deployed weapon systems.

B. PRIORITIES AND METHODS

Although the U.S. and Soviet research, development and military acquisition processes are quite similar in terms of functional stages, there are important differences in decision processes, organizational structure and operating methods which affect both the inputs and outputs of the two systems. Since these differences cut across all elements of the technology and acquisition process, they will be identified as a preface to the detailed comparison of the component balances in Sections C. and D. which follow.

The Soviet Union's decision process is highly centralized, rigidly structured and nearly exempt from public scrutiny and criticism. The management structure is strongly focused on providing those resources essential to the support of priority national goals. Since military needs have been placed consistently among the highest national priorities, both Soviet research institutions and industry are required to ensure the availability of manpower, research facilities, and production and material resources necessary to satisfy military requirements expeditiously, even at the expense of other sectors of the economy.

Thus the momentum of the Soviet system, generated by clear, long-term priorities and maintained by constant pressure from the political and military leaders and by salary and perquisite advantages, tends to reinforce rather than dissipate their weapon development and acquisition activities. This momentum is also supported by a high degree of stability in terms of budgets, manpower levels and composition of research institutes and design teams and by established relationships among military "customers" and suppliers. The almost total absence of public debate on the goals, activities and costs of the military sector effectively precludes external interference with military development and acquisition plans and programs.

But what in theory is a monolithic, smoothly operating system turns out in practice to contain several important shortcomings. There is little flexibility in the centrally administered system; the supply system is unreliable; managers are confronted with a complex series of regulatory constraints and disincentives to innovate; and compartmentalization and discontinuities among the research, development and production phases create interface problems which inflate Soviet weapons costs, delay production and tend to reduce innovation, technical sophistication and performance.

By contrast, the highly diversified U.S. and allied decision and management process generates a complex array of participants, interests, procedures, and regulations which diffuses goal definition and a coordinated, focused and continuous effort to apply resources to meet established goals. U.S. military requirements and programs compete openly and on an annual basis with other national needs; priorities, funding, resource allocations and even the requirements themselves often lack durability. Thus, the development and acquisition process tends to be episodic rather than regular, and continuity is difficult to achieve.

Nevertheless, the flexibility, innovative nature, technical competence and incentives of U.S. and allied industry allow levels of system performance that often cannot even be contemplated by the Soviets. The industrial establishments of the U.S. and its allies are highly flexible and, given appropriate incentives, can respond rapidly to changing military demands. Competition and relatively open debate throughout the entire technology and acquisition process encourage competence in both ideas and end products.

In summary, the Soviet Union has established considerable momentum in its program of military technology and acquisition. Serious structural and procedural weaknesses reduce the efficiency of the Soviet effort and their ability to innovate. The Soviets recognize these difficulties and are attempting to remedy or compensate for them, but many of their problems are fundamental to their system.

The U.S. and our allies confront this Soviet momentum and purpose with the flexibility and competence that only a competitive environment can provide. These are great inherent strengths, but we must apply them more coherently and effectively if we are to achieve those improvements in our deployed military capabilities which will meet the future Soviet challenge.

The major goals we have established to improve the application of our technology during the next few years are as follows:

- Develop a long range plan for the near optimal application and management of acquisition resources that will exploit U.S. strengths and Soviet weaknesses, and will hedge against future uncertainties.
- Improve U.S. deployed military technology and capability by better exploiting U.S. basic technology. (The Soviets have advantages in deployed capability in many areas where the U.S. has an advantage in basic technology.)
- Identify and exploit Soviet weaknesses with U.S. military systems.
- Make more effective use of civilian R&D by the military (civilian R&D is an area of significant, and probably lasting, U.S. advantage over the Soviet Union), and of commercial incentives and products in military R&D and procurement.
- Increase survivability as a means of increasing deterrence. For example, C^3, ICBMs, aircraft basing, and theater nuclear forces.
- Increase cooperation in R&D and production with our NATO allies so that our resources can be more effectively meshed.

C. THE TECHNOLOGY BALANCE

The process which ultimately results in the deployment of new and improved military weapons is founded in the basic sciences and a wide range of technologies which translate knowledge into concepts, designs and experimental hardware with potential applicability to military requirements.

1. Basic Science and Technology

Soviet basic science appears to be on a par with our own, both in scope and quality of effort. Excellent work is being done in theoretical physics, medicine, aerodynamics, and marine biology, to name but a few areas of Soviet strengths. They are at the forefront of research in nuclear fusion, high-pressure and ionospheric physics, high frequency radio-wave propagation, and magnetohydrodynamic power generation. We believe that their high energy laser program is comparable to our own. However they are still several years behind us in such critical areas as computers, integrated circuitry, and microtechnology.

2. Civil Technology

Scientific possibilities alone do not pay off in useful end products, and the Soviets continue to be hampered by the lack of a strong civil science and technology base, which in the U.S. is the source of advanced research and engineering capabilities that translate theories and concepts into designs for the mass production of almost any item the market demands. The weakness of the Soviet non-military sector is the product of its distinctly second-class status with respect to resources and incentives. The result is twofold: an average level of Soviet civil technology that is below that of the U.S. in almost every major industrial area; and a civil technological base that is unable to provide significant assistance to the military acquisition process.

3. Military Technology

The situation is entirely different in the military sector, where Soviet priorities have focused massive and growing human and material investments for over 20 years. Nevertheless, we believe the

U.S. still holds an overall lead in basic military technology, although the scope and magnitude of the Soviet effort has reduced this lead, and, in a few areas, the quality of their military technology appears to be on a par with, or perhaps ahead of, our own.

a. Strategic Forces Research and Development

The Soviets have placed heavy emphasis on strategic missile development. The peak of their test activity in 1973-4 is now being translated into deployment of a significantly improved strategic missile force. There is no doubt that the activity in the last several years has enabled the Soviets to reduce our lead in MIRV and inertial guidance technology. The impact of these developments on the strategic nuclear balance and their future implications are discussed more fully in Section D.

In other technologies applicable to the strategic balance, the Soviets have had relatively less success. The U.S. remains significantly ahead of the USSR in space-based surveillance technology, in the light-weight guidance and propulsion technologies applicable to cruise missiles, and in solid fuel propulsion technology. The balance in over-the-horizon backscatter radar technology appears roughly even, although the Soviets are currently developing very powerful facilities. The balance in technologies applicable to anti-submarine warfare is difficult to assess because there are gaps in our knowledge of the extensive Soviet development efforts and their significance.

b. Tactical Forces Research and Development

The U.S. leads in most basic technologies primarily applicable to tactical weapon systems, but, as will be discussed later, we have not adequately exploited many of these leads. A major exception is in tactical aircraft technologies, where the U.S. advantage in jet engine and avionics technologies has produced superior system performance. The U.S. propulsion lead is due in large measure to our ability to achieve higher turbine inlet temperatures than Soviet engines, which in turn is the result of coupling better advanced cooling techniques and high quality, high temperature alloys, with superior manufacturing capability.

The current U.S. lead in avionics technologies may increase in the near term, although a longer term estimate is difficult, because of our uncertainties about Soviet progress in R&D. The U.S. clearly has an ability to improve its deployed inertial navigation, radar guidance, and airborne digital computer systems; the Soviets have yet to introduce comparable systems into their deployed forces.

Although the Soviets have already mastered the technologies requisite to swing-wing aircraft, future major improvements in aircraft maneuverability and survivability may hinge on the development of light-weight composite materials, new wing designs and low observable aircraft. We believe the U.S. leads in all of these development areas.

The technology balance in the land and naval mission areas shows current parity or a U.S. lead in almost all basic technologies, but a Soviet advantage in deployed technology in certain significant areas (see Section D below). The U.S. leads in basic technologies applicable to torpedoes, precision guided weapons, armor, armor penetration, rapid-fire cannon, fire control, and battlefield surveillance and warning. The Soviets lead in application of ship propulsion and hull technologies.

Many of our current leads in basic technologies applicable to both strategic and tactical forces can be traced to our superiority in certain key technologies which we believe will become even more important to military force capabilities in the future. These technologies include computers, sémiconductors, electronic solid-state devices, optics, and sensors. Although the Soviets have vigorous military R&D programs in most of these areas, we do not expect them to close current technology gaps by indigenous efforts alone in the near future.

c. High Risk/High Payoff Technologies

The Soviets are making major R&D efforts in the areas of high-pressure physics, pulsed power technology, magnetohydrodynamic (MHD) power generation and high energy lasers. Their MHD work is the largest in the world and continues to grow. MHD is a technology area where the Soviets clearly lead the U.S. in demonstrated capability, but specific military applications are not yet clear.

Overall, we believe the U.S. and USSR high energy laser (HEL) programs are roughly equal at the present time, although we believe we have an advantage in the technologies by which HEL outputs must be applied to meet future military requirements.

d. Translating Technology into Deployed Systems

The Soviets have done an excellent job of translating the R&D-level technology they have available into deployed weapon systems. In the main, the Soviet approach has been dedicated to large quantities of effective, reliable systems that can be built, operated, and manufactured within the constraints of their industrial base. Many Soviet weapons have tended to be designed with a single mission in mind. The U.S., on the other hand, has opted for smaller quantities of systems that are usually more technologically advanced and designed for multiple missions. The Soviets have ordinarily proceeded incrementally with newer systems evolving from older ones with a great deal of commonality of components. They have subsequently fielded some systems in relatively small quantities despite apparent deficiencies, and they have introduced follow-on modifications on newer models and upgraded the older models. By contrast, we have often tried to eliminate all the deficiencies during the R&D process and have frequently introduced modifications to basic designs before the first operational system is deployed.

4. Conclusions

We believe that the U.S. continues to lead in most basic technologies applicable to future military capabilities, but our leads are perishable. The Soviet military R&D effort is comprehensive and significantly larger than our own. It is also focused on offsetting particular areas of U.S. strength. Several of our former leads have already been eliminated or reduced. In a number of areas, the Soviets have demonstrated an ability to narrow substantial U.S. technological leads in a short period of time, e.g., missile guidance technology. In areas where the Soviets have made relatively little progress--in microelectronics and computers, for example--the Soviets are attempting to close the gap by combining their indigenous R&D with a deliberate effort to acquire advanced Western technology.

We should also emphasize that although a technological lead can be important in influencing perceptions of capability, it is not militarily significant if it is not translated into a deployed military capability. Too many of our potential advantages have yet to be exploited. For example, our lead in technologies fundamental to target acquisition, fire control, and munitions has not been <u>fully</u> exploited, while the Soviets are making a major effort to develop somewhat less sophisticated technologies for ultimate deployment.

On the other hand, the Soviets have developed and deployed very capable weapon systems in spite of relatively unsophisticated component technologies. The ZSU-23-4 and the MIG-25 are examples of excellent deployed weapon systems employing relatively obsolete technology by U.S. standards. All of this emphasizes again the importance of applying technology well.

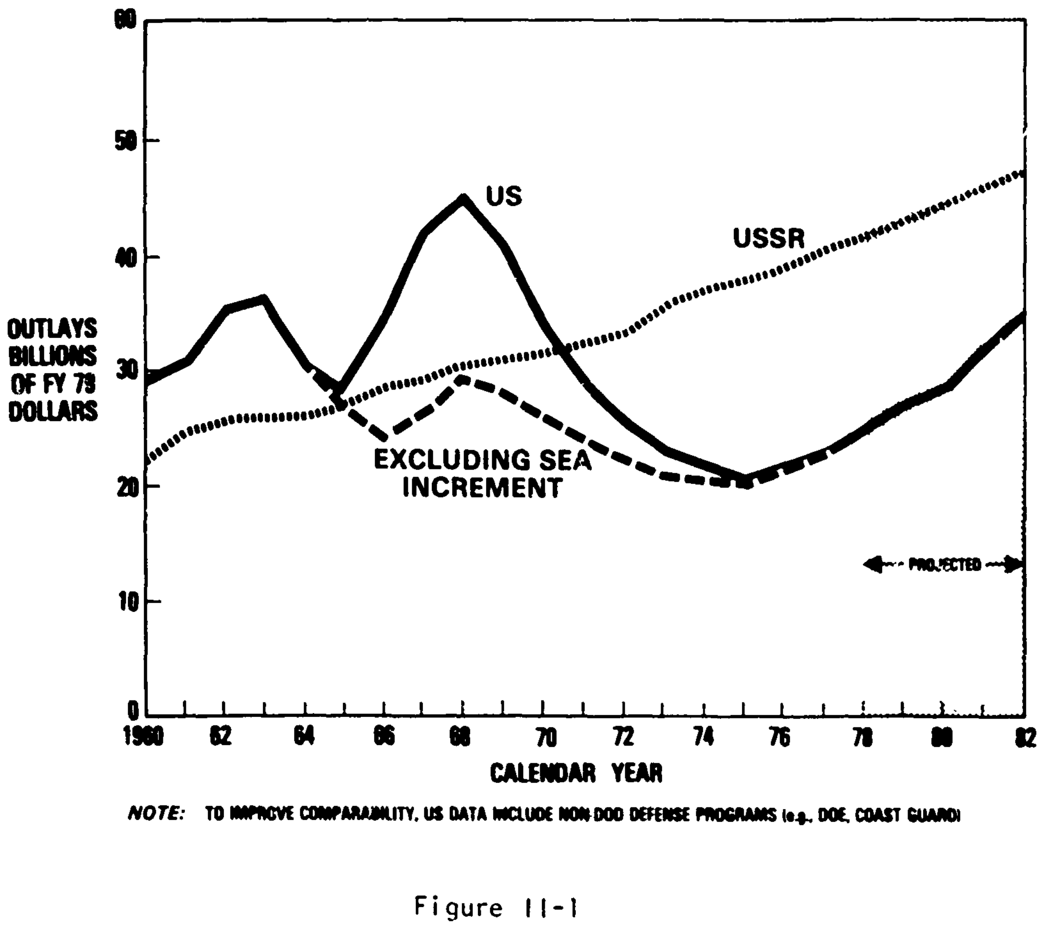
Finally, the size and scope of the Soviet military R&D program now provide them with a variety of alternative approaches by which to offset deficiencies created by U.S. qualitative advantages in a particular system. Their large investments in speculative military technologies and a number of enigmatic R&D activities indicate that the Soviet leaders are committed to expanding their options for developing future military advantages, countering our own strengths, and seeking potential technological breakthroughs.

D. THE MILITARY ACQUISITION BALANCE

1. Introduction

Since 1960, the Soviet Union's remarkable program of military growth and force modernization has strengthened every major element of the Soviet force structure with large procurements of improved weapons. Figure II-1 indicates the relative Soviet procurement effort since 1960.

COMPARISON OF US MILITARY PROCUREMENT PROGRAMS AND ESTIMATED DOLLAR COST OF SOVIET PROCUREMENT PROGRAMS



NOTE: TO IMPROVE COMPARABILITY, US DATA INCLUDE NON-DOD DEFENSE PROGRAMS (e.g., DOE, COAST GUARD)

Figure II-1

Note in particular that the Soviet spending trend is consistently up and has exceeded U.S. outlays for the past eight years. During this period the Soviets have achieved a quantitative advantage or narrowed the existing U.S. quantitative leads in nearly all weapons categories. While many U.S. margins of qualitative superiority remain, in several key areas U.S. leads in deployed weapon system performance have either vanished or diminished to the point where Soviet quantitative advantages could become dominant factors in the military balance of power.
A summary comparison of the quality of some of the more significant types of weapon systems is shown on pages II-26, II-27, and II-28.

The Soviets have achieved an impressive force by configuring their military production base close to the needs of war-time mobilization and by insulating this base as much as possible from the shortcomings of their non-military economy. This is discussed more fully in Section D.5. below, but we emphasize here that the implications of the diverging trends between the Soviet and U.S. production base are serious and we intend to analyze this issue thoroughly in 1978.

2. Strategic Forces

The USSR is continuing vigorous production and deployment of intercontinental strategic missiles. Since 1966, the Soviets are estimated to have produced many more ICBMs than the U.S. during this period. Since 1970, the Soviets have deployed variants of at least five ICBM systems (SS-9, SS-17, SS-18, SS-11 and SS-19) and development of a sixth, the SS-16, is essentially complete. The SS-16 may be intended as a land-mobile system, although we have no evidence that deployments to date have been in a mobile configuration. In addition, there are at least four more ICBMs currently in development and about to enter flight-test status. By contrast, the most recent U.S. ICBM, MINUTEMAN III, was deployed during the 1970-75 period, and we will have no follow-on system in flight test until the 1980s, at the earliest.

Technological improvements in deployed Soviet ICBMs manifest themselves in improved accuracy, increased throw-weight, MIRV capability, improved survivability and the introduction of "cold launch" systems. Of particular importance in this regard is the Soviet accuracy improvement effort, which is closing one of the key U.S. ICBM performance leads that has given us our past strategic force advantage and which today offsets Soviet throw-weight superiority. Most importantly, the Soviet deployed accuracies expected in the early to mid-1980s, coupled with projected throw-weights and numbers of warheads, could place at risk the U.S. fixed, land-based ICBM force.

Similarly high levels of Soviet activity are evident in other strategic weapons categories. During the period 1966-76, the estimated dollar costs of Soviet activities have exceeded comparable U.S. outlays by sizable amounts in the following areas: ballistic missile submarine production and operation; strategic defense and strategic command, surveillance and warning. Only in strategic heavy bombers has the U.S. undertaken a larger effort.

3. Military Capabilities in Space

U.S. space-based systems are generally superior in performance to their Soviet counterparts across the board, although the Soviets lead in deployed radar surveillance from space, and may be closing the gap in operational missile detection capabilities. The Soviets have in part attempted to compensate for limitations in the performance of their satellites by launching a greater number of vehicles. The U.S. has been able to reduce its numbers of launches and costs in many cases without a reduction in capability by developing and orbiting longer-life satellites.

Before anti-satellite attacks were viewed as a real threat, the relatively small number of satellites deployed by the U.S. entailed no penalty in terms of survivability. However, the recent Soviet achievement of an anti-satellite capability now threatens our important satellite capabilities in the mission areas of C^3, surveillance and warning, and navigation. The Soviet anti-satellite program is another example of a Soviet lead in deployed capabilities despite relatively unsophisticated technologies.

4. Tactical Forces

The Soviets outproduce the U.S. in numbers of most key conventional warfare equipments. But several factors which are not applicable to assessing relative strategic force and space capabilities must be taken into account in assessing this production balance. First, in selected areas such as Europe, the U.S. counts on its allies to produce and deploy a substantial percentage of the conventional warfare equipment used to counter the Soviet threat. Second, the USSR uses its relatively high rates of production to maintain modern equipment in Soviet forces and regularly transfers older weapons to the forces of its allies. This results in a high degree of standardization and compatibility within the Warsaw Pact. Third, sustained high production rates give the Soviets flexibility in transferring modern armaments to client states on short notice in an emergency. Fourth, differences in tactical doctrine influence production rates.

For example, the Soviets may produce a large number of T-72 tanks during 1978. The T-72 has better accuracy, better protection, greater agility, higher rates of fire and greater lethality than U.S. and NATO tanks now in the field. The XM-1 and Leopard II, scheduled for deployment in the early 1980s, will provide a qualitative edge to NATO on a tank-for-tank basis over any Soviet tank currently being produced.

High production rates for Soviet artillery are a reflection both of doctrine which emphasizes this capability and of the large deployments of Soviet and Warsaw Pact units. Current Soviet artillery provides mobility improvements and significantly greater sustained-fire throw-weight over longer ranges than its U.S. counterparts in Europe. The U.S. lead in munitions, target acquisition and fire control technologies has not yet been exploited fully in terms of deployed weapons.

The Soviets currently lead the U.S. in deployed attack helicopter firepower and this lead appears to be increasing. The Soviets deployed the HIND helicopter in 1972 as their first attack helicopter. The HIND D was introduced into the field in 1976 with improved fire control and armament. Soviet acquisition rates are now higher than those of the U.S.

The Soviets also lead the U.S. and our NATO allies in deployed chemical weapon (CW) systems. Their CW munitions stockpiles and delivery systems appear to be sufficient for sustained operations on a large scale, and their forces are better prepared to conduct chemical warfare than any other nation. By FY 1982, the U.S. will have a substantially improved capability to withstand a limited CW attack, but probably an insufficient capability to defend against sustained CW operations on a scale currently within Soviet capability.

Since the end of the Vietnam War, Soviet tactical aircraft acceptances have been about double the U.S. total. The introduction of new Soviet tactical aircraft (FITTER C, FLOGGER and FENCER) has brought a significant increase in the offensive capabilities of the Soviet Frontal Aviation force. This force is now highly flexible and its ordnance delivery capability in terms of aggregated range-payload measures is comparable to U.S. tactical air forces in Europe. We expect the Soviet tactical aircraft modernization rate to continue to lead that of the U.S. during the next five years.

In battlefield air defenses, the Soviets and their Pact allies have deployed many more low- and medium-altitude SAMs and anti-aircraft artillery systems than NATO. The Pact air defense systems enjoy superior mobility, salvo capability and survivability (most have crew protective armor), and the diversity of types of systems in the field makes effective countermeasures more difficult. U.S. systems generally have greater engagement envelopes and superior lethality, although we will not deploy a system comparable to the four-year-old Soviet SA-8 until the early 1980s.

Two factors must be considered in assessing the impact of relative U.S./USSR production rates on naval force capabilities. First, the NATO allies make a substantial contribution to the naval balance in terms of both numbers of ships and combat capabilities relative to the Soviets and their Pact allies. This contribution would be important in NATO-related conflicts, e.g., in operations in the Atlantic and Mediterranean Oceans and the Baltic and North Seas, and is not reflected in comparisons of U.S. and Soviet naval production rates alone.

On the other hand, the U.S. Navy also has worldwide missions to which our NATO allies would not be expected to contribute. In this context, the relative U.S./USSR naval production rates indicate the dimensions of the serious problem we will face in the out years--how to procure the number and mix of capabilities sufficient to maintain open-ocean sea control and to selectively project power globally when confronted by a Soviet naval force which already possesses a significant sea denial capability and whose strength is growing qualitatively. The USSR now outbuilds the U.S. by a three-to-one margin in numbers of all types of combatant ships, although the U.S. leads in total displacement because we build larger ships than the Soviets. We note in particular that recent Soviet naval deployments have raised the complexity of the threat to our surface units and required us to build more sophisticated counters into our platforms. This, in turn, has raised the cost of individual platforms and correspondingly decreased the numbers of units procured for our forces.

5. Manufacturing Capabilities

The Soviets have achieved a large output of highly capable military weapons in all mission areas by constructing an extensive and growing military industrial base. However, the quality of the Soviet industrial base is uneven. In some high priority areas the Soviets have mastered the very demanding manufacturing technology involving forming, fabrication of materials that are difficult to work with, and assembly of components requiring precision techniques and extremely close tolerances. In other areas, such as semiconductor devices and very high temperature resistant turbine blades, we have in the past seen evidence of a deficiency in translating technology into the mass production of high quality products. While deficiencies still exist, the Soviets may be in a "break-out phase," permitting them soon to close some of the more glaring weaknesses in this area.

Three points must be emphasized in our net assessment of U.S. and Soviet production capabilities. First, the Soviets are well aware of the advantages accorded to the U.S. by its superior production capability. Their weapons designers seem to establish less stringent specifications and standards. Second, the Soviets are investing heavily in the development of new production technologies and are placing a high priority on obtaining production "know-how" from the

West, particularly in those areas of large Soviet deficiencies. Third, the long-standing capability of the U.S. industrial base to mass-produce high quality end products rapidly and efficiently in many areas can no longer be taken for granted.

We have already lost our superiority in several areas of production technology to allied nations and to Pact countries, and our lead in others is perishable. Obsolescence is a severe problem in a number of heavy industries. Further, the responsiveness of our industrial base to military requirements has declined. For example, attempts to increase tank production were delayed due to a lack of key component production capabilities.

6. Technology Sharing

The Soviet drive for military superiority will continue to increase their requirements for certain classes of high technology, particularly in areas where their deficiencies are growing relative to the West. Overt Soviet efforts to acquire advanced technologies through trade have already focused on areas where the large U.S. lead has given us important weapons performance advantages. We expect these efforts to continue, and the Soviets will attempt to supplement them with a deliberate program to acquire critical technologies through covert means.

Controlling the diffusion of technology is a complex issue, requiring a balanced assessment of political factors, potential economic benefits--including the impact of controls on incentives for further technological advances in the U.S.--and national security considerations in the long run. The DoD recognizes that technological diffusion is inevitable over time and that the sharing of certain technologies and end products is essential if we are to maintain a dynamic U.S. industrial base. In addition, the capability of our allies to deter or fight Warsaw Pact aggression will be enhanced if we ensure that NATO maintains a strong technological position. To this end, the sharing of technology within the Alliance is essential. On the other hand, we believe that design and manufacturing know-how must be closely controlled to retain our national technological advantage relative to our principal adversary, particularly in those leading-edge, high risk technologies and keystone manufacturing equipments which are the keys to maintaining the future military balance. This same know-how, when shared within NATO, can lead to a more credible deterrent and a more efficient fighting capability.

7. NATO Standardization and Rationalization

Cooperative actions to integrate more fully the NATO members' research, development and production capabilities, and to achieve interoperable systems would greatly enhance the effectiveness of deployed NATO forces and increase the efficiency of the limited resources the individual NATO members allocate to their security requirements. The Warsaw Pact enjoys a significant advantage over NATO in terms of weapons standardization and the integration of military production. This advantage tends to offset NATO's superior but fragmented technological and industrial base. The U.S. and its NATO allies can no longer afford the costs of inefficient and militarily ineffective independent RDT&E and acquisition programs. The U.S. will therefore continue its emphasis on coordinating research, development and major acquisition decisions with its NATO partners. We will also give greater weight in technological sharing issues to the additional strength such sharing can give to NATO's military capability.

8. Conclusions

The acquisition balance now clearly favors the Soviets in terms of quantities of weapons being produced in almost all mission areas. Moreover, our qualitative lead may have declined to the point where, in some cases, it may not offset entirely the Soviet numerical superiority.

In too many cases, we have not translated our technological leads into deployed weapon system capability. The Soviets, in contrast, have applied their technology more effectively, even in areas where their technology is comparatively weak. In addition, the Soviet military production base operates at near capacity levels, is expanding, and is closely integrated with that of its Warsaw Pact allies.

In view of the impressive Soviet build-up of military power, it is evident that we must improve our ability to translate technology into deployed weapon systems to maintain confidence in our defense, to ensure deterrence, and to get the most for every dollar we spend on defense.

E. TECHNOLOGY AND ACQUISITION IN PERSPECTIVE

Although there is little doubt that the current trends in the magnitude of military research and development, acquisition and investment favor the Soviet Union, the ultimate outcome of these trends in terms of the character of the future military balance remains uncertain. This is so because the current levels of effort and competence alone are not indicative of relative military capabilities. Of great importance is the success of the competitors to exploit and to use their existing technology and productive capacity.

Our "track record" of recent years must be improved, for as the qualitative balance approaches rough parity, the efficient application of technology will become at least as important to the overall military balance as the level of technology itself.

There are two essential steps in improving the use we make of our technological and productive assets. First, technology and production are not ends in themselves. Instead, they are means to objectives defined by military doctrines, strategies, tactics, roles and missions, as well as by other significant elements of national policy. Therefore, we must understand better the inter-relationships among these factors and our technology.

Second, we must improve our understanding of how the Soviet Union applies its assets toward achieving its own military goals and how this will affect the future Soviet military posture. Clearly the emerging Soviet threat will include weaknesses we can exploit, as well as challenges we must offset. Identifying these and implementing appropriate responses require better information and better assessments of Soviet strengths and weaknesses relative to our own.

SOME PERFORMANCE COMPARISONS BETWEEN DEPLOYED U.S. AND USSR SYSTEMS TECHNOLOGY

Strategic Forces (Deployed Systems)

ICBM

-- Accuracy: The U.S. leads, but the Soviets are rapidly improving and narrowing the gap.

-- Throw-weight/ Propulsion: The USSR has achieved a greater throw-weight capability than the U.S.; basic U.S. solid propellant technology is more advanced.

-- MIRV Technology: We are not certain. The U.S. appears to lead, but the Soviets are rapidly improving and closing the gap.

-- Silo Hardness: The Soviets have emphasized achieving greater hardness than the U.S.

SLBM

-- Accuracy: We are not certain. The U.S. appears to lead.

-- Throw-weight/ Propulsion: The Soviets deploy larger missiles than the U.S. The U.S. leads in solid-propellant technology, but the USSR has successfully employed liquid propellants to achieve greater ranges.

-- MIRV Technology: The U.S. leads.

Heavy Bombers

-- Payload: The U.S. leads, unless BACKFIRE is converted.

-- Range: The U.S. leads.

Defensive Systems

-- USSR leads in mobile SAMs, diversity.

-- U.S. leads in look-down/shoot-down interceptor technology.

-- USSR is making a substantial effort to advance ABM technology.

Tactical Forces (Deployed Systems)

Land Forces

-- Tanks:	Soviet tanks being deployed are less vulnerable than U.S./NATO tanks and fire a more lethal round at higher rates of fire.
-- Artillery:	The U.S./NATO lead in accuracy and lethality, but USSR artillery leads in range.
-- Infantry Combat Vehicles:	Soviets/Pact lead in survivability, firepower, and chemical warfare defense equipment.
-- Battlefield Air Defense:	Soviets/Pact lead in diversity, mobility, salvo capability and crew protection. The U.S. leads in lethality and in engagement envelope.
-- Anti-tank Guided Munitions:	The U.S. leads, but Soviets are improving.
-- Helicopters:	Soviets have a slight overall lead in firepower.
-- Chemical Warfare:	Soviets lead; U.S. effort only in defensive capability.

Tactical Air Forces

-- Air to Air Combat:	U.S. leads, but MIG-25 is the fastest operational fighter in the world.
-- Weapons Payload/ Range:	U.S. leads, but the Soviets have focused on improving this capability.
-- Surveillance and Reconnaissance:	U.S. has a strong lead.
-- Accuracy of Air to Surface Munitions:	The U.S. leads, but the USSR has major effort underway to improve their capability.

Naval Forces

-- Anti-ship Cruise Missiles:	The USSR leads, but the U.S. has some capability in Harpoon.
-- Surface Ships:	Soviets lead in speed, sea-keeping properties and armament. The U.S. leads in ship range and size, and has a substantial advantage in sea-based tactical air.
-- ASW:	The U.S. appears to have an overall lead, but the Soviets appear to be striving to achieve substantial capabilities.
-- Mine Warfare:	The USSR leads.

Command, Control, and Communications (Deployed Systems)

-- Survivability:	Soviets have an advantage in the survivability of C^3 systems and installations against physical and jamming attack.
-- Information Collection Systems:	U.S. leads, but the USSR has unique ocean surveillance and targeting capability.
-- Data Communication Links:	U.S. leads in this technology.
-- Satellite Based Systems:	U.S. satellites are superior in performance, but some Soviet systems have no U.S. counterparts.
-- Automated Control of Combat Forces:	U.S. leads, but the Soviets are placing emphasis on this area.

III. ACQUISITION MANAGEMENT

Our Defense acquisition programs involve expenditures of such enormous amounts of money that any management improvement or technological breakthrough, no matter how small, can provide a very significant payoff in absolute dollars and operational advancement. Considering the challenges at hand and our restrained resources we must continually look for ways by which we can improve our acquisition management. The new Federal policies and practices for acquisition management, prescribed in OMB Circular A-109, have done much to add impetus to our efforts and while we have moved ahead in implementing many new policies and practices, a great deal more has to be done.

III

A. NEW ACQUISITION STRUCTURE

1. Overview

Realignment of our personnel resources at the OSD level will enable us to develop an integrated approach to management more in line with the business-oriented approach taken by firms in the private sector. Our purpose is to construct an acquisition policy that spans the system life cycle and brings to bear the business management factors necessary to develop and produce a successful product. Our principal thrust is to establish an acquisition team responsible at the policy level for all major system program activities, including research, engineering, production, industrial readiness, standardization and contracting.

2. Consolidation of Acquisition Functions

We have instituted a life cycle business management strategy for our major systems. Programmatic and technical aspects have been combined and our Deputy Under Secretaries for Research and Engineering are now responsible for research and development, production and life cycle considerations for their assigned programs. This alignment is similar to the product line assignment of responsibilities in industry where market development and production functions are grouped under one product line manager.

We intend to construct a DoD-wide acquisition strategy that will highlight priorities, risks and magnitude of programs. Emphasis will be placed on introducing more active competition throughout development, beginning with solicitations for alternate concepts and extending, where practical, into production. Selection of the right type of contract and the use of incentive clauses and other provisions will be made commensurate with program experience and risk. We are promoting a direct tie between those who develop the policy within OSD and those who manage the execution of that policy. Our objective is to bring the manager into closer association with his business-oriented functions and tailor our policy to the environment of the manager.

B. SYSTEM ACQUISITION CHANGES

1. Overview

Although we believe the DoD's acquisition process is fundamentally sound, we must search for ways to improve the system. The changes we make should be in recognition of and within the framework of the competitive environment of our free enterprise system. Profit and other incentives will be emphasized to motivate the firms in our defense industry to better self-management rather than the regulatory approach emphasized in the past. As our contractors become more competitive, we in DoD will share in the benefits of better performance and lower cost.

2. Front End Management

Much of the improvement in the acquisition process will have the objective of improving the stature of DoD as a stable and reliable customer. Program stretchouts, abortive program starts and costly contract cancellations undermine public and Congressional confidence. They also are disruptive to the government-contractor relationship. To remedy these problems it is important that the acquisition process be started off properly. We must first be sure of the validity and priority of the mission task we want to perform and, equally important, determine whether we can afford it. At stake is the premature commitment to a false and costly start, an unproductive industry buildup and injury to government-industry relationships.

Particular attention has been paid to strengthening the first phase or the front end of the acquisition process, so that proper management attention and visibility are focused on a new program before it starts. A program "GO" decision will be given when the Secretary of Defense approves a mission need document termed "Mission Element Need Statement" (MENS). The MENS will form the basis for advising industry and the academia of our mission deficiencies and requesting their alternative proposals for solution in a wide latitude of conceptual approaches.

We have been conducting concept formulation and mission need determinations in the DoD for some time. The MENS approach formalizes the process in such a way that program initiation, operational need date and affordability are highlighted. In a program's early phase, alternate conceptual solutions will be identified. The most promising ones will be competitively selected and then evaluated. Our new front end policy will require, among other things, a very careful assessment of design and manufacturing technologies, logistics factors and an early, aggressive pursuit of program voids and deficiencies.

3. The Affordability Issue

A second change in the acquisition process is the coupling of a tentative decision to produce and deploy with the decision to enter full-scale development. Since full-scale development entails a major expense, we should also explicitly consider the follow-on affordability issue at the same time. Hopefully, the affordability issue will be faced early enough to prevent the government and industry from committing resources to the full-scale development of a system which will never be produced.

4. Revisions to DoDDs 5000.1 and 5000.2

In January 1977 DoD's two top policy regulations on the acquisition process, DoDD 5000.1, "Major System Acquisition" and DoDD 5000.2, "Major System Acquisition Process", were completely revised and reissued. These revisions implement the principal recommendations of the Commission on Government Procurement as set forth by the Office of Federal Procurement Policy (OFPP) in OMB Circular A-109, issued in April 1976.

The changes to DoDDs 5000.1 and 5000.2 cover the entire acquisition process. The importance of and priority to be afforded maintenance and advancement of the technical base is highlighted, including system technology and manufacturing technology. Emphasis is placed on the industry and university role in providing this technology. A technology assessment of the voids and risks entailed in the new system is specified for incorporation in the program's high level decision document, the Decision Coordinating Paper (DCP).

During demonstration and validation, the producibility of the design concepts and the availability of manufacturing technologies will be carefully considered. Production engineering and planning and industrial preparedness planning will be conducted during full-scale engineering development. The goal is to reduce the cost of transitioning a program from development to production.

The logistics side of the program has been emphasized to require closer attention to logistics support planning. Consideration of alternative maintenance concepts and high priority for reliability and maintainability factors will be influential in the design.

We are making every effort to minimize total system life cycle cost by emphasizing and translating the principles of design-to-cost and life cycle cost management into our acquisition process. Our goal is to prioritize and evaluate cost on the same level as the system's technical requirements which are the cost drivers in any system acquisition program. Cost reduction tradeoffs made early in the development cycle offer high potential in cost avoidance during the system's procurement and support phase. Application of these principles to specific system programs is discussed under the Programs Section of this statement.

Additional flexibility is afforded the contractor in responding to and fulfilling the DoD's stated needs. Military specifications and standards and data requirements must now be tailored specifically toward the requirements of the given system. We also have established policy requiring the use of commercial specifications and the incorporation of commercially available components wherever practical.

The requirement that a system demonstrate its technical and operational sufficiency to meet the specified military need is reaffirmed in the revised directives. The program manager is given additional responsibility to evaluate tradeoffs in performance and schedule against the cost of the system.

C. CONTRACTING CHANGES

During the past five years the DoD has reported to the Congress on changes to the acquisition process proposed by the Commission on Government Procurement in 1972. The DoD has acted to implement many of the recommendations.

1. Defense Acquisition Regulatory System

We have established the new Defense Acquisition Regulatory System (DARS); a system of policies and procedures to guide managers in the conduct of Defense business. The DARS will focus on tasks at the operating levels and the Government's contractual actions in dealing with industry in the acquisition of goods and services. The policies and procedures issued within the DARS direct special attention to the unique demands of major system acquisitions.

2. Four-Step Source Selection Process

During the past year, we conducted a program to test a proposed Four-Step Source Selection process. This method of source selection has potential for reducing or eliminating government levelling of contractor technical proposals, contractor program buy-ins, and government auctioning of contractor proposals. A total of 17 programs was selected to test the Four-Step procedures. These programs represent various stages of the system development cycle and magnitudes of complexity and program costs. Implementing procedures for the Four-Step Source Selection process are currently being developed.

3. Business/Contract Strategies

The success of our changes to the acquisition process is dependent upon how well they are reflected in the thinking and philosophy of our managers at the operating level. Business judgements and business considerations must be an integral part of planning for the total program at the earliest point in the acquisition process. Our goal is to ensure that effective business management is accomplished DoD-wide. We have made important staff changes to give us the capability to pursue this facet of management and believe it will lead to major improvements in technical, cost and schedule performance and ultimately in the effectiveness of the equipment we field.

4. Contractor Incentive Initiatives

A continuing DoD policy is to encourage contractors to make their own investments in cost reducing capital assets. The Special

Termination Buy-back Technique is one of the most important initiatives we have taken to accomplish this goal. This technique recognizes that contractors are often reluctant to make large capital investments because some contracts (programs) may be curtailed much earlier than the period used in the investment decision calculations. If such curtailment occurs, the DoD, in very selective circumstances, will agree to buy back, at somewhat less than the unamortized cost, capital equipment bought specifically to support a contract (program).

Three other techniques which will help us meet our investment policy goals are multi-year contracts, value engineering and award fee incentives. Multi-year contracting provides a means to competitively contract for known requirements for the period of the Department of Defense Five Year Defense Program. Contractors are asked to provide a one-year bid response with nonrecurring or "start-up" costs lumped together and a multiyear bid response prorating these costs over the entire period of the contract. If the award is made on a multi-year basis, funds are obligated only for the first year's quantity, with succeeding years' contract quantities being funded annually thereafter. If funds for the succeeding years are not made available, cancellation occurs, and the contractor is reimbursed for the unrecovered nonrecurring costs included in prices for the cancelled items. These cancellation charges are presently limited to $5 million. We propose that this limitation be removed or raised to a more realistic level.

The Value Engineering incentive technique is appropriate when an engineering change to the contract is required to permit the use of a particular capital investment such as a newer or more modern piece of equipment. The contractor and the Government share in resulting labor and material savings through the value engineering contractual provisions.

The third technique--award fee incentives--is used, for example, when it is desired to have the contractor begin to design for producibility during the development stage. The amount of fee awarded is based upon the quality of the planning for facilities, the extent of interaction between the design, facilities and manufacturing engineers during the design of the product and the determination of which production facilities to use. Payment of the maximum award fee may be contingent upon the eventual use of the capital equipment in the manufacture of the product.

5. Minority and Small Business Adjustments

In examining our organization we have concluded that Small Business and Minority Business Enterprise (MBE) business functions should be separated with both activities placed on the same level of reporting to the Deputy Under Secretary of Defense Research and Engineering (Acquisition Policy). Such realignment permits the DoD to place increased emphasis on MBE matters while concurrently supporting small business located in labor surplus areas. Minority businessmen and trade associations will now have a separately identified office from which to seek advice, counsel and support regarding procurement opportunities within the DoD.

We are developing initiatives which will enable minority and small business firms to compete more effectively for a greater share of our awards for products and services both on a prime and subcontract level. About six percent of our contract dollars are awarded to small business on the basis of the small business set-aside program while approximately another 15 percent is won by these firms in unrestricted competition with big business. If we purchase a product or service successfully on the basis of a small business set-aside, it appears reasonable to establish an automatic repetitive set-aside for any future requirements of the particular product or service.

We are well underway in our test of mandatory small business subcontracting. This test involves 25 contracts covering requirements for manufacturing, research and development, construction, supply and maintenance and operations services. The contract requires that, as a condition of award, a prime contractor place a specified percentage of his subcontracting effort with small business. While a final evaluation of this concept is not planned until September 1978, present indications are that required small business subcontracting shares are feasible.

Subcontracting goals will also be proposed for minority businesses. In response to a Presidential objective to double the amount of purchases from minority firms, new procedures will be developed and implemented. The system for monitoring prime contractor compliance with minority enterprise contractual clauses will be analyzed and revised to produce more timely, accurate and comprehensive data.

D. INTERNATIONAL ACQUISITION POLICIES

We intend to promote, to the maximum extent practical, cooperative materiel programs with our Allies--particularly NATO countries--in order to further our mutual economic interests and common defense needs. Such cooperation can improve the overall effectiveness of our forces and simultaneously reduce cost through the employment of commonality, standardization and other efficiencies in operation and support.

1. Foreign Research and Development

We will utilize foreign research and development wherever expedient to conserve our own research and development dollars, to capitalize on the significant advancements and contributions made by other nations and to enhance NATO standardization and interoperability. We will encourage cooperative military and related commercial ventures between our own firms and foreign concerns which strengthen the overall industrial and military capabilities of our alliances and reduce our own acquisition costs. An example of this thrust is the publication on 11 March 1977 of a new regulation (DoDD 2010.6) which requires the Military Departments to consider NATO developments or derivatives prior to embarking on any new weapon system development.

2. Technology Sharing

In our efforts to promote overseas trade and commerce, we recognize that our technology constitutes our most valuable and desirable export product. Our technology is also key to maintaining our strategic lead time and defense posture. We must strike a balance between enhancing trade and foregoing the transfer of our strategic technologies which directly or indirectly contribute to the military potential of other nations where our own national security is endangered.

We will support the sharing of critical technology where such sharing can strengthen our collective security, contribute to the goals of standardization and interoperability and maximize the return of combined NATO or other Allied investment in research and development. We will be cognizant of the observations of the Defense Science Board Task Force on Export Control of US Technology (Bucy Report)--that our manufacturing technology constitutes our most critical defense-related commodity.

3. Reciprocal MOUs and Offsets

At the present time DoD has Reciprocal Procurement Memoranda of Understanding (MOUs) with Canada and the UK, and specific procurement offset agreements (specific percentages of the sale value) in connection with US defense sales to Australia, Norway and Switzerland. In addition, the F-16 aircraft sale included offset provisions to be accomplished within the program.

In the furtherance of our standardization and interoperability objectives, we anticipate entering into reciprocal procurement MOUs with other NATO allies. Agreements of this type provide for cooperation in research, development, production and procurement over the whole spectrum of defense equipment, in order to achieve greater military capability at the lowest possible cost through a more rational use of the respective industrial, economic and technological resources of each country. Such arrangements enable the foreign purchaser to recoup a portion of his investment, thus helping to alleviate the economic imbalance that would otherwise result.

We intend to meet our commitments under the above agreements. However, we prefer that sales of defense equipment be negotiated without specific offset procurement arrangements wherever possible. In the future, the DoD plans to be more selective in such arrangements, giving due consideration to related US objectives such as standardization and interoperability of defense equipment with our NATO allies. Offset agreements related to particular weapon system purchases will be entered into on a case-by-case basis considering the interests of the US, and the accommodation of the needs of the other nation within US policies, laws and regulations.

4. Acquisition Authority

The Culver-Nunn Amendment to the DoD Appropriation Authorization Act, Public Law 94-361, has established the policy that equipment procured for our personnel in Europe be standardized or interoperable with equipment of other NATO members. Further, the law requires the Secretary of Defense to initiate and carry out procurement procedures to implement this policy; and authorizes waiving the provisions of the "Buy American Act."

There are a number of restrictions to the placement of contracts with foreign sources for purposes of NATO standardization and interoperability as well as to fulfill other international agreements:

- o Annual Appropriation Act Restrictions on DoD Procurement such as the Berry Amendment prohibition on articles of clothing, textiles and specialty metals; the Bayh Amendment restriction on research and development contracts with foreign sources when there is a lower cost US source; and the Burns-Tollefson Amendment prohibiting contracts for the foreign construction of Naval vessels.

- o Statutory Provisions for Protection of the US Production Base such as 10 USC 2304a(16) which authorizes procurement by negotiation in the interest of national defense; and ASPR 1-2207 restricting purchases of miniature ball bearings and precision components for mechanical time devices.

- o Statutory preferences for small business and labor surplus area concerns, prison-made or blind-made goods and the use of US vessels and air carriers.

- o Concerns for security and the transfer of technical data.

- o Laws and policy relating to contracting procedures (e.g., Cost Accounting Standards, access to records and right to audit).

We have taken several approaches to reduce or remove these restrictions. The FY 1978 DoD Appropriation Act authorizes waiver of the Berry Amendment restriction against the foreign purchase of specialty metals where purchases are necessary in furtherance of NATO standardization and interoperability or to comply with offset agreements with foreign governments. We are presently proposing legislation to authorize the Secretary of Defense to waive the application of certain laws that inhibit entering into agreements with foreign governments and international organizations. We have also proposed a similar provision in the Federal Acquisition Act of 1977, currently being considered by Congress. Legislation proposed for inclusion in the FY 1979 Appropriation Act would provide additional relief from some of the restrictions previously mentioned.

