DEPARTMENT OF DEFENSE

AGENCY-WIDE FINANCIAL STATEMENTS

REQUIRED SUPPLEMENTARY STEWARDSHIP INFORMATION

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NATIONAL DEFENSE PROPERTY, PLANT AND EQUIPMENT
For Fiscal Year Ending September 30, 1999
(Stated in Number of Systems or Items)

	Beginning Balance 10/1/1998	Additions	Deletions	Balance As of 9/30/1999	Condition Operational (%)
Aircraft					
Combat	8,660	52	351	8,361	79%
Airlift	6,059	23	148	5,934	94%
Other	3,740	67	247	3,560	76%
Sub-total	18,459	142	746	17,855	
Ships					
Submarines	123	1	7	117	68%
Aircraft Carriers	18	0	0	18	67%
Surface Combatants	269	26	13	282	70%
Amphibious Warfare Ships	83	0	7	76	67%
Mine Warfare Ships	38	1	0	39	69%
Support Ships	241	6	33	214	72%
Other Ships	3,921	55	229	3,747	74%
Sub-total	4,693	89	289	4,493	
Combat Vehicles					
Tracked	44,522	328	684	44,166	85%
Wheeled	140,376	1,596	0	141,972	94%
Towed	7,044	0	78	6,966	78%
Other	12,744	829	19	13,554	79%
Sub-total	204,686	2,753	781	206,658	
Guided, Self-propelled Ordnance					
Missiles	453,056	18,094	6,832	464,318	79%
Torpedoes	8,486	216	29	8,673	83%
Space Systems					
Satellites	78	8	1	85	100%
Weapon Systems Support					
Real Property					
Active Ammunition Bunkers	23,468	398	756	23,110	100%
Active Missile Silos	993	1	158	836	100%
Active Satellite Ground Stations	0	81	0	81	100%

Narrative Statement

In order to more clearly present National Defense property, plant and equipment (ND PP&E) information, the Department of Defense (DoD) made several changes to reporting formats, clarified reporting requirements, and incorporated definitional changes during the fiscal year (FY). These changes account for numerous adjustments to FY 1999 beginning balances for ND PP&E. New categories of reporting, such as "Wheeled Vehicles," were added to the FY 1999 reporting requirements. Other categories, such as "Tracked Vehicles" and "Towed Vehicles," were more clearly defined to include many items previously categorized as "Other Combat Vehicles" in FY 1998. Similarly, definitional changes prompted the reclassification of items within these categories, as well as, within the three categories of Aircraft. Other beginning balance adjustments are a direct result of additional reporting by the Special Operations Command.

Also, an adjustment was made within the "Guided, Self-Propelled Ordnance" category, "Missiles." In consideration of the high level of sensitivity within this area, each of the Military Departments intensely manages and tracks these items. Thus, several systems have been developed over time to monitor specific aspects of these items. The information provided by these systems is combined to produce a final inventory count for this report. During FY 1999, it was found that two of these systems, in fact, tracked exactly the same items within the Missile inventory, prompting an intense "scrub" of system information in FY 1999. A similar situation occurred with respect to the Army's Aircraft inventory resulting in a decrease in the Aircraft beginning balances for FY 1999.

Because the information presented in this report is merely a "snapshot" image of a fluid system, categories of ND PP&E items displaying low "Condition Operational Percentages" can be misleading. Much of this information is simply reflective of the number of ND PP&E items that have entered a regular maintenance cycle. Many of these items could be reactivated in case of a National emergency.

Aircraft

The Department of the Army's beginning inventory balance for FY 1999 is 577 less than the ending balance reported by the Army in FY 1998. In FY 1998, information was extracted from several different systems resulting in some duplication in areas such as "Aircraft Model Conversions," "Intransit Distributions," "Aircraft in Refurbishment," and "Modernization Redistribution." In FY 1999, however, the aircraft inventory activity was recorded and reported by one system – the Program Management System. The remaining beginning balance adjustment is due to the addition of 47 Special Operations Command aircraft that were not included in FY 1998 totals.

Of 177 aircraft deleted by the Department of the Army during FY 1999, 73 were attributed to the sale and/or transfer of aircraft as part of Foreign Military Assistance programs.

The remaining deleted aircraft either were destroyed in crashes or otherwise classified as inactive. The Department of the Navy transferred 40 aircraft, deemed inactive, to the Aerospace Maintenance and Regeneration Center (AMARC). Other Department of the Navy deletions were due to crashes and transfers to depots. Finally, the Department of the Air Force reported a decrease of 464 aircraft during FY 1999 that either were sold to foreign governments, destroyed in crashes, or dismantled as part of a reclamation project at the AMARC.