E. IMPROVING PRODUCTION CAPABILITY

1. Production Management

Priority emphasis on the production management function is a major thrust of the business management concept being implemented by OSD on its major systems. A new DoD directive entitled "Defense Production Management" has been issued which consolidates DoD policy on production management in one parent document. This directive (DoDD 5000.34, dated 31 October 1977) was developed in consultation with industry and spells out the policy initiatives to be undertaken by the Military Departments and their system contractors during the acquisition cycle. The directive enumerates the production management considerations appropriate to each major program milestone decision. The program's production management status will be reviewed by the Defense System Acquisition Review Council in a manner similar to the independent assessments made for cost and test and evaluation. Particular attention will be given to production feasibility and manufacturing technology requirements during the validation phase and to producibility and production planning during full-scale development. A thorough production readiness review of each program will be conducted prior to a limited production and/or full production release. The responsibility for executing production management, including the conduct of production readiness reviews, has been delegated to the Military Departments. Each Department has established a focal point to coordinate its overall production management activities.

2. Advancing Manufacturing Technology

We will continue to strongly support the DoD Manufacturing Technology Program. This program applies technology to improve productivity. It does this by developing advanced manufacturing techniques, processes, materials and equipment for timely, reliable and economical production of defense systems and equipment. By sharing the cost and risk of application of new manufacturing techniques with industry, this program diffuses new technology throughout the US industrial base. thereby expanding its capability and competitive posture and reducing the cost of DoD production programs.

3. Strengthening the Industrial Base

We will continue to place major emphasis on the effective management of our industrial resources, both government and privately owned, to give us cost-effective weapon systems in peacetime and to meet our emergency defense production needs under the full spectrum of potential conflicts. Emphasis will be placed on measures to increase private investment in the base, reduce government ownership of plant and equipment, modernize the essential nucleus of plant and equipment to increase productivity, further integrate industrial preparedness considerations into our peacetime procurement programs, reduce investment in war reserve materiel through prestockage of critical long-leadtime components, sub-assemblies and upgraded material forms and increase cognizance over diminishing manufacturing and materials sources and sole dependencies on foreign sources of supply.

F. INCREASING USE OF COMMERCIAL PRODUCTS, SERVICES AND PRACTICES

The DoD is moving toward the procurement of more commercial, off-the-shelf products, in accordance with the OFPP Commercial Acquisition Policy. A pilot program was started in January 1977 to test this concept over a broad range of commodities, and will continue through December 1978. Expected benefits include the avoidance of R&D time and cost, lower unit cost, reduced support (O&S) costs, increased competition and a broader Defense industrial base.

Standard procedures and practices developed for use by the private sector are being used by the DoD wherever applicable, in preference to military specifications and standards. The military documents are being phased out to the extent possible. Special emphasis is being placed on the tailoring of all specifications and standards to specific programs and contracts, as opposed to their blanket application. This policy will necessitate review and restructure of many DoD documents.

IV. INTERNATIONAL ACTIVITIES

A. OVERVIEW

Our international programs pursue several important objectives. The primary thrust continues to be enhancement of the military capabilities of the NATO Alliance through closer, in-depth cooperative efforts in armaments development, production and procurement. Major new and unprecedented initiatives for comprehensive NATO defense planning and cooperation were launched by the President during 1977. The initiatives provide the basic impetus and guidance to our international programs in 1978. Our goal is to make increased NATO military effectiveness through armaments equipment rationalization a reality.

IV The ever-growing Soviet threat coupled with inflation pressures make imperative the best collective use of the funds the Alliance, as a whole, spends on defense.

Standardization and interoperability of military equipment is at the heart of our NATO Rationalization effort. To make progress toward this goal we will be working with the Congress toward structuring our programs in such a way as to make this a joint endeavor with our Allies and with industry on both sides of the Atlantic. A number of groups under the Conference of National Armaments Directors (CNAD) of NATO exchange technological and requirements data and work on cooperative programs over a wide spectrum of military needs. The anticipated Transatlantic Dialogue between US and Canada and the Independent European Program Group (IEPG) is expected to commence under the auspices of CNAD to resolve some of the problems that impede armaments cooperation. The Four Power discussions with the active involvement between the Armaments Directors in which I take an active part present an additional forum for accelerating cooperation in NATO while the Technical Cooperation Program (TTCP) provides for technology sharing among US, UK, Canada, Australia, and New Zealand.

We have also important cooperative and technology sharing programs with our other Allies and friendly neutrals. There has been a general increase of interest on the part of these countries in R&D cooperation and assistance to enable greater self-reliance with the phase out of the various Military Assistance Advisory Groups. This cooperation is accomplished primarily by establishing and managing the many Memoranda of Understanding (MOU's), Data Exchange Agreements (DEA's) and Technical Assistance and Licensing Agreements (TALA's) as well as through programs for exchange of engineers and scientists. The scope of our cooperative efforts is reflected by the 436 DEA annexes with 18 countries, 60 information exhange projects with four commonwealth countries, hundreds of MOU's for specific programs, and approximately 350 TALA's which are requested annually.

We also are responsible for the technical positions on FMS cases for the various countries of the world where US Government policy is to provide security assistance. A major responsibility in this area is the development of technology release guidelines for coproduction programs. Appropriate programs are devoted to special areas of interest and commitment such as Korea and Israel.

Concomitant with cooperative efforts in research, development and acquisition, we have the responsibility to control exports of technology and goods which could make a significant contribution to the military potential of any nation or nations contrary to the security interests of the United States. This DoD responsibility for the techno-military and programmatic judgments on matters of export control is executed primarily through the review of the many munitions and strategic trade control case applications, and the support of the various groups concerned with export control. In this area we are responsible for the final technical position on over 3,000 commercial munitions license applications annually. Although more than half of these cases are straight-forward sales or marketing endeavors concerning relatively innocuous equipments, a substantial number require in-depth review due to the significance of the equipment or the level of technology.

Finally, to maximize the effective return on the collective NATO and other Allied investment in R&D and to accelerate the goals of standardization and interoperability, we are developing programs that trade off the need for technology control against the benefits of cooperation and transfer of critical technology to our Allies; the deciding criteria being strengthened collective security. In August 1977, the Secretary of Defense issued a departmental directive on export control and defense technology. This states that:

> "Defense's primary objective in the control of exports of US technology is to protect the United States' lead time <u>relative to its principal adversaries</u> in the application of technology to military capabilities."

The directive further states that:

"Defense will support the transfer of critical technology to countries with which the US 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 the collective NATO Alliance or other Allied investment in R&D."

We are using this policy as an inducement for accelerated progress in interoperability and standardization.

The following section presents in greater detail our most important international program activities, namely our NATO initiatives, followed by a discussion of specific progress already made toward standardization and interoperability.

B. MAJOR NEW INITIATIVES TO SUPPORT NATO

Major new initiatives to promote the enhancement of NATO military strength were launched during 1977 and give substance and direction to our international programs for the coming year.

These include:

- President Carter's initiative at the NATO Summit
- Special Budget Elements Relating to NATO
- New initiatives in Cooperative Armaments Planning and Management

1. President Carter's Initiative at the NATO Summit

At the May 1977 Summit Meeting in London, President Carter stated that the United States will continue to make the Alliance the heart of our foreign policy and will join with its Allies in strengthening the Alliance politically, economically, and militarily. He further cautioned that the Alliance needs to use limited resources wisely, particularly in strengthening conventional forces. To this end, he called for NATO countries to combine, coordinate and concert national programs more effectively, find better ways to bring new technology into the armed forces, and give higher priority to increasing force readiness. In order to fulfill these goals, President Carter expressed the hope that NATO's Defense Ministers, meeting the following week, would begin developing a long-term program to strengthen the Alliance's deterrence and defense in the 1980's and would agree to make high priority improvements in the capabilities of NATO forces over the next year.

President Carter also emphasized the need for improved cooperation by NATO countries in development, production, and procurement of Alliance defense equipment, calling for a major effort to eliminate waste and duplication in national programs, to develop, produce and sell competitive defense equipment, and to maintain technological excellence in all Allied combat forces. In this regard, he stated (1) that the United States must be willing to promote genuine two-way transatlantic trade in defense equipment, (2) that he had instructed the Secretary of Defense to seek increased opportunities to buy European defense equipment where this would mean more efficient use of Allied resources, and (3) that he, President Carter, would work with Congress to this end. President Carter then offered Washington as the site of the Spring 1978 meeting at which

NATO Heads of State could review progress in the defense initiatives he was proposing.

Long and Short-Term Initiatives

In furtherance of President Carter's initiatives, Secretary of Defense Brown proposed at the 17 May DPC Ministerial that NATO Defense Ministers agree to (1) a long-term program to be developed over the next year and approved in Spring 1978 and (2) approve in principle the development of a series of short-term measures by the NATO Military authorities in consultation with nations, with formal commitment by the nations to be worked out over the next six months.

The recommended short-term measures, aimed at early correction of certain critical deficiencies in the areas of anti-armor, war reserve munitions and readiness/reinforcement, were sent to NATO nations for action on 26 July. A comprehensive report on the national responses was considered by NATO Defense Ministers at their December 1977 meeting. National replies were prompt and responsive, providing a clear demonstration of the Allies' willingness and capacity to act rapidly and effectively when given clear political direction.

The NATO Defense Ministers endorsed Secretary Brown's proposal for a NATO LOng-Term Defense Program, invited the NATO Defense Planning Committee to prepare the program for approval by Ministers in Spring 1978, and agreed that it would consist of a series of carefully selected priority programs each of which should: (1) be designed to remedy a serious deficiency in NATO defenses, (2) identify national or multi-lateral contributions required to remedy the deficiencies, over the long-term as well as mid-term, (3) establish timings for the critical phasing of these contributions, (4) exploit all opportunities to achieve greater interoperability and standardization, and (5) recommend machinery to facilitate greater Allied cooperation. Ministers further agreed that a report on progress made on the programs should be made to NATO Heads of State and Government meeting in late Spring 1978 in Washington.

The NATO Defense Planning Committee selected ten long-term priority program areas and established task forces to develop a long-term program in each area. Terms of Reference were approved for each task force which stress the need to project at least ten years in the future, to establish priorities, to identify cooperative projects which need to be funded in common, and to take relevant new technology into account. The ten areas selected are readiness, reinforcement, reserve mobilization, NATO's maritime posture, air defense, communications, command and control, electronic warfare, rationalization including standardization and interoperability, consumer logistics, and theater nuclear force modernization.

Typical of these, a special rationalization task force is developing plans and procedures for harmonizing Allied R&D armaments production, as is essential for achieving standardization or at least interoperability. It is attempting to design a workable periodic armaments planning system, including procedures for preparing NATO "military equipment need statements," measures for facilitating licensing or coproduction, and cooperation in all phases of equipment development and procurement. Of course, each of the Long-Term Program Task Forces will work on specific standardization and interoperability measures in their respective areas. (See the Fourth Report to Congress on NATO Rationalization/Standardization for more complete descriptions of the task forces.)

2. Special Budget Elements Relating to NATO

Interwoven with all the other aspects of NATO defense inprovement, and indispensable to their success at politically feasible cost, is greater inter-Allied willingness to cooperate in the field of R&D and armaments production. President Carter stressed this aspect heavily in his third defense initiative put forth at the NATO Summit, and promised full US collaboration.

a. NATO Initiatives

The DoD NATO Action Plan has provided the framework for a set of NATO initiatives selected towards improving NATO force capability, standardization and interoperability by cooperative programs. The initiatives are in consonance with Presidential and Congressional direction. The Congress has clearly expressed their direction and interest through Public Law 94-361 of CY 1976. This law stresses that the policy of the United States is to ... "the maximum extent, initiate and carry out procurement procedures that provide for the acquisition of equipment which is standardized or interoperable with equipment of other members of NATO...." This administration is determined to follow that direction.

In response to guidance received from OSD, the Services submitted studies last fall which identified potential purchase/joint development of European equipments. The study set forth four different categories for possible cooperation; cooperative R&D, coproduction, production under license, and buy-off-the-shelf. A further breakdown identified three categories of equipments; those suitable for present consideration, those which appear promising depending upon results of test, evaluation or further study, and those in preliminary stages of consideration or otherwise requiring resolution.

Our NATO initiatives include reinforcement of current actions, such as our PATRIOT initiative, or new efforts such as evaluation of the SP-70 UK/FRG/IT Self-Propelled Howitzer. We have also identified a number of on-going programs for intensive management. These initiatives are further described in the sections dealing with our Tactical Warfare and C^3I Programs.

b. Foreign Weapons Evaluation

Increased standardization with our NATO Allies is necessary if NATO is to maintain an adequate deterrence and fighting capability within the resources available to the Alliance. Public Law 94-106 requires the Secretary of Defense, to the maximum feasible extent, to initiate and carry out procurement procedures that provide for the acquisition of equipment which is standardized or interoperable with members of NATO.

DoD Directives require that foreign systems must be evaluated and considered as possible alternatives prior to initiation of new US developments. To support this evaluation requirement, we have established Program Elements with each Service. These programs provide for evaluating foreign developed weapon equipment having potential for application toward US requirements thereby improving standardization and interoperability of weapon equipment with NATO and minimizing duplicative development expenditures.

Presently under evaluation, and planned for completion in FY 1978, is a series of bomblets which are components of the FRG's STREBO air-to-surface cluster munition system. Other evaluations planned for FY 1978 are the French Matra general purpose bomb, the FRG's Mauser F 30mm cannon, the Oerlikon KCA 30mm gun, the Swedish FFV 50 Cal gun pod, Belgian and Italian 9mm aircrew handguns, and the Norwegian Kongsberg PPD-440 bomb fuze. FY 1979 efforts will include the French Matra 550 air-to-air missile, the FRG's Mauser 27mm gun, the French Beluga Cluster munition, and French and German 9mm aircrew handguns.

Other potential candidates for the FY 1979 program include: (1) the Penguin, a Norwegian surface-to-surface missile and its associated fire control system; (2) TAVITAC, a French two-man Naval Tactical Data System display console; and (3) interoperability of a US NATO SEASPARROW with the Italian ASPIDE missile.

3. New Initiatives in Cooperative Armaments Planning and Management

a. Standardization Packages (Families of Weapons)

While the NATO countries have a much stronger industrial base than the Warsaw Pact countries, we must learn how to use it efficiently in cooperative efforts. Any plan which we evolve for cooperation in armament production must recognize that NATO is a confederation of sovereign nations each of which has unique national needs and interests. Therefore, the problem for national armament directors of NATO nations is to determine how to cooperate in armament programs to improve the military effectiveness of NATO in a way that is compatible with each nation's legitimate economic interests. We have tried coproduction as a solution to this problem--an arrangement by which each nation involved receives a share of the production responsibility proportionate to its buy in the program. This technique achieves the desired standardization and maintains each country's economic interest. However, it usually leads to increased unit cost because no one factory is able to achieve production economies by building all of the units. We therefore cannot rely on this approach as our dominant means of cooperation because we will not be able to afford the quantities of weapons needed to compete with Warsaw Pact forces. An alternative solution is to work out agreements on families of weapons where each country agrees to take responsibility for a given weapon in the family and all other countries agree to buy that weapon from the single manufacturer. Aggregating over the entire family, each country will receive a proportional share of the total effort. By this concept of mutually agreed families of weapons we can achieve the military benefits of standardization, as well as the economic benefits of shared production and reduced unit cost.

Some of the other on-going procedures to improve effective cooperation in the Alliance include Periodic Armaments Planning System (PAPS), increased effectiveness of NATO Standardization Agreements (STANAGS) and the use of reciprocal procurement MOU's.

b. Periodic Armaments Planning System (PAPS)

The NATO Conference of National Armaments Directors (CNAD) is investigating procedures for creating a Periodic Armaments Planning System (PAPS). NATO members already have provided five-year equipment replacements lists and descriptions of their arms procurement procedures. The success of PAPS--an institutionalized process for planning and programming key NATO research and development and procurement--is basic to more efficient resource allocations within the Alliance.

A Periodic Armaments Planning System should provide measures not only to coordinate national programs, but also to establish the standardization/interoperability criteria which nations can adopt in their development programs, e.g., common specifications and standards. Within national ministries of defense, procedures should be strengthened which require at each milestone in the development process of a new system, an evaluation of the effect on NATO standardization/interoperability.

c. NATO Standardization Agreements (STANAGS)

NATO studies have concluded that some of the problems in weapons standardization and associated interoperability among forces are due to deficiencies in STANAGS in the basic areas of assemblies, components, spare parts, and materials (ACSM). Subsequent US studies have indicated that both the quantity and quality of STANAGS are lacking, that more STANAGS are needed and many existing documents are outdated and unusable. NATO now has only 600 STANAGS of which 300 (approximately) pertain to materiel.

In order to improve this condition, during 1975, the US proposed a major new initiative which resulted in the formation of a cadre group of national materiel standardization directors to oversee, among other things, all activity in producing STANAGS in the ACSM area. The group (AC/301) held its second meeting in November 1977 and is expected to foster the preparation ofSTANAGS to meet the needs of NATO in the long term as well as the near future.

d. Reciprocal Defense Procurement Memoranda of Understanding (MOUs)

Since late 1975 the US has had a Memorandum of Understanding with the UK aimed at promoting Alliance standardization by (1) reducing, on a reciprocal basis, impediments to defense procurement; (2) eliminating the need for cumbersome item-by-item offset arrangements; and (3) working toward an equitable equilibrium on defense programs. The US implementing instruction for this MOU was signed by the Secretary of Defense in May 1977. We are discussing similar agreements with other Allies. We have emphasized, however, that such bilateral arrangements are intended to be consistent with broader NATO agreements on defense trade cooperation which may evolve in the Alliance framework and to be based on mutual efforts. Specifically our European Allies, through the Independent European Program Group, have indicated their willingness to begin talks in NATO with Canada and the US to explore ways to increase the opportunities and reduce the obstacles to Alliance-wide cooperation in defense trade.

C. SPECIFIC PROGRESS TOWARD STANDARDIZATION AND INTEROPERABILITY

The primary goal of cooperation in armaments is increased military effectiveness within probable NATO budget constraints. The more that equipment, munitions, and their logistic support are interoperable, if not fully standardized, the more effectively Allied forces can operate together against the common foe. Standardized or interoperable C^3 (command, control, communications) and interchangeable munitions in particular have a very high payoff in force effectiveness.

We have a number of specific programs and activities underway that demonstrate real or potential progress toward the NATO standardization and interoperability objective.

1. Army Programs

a. ROLAND Air Defense Missile System

In 1974 the US selected the French-German designed ROLAND II air defense missile system instead of developing a new US short range air defense system. Hughes Aircraft Corporation won the bid for technology transfer, fabrication and test of the US ROLAND. The three countries have established a joint control committee to insure a maximum level of standardization between the European and American configurations, and Norway plans to purchase the US version. ROLAND entered into production in Europe in 1977, and a US production decision will be made in 1978. Unanticipated difficulties in the exchange and translation of detailed technical information, resulting in some US timetable delays and cost increases, have now been resolved with data transfer essentially complete.

The restructured program approved by OSD in December 1976 with total RDTE expenditure is planned at $276 million.

b. COPPERHEAD Cannon Launched Guided Projectile) (CLGP)

Type classification is now scheduled for 2nd quarter 1978. The UK, FRG and Canada have expressed definite interest in acquiring CLGP. A Memorandum of Understanding (MOU) with the UK is under negotiation for interdependent development with US as lead country and for making independent tests and evaluation as a basis for a procurement decision either through FMS or in-country production. The FRG and Canada have indicated interest in negotiating a similiar MOU.

c. Modular Infrared Equipment

Using Common Modules which can be configured to satisfy the requirements of a variety of systems, the US is developing infrared equipment to be used by the Army, Navy and Air Force in weapons systems requiring a night vision capability. The US has loaned developmental models of the equipment to the FRG, the UK and France. In FY 1977 a MOU was prepared for the cooperative production of these modules with FRG, which is expected to use them on the Leopard tank, Luchs reconnaissance vehicle, and Marder infantry vehicle. We expect this MOU will be approved in early CY 1978. By 1979 NATO Allies' equipment will begin to have the night vision capability of the Common Module.

d. 155mm Howitzer Ammunition

All US projectiles and propellants currently under development are being designed to meet a 1969 MOU on 155mm ammunition standardization, ratified by the US, the UK, the FRG and Italy. Although this memorandum requires all new 155mm ammunition to be interoperable with the 155mm howitzers of other member countries, it is not sufficiently comprehensive to achieve complete ballistic standardization. In order to develop a more definitive agreement, the four countries agreed to revised wording of the MOU during quadrilateral working group meetings in 1977. Ratification by the four countries is expected in 1978.

e. Main Battle Tanks and Tank Guns

Under the provisions of a 1974 MOU the US and the FRG are seeking to achieve maximum standardization between the American XM-1 and the German Leopard 2 tanks. To ensure maximum commonality the US and the FRG negotiated an Addendum to the MOU in July 1976. This new agreement identified specific common items for the two tanks including guns, ammunition, fuel, engine, transmission, gunner's telescope, night vision device, fire control system, track and metric fasteners. Additionally, the US agreed to modify the XM-1 turret design to ensure it will be able to accommodate a 120mm gun as well as a 105mm gun. In mid-1976 the US entered into separate agreements with the UK and the FRG to follow-up the 1975 Tank Main Armament Evaluation Program with further tests of 105mm and 120mm tank guns. Firing tests of the US and UK rifled bore and FRG smoothbore systems began in November 1976 with the objective of determining a standardized gun configuration capable of countering the postulated long-term armor threat. To permit full compliance with Congressional guidance the evaluation of the gun system was extended until December 1977. Additional tests and evaluation of the candidate gun system were completed in December 1977. A US decision was announced January 31, 1976 to recommend to the Congress that the FRG's 120mm smoothbore gun system design begin US development and testing to adapt it to production as the future main armament system for the XM-1 tank.

f. PATRIOT (SAM-D) Surface-Air-Air Missile

The US, Belgium, Denmark, France, the FRG, Netherlands, and the UK are participating in a NATO study on future SAM's. US/FRG have just concluded a bilateral study on the role of PATRIOT in NATO. US plans to replace all NIKE-HERCULES and I-HAWK with PATRIOT. PATRIOT (formerly called SAM-D) is in full engineering development, with the US deployment scheduled for early 1980s. No other NATO nations have announced plans although the FRG has established a full time liaison staff with PATRIOT in Huntsville, Alabama. A NATO Project Group was established in FY 1977 to consider PATRIOT as the replacement for NIKE-HERCULES and a second NATO study group was established to consider PATRIOT and EURO-SAM as a possible replacement for I-HAWK to meet the air thrust of the 1980s and to better achieve interoperability and standardization of NATO ground-based air defense. The first meeting was held in Brussels, 20-24 JUne. The Army has provided a coproduction plan to OSD which identifies options for NATO coproduction.

g. General Support Rocket System (GSRS)/Multiple Launch Rocket System (MLRS)

The US Army has an urgent need to supplement cannon artillery with a low cost indirect fire multiple rocket launcher system. The GSRS will provide a nonnuclear capability to suppress the massive numbers of enemy counterfire and air defense weapons, especially during surge conditions. The Army has evaluated existing and planned NATO Allies systems and has found them to be noncompetitive in satisfying the GSRS requirement. The Army initiated development of the GSRS in September 1977 but continues to actively seek Allied participation toward a common solution. The planned US IOC date is in the early 1980s.

The US and FRG have recently signed a Declaration of Intent on development of a medium multiple launch rocket system. The signatories intend to establish an agreement on the design, development and production of a MLRS which satisfies the agreed upon tactical requirements of both nations and potentially meets similar requirements of other NATO armies. A detailed Memorandum of Understanding will be developed prescribing the specific steps for a cooperative MLRS developemnt and production program.

h. Bridging for the 1980s

NATO bridging equipment requirements are currently met through the capabilities of individual member nations, which include a broad spectrum of types of bridging to meet varied mission demands. In accord with 1972 and 1974 agreements, the US, the UK and the FRG are participating in a cooperative program with each nation conducting research and development to satisfy particular bridging requirements.

The interim phase, examining alternatives and conducting feasibility tests prior to entering final engineering development is to be completed in 1978 with a final design selection to be made in 1979. A tentative agreement on cooperation during the development phase and subsequent procurement positions for Bridging in 1980s was reached in 1977. All NATO nations are informed of the progress of the bridging efforts through regular status reports. Additionally, short term standardization is being accomplished by an ongoing (FY 1977 contract) US purchase of a UK lightweight, dry span, medium girder bridge, to partially replace the Bailey Bridge. Also, the FRG has tested the US developed ribbon bridge, accepted it, and is considering producing it under a licensing agreement for their own interim requirement.

2. Navy Programs

Under the Terms of the various Government to Government Agreements, the US Navy initiated the following bilateral and multilateral projects. These projects demonstrate real or potential progress toward the NATO standardization and interoperability objectives.

a. Medium Range Air-to-Air Missile (SKYFLASH)

The US Navy continues to assist the UK in flight tests of the air-to-air version of the British SKYFLASH missile. The US will evaluate the SKYFLASH in order to determine whether or not to purchase some quantity of them for use with the US F-4 aircraft. The UK has been invited to witness the tests and will receive the resulting test data.

b. Anti-Ship Missile Defense System

The US and Germany are cooperating in the joint development of an anti-ship missile defense system, with the potential for full scale development and joint production. In 1976 the US Navy signed a MOU with Germany, establishing a jointly funded missile test flight validation program which will be concluded in early 1978. The Navy is in the process of negotiating a follow-on MOU for full scale engineering development to commence early to mid-1978. Denmark, Norway, Italy and The Netherlands have expressed interest in the joint engineering development.

c. AIM-9L Air-to-Air Missile

In October 1977, the US signed a MOU with Germany to coproduce the AIM-9L missile in Europe. An amendment to admit the UK, Belgium and Italy was sent to Congress on 22 December 1977. In addition to employment of AIM-9L on numerous US aircraft, the missile will be compatible with the F-16 being procured by Belgium, Denmark, The Netherlands, Norway and the US, as well as the TORNADO Multi-Role Combat Aircraft (MRCA) under development by a European consortium consisting of Germany, Italy and the UK.

d. Surface-to-Surface Missile System (PENGUIN)

The US Navy is negotiating a MOU with the Royal Norwegian Navy (RNON) on a test and evaluation project to adapt the Norwegian PENGUIN MK 2 surface-to-surface missile system to US Navy combatant craft. The PENGUIN Missile MK-1 was developed in 1962-1970 by the RNON with US Navy participation. The missile and the system have been employed operationally in RNON since 1972. The system provides combatant craft and patrol boats with the means to launch surface-to-surface anti-shipping missiles against surface vessels. The PENGUIN missile system MK-2 is a further development of the MK-1 system. The MK-2 system has been evaluated by RNON and is now in production for the RNON and other European countries. It is expected that the MOU will be signed by mid-1978.

e. NATO SEA GNAT (Ship Launched Decoy System)

The NATO SEA GNAT project is investigating the feasibility of collaborative development of a ship-launched decoy system for defense against the anti-ship missile. The US is the principal development nation, with Denmark, Germany, Norway and the UK as partners sharing the costs. Participants signed a MOU in December 1976 implementing the project, and the development phase has begun. A further production MOU is presently being drafted.

f. NATO Anti-Surface Ship Missile (ASSM II)

The US Navy is participating in a NATO project with Denmark, France, Germany, Norway, the United Kingdom and The Netherlands for the development of a second generation anti-surface ship missile. This missile would be similar to HARPOON in size and range, but it would be able to accept varying modules within its configuration to meet different national requirements. Participants completed a prefeasibility study in 1975 and signed a MOU for a full feasibility study in May 1977. The US expects to continue participation in the NATO ASSM II. Negotiations for the next stage (Advanced Development) are presently underway. This is a European led effort with UK, France and Germany having major roles, and the US, Norway, The Netherlands and Denmark minor ones.

g. Explosive Resistant Multi-Influence Sweep System (ERMISS)

A cooperative development program is being negotiated with France, Germany, The Netherlands, the UK and the US on an Explosive Resistant Multi-Influence Mine Sweeping System (ERMISS). This project is the result of a bilateral feasibility effort conducted by the US and German Navies. In 1976 a NATO Project Group completed a prefeasibility study which concluded that a relatively small ERMISS craft can adequately perform a mine-sweeping task. Based on the results of this study, the ERMISS project will proceed into a three-year cooperative research and development phase commencing in 1978. Participating nations are now negotiating a MOU to determine cost sharing.

3. Air Force Programs

a. Munitions for State B Cross-Servicing

Stage B cross-servicing is the capability to rearm and prepare aircraft of other countries for combat missions. Stage A involves only fuel/oil/LOX; Stage B is Stage A plus limited maintenance and rearming. The concept should increase overall combat capability in NATO through increased efficiency and flexibility, increased sortie rate, optimized efforts against certain classes of targets, and reduced dependency on favorable weather at launch/recovery bases. Obstacles to implementation of a full Stage B capability are cross-certification of a common family of weapons, training for maintenance and munitions personnel, low stocks of munitions in Allied inventories, and lack of realiable C^3.

The identification and validation of the common family of air-to-air and air-to-surface munitions is the most important initial effort toward attaining a viable Stage B cross-servicing capability. In concert with the North Atlantic Council Ad Hoc Committee on Equipment Interoperability, Working Group on Tactical Aircraft Rearming, we have identified an initial list of candidate munitions for both air-to-air and air-to-surface.

The technical aspect of this capability in Allied nations is addressed under auspices of the Conference of National Armament Directors (CNAD). Implementation of the capability is the responsibility of the major NATO commands.

b. NAVSTAR Global Positioning System (GPS)

This space-based system, which will enter full scale development in FY 1979, will provide worldwide continuous, three dimensional position and velocity information to all interested NATO users. Reconnaissance, targeting, force development, all-weather delivery of guided and free-fall munitions and joint military operations will be significantly enhanced by integrating NAVSTAR equipment with weapons system components. The program will accommodate initiatives for NATO standardization and interoperability through widespread use of the common coordinate grid provided by NAVSTAR.

c. Joint Tactical Information Distribution System (JTIDS)

JTIDS is a joint-Service development, led by the U.S. Air Force, to develop a secure, highly jam-resistant digital information distribution system for use in a tactical combat environment such as that anticipated for a European scenario. Different classes of terminals are being developed for large airborne platforms, for smaller aircraft and ships, and for combat applications. Surface terminals are being developed for interface with ground or shipboard command and control centers. The US has proposed that NATO adopt JTIDS as the basis for ECM Resistant Communications Systems. We anticipate NATO-wide acceptance following Frequency Clearance in Europe.

d. NATO AWACS

NATO's acquisition of its own force of E-3A derivative aircraft will greatly enhance the military effectiveness of the Alliance. As a part of the total NATO Airborne Early Warning and Control (AEW&C) system (E-3A/UK NIMROD), it will increase the effectiveness of Allied weapon systems while helping to standardize system capabilities. This AEW&C system, with appropriate equipage, basing, and modifications to the European ground radar environment, will provide for improved air defense and counterair operations for NATO forces. With its long range, all-altitude radar, capable of detecting airborne targets over land as well as water, NATO AWACS will provide deep-look surveillance and a substantial measure of deterrence against potential Warsaw Pact threats. Should deterrence fail, it will improve the military responsiveness of the Alliance through its early warning, tracking, and information dissemination capabilities. The NATO AWACS will be interoperable with the USAF E-3A, the UK NIMROD, and with the US tactical and European national command and control systems ashore or afloat.

e. NATO Aircrew Electronic Warfare Tactics Facility (AEWTF)

NATO has recognized a need for a multinational capability to test airborne electronic warfare (EW) equipment and train aircrews/maintenance personnel in Central Europe. In October 1973, the NATO Air Forces Armaments Group (NAFAG) established an Ad Hoc Group to establish the requirements. It was recognized early that a large government-owned range of the Nellis-type would not be feasible so a multiple-site solution was proposed. A multinational subgroup (Belgium, France, FRG, The Netherlands, UK, and US) examined possibilities offered by several specific sites, considering such factors as electro-magnetic interference, security, airspace availability, and ground environment. A basic plan was developed incorporating a general concept of operations, a threat simulator list in relation to proposed sites, and a phased implementation schedule. France, Germany, UK, and US have agreed to contribute funding for acquisition of the needed equipment. The participating nations are developing a MOU concerning the arrangements for establishing and operating this much needed facility.

f. F-16 for NATO

The F-16 program contributes to NATO commonality/interoperability by virtue of the fact that five NATO nations are acquiring it. A coproduction arrangement with the European Participating Governments (EPG) provides for acquisition of 650 aircraft by the US and 348 aircraft by the EPG. An economic offset arrangement is provided based on aircraft procurement value. European manufacturers will share in the production and will share in a percentage of further foreign sales.

The US and the EPG intend to maintain standardization through tight control of all country peculiar modifications. We are also discussing other areas of cooperation such as joint training, joint testing, colocated bases and combined logistics.

V. STRATEGIC PROGRAMS

A. INTRODUCTION AND SUMMARY

"This Administration is determined to maintain the U. S. strategic deterrent. We would prefer to maintain it through equitable and verifiable agreements for nuclear arms limitations and reductions. But we will maintain it by whatever means and resources are necessary. No one should have any doubts whatsoever on that score"--Harold Brown, September 15, 1977.

To maintain our strategic deterrent we remain firmly committed to diversity in our strategic forces. The purpose of this diversity is to be relatively insensitive to unexpected developments and deployments by the Soviets and to an unanticipated failure of one of our strategic force components.

Our SLBM systems, at-sea and alert, are inherently survivable and therefore form a sound foundation for our deterrence posture. The survivability of these systems leads to stability since the threat of retaliation will remain no matter what level of attack might be launched against us. We cannot, however, rely solely on our SLBM forces for deterrence since an effective ASW system, developed and deployed by the Soviets, could leave us open to a Soviet disarming first strike and nuclear blackmail. We consider that Soviet development of such an ASW system is unlikely in the near term but cannot dismiss the possibility in the medium or far term.

Land based missile systems provide us with our most tightly controlled and highest accuracy strategic system. Their fixed locations contribute to both of these advantages but this characteristic also makes them more susceptible to an enemy attack. While the accuracy of ICBM's need not always be better than SLBM's, that situation will continue at least for the next 5 to 10 years. This accuracy advantage, plus the need to hedge against a failure of our SLBM forces, argues for the retention of ICBM's in our mix of strategic forces.

The bomber forces provide different survivability and penetration modes, and permit a launch on warning without an irrevocable decision to attack.

Thus, our diversified forces provide a hedge against possible Soviet breakouts or breakthroughs, and provide high confidence in our retaliatory capability. We consider that the Soviets cannot achieve, in the near term, a credible capability to threaten these forces to the extent that they could not inflict unacceptable damage on the Soviet Union in a retaliatory strike.

We are committed to the maintenance of our strategic deterrent, but we have no illusions about the relative difficulty of doing so. The strategic balance between ourselves and the Soviets is not static; it is a highly dynamic process due principally to the substantial and continuing Soviet effort to increase strategic capabilities.

The Soviets are now deploying a fourth generation of ICBM's. These missiles are, almost uniformly, first class in terms of accuracy and payload. At the same time, they have four new ICBM's under development; they are continuing work on the SS-16 ICBM, which we believe to be intended as a land-mobile system, and are modifying four other missiles. In the face of a continuing and pervasive qualitative improvement in Soviet strategic nuclear capabilities, what are we doing to maintain our strategic deterrent?

1. SLBM's

Five TRIDENT submarines are currently under construction. The first will deploy in 1981. The TRIDENT I missile development program will be essentially completed in FY 1979 with initial deployment in a POSEIDON submarine scheduled for October 1979.

The SSBN force is the least vulnerable element of our mix of strategic forces. Based upon this fact, and the fact that TRIDENT continues to be the most cost-effective replacement for our aging POSEIDON force, we plan to continue procurement of TRIDENT consistent with SALT force levels. In order to provide near-term enhancement of POSEIDON survivability we also plan on backfitting the long-range TRIDENT I missile into a portion of this force, thereby increasing its operating area and resistance to any developing Soviet ASW threat. Finally, we will continue concept development of a follow-on TRIDENT II missile to provide the option of an SLBM capability against the entire target spectrum.

2. ICBM's

We will produce about 40 MINUTEMAN III missiles without reentry vehicles from the funds appropriated for FY 1977. These 40 missiles will not be used to increase the size of the MINUTEMAN III force, but will be stored as spares. Production will be terminated after the current buy. We do not plan to upgrade the MINUTEMAN II because of the large investment required, and the limited payoff--it would contribute nothing to the fundamental ICBM problem of increasing silo vulnerability.

The ICBM accuracy improvement program has been completed and will be introduced this year in the MINUTEMAN III force. The development of the Mk-12A RV is continuing toward an IOC in the early 1980's.

Rather than make further substantial investments in fixed based ICBM's, we plan to devote major efforts to a mobile ICBM system--M-X--to directly address the problem of fixed base ICBM vulnerability. While there is disagreement about when the vulnerability of fixed based ICBM's becomes unacceptably low, there is agreement on the trend. In the absence of a capability to defend fixed based ICBM's, a multiple aimpoint system can provide a viable ICBM force, in the face of a high volume, highly accurate attack.

3. Bomber Forces

During the past year the President decided not to proceed with production of the B-1 bomber. This decision did not reflect a judgment that the B-1 was not capable of performing the job for which it was designed. Rather the decision was based on the judgment that our progress in cruise missile development has been such that the use of cruise missiles in lieu of procuring the B-1 will better assure the effectiveness of the bomber component of U. S. strategic forces into the 1980's, and moreover do this job at less overall cost.

There are those who read into the President's B-1 decision the demise of manned bombers and complete reliance on cruise missiles. These judgments are incorrect. For several years the Department of Defense has endorsed the concept of a mixed force of manned bombers and cruise missiles. Such a force stresses Soviet air defenses since the problems of defending against bombers and cruise missiles are different in some fundamental ways. Our approach to this mixed force for the medium term is to use the existing B-52's as penetrating bombers and also as cruise missile carriers and the existing FB-111's as penetrating bombers. As a further possibility for significant early expansion of the capability of this element of our strategic forces, should it be required, we will be evaluating the use of a wide-body jet as a cruise missile carrier.

When the President decided to terminate production of the B-1 he also decided to continue the B-1 R&D program and to hold open for a few years the option for B-1 production in the event that should be deemed necessary. During the coming year we will be examining various ways of maintaining a bomber production option through the 1980's.

In summary, there are no acquisition actions in FY 1979 to produce new bombers but we have programmed substantial developmental activities in cruise missiles, B-52 modification and enhancement, and a cruise missile carrier assessment.

4. Strategic Defense

Our active forces for air defense and ballistic missile defense (BMD), except for warning and assessment, have been reduced, either through treaty or by our deliberate decision to very low levels.

In air defense our objective is to prevent unchallenged access to our airspace by enemy manned bombers. In BMD we seek to maintain our technological lead over the Soviets and maintain, but without prototype development, an underlying capability to rapidly develop and deploy a defensive system for ICBM forces, C^3 systems or other high-value targets, if such a defense be required.

Another area of defense which is receiving emphasis this year is Space Defense. The Soviets have developed an anti-satellite capability and have conducted numerous tests demonstrating an ability to attack low altitude satellites. Since we have a significant dependence on space assets for essentially defense-related capabilities, this potential vulnerability is a matter of serious concern. Our objective is to reach a verifiable agreement with the Soviets for a mutual sanctuary for space assets. However, as a hedge against the inability of achieving this objective, we are devoting substantial R&D resources to protect our satellites from attack.

The RDT&E and procurement requests for FY 1979 are summarized below:

	RDT&E	Procurement
Strategic Offense	$1.5B	$3.6B
Strategic Defense	.4B	.3B
Strategic Control	.3B	.2B
	$2.2B	$4.1B

B. OFFENSIVE SYSTEMS

The overall objective of strategic offensive forces is to provide militarily effective systems to deter strategic nuclear attack on the U. S., its allies and its forces overseas. The achievement of this objective requires that we devote major attention to the basic problems of prelaunch survivability and penetrativity in the face of Soviet quantitative advantages in offensive and defensive capabilities and evolving qualitative improvements. While we consider it unnecessary to match the Soviets quantitatively in all our measures, our programs are structured to assure that we maintain essential equivalence, and therefore deterrence, through technological advantages and the capability to increase quantitatively if required.

The major objectives for the FY 1979 program for Offensive Systems are to: (1) complete the development of the TRIDENT I missile, and continue the production of the TRIDENT submarines and TRIDENT I missiles; (2) complete the competitive development of the Air Launched Cruise Missile; (3) continue the advanced development of M-X, a mobile ICBM to assure prelaunch survivability of an effective ICBM force; (4) continue the development of options to maintain or improve the effectiveness of strategic offensive forces (SLBM Improved Accuracy, TRIDENT II missile, B-1, Cruise Missile Carrier); and, (5) broaden the technology base for future initiatives for preserving U. S. strategic offensive capability (ABRES, SSBN Security, ASALM, Strategic Bomber Enhancement).

1. Sea Launched Ballistic Missiles

The at sea SLBM force is the most survivable element of the U. S. strategic force. Preservation of our strategic posture requires continuing reliance on these weapons into the 1980's and beyond. Development and deployment of the TRIDENT Weapons System is our principal effort toward providing an SLBM force with the greatest possible capability to respond to emerging and unforeseen threats.

Several other R&D efforts in FY 1979 are devoted to upgrading the SLBM force effectiveness. The SSBN Security Technology program conducts technological research and analysis to assess the potential Soviet ASW threat to our SLBM force and to develop technology for countermeasures where appropriate. The FBM Systems program develops and procures improvements to the deployed SLBM force. The Strategic Technical Support program develops strategic concepts and identifies technology requirements and the SSBN Subsystem Technology program develops technology for future SSBN's. The Seafarer ELF communications system will enhance the day-to-day survivability of the SSBN force by relaxing the speed and depth constraints currently associated with SSBN communications systems.

a. TRIDENT Weapons System

(RDT&E: $280.6 Million, Procurement: $2456.6 Million)

The principal objectives of the TRIDENT Weapons System program are: to develop and procure the new long range TRIDENT I missile for backfit into the deployed POSEIDON submarines and deployment in the new TRIDENT submarines; to develop and procure the TRIDENT submarines capable of launching the TRIDENT I missile and the larger more capable TRIDENT II missile; and to develop the TRIDENT II missile which could utilize the full launch tube envelope of the TRIDENT submarine for improved performance and capability.

(1) TRIDENT I (C-4) Missile System

(RDT&E: $191.8 Million, Procurement: $892.3 Million)

Through February 1, 1978, 10 TRIDENT I development flight tests have been successfully conducted from a flat pad at Cape Canaveral.

The TRIDENT Mk-4 reentry body design has been successfully tested in these development flights and in DOE warhead tests. The Mk-500 EVADER design has also been tested on TRIDENT I development flights. The Mk-500 EVADER is designed to provide an early deployment option if it becomes necessary to counter Soviet SAM upgrades or ABM treaty abrogation. Testing of the TRIDENT I will continue in FY 1978 with emphasis on the tactical prototype design. Development of supporting systems such as fire control and navigation will continue. Of particular interest will be the result of the Electrostatically Supported Gyro Monitor (ESGM) development. This development, in conjunction with the TRIDENT missile stellar-aided inertial guidance system, should extend the intervals between position fixes and resets of the TRIDENT navigation system and thereby significantly decrease mast exposure and the resulting potential for increased SSBN vulnerability. In FY 1979, the TRIDENT I missile system development will be largely completed, culminating in Production Evaluation Missile flight tests from a TRIDENT I backfit SSBN in March 1979 and the launch of the first backfit Demonstration and Shakedown Operation (DASO) from a POSEIDON submarine in July 1979.

The TRIDENT I missile was approved for production following the December 1976 DSARC. We plan to deploy TRIDENT I in the TRIDENT submarines and in 10 POSEIDON SSBN's. The operational availability date of TRIDENT I is September 1979 and initial deployment will be in a POSEIDON SSBN.

(2) <u>TRIDENT II Missile System</u>

<u>(RDT&E: $15.0 Million)</u>

The TRIDENT I missile was sized and designed to allow for backfit in POSEIDON submarines with minimum modification and for deployment as the initial weapon of the TRIDENT submarine. When deployed in the larger (about 50% larger) TRIDENT submarine launch tube, the TRIDENT I missile does not fully exploit the potential range or payload capability as compared to a missile optimized for the TRIDENT submarine. Concept definition began in FY 1976 to better define the requirements for improved SLBM capability and the TRIDENT II alternatives that could contribute to satisfying these requirements. The FY 1979 effort will continue concept definition leading to a DSA[illegible] I in early FY 1980.

(3) <u>TRIDENT Submarine</u>

<u>(RDT&E: $73.8 Million, Procurement: $1564.3 Million)</u>

TRIDENT submarine subsystem development has been proceeding in accordance with plans. While some subsystem testing remains to be completed and some subsystems can be completely tested only at sea on the lead ship, all major subsystems have been delivered to the ship builder on time. Nevertheless, delays in construction have occurred primarily as a result of inefficiencies and lower than expected productivity. Delays in delivery have been projected for the 5 ships currently under contract. New management initiatives have been implemented and it is expected that the program will be back on the original schedule by the time of the delivery of the sixth ship in December 1982. The Navy estimates that initial deployment of the TRIDENT submarine will occur in January 1981.

b. <u>FBM Systems</u>

<u>(RDT&E: $135.9 Million, Procurement: $42.3 Million)</u>

The FBM Systems program consists of efforts for improvements to the deployed SLBM force effectiveness and their applications in the future.

(1) <u>Linear Chair</u>

<u>(RDT&E: $7.1 Million)</u>

This program will develop countermeasures that will reduce submarine vulnerability to open ocean search and detection and mine warfare.

(2) <u>FBM System</u>

<u>(RDT&E: $7.1 Million, Procurement: $42.3 Million)</u>

This effort includes weapon system vulnerability and effectiveness projects including improvements to the FBM navigation and sonar systems. In FY 1979 we will start development of specifications and design drawings to convert a reserve fleet Maritime Administration (MARAD) C-3 hull in order to maintain logistics support to our overseas SSBN sites.

(3) <u>FBM Improved Accuracy Program (IAP)</u>

<u>(RDT&E: $102.3 Million)</u>

The basic objective of the IAP is to develop a better understanding of factors which govern SLBM accuracy and, based on this understanding, to establish the feasibility of improving weapon system accuracy. Our effort will continue to examine the error sources of the current SLBM systems and proposed accuracy improvements so that the potential benefits of improved components and advanced system concepts may be understood. An essential element of this program is the satellite tracking system (SATRACK) that will be used to separate inflight errors from errors due to initial conditions. This system, which will use precision missile tracking signals from the NAVSTAR GPS Phase I satellite, is expected to be operational for tracking TRIDENT I missile development flights near the end of FY 1978. The FY 1979 program continues the analysis of TRIDENT I test missile flights and testing of improved components. If successful, a development program will be defined that will provide the option for improved accuracy in the TRIDENT II missile.

(4) SSBN Unique Sonar
(RDT&E: $19.4 Million)

The SSBN Unique Sonar program will develop improved sonar processing equipment (ISPE) for POSEIDON SSBN's. The improved displays and information and signal processing associated with ISPE will permit full utilization of the capability of existing sonar sensors with a reduction in manning levels.

c. Future Systems
(RDT&E: $8.5 Million)

The SSBN Subsystem Technology and the Strategic Technical Support programs have as their objective the identification and development initiation of technologies that could lead to more efficient sea-based strategic systems in the future.

(1) SSBN Subsystem Technology

(RDT&E: $5.4 Million)

This program will identify those areas of technology which offer significant promise of improving the cost effectiveness of SSBN's. The program will initiate investigation in these areas, and will apply the technology advances achieved under these programs to specific designs for more cost effective SSBN subsystems. The FY 1979 program continues investigation of technology identified in the FY 1977 and FY 1978 programs.

(2) Strategic Technical Support

(RDT&E: $3.1 Million)

The Strategic Technical Support program develops strategic concepts, defines systems and identifies technology for future sea based weapons. In addition, its efforts include; identifying required reentry system technology to and reviewing the technology generated by the ABRES program, and identifying human factors and engineering that will contribute to maximizing human performance in the FBM submarine environment.

2. Land Based Ballistic Missiles

By 1986, the Soviets are projected to have a large inventory of missiles with significantly improved accuracy. The effect is to increase the vulnerability of our silo-based ICBM's and place an added burden on the other legs of the TRIAD. This will also degrade our strategic posture for time-urgent response against hardened targets. The only on-going program which addresses the near-term survivability of land based missiles is the MINUTEMAN silo upgrade program. This work is scheduled to be completed in FY 1979. While fruitful, the MINUTEMAN upgrade program falls far short of coping with the potential threat in the mid-1980's.

M-X, a potential solution to this problem, would achieve its survivability through a combination of concealment and mobility. The multiple aimpoint approach combined with sufficient hardness assures that the kill of one M-X missile would require many attacking warheads. This ratio would discourage a pre-emptive "first strike" against the system and, in so doing, would provide a measure of stability.

a. MINUTEMAN

(RDT&E: $54.1 Million, Procurement: $68.7 Million)

During this past year the MINUTEMAN III FY 77 production was terminated by the Department of Defense and then restarted due to failure of the rescission proposal. However, production will be terminated following the FY 1977 buy which will consist of about 40 missiles. The efforts to be continued include silo upgrade, guidance improvement, Mk-12A, and radar signal processor. (These efforts, except for silo upgrade, are aimed at making the surviving MINUTEMAN more effective.) The silo upgrade program will be completed in FY 1979, with the last production funding in FY 1978.

The guidance improvement software will be implemented in all MINUTEMAN III missiles in FY 1978 with some follow-on R&D testing to be accomplished in FY 1979. This software, in conjunction with improved geodetic and geophysical data, will materially improve the actual MINUTEMAN III accuracy.

The Mk-12A development is about 90% complete. The R&D program will be completed in FY 1979. The planned program includes retrofit of 300 MINUTEMAN III missiles which now carry the Mk-12.

The radar signal processor is a planned part of the MINUTEMAN site security system. This processor will be developed to reduce the high number of false alarms of security zone violations now occurring at MINUTEMAN launch facilities. Production go-ahead for this unit is planned for early calendar year 1981.

b. M-X (Includes Advanced ICBM Technology) (RDT&E: $158.2 Million)

The M-X program is now in the validation phase and is designed to focus on those items which comprise the key technology and costs in the weapon system concepts. Of major concern from the cost standpoint is the basing mode. In order to make the M-X a viable weapon system, numerous credible aimpoints must be projected for each missile such as in the trench or the shelter approach. The basing mode and the equipment and facilities necessary to allow concealment and mobility of the missile, will comprise about half of the total system cost. It is imperative that the technology and the cost associated with the several basing approaches be thoroughly examined and validated. Nearly half of the development funds through FY 1978 will have been spent on basing design and basing associated effort. The emphasis on basing study and validation will be continued in FY 1979 so that the program will be ready for a full scale development decision during the year. Design and development will be initiated for the vehicles, facilities, ground power, command, control and communications and physical security system appropriate for the basing mode.

During FY 1979, competitive contracts will be awarded in guidance and control systems; reentry systems; post boost control systems; and 1st, 2nd, and 3rd stage boosters. In the guidance area, the Inertial Measurement Unit design will be initiated based on the preprototype Advanced Inertial Reference Sphere (AIRS) developed previously under the Advanced ICBM Technology Program. In reentry, the technology demonstrated in the Advanced Ballistic RV (ABRV) design developed under ABRES will be considered in the M-X RV design. The booster designs will incorporate technology advancements in propellants, light-weight cases, and advanced nozzles developed previously. The post boost vehicle will incorporate technology advancements in axial engines, attitude control system engines, and propellant expulsion systems developed by the Air Force Rocket Propulsion Laboratory. System test planning will be initiated including design of flight and range safety instrumentation. Flight and targeting software will be designed.

3. Bombers

B-1 bomber procurement was terminated in FY 1977 while development was accelerated on the cruise missile. Our judgement is that the smaller cruise missile will be able to penetrate more effectively and deliver weapons at a lower cost than the sophisticated, much larger B-1 bomber, even in the face of advanced defenses. Nonetheless, to hedge against the unlikely event that the B-1 will still be needed, the option of producing it is being kept alive for a period of time by continuing the R&D program.

A mix of penetrating B-52's and standoff B-52's carrying cruise missiles will be maintained in our bomber force for the medium term. To insure that the B-52 can carry out its expanded role, we are planning to modernize its offensive avionics and analyze its potential self defense capabilities in more detail.

a. B-1

(RDT&E: $105.5 Million)

As of 1 January 1978 more than 870 flight hours have been accumulated on aircraft 1-3 and about 80% of the flight envelope has been cleared. The design of the aircraft is almost completed. Offensive avionics testing is progressing and is over 90% complete. Engines and structures testing is continuing. Fabrication of aircraft #4 is about 75% complete.

We plan to continue development of the B-1 through the 4th aircraft, which is the last R&D aircraft to be purchased. The first three aircraft will be flown until aircraft #4 begins flight testing at which time the testing on aircraft #1-3 will be terminated. Aircraft #4 will then be flown until its flight test objectives have been accomplished. Aircraft #4 is the first aircraft with defense avionics and testing of the totally integrated avionics will begin in February 1979. No deployment related efforts are planned.

b. B-52 Squadrons

(RDT&E: $64.9 Million, Procurement: $220.4 Million)

This program is to modernize the bombing and navigation system (BNS) on the B-52G/H. This will be the first BNS modification of significance since the B-52 was produced. The program will reduce B-52 O&M costs by replacing BNS parts no longer in production and increasing system reliability. We also plan to institute a program to improve the defensive systems on the B-52 based upon the results of studies conducted under the Strategic Bomber Enhancement Program. This program will be designed to quantify B-52 penetration capability beyond 1985 and improve the confidence level for mission success. Procurement will be initiated for modifications required to enable the B-52 to function effectively as a cruise missile carrier and for long-lead time provisioning for avionics items that have been identified.

c. Strategic Bomber Enhancement (RDT&E: $63.3 Million)

The purpose of this program is to sustain a technology base which will reduce the lead-time for system development when dictated by threat evolution. This year marks increased effort for the Advanced Strategic Air Launched Missile (ASALM) integral rocket-ramjet development. ASALM Technology Integration Studies will be completed during FY 1979 and competitive validation phase efforts will be initiated. ASALM propulsion validation ground tests will be completed and flight tests started. A study will be conducted to determine the most effective way of maintaining a manned bomber production option. Bomber defense technology will be accelerated with initial study efforts giving way to hardware demonstration.

4. Cruise Missiles

The weapon systems operational today are largely the extension of weapon system concepts that evolved during the 1950's. A continuing DoD goal is to develop low cost alternatives to existing weapons systems as applicable technology emerges. The cruise missile is the result of such a development initiated in the early 1970's. The technologies utilized include the small, efficient turbofan engines, accurate miniaturized guidance systems, lighter nuclear munitions, and techniques for reducing the radar cross section. In conducting the cruise missile programs, emphasis has been placed on competitive development, commonality of major component design, reduced observables, and a multiple launch platform and mission capability. The result has been a remarkably successful development program with two competing systems for the strategic bomber mission and with one of these systems also capable of employment in both the tactical anti-ship and theater nuclear land-attack roles.

Although our analysis affirms that the cruise missiles now being developed will penetrate current Soviet defenses, we plan to carefully test these missiles against the best array of defensive systems we can devise to determine if there are unsuspected vulnerabilities or weaknesses that can be exploited by an opponent. The outcome of these tests will be the basis for improvements to the weapons now in development and for possible follow-on weapons.

a. Air Launched Cruise Missile
(RDT&E: $237.8 Million, Procurement: $174.9 Million)

The Air Launched Cruise Missile (ALCM) program will provide the B-52 strategic bomber force with a long range nuclear armed cruise missile for standoff launch outside of enemy defenses. The air launched cruise missile will reduce bomber exposure to defenses and provide additional targeting flexibility.

The B-1 bomber production cancellation decision has placed increased importance on the ALCM contribution to the continuing effectiveness of the strategic bomber. To insure the best missile can be developed for the ALCM mission, the AGM-86B (the Boeing ALCM design) and the AGM-109 (the General Dynamics modified TOMAHAWK) have been placed in parallel competition for the bomber weapon role. The competition calls for each competitor to fabricate 14 missiles in FY 1978 and FY 1979 with 10 competitive flights of each missile type between May and October 1979. Both competitors will begin limited production in FY 1978. This will give us an opportunity to evaluate the production readiness of the competing missiles. Source selection will be completed by January 1980. We are also examining the option to develop a standoff cruise missile carrier in the event that the current force could not carry cruise missiles in sufficient quantities to meet projected requirements.

b. Sea Launched Cruise Missile
(RDT&E: $152.1 Million)

The Sea Launched Cruise Missile (SLCM) program combines in a single program the Navy's efforts to develop both anti-ship and land attack TOMAHAWK cruise missiles adapted for launch from both submarines and surface ships. The mix and numbers of anti-ship and land attack missiles carried can vary as designated by the theater commander to respond to the tactical situation.

(1) Land-attack SLCM

This program seeks to develop a sea-launched cruise missile whose attributes include: mobility and penetrativity combined with long range and high accuracy. The land-attack SLCM thus is a candidate for ultimate deployment with the theater nuclear forces.

(2) Anti-ship SLCM

Although the U. S. Navy is improving its anti-ship capability with the employment of the HARPOON missile, there are Soviet ships at sea today with anti-ship missiles that far outrange the HARPOON. With the deployment of the anti-ship SLCM in submarines and surface ships, the U. S. Navy would achieve a standoff advantage over the Soviets.

The FY 1979 SLCM program will continue full scale engineering development to include submarine launched test flights of the anti-ship and land-attack missiles. The program also will initiate in FY 1979 the surface ship launched test flights of the anti-ship and land-attack missiles. Initial production is planned for FY 1980.

c. Ground Launched Cruise Missile
(RDT&E: $33.0 Million, Procurement: $40.1 Million)

Development and deployment of the Ground Launched Cruise Missile (GLCM), a variant of the TOMAHAWK missile, would permit the release of dual capable aircraft for conventional missions in the European theater. Furthermore, this system would serve to offset an imbalance presented by the SS-X-20 missile, that is not presently opposed by any long range land based weapon system on the Continent save, perhaps, F-111 multipurpose aircraft and aged British VULCAN bombers. GLCM development funds are relatively low because of the commonality of GLCM with SLCM effected by the Joint Cruise Missile Program Office. Initial production funding for GLCM is planned in FY 1979 to allow an early deployment date.

5. Supporting Systems

Several supporting programs are included in FY 1979 to maintain the effectiveness and survivability of our strategic systems in the future. The SSBN Security Technology Program assesses Soviet ASW capability against our FBM fleet and evaluates potential countermeasures to these threats. The tri-Service effort in the Advanced Ballistic Missile Reentry Systems Program not only supports on-going missile development but also develops basic technologies such as penetration aids, heat shield material, terminal sensors, fuzing techniques, etc. Efforts in the KC-135 will emphasize re-engining so that the tankers not only will serve our bomber fleet much more efficiently but also will better meet the airlift and tactical aircraft requirements. For the B-52 bomber modernization effort, the FY 1979 Supporting Program includes the development of the Electronically Agile Radar for the bombing navigation system.

a. SSBN Security Technology Program
(RDT&E: $37.2 Million)

The SSBN Security Technology Program (formerly the SSBN Security Program) carries out a wideranging theoretical and experimental effort in advanced ASW in order to provide an authoritative technological assessment of the Soviet capability to threaten the FBM force. In addition, the program seeks countermeasures for any real or potential vulnerabilities that may be uncovered.

b. Advanced Ballistic Reentry Systems (ABRES)
(RDT&E: $105 Million)

The ABRES program, managed by the Air Force, is the principal effort within the Department of Defense to advance reentry technology.

The program provides a technology base which is used by all three Services for their respective developments in reentry systems. The program objective is to improve the performance, efficiency, survivability, and penetrativity of our reentry systems through the development and demonstration in a flight test environment of new materials, RV designs, and RV components. In addition, ABRES serves as a national center of expertise in reentry technology available to the SALT, BMD, and Intelligence communities.

While continuing to support the Mk-12A and TRIDENT developments, ABRES has been devoting an increasing portion of its budget to the development of technology for use in the M-X and TRIDENT II missiles. Both weapon systems will place great stress on their reentry vehicles in terms of their ability to survive hostile environments, and to minimize the RV accuracy error contribution than has been the case in the past. The FY 1979 program will concentrate on the demonstration of the needed technology. The program is organized into four principal tasks: Ballistic Reentry Systems, Maneuvering Reentry systems, Penetration Aids, and Systems Technology.

The major accomplishments of the ABRES program this year were the successful flight tests of the Technology Development Vehicles (TDV). The TDV's are ballistic reentry vehicles which carry experiments related to penetration, vehicle survival, and maneuvering. Data gathered from the TDV flights will be used to design the M-X reentry vehicle so as to minimize trajectory dispersions which occur during reentry.

In FY 1979, the Ballistic Reentry Systems task will culminate in the four flights of the Advanced Ballistic Reentry Vehicle (ABRV). The purpose of the ABRV is to demonstrate an advanced technology alternative to meet M-X requirements. Experiments to be flown on the ABRV include: the demonstration of a carbon-carbon nose to survive the extremes of weather that the M-X RV must survive, a transpiration cooled nosetip which could provide a true all weather capability, and, possibly, a new, composite material substructure. The series of flight tests will also be used to test the new arming and fuzing concepts which have been developed in the Systems Technology task.

The Maneuvering Reentry Systems task will provide the first flight of the Advanced Maneuvering Reentry Vehicle (AMaRV). The AMaRV program is designed to penetrate advanced SAM and ABM systems without loss of the overall system accuracy now achievable only with ballistic reentry systems. Later AMaRV flights will test new technology being developed as [illegible] of this task such as the Ring Laser Gyro and terminal sensors.

The Penetration Aids task will increase efforts to develop penetration aids suitable for use against advanced missile defenses. Concepts for ballistic and maneuvering reentry systems will be explored and in both cases the emphasis will be on penetration deep into the atmosphere. Traffic decoy concepts will predominate but precision decoys for ballistic RV's will also be examined.

Finally, the Systems Technology task will carry out two major flight tests this year, the fourth flight of the Advanced Nosetip Test (ANT) vehicle and the first flight of the Interim Recovery System (IRS). The ANT vehicles have so far been used to explore the response of nosetip material to the highest pressures that the M-X RV will experience. The

FY 1979 flight will continue this process and will also test a heatshield which was specially prepared to minimize the tendency of the RV to roll. The IRS flights will also consider ways to eliminate the irregularities which cause an RV to change its roll rate and, in addition, they will be used to gather data needed to estimate the erosion caused by weather on the antennas and flaps of maneuvering reentry vehicles.

c. Electronically Agile Radar (EAR) (RDT&E: $14.2 Million)

The EAR is an advanced state-of-the-art bombing, navigation, and terrain following radar. This radar system will be significantly more difficult to track by passive detection systems; it has far greater resistance to jamming than previous systems; it has better all weather capability as well as improved reliability, maintainability, and weapon CEP. Flight tests should be completed in early FY 1979 and system integration studies initiated.

C. DEFENSIVE SYSTEMS

Although our deterrent posture basically depends upon maintaining strong strategic offensive forces, it is nevertheless important to maintain an active strategic defensive R&D program. For example, fundamental research in air defense or ballistic missile defense could yield a technological breakthrough that might change the strategic balance. Our defensive warning systems can provide warning of bomber and missile attacks and give timely alert to safely launch our bomber and interceptor forces. Strategic defense also includes areas of space activities which are taking on added importance.

Our strategic defensive research and development programs are structured to: (1) provide an adequate surveillance and warning network to detect and characterize hostile actions by strategic aircraft, missiles, or spacecraft; (2) develop defensive options for the protection and survival of our strategic offensive and defensive forces and satellite systems; and (3) maintain leadership in the technology of defensive systems to minimize the possibility of surprise by our adversaries.

We propose to undertake an active research and development program in strategic defense to provide options for the future and to keep abreast of the Soviets where necessary. Our principal activities involve Warning and Attack Assessment, Ballistic Missile Defense, Air Defense, and Space Defense.

1. Warning

Reliable warning is required for a variety of reasons. Of foremost importance, it provides valuable time to allow the intercontinental bomber force, the recallable arm of the Strategic TRIAD, to be launched prior to arrival of an SLBM, ICBM, or bomber attack. In the same light, it permits the escape of time-sensitive command and control elements. It also provides critical and timely information to the National Command Authorities regarding the nature of an attack. Warning, then, is an integral and vital component of a credible deterrent posture. To keep this component effective, we are maintaining an active research and development program to capitalize on new technology advances and to keep pace with changes in the threat.

a. **Bomber Warning**

(RDT&E: $27.9 Million)

Our bomber warning programs are oriented towards two major objectives: providing increased capability for tactical early warning and significantly reducing the current cost for facility operation and support. Long-range early warning of bomber attacks is provided by the present Distant Early Warning (DEW) Line which has been operational since 1957. Because the DEW Line was designed to warn of medium and high altitude bomber attacks, it has coverage gaps for low altitude bombers. We are developing a new generation, low-cost unattended radar to replace the current radars that form the DEW Line across Alaska, Northern Canada, and Greenland. All of the basic system elements, including the short range surveillance radar, communications, and power supply, would operate in an unattended mode for extended periods; hence, the development is technologically challenging. Deployment of these stations would provide increased low altitude radar coverage at significantly reduced operations and support cost as compared with the current DEW Line. The development program is being coordinated with Canada to insure that it would support our combined North American Air Defense (NORAD) objectives. We will continue with the definition and development of the critical elements for the unmanned system during 1979.

We are also developing a minimally attended radar to replace the equipment used in the 13 Alaskan Air Command (AAC) radar stations. This improved radar will be a long range surveillance sensor with built-in height finding capability and will feature improved clutter performance.

It will function as the sensor element within Alaska for the Joint Surveillance System (JSS) described below. The introduction of the minimally attended radar into the AAC will reduce personnel at each radar site from approximately 100 to under 10. Fabrication of a prototype system will begin in 1979.

In addition to these two "site-improvement" programs we are continuing with an experimental Over-the-Horizon Backscatter (OTH-B) radar program to evaluate the potential utility of OTH as a CONUS aircraft warning system. The OTH radar technique can potentially provide all-altitude surveillance and early warning of bomber attacks to far greater ranges than can be achieved by conventional ground-based radars. An experimental OTH radar is being constructed in Maine and will be used to assess basic areas of technical risks. These include data handling for the large volume of air traffic in the North American air traffic corridors and the adverse effects of ionospheric disturbances such as auroral phenomena. Our current schedule calls for a complete technical feasibility demonstration in late 1980.

b. Missile Warning and Attack Assessment
(RDT&E: $74.1 Million, Procurement: $161.1 Million)

We are continuing to upgrade both our ground-based and our space-based missile warning and attack assessment systems. The Ballistic Missile Early Warning System (BMEWS) radars are being improved through new R&D in FY 1979 to provide more accurate tracking and impact prediction of Soviet MIRV's. Computers and software will be procured for Site I (Thule, Greenland) in 1979 and in Site II (Clear, Alaska) in 1981. The

Perimeter Acquisition Radar (PAR), which was originally part of the Safeguard BMD system, is being upgraded to increase the detection range and permit handling of a greater traffic volume. While nc RDT&E effort has been budgeted for PAR in 1979, operations and maintenance will continue and software developed in FY 1978 will be incorporated. PAVE PAWS, the two SLBM radars to be installed on the East and West Coast, are being procured.

Major procurement activities in FY 1979 are for retrofit of two spacecraft for TITAN III Inertial (formerly Interim) Upper Stage (IUS) compatibility, two spacecraft for Shuttle IUS, and for procurement of modified sensors.

Under the Air Force's Missile Surveillance Technology Program, a unique mosiac sensor is being developed. We are currently evaluating the strategic and tactical implications of this new technology. The DARPA High Altitude Large Optics (HALO) Program represents advancements beyond this mosiac sensor program.

The capability to detect strategic and tactical nuclear bursts is cur ly provided by sensors carried aboard several space vehicles. We a urrently investigating the merits and risks of other approaches. Researc elopment and tests to date indicate that other concepts are very p ing and much less expensive.

Under the Warning Information Correlation (WIC) program, data from the various warning sensors are integrated and correlated to give an overall assessment of missile attack against the U. S. As a result of this effort, required modifications have been identified and improvements budgeted for BMEWS and the supporting command and control links. Operational changes have been specified and are under development to provide better assessment of mass raid attacks on CONUS.

2. Ballistic Missile Defense

In the past five years--since the ratification of the ABM Treaty--the goals and the direction of our Ballistic Missile Defense program have been significantly altered. The Safeguard System has been deactivated except for the Perimeter Acquisition Radar which has been transferred to the Air Force. A System Technology Program that addresses critical system technology issues has evolved from an earlier prototype demonstration effort; and the emphasis placed on our Advanced Technology Program has been toward more advanced concepts and technologies. Funding for BMD has dropped substantially from a peak of $1.4 billion in FY 1971 to a stable level in the past few years of slightly more than $200 million.

In recent years, however, we have not witnessed a corresponding decrease in the level of Soviet BMD activity. In addition to continuing the operation of their Moscow ABM System, the Soviets are continuing a high level of BMD component development and testing involving radars, interceptors and optics. They are developing a BMD system which appears to be rapidly deployable and they have an active interceptor flight test program. They are constructing several new large phased-array radars and other large phased-array radars are being deployed. Although our significant research and development efforts conducted over many years has given the U. S. a clear technological advantage in this difficult area, we are concerned that the persistent Soviet efforts may seriously erode this lead. Consequently we must, as an absolute minimum, maintain our current level of BMD research and development. In accordance with Congressional guidance, the level of the BMD programs is being maintained at a constant level of purchasing power relative to that appropriated in FY 1978.

a. Ballistic Missile Defense Advanced Technology (RDT&E: $113.5 Million)

The objective of our BMD Advanced Technology Program is to insure that any major technological breakthrough that might occur in BMD be discovered first by the United States. Thus it provides a hedge against the Soviets attaining an advantage that might alter the strategic balance by maintaining an aggressive search for innovative concepts and new technologies. New approaches to missile defense, including high-energy lasers, particle beam weapons, and space-based sensors are a part of our continuing probe for revolutionary concepts and ideas which could dramatically enhance our technical position. Major research efforts are also conducted to advance technologies in the areas of radar and optical sensors, interceptor missiles, data processing, and reentry physics.

Key field experiments continue to be an essential part of this program. In the past year we completed installation of a laser tracking and imaging system at the Kwajalein Missile Range that will be used to obtain signature data on reentering ICBM complexes. A new ground-based optical sensor recently installed at Kwajalein has been collecting extensive infrared (IR) data. In early 1978, the advantages of IR sensors for BMD will be investigated with the initiation of a series of key rocket-borne IR experiments at Kwajalein.

b. <u>Ballistic Missile Defense Systems Technology</u>

<u>(RDT&E: $114.0 Million)</u>

Although extreme demands are placed on major BMD system components, the most difficult problem in the development of a BMD system is making these components work together effectively. The Systems Technology Program addresses this by focusing on the critical interplay between complex BMD elements which involves the realtime allocation of radar, computer and interceptor resources. By integrating components into a system structure, we maintain and improve the capability to develop and deploy a BMD system in the future, should the need arise.

As a major part of the System Technology effort, critical field tests are conducted to determine that each component not only performs well singularly but also in conjunction with others to insure that we have a satisfactory command of the overall system technology. During the past year we completed the integration and checkout of the Systems Technology radar and computer facility at Kwajalein and initiated tests to verify the solution to previously identified key technical issues (e.g., discrimination, software operation). This series of tests will be nearing completion in 1979.

The Systems Technology Program draws heavily upon those technologies pursued under the Advanced Technology Program which have been adequately developed and are suitable for transition to system application. Also in 1979, we will be preparing for an experiment to demonstrate the utility of an optical sensor as an adjunct to a terminal system and also will be undertaking a modest effort to examine key technologies for a very low altitude concept applicable to the defense of a mobile ICBM force.

3. Air Defense

Since the decision several years ago to forego a defense against a large Soviet surprise bomber attack, the emphasis of CONUS Air Defense has shifted to maintaining peacetime airspace sovereignty and performing surveillance and warning activities. In this respect, it is our objective to maintain sufficient dedicated CONUS Air Defense forces and tactical augmentation options to prevent unchallenged access to our airspace by enemy manned bombers and airborne reconnaissance vehicles. This includes providing a force which can be surged and employed in times of crisis to defend against limited attacks. In so doing, we raise the uncertainty that must be considered by a potential aggressor and increase the price he would have to pay for any exploitation of CONUS airspace. Our goal is to accomplish these objectives with minimum cost and maintain a sufficient research and development program to provide hedges against uncertain future requirements.

a. Joint Surveillance System (JSS)
(RDT&E: $8.5 Million, Procurement: $35.0 Million)

We have initiated development of the JSS to perform the peacetime surveillance and control mission in place of the aging SAGE/BUIC system. The sensor segment will consist of 44 radars located around the CONUS periphery, 14 in Alaska and 24 in Canada. The CONUS military sensors will be upgraded using moving target detection technology to improve their ability to detect targets in a heavily cluttered environment.

The majority of the U. S. radars are owned and operated by the Federal Aviation Administration (FAA) but the data will be jointly used by the Air Force and FAA. The sensor information will be processed in 7 Regional Operations Control Centers (ROCC's), 4 located in CONUS, 1 in Alaska, and 2 in Canada. Design verification for the critical hardware and software components of the ROCC's is underway and will be completed in early 1979 and the first ROCC System Support Facility will be procured. The Air Force estimates that when JSS is fully deployed in the early 1980's, it will provide a yearly reduction in operating costs of about $165 million as compared to the current SAGE/BUIC system.

4. Space Defense

Space systems play an important role in the capabilities and effectiveness of military forces, performing such functions as communications, missile warning, meteorology, and navigation. Today, the Soviets have a satellite-borne ocean surveillance system that can provide targeting information against Naval surface forces. U. S. satellite systems provide early warning against missile attack and furnish position updates to our SSBN force. With the pace of space activities continuing to increase, we can expect improved capabilities, broader, more sophisticated usage, and increased importance of space systems to the military in the future.

The Soviets have reacted to the military importance of space systems by the development and test of an anti-satellite (ASAT) interceptor that has capability against our satellites. The U. S. currently has no operational ASAT system. In response to this asymmetry, we began accelerating our research and development programs last year. These programs will permit us to increase our ability to observe and monitor space objects, to improve the survival of our satellites, and to have the capability to, if necessary, destroy Soviet satellites. We feel that it is vital that we continue to increase our efforts in FY 1979 on these important space defense activities.

D. OTHER PROGRAMS

1. Space Systems

Space systems continue to play a major role in supporting strategic and tactical military operations worldwide. Support is provided in communications, ballistic missile early warning, surveillance, navigation, and weather systems. In FY 1979, our RDT&E efforts will continue to emphasize improvements in navigation and communications systems, satellite survivability and defense, launch system reliability and use of the Shuttle to achieve more effective space operations.

a. Space Shuttle

(RDT&E: $169.5 Million, Procurement: $108.8 Million)

Present plans are to transition all DoD space system payloads from launch on current expendable space boosters to Shuttle launch after the Shuttle becomes operational in 1980. The Air Force is developing an Inertial (formerly Interim) Upper Stage (IUS) which will be operational by mid-1980 for use on both the Shuttle and the TITAN III booster during the transition period. The Air Force is also developing the Shuttle launch and landing capability at Vandenberg AFB, which will be operational in June 1983. Some TITAN III boosters will be procured as a backup for our critical launches in the event that the Shuttle encounters delays during development or early operational use. When the Shuttle is fully operational, expendable boosters will be phased out of the inventory. Current DoD planning is predicated on the timely availability of an adequate orbiter fleet, based on NASA's national traffic projections for Shuttle use.

The Space Shuttle can support the launch of all projected DoD space systems in the foreseeable future. The Shuttle provides significant new technological opportunities which can lead to more effective and flexible military space operations. Compared to our largest current space booster, the Shuttle can deliver twice the payload weight and three times the payload volume to orbit. We can use this increased capability to incorporate redundancy in critical subsystems, thereby improving the life of our spacecraft in orbit. We can also improve the capability of our spacecraft by prudently adding sensors and communications links. We can improve the survivability of our space systems, in a natural or hostile space environment, by selecting from a number of Shuttle-related options. These survivability options include placing spare spacecraft in orbit, carrying additional on-board propellants for spacecraft maneuvering, or perhaps placing in orbit more spacecraft of a simpler, lower cost design. The Shuttle capabilities offer the opportunity to achieve greater spacecraft modularization and standardization of subsystems while avoiding costly weight reduction programs. The reliability of placing a satellite in its desired orbit projected for the Shuttle/IUS (.97) is higher than the average we are experiencing today on our current expendable boosters (.93). We anticipate that the Shuttle can be used routinely as a development test bed for various sensors and subsystems thereby reducing the development time for new space systems and enhancing our capability to respond rapidly to changing needs.

Initially, we will use the Shuttle as we would a larger replacement launch vehicle. However, should the Shuttle arrive on-orbit with a payload that did not check out properly, most payloads could be returned to earth for adjustment or modification. In the future, we can design our payloads so that the Shuttle can retrieve them from low orbit when the mission is complete, and return them to earth for refurbishment and reuse, diagnostic purposes, or technological update. Another option which might be equally attractive in the Shuttle era is on-orbit servicing of payloads. Spacecraft designed for automated subsystem replacement could be serviced while in low orbit depending on mission requirements. In the long term, the Shuttle will open the way for many new technical advances in the military use of space.

In FY 1979 we will procure some IUS ground support and logistics support equipment. We will also procure unique ground support equipment for Vandenberg AFB, and continue co-procurements with NASA of common Shuttle ground support and launch processing equipment. The construction of Vandenberg AFB Shuttle facilities is planned to begin in April 1979. Our FY 1979 Vandenberg AFB construction program includes the Shuttle landing field, mate/demate facility, launch pad area, and the launch control center. We are also modifying our Solid Motor Assembly Building for IUS processing at Kennedy Space Center.

Since DoD plans to make extensive use of the Shuttle, the timely availability of an adequate national fleet of orbiters to support military as well as civil users of the Shuttle is a matter of serious concern to us. The fleet size must be based on total traffic--foreign and domestic, civil and military--projected for the Shuttle. Extensive studies conducted by NASA, with Air Force support, plus detailed reviews within the Administration have led to the decision that NASA should proceed with the production of a four orbiter fleet. Additional orbiters can be considered for funding in future years in the event that projected flight rates (or loss of an orbiter) warrant augmentation of the operational fleet.

Present DoD planning for Shuttle launch is predicated on the use of NASA's Johnson Mission Control Center (JMCC) for simulation, training, and Shuttle flight control for all DoD missions. However, as currently designed, JMCC cannot handle classified payload data. A number of options for accommodating classified DoD launches in the JMCC have been evaluated over the past year by both DoD and NASA. Recently we have tentatively agreed with NASA on a low cost approach to modifying JMCC which should adequately protect classified payload launches on the Shuttle with minimum disruption to civil users. We expect to complete the validation of this approach, which we call the "controlled mode" concept, and assuming that our validation phase is successful, proceed in FY 1979 with necessary modifications to JMCC.

The Department of Defense Space Mission Model for the period FY 1977-1991 projects 195 launches, 109 of which are Shuttle launches. Initial DoD use of the Shuttle is planned for an experimental payload within the first year of its operation. Launch of DoD operational payloads begins in FY 1982, and by the mid-1980's all DoD payloads will have transitioned from launch on current expendable boosters to Shuttle launch. During FY 1979 Satellite Data System, Defense Meteorological Satellite Program, and Global Positioning System spacecraft will undergo design modifications and necessary developmental tests to assure spacecraft compatibility with the Shuttle payload bay environment. The new Defense Satellite Communications System III spacecraft is being designed from the outset for Shuttle launch.

The Inertial (formerly Interim) Upper Stage (IUS), which is being developed so that DoD spacecraft can be delivered to the required orbital attitude and inclination using the Shuttle from Kennedy Space Center, is now in the validation phase and will enter full scale development in March 1978. The IUS will be available in mid-1980 and will be used on both the Shuttle and the TITAN III launch vehicle. Using the IUS on TITAN III will greatly enhance mission success and reduce costs during the early transition period when a number of our spacecraft will still require TITAN III launches.

We are providing a Shuttle launch and landing capability at Vandenberg AFB so that we can continue to support high priority, high inclination DoD launches. Launches into sun synchronous, polar or near polar orbits cannot be conducted from Kennedy Space Center without unacceptable performance loss and overflight of populated land areas during launch. This year we will complete all design criteria, support equipment specifications and initial design work necessary to support start of facility construction in FY 1979. The facility will be ready to support Shuttle flights beginning in June 1983.

For launches from Kennedy Space Center, payload ground processing and flight control procedures have been defined. Work will continue in FY 1979 on payload interface documentation, common support hardware, and security provisions. Modifications to Johnson Mission Control Center to protect classified payload data should begin. In addition, we will provide a minimum number of TITAN III vehicles as a backup for launching priority DoD payloads, should the Shuttle be delayed during the early operational period.

b. Other Space Programs

Space Defense, early warning and communications programs are discussed in Sections VII and VIII-A of this report.

2. Defense Nuclear Agency
(RDT&E: $168.6 Million)

The effects produced by nuclear weapons and the vulnerability of our weapon systems to them are matters of continuing concern. Thus, the Defense Nuclear Agency carries out a comprehensive research program based on analysis, laboratory experimentation, simulation, and underground nuclear testing to be certain that we have identified and quantified all the important effects. DNA's programs help to insure that in wartime we have the right mix of nuclear weapons delivered in the right way to have the required military effect and, turning the technology in the other direction, help insure that our vital systems have the required survivability against an enemy's weapons. The DNA development and test program covers the whole spectrum of DoD nuclear weapons interests. Major activities in FY 1979 will include development of prototype photon sources for radiation simulators to replace most underground nuclear tests; a new program on survivability and security of theater nuclear forces, an underground nuclear test to investigate the hardness of Air Force reentry systems, TRIDENT missile components, and satellites; and continuation of close support of the M-X missile system. Programs on theater nuclear warfare and the survivability and security of nuclear forces are discussed in more detail in Section VI.

A major thrust of the DNA program at this time is development of advanced radiation simulators to take the place of most of the nuclear effects testing now done in underground nuclear tests. This work has recently assumed increasing importance as the possibility grows of a complete ban on nuclear testing in the near future. Fortunately, our pulse power development program, which has produced several major facilities in continual use, continues to make very satisfactory progress. We are now planning a Satellite X-Ray Test Facility (SXTF) to be ready in 1983. The SXTF will produce x-rays of an appropriate energy spectrum to produce realistic responses in full-scale satellites. This facility will provide a major advance in our capability to harden our satellites against nuclear attack in space. In the somewhat longer term, we are now quite optimistic about the possibility of providing a laboratory facility capable of exposing complete reentry vehicles to x-ray fluences. Such a facility could replace a substantial fraction of the current DoD underground testing program.

Radio communications with satellites can be seriously degraded when their propagation path passes through an atmosphere disturbed by a nuclear explosion. This past year DNA has conducted two highly successful field tests to provide detailed data on the magnitude of these problems and methods for mitigating them. The two experiments are named WIDEBAND and STRESS. In the WIDEBAND experiment the effect of naturally occurring structured ionization was measured. On a dedicated satellite launched into a sun synchronous 1000 km circular polar orbit we have a phase coherent radio beacon broadcasting from VHF through S band. Ground stations at Ancon, Peru, Kwajalein Atoll and Poker Flats, Alaska are measuring the phase and amplitude fluctuations of these emissions. In conjunction with a WIDEBAND pass, rocket probes were launched to measure the "in-situ" ionosphere that the tones propagated through. This set of propagation data in well characterized natural disturbances will be compared, through elaborate computer codes, with our predictions of the essentially similar but much more intense phenomena expected after nuclear attacks. The second field experiment, STRESS (Satellite TRansmission Effects SimulationS), measured the effect of barium-induced structured ionization on RF signals formatted in the same way as an actual satellite system. A barium cloud was released at 185 km, sun light ionized it, and interaction with the earth's magnetic field caused the ionization to become structured. A message from the LES 8/9 satellite was propagated through this structured ionization to a listening aircraft. Data on the effect of the structured ionization on signal acquisition and interpretation are currently being reduced.

Propagation problems are important but only a subset of the complex of difficulties which a nuclear attack would present to command, control, and communications. We have recently completed most of our analyses planned on survivability and continuity of C^3 in the Pacific theater. In the near future, we will be conducting tests on EMP vulnerability of major C^3 installations in Hawaii. These tests, using the Transportable EMP Simulator (TEMPS), will provide confirmation of the theoretical predictions and help point the way to future improvements in this vital area.

DNA is addressing an array of current strategic targeting issues in direct support of OSD, JCS, and the Joint Strategic Target Planning Staff. The amount of high-confidence test data on the survival of hardened facilities is very small, and the amount of data which proves the requirements for destruction of such facilities is smaller still. We are executing, over a period of time, a carefully planned set of experiments which will greatly increase the ability to target such structures efficiently and will directly show how intelligence uncertainties can influence the results. Our work is shedding new light on requirements for targeting of industrial complexes, improving the ability of strategic planners to destroy military targets while minimizing damage to areas they do not desire to attack, and indicating the potential for rapid hardening of industrial installations which are now considered relatively soft. Carrying these engineering programs a step further we are providing new data which will lead to the most efficient application of weapons by combining our knowledge of vulnerability of various types of targets with the importance of these targets to post-war recovery.

VI. TACTICAL PROGRAMS

A. INTRODUCTION

1. Defining An Investment Strategy

The approach to defining the FY 1979 development and acquisition program in the Tactical Program category was based on the following criteria:

- o Applicability to stated defense policy--NATO focused;
- o Relevance to the threat to NATO--including attempts at sea denial
  - -- Threat capabilities and trends
  - -- Impact on Force Balance

The resultant investment strategy emphasizes the following:

- o Rationalization, standardization and interoperability in a NATO context;
- o "Force Multipliers" to overcome potential force deficiencies;
- o Increased system survivability;
- o Improved night/adverse weather capability;
- o Fallout to other potential scenarios.

As is the case for development and acquisition to support other Defense missions, the Tactical Program also emphasizes:

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- o Decreased acquisition and support cost, to enable proliferation;
- o Improved acquisition management in a mission-relevant context.

To carry out the FY 1979 Tactical Program, $5.1 billion in RDT&E and $23.5 billion in procurement is requested. These figures compare with $4.4 billion (RDT&E) and $21.7 billion (procurement) for FY 1978.

a. Applicability to Stated Defense Policy

The following recent statements by Secretary of Defense Brown, summarizing the Administration's General Purpose Forces policy, define the framework within which Tactical Programs development and system acquisition must take place:

- "...Our main defense objective, in conjunction with our allies, will be the maintenance of an overall military balance with the Soviet Union at least as favorable as that which now exists. Deterrence, ...is what we seek. ...To have it we must have a credible fighting capability."

- "...In an era of strategic nuclear parity, we must become more concerned than ever about a number of tactical balances, and about the adequacy of U.S. and allied conventional capabilities."

- "...The Soviet bloc maintains and continues to improve its capability to launch a major attack on Western Europe. Such an attack could be nuclear or non-nuclear. ...we cannot rule out the possibility that the powerful Pact forces already positioned in Eastern Europe would attack without reinforcement, and with very little tactical warning in the midst of a major East-West crisis."

- "...(NATO) emphasis on flexible response and the need for conventional as well as tactical... nuclear forces remains entirely appropriate. ...Improvements are most needed in four areas:
  -- NATO conventional capabilities
  -- the forward defense of the alliance
  -- the initial combat capabilities of the NATO forward defense forces
  -- allied rapid reinforcing capabilities."

- "The United States has a...commitment to do our share to ensure that NATO has the capabilities--nuclear as well as non-nuclear--to maintain the independence and territorial integrity of Western Europe. ...we are committed to help stop any attack (on NATO) with a minimum loss of allied territory, and to restore pre-war boundaries."

- o "In addition to Europe, there are a number of other areas around the world in which there are delicate or even potentially explosive situations. The Middle East, the Persian Gulf, and Korea are three examples.... We must continue to maintain a defense posture that permits us to respond effectively and simultaneously to a relatively minor as well as a major military contingency. The needs of such a posture, over and above the forces we program for Europe, are basically,
  -- a limited number of relatively light land combat forces (such as the three Marine divisions and some light Army divisions);
  -- moderate naval and tactical air forces;
  -- strategic mobility forces with the range and payload to minimize our dependence on overseas staging and logistical support bases."

- o "The United States is a maritime nation. Unlike the Soviet Union, we depend on access to major air and sea lanes, not only to acquire critical raw materials and engage in other peaceful pursuits, but also to protect our vital interests, forces and allies overseas in wartime. The Soviets have developed a long-range aircraft force and a Navy capable of challenging our maritime interests. We must maintain the air and naval forces necessary to deal with the challenge, and project U.S. power ashore where and as required."

Our development and acquisition program is effective only to the degree that it serves to meet the above Defense policy. Thus in formulating our FY 1979 Tactical Program, each effort was weighed in terms of its contribution to meeting overall Defense policy.

Severe resource constraints have limited the main thrust of tactical development and acquisition to the NATO scenario and related maritime scenarios. While our forces must also provide a capability to meet other threats in other theaters, specific improvement to these capabilities must take advantage of the force development addressed to the Pact threat.

The tactical development and acquisition program is managed under major mission areas: Land Warfare, Air Warfare, and Sea Control. These major areas are closely related and contain mission areas which group systems of like functions, to minimize the likelihood of duplication. The focus on NATO defense against the Warsaw Pact requires an emphasis on land and air warfare systems to counter enemy armored and air forces. In sea control systems, the emphasis is placed upon the capability to provide maritime support to NATO as well as other contingencies and military-political situations that demand sea control and power projection systems.

b. Relevance to the 1980s Threat

As described in Section II, while our one-time strategic superiority has eroded to a present position of rough parity, the relative posture of opposing general purpose forces in Europe is slowly tipping in favor of the Warsaw Pact.

NATO's capabilities to respond to the classic U.S. warning/mobilization scenario have been analyzed and exercised for several years now. The development and acquisition program to meet this scenario is well understood. However, for some time the Pact has been increasing its capability to strike NATO from an essentially unreinforced "short-warning" posture. This has been evidenced by a steady modernization and upgrading of frontal units in East Germany and other key locations.

Warsaw Pact forces in the Central European region currently have a quantitative superiority of almost two to one to over three to one (depending on the category) in tanks, other armored vehicles, artillery and combat aircraft. Given the substantially higher Soviet production rates of these systems, Pact quantitative superiority easily could increase.

While most individual NATO systems are qualitatively superior to those of the Pact, in many areas Pact forces are achieving equality and, in a few areas, have achieved qualitative superiority. Over the past year, this alarming trend has continued.

The highly mobile force which the Pact has in place, coupled with announced Soviet doctrine and military art, lend credence to the potential for a short-warning, limited objective attack which could unbalance the European economy and disarm NATO. The focus of our FY 1979 program, as well as adjustments to on-going programs, has been driven mainly by responding to this threat. A likely means by which the Pact might attack is described more fully below.

(1) Land

As noted earlier, Pact forces are capable of executing a relatively short-warning attack on NATO. Their doctrine, tactics, equipment, training and exercises all are consistent with this characterization. These attacks could be launched from an exercise or directly from Kasernes. Warsaw Pact ground forces planning and doctrine include:

- Use of massed numbers of armor and mechanized infantry supported by large amounts of suppression fire;
- Multiple axes of advance across the front;
- Rapid rates of advance;
- Deep envelopment;
- Emphasis on maintaining momentum through echeloned forces at all levels;
- Top-down control;
- Organization designed to support and allow massing of assets;

- Proliferation of air defense systems at all combat levels;
- Jamming and attack of our Command, Control, Communication and Intelligence (C^3I) Systems.

The Soviet military forces prefer to attack from a line of march to maintain the attack momentum, but if confronted by a well-prepared defense, they can rapidly organize to permit massing of forces and firepower to force a breakthrough.