Not included in the quantities reported above are 2,518 aircraft in inactive inventory. These aircraft are stored at the AMARC and are in various stages of dismantle and/or are in long-term storage. Some of the inactive aircraft could be reactivated in case of a national emergency.

Ships

The majority of the reported ships currently are in the possession of the Department of the Navy. However, the Department of the Army reported 211 "Other Ships" that were not included in the number of ships reported in FY 1998. The Special Operations Command also reported 38 "Surface Combatants," 13 "Support Ships," and 10 "Other Ships" in FY 1999, that were not included in the FY 1998 report.

The category, "Other Ships," includes Service Craft, Landing Craft Air Cushion and Small Boats. In the FY 1998 report, 2,431 ships classified as Other Ships were reported as Small Boats. Within the Other Ships category, 210 either were deemed to be inactive or in the process of being dismantled and/or sold for salvage, and 19 were classified by the Department of the Navy as "open allowance."

Combat Vehicles

Additional categories were added to the "Combat Vehicles" section of the report in FY 1999. In addition, definitional changes and clarifications to existing categories during the FY made it difficult to pinpoint item-by-item additions and reclassifications to beginning balance information. However, it is certain that the majority of the net difference from the FY 1998 ending balance to the FY 1999 beginning balance is attributed to the addition of "Wheeled Vehicles" and "Towed Vehicles" to the required reporting information. The Department of the Army reported 108,752 vehicles in the "Wheeled Vehicles" category that were not reported in FY 1998. Similarly, the Department of the Navy reported 31,624 vehicles in "Wheeled Vehicles" and 4,821 vehicles in the "Towed Vehicles" categories that were not reported in FY 1998.

In addition to the vehicles presented in this report, the Department of the Navy reported 91 Combat Vehicles in a disposal cycle and 11,823 in storage. The Combat Vehicle categories with low condition operational percentages include vehicles in the "phase-out" process.

Guided, Self-Propelled Ordnance

Several systems within the DoD are used to track Guided, Self-Propelled Ordnance items for different purposes. During the FY 1998 data collection process, information from two Department of the Army systems, the Commodity Command Standard System and the Worldwide Ammunition Retail System, were included in the final count. Both of these systems track the same items for different internal purposes. During FY 1999, it was determined that the Missile inventory reported in FY 1998 duplicated quantities included in both systems. For FY 1999 reporting, the Military Departments were required to present final physical inventory counts. However, in FY 1999 some systems were still incapable of reporting addition and deletion information. Therefore, the 18,855 additions and 6,071 deletions reported are only a subset of the actual additions and deletions. The Military Departments currently are in the process of implementing system changes that will allow them to report discreet add and delete information in the future.

Space Systems

The Department of the Air Force owns 67 of the Department's 85 reported satellites. Of those 67 satellites, 43 are in operational orbit and 24 satellites are in storage with contractors. The Department of the Air Force also has other classified satellites in operational orbit or storage that cannot be reported. During FY 1999, one satellite, valued at approximately $1.6 billion, was destroyed during an unsuccessful launch. The remaining 18 reported satellites are owned by the Department of the Navy. Not included in the report are research and development satellites.

Weapon System Support Real Property

Weapons System Support Real Property is an additional category not reported in FY 1998 and, therefore, is reported for the first time in FY 1999. The Department of the Air Force reported the 81 satellite ground stations displayed in this report.

Other Information

As of the date these statements were prepared, the Federal Accounting Standards Advisory Board (FASAB) had not determined the final reporting requirements for ND PP&E. Therefore, the DoD elected to report ND PP&E in FY 1999 in a manner similar to how it was reported in FY 1998. For FY 1998, the DoD implemented early, as encouraged by the FASAB, then proposed amendments to the accounting standards that required the reporting of quantities, condition and investment trends for major types of ND PP&E. At subsequent FASAB meetings, the Board chose not to implement the proposed amendments but, rather, to continue studying various alternatives for reporting ND PP&E.

Since the FASAB did not adopt the proposed amendments, the DoD is not in full compliance with the existing reporting requirements that require the Department to report the

value of ND PP&E (utilizing the latest acquisition cost method). The DoD cannot fully comply with the existing reporting requirement, because many of the Department's ND PP&E accountability and logistics systems do not contain a value for the ND PP&E assets. These systems were designed for purposes of maintaining accountability and meeting other logistics requirements, and not for reporting the value of ND PP&E.