(2) Air Attack

The air attack is designed to annihilate or pin down NATO tactical air forces. An attack involving hundreds of aircraft should be anticipated. Aircraft probably would be directed toward NATO air surveillance, C^3, and air defense assets. The attacking forces can be expected to use jamming, anti-radiation missiles, and direct attack to suppress defenses. Other aircraft would attack NATO air bases and engage surviving NATO aircraft in air-to-air combat. The airbase attack might involve use of precision-guided air-to-surface munitions.

(3) Counter C^3

The Pact is proliferating Electronic Warfare (EW) systems and weapons consistent with their doctrine and training for attacking NATO C^3 and surveillance assets. An effective counter to NATO C^3 could be advantageous to the Warsaw Pact. Comparing the Pact EW capability to that of the U.S. at the Corps level, we find that they outnumber us in people and equipment. In addition, their equipment is organically deployed with combat units. As for air defense, Soviet doctrine is to locate and jam a significant fraction of NATO C^3 capability and to destroy other parts by direct fire. This doctrine is followed in training and in operational exercises. We must be concerned not only about NATO command posts and communications equipment at all echelons, but also surveillance assets of all types and especially airborne surveillance, in view of the Soviet FOXBAT.

(4) Sea Denial

Unlike the Pact, we have a heavy dependence on sea lanes for resupply and support of a European conflict. They have developed and are continuing to upgrade a "sea denial" capability, including an extensive and responsive ocean surveillance system which has been demonstrated both in exercises and crisis situations. Their open ocean anti-ship capability is concentrated in a diversified family of air, surface ship, and submarine-launched cruise missiles. The USSR has deployed the BACKFIRE weapon system challenging our ability to move troops and supplies by sea from CONUS.

(5) Theater Nuclear Forces Attack

The Soviet Union maintains a large and capable land- and sea-based theater nuclear force. The Soviet Union is capable of utilizing these weapons against our land or naval forces as part of a combined conventional-nuclear attack. On land, major targets would include our airfields, C^3 sites and reserve forces. At sea, they might be used against either our surface, submarine or naval air forces.

(6) World-Wide Operations

There is also a continuing stream of Soviet developments in naval and air transport systems that demonstrates a growing ability to extend Soviet presence and influence worldwide. The Kiev carrier can provide limited support to almost every conceivable combat scenario with its missiles, electronics, and integral air elements.

2. Resultant Program Approach

a. Response to the Warsaw Pact Threat

Short-term efforts to improve our NATO posture must center on employing more realistic operational concepts, improving readiness, defining short-term survivability improvements for key nodes, correcting maldeployment of forces, equipment and stores, improving interoperability and in adjusting the NATO Command structure and C^3I to enable more timely information flow. These efforts are under way.

The role of RDT&E and acquisition is to enable prudent and timely force upgrade over the longer term, to assure continued deterrence in the 1980s and 1990s. Providing this deterrence requires that the U.S., with NATO, develop and deploy a capability to:

- Perceive an attack in the formative stages;
- Shift strength along the border, as required;
- Survive and counter initial attacks directed against NATO air;
- Blunt the major armored thrusts;
- Counter with allied thrusts that can destroy the cohesion of the Pact total effort;
- Resupply and reinforce our forward-deployed forces to maintain the initiative, once regained;
- Maintain a survivable, flexible, and effective (with minimal collateral damage) theater nuclear force as a deterrent against enemy nuclear attack or in the event of a major failure of the conventional defense.

The measure of success in meeting these objectives would be the degradation of Pact confidence such that their plans for any attack against NATO would require an extensive buildup and deployment of Soviet reserves, thus providing NATO with more adequate time to mobilize and deploy countering forces.

The major thrusts we have defined to enable meeting the above objectives are:

- NATO cooperative defense initiatives through rationalization;
- Emphasis on force multipliers to overcome quantitative deficiencies:
  - -- More responsive reconnaissance, C^3I and targeting systems
  - -- Precision guided munitions for artillery, aircraft, rockets and missiles
  - -- Improved conventional munition lethality through kinetic energy and area munitions technology;
- Improved system survivability;
- Systems to operate at night and in adverse weather;
- Decreased acquisition and support costs;
- Applicability to other potential scenarios.

b. Rationalization in a NATO Context

The primary goal for new developments in harmonious introduction into the NATO environment. While NATO has a higher Gross National Product and a more advanced technology and industrial base than the Warsaw Pact, we have been less successful in deploying the output of our laboratories in a timely fashion. A major thrust is rationalization of our new developments with our NATO allies, agreement on operational requirements and shortening of the development cycle, without overly increasing program risk.

Significant progress has been made in complex international programs such as the F-16 multi-national fighter/attack aircraft and the ROLAND surface-to-air missile. We plan to follow these successes with the joint development of ASSAULT BREAKER, a potentially highly-leveraged system using a new battlefield attack missile for the destruction of armor targets deep in the enemy's territory. Further, the joint pursuit of an improved family of air-to-ground munitions for NATO attack aircraft will provide for munitions cross-servicing from any allied airfield. These major efforts will significantly increase the defense capability of the NATO countries.

Table VI-1 summarizes on-going efforts at strengthening alliance force capabilities.

A portion of the FY 1979 tactical development and acquisition program augments the funding of some of the items in Table VI-1 and supports a number of new initiatives. Table VI-2 summarizes the FY 1979 new initiatives in NATO cooperative defense. While the gaps in both tables imply that much remains to be accomplished in broadening the base of support for these initiatives, the key point is that we are taking steps to define a number of foreign candidates for a true "two-way street" with NATO. A key ingredient in many of these programs is the transfer of technology among the NATO countries. As discussed in more detail in Chapter IV, our policy is to provide critical technology to NATO nations if the return on investment is an improved NATO force posture.

c. Force Multipliers

Given the apparent Soviet/Pact commitment to upgrade the quality and quantity of their forces at the expense of the civilian

TABLE VI-1. ON-GOING NATO COOPERATIVE DEFENSE INITIATIVES

PROGRAM	BELGIUM	CANADA	DENMARK	FRANCE	GERMANY	GREECE	ICELAND	ITALY	LUXEMBURG	NETHERLANDS	NORWAY	PORTUGAL	TURKEY	UK	USA	COMMENTS
	PARTNER COUNTRIES															
F-16 FIGHTER/ATTACK AIRCRAFT	X		X							X	X				X	ENTERING COPRODUCTION
AIR-TO-SURFACE MUNITIONS • FRG STREBO SUBMUN & DISPENSER • UK JP233 LO-ALTIT. MUNITIONS • US MAVERICK				X	X									X	X	FAMILY OF AIR-TO-SURFACE MUNITIONS IN DEVELOPMENT. COMPLEMENTARY AIRCRAFT CROSS-SERVICING EFFORT UNDERWAY.
GENERAL SUPPORT ROCKET SYSTEM				X	X									X	X	RATIONALIZATION UNDERWAY
COPPERHEAD CANNON LAUNCHED GUIDED PROJECTILE					X									X	X	POTENTIAL COPRODUCTION
ADVANCED HEAVY ANTI-TANK MISSILE (AHAMS)				X	X									X	X	RATIONALIZATION UNDERWAY
ANTI-TANK MINES					X										X	JOINT EVALUATION
ROLAND LOW-ALT SURF/AIR MSL				X	X										X	TECHNOLOGY TRANSFER, FABRICATION AND TESTING
PATRIOT MED/HI-ALT SURF/AIR MSL	X		X		X					X	X				X	POTENTIAL COPRODUCTION
STINGER MAN-PORTABLE SAM					X			X							X	FRG, ITALY INTEREST EXPRESSED
SEA SPARROW SHIP DEFENSE SAM	X		X		X			X		X	X				X	COPRODUCTION. TRANSITION TO ADV SPARROW VERSION PLANNED
SEA GNAT SHIP DEFENSE DECOYS			X		X						X			X	X	JT DEVEL VS RADAR, IR, RADAR/IR ASMS
ADV SHIP-BASED SAM (ASMD)					X										X	JT DEVEL TO COMPLEMENT SEA SPARROW
ANTI-SURFACE SHIP MISSILE (ASSM)			X	X	X					X	X			X	X	HARPOON FOLLOW-ON (EURO. DEVEL)

TABLE VI-2. FY 1979 NEW INITIATIVES-NATO COOPERATIVE DEFENSE

PROGRAM	PARTNER COUNTRIES: FRANCE	GERMANY	US	UK	OTHER	COMMENTS
SP-70 155mm HOWITZER		X	X	X	X	T&E AS FOLLOW-ON TO OBSOLESCENT U.S. M109.
UK ARTILLERY STICK PROPELLANT			X	X		TEST FOR POSS USE IN ALL U.S. 155MM WPNS
U.S. ADV ANTI-ARMOR VEHICLE		X	X	X		BUYS 2ND VEHICLE FOR JOINT T&E
ADV SCOUT HELICOPTER	TO BE DETERMINED					ASSESS FOREIGN PLATFORMS TO MEET U.S. NEEDS
FRG LAND MINE		X	X			U.S. TEST OF FRG DT-21 ANTI-TANK MINE
CANADIAN REMOTELY-PILOTED VEHICLES			X	X	X	U.S. TEST OF CL-227 ROTARY-WING RPV SENSOR EQUIPMENT AND DATA LINKS
UK SKYFLASH RADAR-GUIDED AAM			X	X		EVALUATION FOR POSSIBLE PROCUREMENT
U.S. ASSAULT BREAKER	TO BE DETERMINED					JT U.S. ARMY/AF PROGRAM. RANGE TO ATTACK KEY 2d, 3d ECHELONS, SUPPORT, C^3
30-MM GUN POD		X	X		X	U.S. PROPOSED FOR USE ON F-16 AND OTHER AIRCRAFT IN ANTI-ARMOR OPERATIONS
MSL MID-COURSE GUIDANCE		X		X		FEASIBILITY DEMO FOR VERTICAL LAUNCH MISSILE
PENGUIN ANTI-SHIP MISSILE			X		X	BUYS IMPROVED PENGUIN WITH INERTIAL MID-COURSE & IR TERMINAL FOR 65' PATROL BOATS
JOINT IFF		X	X			EFFORT TO INTEGRATE GERMAN CAPRIS SYSTEM IN U.S. IFF SYSTEM
COMMUNICATIONS INTEROPERABILITY	X	X	X	X	X	FUNDS INTEROPERABILITY TESTING AMONG NATO TACTICAL C^3I SYSTEMS WITHIN JINTACCS, FOR INTEROPERABILITY WITH NATO SHIP-BOARD TACTICAL DATA SYSTEMS

economy, the most affordable way that we can continue to maintain deterrence is by more clever application of our technology through force multipliers. A major thrust of our FY 1979 development and acquisition program is focused on several potential force multipliers, examples of which include:

- o <u>More responsive reconnaissance, intelligence and targeting systems</u>--to provide real-time or near real-time information for attack and reaction to look beyond the Forward Edge of the Battle Area (FEBA).

- o <u>Precision Munitions Guidance</u> for artillery, aircraft, rockets and missiles to provide a higher single-shot kill probability.

- o <u>Improved Conventional Munitions Lethality</u>, through (a) kinetic energy rounds for the direct fire destruction of armor, and (b) area munitions to attack a wide variety of battlefield targets by artillery, rockets and aircraft.

(1) <u>Responsive Targeting</u>

For the first time, we are testing sytems, utilizing various sensors, which will synthesize the battlefield intelligence picture, and provide for battlefield sensor management and real-time targeting information. An example of this integrated effort is a joint Army/Air Force/DARPA test project called the Battlefield Exploitation and Target Acquisition (BETA) system. It will provide a test-bed for the development of automated sensor fusion centers for use at Army Corps/Divisions and at the Air Force Tactical Air Control Centers which will be interoperable, in that they will be able to exchange sensor-derived data in near real-time. Targeting systems like BETA, coupled with high-leverage lethal systems such as the ASSAULT BREAKER, will provide the force multiplier which should prove, "If you can sense it to a significant range in front of the line of contact, you can kill it." A successful "BETA" will make enemy rear areas and second-echelon forces vulnerable as never before.

(2) Precision-Guided Munitions

Precision-guided munitions are going to revolutionize warfare to a degree not yet fully analyzed or understood. Our first generation television and laser-guided munitions demonstrated small CEPs (Circular Error Probable) in application in Vietnam; this small CEP only scratched the surface. The laser semi-active COPPERHEAD projectile and HELLFIRE missile now in engineering development have demonstrated substantially smaller CEPs. The impact of these weapons, compared to the ballistic weapons they replace, has dramatically improved weapon single-shot kill probability.

Examples of significant activities in FY 1979 are:

- Completion of Engineering Development and Production Facilitization and award of the Low Rate Production contract for the COPPERHEAD.
- Imaging IR (infrared) and E-O versions of GBU-15, giving capability to deliver a 2000-lb warhead to small CEPs.
- Feasibility Demonstration of Terminally-guided submunitions for delivery by the General Support Rocket System (GSRS), ASSAULT BREAKER, and Wide-area Anti-Armor Munitions.
- Continuation of the PERSHING II radar area correlation guidance development--capability to deliver an earth penetrator or low-yield nuclear warhead with great accuracy at long range.

(3) Improved Conventional Munition Lethality

Improved conventional munitions lethality is necessary to offset the large force imbalance favoring the Pact. Cannon-launched artillery rounds which can dispense dual-purpose, anti-personnel and anti-armor submunitions have increased effectiveness over present artillery rounds. These same concepts have been extended to air-to-surface munitions. There are also a series of gun improvements under way.

Examples of significant new FY 1979 thrusts in the area include:

- Kinetic Energy (KE) discarding-sabot anti-armor round for the XM-1 tank main gun, which will provide a significant improvement over present lethality of fire.
- Higher-rate-of-fire, high-velocity automatic-loading 75mm gun firing an improved KE projectile.
- Development of an improved capability for the PHALANX Close-In Weapon System to improve its lethality against Soviet anti-ship missiles.
- Development of "cargo" rockets for specialized submunitions, illumination flares, chaff, and smoke devices, in addition to explosive warheads.
- Air-scatterable munitions such as the Combined Effects Bomblet and Anti-Armor Cluster Munition will provide high lethality through application of new, low-altitude delivery systems and multi-directional kill mechanisms. These compact devices allow both greater areas of coverage and higher densities in the delivery area.

d. Increased System Survivability

We are insisting that the survivability lesson learned in Vietnam be incorporated in new systems, especially in airplanes and helicopters. Examples are:

- Redundant control systems and structure and selective use of armor in aerial attack systems.
- The AAH and BLACK HAWK (UTTAS) helicopters have transmissions that continue functioning up to one hour after fluid loss, a tail rotor gearbox that uses grease instead of oil, and self-sealing fuel cells.

- Updated warning and self-protection countermeasures systems for aircraft and ships.

- Emphasis on ECCM (electronic counter-countermeasures) capability for airborne, land and ship electronic systems.

e. <u>Improved Night/Adverse Weather Capability</u>

NATO land and air force effectiveness is limited in poor-visibility conditions. Effective night/adverse weather target attack capability is required to: (1) deny the enemy a sanctuary under which to attack, deploy or regroup, and (2) to capitalize on an area where we are technologically ahead.

It is important to distinguish between restrictions due to darkness and those due to climatic conditions such as rain, fog, smoke and dust. Imaging infrared systems have enabled our tank and air crews to overcome darkness to a high degree, and such devices as Forward Looking Infrared (FLIR) subsystems are essential parts of our direct-strike systems. The Army's Advanced Attack Helicopter, the Navy's A-6 and A-7 TRAM and the Air Force's PAVE TACK are examples of current developments using FLIR technology. In cases of precipitable moisture, smoke and dust, the FLIRs suffer some degradation in their ability to image the target scene, and radar imaging systems have more utility in those situations. Finally, some applications do not require finely-depicted targets for acquisition and terminal homing. Here, approaches such as laser spot seekers and IR terminal guidance have proven adequate. While some progress has been made, much effort remains before we will achieve a fully-effective day/night/adverse-weather battlefield visibility.

f. Other Scenarios

While the major thrust of the tactical warfare development and acquisition program is to deter the Warsaw Pact threat in NATO's Central Region, assuring the effectiveness of such a deterrent requires:

- Deterrence to Pact adventurism against the NATO flanks.
- Control of sea lanes to Europe from CONUS and the Persian/Arabian Gulfs, to assure adequate resupply of personnel, POL and supplies.

Meeting these additional needs, over and above the forces we program for the central region, has defined our program to improve:

- Sea control capability in the Atlantic, North Sea, and Mediterranean with emphasis on (1) detecting, tracking and defeating enemy submarines, surface ships and aircraft, (2) confusing or defeating enemy surveillance and targeting systems, and (3) identifying alternate means of projecting air over wide ocean areas beyond the capability of our limited conventional aircraft carrier forces.
- Range and payload of Strategic Mobility forces to minimize dependence on overseas staging and logistical support bases.
- The mobility and equipment of Marine land combat forces, including the possible use of a lightweight anti-armor vehicle to reduce mobility requirements.

In addition to Europe, there are a number of other areas around the world in which there are delicate or even potentially-explosive situations. The Middle East, the Persian Gulf and Korea are examples of areas where the United States and its allies have vital interests. Conflict in one of these areas might require the dispatch of appropriate U.S. forces to the scene in support of friends and allies. Such a contingency might precede or even cause a crisis or war in Europe.

While much of the output of programs directed to the NATO or related maritime scenarios is applicable to these other potential conflict situations, these scenarios also require specialized systems tailored to limited warfare. While some resources are devoted to limited war, in general, significant development devoted to limited war ceased with our withdrawal from Vietnam.

g. Decreased Acquisition & Support Costs

While the Tactical Warfare program thrusts noted above enhance our deterrent posture, they are costly and must be managed efficiently. As discussed in Chapter III, design-to-cost, minimization of total system life cycle cost and elimination of duplicative acquisition programs are among the means by which acquisition and support costs can be reduced. The concept of life cycle cost management has been applied to programs such as the UTTAS, the F-16 and the F-18, and continues to be practiced in many others. We have initiated a number of joint service programs such as the Beyond Visual Range Air-to-Air Missile to minimize development expenditures, to achieve production economies of scale, and to reduce logistics expenses, once these systems become operational. Other examples of cost-reduction efforts include substitution of less-expensive land-based testing for sea trials as in the AEGIS program, and the replacement of a complex launching system of the STANDARD Missile, ASROC and HARPOON with a relatively simple launcher, providing high performance at subatantially reduced cost.

3. Structure/Approach to Subsequent Sections

Tactical development and acquisition programs are managed under one of three major mission areas, depending on whether they support our deterrent posture in Land Warfare, Air Warfare, or Sea Control. Each of the three major mission areas is further subdivided into a number of more precisely defined mission areas as shown in Table VI-3. These mission areas and programs are addressed in detail in the following sections.

TABLE VI-3
TACTICAL ~~PROGRAMS~~ MISSION AREAS

LAND WARFARE	AIR WARFARE	SEA CONTROL
Battlefield Surveillance	Air Superiority	Multi-Mission Naval Systems
Close Combat	Interdiction	Surface Ocean Surveillance
Fire Support	Air Defense Suppression	Undersea Surveillance
Air Defense	Air Mobility*	Anti-Surface Warfare
Amphib/Special Warfare	Theater-Wide Nuclear Forces*	Anti-Air Warfare
Land Mine Warfare		Anti-Submarine Warfare
Logistics*		Naval Mine Warfare
Physical Security*		Sea Denial Nuclear Forces*
Battlefield Nuclear Forces*		

* Managed under this major mission area, although contributing to this and other major mission areas.

B. LAND WARFARE

1. Overview

As noted earlier, the rate of improvement in quality and quantity of the Soviet and Warsaw Pact General Purpose Forces is cause for considerable concern. The overall focus for U.S. and NATO force development and acquisition has been discussed in Section VI. A, Introduction, above.

The Land Warfare major mission area emphasizes all conventional weapon system development and acquisition programs related to ground combat, and covers the mission areas of Battlefield Surveillance, Close Combat, Fire Support, Field Army Air Defense, Amphibious and Special Warfare and Landmine Warfare, plus the related areas of Physical Security and Logistics and General Combat Support.

Major deficiencies in land combat forces being addressed in the FY 1979 Land Warfare development and acquisition program are:

- o Limited conventional weapon capability to destroy massed targets, moving tanks, armored personnel carriers and organic mobile air defense assets
- o Lack of real-time target acquisition capability and related employment doctrine
- o Limited land combat force operational capability in night and adverse weather
- o Marginal survivability, low mobility and inadequate firepower of current armored vehicles
- o Marginal survivability, target acquisition capability, and adverse weather capability of present attack/scout helicopters
- o Poor low/medium-altitude air defense capability in night/adverse weather

- o Limited capability to rapidly implant mines
- o Excessive dependence on manpower to provide physical security at nuclear weapon storage sites, and inadequate security at other high value locations

Our main FY 1979 thrusts in each mission area are as follows:

- o Battlefield Surveillance -- improve surveillance and real-time target acquisition beyond ground line-of-sight
- o Close Combat -- improve our antitank capability, to counter the imbalance in armor forces favoring the Warsaw Pact, not by attempting to match the Soivets tank for tank, by an approach where several complementary anti-armor weapons are integrated into the total force structure
- o Fire Support -- improve our ability to mass firepower at the point the enemy chooses for his attack
- o Field Army Air Defense -- provides:
  - (1) a night/adverse weather, short-range air defense capability to protect our mobile ground fire units and high-value point target assets,
  - (2) complementary high-altitude air defense systems, and
  - (3) updated man-portable systems
- o Landmine Warfare -- move to an effective family of mines capable of implantation by artillery, helicopter, fixed-wing aircraft, and ground means to enhance our ability to establish quick and effective barriers to enemy mobility; improve ability to rapidly clear enemy minefields
- o Physical Security -- provide an effective means to protect both nuclear and non-nuclear assets
- o Logistics and General Combat Support -- provide:
  - (1) improved air delivery in combat zones
  - (2) an integrated logistics system for more expeditious loading, transport, and discharge of military cargo; and
  - (3) more effective aircraft handling systems matched to the fast turn-around needs of tactical air combat in high-intensity warfare

The proposed FY 1979 funding for Land Warfare RDT&E programs is $1.2 billion, compared to $1.1 billion appropriated for FY 1978; for procurement $6.3 billion is requested as compared to $5.3 billion in FY 1978. The largest programs in the FY 1979 Land Warfare RDT&E funding request are:

- PATRIOT (formerly SAM-D) air defense system ($228.4 million)
- the Advanced Attack Helicopter (AAH) ($177.4 million)
- the Air Defense Gun ($75.7 million)
- the General Support Rocket System (GSRS) ($70.8 million)
- XM-1 Tank ($78.4 million)
- HELLFIRE Missile ($65.1 million)

The following sub-sections address the mission areas within Land Warfare, describing mission objectives, these major programs, and other significant programs.

2. Battlefield Surveillance

Battlefield Surveillance developments are emphasizing early warnings to allied forces of Soviet Force movement or concentration to allow sufficient friendly maneuvering time and to designate lucrative targets at ranges beyond the FEBA. In general, systems developed within the Battlefield Surveillance mission area provide timely and accurate information on enemy force structure and movements in the combat area, precision targeting data on enemy threats, and fire adjustment data to friendly fire support for maximum effective fire to meet established military requirements.

The FY 1979 budget request for RDT&E programs in the Battlefield Surveillance mission area is $95.7 million. Representative programs are:

- o Stand-off Target Acquisition System (SOTAS) ($36.9 million)
- o Remotely Piloted Vehicles (RPVs) ($22.0 million)
- o Remotely Monitored Battlefield Sensor System (REMBASS) ($8.7 million)
- o Firefinder - Counterbattery and Countermortar Radars ($11.2 million)

Additional details of the Battlefield Surveillance mission area are contained in Subsection D, Surveillance and Target Acquisition.

3. Close Combat

The major goal of Close Combat mission acquisition is significantly improved weapons for armored and infantry units for use in direct engagements with the enemy. The objective is to develop a combined arms force capable of successfully engaging a numerically-superior armored force. Because Close Combat represents more of a war of numbers than other mission areas, acquisition and life cycle costs of close combat systems must be low enough to allow proliferation, while at the same time exhibiting adequate system performance, survivability and availability.

The FY 1979 budget request for RDT&E programs in the Close Combat mission area is $176.2 million. Major FY 1979 Close Combat development programs include the:

- o XM-1 tank ($78.4 million)
- o M60 tank product improvement ($10.0 million)
- o NATO cooperative tank gun program ($8.1 million)
- o Infantry Fighting Vehicle (IFV) ($28.9 million)
- o BUSHMASTER ($7.2 million)

- o Improved Light Antitank Weapon ($6.3 million)
- o TOW/COBRA TOW ($14.3 million)
- o Advanced Heavy Attack Missile System ($8.1 million)

These programs are discussed in more detail below:

a. XM-1 Tank and Main Gun

Developing a modern, affordable replacement for tne obsolescent M48A5 and M60 is one of our highest priority Land Warfare development objectives. The XM-1 program involves a total development cost of about $600 million over an eight-year period, with $78.4 million being requested for RDT&E and $403.1 million for procuring 110 units in FY 1979.

Properly supported with mechanized infantry and artillery suppression of antitank weapons, the tank continues to be one of the most effective antitank weapon systems and a principal element of the combined arms weapons concept. For operations in a NBC environment, the XM-1 will require individual masks and protective clothing for the crew. However, the Army is currently re-examining alternative methods for improved protection. XM-1 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).

The XM-1 validation phase was completed on schedule, and extensive tests of the competing Chrysler and General Motor prototypes showed excellent results. In parallel with the XM-1 advanced development, the FRG developed a prototype LEOPARD 2 (austere version) to meet U.S. XM-1 requirements and delivered it to the U.S. on schedule in September 1976. This tank underwent testing identical to the XM-1. The U.S. and FRG have signed a Memorandum of Understanding with the objective of standardizing components on these two excellent tanks.

During the XM-1 validation phase effort, proposals were obtained from Chrysler and GM for configuration options to enhance XM-1 standardization and interoperability with tank forces of the NATO Alliance. In November 1976, the Army selected the Chrysler XM-1 prototype design for full-scale development. This design was equipped with the AGT-1500 turbine engine and a turret capable of accepting either the 105mm gun or a 120mm gun.

Future XM-1 milestones are:

- o Dec 1978 - Complete Operational Test II
- o Feb/Mar 1979 - DSARC III (Low Rate Initial Production)
- o Feb 1981 - DSARC IIIA (Full Production)

Funding of production facilities to meet these objectives was initiated in FY 1977. The FY 1979 production fund request of $592.4 million includes $403.1 million for tank hardware procurement (including $188.4 million for initial production facilitization and $143.1 million for production base support. These facilitization costs are preliminary estimates of the FY 1979 portion of the facilities required to reach a peak production rate in FY 1984. These estimates are currently being re-examined to assure that the most economical alternative consistent with our force goal objectives is chosen.

On 31 January 1978, the Army, with OSD concurrence, recommended to the Congress that the Federal Republic of Germany's 120mm smoothbore gun system design begin U.S. development and testing to adapt it to production as the future main armament system for the XM-1 tank. This selection will provide the U.S. with increased capability against long-term armor threats as well as enhance the prospects for interoperability of the next generation of tank guns within NATO.

The date of introduction of the German 120mm smoothbore gun into XM-1 production is dependent on successful completion of essential development and test efforts. These will ensure that this 120mm gun meets U.S. Army requirements for internal turret volume. In addition, certain design modifications will be required to reduce the cost of producing the gun system in this country and to take advantage of certain ammunition advances recently demonstrated. It is expected that questions will be resolved by late 1981. With successful completion of development efforts, the Army expects XM-1 production with the 120mm gun could be initiated in 1984.

We request $8.1 million in FY 1979 to support the cooperative tank gun development effort as a separately funded program from the XM-1 tank program.

b. M60 Product Improvement

Even with the XM-1 in production through the 1980's, we will have more than 6,000 M60 series tanks in our first-line armor forces over the next 20 years. Facing an advancing threat in both quantity and quality, it is vitally important that we continue a product improvement program for the M60 series tanks. For FY 1979, $10.0 million RDT&E is requested for near-term improvements of the M60A1/A3, including an auxiliary power unit/winterization kit, a muzzle position sensor to improve fire control accuracy, a heading reference unit, improvements to the final drive system to enhance reliability, modifications to improve fire survivability, and a program to adapt several devices to improve survivability. Also included is a secure communications device, a radiation/gas alarm, foliage brackets, and an engine smoke generator. In addition, a set of training devices will be developed toward the goal of increased crew proficiency and lower yearly training costs. Procurement request in FY 1979 is $98.4 million for improvement modifications and $383.8 million for 480 M-60 A3s for the Army; and $17.3 million for 28 Marine M-60 A1s.

The competitive prototype phase to select a common module tank infrared thermal sight to enhance night fighting capabilities was completed in May 1976. Planned for use on the M60A3, the sight employs the common module components developed for all vehicular systems including the XM-1 fire control system. Cost savings in production and operations will result from this modular approach. The FY 1979 RDT&E budget request is $1.0 million to complete testing of this unit. Initial production deliveries are scheduled in CY 1978.

c. IFV (Infantry Fighting Vehicle)

The IFV, formerly MICV, has the objective of providing the mechanized infantry forces with an armored squad carrier that has significantly increased firepower, mobility and protection,and the option for mounted attack. As noted earlier, 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 M113 armored personnel carrier in selected mechanized infantry units in the European theater. For operations in a NBC environment, the IFV/CFV will require individual masks and protective clothing for the crew. However, the Army is currently re-examining alternative methods for improved protection. A Cavalry Fighting Vehicle (CFV) version of the IFV will be issued to cavalry units for armored reconnaissance scout roles. Extensive prototype vehicle testing has been accomplished and good progress was made last year toward meeting stringent reliability goals, especially in improvement of transmission reliability. The IFV/CFV program is presently under review to determine reduced cost derivatives and the armament to be placed in the vehicles, whether it should be the TOW missile system and the BUSHMASTER, or just one of the systems dependent on the mission. In 1977 Congress directed the Army to review the IFV/CFV requirement and design. This evaluation is being conducted by a Task Force and should be finalized in March 1978. Procurement funds may be requested for an IFV/CFV derivative in FY 1980 as a result of this evaluation. FY 1979 R&D funds requested are $28.9 million and will be directed toward the recommended program following the OSD evaluation.

d. BUSHMASTER

The primary application of the BUSHMASTER Vehicle Rapid Fire Weapon System is as the main gun armament for the IFV/CFV. To harmonize these developments, the Fighting Vehicle Systems (FVS) program manager has been assigned responsibility for the IFV,CFV, and BUSHMASTER. Two 25mm weapon candidate guns are being developed for this program which incorporates two separate concepts of operation. A self-powered gun which utilizes propellant gases and an externally-powered gun driven by a motor will compete in side-by-side tests. The 25mm ammunition and the self-powered gun candidate selected for the BUSHMASTER have been adapted to U.S. production techniques. A contract for development of an externally-powered candidate gun was awarded in February 1976. After further development, a competitive shoot-off between the two designs will be conducted in early 1978. FY 1979 funding of $7.2 million is requested to conduct final evaluation and selection of the primary weapon for the IFV/CFV. Producibility Engineering Planning (PEP) will be initiated and the IFV Prototype Qualification Test-Government (PQT-G) and Operational Test (OT II) will be supported.

e. Improved Light Antitank Weapon

The Improved Light Antitank Weapon (ILAW or VIPER) is a low-cost (approximately $100 per unit), lightweight, short-range shoulder-fired antitank weapon to replace the M72A2 LAW, which is deficient in range, accuracy and kill probability given a hit. Planned for use as a general assault weapon against bunkers and pill-box type targets, and as a last-ditch defense against surging armor, VIPER is a high priority U.S. Army program. FY 1979 RDT&E funding of $6.3 million is requested for finalizing the hardware development, and $8.3 million procurement money is requested. Producibility Engineering and Planning (PEP) and the Technical Data Package (TDP) will be completed and production will be initiated.

f. TOW

TOW is presently our main antitank weapon system. Investigation of a compatible guidance system for exploiting the capability of the night sight must be initiated in order to overcome a present deficiency. FY 1979 funding of $3.5 million for RDT&E will be used to improve the system. The procurement request contains $42.3 million for the Army and $8.3 million for the Navy, plus $3.4 million for Army TOW modifications. FY 1979 funding of $10.8 million RDT&E in the COBRA TOW program will complete development and testing of the weapons fire control. Seventy-eight COBRA TOW systems are funded for $136.9 million.

g. Advanced Heavy Attack Missile System (AHAMS)

This new weapon system is being developed as a TOW follow-on. Conceptually, the weapon will have a faster time of flight and extended range compared to current systems. In addition, this system will have a self-defense capability against attack helicopters. The program was initiated in FY 1978 with a concept definition phase. A competitive advanced development will be initiated in late FY 1978. This program envisions a NATO cooperative effort to enhance rationalization, standardization and interoperability. FY 1979 RDT&E funding request is $8.1 million.

4. Fire Support

Although the anti-armor capability of our armor, 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 anti-armor weapons to counter massed attacks. Therefore, the anti-armor capability of the close combat forces must be augmented by the fire support arms, artillery, attack helicopters and 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. Command and control of these weapons is also receiving increased emphasis. The FY 1979 budget request for RDT&E programs in the Fire Support Mission Area is $476.6 million. Major FY 1979 Fire Support development programs include the:

- o Advanced Attack Helicopter (AAH) ($177.4 million)
- o HELLFIRE missile ($65.1 million)
- o COPPERHEAD (formerly CLGP) projectile ($13.0 million)
- o General Support Rocket System (GSRS) ($70.8 million)

Discussion of individual programs follows:

a. Advanced Attack Helicopter (AAH)

Studies conducted of close air support requirements have concluded that both attack helicopters and fixed-wing aircraft are needed and that the two are complementary in covering the full spectrum of close air support requirements for range, responsiveness, flexibility and lethality of firepower.

We believe the agility, survivability, long-range standoff and remote designator capability with the HELLFIRE missile will insure that the AAH will be effective as the rotary wing member of the future close air support team. The first phase of the AAH program, a two-contractor competitive airframe engine development, was completed in December 1976 when Hughes Helicopter was selected as the winner.

During Phase 2 the prime contractor will complete the airframe development and integrate the Target Acquisition and Designation System (TADS), Pilot's Night Vision System (PNVS), and other mission equipment into the airframe. Contracts for the TADS/PNVS competitive fly-off were awarded on 10 March 1977. Design-to-cost (DTC) principles are being stringently applied, and the AAH DTC goal of $1.7 million (flyaway unit cost, FY 1972 dollars, including TADS/PNVS cost) remains valid. In FY 1979, $177.4 million is requested to continue AAH development. Both government and contractor flight testing of fully equipped AAHs will be conducted during that period.

b. 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, the greater standoff range, rapid fire, shorter time-of-flight, and the provision of self-target designation and "Launch and leave" (through remote target designation) capability of laser HELLFIRE will significantly enhance the effectiveness and survivability of the AAH. The HELLFIRE warhead will maintain 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). The laser seeker is being developed with the Air Force as lead Service, and incorporates Air Force and Army specifications to satisfy both MAVERICK and HELLFIRE requirements. Cost of the seeker has increased above initially projected level due to engineering changes to correct technical problems experienced in engineering development. A cost reduction program for the baseline seeker has been initiated. An alternate low-cost seeker approach is being concurrently funded to assure that the unit cost remains at or below projected flyaway costs. The FY 1979 request for the laser HELLFIRE is $65.1 million.

c. COPPERHEAD - Cannon Launched Guided Projectile

The COPPERHEAD laser guided projectile offers 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. The first four rounds fired were unsuccessful. Appropriate design changes were made and a successful shot was achieved on round number five. On the sixth round, the gyro failed, resulting in the incorporation of metal parts for some plastic components. We have high confidence that the design is sound as demonstrated by successful tests on the next two attempts. The full impact of these design changes on the design to unit production costs is being evaluated.

Congress has directed IOC dates for both COPPERHEAD and the Navy 5-inch Guided Projectile and expressed a strong desire for maximum component commonality between these two rounds. Congress further directed that the technical data packages for each round be validated in-house. This validation must be done to assure production capability by a source other than the prime development contractor. In order to achieve these goals, the Army has been designated lead Service for the development of all semi-active laser cannon-launched guided projectiles. The COPPERHEAD contractor will conduct the engineering development phases for the Navy 5-inch and 8-inch development. This will assure maximum component commonality between all three rounds, and offers the best opportunity for achieving early IOCs. Competitive procurement programs will be structured to obtain the lowest possible acquisition cost.

Commonality within NATO has been a key goal within this program, and we are taking steps to provide the opportunity to at least ten NATO countries to utilize the round in their 155mm weapons. The FY 1979 RDT&E budget request is $13.0 million, and the procurement request is $55.8 million.

d, General Support Rocket System - GSRS

The Soviets, and Warsaw Pact in general, place great emphasis on the use of artillery and free rockets. NATO artillery is outnumbered by a factor of three to one. The Soviet massive artillery and multiple rocket capability could rapidly diminish the effectiveness of NATO anti-armor weapons and artillery. Resource limitations have precluded NATO from offsetting this artillery superiority with additional howitzers. The General Support Rocket System is a promising, potentially affordable way to enhance our surge fire support capability for counterbattery, air defense suppression and delivery of scatterable mines while having the capability to operate in an NBC environment. Several foreign rocket systems, as well as adaption of existing U.S. rockets and new development systems have been evaluated for this mission. No existing or developmental systems will satisfy the Army requirements, and a DSARC held in January 1977 approved a new development program.

A two-contractor competitive accelerated Advanced Development phase was initiated in September 1977. The design being competed provides for the development of a tracked vehicle/launcher capable of firing 12 rockets from two pods containing six rockets each. This system is designed to receive a fire mission, fire the entire load, and evacuate the position in a short period of time. The rocket design allows some flexibility in diameter so that tradeoffs can be made to accommodate various payloads. 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.

There is considerable NATO interest in the program and rationalization and standardization within the NATO alliance is a major consideration in the program structure. The U.S. and FRG have recently signed a Declaration of Intent on development of a medium multiple launch rocket system (MLRS). It is a declaration of the intent of the signatories to establish an agreement on the design, development and production of a MLRS which satisfies the agreed upon tactical requirements of both nations and potentially meets similar requirements of other NATO armies. A detailed Memorandum of Understanding will be developed prescribing the specific steps for a cooperative MLRS development and production program. The FY 1979 request for $70.8 million is to support an accelerated competitive advanced development program, while working with NATO to assure maximum rationalization and standardization.

e. Other Major Procurement Programs

Major FY 1979 procurement programs in Fire Support not addressed above include:

- 155mm HE (ICM) Ammunition $144.4 million/340,000 rounds
- 8-inch HE (ICM) Ammunition $115.7 million/129,000 rounds

5. Field Army Air Defense

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 (shoulder- as well as vehicle-launched); larger, more complex and costly surface-to-air missile systems for providing area coverage at medium and high altitidues; and manned (discussed under Air Warfare) interceptors/air superiority aircraft to police the air space and to counter massed air attacks in a complementary role to the ground-based air defense systems.

The recently completed Air Defense Requirements Study confirmed that serious deficiencies exist in our deployed abilities to perform in the projected threat air defense suppression environment. A replacement system for each of the currently deployed systems is in development to correct these deficiencies. The FY 1979 RDT&E budget request in the Field Army Air Defense Mission area is $382.6 million. Major FY 1979 Field Army Air Defense development programs include:

- o PATRIOT ($228.4 million)
- o Improved HAWK ($3.1 million)
- o ROLAND ($22.7 million)
- o STINGER ($24.6 million)
- o Division Air Defense Gun ($75.7 million)

These programs are discussed in more detail below.

a. Medium/High-Altitude Air Defense

1) PATRIOT

The PATRIOT (formerly SAM-D) is planned to replace the NIKE HERCULES and Improved HAWK, providing greatly increased electronic counter-countermeasures and simultaneous engagement capability. PATRIOT has been in Engineering Development since March 1972. A production contract award decision is planned for April 1980.

To date a total of 23 guided flight tests have been conducted with 22 successes. During 1977, the PATRIOT test program conducted eight firings, all in a countermeasures environment. A flight of two drones permitted the system to exercise its multiple simultaneous engagement capability. All 1977 flights were successful. The program plan for 1978 involves higher stress level testing in the ECM environment as well as exploration of engagement boundaries. Fifteen of the 19 firings scheduled for FY 1978 will be for specifications/compliance purposes.

During the last year, NATO has established a PATRIOT Project Group whose objective is to formulate a Memorandum of Understanding for those nations interested in replacing NIKE HERCULES with PATRIOT. The draft MOU is planned to be presented to the 1978 spring meeting of the Council of National Armament Directors.

The FY 1979 RDT&E budget request for PATRIOT is $228.4 million. The procurement request is $67.3 million. The PATRIOT program is in the final development phase. The requested RDT&E funding is needed to complete the contractor test program and begin government testing (DT II/OT II).

2) Improved HAWK

While PATRIOT is planned to replace Improved HAWK, there will be significant HAWK quantities in the inventory into the 1980's. The FY 1979 RDT&E funding of $3.1 million will allow continuation of near-term improvements on critical techniques and equipment modifications to increase the system survivability. The

Army is buying 608 HAWK missiles in FY 1979 for $72.3 million, and the Marines are spending $2.4 million on the Improved HAWK PIP program.

b. Short-Range Air Defense

1) ROLAND

ROLAND will replace the fair-weather/daylight CHAPARRAL system in the Corps and rear areas and is required to counter the increasing night/adverse weather air threat. The ROLAND RDT&E program consists of a technology transfer and fabrication effort from Europe (French/German). The program is a significant U.S. effort to adopt a foreign-developed major weapon system to U.S. fabrication and will, therefore, have a major impact on the future success of weapon system cooperation and standardization with our NATO Allies. The restructured technology transfer, fabrication and test (TTF&T) program was approved in December 1976 and is proceeding on schedule to a planned production decision in September 1978. The first two U.S.-produced missiles were successfully fired from French-built fire units in December 1977. During the FY 1978 Appropriation Hearings, the Congress directed that $11.4 million in procurement effort be transferred to the RDT&E program with appropriate adjustments in funds. Total development cost is now estimated at $276.4 million (previous $265 million plus $11.4 million). The FY 1979 RDT&E request is $22.7 million, and the procurement request is $200.1 million.

2) STINGER

Compared with REDEYE, which it will replace, the

STINGER shoulder-launched IR-guided missile will provide improved point (self) defense against the air threat by its all-aspect, high-speed target engagement capability and reduced susceptibility to countermeasures. STINGER development commenced in May 1972. Production was approved in November 1977. Engineering development of an improved seeker for STINGER, the Passive Optical Scanning Technique (POST) seeker, was approved in June 1977. The FY 1979 RDT&E funding request for POST seeker development is $24.6 million. The procurement request is $104.9 million for 2,250 missiles for Army and $17.5 million for 428 missiles for the Marine Corps.

3) Division Air Defense Gun

The Division Air Defense Gun development is addressing 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 the role by virtue of their lack of armor protection, limited range and effectiveness, and fair-weather/daylight capability only. The Army has completed an extensive cost and operational cost effectiveness analysis which considered alternatives for fulfilling the role. Alternatives included VULCAN, ROLAND, DIVADS and a conceptual gun derivative system in addition to the DIVAD gun. The generic air defense gun was found to be the preferred system. In January 1978, contracts were awarded to Ford Aerospace and Communications Corporation and General Dynamics, Pomona Division, for an accelerated 27-month competitive prototype engineering development program. Total RDT&E

cost is estimated at $184 million of which $76 million is requested in FY 1979.

6. Amphibious Assault and Special Warfare

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. Recognized deficiencies in the are include:

- o slow speed and low survivability of present landing craft
- o decline of gun fire support assets
- o inadequate mine clearance capability
- o combatant landing craft have no effective weapon system capability beyond line-of-sight range

Special warfare is also included in this mission area, but due to priority shifts and fiscal constraints, the special warfare RDT&E program is at minimum levels.

The FY 1979 RDT&E budget rquest for programs in the Amphibious Assault and Special Warfare mission area total $36.3 million. Major programs in this mission area are:

a. Landing Vehicle Assault (LVA)

The LVA is a high-mobile amphibious landing vehicle, designed to replace the LVTP7 in the mission of transporting and supporting Marine assault forces during amphibious assault and subsequent operations ashore. Funding of $12 million is requested in FY 1979 to complete small-model testing, and to conduct single and multi-rotor rotary combustion engine full power demonstrations. DSARC I is scheduled for late FY 1979.

b. Landing Ship, Dock - LSD-41 class

$18.3 million is requested in FY 1979 to complete design efforts in preparation for an award of the lead ship construction contract in FY 1980 of this new class of Amphibious Force vessels to replace the 30-plus year old LSDs now in the fleet. The LSD-41 will carry amphibious force landing craft, amphibious vehicles, troops and helicopters in support of amphibious operations.

7. Landmine Warfare

We are still limited in our ability to rapidly dispense munitions for area denial or barrier purposes. The Army continues to make significant progress on the tactical effectiveness and responsiveness of landmines through the development of a family of scatterable mines which can be dispensed rapidly from helicopters, ground dispensers, cannon artillery, rockets and tactical aircraft. As a result of this application of new and improved technology, the minefield continues to be one of the most effective, efficient, and adaptable obstacles available. The increased pace of modern warfare together with the fluidity and porosity of today's battlefield make the use of labor intensive, hand emplaced, logistically burdensome, conventional mines less effective than in previous wars. Scatterable mines placed with multiple delivery means provide a formidable threat and deterrent to mass armor attacks such as can be mounted by the Warsaw Pact.

Likewise, we are lacking both in quality and quantity of means for clearing mines. We are also deficient in the capability to detect mines and booby traps. Major efforts in this mission area include artillery delivered antitank/antipersonnel (AT/AP) mine systems, the remote anti-armor mine (RAAM), and area denial artillery AP munition (ADAM); and the ground-emplaced mine scattering system (GEMSS). These programs are described briefly below. RDT&E funding requested for this mission area in FY 1979 is $34.4 million.

a. RAAM

This antitank round will be delivered by a 155mm howitzer and consists of a projectile containing nine XM-70 AT mines. The individual mines can be factory-set for two options of self-destruct times. The round will be type classified standard for full-scale production in FY 1978, and production will commence in FY 1978. FY 1979 RDT&E funding is $1.6 million, and the procurement request is $51.7 million for 24,000 units.

b. ADAM

ADAM, the antipersonnel complement to RAAM, will also be employed as a 155mm round, consisting of 36 AP mines also with options for self-destruct times. The procurement request in FY 1979 is $65.8 million for 16,000 units.

c. GEMSS

This program provides a dispenser to rapidly emplace mines. The GEMSS employs both AT and AP mines costing about $90 each that have present self-destruct times. Production of GEMSS will begin in FY 1979. The RDT&E request is $2.1 million and the procurement is $7.6 million for six dispensers and 11,000 mines.

8. Physical Security Equipment

The tri-Service physical security equipment program was established to coordinate efforts to develop and install fully integrated interior and exterior physical security sensor systems for the protection of nuclear and conventional weapon sites, critical supply and POL facilties, and rear-area security for tactical units. Some components of the system will be capable of satisfying the anti-terrorism needs of both the DOD and other government agencies. To that end, a process for sharing with other agencies of the federal government the information and equipment derived from this program, is being investigated. The total physical security system will provide the means to detect attempted intrusions over land or water and will possess the capability to deny access to selected DOD assets within the parameters of the postulated threat; and to disable or destroy certain items through activation of remotely controlled disabling/destruction elements should denial measures fail. To accomplish these objectives, $31.8 million is requested in FY 1979. Certain responsibilities have been assigned using the "lead agency" management technique and are described below:

a. Defense Nuclear Agency

The Defense Nuclear Agency (DNA) will oversee all exploratory development work aimed at physical security equipment and apportion $2 million for this effort in FY 1979.

b. Army

The interior segment of the DOD standardized system is being designed to interface with existing military security sensors, and an interface module to permit integration of commercial devices will be in production by FY 1978. $8.9 million is requested for FY 1979. A major effort is planned to effect better lighting and barriers, with application beyond nuclear and chemical storage sites.

c. Air Force

The land-based portion of the exterior segment of the DOD standardized system has a scheduled IOC of FY 1981. The waterborne intrusion detection segment of the exterior system will now be available in FY 1983 to link up with the land-based elements. In the interim, security personnel will be utilized to fill the void. $18.2 million RDT&E is requested in FY 1979 to meet the projected IOCs, and the procurement request is $27.9 million.

d. Navy

The shipboard physical security equipment system will utilize, to the extent practicable, devices developed by the Army and Air Force. The analysis necessary to accomplish program definition is scheduled to continue in FY 1979 and $5.3 million has been requested for that purpose. The anti-compromise emergency destruct program will also continue, with Service requirements being defined in FY 1978 and selected items entering advanced development, as necessary, in FY 1979.

9. Logistics and General Combat Support

This mission area includes numerous programs designed to meet the objective of providing responsive support to our operating forces. Action efforts include development of such items as relocatable hangers, aircraft flight simulators, aircraft handling equipment, fuel and container handling systems, aircraft maintenance and servicing equipment, and engineer and construction equipment. Major deficiencies in this area are:

- o Commercial container ships and tanks are not configured for efficient off-loading at unimproved operating areas such as might be expected in a war situation
- o Lack of sufficient POL distribution and storage in forward areas; and
- o High aircraft and vehicle support costs.

Funding requested for this mission area for RDT&E in FY 1979 is $54.6 million. Significant programs are as follows:

a. General Combat Support

This is a continuing U.S. Army development program to improve numerous areas of logistics support. Ongoing efforts include: Combat Engineer Equipment; Container Distribution; POL Distribution Systems; Tactical Rigid-Wall Shelters and Camouflage Equipments. In FY 1979, $6.2 million RDT&E funding is requested for combined Advanced Development and Engineering Development efforts.

b. Advanced Logistics

This is a U.S. Navy logistics development program developing, among other things, a system to transfer POL from deep-draft commercial and MCS tankers in support of amphibious forces ashore. In FY 1979, $5.9 million is requested for this effort.

C. AIR WARFARE

1. Overview

Air Warfare covers the mission areas of Air Superiority, Interdiction, Tactical Air Reconnaissance, Defense Suppression and Air Mobility. The primary goals of the Air Warfare programs are to increase the effectiveness of tactical air in countering the Warsaw Pact, to defend against air threats to our Naval forces and to improve the capability for projection of sea-based air power against land objectives.

Deficiencies in the Air Warfare area include:

- o Assured capability to kill low-altitude formations of attacking aircraft.
- o Effective interdiction of combined arms beneath low ceilings.
- o Continuous surveillance of moving vehicles.
- o Full exploitation of minimum-altitude tactics.
- o Effective suppression of air defenses.
- o Aging effects on stragetic and tactical airlift fleets.

Primary RDT&E thrusts in the Air Warfare area are:

- o Air Superiority--providing a combination of air-to-air weapons and fighter aircraft which can assure us air superiority over the ground battle such that our attack aircraft effectively can perform close air support and interdiction of the battlefield.
- o Interdiction--providing aircraft and weapons effective both for close air support and interdiction of second-echelon armor and support forces under night/adverse weather conditions in Europe.

- o **Tactical Reconnaissance--providing theater and Corps Commanders with adequate and timely information on opposing force's major thrusts, feints and weaknesses. Standoff all-weather sensors, coupled with direct observation, will accurately target those activities so that appropriate strike responses can be selected.**

- o **Defense Suppression--developing tactics and appropriate systems needed by our air forces to avoid, degrade or destroy enemy surface-to-air defenses, thereby permitting our air forces the option of exercising the full range of attack tactics.**

- o **Air Mobility--enhancing the operational effectiveness of strategic and tactical airlift systems, increasing availability and endurance of tactical support helicopter systems, providing operationally effective, survivable, and affordable vertical takeoff and landing transport aircraft.**

The requested RDT&E funding for the Air Warfare area is $1.3 billion in FY 1979 as compared to $1.5 billion for FY 1978; for procurement $9.8 billion is requested in FY 1979, as compared to $9.4 billion in FY 1978. The major Air Warfare RDT&E programs are:

- o F-18 ($473.6 million)
- o F-16 ($107.9 million)
- o AV-8B V/STOL attack aircraft ($35.6 million)
- o GBU-15 air-to-surface weapons family ($26.0 million)
- o PERSHING II ($10.1 million)
- o HARM ($43.4 million)
- o New Beyond Visual Range air-to-air missile ($36.7 million)

The following sections address the mission areas within Air Warfare, describing mission objectives, these major programs, as well as other significant programs.

2. Air Superiority

Soviet and Warsaw Pact tactical aircraft enjoy a quantitative advantage. This constitutes a formidable threat and basically establishes the requirements for our Navy and Air Force air superiority developments. Past Soviet aircraft generally have been tailored to a single mission, although recent Soviet fighters, such as FLOGGER and FENCER appear more multi-mission in nature and have the capability of operating from dispersed sod runways. Pact tactical air forces are designed to deny allied air superiority, degrade effectiveness of our attack aircraft and conduct air strikes against allied air bases. NATO must acquire and maintain air superiority in the vicinity of the FEBA to allow optimum use of our attack aircraft in providing the mobile added firepower required to blunt a massive enemy armored attack. Our fighter/interceptor aircraft must also make a significant contribution to the defense of high-value land and sea based combat units complementing their surface-based air defenses by denying the enemy the low-altitude attack area. This supports the need for an effective look down/shoot down capability.

Since the Pact tactical air forces have numerical advantage, our fighters must have a significant capability advantage in order to ensure very high loss exchange ratios and yet be able to generate high sortie rates from the outset of a war. Our high/low fighter mix, coupled with effective weapons, will allow us to meet these objectives.

We are shifting development emphasis to the "low" portion of the mix as the procurement of the more costly F-14 and F-15 aircraft proceed. These new fighters are smaller, lighter, more maneuverable and less costly and complex. They will fire weapons with higher aerial combat kill probabilities. All fighters under development or in production will have an integral 20 mm cannon for close-in aerial combat and carry the AIM-9L as an interim within-visual-range (WVR) air-to-air missile. The F-14 fleet air defense aircraft also carries the long range AIM-54 PHOENIX missile.

In 1979 we are requesting $689.7 million for RDT&E in the Air Superiority mission area. Major FY 1979 development programs include:

- F-18 ($473.6 million)
- F-16 ($107.9 million)
- Beyond Visual Range Air-to-Air Missile ($36.7 million)
- Within Visual Range Air-to-Air Missile ($12.2 million)
- F-14A/AIM-54C ($24 million)
- F-15A ($10 million)

a. F-18 Naval Air Combat Fighter

Full-Scale Development of the F-18 started in 1975 and all major milestones have been on schedule. For FY 1979 we are requesting $473.6 million in development funds. Both fighter and attack versions are being developed concurrently, with a considerable savings in cost and time. The F-18 will provide the Navy and USMC with a superior fighter aircraft at much lower cost than the F-14 and will replace the aging F-4 fleet in both services. The A-18 attack model will provide a replacement for the A-7E with vastly superior air-to-air capabilities while retaining a comparable air-to-surface capability. A reconnaissance version may also be developed. The future production of F-18/A-18 is expected to arrest the decline of the Navy/USMC tactical fighter/attack aircraft inventories. First flight is presently scheduled for late 1978. $350.5 million is sought to begin procurement of the first five production aircraft.

b. F-16 Air Combat Fighter

The F-16 is a result of the USAF Lightweight Fighter competition. The F-16 has been configured for the general purpose tactical role, including nuclear strike, and yet retains its superior air-to-air combat potential, using the AIM-9L Advanced Sidewinder WVR air-to-air missile and the 20 mm M61 Gatling gun. The first Full-Scale Development aircraft was rolled-out in October 1976 on schedule and is undergoing development testing. In late CY 1977, funding was released for production of 105 F-16s. This aircraft is being co-produced by four European nations: The Netherlands, Denmark, Norway and Belgium, known as the European Participating Group (EPG). Delivery of first production USAF aircraft is scheduled in August 1978. First production EPG aircraft will be delivered in January 1979. In 1979, we are requesting $107.9 million in development funds and $1,375.1 million for procurement of an additional 145 F-16s.

c. Beyond Visual Range (BVR) Missiles

Beyond Visual Range air-to-air missiles are required to enable our fighter/interceptor aircraft to kill enemy aircraft and missiles which threaten our land and sea-based, high value combat units. Our current missiles, the radar-guided AIM-7F Advanced Sparrow and the AIM-54 Phoenix, both have disadvantages such as excess weight, cost and complexity. We have on-going programs to develop improvements for both of these missiles.

Our major long term emphasis is the development of a new radar-guided BVR missile which is significantly smaller than the AIM-7F. A key objective is low cost so we can afford to buy these missiles in large quantities and expedite replacing less reliable early models of the AIM-7 missiles. Another BVR missile objective is compatibility with future fighters as well as those manufactured by our NATO allies. We have established a joint BVR Project Office, under Air Force leadership, which has the task of developing this new missile. This office is drawing together a number of technology-related efforts and from them will initiate a prototype development program patterned after the highly successful USAF Lightweight Fighter prototype program. In FY 1977 we funded a study to evaluate our air-to-air BVR requirements against possible competitive concepts, such as the Navy Shipboard Interim-Range Combat System (SIRCS). We believe we will find areas of potential commonality with possible cost sharing and significant savings.

By applying the "shoot-before-buy" concept to BVR development, we hope to shorten the development process, save money, and resolve some fundamental questions as to our next generation of radar-guided missiles. In FY 1979, $36.7 million RDT&E is being requested to continue advanced development. Full-scale development is slated for 1981 with an IOC scheduled for the mid 1980s.

We are also evaluating the UK-developed XJ521 SKYFLASH missile as a possible interim weapon for some of our existing aircraft, which will phase out of the inventory before the new BVR missile can be developed. In order to continue to fill our air-to-air missile inventory, we have requested procurement funds of $193.0 million for 2010 AIM-7/RIM-7F missiles and $86.1 million for 210 AIM-54 missiles in FY 1979.

d. Within Visual Range (WVR) Missiles

This family of missiles is intended to be the primary air-to-air weapons for "dogfighting" when target is beyond effective gun range. Our interim weapon, the AIM-9L SIDEWINDER is currently in production. The missile will provide a head-on potential against non-afterburning targets and will be produced both in the U.S. and the Federal Republic of Germany. We are in the process of improving critical AIM-9L components such as the seeker, the rocket motor and the optical fuze, to make them more effective and producible. The funding requested is $129.9 million for 3150 AIM-9L missiles procurement in FY 1979. Our major emphasis for the future is to tie together a number of technology-related programs and requirements studies into a joint Navy/USAF effort for a new missile. The AIMVAL program was a joint Navy/USAF effort which was directed by Congress with the purpose of determining the value of seeker sensitivity and off-boresight target acquisition for WVR missiles. AIMVAL has completed flight testing and initial reports are presently being reviewed by OSD. As a result of the AIMVAL data analysis, a Joint Services Operational Requirement (JSOR) is being prepared. AIMVAL, however, provides only a portion of the answers. We have also initiated efforts with both the Navy and Air Force which can resolve some of the other important issues involved in development of a new WVR missile. We need to know, for example, the relative value of cryogenic versus thermoelectric cooling, and the potential of Advanced Technology Warheads and fuzes. When we have sufficient data to merge the efforts of the two services into a joint program, a lead service will be designated and a prototype development effort initiated similar to the BVR effort now underway. For FY 1979, $12.2 million (equally divided between the Navy and Air Force) is requested to investigate promising technologies involved with seeker components and other related hardware. We believe this program meets with the guidance provided by Congress, and that this approach is the best way to gain a confident understanding of the value of these technologies and associated problems.

e. F-14A TOMCAT

We are correcting deficiencies in the F-14A engine and avionics systems and are proceeding with a program to develop improvements in the AIM-54 PHOENIX missile system, for which we are requesting \$24.0 million in FY 1979. We expect current aircraft deliveries to exhibit improved reliability, and especially improved engine serviceability. We are continuing to examine ways to improve this weapon system, as it will be a mainstay of our fleet air defenses for many more years. Procurement funds for the next increment of 24 aircraft total \$632.2 million in FY 1979.

f. F-15A EAGLE

The F-15 is continuing toward maturity and is meeting its goals. The PEP 2000 program is underway and will provide increased combat time through the addition of 2000 pounds of internal fuel. The F-15 with the AIM-7F will serve as our primary theater air defense interceptor and escort fighter, particularly in Central Europe. We are requesting \$10.0 million in development funds for FY 1979 and \$1,328.7 million in procurement for 78 aircraft.

3. Interdiction

The threat is a Warsaw Pact combined-arms attack, coupled with massive air attacks against NATO high-value targets, such as airfields, command centers, POL, second-echelon forces, and conventional and nuclear weapon storage sites. To counter this threat, our development programs in the interdiction mission area are oriented toward expanding our options for attacking Pact main operating air bases and toward enhancement of our effectiveness for close air support and interdiction of second-echelon armor under night/adverse weather conditions in Europe. We are requesting $322.1 million in FY 1979 for development in this mission area. Major development programs included are:

- o AV-8B ($85.6 million)
- o PERSHING II ($10.0 million)
- o Conventional Airfield Attack Missile ($5 million)
- o PAVE TACK ($2.9 million)
- o Advanced Attack Weapons ($28.6 million)
- o Low Altitude Airfield Attack System ($26.0 million)

a. AV-8B Improved HARRIER

We have under advanced development an improved version of the currently-operational AV-8A light attack V/STOL aircraft. The purpose of this new aircraft is to maintain the USMC light attack force capabilities to meet the projected threat of the 1980's and to transition the Marine light-attack assets to an all V/STOL force. Payload capability and delivery accuracy of the AV-8B Improved HARRIER would be approximately double that of the present-day HARRIER. A two-prototype aircraft flight demonstration phase has been authorized. $85.6 million is requested in FY 1979 to complete this flight demonstration phase to initiate full-scale engineering development.

b. PERSHING II

The PERSHING is a theater tactical nuclear mobile missile which constantly maintains readiness in order to deliver quick-reaction alert nuclear strikes in support of the Supreme Allied Commander, Europe. Upon completion of this mission, the system reverts to general support of the Army in the field. The proposed PERSHING II system is a modernization of the currently-fielded PERSHING Ia system utilizing the same propulsion stages and modified launch equipment. Improvements involve replacing the PERSHING Ia re-entry vehicle and its guidance and control components with a new guided re-entry vehicle and warhead. Accuracy is improved through a radar area correlator terminal guidance system using a prestored reference. These improvements will increase system accuracy permitting the use of lower yield warheads thus reducing the anticipated collateral damage resulting from use of the PERSHING system. The funding requested for this program includes $10.1 million which provides for continued component development and testing in FY 1979. PERSHING Ia production to fill a shortfall in force strength will be continued in FY 1979 with a missile buy at a cost of $65.6 million.

c. Conventional Airfield Attack Missile (CAAM)

The combination of the Warsaw Pact Air Force numerical superiority, coupled with their opportunity to initiate an attack against NATO airbases and other high-value targets continues to be a difficult problem. Our efforts to counter the Pact advantage have included aircraft sheltering, ground and air defenses, and a conventional second-strike capability utilizing attack aircraft. The interdiction of Pact main operating air bases (MOBs) to reduce their aircraft sortie rate potential is difficult because of the combination of airbase hardening, air defenses and weather. Technology now will permit effective, immediate and virtually unstoppable counter attacks with conventionally armed surface-to-surface missiles, regardless of weather or defenses in the target area. Cost and operational effectiveness analyses conducted during the past year have verified that such a system would have a relatively high payoff for an initial attack supported by follow-up aircraft attacks. A conceptual design and feasibility demonstration activity for a PERSHING II version of a Conventional Airfield Attack Missile (CAAM) was initiated last year. We are requesting $5.0 million in FY 1979 to continue this feasibility demonstration activity.

d. PAVE TACK

The problem of interdicting Warsaw Pact armored thrusts and second-echelon forces on the battlefield requires a round-the clock attack capability. We have developed this capability in the form of PAVE TACK which provides a FLIR-equipped target acquisition pod for selected aircraft, such as the F-4 and F-111. This affords USAF pilots the assistance they require to attack surface targets during limited-visibility conditions and to employ Imaging Infrared (IIR), Laser Guided and other weapons. We are requesting $2.9 million for PAVE TACK development in FY 1979 and procurement of 48 pods for $67.9 million.

e. Advanced Attack Weapons

We have begun the development of an appropriate family of area munitions, dispensers, warhead and guidance systems in the Advanced Attack Weapons program, for which we are requesting $28.6 million in FY 1979. These weapons will complement other Precision Guided Munitions (PGMs), and systems which operate in concert to give tactical aircraft capability to effectively attack armor and support forces under the anticipated weather conditions and defensive environment of Central Europe. In addition, these direct-attack weapons will be deployable from aircraft flying at very low altitude and will enhance the exploitation of minimum-altitude, direct-attack tactics, which will increase kills per pass and improve aircraft survivability.

f. Low Altitude Airfield Attack System

We have initiated a joint US/UK engineering development program for the JP-233 Low Altitude Airfield Attack System (LAAAS). JP-233 was designed originally for the MRCAs and includes runway and area denial munitions.

g. Other Major Procurement Programs

Major FY 1979 procurement programs in Interdiction not addressed above include:

- A-4M Skyhawk aircraft - $113.0 million.
- A-6E Intruder aircraft - $186.1 million.
- A-10 Close Air Support aircraft - $884.6 million.

4. Tactical Reconnaissance

A detailed discussion of this area is contained in Chapter VII.

5. Defense Suppression

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 supporting 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 scenario analysis, equipment/concept testing and hardware development to define an appropriate mix of lethal and non-lethal systems.

a. Lethal Suppression Systems

For FY 1979, $74.9 million is being requested for lethal defense suppression, with the largest funding in the High Speed Anti-Radiation Missile (HARM) and the GBU-15 weapon systems.

(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 offers the potential of being able to attack radar threats which are beyond the capability of either SHRIKE or standard ARM anti-radiation missiles. It is a joint USN/USAF program and is intended to be used with the USN A-7 and F/A-18 and the USAF F-4G Wild Weasel aircraft. This program has undergone thorough review within DoD during the last calendar year and has been redirected to be more responsive to the Warsaw Pact threat scenario. As a result, the missile's passive radar seeker design has been improved to also counter air defense systems operating in a higher frequency band. Further, the missile's reaction time-to-target has been improved through air frame maneuverability design changes. We are requesting $43.4 million in FY 1979 for the continued development of this program.

(2) GBU-15

We are requesting $26.0 million in FY 1979 for the GBU-15 program. This is a modular weapon that accommodates the Mk-84 unitary warhead and the SUU-54 cannister filled with submunitions. It will have the capability of a stand-off weapon by virtue of various mid-course and terminal guidance schemes such as TV, Imaging Infrared, Laser and the Distance Measuring Equipment (DME) modules. The DME guidance module makes the GBU-15 compatible with the Position and Location Strike System (PLSS) target location system, to facilitate the destruction of radiating targets. Flight test programs that have been accomplished during the last year have been successful, particularly those tests of the cruciform GBU-15 at low altitudes, which suit well the weather and defensive environments of Europe.

b. Non-Lethal Suppression

The principal needs in the non-lethal area of defense suppression include improved self-protection warning/jamming systems for attack and bomber aircraft against advanced SAM's; support jammers to counter enemy surveillance and fighter-control radars; capability to locate hostile radars accurately; and communications location, and jamming systems to counter enemy command, control and communications (C^3) thus disrupting air, land, and sea combat operations.

Significant progress was made during CY 1977 to strengthen our program of developments to protect our forces against enemy radar and electro-optically controlled weapons and to locate, exploit or jam enemy command, control and communications systems. The PACT has continued to develop new SAM and AAA systems and improve the older versions of these weapons, as well as the surveillance/target acquisition radars that serve as the "eyes" for their air offense and air defense operations. There are three major RDT&E efforts to counter the PACT's increased capability.

(1) Precision Location Strike Systems (PLSS)

Development of PLSS was initiated in 1977. The PLSS objective is to locate and destroy the enemy's most lethal and difficult-to-jam radars. The PLSS will require $86.8 million to support its development in FY 1979.

(2) EF-111A

The EF-111A aircraft is designed to jam enemy radars and thus deny him radar surveillance and acquisition of our strike aircraft. The EF-111A will require $8.8 million in FY 1979 to complete development.

(3) Other Systems

The third counter-radar effort is the Advanced Special Purpose Jammer (ASPJ) for the F-14 and F-18 aircraft and future internal Electromagnetic Countermeasures (ECM) requirements which, combined, will require $16.1 million in FY 1979. Other important non-lethal defense suppression requirements include $11.8 million to add an additional jammer capability and to install and flight test the ALE-40 chaff and flare dispenser in the F-15 aircraft.

6. Air Mobility

Air Mobility encompasses development programs designed to provide new transport aircraft capabilities, as well as to modify and modernize existing transport aircraft assets. The historical trend of placing increased emphasis on air mobility continues. Continued emphasis is being placed upon the goal of improving combat survivability, decreasing costs, and achieving greater use of common aircraft throughout the Services and consolidation of present aircraft models to standard configuration. This goal is being accomplished by:

- Requiring the Services to consider utilizing aircraft being developed by other Services, e.g., a derivative of the Army's UTTAS has been selected for the Navy ASW (LAMPS) requirement;

- Modernizing older aircraft models to a standard configuration, e.g., CH-47 Modernization Program and the CH-53 Modernization Program;

- Improving survivability. The new and modernized generation of helicopters will have enhanced survivability afforded by: (1) ballistically-tolerant dynamic components, (2) redundant load paths and redundant components, (3) crashworthy, fire resistant fuel tanks, (4) greater acceleration capability, (5) optical countermeasure paint/glass, (6) IR countermeasure paint/devices;

- Decreasing costs. The DoD helicopter commonality policy and supporting committees are designed to ensure that the next generation of DoD helicopters will consist of a small family of baseline helicopters, having incremental ranges of complementary performance capabilities consistent with all the U.S. Services' requirements. This approach is expected to avoid $1.5 billion in RDT&E costs and produce a significant acquisition and support cost avoidance.

Air Mobility encompasses both strategic and tactical mission objectives. Strategic objectives include the capability to meet worldwide deployment requirements. Tactical mission objectives include the capability to air deliver/resupply combat units within a battle theater, perform search and rescue missions, and provide aeromedical evacuation.

Recognized defieiencies in this area include:

- o The tactical transport aircraft fleet is aging and is deficient in overall capacity. Programmed service life attrition requires replacement/modernization of the fleet.
- o The remaining wing life of the C-5A aircraft is deficient.
- o Maintainability, safety, and combat survivability features of present helicopters are deficient.
- o Navy fleet logistics support aircraft are deficient both in service life and quantity.

FY 1979 RDT&E funding for Air Mobility programs is proposed at $75.5 million, with approximately 70% of that devoted to the modification of existing aircraft such as the C-5A transport and CH-47 and CH-53 helicopters.

a. Helicopter Developments

(1) Utility Tactical Transport Aircraft System (UTTAS)

The UTTAS helicopter (BLACKHAWK) is being procured by the Army to replace the aging UH-1 series helicopters in the assault and utility missions. Reliability, maintainability, and survivability are being emphasized during the design and development of UTTAS.

Sikorsky Aircraft was selected as prime contractor in December 1976 after a flyoff competition with Boeing Vertol. The FY 1979 UTTAS RDT&E request is $3.0 million, which will provide for airworthiness, flight characteristics, and cold region testing. Initial production delivery of the planned 1107 UTTAS helicopters will begin in mid CY 1978 with an IOC scheduled for the late 1980s. FY 1979 requested procurement funding is $346.3 million.

(2) 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 1979, $19.5 million is requested for roll-out of two prototypes and first flight.

(3) CH-53 Modernization

This program is to modify the CH-53A model helicopters to a new F-configuration and will result in improved reliability and maintainability, increased range, and extended service life of the CH-53A fleet. In FY 1979, $4.6 million is requested to initiate extensive analysis of two fleet aircraft, which will be selected for modification as developmental prototypes for this program.

b. Fixed Wing Aircraft Development

(1) C-5A Wing Modification

The Air Force has determined that the fatigue lift 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 will be completed during CY 1978. $37.2 million is requested in FY 1979, to continue development and begin testing of the modification kits. Full scale production of the kits will begin in FY 1980, with installation beginning in FY 1982 and completion scheduled for CY 1987.

D. SEA CONTROL

1. Overview.

The major mission area of Sea Control includes the mission areas of Multimission Naval Systems, Surface Ocean Surveillance and Targeting, Undersea Surveillance, Anti-Surface Warfare, Anti-Air Warfare and Electronic Warfare, Anti-Submarine Warfare, and Naval Mine Warfare. The primary goals of the Sea Control development and acquisition program are to enable our tactical naval forces to maintain control of the seas into the 1980s and 1990s, especially for critical sea lanes of resupply between CONUS, Europe and the sources of energy, and secondarily to maintain sea control when and wherever else is needed to permit military operations needed for our security and that of our allies, especially Japan and South Korea. As stated earlier, the Soviets are now a worldwide naval power, capable of projecting force far beyond its bordering seas. The expanding Soviet presence and the increasing quality and quantity of Soviet naval forces are most evident in:

- A large tactical submarine force, which the Soviets are continuing to upgrade;
- A large force of long-range, land-based naval aircraft, which includes growing numbers of BACKFIRE aircraft with range sufficient to reach major portions of our sea lanes to Europe and Japan;
- A significant fleet of surface combatants, which includes V/STOL aircraft carriers, proliferated smaller vessels with anti-ship missile capability, and a growing amphibious assault force;
- A well-exercised worldwide surface surveillance and command and control capability for coordinated employment of these forces.

This Soviet threat requires force improvements and new capabilities. For example, the BACKFIRE Bomber with its advanced anti-ship missile severely stresses our existing naval air defense systems. Soviet submarines have evidenced increased speed, endurance and reliability, reduced detectability, more capable anti-submarine and anti-ship weapons, and effective communication and control for coordinated operations with surface and air forces. These Soviet improvements demand improved U. S. sensors and weapons to maintain our essential advantage.

The current and projected world environment, taken together with factors such as those noted above, gives highest priority to these specific objectives for our tactical naval forces:

- Provide protection of vital sea lanes for supply of materials critical to U.S. industrial and defense needs; assure that sea transport resupply to NATO war can be achieved with acceptable losses;
- Provide sea-based power projection and support forces in a NATO war;
- Provide a flexible offensive and defensive naval response in crisis situations.

Primary RDT&E thrusts in each Sea Control area are:

- Multimission Naval Systems -- developing new and improved vehicles to offset increasing procurement and operating costs.
- Surface Ocean Surveillance and Targeting -- improving our capability to detect and track hostile surface forces and target them with anti-ship missiles.
- Undersea Surveillance -- timely location, identification, and tracking of tactical submarines.

- o Anti-Surface Warfare -- faster response times to enemy threats, more penetrable anti-ship systems and systems to attack shore targets.

- o Anti-Air Warfare and Electronic Warfare -- improved shipboard self-protection systems able to defeat the intensifying Soviet anti-ship missile threat.

- o Anti-Submarine Warfare -- upgrading and integrating ASW capabilities in the face of continuing Soviet submarine improvements.

- o Naval Mine Warfare -- development of both improved mines and techniques for countering enemy mines.

For FY 1979 we are requesting $1.4 billion for Sea Control RDT&E as contrasted to $1.0 billion appropriated for FY 1978; for procurement $5.4 billion is requested in FY 1979 as compared to $5.6 billion in FY 1978. The increase is primarily associated with the transition of major programs from advanced development to engineering development and contract awards. The major Sea Control RDT&E programs are:

- o Advanced V/STOL "A" Aircraft and related advanced development programs ($52.5 million combined).

- o LAMPS ASW Helicopter ($124.5 million).

- o Ship Design ($92.3 million in 3 programs).

- o AEGIS with associated CSEDS land-based test site ($51.6 million).

The following sections address the mission areas within Sea Control, describing mission objectives, these major programs as well as other significant programs.

2. Multimission Naval Systems.

This mission area includes development efforts for submarines, surface ships, and certain naval aircraft. The high cost of multipurpose systems means that they exercise the dominant influence upon the overall cost-effectiveness of our sea control forces. The efforts are divided between design support for near-term procurement programs, e.g., CVV, DDG-47, LSD-41 and development of new vehicle systems such as CGN-42, SSNX, LCAX; LAMPS MK III and FFGX. $181.0 million of the total of $429.6 million funds requested for FY 1979 are intended for new vehicle development, with the objective to meet new and upgraded threats with affordable costs.

a. LAMPS MK III

The largest new-vehicle program for FY 1979, with $124.5 million requested for RDT&E is the LAMPS MK III. The LAMPS MK III helicopter will be carried aboard frigates, destroyers, and cruisers commencing in the mid-1980s. It will restore to them an advantage in speed and weapon reach against the nuclear submarine. When employed in conjunction with the Tactical Towed Array Sensor System (TACTAS) (discussed under the Anti-Submarine Warfare mission area), we expect that the LAMPS MK III will, for the first time, give our surface ships an effective organic counter to advanced missile-firing submarines. In addition, the LAMPS MK III will provide over-the-horizon targeting for HARPOON anti-ship missiles and will help give warning of enemy missiles.

In FY 1979 we will complete prototype LAMPS MK III helicopters, and continue systems development and integration efforts. Tests to date, including at-sea tests in operational environments, give high confidence in LAMPS MK III's ultimate ASW effectiveness.

b. Advanced Naval V/STOL Aircraft

Our other major new-vehicle efforts are directed toward exploring the sea control potential of V/STOL (Vertical and/or Short

Take-off and Landing) aircraft technology. The V/STOL Aircraft Development Program ($40.8 million) supports testing of the XFV-12A thrust augmented wing prototype aircraft as well as concept formulation for a "Type A" V/STOL aircraft development effort. The Type A would be a generic subsonic aircraft, capable of flying from both aircraft carriers and smaller ships, with various versions performing airborne ASW, airborne early warning and control, carrier-on-board delivery and Marine Corps aerial assault missions. Present aircraft that the V/STOL "A" might replace include the S-3A, E-2C, C-2 and CH-46. The related Advanced Aircraft Subsystem program ($11.7 million) is developing the technology for a wide variety of aircraft subsystems to meet future needs. These subsystems will be applicable to V/STOL as well as other types of new aircraft.

Replacement of existing subsonic sea-based aircraft must begin in the early 1990s. The early funding for V/STOL "Type A" efforts is in recognition of the problems DoD has experienced with V/STOL technology and is intended to ensure that we will have adequate confidence by the early 1980s in our ability to produce a satisfactory V/STOL aircraft. Should we run into unforeseen or inherent technical problems with V/STOL, we would then have sufficient time to develop one or more new conventional aircraft to fill the gap. A supersonic type V/STOL "B" fighter-attack aircraft is planned for later development as an eventual replacement for the F/A-18 and AV-8B.

c. Advanced Aircraft Carrier (CVV)

A companion effort to the development of the V/STOL aircraft is the design of a medium-sized, conventionally-powered aircraft carrier of about 60,000 tons full load displacement. This ship will initially be designed to operate all of the aircraft in our present air wing as well as being able to accommodate V/STOL aircraft as that technology advances. It is envisioned that subsequent CVV will be principally V/STOL platforms.

d. Surface Effect Ship

The Surface Effect Ship (SES) program is being terminated. Although technical progress had been satisfactory, projected costs were very high. Moreover, no important mission has been identified in which the SES offers significant cost savings or effectiveness gains over other, lesser-risk alternatives. In light of this, the additional $450 million which would have been necessary to carry the program through the prototype phase did not appear to be a prudent investment.

e. Advanced Maritime Patrol Aircraft

The Advanced Maritime Patrol Aircraft (AMPA) program seeks to define a successor to the P-3C, and to develop a cost-effective land-based supplement to our sea-based anti-air and anti-ship forces. In accordance with guidance from the House and Senate Armed Services Committees we will thoroughly explore the potential of existing types of aircraft, including non-Navy aircraft, before making any commitment to a new development. The FY 1979 request, for initial exploratory work, is $4.0 million.

f. Surface Ships and Submarines

Surface ships and submarines remain the workhorses of our fleet. While we see no dramatic breakthroughs in their basic technology, there are a number of areas in which significant improvements can be made.

Eighteen programs, totaling $169.1 million pursue these improvements on a broad front, supporting: design of new ships and submarines; improvements to nuclear and non-nuclear propulsion systems; better auxiliary, electrical; and interior communications subsystems; new concepts and materials for survivability improvement; means to reduce ships' consumption of energy; and new submarine hull materials. Although presented separately in the budget request in order to improve management visibility, these programs are carefully coordinated to form a meaningful and coherent whole.

g. Other Major Procurement Programs

Other major procurement programs in this mission area include:

- o P-3C ORION Patrol Aircraft - $321.6 million.
- o SSN-688 Class Submarines - $458.8 million.
- o DDG-2 Modernization - $151.0 million.
- o FFG Guided Missile Frigate - $1,543.7 million.
- o AD Destroyer Tender - $322.4 million.

3. Ocean Surface Surveillance and Targeting

Ocean Surface Surveillance and Targeting includes surveillance sensors whose objectives, when combined with dedicated Command and Control (C^2) systems, are to acquire, correlate, and provide surveillance data to naval tactical commanders and National Command Authority in forms suitable for tactical exploitation. Modest location accuracies and response times on the order of an hour have been current goals. Advancing technology in U. S. anti-ship cruise missile weapon systems, which will permit engagement ranges well beyond the radar horizon, calls for corresponding improvements in location accuracy and response time. In particular, we are focusing on the development of an over-the-horizon detection, classification and targeting (OTH/DCT) capability for the TOMAHAWK and HARPOON.

We are continuing to refine mission objectives and to address known deficiencies with a series of fleet exercises and advanced planning efforts. The successful at-sea experiments known as OUTLAW SHARK which originally addressed the capability of shore-based surveillance inputs to contribute to the OTH/DCT capability of the submarine-launched HARPOON and TOMAHAWK, are being expanded to include a surface ship and aircraft. In FY 1978 and FY 1979, wide ranging tests with multi-sensor inputs in both the Mediterranean and the Pacific will be conducted.

Major efforts during the next year will continue to be directed toward the development of systems for OTH/DCT and the development of ashore and afloat command and control systems for tactical exploitation for all surface data.

a. <u>Sensor Systems</u>

Ocean Surface Surveillance information is provided by a combination of sensor systems with worldwide and local-area coverage. Our present sensor systems center on a space-based system and on several surface-based systems.

b. <u>Over-The-Horizon Targeting</u>

The definition of techniques for the targeting of submarine-launched, surface launched, and air-launched long range anti-ship weaponry continues to be of first-order importance. With HARPOON in the operational inventory and TOMAHAWK under development, it is imperative that practical targeting techniques be developed which, to the extent possible, are threat insensitive and do not limit operational flexibility. Tradeoff studies initiated in FY 1977 and critical low-cost experimentation in FY 1978 will be followed in FY 1979 by procurement of an advanced development system of weapon platform terminals, data fusion center and communications interfaces. Funding requested in FY 1979 is $6.4 million in a new program element.

4. Undersea Surveillance

Undersea surveillance, as part of ocean surveillance, responds to operational commanders and is designed to collect and report information on the growing Soviet submarine threat. Specific objectives are to: provide information on the deployment, type and location of hostile and potentially hostile submarines; provide accurate and timely data to tactical ASW commanders; and, provide technical information on Soviet submarines.

The thrust of the Undersea Surveillance programs is to develop a coordinated surveillance system with integrated processing at common sites In FY 1979, $115.3 million in procurement is requested to support the following developments.

a. Improved SOSUS

The Improved SOSUS program involves a phased backfit program, new deployments, and the development of advanced sensors and processing. The backfit program provides improvements in shore-based electronics to improve system sensitivity, classification capability, localization accuracy and response time; and reduce operating personnel billets through consolidation of facilities. The proposed new deployments will improve detection, coverage and localization. Consolidation will improve coverage and reduce manning requirements. The primary goal of the advanced sensors and processing program is to find practical and economical means for further SOSUS improvements. $106.0 million in procurement for CEASAR is requested in FY 1979.

b. SURTASS

SURTASS will provide a mobile, long-range passive surveillance capability. An acoustic hydrophone array will be towed from a dedicated surface platform. The Platform Segment will be a civilian-manned Ocean Surveillance Ship (T-AGOS), built to commercial standards and similar in design to offshore supply-tugs vessels used in the petroleum industry. Three T-AGOS are planned for procurement in FY 1979 Shipbuilding and Conversion Appropriation. $9.3 million in procurement for SURTASS is requested in FY 1979.

c. RDSS

The Rapidly Deployable Surveillance System, RDSS, is an outgrowth of the former Moored Surveillance System (MSS). RDSS is a flexible, quick-response, deployable undersea surveillance system to detect, classify, localize, and track threat submarines. Some acoustical processing is carried out in the sensor buoy, and the data is then relayed via satellite for further processing, contact reporting and other C^3 functions, and follow-up by tactical ASW platforms. The buoys are also configured to allow real-time raw data readout by tactical ASW platforms. The RDSS program is an "umbrella" concept for the evaluation and development of a small family of undersea surveillance buoys.

d. Major Procurement Programs

The major procurement programs in this mission area include:

- o T-AGOS SURTASS Ship - $98.0 million.
- o T-ARC Cable Repair Ship - $191.0 million.

5. Anti-Surface Warfare

Anti-Surface Warfare relates to the destruction or neutralization of enemy surface combatants and merchant ships and their operating bases. It also includes fire support to conduct amphibious and strike operations.

Major efforts during the next year will continue to be directed toward the development of an offensive anti-ship missile and guided projectile capability and the development of associated fire control systems. $82.3 million is requested to support the development of the programs in this mission area in FY 1979. Major programs included are:

a. HARPOON

HARPOON is being acquired by the U.S., NATO, and other allied countries. The development effort is primarily devoted to providing a Vertical Launch capability. Under the Weaponizing (Prototyping) program, a demonstration of providing mid-course guidance will be conducted. With this guidance, cruise missiles will be able to attack targets at sea and ashore. Funding requested to support the Vertical Launch effort is $2.6 million in FY 1979. $129.0 million is requested for HARPOON procurement.

b. PENGUIN

PENGUIN, a lightweight anti-ship missile system is being procured from Norway, supported by the NATO initiative program. This system will provide an offensive punch to small surface craft.

c. Guided Projectile

Guided Projectiles using semi-active laser (SAL) seekers are being developed for 5-inch and 8-inch guns under a Joint Army/Navy program. The accuracy obtained will provide high lethality against point targets such as bunkers, tanks and ships. The IR Guided Projectile will use the same projectile configuration guidance and control as the SAL round. Funding requested to support the guided projectile effort is $19.8 million in FY 1979.

d. Improved Ballistic Projectiles

Improved Ballistic Projectiles offer substantially greater lethality against soft targets and area targets. The high-fragmentation projectile and the cannister (bomblet) round have proven significantly more effective than older rounds. When used with the high-rate-of-fire naval guns, this new ammunition will provide significant and quick neutralization at a relatively low cost.

e. SEAFIRE

SEAFIRE is a fire control system capable of operating in an ECM environment. The system will provide target designation to the horizon for directing guided projectiles. In addition, a SEAFIRE pod for the LAMPS helicopter will allow over-the-horizon targeting. Funding requested to support the fire control system effort is $12.3 million in FY 1979.

f. Major Caliber Lightweight Gun

The Major Caliber Lightweight Gun (MCLWG) should enter production in FY 1980. It will be backfitted on thirty DD-963 Class ships, twenty-four of which are still under construction. The MCLWG with SEAFIRE, the guided projectile, the Improved Conventional (Cannister) Munition (ICMs) will be controlled by the MK-86 gunfire control system and provide an anti-surface capability for the DD-963. The requested $14.5 million provides for the development of the Guided Projectile interface, ammunition handling components, and the MK-86 system software changes.

6. Anti-Air Warfare (AAW)

Fleet Air Defense utilizes the defense-in-depth concept. Area defense systems, such as fighter aircraft and area SAMs (STANDARD missiles), are needed to attrite attacking aircraft and anti-ship missiles to levels which can be successfully countered by the ship's Self Defense System.

The Soviets' rapidly expanding capability to attack our ships with a variety of improved anti-ship missiles has driven the requirements for Anti-Air Warfare. These missiles can be launched from air, surface or sub-surface platforms.

Major efforts during the next year will continue to be directed toward the development of an improved capability for ship area and point self defense including both missiles and fire control systems, $313.1 million is requested to support the development of the program in this mission area in FY 1979. Major programs included are:

a. AEGIS and CSEDS

AEGIS is a fully-integrated AAW system which is capable of processing the target from detection to kill and will be the focal point of Task Force Anti-Air Warfare. The Engineering Development Model (EDM-1) aboard the USS NORTON SOUND has repeatedly demonstrated, in operational test, superior capability against the most stringent targets available. AEGIS is planned for the DDG-47 class and CGN-42 class ships. The DDG-47 class lead ship is planned for a construction contract award in mid-calendar 1978. Sixteen DDG-47 class destroyers and four CGN-42 class cruisers, equipped with AEGIS weapon systems, are planned for procurement at this time.

Design modifications derived largely from the at-sea tests will be integrated and tested in a land-based Combat System Engineering Development Site (CSEDS). This will be followed by further integration and test of the total AEGIS ship combat system. $14.4 million is requested for the AEGIS system development and $37.2 million is requested for the AEGIS ship CSEDS in FY 1979.

b. STANDARD Missile

Programs to improve present TERRIER and TARTAR SAM systems include the SM-2 Missile, development of Improved Propulsion for the STANDARD Missile, and a Vertical Launching System to reduce cost, complexity and reaction time. A parallel effort is underway to accommodate required ship sensor integration and fire control system updating. Additional work is being accomplished in the area of task force AAW coordination and reliability improvements in present shipboard systems. Funding requested to support the above efforts is $106 9 million in RDT&E and $143.9 million in procurement in FY 1979.

c. Shipboard Surveillance Radar Upgrade

Shipboard surveillance radar in support of fleet air defense will continue to be emphasized on two fronts. We are requesting FY 1979 funding of $15.8 million to continue an aggressive program of upgrading near-term fleet capability. For the longer term, the Shipboard Surveillance Radar Systems program (SSURADS) is addressing the next-generation capability to meet the fleet needs of the 1990's time period. Emphasis in both is being placed on platform integration, automation of detection and track functions, integrated operation, improved availability, superior ECCM performance, and ability to detect and track the high angle-of-arrival anti-ship missile. For FY 1979, during which the SSURADS program will move into validation phase, we are requesting $7.5 million. SSURADS is also a NATO initiative with an additional $2.0 million for FY 1979 requested to secure non-U.S. NATO country participation in the definition of a NATO radar suite. Navy procurement for shipborne radars in FY 1979 totals $62.4 million.

d. Close-In Weapon System (CIWS)/PHALANX Improved Point Defense

The PHALANX, Close-In Weapon System (CIWS), and Improved Point Defense weil enter the Fleet in FY 1979. This will be installed on new ship classes such as the FFG-7, DDG-47, DD-963 and CGN-42, now under or planned for construction. Funding for CIWS supports incremental improvements to meet the threat. The NATO SEA SPARROW funds support the adaption of the SPARROW Missile for improved performance and reliability. Development of an effective IR guided projectile is planned to add significantly to the AAW effectiveness of the installed 5-inch/54 guns. Funding requested to support the above efforts is $11.9 million in RDT&E and $95.5 million in procurement in FY 1979.

e. Anti-Ship Missile Defense

To provide a low cost Anti-Ship Missile Defense missile a joint development program with the Germans is underway. The $19.5 million requested in FY 1979 represents the U. S. half of the development cost. Other NATO countries have expressed interest in joining the program as an effective complement to NATO SEA SPARROW.

f. Shipboard Intermediate Range Combat System

To provide affordable solutions to the ship defense problem, the Shipboard Intermediate Range Combat System (SIRCS) has been initiated. SIRCS is intended to be a fully-integrated self-defense system. SIRCS will use existing systems, improved versions of existing systems or replacement systems as necessary to meet the 1990 Soviet threat characteristics. Commonality of the SIRCS missile with other anti-air missiles, such as AMRAAM, is being studied. Competitive advanced development will begin in FY 1978 to validate the technical approaches taken by the two winning contractors. Funding requested to support the SIRCS efforts is $14.5 million in FY 1979.

g. Self-Defense Electronic Warfare

Self defense includes electronic warfare (EW) systems. A $3.6 million program continues the development through OPEVAL of devices to protect U.S. Navy high-value ships. In Surface Electronic Warfare, the $4.4 million request is for advanced development of techniques and components. We are also requesting $6.9 million in this element for engineering development of tactical deception systems and effectiveness evaluation simulators. A new start for FY 1979 in Shipboard EW improvements is designed to coincide with introduction into the fleet of the AN/SLQ-17 and AN/SLQ-32 EW suites. This new development will provide RDT&E for concurrent upgrade of these suites to meet the high-angle anti-ship missile threat, to define the CROSSEYE implementation, and to evaluate the AN/SLQ-32. RDT&E funding of $4.1 million is requested for that element in FY 1979;

.8 million is requested for procurement of Electronic Warfare ipment.