Given the complexity of the existing temporary reporting requirements, the enormous cost of implementing those temporary reporting requirements and the interim nature of the temporary reporting requirements, the Department is continuing its FY 1998 reporting displays. The Department believes that the most reasonable and responsible course of action is to report quantity and investment information for the DoD's ND PP&E until such time as the FASAB adopts permanent reporting requirements.

NATIONAL DEFENSE PROPERTY, PLANT, AND EQUIPMENT
YEARLY INVESTMENTS
For FY 1998 and FY 1999
(In Millions of Dollars)

	FY 1998	FY 1999
Aircraft		
Combat	$5,269	$6,901
Airlift	3,727	4,354
Other	1,512	2,662
Aircraft Support Principal End Items	3,340	1,387
Other Aircraft Support PP&E	0	1,418
Ships		
Submarines	$1,089	$1,409
Aircraft Carriers	1,301	823
Surface Combatants	2,932	3,591
Amphibious Warfare Ships	753	581
Mine Warfare Ships	89	73
Support Ships	11	371
Other Ships	575	30
Ship Support Principal End Items	851	852
Other Ship Support PP&E	5	6
Combat Vehicles		
Tracked	$256	$354
Wheeled	270	261
Towed	3	0
Combat Vehicles Support Principal End Items	842	1,199
Other Combat Vehicles Support PP&E	0	1
Guided, Self-propelled Ordnance		
Missiles	$1,464	$1,299
Torpedoes	125	70
Guided, Self-propelled Support Principal End Items	1,318	815
Guided, Self-Propelled Ordnance Support	414	34
Guided, Self-Propelled Ordnance Support PP&E	0	245
Space Systems		
Satellites	$517	$1,438
Space Systems Support Principal End Items	667	558
Other		
Other Weapons Systems	$129	$115
Other Weapons Systems Support Principal End Items	135	37
Other Weapons Systems Support PP&E	0	62
Weapon Systems Support Real Property		
Active Ammunition Bunkers	$28	$19
Active Missile Silos	0	0
Active Satellite Ground Stations	0	0
General Mission Support PP&E	$4,968	$5,274

Narrative Statement

Investment values included in this report reflect DoD Procurement Appropriation outlays (expenditures). Outlays are used because current DoD systems do not capture and summarize acquisition costs in accordance with the accounting standards.

The Weapon Systems Support Real Property category includes ammunition bunkers, missile launch facilities and satellite tracking and ground stations. In the FY 1998 report, satellite ground stations were not reported as ND PP&E, but have been included this year due to a clarification in DoD reporting requirements.

The General Mission Support PP&E category in this report includes ordnance support equipment, electronics equipment, communications equipment, and other support equipment used during the conduct of military missions.

HERITAGE ASSETS
For Fiscal Year Ended September 1999

	Measurement Quantity	Beginning Balance 10/1/98	Additions	Deletions	Balance As of 9/30/99
Collection Type:					
Archeological Artifacts	Cubic Feet	5,982	369	0	6,351
Archival	Linear Feet	149,035	3,439	1,089	151,385
Artwork	Item	58,052	7,524	0	65,576
Historical Artifacts	Item	1,138,573	72,864	3,433	1,208,004
Non-Collection Type:					
Archeological Sites	Site	28,823	597	8	29,412
Buildings and Structures	Item	12,857	5,117	837	17,137
Cemeteries	Site	453	57	8	502
Memorials and Monuments	Item	2,005	62	57	2,010

Narrative Statement

Heritage assets are property, PP&E items that are unique due to their historical or natural significance; cultural, educational or artistic importance; and/or significant architectural characteristics. Heritage assets are reported by two major categories – Collection Type and Non-Collection Type. Within each of the major categories are subcategories or types of items as follows:

Collection Type Category:

Archeological Artifacts: Archeological Artifacts include items recovered as a result of archeological techniques, including surface collection and excavation on land or underwater.

Archival: Archival includes audio visual, electronic, text, and other similar documentation containing information of historical significance or association.

Artwork: Artwork includes objects of fine art such as paintings, engravings, sculptures, etc., and/or noted for aesthetic or representational value.

Historical Artifacts: Objects with material cultural value or historical significance or objects with historical significance due to their association with a person, place, organization, event, and/or technology.

Non-Collection Type Category:

Buildings & Structures: Buildings and structures that are listed on, or are eligible for listing on the National Register of Historic Places, including multi-use heritage assets. This designation includes properties determined to be National Historic Landmarks.