7. Anti-Submarine Warfare (ASW)

Anti-Submarine Warfare includes various platforms, sensors, weapons dedicated Command and Control (C^2) systems whose objectives are to pro- : naval forces with sufficient protection from hostile submarines to ıit them to perform their primary mission and to assure that material »ped by sea transport reaches its destination with minimal losses from ıarine attack. Advancing technology in U.S. anti-submarine systems, :h will permit long range detection and engagement, calls for corresponding rovements in location accuracy and response time.

The Soviets continue to emphasize the quantitative and qualitative ects of their submarine force. The orientation of this force, already largest in the world, is clearly focused toward contesting our control vital sealanes of communications. The numbers of nuclear attack sub- ines with improved sensors and weapons are increasing and predictions : that they are pursuing major efforts to increase speed and depth »abilities and to make other improvements which will impose strains our ASW systems. In response to this thrust we must be able to react ickly and be able to handle a large number of hostile submarines in idely separate areas.

Major efforts during the next year will continue to be directed toward : development of ASW vehicles, sensors and weapons that complement and :egrate our undersea surveillance and command and control systems. $332.3 lion is requested to support the development of the programs in this sion area in FY 1979. Major programs included are:

a. Tactical Towed Array Sonar

The greatest increase in ASW capability for surface ships is expected to be realized from the Tactical Towed Array Sonar (TACTAS). This will be an advanced passive acoustic sensor for detection and localization of submarines, for deployment from ships of the DD 963, FFG-7, DDG-47 and CGN 42 classes. Funding requested to support the towed array effort is $25.2 million in RDT&E and $62.9 million in procurement for FY 1979.

b. ASW Combat System Integration

The ASW Combat System Integration program will improve surface ships overall effectiveness by developing a fully integrated ASW control subsystem. The resultant federated ASW Combat System will control and manage multiple ASW sensors (AN/SQR-19 TACTAS, LAMPS MK III, and modernize AN/SQS-26 Sonar) and weapons systems to provide coordinated employment in FFG-7, FF-1052, DD-963, and DDG-47 class ships. Use of common hardware will reduce space, manning and operating cost requirements. Funding requested to support this effort is $10.3 million in FY 1979.

c. Submarine Sonar Development

The Submarine Sonar Development program will provide subsyster improvements to existing (AN/BQQ-5) and future sonars by developing Adva Development Models (ADMs) to test new techniques and answer critical que The Wide Aperature Array (WAA) hull mounted sonar will continue with the selection of ADM contractors. This array is designed to provide range information to fire control for torpedoes and missiles. Funding requested to support these efforts is $54.9 million in FY 1979.

d. Submarine Tactical Warfare System

The Submarine Tactical Warfare System program will improve the defensive and offensive capabilities of U. S. submarines through the development of acoustic systems, target information handling concepts, improvements to the torpedo fire control systems, and improvements to the MK-48 torpedo. Funding requested to support these efforts is $54.0 million in FY 1979.

e. Advanced Lightweight Torpedo

The need for an improved weapon to deal with the most recent Soviet submarines and those projected to constitute the 1990 threat is being met in the Advanced Lightweight ASW Torpedo program. This is expected to produce a weapon capable of being carried on ASW surface ships as well as aircraft. It will go faster, dive deeper, acquire targets at greater range, and have a higher probability of kill than the existing MK-46 torpedo. During FY 1979 two Advanced Development contracts will be pursued. Funding requested to support this effort is $44.3 million in FY 1979.

f. Anti-Ship Torpedo Defense

The Anti-Ship Torpedo Defense program will provide military high-value units with a self-protection capability against torpedo attack. During FY 1979, multiple contracts will be awarded for competitive Advanced Development of the more promising system concepts. Funding requested to support this effort is $8.7 million in FY 1979.

g. Other Major Procurement Programs

Other major procurement programs in this mission area include:

- o MK-48 Torpedo - $110.7 million.
- o MK-46 Torpedo - $85.2 million.
- o AN/BQQ-5 Sonar - $139.1 million.

8. Naval Mine Warfare

Often thought of as a defensive weapon, the mine can actually be a highly-effective instrument of offensive sea power. The key is the ability to deliver mines in quantity to critical locations. The U.S., with its air and submarine forces and favorable strategic geography, is in an excellent position to do so. In this mission area we develop the mines and supporting systems to take advantage of this capability.

Our primary defense against mines is our sea control capability, preventing an enemy from delivering them. There are situations in which we would have to face minefields, however, and we need to develop effective mine countermeasures (MCM) against such requirements.

Our funding for both offensive and defensive mine warfare totals $59.1 million for FY 1979, which includes major programs in advanced mine development, and airborne and surface mine countermeasures.

a. CAPTOR

The initial version of the Encapsulated Torpedo (CAPTOR) anti-submarine deep-water mine is now in production. Analyses show that, within the limits in which it can be employed, CAPTOR will kill more submarines per dollar than any other ASW system. As with all mines, a continuing program of development is necessary to ensure that CAPTOR can continue to defeat enemy countermeasure techniques. $17.7 million in procurement is requested for FY 1979.

b. Propelled Rocket Ascent Mine

Propelled Rocket Ascent Mine (PRAM) is a dual-purpose (anti-submarine and anti-ship) mine for intermediate water depths. It will greatly extend our mine coverage, particularly against surface targets. Funding requested to support this effort is $13.7 million in FY 1979.

c. QUICKSTRIKE

The QUICKSTRIKE family of mines, now in engineering development, will provide a greatly-improved and more economical capability in the crucial shallower waters. Included in this family is a mobile version which will allow our submarines to vector mines into waters too shallow or constricted or heavily defended to be safely traversed. Funding requested to support this effort is $10.9 million in RDT&E and $12.3 million in procurement in FY 1979.

d. Airborne Mine Countermeasures

In MCM we have had great success in using helicopters to sweep mines in the shallower waters. In the Airborne Mine Countermeasures Program we are developing a whole new series of helicopter sweep gear, needed to keep up with threat development, and systems to add mine hunting to the helicopter's repertoire. Funding requested to support this effort is $15.9 million in FY 1979.

e. Surface Mine Countermeasures

Some MCM missions must be performed by ships. Under the Surface Mine Countermeasures Program, we are developing new systems for hunting mines.

A new class of Mine Countermeasures ships will be procured, commencing with the FY 1980 shipbuilding and conversion program. The ultimate number of these ships to be procured is the subject of current study. This is a program in which we are cooperating actively with some of our NATO allies to solve common problems. Funding requested to support this effort is $9.8 million in FY 1979.

E. THEATER NUCLEAR FORCES

1. Overview

Theater Nuclear Forces (TNFs) are maintained to deter aggression, conventional or nuclear. If deterrence fails, TNFs in conjunction with conventional forces must be capable of functioning as part of a controlled escalation intended to terminate the conflict at the lowest possible level on terms acceptable to the U.S. and its allies. TNFs must possess significant advantages over conventional forces and they must be postured for use such that they will demonstrate determination while causing maximum shock to the enemy. They are intended to deter theater nuclear or conventional attack, and to provide a capability for combined nuclear and conventional attack in the face of a major failure of the conventional defense.

The Soviet Union maintains a large and capable land and sea-based theater nuclear force which includes surface-to-surface missiles, rockets, tactical aircraft bombs, cruise missiles based on various launch platforms, naval torpedoes, depth bombs, and fleet surface-to-air missiles. Our TNF must be capable of surviving and responding to a first battlefield use of nuclear weapons by the Soviets.

The existence and threat of use of theater nuclear forces has forced profound changes on the employment of Soviet and NATO land combat forces. While their possession by both sides is a deterrent to use, each has seen the necessity to deploy combat forces in a dispersed state for conventional operations so that there are not steady state concentrations of troops and material which might appear to be inviting targets for nuclear weapons employment.

The greatest impact has been on offensive forces immediately rearward of the contact zone and their reserves and rear area support where battlefield delivery systems present the major threat. Today, Soviet doctrine dictates a lateral and rearward dispersion of forces in a division zone at densities very much less than those prescribed for the conventional battlefield of the mid-1950s prior to the time when battlefield systems were available to NATO. Reserves and near service are now located 20 km to 40 km rearward of the Forward Edge of the Battle Area (FEBA) in order to remain out of range of rockets and artillery.

Conventional offensive operations are substantially complicated by the need to operate under these constraints. Transient massing of attacking forces is now a requirement. If reserves arrive too soon, congestion results creating attractive concentrations. If they arrive too late, attack momentum is broken at the least. Under the worst conditions, the attack is carried out piecemeal, a condition extremely favorable to the defense.

Typically, defenses operate at densities somewhat lower (by a factor of 2 to 3) than do offenses. It would seem that both sides lose equally. This, however, is not the case. Improvement in range and engagement rate of conventional weaponry (tank guns, fire control systems, ATGMs) can provide the necessary coverage if they are deployed in adequate numbers and training and command and control permit their full range of capabilities to be realized. Thus, the net gain is to the defense in those situations in which the attacker postures his forces for survivability because of the threat of battlefield nuclear weapons.

Planning for TNFs focus on scenarios involving (1) enemy first use of nuclear weapons in the theater; or (2) U.S. or Allied first use faced with the prospect of a major failure of the conventional defense. In such cases TNF options include:

- o In conjunction with conventional forces, blunting a major attack; and

- o Attacking selected targets throughout the theater.

In order to carry out the above policy, TNFs and their essential support (intelligence, command, control and communications and target acquisition) must emphasize the following characteristics:

- o Survivability under nuclear and conventional attack.

- o Responsiveness and control to assure timely and appropriate nuclear employment.

- o Capability for effective, flexible and limited employment options without excessive collateral damage.

- o Military utility including significant advantage over conventional force alternatives.

- o High security in peacetime as well as during periods of increased alert and conventional or nuclear operations.

In previous years we began a series of actions to give the TNF the characteristics described above. For example, the survivability of the battlefield TNF will be improved by virtue of the longer range available in the new 155mm and 203mm (8") artillery fired atomic projectiles (AFAPs). Also, the proliferation of 155mm and 203mm dual capable artillery batteries on the battlefield enhances TNF survivability by compounding the enemy's targeting problems.

The present responsiveness and control of TNF is being enhanced by the improvements in the NATO C^3 system and the Army's advanced development program for a nuclear burst detection and monitoring system.

Effectiveness, flexibility and minimization of collateral damage, which are often below desired levels, are being improved by the designs of the 203mm (8") and 155mm AFAP, the PERSHING II advanced technology development program, and various target acquisition systems.

Physical security of deployed TNFs is now provided by both storage site protective measures and permissive action links for individual weapons. Operational improvements are under way to improve site security. The AFAP developments include substantially improved security and safety devices. The developmental B61 MODs 3 and 4 bombs provide improved security devices and techniques to inhibit accidental dispersal of special nuclear material. All future theater weapons will provide improved security devices.

The modernization effort has led to the development of enhanced radiation (ER) warheads to reduce the collateral damage caused by unwanted blast and thermal radiation. The production of these weapons has been held up pending the completion of consultations with our NATO allies. However, R&D has gone forward.

In addition to these improvements, we continue to review the posture and needs of the TNF. The Secretary of Defense has requested that we examine theresearch, development, and acquisition requirements to support long-term theater nuclear force modernization plans. In response we have organized a TNF Modernization Study which will consider such questions as the force needed in the 1990s, new concepts for storage, security, and survivability, how to work within the MBFR ceiling, and so

Finally, the Secretary of Defense has directed a comprehensive evaluation and technology program to provide solutions for our present and expected TNF survivability and security (TNF/S^2) problems to be carried out by the Defense Nuclear Agency (DNA).

The proposed FY 1979 funding for theater nuclear force RDT&E is in the same order as for FY 1978. Procurement, however, is increasing modestly in FY 1979.

2. RDT&E Programs

a. Nuclear Munitions

New warheads for the 203mm (8") and the 155mm artillery fired atomic projectiles (AFAPs), and for the LANCE missile are under development.

The LANCE Reduced Blast/Enhanced Radiation (RB/ER) warhead is currently under review by the President and upon his approval will enter full scale production.

The new 155mm AFAP warhead entered a DoE Phase 3 program in Fy 1978. As with the 203mm (8"), the new 155mm AFAP is expected to have a greater range and effectiveness. The shell will contain improved safety and security features. The improved range and greater yield are expected to enhance the survivability and effectiveness of the TNFs and thereby increase the degree of deterrence to the Soviets.

b. PERSHING II

The PERSHING II program is described in Section VI.C above.

c. Standard Missile (SM-2)

The SM-2 extended range and medium range interceptor will be the basis of the Navy's air defense in the 1980s and beyond. A nuclear warhead for this system to counter the threat posed by cruise missiles is under study. A limited DoE Phase 3 development of the warhead began in FY 1977 and is continuing. It will permit continued R&D on a nuclear warhead, but requires a further decision on production. $9.6 million for RDT&E is requested for FY 1979.

Effort in FY 1979 will include laboratory evaluation of the fuze and modification of the launcher and software on the "desert ship" at White Sands in preparation for missile test firings in FY 1980.

d. Survivability and Security for Nuclear Storage

Physical security of deployed TNFs is now provided by both storage site protective measures and permissive action links for individual weapons. Operational improvements are under way to improve site security. The AFAP developments include substantially improved security and safety devices. The developmental B61 MODs 3 and 4 bombs provide improved security devices and techniques to inhibit accidental dispersal of special nuclear material. All future theater weapons will provide improved security. Notwithstanding these actions, we are concerned over the survivability and security of theater nuclear forces and the Secretary of Defense has directed a comprehensive evaluation and technology program to provide solutions for our present and expected TNF survivability and security problems. The program, to be carried out by the Defense Nuclear Agency, will identify the critical survivability and security issues, define tests, exercises, and analyses needed to validate programs and solutions, and recommend possible improvements to increase TNF survivability and security. $14.5 million in RDT&E is requested for FY 1979.

VII. COMMAND AND CONTROL, COMMUNICATIONS AND INTELLIGENCE (C^3I)

A. INTRODUCTION

The functional areas of command and control, communications, and intelligence (C^3I) encompass the apparatus, personnel, and facilities needed for both peacetime management of Defense activities and control of force operations throughout all levels of conflict. C^3I efforts span four separate programs: Telecommunications and Command and Control, Consolidated Defense Intelligence, Combat Support, and Surveillance and Warning. Most of the resources we devote to these programs are committed to maintaining the readiness posture of our in-being forces, and entail expenditures for operations and maintenance, personnel, equipment procurement, and construction of facilities. This chapter describes the steps we are taking to improve our C^3I capabilities in the future:

- To enhance the combat effectiveness of our forces, and thereby deter conflict, in the face of growing military capabilities of potential adversaries, and
- To reduce costs and increase the efficiency of C^3I activities.

1. C^3I Integration

One of the actions we have taken for achievement of these goals stems from recognition of the fact that command and control, communications, intelligence, and other information support activities are closely interrelated functions.

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Command and control, in a broad sense, describes the management capabilities we must have to:

- Employ our forces effectively in times of crisis and conflict;
- Insure our readiness to deal with impending crises;

- o Maintain adequately prepared and appropriately deployed forces; and
- o Formulate plans and policy for utilization of our forces in future contingencies.

Defense intelligence provides essential information needed for command and control:

- o Warning of impending crises and hostile actions;
- o Crisis and conflict situation data and, with regard to potential adversaries:
- o Size, deployment, and capabilities of opposing forces;
- o Doctrine and tactics practiced by such forces; and
- o Quantitative and qualitative trends in opposing military equipment and systems.

Our defense communications systems provide the essential connectivity:

- o To insure timely delivery of relevant intelligence information on which command decisions and force operations are based;
- o Between command echelons for force control; and
- o Among force elements for operational coordination.

These three functions must be performed well and in concert, or the war-fighting effectiveness of our forces will be seriously degraded, and our capability to deter conflict and to deal with crises will be eroded. It is for this reason that the responsibilities for command and control, communications, and intelligence systems, together with certain other closely related defense support functions, have been consolidated within a single office, that of the Assistant Secretary of Defense (Communications, Command, Control, and Intelligence)--OASD(C^3I). The ASD(C^3I) also serves as my Principal Deputy. In so doing, we have taken a key step for insuring balanced and coordinated development, acquisition, and operational efforts for providing these essential defense functions in the future.

The leverage that can be attained by managing C3I functions on an integrated, coherent basis is great, and can significantly help in sustaining our capability to prevail against numerically superior forces. More specifically, effective C3I can:

- Enhance readiness and survivability of force elements in performance of their assigned missions;
- Increase precision and timeliness of U.S. and allied force operations; and
- Enable employment of weapons and forces with greatest effectiveness against the most important targets.

Our prospects for achieving these essential objectives are good. The technology we need for effective exploitation of integrated C^3I is in areas where the United States has a strong and increasing lead, and we have taken the important step of consolidating C^3I management to assure effective use of that technology.

2. C3I Requirements and Strategy

Achievement of requisite improvements in war-fighting efficiency does not come from improved weapon performance alone. There are concomitant demands on our capability to locate and identify key units of aggressor forces and to designate appropriate fire-power elements quickly and accurately against those units. To enhance the readiness and survivability of our forces and those of our allies, we must know the movements of opposing forces, detect preparations for hostilities, and be able to characterize the size and objectives of an attack if hostilities commence. An effective C3I capability is key to these activities.

The effectiveness of our C^3I capability hinges on its survivability against physical and electronic attack. Our C3I capabilities must be secure in the broadest sense--capable of surviving physical attack against individual elements, resistant to countermeasures, and invulnerable to exploitation by hostile intelligence activities.

Another kind of challenge we must face stems from Soviet advances in command and control. Greater mobility of force elements, increased firepower, and extended weapon range collectively imply a need for enhanced force allocation and control capabilities, regardless of the nationality of the forces. Although much of the Soviet command and control technology we have seen is primitive, by U.S. standards, there is clear evidence that the Soviet Union has recognized this need. Moreover, Soviet military writings indicate a strong interest in using computers to assist in the control of land combat forces. We believe that development of automated systems for this purpose has been underway in the Warsaw Pact countries since 1970. The Soviet Union has also been developing new information collection capabilities and data communication links for land, sea, and air warfare, and continues to gain experience with the use of satellite-borne systems for global force support. It is readily apparent that one way to reduce the effectiveness of enemy attacks is to degrade the C^3I capabilities of opposing forces, and we are taking appropriate action to develop the required systems.

Finally, we must recognize that the threat will continue to evolve. In this connection, we must be able to determine the technical capabilities of Soviet weapon developments with sufficient timeliness and precision for efficient management of our defense development and acquisition resources.

Our program for meeting these requirements is aimed at exploiting advances in C^3I-related technologies, such as sensors, signal processing, and digital computation. These advances will support the achievement of needed capabilities in the basic functional areas of C^3I, such as near-real-time surveillance and targeting, secure and jam-resistant communications, and precision navigation and position-fixing.

B. MAJOR PROGRAMS

1. National and Strategic C^3I

Defense research and engineering programs which are being undertaken in support of the national-level decision-making process and strategic force control address three principal tasks:

- Provision of command connectivity from the National Command Authorities (NCA) to the forces;
- Information support for national-level decision-making and policy formulation; and
- Exploitation of national and tactical intelligence assets jointly during crises.

a. NCA Command Connectivity

Our efforts to improve connectivity from the NCA to our military forces have two major thrusts: insuring connectivity to the strategic forces during and following general war, and improving the quality of NCA connectivity with the forces during all crises.

U.S. strategy for general war has shifted over time. In the past, our planning has, in effect, been predicated on the assumption that general war would terminate with the execution of a massive retaliatory strike by U.S. strategic forces against those precipitating the conflict. Under this assumption, NCA connectivity need only survive long enough for determination that a major attack on the United States has occurred and for transmission of Single Integrated Operational Plan (SIOP) messages to the strategic forces.

Today's strategy includes flexible response, in addition to assured destruction, and places greater demands in terms of needed C^3I capability. First of all, means must be provided to insure NCA connectivity following an initial attack against the U.S. This connectivity takes the form of information on the damage sustained by the U.S. and its allies, the status of U.S. and allied forces, counterpart information regarding the enemy and the capability to command the surviving forces at the NCA's disposal.

Key to these objectives is insuring survivability of the NCA decision-making and communications capability, and that of the force commanders. Our near-term efforts in this regard exploit the concept of mobility for survivability in the form of the Advanced Airborne Command Post (AABNCP). Research and engineering efforts are underway to upgrade the current National Emergency Airborne Command Post (NEACP) and CINCSAC mission capability with enhanced communications, which will provide improved connectivity to SIOP forces under wartime conditions. Support of ground and flight testing of the E-4 AABNCP-testbed R&D aircraft will require $32 million in FY 1979.

NCA connectivity to U.S. forces is provided through the World Wide Military Command and Control System (WWMCCS) and a key constituent of that system, the Minimum Essential Emergency Communications Network (MEECN). $40.5 million is requested for FY 1979 to continue development of Extremely Low Frequency (ELF) communications, with the objective of improving MEECN connectivity with our strategic submarine forces.

The Air Force Satellite Communications (AFSATCOM) effort was undertaken to provide a satellite communication link for transmission of Emergency Action Messages from the NCA to SIOP forces. Additional support in this regard will be provided by the Fleet Satellite Communication (FLTSATCOM) program which will be discussed subsequently. The Strategic Satellite System is a follow-on program which includes efforts aimed at developing system alternatives to permit adaptation to a changing threat. The AFSATCOM research and development budget request for FY 1979 is $33 million.

Additional studies, tests and advance design efforts are underway to improve survivability of the Alternate National Military Command Center. These activities, for which $5 million is requested for FY 1979, are needed to support analyses of the feasibility and desirability of this approach. Actual implementation of the ANMCC survivability improvement effort is not anticipated prior to FY 1980.

b. <u>National and Strategic Information Support</u>

The World Wide Indications and Warning System is a network which provides integrated analytical reports to national decision-makers. The existence of this system provides major benefits by:

- o Providing information support to a national level decision-maker to maximize the readiness posture of U.S. forces;
- o Maximizing the risk to a potential enemy attempting a surprise attack; and

- Speeding the response to crisis situations, thereby minimizing the risk of escalation.

In this regard $7.3 million is requested to continue the phased upgrade program, including improved communications and automatic data processing capabilities.

Advances in Soviet strategic weapon capabilities include substantial increases in the range and payload capabilities of submarine-launched ballistic missiles, and extensive use of multiple, independently targetable re-entry vehicles in Soviet ICBMs. These advances complicate the problems of obtaining tactical warning--determination that an attack is actually occurring--and estimating the size and objectives of the attack. These is strong evidence that Soviet efforts to enhance their strategic offensive weapon capabilities will continue.

Improvements in missile attack warning capabilities are being developed via upgrade of the Ballistic Missile Early Warning System (BMEWS). Related efforts to achieve needed surveillance and warning improvements include the DEW LINE, Alaskan and prototype CONUS Over-The-Horizon Backscatter (OTH-B) radar developments for bomber warning; space surveillance and nuclear detection developments; and the Warning Information Correlation program. These activities were described earlier in Chapter V.

c. The National/Tactical Interface

In recent years, the technical capabilities of national intelligence collection systems have increased dramatically, and there is significant opportunity for further growth. It is fortunate that this is indeed the case, because the increasing sophistication of foreign systems and the diversity of foreign activities that are of interest at the national level demand such advances. The same problem impacts on the military forces, however, and it must be recognized that increased capability does not come without cost.

Historically, national and tactical intelligence systems have been developed and operated essentially independently. Given the need for increased intelligence support capability at both levels, it is apparent that means for mutual intelligence support must be increased. We are, therefore, taking additional steps to achieve greater access by the military commands to national intelligence systems for both contingency planning and support of combat operations. At the same time, we are undertaking efforts to insure that maximum national level intelligence support is provided by the service tactical intelligence systems.

2. C^3I for the General Purpose Forces

a. Battlefield Surveillance and Reconnaissance

Dominating consideration of C^3I for land and tactical air forces is the need to achieve efficient--timely and precise--force control. Some implications of this observation are:

- We must take an integrated view of land and air operations, emphasizing coalition defense with our NATO allies;
- We must insure C^3I interoperability both for our own services and with the forces of our allies; and

- Our C3I capabilities must be secure from exploitation by opposing intelligence units and resistant to physical attack and countermeasures against individual elements.

An important step toward greater battlefield force effectiveness is the achievement of improved capability for night and all-weather operations. Our surveillance and reconnaissance research and development initiatives emphasize this objective, together with the need for:

- Diversity and mobility--to insure survivability of these functions against Soviet counter-C3 initiatives; and

- Range and flexibility--to deal with highly mobile and increasingly sophisticated Pact weapon systems.

To attain our objectives, we are developing a number of passive and active systems which complement each other. The passive surveillance systems exploit hostile electromagnetic transmissions and constrain opposing forces to choose between remaining silent--and losing radio communication and radar surveillance--or giving away the location of key force elements. The active surveillance systems provide inputs on the location and movement of opposing forces even if they choose to remain silent. Our major research and development programs for battlefield surveillance and reconnaissance are:

(1) QUICK LOOK: An airborne passive surveillance pod for the Army Mohawk. QUICK LOOK is being developed to work with a companion ground-based facility, the Automatic Ground Tactical Emitter Location Intercept System (AGTELIS). Procurement began in FY 1975, and the FY 1979 procurement program includes $30.7 million for QUICK LOOK.

(2) Tactical Communications Emitter Location and Identification System (TACELIS): a truck-mounted passive surveillance system to be used at the Army Corps level and to supplement Division assets. The FY 1979 program includes $2.6 million to complete a prototype system and to conduct developmental and operational tests, and $53.3 million for production of two equipments.

(3) Stand-Off Target Acquisition System (SOTAS): a helicopter-borne active surveillance radar optimized for detection and localization of moving vehicles. Real-time moving-target detection and position data are transmitted over a data link from the helicopter to a central ground-based facility. SOTAS will therefore provide near-real-time information on opposing force movements to the Division Commander, and has been tested in European field training exercises with great success. The FY 1979 program includes $36.9 million for SOTAS development.

(4) Airborne Moving Target Acquisition System: an Air Force prototype wide-area scanning radar for detection and localization of moving vehicles. We are requesting $5.6 million for this program in FY 1979.

(5) UPD-X Side-Looking Airborne Radar: a consolidated radar development aimed at producing an improved, very high resolution, airborne radar surveillance capability. Congressional concern about possible duplication within three formerly separate radar efforts has led us to consolidate them. We are requesting $10.9 million for UPD-X development in FY 1979.

(6) Airborne Warning and Control System (AWACS): More than just an active radar for airspace surveillance, AWACS provides essential real-time control of air defense interceptors and has growth potential

for an impressive maritime surveillance capability. In 1973, the United States offered to make AWACS available for procurement by NATO. European and Canadian NATO Ministers agreed to the need for a NATO Airborne Early Warning System at the December 1976 Defense Planning Committee meeting. Funding and configuration issues are being resolved now, with a Ministerial session scheduled for early 1978. We expect the Defense Planning Committee to reach an alliance procurement decision, which would be subject to ratification by the appropriate national organizations, including review by the Congress. NATO adoption of AWACS, when achieved, will greatly strengthen the alliance defense posture. Such strengthening is particularly important in view of the growing ground-attack capability--as embodied in the Soviet FLOGGER and FENCER aircraft--of Warsaw Pact tactical aviation forces. We have planned evolutionary increases in AWACS capability, as experience is gained with the system, and funding in the amount of $68.6 million is requested for development and testing of these improvements in FY 1979.

(7) Battlefield Exploitation and Target Acquisition: Having adequately diverse, survivable, and flexible surveillance sensors available to battlefield and theater commanders is an essential first step in achieving the objectives outlined earlier. The profusion of sensor outputs, however, must be assimilated into a useable comprehensive perspective of the combat situation--a timely and specific picture of enemy strength, disposition, and movement. In addition, the utilization of surveillance resources must be tailored to the needs of the immediate situation. One of the key programs we have initiated for these purposes is Project BETA

(Battlefield Exploitation and Target Acqusition). Project BETA is a joint program of the Army, the Air Force, and the Defense Advanced Research Projects Agency to develop a test-bed consisting of three mobile fusion centers for near-real-time integration of data from surveillance sensors. It will draw on and integrate the inputs from a number of sensor systems. We are requesting $15.9 million for Project BETA in FY 1979. The effort is aimed at providing targeting support needed at Army Corps and Division command echelons and at the Air Force Tactical Air Control Center. In addition to furnishing a near-real-time portrayal of the battlefield situation to tactical commanders, BETA will:

- Facilitate battle field sensor management via recommendations to the tactical commander on his allocation and employment of surveillance and reconnaissance resources; and
- Facilitate targeting via identification and location of key targets in the opposing forces, and nomination of firepower elements.

The Army's Tactical Operations System is being reoriented to make it more responsive to real-time battlefield needs at the Corps and Division levels and to enable it to receive BETA outputs. Funding requested for FY 1979 is $36.8 million. Other Army programs in this area are under the Battlefield Systems Integration Project for which we are requesting $7.0 million in FY 1979.

b. Tactical Communications Systems

Our battlefield communications equipment of today is inadequate to meet the requirements imposed by highly mobile weapon system and multi-force operations.

(1) TRI-TAC: The Joint Tactical Communications program is a major effort to provide significant improvements in capability and interoperability over current systems, with the following attributes:

- o Common multi-channel equipment for all four Services;
- o Highly mobile;
- o Securable;
- o Automatic switching for rapid dissemination of messages and voice communications; and
- o Theater-wide interoperability, with interfaces to single-channel tactical users and other theater systems, and between U.S. and allied systems.

Realization of these attributes is both militarily important and technologically challenging. From the military standpoint, implementation of TRI-TAC will provide major improvements in the survivability of tactical multi-channel communications to physical attack and will facilitate orderly introduction of equipment with improved military characteristics. At the same time, TRI-TAC entails the introduction of new multi-channel switching, transmission and technical control technology, with incorporation of features to insure interoperability with a variety of existing equipments that will continue to be used by the forces during the transition period, as well as new subsystems with increased military capability. TRI-TAC RDT&E funding in the amount of $111.6 million is requested for FY 1979.

(2) SINCGARS-V: Command and control, in the immediate vicinity of the battle area, is exercised primarily through the use of combat net radios. For this purpose, the Single Channel Ground and Airborne Radio Subsystem (SINCGARS-V), a family of man-pack, vehicular, and airborne VHF-FM radios, is in advanced development by the Army. We are requesting

$12.7 million in FY 1979 for this effort. SINCGARS-V will interface with TRI-TAC. The SINCGARS-V program is international in character and will contribute to the NATO Rationalization and Standardization Program.

(3) Joint Tactical Information Distribution System (JTIDS):

The JTIDS program is a major joint-Service effort to exploit modern time-division multiple-access communications technology for realization of multi-function, multiple-user digital data link capability. Three classes of terminal equipment are being developed:

- Class I for large aircraft and surface ships;
- Class II for small aircraft and ships with equipment volume constraints; and
- Class III for man-pack and missile applications.

Class III terminals are in the study phase at this time.

JTIDS is designed to share the radio frequency spectrum used by aeronautical radio navigation systems on a non-interference basis. In this connection, an extensive joint agency evaluation was conducted in 1977 to verify the electromagnetic compatibility of JTIDS with the Federal Aviation Administration (FAA) systems, with participation by the Federal Communications Commission and the Department of Commerce as well as the FAA and the Department of Defense. Representatives from the Radio Technical Commission for Aeronautics and the DoD Electromagnetic Compatibility Analysis Center have been involved in establishing test procedures, analyses of data, and preparation of the test report. The test program included a variety of conditions and flight profiles at four ground beacon and ten TACAN/DME locations.

Release of the test report, certifying JTIDS compatibility is expected in mid-1978. The report will provide the basis of a formal request for JTIDS frequency allocation approval by national radio-frequency spectrum management authorities during 1978.

We are now evaluating E-3A (AWACS) engineering development model JTIDS terminals and advanced development models of the Class II terminals for fighter aircraft. Flight testing of the E-3A JTIDS terminal was successfully completed in September 1977, four weeks ahead of schedule. Engineering development of the Adaptable Surface Interface Terminal was initiated during 1977. This equipment will provide interoperability between JTIDS equipment and selected military systems that are current operational. We have also taken an initiative to insure interoperability with NATO forces by offering JTIDS to NATO for the NATO ECM Resistant Communications System. In this regard, we are providing two JTIDS terminals to the SHAPE Technical Center in early 1978 for extensive testing. We are requesting $70.1 million in RDT&E funding for JTIDS in FY 1979.

c. Battlefield Command and Control Interoperability

We and our NATO allies are placing increased reliance on computer and digital data transmission systems to speed the accomplishment of tactical command and control functions. Concurrently, there is growing interdependence among various military units--intra-Service, inter-Service, and in combined operations with NATO tactical units--necessitating the rapid exchange, assessment and dissemination of command and control information. Both of these trends have caused conventional methods for handling command and control data in a dynamic combat environment to be inadequate.

(1) TACS/TADS: One effort for dealing with this problem is the Joint Tactical Air Control Systems/Tactical Air Defense Systems (TACS/TADS) interoperability development program. The Navy is executive agent for this program. TACS/TADS successfully completed the final joint operational effectiveness demonstration in May 1977. As a result of the interoperability standards that were developed in this program, the air defense and air control systems of all the Services will now be able to communicate with each other in real time without intervention. We are making provisions so that TACS/TADS systems will be able to accept outputs from the Project BETA fusion centers. The Joint Chiefs of Staff and the Services have undertaken plans for operational implementation of TACS/TADS standards and procedures, with the Navy serving as Executive Agent. We are requesting total Service funding of $4 million in FY 1979 to provide for changes deemed necessary as a result of the operational demonstration.

(2) JINTACCS: Our program for Joint Interoperability of Tactical Command and Control Systems (JINTACCS) is much broader in scope than the TACS/TADS effort. JINTACCS--formerly the Ground and Amphibious Military Operations (GAMO) interoperability program--has been reorganized by the Secretary of Defense in response to concerns of the Congress as to the adequacy of the program. Actions to:

- Strengthen and streamline the program management structure;

- Insure visibility and guidance at high DoD management levels;

- Provide a valid system architecture and reduce the time required to achieve interoperability; and

- Establish JINTACCS as the DoD focal point for attaining interoperability with NATO tactical command and control systems;

have been accomplished. The program is now well on its course toward providing interoperability of automated tactical command and control systems for joint and combined allied operations. We are requesting $25 million in support of JINTACCS for FY 1979.

d. Electronic Warfare and Counter-C^3

As previously noted, there is a critical need to retain a superior capability for precise and timely force control in order to deter conflict with numerically superior forces. Significant advantage in this regard can be achieved from having means available to disrupt the command-and-control and communications functions of opposing forces--a capability we now term counter-C^3.

In this regard, we have requested and received the assistance of the Defense Science Board in formulating a strategy for counter-C^3. Their findings, developed during their 1977 Summer Study, strongly endorse the need for a comprehensive joint program in this area. The counter-C^3 program proposed for FY 1979 is therefore only a beginning, and we will be seeking your support for new counter-C^3 projects in the future.

One of our major initiatives is the Precision Location Strike System (PLSS), an integrated airborne system which will supply data to assist the tactical commander. We are requesting $86.8 million to support full-scale development in FY 1979.

We have accelerated the EF-111A development program, which will supplement PLSS by providing greatly improved counter-C^3 capabilities. We are requesting $8.8 million in FY 1979 to complete development and qualification of support equipment and to complete the Service Life Assessment Program for the EF-111A.

A related task is that of providing countermeasures protection for our fighters against enemy interceptor aircraft. We are therefore requesting $16.1 million for the Advanced Self-Protection Jammer for F-14 and F-18 aircraft and to meet future requirements for internal ECM capabilities, and $11.8 million for expanded countermeasures capabilities for the F-15 aircraft.

Another area requiring application of counter-C^3 concepts is that within the immediate land-combat battle zone. We have several projects for this purpose. First, funding in the amount of $3.5 million is requested to support development of the MLQ-33 system in FY 1979. Second, we are requesting $2.4 million in FY 1979 for development of the ULQ-14 vehicle-mounted jammer. Finally, counter-C^3 activities and assets must be coordinated for greatest effect because of the redundancy and diversity of systems in opposing forces. We are requesting $2.7 million in FY 1979 to continue development of the Tactical Electromagnetic Warfare Control and Analysis Center for this purpose.

e. <u>Naval C^3I</u>

Introduction of the Tomahawk anti-ship cruise missile into the fleet will provide Navy surface combatant ships (other than aircraft carriers) with their first weapon capable of outranging Soviet anti-ship cruise missiles.

Concurrently with development of the Tomahawk, we must extend our capability to provide targeting data to the missile launch platform. In this regard, we are requesting $5.1 million in FY 1979 for development of improved capabilities for the EP-3E land-based patrol aircraft.

The backbone of our airspace surveillance and interceptor control capability for carrier task forces is the E-2C airborne early warning and control aircraft. The E-2C additionally provides surface surveillance coverage for the task force. We are currently developing evolutionary improvements to the E-2C. The FY 1979 request includes $1.4 million for these evolutionary improvements and $207.8 million for procurement.

Undersea surveillance is also a key element of naval C^3I. The SOSUS, SURTASS, and RDSS programs described in Chapter VI are therefore important initiatives in this larger context.

Assimilation, integration, and dissemination of global ocean surveillance in near-real-time continues to be a key factor for effective exploitation of our sensor technology. The Ocean Surveillance Information System (OSIS), Fleet Command Center (FCC), and the Anti-Submarine Warfare Centers Command and Control System (ASWCCCS) constitute the basis for a worldwide shore-based system for ocean surveillance and naval command and control. Plans for FY 1979 include site surveys for FCC locations in support of the Navy Command and Control System (NCCS) and operational baseline communication capabilities at all OSIS sites. ASWCCCS completed OPEVAL at the Atlantic Fleet test site, and the overall system will be fully operational in FY 1980.

The Tactical Flag Command Center (TFCC) program is aimed at development of an automated shipborne system, the shipboard node of the NCCS, to provide the commander with a total operational situation display for more effective planning, direction, and monitoring of operations at sea. Command and control of task force anti-submarine warfare operations will be improved through development of the shipborne Tactical Support Center (TSC). We are requesting $4.5 million for these two programs in FY 1979.

Satellite communications links to at-sea units are currently provided by means of leased ultra-high frequency transponders on the commercial MARISAT satellites. These links are vital, but they do not provide adequate communications capacity to support crisis operations, nor do they have essential military features. We are, therefore, requesting $18.4 million in FY 1979 for research and development on techniques to improve Navy Satellite Communications, including the Fleet Satellite Communications System (FLTSATCOM). In addition to providing essential military characteristics and capacity for naval communications, FLTSATCOM spacecraft will carry transponders for communications with AFSATCOM receivers. The FY 1979 research and development efforts will be applicable to future leased satellites as well as government-owned systems.

3. Defense-Wide C^3I Programs

a. Navigation and Position-Fixing

Several of our C^3I research and engineering programs are aimed at supporting more than one of the Services or a variety of missions. One of the most important of these is the NAVSTAR Global Positioning System (GPS) program. The availability of precise position data is manifestly important for targeting of our new, highly accurate weapons. It is perhaps less evident that assimilation and integration of multi-sensor surveillance and reconnaissance data is more effectively accomplished if the events and elements being reported are located accurately and in the same coordinate system. This can only be accomplished if the position of the sensor platform is known precisely. GPS will provide, on a worldwide, all-weather, real-time basis, precise three-dimensional position and velocity data and time signals to an unlimited number of users, including our allies as well as our own forces. It will augment the security of military users, because the using system does not radiate electromagnetic signals. The GPS program is therefore not only important for weapon delivery systems, but is a key element of an integrated C^3I capability. We are requesting $129 million for GPS development efforts in FY 1979.

b. Communications

Completion of the development of the AUTODIN II system will significantly upgrade our capabilities for long-haul CONUS digital data communications by providing interactive-computer communication support.

As a common-user system, it will allow elimination of a number of dedicated communication networks with concomitant cost savings. Funding of $2.2 million is requested for the AUTODIN II program in FY 1979.

The Defense Satellite Communication System (DSCS) provides essential connectivity between CONUS and overseas forces. Present coverage is obtained from three DSCS II satellites and the NATO IIIB satellite. We are now developing the DSCS III satellites for the purpose of achieving extended spacecraft useful life and a substantial increase in communications capacity. We are requesting $34.2 million in FY 1979 in research and development funds to support this effort.

The General Purpose Satellite Communications System (GPSCS) development is aimed at deployment some time after 1984, as a follow-on to FLTSATCOM. GPSCS will provide communications to mobile users, including service to ground, shipborne, and airborne platforms, nuclear-capable force elements, and the NCA. We are requesting $8.1 million in FY 1979 for concept studies and development of advanced components that would be required for a government-owned or leased satellite system.

c. Identification

The problem of identifying sensor-detected targets has been with us for many years. The need of positive and reliable means for distinguishing between friends, foes, and neutrals is especially critical with the advent of all-aspect air-to-air weapons which can be used to engage targets beyond visual detection range. Accordingly, we and our NATO allies have undertaken a broad program to develop new and improved identification capabilities that are more consonant with the performance of our weapon systems. This effort entails improvements in the present Identification, Friend, or Foe (IFF) system and investigations of passive techniques and information distribution systems. Total R&D funding requested for all the Services in FY 1979 is $17 million, and will support the development of new identification technology, IFF improvements, and NATO future identification system efforts.

d. Intelligence

National intelligence supports the National Command Authorities, senior civilian and military policy makers and force planners, and Defense officials responsible for development of weapon systems. This effort is included in the National Foreign Intelligence Program (NFIP), which comprises a significant part of the intelligence efforts of the Department of State, Energy, and Treasury, and the FBI and CIA, as well as the Department of Defense. FY 1979 funding requested for Defense intelligence research, engineering and acquisition is aimed at achieving several essential objectives, including:

- reduction of operating costs;
- improvements in the timeliness and accuracy of intelligence products; and
- enhanced capability to monitor foreign activities and developments.

C. C^3I ACQUISITION ACTIVITIES

The discussions of the preceding section have focused on research and development efforts for achieving improvements in future C^3I capabilities. In addition, we have planned a number of procurement actions in FY 1979 which will provide needed near-term improvements. Some highlights of the FY 1979 C^3I procurement program are listed below.

1. TACAMO Communication Improvements

Navy TACAMO aircraft are mobile communications relay platforms for delivery of messages to our ballistic missile submarines. The FY 1979 aircraft procurement appropriation request of $60.5 million includes funds for needed message reception improvements and greater communication coverage.

2. AFSATCOM Equipment

The role of the Air Force Satellite Communication (AFSATCOM) program was discussed earlier. The $60.1 million FY 1979 procurement request will support acquisition of terminal and space segment hardware and modifications to SIOP aircraft for terminal installation.

3. Communications to Special Ammunition Storage (SAS) Sites

A test of satellite communication terminals for SAS communications support was successfully completed last year. The FY 1979 procurement request of $14.2 million will provide additional terminals and equipment for SAS satellite communications network control.

4. Air Force Command and Control Systems

We are requesting $14 million of FY 1979 to support improvement and automation projects for the Tactical Air Control System (485L) and in support of the Air Force command and control project.

5. Digital European Backbone

In FY 1979, $25.9 million is requested for procurement to support needed improvements in the European Defense Communication System.

These improvements will lead to reduced operating and maintenance costs and provide the basis for improved communications security through incorporation of modern digital signal transmission techniques.

VIII. THE SCIENCE AND TECHNOLOGY PROGRAM

A. SCIENCE AND TECHNOLOGY FOR DEFENSE

1. Significance to National Security

One of our nation's greatest strengths is its sustained scientific and technological vigor. This national strength is key to our continuing national security as it is to the performance advantage of U.S. military forces and weapons systems, and the technological advantage of U.S. military R&D capabilities over potential adversaries. The Science and Technology Program provides the foundation for such military technological superiority. It is the source of the ideas and inventiveness which lead to new weapons systems, to the improvement of existing systems and to the integration of disparate development and equipment units into the coherent systems which underlie our military strength.

The Science and Technology Program covers the spectrum of critical military technologies from munitions, guidance, control and electronics through materials, mathematics and physics, through oceanographic and environmental sciences to chemical and biological defense and to the vital areas of training, safety, food, nutrition and life sciences. This program addresses the importance of (a) providing the most technologically effective and safe environment possible for the individual engaged in a combat situation, (b) providing the most technologically advanced and effective weapons and defensive systems for all combat arenas ranging from space to underseas and (c) expediting the progress of ideas and inventions from their conception to their final manifestation as technologically superior field weapons and logistics systems in our military inventory.

The products of this program today are the military systems and capabilities of the future.

2. Highlights of 1978

The FY 1978 Science and Technology Program is now providing significant advances for military systems application. Examples of technology being developed and demonstrated include:

- Ramjet propulsion for advanced missiles to provide longer range and higher target hit probability.
- High acceleration cockpit and digital flight control system designs for highly maneuverable fighter aircraft.
- Night vision goggles to greatly improve combat operations in darkness.
- Better chemical warfare protective equipment.
- Increased accuracy from guns equipped with soft and constant recoil fixtures.
- A much needed variety of advanced target seekers for guided missiles.
- A variable cycle aircraft engine concept able to increase aircraft capabilities while reducing fuel consumption.
- Aerosol obscurants with potential to provide the infrared opacity needed for concealment.
- Sensing systems able to detect 3mm diameter power line wires at a distance of 400 meters from low flying helicopters.
- Flight training simulators with wide field-of-view which do not require motion and which save expensive flight time in pilot training.

- An actuation valve for rapid inflation of G-suits, providing pilot protection in maneuvering accelerations.
- A new medical technique for early diagnosis of inhalation thermal injury, thereby improving likelihood of cure.
- Biochemical techniques for rejuvenation of red blood cells, thus saving out-dated transfusion blood supplies.

B. A PROGRAM OVERVIEW

1. Content.

The Science and Technology Program includes the budget categories of Research (6.1) and Exploratory Development (6.2) and Advanced Technology Demonstrations which are funded under the Advanced Development (6.3) category. For management purposes, the program is divided into 24 separate technical areas (such as aircraft propulsion, electronic warfare and environmental sciences) and grouped into three major components; namely, Engineering Technology, Electronics and Physical Sciences, and Environmental and Life Sciences.

The work is performed by a combination of 72 in-house laboratories, 150-175 universities and a wide segment of industry. The total program is funded at approximately $2.6 billion in FY 1979.

The Defense Advanced Research Projects Agency (DARPA) and the Defense Nuclear Agency (DNA) each have their programs within the Science and Technology Program. They are closely coordinated within the overall program but are managed separately by the DARPA and DNA staffs. The DARPA program is discussed in Section E of this chapter, the DNA program in Chapter V, Section D.

2. Objectives and Priorities.

The overall objective of the Science and Technology Program is to achieve and sustain a national technological superiority in areas of militarily critical technology. It does so through use of the scientific and engineering resources of government laboratories, industry and the academic community.

Crucial to this technological superiority are (a) recognition and concentration of resources in critical technologies, (b) acceleration of the orderly process by which ideas and inventions (Research) are translated into possible applications (Exploratory Development) and then evaluated in systems at practical scale (Advanced Development Demonstrations) and (c) improved maintenance and performance reliability for military systems already in use via technological advances.

The FY 1979 Science and Technology Program gives high priority to each of these three crucial program facets. For example we will:

- Work with industry and the intelligence community to identify those areas of most critical technology so that we can concentrate our own R&D resources on them and also so that we can more effectively control their export to potential adversaries,

- Propose to increase our level of funding for Research (6.1), Exploratory Development (6.2) and advanced technology demonstrations in Advanced Development (6.3) so as to more rapidly move the research products of the academic and industrial communities into application and demonstration,

- Aggressively encourage more active cooperation between DoD laboratories and their academic and industrial counterparts to improve the innovative vitality and R&D productivity of our DoD laboratories,

- Address, with renewed attention, the safety and effectiveness of the individual in the anticipated tactical combat environment scenarios of the near-term future, and

- Ask for greater performance reliability and better performance measures for the electronic and computer systems on which our military technological superiority is so increasingly dependent.

Some specific program areas of high priority in FY 1979 are:

- Continued development and demonstration of dramatically improved technology for advanced fighter aircraft,

- Development and application of terminal guidance system technology for missiles that can seek out and destroy targets, day and night, when launched in a "fire-and-forget" mode,

- Refinement of biomedical criteria and protection or treatment of combat personnel exposed to chemical/biological weapons, combat zone infectious diseases, operational stresses and weapons,

- Demonstration of strategic bomber crew station equipment and procedures for control of air-launched cruise missiles,

- Development and application of new simulation techniques to improve training and utilization of personnel,

- Development of inter-array acoustic signal processing to improve undersea surveillance by precise localization,

- Development of focal plane arrays for night vision, space surveillance and search and tracking with increased performance over present scanning systems,

- Development of a realistic and comprehensive program in charged particle beam technology, and

- Improvement in training of people for military missions and for protecting them while they are performing their functions.

It is apparent that these representative efforts are applicable to tactical and strategic platforms as well as to logistics systems and involved personnel. The technological products of these efforts will accelerate military systems applications at lower overall costs by reducing the numbers of weapons and personnel and the amount of training required.

These facets of our program are discussed in more detail in later sections of this report.

3. Funding Trends and Needs.

It is essential as highlighted earlier to increase funding for the Science and Technology Program over the next several years. We must continue our recovery from a decade of declining effort. It is prudent to accomplish this build-up during peaceful, non-crisis times.

To this end overall Service Research (6.1) funding will be increased by 7% and Exploratory Development (6.2) funding by 2% in FY 1979 in real growth terms. These increases are to the combined Services' Research and total Exploratory Development programs and are not uniformly spread across the Services or across program elements. This selective approach is aimed at funding areas of highest payoff and need.

The increases in 6.1 and 6.2 program funding are made productive by a concomitant increase in Advanced Development (6.3) funding for technology demonstration. It is in this area that the promising technologies determined to be feasible in 6.2 are proven in practice for the technologist and demonstrated in application for the potential military user.

Table 1 reflects the total budget request for the Science and Technology Program.

4. <u>Management Policies.</u>

The management of the Science and Technology Program must be sensitive both to the specific mission needs of the DoD and to the influence this program necessarily exerts on the activities of the scientific and engineering resources of the United States. Put into perspective, this program represents about 9% of the total Federal R&D expenditure and about 25% of those Federal R&D expenditures which support the national science and technology base rather than the development of specific large scale military operational systems.

Some program management changes have been made which will first be apparent beginning in FY 1978 and which will greatly enhance the vitality and utility of our Science and Technology Program in FY 1979 and subsequent years. They are:

a. The staff office responsible for the Science and Technology Program will, for the first time, also have responsibility for the technical aspects of our Technology Export Control Policies. This will ensure close coordination between the DoD R&D efforts in support of critical technologies and DoD controls over exports of critical technologies. The anticipated result will be a better understanding of the processes for selecting critical technologies, for improving national efforts in critical technologies and for controlling the transfer of critical technologies.

b. The manager of the Science and Technology Program will also, for the first time, have responsibility for the DoD

TABLE 1

SCIENCE AND TECHNOLOGY PROGRAM
(Dollars in Millions)

Research	FY 1978	FY 1979
Services	369.5	418.0
Defense Agencies	42.9	50.3
Total Research	412,4	468.3
Exploratory Development		
Services	995.5	1,080.1
Defense Agencies	389.0	451.6
Total Exploratory Development	1,384.5	1,531.7
Advanced Technology Demonstrations		
Services	486.9	592.8
Total Advanced Technology Demonstrations	486.9	592.8
TOTAL S&T Program	2,283.8	2,592.8

Manufacturing Technology Program. The manufacturing process is a most important step in the overall process of advancing the products of research and new technology through engineering development and production to final delivery in operational systems. Its effectiveness depends both on its ability to adapt to new research-derived products which obsolete current production items, and on its ability to utilize new technologies to improve its own materials and procedures. We anticipate that this action will make DoD's Manufacturing Technology Program more responsive to user needs and more receptive to both product and process technological innovation.

c. Improved management mechanisms will be applied to better utilize the research potential of the academic community in meeting DoD's mission requirements. These new mechanisms, subsumed under the Defense Science and Engineering Program (DSEP), accompany the increased funding recommended for university research in FY 1979, described later in this report.

C. MANAGEMENT ATTENTION AREAS

Ten areas have been selected for special management attention. They are described in subsequent paragraphs.

1. Comprehensive Management Review of the DoD Laboratory Program.

Detailed management reviews of the Services' in-house laboratories have been performed over the past four years. Recommendations resulting from these reviews included realignment of some of the laboratories within the Services. In other instances the needs were for increased overall funding for the Science and

Technology Program, for achieving a better balance between research to be performed in-house versus contractually, for block funding to in-house laboratories and for formulation of recommended roles of Service headquarters organizations vis-a-vis laboratories. Most of these recommendations have been implemented with discernable benefit to the Science and Technology Program. Some recommendations, however, still need refining In addition, an evaluation of results achieved through completed management actions is called for.

2. <u>Program Balance Among Academia, Industry and Government</u>

To achieve maximum use of the nation's scientific and engineering resources, the Science and Technology Program relies on three principal sources: the DoD laboratories, the academic community and industrial R&D organizations Each provides particular specialized talents to the overall Program. The in-house laboratories provide essential coupling among participants and maintain a mainstream of technological skills plus an acute awareness of systems applications. Industry primarily provides additional innovation skills and an awareness of production feasibility. Universities are the principal source of knowledge for longer term advances.

In the DoD Research program about 40% of the work is carried out by the DoD in-house laboratories, 40% by universities, and 20% by industry and non-profit organizations. As would be expected, this program balance shifts increasingly from universities through the DoD laboratories to industry during the progression from

Research through Exploratory Development to Advanced Technology Demonstration programs. In the latter program the effort is about 70% in Industry and 30% in DoD laboratories

A factor intended to influence this balance is the plan to increase Research (6.1) by 7% in real dollars in FY 1979. This will increase DoD's utilization of the research creativity potential found in universities. A new initiative, the Defense Science and Engineering Program (DSEP), has been formalized for this better exploitation of university research.

The quality of technical programs--wherever they are performed--will serve as the best measure of research utility. Rather than specifying that a given percentage of the program will be done by each performer (e.g., DoD laboratories, industry and academia), we will use the best scientific and technical talent available, as well as user feedback to advise us on program adequacy and balance.

3. Independent Research and Development (IR&D).

IR&D is contractor initiated and performed, product-oriented research and development that is not sponsored by contract, is not required in the performance of a contract or grant and is not required for the preparation of a specific bid or proposal.

IR&S has been and continues to be a major source of support for building the technological strength, breadth, and depth of DoD industrial contractors. The DoD has profited from this S&T program in industry by obtaining original technical approaches, concepts and inventions that are applicable to DoD needs. DoD engineering, development and production contracts have benefited from IR&D through its development of alternative solutions to difficult technical problems. Availability of such alternate solutions reduces risk of technical failure or of schedule slippage. Recent technical contributions from IR&D efforts include the development of laser gyroscopes and charge-coupled devices discussed in Section VIII D of this statement. In both cases, IR&D efforts expanded the S&T Program and, through competition, accelerated the development of significant systems applications.

The industry-funded IR&D program is about 10% the size of the RDT&E program funded through DoD. Industry recovered about 40% of its IR&D expenditures as overhead on DoD contracts.

4. <u>Technology Export.</u>

An important corollary to our Science and Technology Program is the control of exports in a manner which will maintain our technological advantage relative to our principal adversaries without unduly restricting international commerce. DoD published in August 1977 an interim policy on the control of the export of U.S. technology. Its implementation reflects the following premises:

a. DoD's interests and participation occur within a broad context which reflects basic policies of the U.S. government, relative to international relations. Specific examples are a commitment to free trade and the maintenance within the U.S. industrial base of adequate and growing production capability.

b. In addition to general, long-term U.S. interests in the arena of international relations, there are always more specific interests which have direct impact on DoD's technology export and transfer policies. Specific examples are: (1) the President's policy on arms control and nuclear non-proliferation, and (2) the NATO initiatives discussed in Chapter IV which stress greater technology sharing among our allies.

c. DoD is concerned primarily with establishing and implementing, via appropriate policies and procedures, a clear set of criteria and guidelines allowing acceptable exports of technologies while maintaining national security. This requires that satisfactory technological lead times relative to our principal adversaries be maintained in critical technologies. Reorientation of our export control policy toward technology rather than product control will evolve this year and in FY 1979.

5. <u>Defense Science and Engineering Program (DSEP).</u>

This program is a new initiative in FY 1979 to rekindle and stimulate the interest of the university science and engineering community in problems of national defense. There is a large reservoir of innovative potential within the universities which can serve us in solving difficult defense-related, long term technological problems. New ways are needed to couple more effectively the large national effort in basic research to areas of defense interest. Although DSEP will be part of the Defense Research Sciences (DRS) Program, direct management overview of this program for an initial period will be provided by the Office of the Deputy Under Secretary of Defense for Research and Engineering (Research and Advanced Technology). Key thrust areas will be identified in which DoD has scientific and engineering deficiencies, and which will receive focused attention and funding. The mechanisms for implementation of DSEP are being defined through interactions with the Defense Science Board, the military Services and the academic community. Mechanisms under consideration include a workshop on high priority problem areas, small "starter" programs to expedite novel basic research ideas, and establishment of cooperative research efforts within universities on selected areas of work. Emphasis throughout will be placed on the quality of the basic research. The funding for DSEP in FY 1979 will be $9 million.

6. NATO Standardization and Interoperability.

Management initiatives will provide emphasis to programs which increase DoD contribution to NATO standardization and technology sharing. Increased efforts will occur within NATO technical coordinating groups (Defense Research Group, Advisory Group on Aerospace Research and Development, the von Karman Institute, etc.). Joint development and testing programs in areas such as chemical defense, European meteorology and small caliber guns are already providing significant contributions to our capabilities.

7. <u>Manufacturing Technology.</u>

The Manufacturing Technology (MT) Program is being made more responsive to our production cost reduction objectives. The responsibility for management of this program has been placed with the Deputy Under Secretary for Research and Advanced Technology, which I believe will improve coordination across the traditional boundaries separating the R&D and production communities. The MT program is not an R&D program although development funds as required will be provided from the R&D program. We plan to put greater emphasis on computer-aided-manufacturing in order to further capitalize in industry on efficiencies possible from this important aspect of the MT program. It is important to maintain strong and viable coordination with industry on the MT program, so the Manufacturing Technology Advisory Group will continue to serve as the primary industry-Service interface on MT program matters.

8. <u>Energy Technology.</u>

DoD is the single largest U.S. consumer of energy, consuming about 2% of the national total. DoD has specialized needs, particularly in the areas of liquid hydrocarbon fuels for aircraft and electrical supply systems for weapons and forward observation stations. Because of increased competition for refined petroleum products there is a growing scarcity in these specialized fuels upon which world-wide operations by all elements of the Department of Defense rely. DoD is developing, in conjunction with DoE, an Energy Plan to meet its mobility requirements for military fuels.

Technology goals for the short term are shaped by considerations of the present inventory of ships, planes and tanks, many of which have economic lifetimes extending beyond the 1980's and will, therefore, continue to require those fuels which are today growing increasingly scarce. DoD and DoE are planning expanded technology programs directed toward securing of sources of synthetic military fuels from natural resources available within the continental limits of the United States.

For instance, an interagency agreement of five years duration is now in force to provide for the mining, retorting and test and evaluation of synthetic fuels produced from Colorado shale oil. Its aim is to process under commercial refinery conditions at least 50,000 barrels of shale derived crude oil into military specification fuels and to fully test and evaluate them in military systems. Because of the crucial importance to the mobility effectiveness of DoD and to the energy technology of the nation, more extensive fuel exploitation programs will have management attention and support by my office.

The national and defense implications of these energy technology programs warrant continued emphasis and support.

9. Intelligence Evaluation and Application.

Over the past two years coordination with the intelligence community has increased. There are numerous direct personal contacts between intelligence and science and technology (S&T) specialists and regularly scheduled technology exchange meetings with the DIA/CIA community in selected fields such as materials technology. We now have representatives on the Scientific and Technical Intelligence Committee of the Director of Central Intelligence (DCI). Additionally, a continuing series of briefings from the intelligence community has been held covering technology base areas of high interest.

A problem still exists with the relative paucity of intelligence data concerning S&T activities. We have recommended that increased attention be given to S&T activities, with more use of overt sources including the open literature.

A related thrust is to provide additional feedback of information to the intelligence community on key S&T programs. Our S&T activities are broad and diverse, and it is difficult for the intelligence community to keep pace with the many advances being made. The planned information feedback will make possible a better focus on our needs for intelligence and improved net assessments of our status vis-a-vis other technically advanced nations.

10. Scientific and Technical Information Program.

The DoD recognizes the importance of scientific and technical information as a tool for improving management, reducing costs and preventing unwarranted duplication of R&D work. In recognition of the continuing need for a viable program for dissemination of scientific and technical information, we are examining closely the Defense Documentation Center and its relationship with national scientific and technical information clearing houses, defense contractors, military users, and others who require their services. It is anticipated that this examination will identify specific actions that can be taken to improve our capability in this important technology support area.

D. THE TECHNICAL PROGRAM

Earlier sections of this chapter on the Science and Technology Program have dwelt on its intent, its overall content, and its management. Here we discuss major thrusts of the Program and describe key areas in which we can achieve technical progress, where we can improve performance, and where technical products are progressing into inventory systems, along with our assessment of our relative standing in technology.

These topics are discussed in subsequent paragraphs under the headings of:

- o Areas of Major Emphasis for FY 1979
- o Scientific and Technological Advances
- o Reducing Life Cycle Costs and Increasing Reliability
- o Technology Flow from Invention to Weapon System and--as a unique activity--
- o The High Energy Laser Program

1. Areas of Major Emphasis for FY 1979.

a. In Electronics and Physical Sciences:

- Electronic Warfare. Some initiatives aimed at meeting the growing threat include receivers that can handle a million pulses per second, IR and UV missile early warning systems, countermeasures (CMs) against optically directed weapons, improved CMs for monopulse radars and missile seekers, and obscurant smokes effective far into the infrared wavelengths for concealment of our military operations.

- Computer Software. Key thrusts include the development of a DoD-wide high order programming language for eventual standardization, systematic guidance to improve software planning and management in systems, and a computer-aided system to help identify and reject unreasonable, ambiguous, and incomplete software.

- Electronic Device Technology. This core program provides the major advances in performance and life cycle costs in our electronic systems. Thrusts include work on IR focal plane arrays (with DARPA), charge-coupled devices for imaging and signal processing, very high-speed medium scale integrated circuits, process technology for very large-scale integrated circuits, solid state memories, and lasers for target designators.

- Charged Particle Beam Technology. New program direction is aimed at understanding and solving key technical problems such as beam propagation and beam interactions with matter without attempt at this time to determine warfare potential.

b. In Engineering Technology:

- Aircraft Propulsion. For the past several years the emphasis has been on increasing performance. These efforts continue. In FY 1979 additional efforts are being placed on structural/durability testing. This additional testing should result in further increased reliability and a lower life cycle cost. Lower fuel consumption is also a major target.

- Guidance and Control Technology. Advances in micro-computers and solid state electronic devices will permit major improvements in the guidance and control of helicopters, aircraft, and missiles. Digital flight control for aircraft will enable the integration of aircraft flight control and propulsion control with weapons fire control into a system that is simpler and more responsive than those now in being. For missiles we can now develop low cost inertial midcourse guidance packages and apply advanced signal processing techniques to terminal guidance seekers in order to improve their target discrimination capabilities. We are defining common system interface standards for modular components so that the new technology may be incorporated in fielded systems with minimum system modification, cost and down time.

- Helicopter Concepts. This past year, in a joint program with the National Aeronautics and Space Administration (NASA), the Army took delivery of the Rotor Systems Research Aircraft which will provide a flexible, highly instrumented platform for flight test of future advanced rotor concepts. For FY 1979, we plan a broad technology flight test and demonstration program for the Circulation Control Rotor--a rotor blade with internal air flow regulation for lift control developed by the Navy, the Advancing Blade Concept--a contrarotating rotor system developed by the Army with Navy and Air Force support, and the Tilt Rotor concept--a convertible rotor propeller concept developed jointly by the Army and NASA. Each of these systems promises a major adv[illegible]e in performance, reliability, and flexibility o[illegible]erational use.

- Land Mobility. This program is concerned with development of technology for advanced combat land vehicles. The program has two goals: first, a vehicle demonstration to explore under practical field conditions the contributions that new vehicles can make to countering the Soviet threat and second, the development of advanced components which will make a practical reality of those vehicle concepts which show the most promise. Included is work aimed at minimizing the total cost of development, acquisition and operation of the new vehicles as well as reducing the lead time and risk in new systems developments.

- Missile Propulsion. New high performance rocket propellants producing little or no smoke or condensation fog will be developed for missile applications. They will reduce detectability by the enemy of missile launchings and launch points, and will eliminate obscuration of the target by smoke from previously fired missiles. Strong emphasis will continue to be placed upon development of very high performance ramjet propulsion systems for medium and long-range missiles.

c. <u>In Environmental and Life Sciences:</u>

- o <u>Atmospheric Research</u>. The application of advanced infrared imaging and laser energy technology is constrained by our lack of understanding of the effects of the atmosphere upon optical and infrared energy. We are making a concerted effort to focus our atmospheric research to gain a better understanding of optical energy propagation in the atmosphere.

- o <u>Oceanography</u>. Increased understanding of the ocean environment is fundamental to continued U.S. superiority there. Research in the Arctic marginal ice zone, non-acoustic surveillance techniques, and ocean forecasting will now complement our continuing strong program in acoustics. Projects to optimize the deployment of ocean surveillance systems by ocean forecasting are receiving priority attention.

- o <u>Environmental Quality.</u> Major efforts are to develop toxicological criteria for military-unique chemicals, to devise pollution abatement techniques for ammunition plants, to develop and test waste treatment systems for shipboard use, to develop pollution assessment models for military facilities and operations, and to define prediction methodology for military aircraft and airfields.

- o <u>Life Support and Personal Protective Equipment.</u> This area requires continuing emphasis and support, not only to save lives in routine and readiness operations, but to conserve human and hardware resources and help assure the availability of fully trained personnel ready for combat. FY 1979 funding supports development of automated systems to reduce the likelihood of aviators drowning after their parachute escape and to reduce injuries after ejecting at high speeds. Advanced survival avionics search and rescue locator systems will enter engineering development.

- o <u>Chemical Warfare and Chemical/Biological Defense.</u> This effort provides the basis for equipment and materiel development necessary to detect and warn all forces of a chemical or biological attack, to survive and withstand such an attack, to recover and operate in a toxic environment, and to develop necessary munitions for improving deterrence. Concurrently, the threat is assessed continuously and the vulnerability of U.S. forces is evaluated. The principal developments and first priority are individual and collective protective devices, personal prophylaxis and therapy, reliable chemical and biological agent detection and warning devices (both point and area alarms), improved non-corrosive decontamination materials and techniques and simulant materials to permit realistic training and testing evaluations. Second priority is continued screening for new chemical agents and further development of binary munitions for both lethal and incapacitating agents. Binary systems offer significant safety and logistics improvements over the present filled chemical munitions.

- Training and Simulation Technology. Technology advances are providing dramatically increased capability to train in and maintain a wide variety of combat skills by using advanced training devices and simulators. Last year, we requested increased funding for training and simulation technology. We are continuing to emphasize this area as a major thrust with increased readiness payoffs expected through more effective pilot and aircrew training, increased maintenance proficiency through the use of maintenance training simulators, and increased readiness through combat engagement simulation for the Army's combat arms. Additional payoffs are expected in the areas of reduced costs, increased safety and reduced use of fuel for training.

2. Scientific and Technological Advances.

a. Mini-RPVs.

Substantial progress has been made in the Army mini-Remotely Piloted Vehicle (RPV) program. The purpose of this program is to eliminate the human risk in over-the-horizon (OTH) battlefield surveillance and targetting. The program is now scheduled for transition into engineering development in FY 1979. The difficult problem of finding a simple and reliable landing system has been solved. High landing accuracies are being consistently obtained. An automatic navigation system was successfully demonstrated in which a selected flight path can be preset, thereby lessening stress on the operator. We are nearing final test of an RPV payload consisting of a TV vidicon and laser for OTH location of targets, direction and correction of artillery fire, and designation of targets for a cannon-launched guided projectile.

b. Free-Electron Laser.

In an Air Force research program, lasing action has been demonstrated with a "free-electron" laser. Differing from conventional lasers, no special lasing medium is employed. Instead, the essential physical interactions occur within a spiralling, relativistic electronic beam. This could provide a new option for high energy lasers with three times the efficiency previously achieved and tunable from ultraviolet to infrared, as compared to present systems which are not continuously tunable. The next phase in the program is to demonstrate a self-contained system with reduced size and weight.

c. Graphite Intercalated Compounds.

A new class of high electrical conductivity materials, graphite intercalated compounds, has been demonstrated in a tri-Service/DARPA research program. By diffusing elements such as potassium into graphite, electrical conductivities equal to or even slightly exceeding that of copper at room temperatures have been produced. These materials could provide a conductor 50% lighter than copper.

d. Magnetic Gradiometer.

By employing magnetic field detectors with considerably improved sensitivity, the Navy has demonstrated a new magnetometer that can measure magnetic field gradients for submarine detection.

e. Aircraft Propulsion Technology.

A new compressor with very high pressure ratio per stage of compression has been demonstrated. A compressor of this design will have 40% fewer blades than the compressor presently used in the F-100 engine for F-15 and F-16 fighter aircraft. This reduction in the number of compressor parts should reduce turbine engine procurement cost by 7 to 10%.

A split fan variable cycle engine concept has been successfully tested to demonstrate feasibility and to identify critical technologies necessary for full engineering development. This engine combines the fuel efficiency of a turbofan and the thrust output of a turbojet in a system that will be ideally suited for long range interceptor aircraft.

f. Combat Vehicle Design.

One element of an automatic defense system for combat vehicles has been tested in the laboratory under simulated battlefield conditions. Detection and location has proven to be feasible for tank-to-helicopter distances of high interest. This system element would give us a totally new capability to assist current unaided audio and visual detection by tank crews.

g. Energetic Materials.

For several years we have pursued development of a new initiation theory for energetic materials. Evidence accumulated to date indicates the correctness of the new theory. With this increased understanding of the initiation process, it should be possible to tailor the chemical composition of energetic materials to achieve greater safety through increased resistance to impact and vibration and to recover a slightly larger portion of the energy stored in the system. Early tests indicate more than a 50% increase in impact resistance for TNT explosives.

h. Pollution Control.

A passive, parallel plate oil-water separator has been engineered and installed for testing aboard a Navy submarine tender. This water pollution avoidance system will operate automatically at a 10 gallons per-minute flow rate to separate bilge oil, which can then be readily incinerated in a companion device which also handles combustible solid wastes (trash and food scraps) and sewage sludge. These systems will replace collection and holding tanks of limited capacity and allow our naval vessels to operate effectively while meeting environmental quality standards.

i. Computer Image Generation.

Techniques have been developed to generate circular features for Computer Image Generation (CIG) systems for flight training simulation. Current CIG systems generate and depict imagery through the use of straight lines or edges. The circular feature generation technique provides a significant improvement in image quality and a 10-fold increased efficiency in data base development, storage, and image processing is realized for an additional ten percent hardware investment cost.

j. Marine Biology.

The Navy annually performs maintenance on or replaces more than 160 miles of piers and other wooden structures that have been destroyed by marine borers and foulers. Current protective measures are under criticism as environmentally unacceptable. Research in marine biology has shown that tannin compounds create an environment upon which the larval forms of these organisms will not readily settle. We are now working to develop the implementing technology for a safe, effective, and environmentally acceptable approach to protecting marine structures which additionally will save millions of dollars in upkeep costs.

k. Chemical Defense.

Biomedical research programs have completed the formulation of an improved therapeutic agent for nerve agent poisoning. Additional data are being developed to obtain Food and Drug Administration (FDA) certification for production. A.

promising drug for prophylaxis against nerve agents when used in conjunction with the therapeutic agent has been developed and is being tested for FDA certification. These will replace a fielded interim antidote formulation which provided the first effective treatment for the principal threat agent, nerve agent GD. The new formulation alone almost doubles the protection and when combined with the prophylaxis, protection is increased by 3.5 times over the present fielded antidote.

3. Reducing Life Cycle Costs and Increasing Reliability.

a. Militarized Integrated Circuits.

The costs of militarized integrated circuits (ICs) are typically a factor of four greater than commercial high reliability ICs but their failure rate is less only by a factor of two. A program is now underway to achieve costs only 20 percent higher than high reliability commercial ICs but with ten times lower failure rate. One approach is to provide a nitride layer on the chip as a sealant and then use plastic encapsulation for mechanical protection. Early accelerated tests at high temperature have met the failure rate goal; however, the equivalent of millions of hours of testing must still be accomplished.

b. Hemispherical Coverage Antenna.

In present phased array search radar systems, the angular coverage of a single phased array face is limited and four faces are required for full hemispherical coverage. Now, a microwave "lens" has been developed that can passively bend the radar beam like a glass lens bends a light beam. Using this microwave lens antenna, a single phased array can provide full hemispherical coverage. Compared to a four-faced phased array system, a cost savings of over $10 million per system could be achieved. Construction of a demonstration antenna is nearing completion and tests with high-power microwave beams will soon be initiated.

c. Avionics Reliability.

The Air Force has completed initial flight test and demonstration of an Advanced Environmental Control System. This system is designed to reduce the temperature, dust, and humidity in avionics systems cooling airflow. The presence of these agents is a major cause of avionics system failures in service. It is expected that application of the technology thus far demonstrated will result in a two to six-fold increase in reliability of avionics systems and a weight reduction in environmental control systems.

d. Composite Materials.

The use of metal-matrix composites instead of conventional metal alloys for communications satellite structures should permit the reduction of total satellite weights by ten percent. This weight reduction can be translated into a two-fold increase in mean-mission-duration through increased redundancy of critical components, thereby eliminating the need for an additional annual $60 million launch. The ten percent weight reduction could alternatively be applied to increasing the number of active communication channels by about one-third.

e. Marine Propulsion Systems.

An improved coating for marine turbine blades has demonstrated an increase in operating life from 3,500 hours to 6,000 hours.

f. Food Service.

Garrison and field/shipboard feeding is a high-cost requirement. Current food R&D technology is aimed at reduced cost with improved quality. Projects underway will increase shelf life, eliminate rigid (metal) containers, reduce volume and weight of bulk and individual rations and reduce loss of subsistence items to insect, rodent, or environmental damage.

4. Technology Flow from Invention to Weapons Systems.

a. Extended Range Photoemitters.

Photoemitters are key elements in near-IR detection systems. Extension of their ranges further into the IR band utilizes more of the available photons and, therefore, provides increased sensitivity. With a new concept called "field assisted electronic emission", the wavelength response can be extended from 1.2 microns to 1.6 microns. This could provide operation at a light level ten times lower than the capabilities of present night vision starlight scopes. Exploratory development will now be initiated.

b. Charge-Coupled Devices.

A goal for many years has been to replace the vacuum tube vidicon for TV cameras with a solid-state imaging device to achieve a reduction in size, weight, power consumption and failure rate by a factor of at least 10 for each. Less than a decade ago, a breakthrough was made with the invention of charge-coupled devices which not only promised to allow these goals to be achieved, but also to provide an increased sensitivity for night viewing. During exploratory development various technological problems were overcome, imaging devices with about 10,000 detector elements were fabricated, and low-light-level capability was demonstrated. Under an Advanced Technology Demonstration Program, the number of elements was increased to over 100,000, thereby providing a resolution comparable to ordinary television. A set of modules incorporating various electronic packages and sensors is being developed to allow simple and broad applicability to systems such as periscope viewers, real-time reconnaissance cameras, viewers for optical reconnaissance cameras, cameras for mini-RPVs, and missile seekers.

c. Electronic Flight Control.

First flight of the first production F-16 culminates a successful sequence of conceptual design, development, demonstration, and production of the analog all-electronic flight control system. This approach to flight control was a major contributor to reducing the size and weight of the F-16. Because of a stability and control tailoring advantage of the electronic system over a conventional mechanical flight control, over 300 pounds less fuel were required for the design mission. We expect to find expanding application of electronic flight control system technology in future aircraft.

d. Composite Materials.

From its FY 1972 "new initiative" start in the area of carbon/carbon composites for strategic missiles reentry vehicles and rocket nozzle applications, the DoD has evolved a family of fine weave carbon/carbon (FWCC) composites which have been successfully flight tested as reentry vehicle nose tips in the Advanced Ballistic Reentry Systems Program, and tested in rocket motor nozzle configurations in support of the TRIDENT, MINUTEMAN, and Interim Upper Stage (IUS) space shuttle programs. Derivations of FWCC materials have been chosen as the prime material for the MINUTEMAN MK-12A reentry vehicle nosetip and as the prime rocket nozzle material for all three stages of the MX missile and the IUS-both now in development.

e. Tank Propulsion.

The AGT 1500 turbine engine is an Army development now installed in the XM-1 tank final configuration. This is the first U.S. application of a gas turbine engine to a combat vehicle. This engine will double the time between overhauls required for current diesel engines.

f. Tank Ammunition.

In September 1976, the Army type-classified a 105mm kinetic energy tank gun round, the M735. This round incorporated a new design which resulted from ballistic technology development initiated in December 1973. The new penetrator will defeat representative armor at much greater range than achieved by current inventory ammunition. We expect that continued technology development will result in a design change that can be type-classified in FY 1979 and which will offer enhanced penetration performance and further cost reduction.

g. Ammunition Resupply Vehicle.

The Army has demonstrated a concept for transporting 105mm and small arms ammunition under armor to tanks in battle. A conventional M113 armored personnel carrier was fitted with ammunition racks of M60 tanks. The concept is currently in test and evaluation; early transition is expected to final development and production. Resupply is currently effected with open trucks; this development would provide us with a totally new resupply capability that has mobility and protection compatible with those of tanks.

h. Personnel Effectiveness.

Combat and support effectiveness in military forces having larger numbers of females than at present will be encouraged through utilization of data and guidelines developed in the military environmental stress program. Data on female psychological characteristics in military occupations will be published in FY 1979 along with guidelines to improve utilization and career satisfaction. Physical fitness standards for males and females in all Services' speciality codes are being developed and the results applied to improve selection and assignment. Improved cost effectiveness will be realized through reduced costs for screening and selection of personnel and increased retention rates which will reduce personnel acquisition and training costs.

i. Disease Control.

Infectious diseases, particularly virus and tropical parasitic diseases, remain a significant threat to successful military operations throughout the world. In spite of great medical advances, new virulent hybrid organisms resistant to current prophylactic or therapeutic agents continue to emerge. Research is performed on specific infectious diseases that have the greatest impact on troops in combat operations and training exercises. Programs are coordinated with other departments and with the World Health Organization. Coordinated programs assure that no duplication occurs. Promising new antimalarial drugs recently have been field tested and during FY 1979 will be submitted for FDA approval. Vaccines effective against adenovirus 21 and other viruses have passed final testing and will be produced this year for field testing in 1980. Reduction in casualties due to disease and illness during combat will reduce the number of troops required for any specific operation.

5. The High Energy Laser Program.

The DoD High Energy Laser (HEL) Program is a highly integrated Service/DARPA effort. The program is developing the technology base for laser devices; pointing/tracking/subsystems and fire control to demonstrate the feasibility and potential of high energy lasers as weapons. If high energy laser weapons prove effective and competitive, they could be available for selected applications such as defense of ships, aircraft, high value ground targets or satellites.

The goals and priorities established last year remain unchanged for this early advanced development effort. We are requesting $184.1 million ($145.4 million for the Services and $38.7 million for DARPA) for FY 1979.

Our current goals include:

- Verification at the earliest practical date that HEL weapons can be sufficiently lethal to be competitive with other means to perform the missions of interest.
- Continuing expansion of the technology base to seek new concepts in laser devices and optical systems that could yield marked increases in the capabilities of HEL weapons and new applications.
- Providing a scalable technology base to support, with confidence, decisions to initiate development of prototype weapons at the time effectiveness is demonstrated.

E. THE DEFENSE ADVANCED RESEARCH PROJECTS AGENCY PROGRAM

The Defense Advanced Research Projects Agency (DARPA) manages a program of Research and Exploratory Development which is concentrated on major technological thrusts that could become national security issues in the late 1980's. DARPA's role in the Department of Defense's Science and Technology Program is to explore the "leading edge" of research and development and advance those technologies with potentially the highest pay-off. DARPA, then, becomes our first line of defense against technological surprise by aggressively pursuing developments that have high-risk but important implications to future weapon system development in the Department of Defense. When DARPA sponsored developments have demonstrated the viability of a concept, the program is transferred to a Military Service or other operational agency where further advanced developmental work is undertaken.

The DARPA management approach is to use a small, highly qualified technical group of program managers in a streamlined organization to review, plan and initiate R&D initiatives. DARPA's unique organizational position in DoD allows its program managers to maintain a broad perspective on national security requirements that is unfettered by traditional roles and missions. As a result, DARPA's technology program provides alternatives to on-going Service system developments and new approaches to meeting military mission requirements. DARPA executes its program largely through contracts with industrial, university and not-for-profit organizations in the private sector. The effectiveness of DARPA's management is enhanced by the assistance of selected Service R&D laboratory personnel. This coupling of DARPA and Service laboratories is carefully designed for improved program planning and execution and to facilitate the later transfer of programs to the appropriate Military Department.

1. Major DARPA Program Thrusts.

The following pages highlight the major DARPA program thrusts which are vital to future DoD mission capabilities. DARPA is continuing its emphasis on quantifying the technological risks of new technologies fully, to assure a coordinated program transfer to the Military Services. A more detailed discussion is provided by Dr. Robert Fossum, DARPA's Director, in a statement which is submitted separately to the Congress.

- Space Defense - As a part of the comprehensive DoD high energy laser program previously described in Section D of this chapter, DARPA is continuing to investigate the space applications of high energy lasers. The vacuum of space offers the potential for full utilization of the unique characteristics of laser radiation - the ability to propagate long distances with minimal spread of the laser beam. This property is degraded within the earth's atmosphere by absorption and turbulence effects which reduce the range over which effective communication can be maintained. In addition, some laser devices are able to achieve significantly higher efficiency in the low pressure space environment than is available at or near atmospheric pressure.

  The DARPA high energy laser program is concentrating on the development of efficient infrared chemical and visible electrical laser technologies. Major feasibility demonstrations are being initiated to establish the practicality of laser systems to achieve the performance levels required for space applications.

- Space Surveillance - DARPA's space-based infrared warning and surveillance program has a twofold objective. It is developing the critical technologies necessary to assure that ICBM/SLBM launch warning capability is maintained against an expanding enemy threat and it is also aimed at increasing the sensitivity of space sensors.

  Our national ability to conduct effective surveillance of missile launches and space objects is an absolutely essential ingredient of our strategic defense posture, both for early warning of hostile action and for assuring compliance with any treaty dealing with limitations on strategic force capabilities. Advanced focal plane development underway in DARPA's High Altitude, Large Optics (HALO) program is concentrating on the technologies needed for an enhanced capability to detect missile launches.

o *Cruise Missile Technologies* - As a result of the President's decision to accelerate the development of cruise missiles, the DARPA program for pursuing advanced cruise missile technology was given increased emphasis and scope. There are four major elements to the program. First, in advanced vehicle designs and launch modes, DARPA is developing a variety of subsystem technologies in airframe materials and configurations. Second, advanced engine concepts are being investigated to improve the fuel consumption of small engines. Third, advanced self-contained, adverse weather-capable, guidance techniques are being pursued to enable new mission options to be developed for application to strategic and theater targets. Finally, a program is being initiated to characterize and assess cruise missile defense technologies.

o *Anti-Submarine Warfare (ASW)* - DARPA's major initiative in undersea surveillance (SEAGUARD) and related ASW programs has reached an important stage of development. Our understanding of the physics of acoustic propagation in the ocean is such that we can predict signals confidently in a number of important submarine detection regimes. The Acoustic Research Center (ARC) is now operating on a routine basis evaluating advanced algorithms for submarine detection and localization. These algorithms have demonstrated impressive localization accuracy improvements under certain open ocean test conditions. Major experiments are planned in FY 1978 to evaluate advanced signal processing techniques using different frequency arrays for improved detection, tracking and localization capabilities. Plans encompass evaluating the entire spectrum of acoustic frequencies suitable for moderate to long range detection.

In certains areas ASW is a young technology which offers great promise for future detection capability. It depends on our understanding of the myriad of submarine-generated disturbances and the background ocean ambient phenomena in which such disturbances would have to be detected. DARPA's approach has been to identify specific phenomena and, through a combined theoretical and experimental program to quantify the means by which the basic mechanisms might be observed by an appropriate sensor and determine the background noise against which the sensor would operate. The Soviets are supporting significant R&D in this area, and our program is aimed at preventing any surprises.

o *Land Combat* - Survivability of armored vehicles on the battlefield hinges on the protection inherent in armor and on their ability to avoid being hit. To reduce the size and weight of future armored vehicles, DARPA initiated development of an automatic cannon which can fire at an impressive rate. A companion multi-purpose high explosive round for the gun is also being designed to be effective against structures, light armored vehicles, personnel, and low performance aircraft. Success of the program last year has allowed DARPA to accelerate the program. In concert with the Army and U.S. Marine Corps, a parallel DARPA effort is underway to quantify the trade-offs among mobility, agility, armor protection, crew size, and fire control in combat vehicles. Two high mobility/agility testbed vehicles are in development for this purpose: a 30-40 ton variable parameter test rig, and a lightweight combat vehicle testbed in the 15-20 ton class. Both mount versions of the DARPA cannon. Initial successes in these programs have prompted the Army to assume leadership and responsibility well ahead of schedule.

o Air Vehicle and Weapons - In concert with the Services, DARPA is addressing a family of new aircraft with accompanying sensors and weapons which will greatly enhance tactical air warfare capabilities. One such aircraft is the X-Wing which combines helicopter performance with high-speed swept wing performance. Design and wind tunnel tests have thus far supported the feasibility of such technology and the development of a proof-of-concept testbed vehicle was initiated in FY 1978. If successful, this aircraft will strongly support the Navy V/STOL and Army strike missions, by coupling mobility and hover efficiency with high speed. The composite material technologies, mandatory for fixed rotor operation of the X-Wing, are also supporting a longer term program to evaluate the feasibility of fixed, swept-forward wings to provide higher performance and more maneuverable aircraft.

  In another major program initiative, Assault Breaker, DARPA is pursuing a non-nuclear response to Warsaw Pact massed armor with radically increased kill effectiveness. A surveillance aircraft testbed with sensors capable of locating armor and accurately guiding area munitions against company size groups of armor, and a standoff launched area-munition capable of penetration into Pact second echelon operations is under development. The sensors included in Assault Breaker are the result of a broader technology development.

- Command, Control and Communications - Today's highly mobile forces operate in an almost continuous information overload environment. Military superiority will depend on advances in computer communications and information processing, and DARPA is developing technology building blocks which can be the ultimate force multiplier of the 1980's and 1990's. These include the technology for engineering and designing the human interface for data and voice communication, and for security control in both the tactical and strategic environment. Recent technology advancement in natural language interfaces for data bases will enable individuals to use computers in a way that does not require detailed familiarity with computer languages and procedures. Packet radio technology will provide mobile, rapidly deployable, highly survivable tactical communications. Packet satellite technology will substantially lower the cost and increase the flexibility of strategic communications. Packet speech technology will allow integration of the data and voice communication systems.

  The strategy for evaluating C3 architectural options and for speeding up the process of transferring technology from the research community to the operational community is to develop composite testbeds where system issues can be resolved in a "try-before-buy" mode and where operational users can evaluate the new capabilities in a realistic environment. In the Advanced Command and Control Architectural-Testbed DARPA is working with the Navy to develop a geographically distributed secure system to demonstrate a command and control technology base useful to all the Services.

- Nuclear Detection Research - In 1960, DARPA was designated the lead agency for the U.S. in conducting research to improve nuclear test ban monitoring capability. Substantial progress has been achieved and the continuing DARPA program has been a primary source of technical information for the Nation's policy makers in conducting negotiations on nuclear test limitations. Current political initiatives toward a complete ban on nuclear testing have focussed attention on a number of deficiencies in test detection, identification and yield verification capability which do not appear capable of solution in the near term. Two of the more critical problems are the wide uncertainty in current seismic yield estimates and the limited ability to discriminate between earthquakes and underground explosions in the low kiloton energy range. Therefore, under Defense Research Sciences, an enhanced nuclear test detection and evaluation research program will be undertaken in FY 1979 to reduce the uncertainty in the determination of yields of foreign underground explosions, and to improve the detection and identification of underground explosions at all distances appropriate to future comprehensive test ban treaty monitoring stations. This research thrust will support (a) counter-evasion studies; (b) development of advanced detection methods, sensors, and systems; and (c) fundamental experimental and theoretical studies of the generation, propagation and measurement of seismic waves pertinent to identification of earthquakes and underground nuclear explosions.

- Lower Defense Costs - DARPA is pursuing many technologies that could have a dramatic impact on future weapon system costs. An example is the software technology program where DARPA has a leadership role in the DoD-wide effort to develop the basic tools and techniques to allow better management and control of computer software requirements.

  The aim is to create an institutional environment through the National Software Works program to allow DoD to rapidly, but systematically, exploit i vations of the computer industry. Another example is the development of ceramic turbine engines which offer the potential of a revolutionary breakthrough in achieving higher (1370°C) operating temperatures, hence, greater performance, smaller size, lower fuels consumption, and cleaner operation. This automotive ceramic turbine program is being conducted jointly with the Department of Energy and a highly significant test milestone was achieved during the year. An engine with a full ceramic core and rotor achieved full-bore operation under the DARPA duty cycle, developing 65 hp across a single rotor stage. A third example is the application of revolutionary approaches and new technology to reduce the high cost of computer based training concepts and materials processing. In the latter, focus is on non-destructive methods for quantitatively measuring flaw size, type, and distribution; wear control; and integrated circuit design and fabrication. For example, accelerated wear tests on aircraft splines conducted jointly with the Navy to demonstrate a new wear theory developed by DARPA have revealed dramatic life extensions, which will have a major impact on reducing aircraft maintenance costs and down time. In another development, ceramic coated cutting tools have proven to be more versatile and a much lower-cost approach for many high speed machining applications than tools made of synthetic diamond and cubic boron nitride (Borozon).

o <u>Laying the Groundwork for Future Technological Revolutions</u>
While DARPA has prioritized its R&D program into nine major thrusts that could have major impact on national security in the 1980's, it continues to be a spawning ground for innovative ideas. For example, DARPA is exploring powder metallurgy for developing new classes of nearly homogeneous materials. By means of this technology a significant improvement in temperature capability has been achieved, which has broken the eighteen-year pause in significantly improving superalloys temperature capabilities. Another example is research on a new electronic warfare technique which will have the potential of countering current radar and missile threats. If successful, the proposed system will represent a significant advance over currently deployed or developmental ECM Systems. The final example is the investigation of new advanced digital structures for image processing. During the past year a capability for constructing synthetic photographs from maps has been demonstrated. This could eventually make it possible to use maps for automatic navigation, eliminating the need to obtain and carry detailed photographs of the area to be traversed.

2. EXPLOITING OPTIONS

DARPA has a key technical role in pursuing high-risk, high-pay-off R&D that may be critical to national security. How this role is actually carried out has an important impact on the amount of time it will take to translate an exploratory development to a Service operational system. Consequently, we are increasing the emphasis in DARPA's program upon technology demonstration to reduce the risks and time lag inherent in application of new technology. This can be seen in the Table below in the form of a funding increase proposed for the program of Experimental Evaluation for Major Innovative Technologies. The resources necessary to realistically quantify the payoff for major efforts in this program, with brassboard or testbed experiments, are large -- as indicated by the

$73.6 million proposed for this part of the DARPA budget in FY 1979. Even so, the objectives of this part of the DARPA effort stop short of the detailed product engineering necessarily associated with advanced Service development work. Instead, it is aimed at establishing realistic appraisals of value and technical risks to allow an orderly program transfer to a Service for completion of product development.

As the following table indicates, a $337.0 million FY 1979 budget is requested for DARPA to take advantage of the opportunities inherent in their well managed program. This budget represents an 11% "real growth" over FY 1978, assuming inflation at 6%. This budget will permit the timely exploitation of technologies that, when successful, will make a major difference to national defense, and it provides for DARPA's portion of the overall growth in Defense Research Sciences that we are supporting.

DARPA PROGRAM	FY 1978	FY 1979
Defense Research Sciences	42.0	49.1
Experimental Evaluation of Major Innovative Technologies	39.9	73.6
All Other Program Elements	204.7	214.3
TOTAL PROGRAM	286.6	337.0

F. CONCLUSIONS

Our Science and Technology Program has provided the foundation for our technologically superior weapons and through its spin-offs has also benefited the commercial sector of our nation. Our laboratory work is performed by some of the nation's best scientists and engineers. The program is closely coordinated with the intelligence community, DoD development organizations and operational commands. It is also coupled with and complementary to the science and technology programs in the Departments of Energy and Transportation and at NASA. It relates well to similar program pursued by our Allies.

The Science and Technology Program is the principal means by which we utilize the creativity in research and engineering of the U.S. academic community, of our industrial base and of our DoD laboratories. This program is the mechanism through which our directed research activities are applied to military ends and are demonstrated for proven technological effectiveness.

We intend to strengthen the Science and Technology Program through increased funding and through already accomplished managerial changes linking its management with that of manufacturing technology and of technology export.

The United States enjoys world leadership in Science and Technology, but we must not become complacent about our lead. As highlighted throughout this Statement, the Soviets are heavily committed to a steadily expanding technology program supporting their military systems. Soviet accomplishments in manned space flight, high technology aircraft and land vehicles, guns and surface-to-air missiles are impressive. The Soviets are graduating engineerings at a faster rate than we, and their comparative investment in military science and technology work has been larger than ours for several years. If they can develop significantly improved manufacturing and process know-how, they will have a powerful combination.

Your continuing support of our Science and Technology Program is needed. Our future national security depends upon it.

IX. TEST AND EVALUATION

A. INTRODUCTION

The DoD test and evaluation program provides assurance that the systems which we develop and deploy will have the operational capabilities required to meet essential mission needs. We provide this assurance through early development testing to identify system deficiencies and provide the feedback necessary to allow system designers to correct them. Further, we conduct combined development and operational testing to provide decision makers with the information they need on the progress and predicted performance and operational effectiveness of systems. Finally, we conduct operational testing to define the operational effectiveness of new or existing weapon systems so that our need for these systems and their contributions to our military capabilities can be estimated.

As part of an overall reorganization of the Office of the Secretary, certain organizational changes have been made to improve the effectiveness of test and evaluation. The former Deputy Director (Test and Evaluation) is now the Director, Defense Test and Evaluation (DDTE) with overall responsibility for all test and evaluation matters. I have delegated principal staff responsibility for operational testing to the Assistant Secretary of Defense (Program Analysis and Evaluation). This change provides an independent analytical approach and is designed to place even more emphasis on operational testing.

B. TEST AND EVALUATION IN WEAPON SYSTEMS ACQUISITION

There are two principal kinds of test and evaluation conducted in the weapon system acquisition process: Development Test and Evaluation (DT&E) and Operational Test and Evaluation (OT&E). DT&E is that testing conducted by, or under the supervision of, the development agency to evaluate the technical performance of prototype equipment. It is generally conducted by skilled technicians under controlled conditions. OT&E is that testing conducted or supervised by military personnel to determine the degree to which new equipment fulfills operational requirements. It is conducted under conditions which duplicate as closely as possible the environment expected in field operations. OT&E is conducted on early production models as well as research and development prototypes of new equipment.

For major system acquisition programs, test and evaluation impacts on the acquisition process primarily through the operation of the Defense Systems Acquisition Review Council (DSARC). Much of the information required by the DSARC in its reviews is derived from the test and evaluation conducted on these systems. For this reason, test and evaluation for major programs will normally be keyed to DSARC decision milestones. This is accomplished by establishing performance objectives to be demonstrated by the system at each major milestone. An independent assessment of whether a system is meeting its performance objective as determined by appropriate test and evaluation is provided to the DSARC for its consideration in deciding whether a system acquisition program should be advanced to its next phase. A system which is not meeting its established performance objectives will receive close scrutiny by the DSARC in formulating its recommendations to the Secretary of Defense.

Table IX-1 provides an indication of the test and evaluation to be conducted on major acquisition programs in FY 1979. As shown, 61 major programs will, in FY 1979, undergo some test and evaluation subsequent to Milestone I (initiation of demonstration and validation). Of these, 7 will undergo testing to support a Milestone II Full-scale Development decision, while 32 will undergo testing to support a Milestone III Full Production decision. The remaining 22 programs will undergo post-Milestone III testing to support tactical deployment and utilization.

C. AREAS OF CURRENT EMPHASIS IN THE DOD TEST AND EVALUATION PROGRAM

An area of continued emphasis in our test and evaluation (T&E) program is the reduction of vulnerabilities of our weapon systems. The Special Electromagnetic Interference (SEMI) Test Program, the Data Link Vulnerability Joint Test, and the E-O Guided Weapon Countermeasures Joint Test are examples of T&E projects that have been established to investigate vulnerabilities of particular classes of weapon systems. We currently require all major weapon systems which are, as a class, susceptible to certain stimuli to undergo testing by these projects. Weapon vulnerabilities discovered through these tests are reported to the appropriate developing agencies for correction. In addition, as we learn more about the causes of these vulnerabilities we modify our military specifications and handbooks to insure that susceptible designs discovered under these projects are not repeated in future systems.

TABLE IX-1

MAJOR DEFENSE PROGRAMS
FY 1979 Test Status

Testing in Preparation for a Milestone II Decision	Testing in Preparation for a Milestone III Decision		Post Milestone III Testing
M-X	Adv. Signal Processor	Tactical Ops. Sys.	Advanced Tanker Cargo Aircraft
ASALM	E-3A Enhancements	Wide Aperture Sonar	A-10
AV-8B	GBU-15	GSRS	AIM-9L SIDEWINDER
PLSS	SURTASS	5" & 8" Guided Projectiles	B-1 (R&D only)
SINCGARS	TACTASS	Space Shuttle/IUS	BQQ-5 Sub Sonar
NAVSTAR	XM1 Tank	AN/TTC-39	CAPTOR
AFSATCOM	BUSHMASTER	TOMAHAWK	CGN-38
	COPPERHEAD	(A) TLAM	Close-in Weapon System
	C-5 Wing Mod	(B) TASM	F-16
	CGN-42	(C) GLCM	FFG
	SEAFARER (ELF)	CH-53E	FLSATCOM
	AABNCP	C-142 Stretch	HARPOON
	AAH	SOTAS	SSN-688
	ALCM		STINGER
	CH-47D		TRIDENT System
	DSCS III		SOSUS Improvement
	F-18		BLACKHAWK
	HARM		AEGIS/CSED
	HELLFIRE		MCLWG
	LAMPS		DDG-47
	PATRIOT		U. S. ROLAND
	Phase II SVS		ASMD-EW

We continue to emphasize reliability improvement in weapon systems. To insure adequate reliability in our fielded systems, we first define optimal operational reliability goals based on system availability and life cycle cost considerations. We then specify interim reliability levels that must be achieved by a system and its components at various stages of their development. Through appropriate test and evaluation we then determine whether the system is making adequate progress toward its eventual operational reliability goal. These reliability progress assessments are considered during DSARC reviews to determine whether the system should proceed to its next phase in the acquisition process.

Our test and evaluation program is also emphasizing the need to achieve greater commonality and standardization of weapon systems both among our own military Services and between ourselves and our European allies. Examples of systems that are currently being tested for Joint Service use include HARM, STINGER, TRITAC, and JTIDS. In addition, we have been holding discussions with the United Kingdom on harmonization of test procedures. These and other planned initiatives could eventually lead to an agreement on mutal acceptance of test data for systems being considered for joint procurement among the NATO countries.

Finally, we are emphasizing the need to conduct operational testing in conjunction with development testing earlier in the weapon system development cycle. These earlier combined tests can provide useful feedback to system designers and can assist in early development of tactical doctrine and employment concepts. Early operational testing can also reduce program costs by identifying problems at a point in the development cycle when they can be corrected at relatively small expense.

D. THE DOD JOINT TEST AND EVALUATION PROGRAM

To evaluate the effectiveness of a weapon system in its intended operational environment frequently requires the use of forces and systems from two or more Services. Joint Test and Evaluation (JT&Es)--tests wherein the assets of one or more of the Services are used with or against the assets of another Service--have provided a useful tool in assessing the effectiveness of our weapon systems in an operational context. In recognition of their usefulness, the Secretary of Defense in 1971 assigned the Office of Test and Evaluation the responsibility for initiating and coordinating appropriate JT&Es. In 1973 a new program was established by the Secretary of Defense for the primary purpose of supporting joint testing and later that same year Congress established a new RDT&E appropriation entitled · rector of Test and Evaluation, Defense" to ·ovide funding for joint testing. For fiscal year 1977. $30.0 million was approved and in FY 1978 $25.0 million was provided by the Congress. In FY 1979 a total of $27.6 million is requested.

The first joint test, the Electro-Optical MAVERICK Joint Test, was initiated in FY 1972. Since then 21 JT&Es have been started, usually for the express purpose of either: (1) Evaluating individual weapon system effectiveness in two-sided simulated battle situations, or (2) evaluating weapon system interoperability and compatibility with other combat equipment. With two new starts planned, there will be eight ongoing JT&Es in FY 1979.

Of the funds requested for FY 1979, most will be expended on the following six ongoing tests:

- o Aircraft survivability in Anti-Armor Operations Joint Test will evaluate the ability of fixed-wing aircraft and helicopters to destroy armor and survive in a European-type conflict. Various aircraft, ordnance and tactics will be evaluated to aid in future development and procurement decisions and effectiveness analyses.

- o Data Link Vulnerability Joint Test will provide an assessment of the electronic countermeasures hardening required for current and future weapon systems and command and control data links to operate successfully in a combat situation.

- o Electro-Optical Guided Weapons Countermeasures Joint Test has been determining the operational effectiveness of our Electro-Optical Guided Weapons (UV, IR, TV and Laser) in a countermeasures environment since it was initiated in FY 1976.

- o The Electronic Warfare (EW) During Close Air Support Joint Test will evaluate the susceptibility of our ground and air operations to disruption by enemy EW and the ability of our EW to protect our aircraft from the radar directed weapons of enemy air defenses. Initial testing will be concerned primarily with the susceptibility of our communications to enemy jamming.

- o Identification of Friend, Foe or Neutral Joint Test will use simulators and field testing to determine the capability of our command and control systems and equipments to perform the IFFN functions in an accurate and timely fashion during the employment of our various air-to-air and ground-to-air weapon systems.

- o Laser Guided Weapons in Close Air Support Joint Test determined from preliminary tests conducted during FY 1976 the level of density of Laser Guided Weapons that could be employed effectively in close air support and identified the command and control problem which might limit their number or effectiveness due to interference. The main test will examine the interaction between the Services' laser designators, targets, launch vehicles and command and control employed in a realistic close air support environment.

From the results to date the JT&Es covered by this appropriation will continue to provide us with essential information available from no other source. A listing of the funding for each joint test, ongoing or currently planned, is provided in Table IX-2.

E. THREAT SIMULATION TEST AND EVALUATION

The development of realistic aerial targets to simulate a variety of air threats is essential to the success of many of our test and evaluation programs. Since these targets must accurately reflect the performance characteristics of the sophisticated aircraft and missiles they are simulating, the development of targets poses many of the same problems as development of weapon systems.

We believe we are making significant progress in the development of realistic aerial targets. For example, we have completed prototype development of the High Altitude Supersonic Target (HAST) which simulates the high altitude, high performance aircraft threat. A target with these capabilities required by all three Services. In addition, we are beginning development of the FIREBRAND aerial target to simulate the antiship missile threat. We are also developing Vector Miss Distance Indicators (VMDIs) to improve our ability to assess the results of missile firings against aerial targets. Funds requested for the development and engineering of aerial target systems shown in Table IX-3, along with other categories of test support programs.

To simulate the electromagnetic threat to our weapon systems, we are well underway in the procurement of a number of simulators which

TABLE IX-2
Joint Tests Under
Director of Test and Evaluation, Defense Appropriation
(TITLE V RDT&E)

(thousands of dollars)

Joint Test Activities	FY 1977 Program	FY 1978 Program	FY 1979 Program
JT&Es Initiated in FY 1977 & Prior Years			
Aircraft Survivability in Anti-Armor Operations	$ 3,325	$ 7,000	$ 1,000
Data Link Vulnerability	865	3,135	4,000
Electro-Optical Guided Weapons Countermeasures	3,200	3,850	3,500
Electronic Warfare During Close Air Support	11,552	5,640	7,000
Imaging Infrared MAVERICK	1,815	-	-
Laser Guided Weapons in Close Air Support	-	2,300	1,000
Logistics Over-the-Shore	3,715	600	-
Multiple Air-to-Air Combat	2,131	628	-
Short Range Air-to-Air Missile	747	-	-
JT&E Initiated in FY 1978			
Identification of Friend, Foe or Neutral	-	1,000	3,000
JT&Es to be Initiated in FY 1979			
Lightweight Advanced Armored Combat Vehicle (AARMVAL)	-	-	6,000
Tube-launched Guided Projectile	-	-	1,000
Other Activities			
Feasibility Determination	351	109	300
T&E Independent Activities	-	263*	300
Joint Instrumentation	2,021	**	-
T&E Facility, Instrumentation, and Procedure Studies	278	475	500
Total RDT&E Funds	$30,000	$25,000	$27,600

* T&E Independent Activities of selected Service-sponsored joint tests have been included as a line item for FY 1978.

** Instrumentation funding requirements for the post-FY 1977 time period have been included in individual joint tests.

will accurately represent the threat emitters that would be encountered in the operational environment. These simulators will be initially utilized in the Electronic Warfare During Close Air Support Joint Test which was discussed in the previous section.

Examples of the extensive use being made of simulation techniques during test and evaluation are the Navy's land-based test sites. These sites provide a shore-based simulation of a ship environment. They provide an efficient and relatively inexpensive means of testing shipboard systems under simulated operational conditions. Two of the Navy's land-based test sites are the nearly complete Combat Systems Engineering Development Site (CSEDS) for the AEGIS program and the existing System Test Site for the FFG-7 class Frigate which has been in use for several years.

F. MAJOR RANGE AND TEST FACILITY BASE (MRTFB)

The Major Range and Tes. Facility Base (MRTFB) is composed of 26 DoD major ranges and test facilities and related support activities which provide essentially all of the test support to the defense systems acquisition process. The military departments are responsible for the management and operation of the MRTFB, including the effective use of assigned land, sea, airspace, electromagnetic spectrum and test instrumentation. The Director of Defense Test and Evaluation exercises OSD responsibility to insure the adequacy of the MRTFB to meet present and future requirements, to avoid unnecessary duplication and to dispose of obsolete assets. The FY 1979 request for the 19 MRTFB facilities supported by RDT&E funds is shown in Table IX-3.

TABLE IX-3

Test Support Programs Under
Director of Defense Test and Evaluation Cognizance
(RDT&E)

(millions of dollars)

	FY 1977 Program	FY 1978 Program	FY 1979 Request
Major Range & Test Facility Base	$ 718.7	$ 718.2	$ 750.3
Army Test Ranges	(235.4)	(242.1)	(253.6)
Navy Test Ranges	(165.8)	(167.8)	(203.5)
Air Force Test Ranges	(317.5)	(308.3)	(293.2)
Aerial Targets	28.2	21.7	50.6
Electromagnetic Vulnerability Testing	30.4	27.8	36.3
Aircraft Survivability Testing	4.7	5.0	6.0
Other Test Support	101.7	115.2	138.3
Total Test Support	$ 883.7	$ 887.9	$ 981.5
Joint Tests (from Table IX-2)	30.0	25.0	27.6
Total	$ 913.0	$ 912.9	$1009.1

During FY 1979 the trend toward significant personnel reductions and increased emphasis on range instrumentation improvement and modernization (I&M) has continued. Although the total civilian and military personnel have been reduced from approximately 40,800 to 31,800 since 1975 (a reduction of 22 percent), we continue to support additional and more sophisticated testing because of a well-planned I&M program which improves efficiency and responsiveness. Funds for I&M will increase at a modest rate in the future and personnel levels will slowly decrease. Instrumentation systems which will contribute to the overall improvement of efficiency and effectiveness include an Air Combat Maneuvering Instrumentation System at the USAF Tactical Fighter Weapons Center at Nellis AFB, a highly accurate time-space-position-information system on the Hill/Wendover/Dugway ranges in Utah, a multi-sensor laser tracking network at Yuma Proving Ground, and the extension of the Barking Sands Tactical Underwater Range in the Hawaiian Islands. Significant advances are being made in the use of real-time data processing throughout the MRTFB. Low cost mini- and micro-computers are making real-time [illegible]tems affordable at most of our activities, thus providing quick[illegible] urnaround, more data points per test, and an ability to obs[illegible] ystem interactions not otherwise possible.

Ex[illegible]es of ongoing improvement projects at our test facilities for which FY 1979 funds are requested include the Navy's Mobile Sea Range (MSR), a transportable shipboard system divorced from land-based elements which will provide tracking information, communications and related functions for large scale "at sea" tests and exercises; a DoD High Energy Laser Systems Test Facility (HELSTF) at White Sands Missile Range for testing laser weapons against stationary and mobile land targets and airborne targets; the Aeropropulsion Systems Test Facility (ASTF), a $437 million military construction project at the Air Force Arnold Engineering Development Center, Tullahoma, Tennessee, to permit testing of large full-scale systems under conditions simulating anticipated critical aerodynamic parameters; and a Telemetry Integrated Processing System (TIPS) at Vandenberg AFB, California, which provides an enhanced and more efficient capability to process data in real time for the entire spectrum of missile operations.

Finally, there are a number of ongoing and recently completed studies within the MRTFB to evaluate specific proposals for economy and efficiency. One study has resulted in the decision to close the National Parachute Test Range at El Centro, California, and move its mission to the Naval Weapons Center at China Lake, California. This will result in an annual savings of $3 million. Another effort will result in the consolidation, under Air Force management, of the airspace associated with the Hill/Wendover/Dugway ranges in Utah.

G. COSTS FOR TEST AND EVALUATION

In FY 1979, we will monitor a total of 84 major weapon systems. These systems will require about $3,683 million for their development, engineering, and testing. The test and evaluation portion of these

RDT&E costs covers the building of advance development models, technical development tests by the developer, test items for initial Operational Test and Evaluation (IOT&E), and other costs related to performing thest tests. These T&E costs represent a significant part of the RDT&E cost estimate for these programs and have averaged about 15 percent of these program funds in the past five years.

In addition to the direct costs to the programs for test and evaluation, an estimated $1,009 million of RDT&E funds are devoted to institutional funding of the MRTFB facilities, aerial targets, joint tests, and related test support programs (Table IX-3). From this amount, 19 of the 26 MRTFB facilities will be RDT&E funded at a total level of $750.3 million, which supports operations, maintenance, improvement and modernization activities. Taking inflation into account, this represents a 2% decrease in real effort compared to FY 1978. The remaining seven MRTFB facilities are supported by O&M and Procurement funds, which will total about $316 million in FY 1979.

H. SUMMARY

The DoD test and evaluation program is an important contributor to improving the performance and reliability of our weapon systems and reducing their vulnerabilities. Greater economy and efficiency is being achieved in test and evaluation through better test planning, greater use of simulation techniques, and consolidation of test facilities.

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RDT&E PROGRAM BY CATEGORY

($ Millions)

CATEGORY	FY 1977	FY 1978	FY 1979	FY 1980
Research	373.0	412.4	468.3	545.3
Exploratory Dev	1,305.0	1,384.5	1,531.7	1,646.7
Advanced Dev	1,859.9	2,197.8	3,008.0	3,646.0
Engineering Dev	4,079.1	4,389.9	3,933.4	4,299.6
Mgt & Support	1,366.8	1,345.1	1,450.8	1,699.6
Oper Sys Dev	1,604.3	1,682.9	2,075.8	2,361.5
TOTAL RDT&E	10,588.1	11,412.6	12,468.0	14,198.7

RDT&E BY TYPE OF PERFORMER

($ Millions)

PERFORMER	FY 1977	FY 1978	FY 1979	FY 1980
Industry	6,967.0	7,749.5	8,777.5	10,460.2
Government In-House	3,102.3	3,126.8	3,129.4	3,138.0
Federal Contract Research Centers (FCRC)	190.6	205.4	212.0	237.4
Universities	328.2	330.9	349.1	363.1
TOTAL RDT&E	10,588.1	11,412.6	12,468.0	14,198.7

RDT&E PROGRAM BY BUDGET ACTIVITY

($ Millions)

BUDGET ACTIVITY	FY 1977	FY 1978	FY 1979	FY 1980
Technology Base	1,677.9	1,797.0	1,999.9	2,192.0
Advanced Tech Dev	528.0	486.8	593.1	782.7
Strategic Programs	2,327.9	2,536.4	2,177.9	2,393.0 1/
Tactical Programs	3,872.3	4,382.5	5,051.2	5,496.7 1/
Intel & Comms	794.8	828.2	1,095.2	1,539.3 1/
Programwide Mgt and Support	1,387.2	1,381.7	1,550.7	1,795.0
TOTAL RDT&E	10,588.1	11,412.6	12,468.0	14,198.7

RDT&E PROGRAM BY COMPONENT

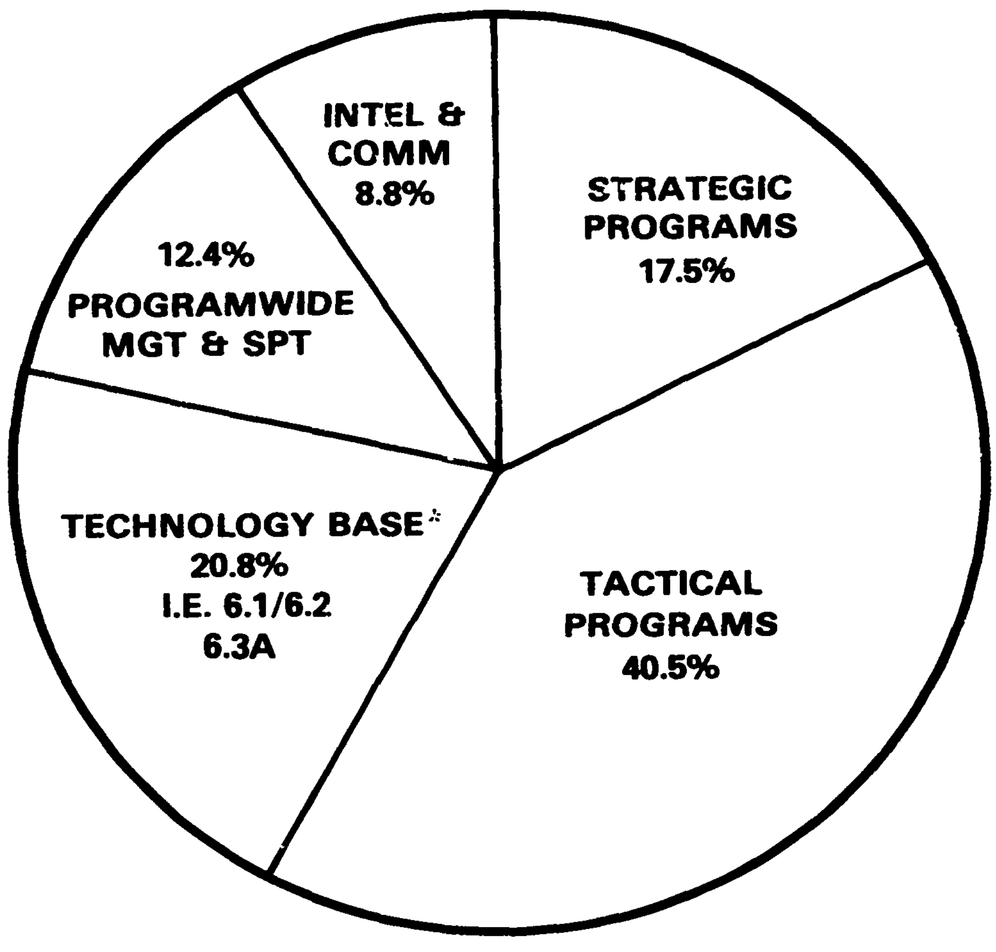
($ Millions)

DEPARTMENT	FY 1977	FY 1978	FY 1979	FY 1980
Army	2,290.7	2,418.3	2,721.4	2,958.0
Navy	3,800.1	4,021.8	4,490.5	4,762.4
Air Force	3,816.0	4,193.2	4,339.1	5,293.4
Defense Agcys/DT&E	681.3	779.3	917.0	1,184.9
TOTAL RDT&E	10,588.1	11,412.6	12,468.0	14,198.7

1/ Although the discussion of C3I related activities has been consolidated in the text, funding of these activities is distributed across the areas footnoted.

RDT&E FY 79 BUDGET

BY BUDGET ACTIVITY



	(MILLIONS)
TECHNOLOGY BASE	2,593.0
STRATEGIC PROGRAMS	2,177.9 1/
TACTICAL PROGRAMS	5,051.2 1/
INTELL & COMM	1,095.2 1/
PROGRAMWIDE MGMT & SUPPORT	1,550.7
TOTAL	12,468.0

* INCLUDES ADV TECH DEV

1/ Although the discussion of C3I related activities has been consolidated in the text, funding of these activities is distributed across the areas footnoted.

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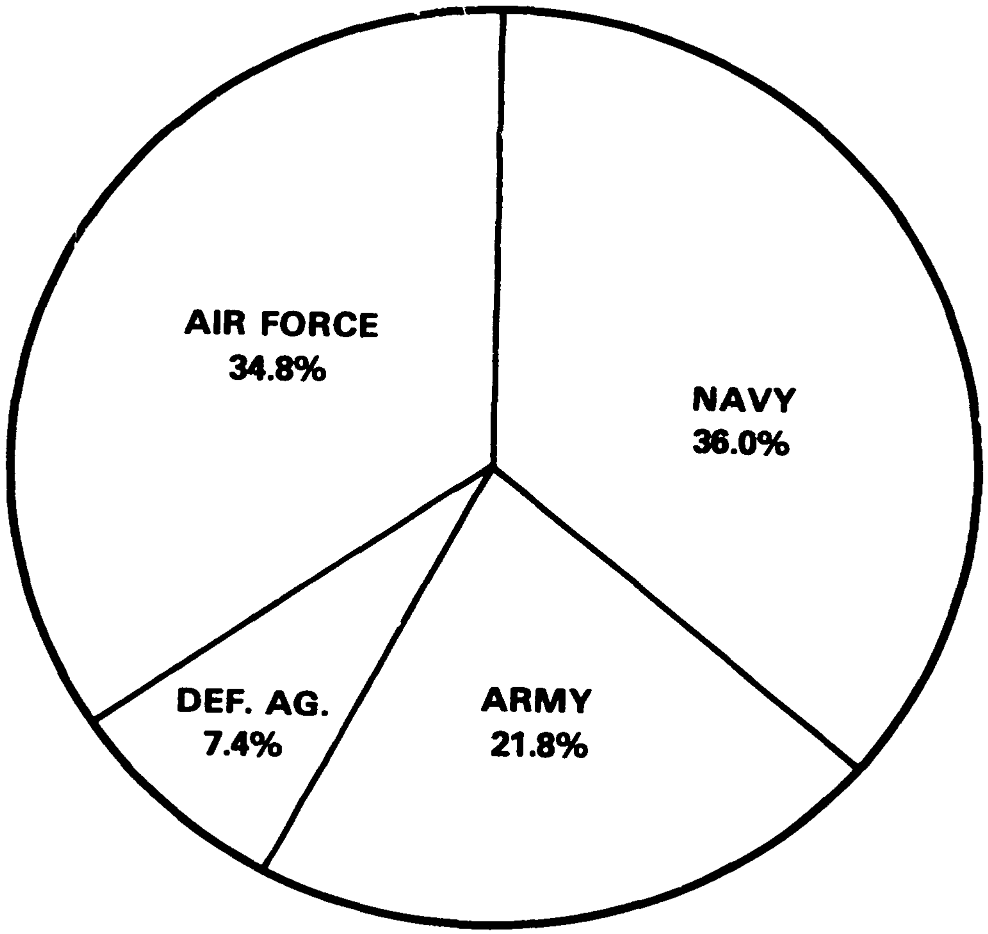
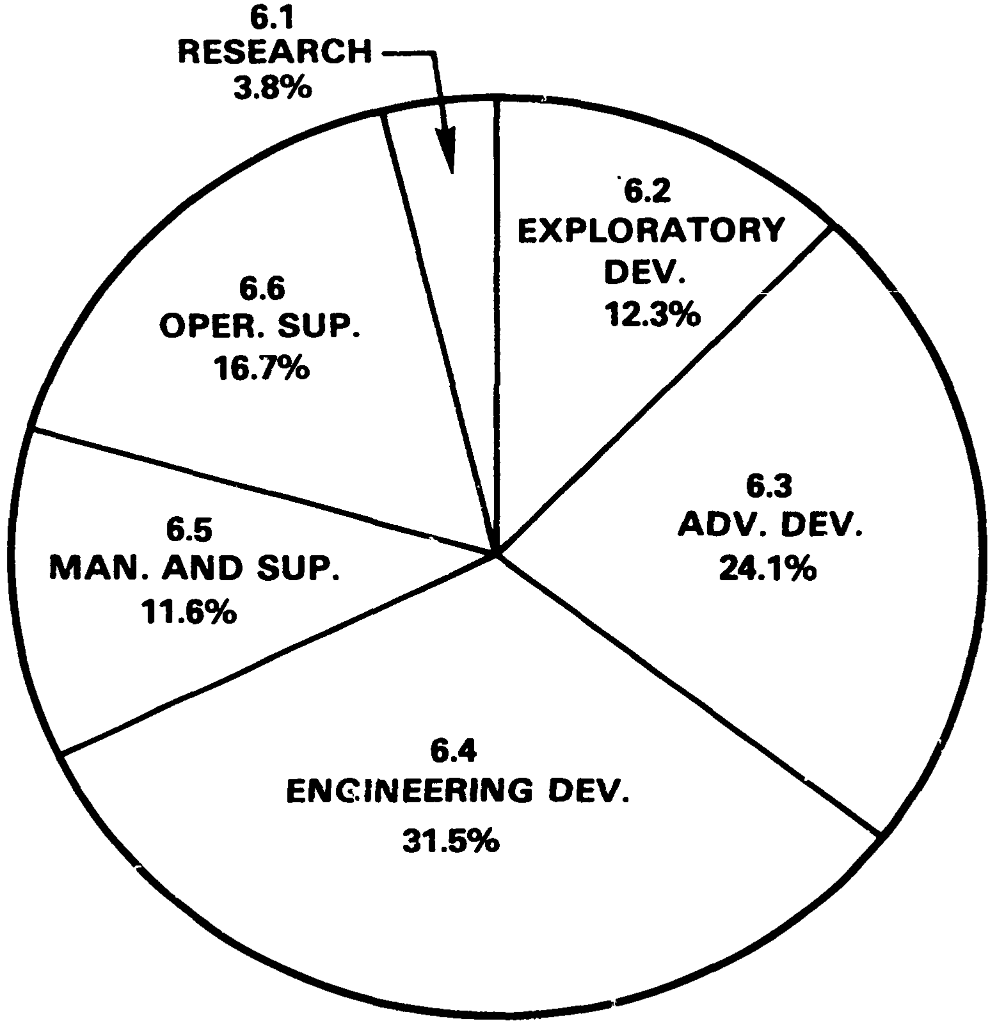
RDT&E FY 79 BUDGET
BY COMPONENT



	(MILLIONS)
ARMY	2,721.4
NAVY	4,490.5
AIR FORCE	4,339.1
DEFENSE AGENCIES	917.0
TOTAL	12,468.0

882-8



RDT&E FY 79 BUDGET

BY TYPE OF WORK

	(MILLIONS)
RESEARCH	468.3
EXPLORATORY DEV.	1,531.7
ADVANCED DEV.	3,008.0
ENGINEERING DEV.	3,933.4
MANAGEMENT AND SUPPORT	1,450.8
OPERATIONAL SYS. DEV.	2,075.8
TOTAL	12,468.0

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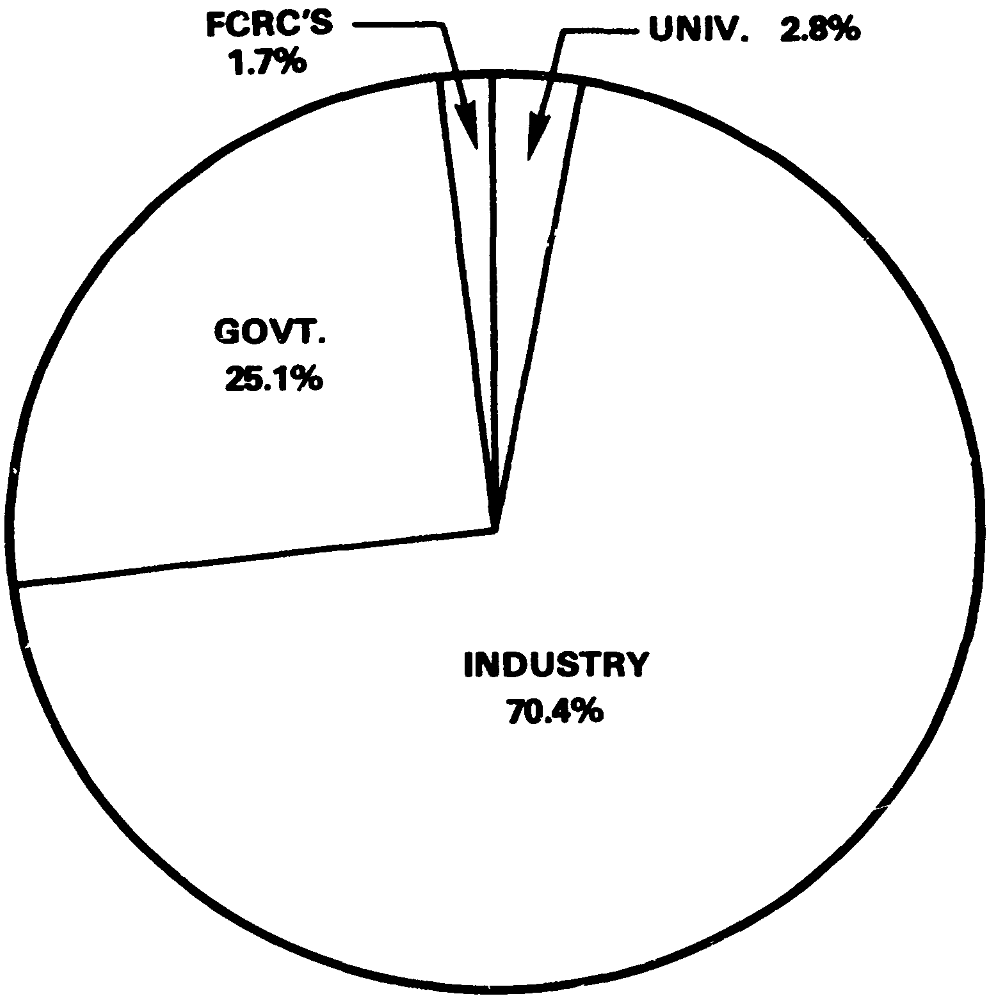

RDT&E FY 79 BUDGET
BY PERFORMER

	(MILLIONS)
INDUSTRY	8,777.5
GOVT. IN-HOUSE	3,129.4
FEDERAL CONTRACT RESEARCH CENTERS (FCRC'S)	212.0
UNIVERSITIES	349.1
TOTAL	12,4[illegible].0

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DOD PROCUREMENT BY COMPONENT

($ Millions)

	FY 1977	FY 1978	FY 1979	FY 1980
Army	4,430.7	5,300.8	6,636.9	3,819.4
Navy	13,154.7	14,285.3	13,919.2	14,514.8
Air Force	9,684.9	10,407.0	11,090.6	11,171.6
Defense Agencies	244.7	327.9	280.9	
TOTAL	27,515.0	30,321.0*	31,927.6	29,505.8

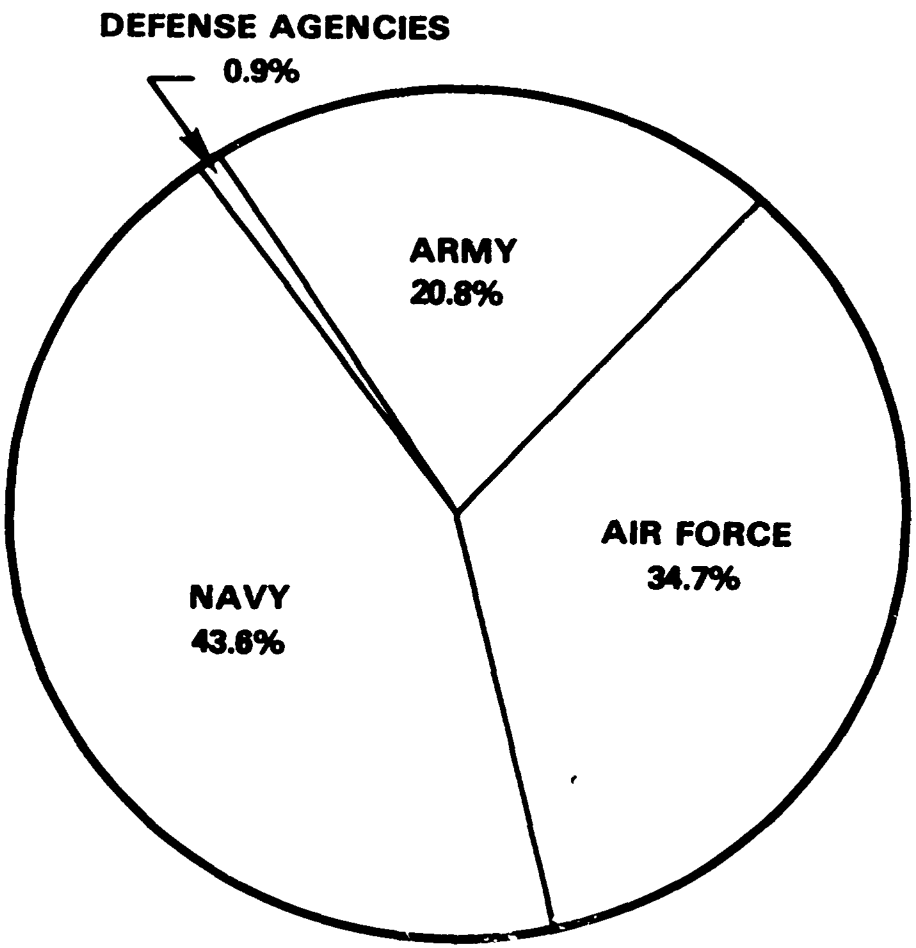
* Includes pending FY 1978 Supplemental Appropriations of $229.6 Million

PROCUREMENT PROGRAM BY AUTHORIZATION

($ Millions)

	FY 1977	FY 1978	FY 1979	FY 1980
Aircraft				
Aircraft Procurement, Army	543.5	659.7	1,017.8	1,127.4
Aircraft Procurement, Navy	2,931.5	3,552.9	4,078.8	4,195.5
Aircraft Procurement, AF	5,631.7	6,274.5	6,897.7	8,567.1
Sub-Total Aircraft	9,106.8	10,487.1	11,994.3	13,890.0
Missiles				
Missile Procurement, Army	480.9	536.9	773.2	938.7
Weapons Procurement, Navy	1,702.3	1,871.5	1,553.6	2,022.5
Missile Procurement, AF	1,790.5	1,804.3	1,676.8	2,604.5
Procurement, Marine Corps	55.6	97.2	23.1	30.4
Sub-Total Missiles	4,029.3	4,309.9	4,026.7	5,596.1
Naval Vessels				
Shipbldg & Conversion, Navy	5,700.4	5,802.5	4,712.4	7,496.9
Tracked Combat Vehicles				
Procurement of Weapons and Tracked Cmbt Vehicles, Army	1,065.0	1,370.4	1,532.5	1,626.2
Procurement, Marine Corps	36.3	73.1	21.7	6.1
Sub-Total Tracked Combat Veh	1,101.3	1,443.5	1,554.2	1,632.3
Torpedoes & Related Support Equip.				
Weapons Procurement, Navy	226.7	323.7	364.1	575.2
Other Weapons				
Procurement of Weapons & Trk Combat Vehicles, Army	64.6	50.8	104.1	127.1
Weapons Procurement, Navy	73.3	98.1	129.8	174.3
Procurement, Marine Corps	1.8	2.9	28.0	14.0
Other Procurement, AF	.4	-	.3	-
Sub-Total Other Weapons	140.1	151.8	262.2	315.4
TOTAL PROCUREMENT (Subject to Authorization)	20,304.6	22,518.5	22,913.9	
Other Support Equipment (Not Subject to Auth.)	7,210.4	7,802.5	9,013.7	
	27,515.0	30,321.0*	31,927.6	29,505.8

*Includes pending FY 1978 Supplemental Appropriations of $229.6 Million



PROCUREMENT FY 79
BUDGET
BY COMPONENT

	(MILLIONS)
ARMY	6,636.9
NAVY	13,919.2
AIR FORCE	11,080.6
DEFENSE AGENCIES	290.9
TOTAL	31,927.6

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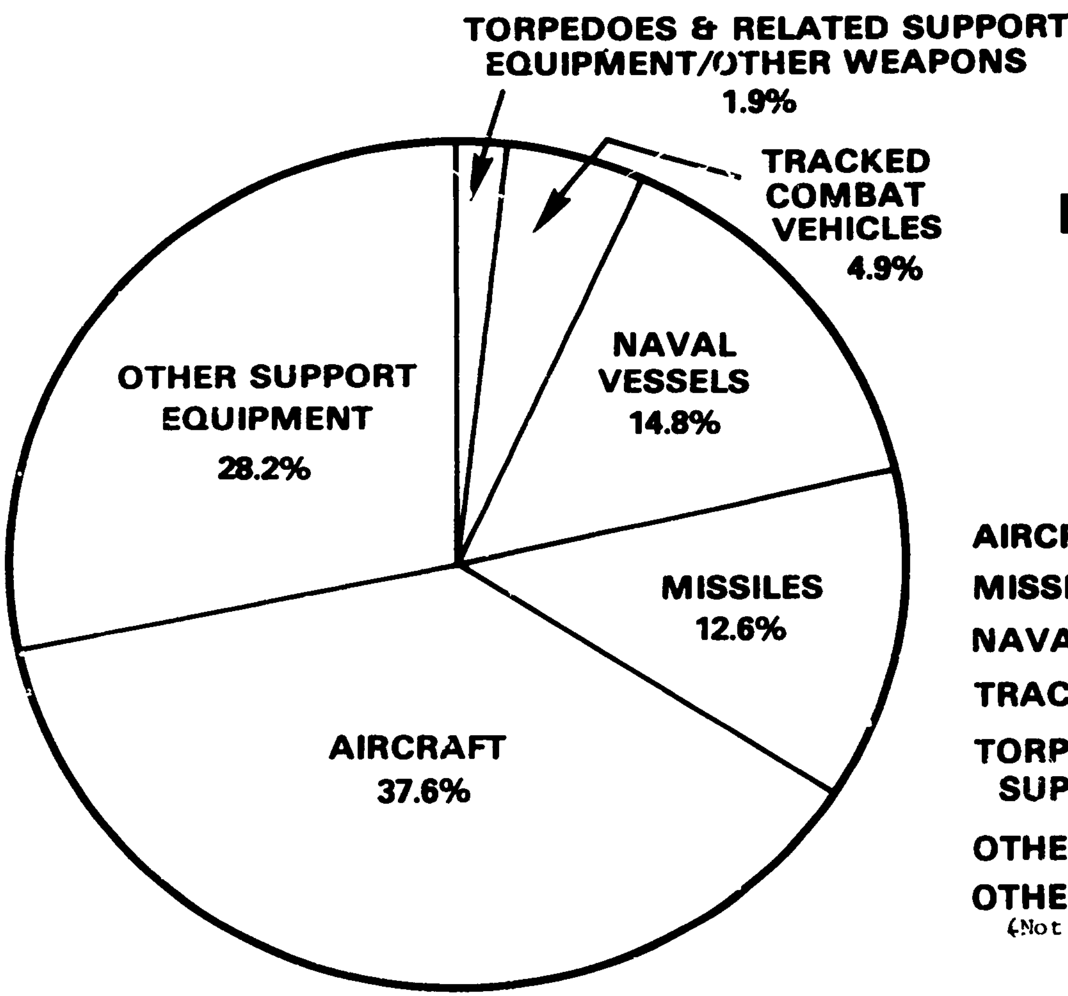

PROCUREMENT FY 79 BUDGET

BY AUTHORIZATION TITLE

	(MILLIONS)
AIRCRAFT	11,994.3
MISSILES	4,026.7
NAVAL VESSELS	4,712.4
TRACKED COMBAT VEHCLES	1,554.2
TORPEDOES & RELATED SUPPORT EQUIPMENT	364.1
OTHER WEAPONS	262.2
OTHER SUPPORT EQUIPMENT (Not Subject to Authorization)	9,013.7
TOTAL	31,927.6

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