Cemeteries: Government owned burial grounds located on DoD bases and installations.

Memorials & Monuments: Memorials and monuments that have significant and/or historical value to the respective DoD Component or the United States.

Archeological Sites: Archeological sites listed on, or determined eligible for, the National Register of Historic Places.

The DoD has heritage assets located at museums and military installations worldwide. Each of the Military Departments has made improvements in the reporting of heritage asset information for FY 1999. Items are accounted for Department-wide using the same methods utilizing a variety of automated and manual systems. Specific heritage asset information by each of the Military Departments follows.

Department of the Army

Heritage assets reported by the Army include items that have been registered and catalogued in the Army Museum Information System (AMIS), which is a computerized application for managing and accounting for the Army's historical property. The AIMS consists of the Universal Site Artifact Management System (USAMS), which is an application installed at 58 active Army museums and museum activities, and the Central Site Artifact Management System, which is an application that summarizes all USAMS data into a centralized database.

Because more items have been registered and catalogued into the AMIS, in accordance with Army Regulation 870-20, Chapter 2, dated January 11, 1999, the Army's heritage asset amounts have increased from the FY 1998 report. The general condition of the historical collection is stable. Museum conservation and preservation efforts ensure that the heritage assets are preserved for posterity.

In the Army Museum System, archival materials are counted and registered as an item, not in linear feet. This information has been converted using a general conversion factor of 2,000 items per linear foot for this report.

Department of the Navy

The collection-type heritage asset data compiled and reported for FY 1999 includes Navy Components that maintain and manage heritage asset inventories by automated methods, as well as Components that maintain control by manual methods. During FY 2000, those Navy Components utilizing manual accountability and management controls will migrate to standard

automated systems, as well as conduct physical inventories and update their accountability systems accordingly.

The largest holder of heritage assets within the Navy is the National Museum of Naval Aviation in Pensacola, Florida. It reported an estimated amount of 500,000 objects including artwork and historic artifacts. This estimate is noted due to the material amount of heritage assets that this museum maintains in relation to the aggregate number of artwork and historic artifacts. Subsequent heritage asset reporting may have material shifts in amounts from prior years due to the enormity of the Naval Aviation Museum's estimation and probable changes due to physical inventories and future automated reporting.

The majority of the Navy collection and noncollection-type heritage assets are being cared for and maintained in accordance with relevant federal regulations. Where control or care weaknesses exist, during FY 2000, the Navy intends to thoroughly investigate such weaknesses and take appropriate corrective actions.

Department of the Air Force

The Air Force inventory of archeological artifacts reflects information governed by 36 CFR, Part 79. In most cases, the archeological artifacts have been discovered during Air Force construction activities. Items found include American Indian artifacts, such as arrowheads, weapons and pottery. In addition, artifacts from colonial Americans have been found consisting of tools, pottery and furniture. The DoD has sponsored an initiative to evaluate and inventory all archeological artifacts to meet the requirements of CFR 36, Part 65. The U.S. Corps of Engineers, St. Louis District, managed the archeological artifact project. The district has completed an assessment of each Military Department and reported the Air Force collection as being maintained in good condition.

The Air Force holds its Archival materials in the permanent collections of the Historical Research Agency located at Maxwell Air Force Base, as well as unique and permanent documentation in other Air Force historical and museum repositories. Data was accumulated via two separate entities for FY 1999 reporting. The Air Force Historian reported a beginning balance of 49,544 linear feet, acquisitions of 544 linear feet, no deletions, for an ending balance of 50,088 linear feet. In addition, The Air Force Environmental Division reported a beginning balance of 607 linear feet, no additions or deletions, and an ending balance of 607 linear feet. The items included in the collections are collected from various internal and external Air Force sources throughout the world. The increases made during the year reflect normal accessions. The Air Force rates the overall condition of the materials as good. Almost all of the materials are protected in an environment suitable for long-term storage.

The Air Force art collection consists of paintings, drawings, sketches, and sculptures. The new art works acquired during FY 1999 were paintings donated by the respective artists or by other donors. Most of the Air Force art collection is considered to be in good condition. The condition was determined by visual inspection.

Historical artifacts are registered as historical property in the Air Force Museum System at Wright-Patterson AFB or the Air Force Academy Museum System at Colorado Springs. The Air Force Historical Artifacts collection consists of Air Force, and its predecessor organizations, significant cultural items and include items depicting advances in technology, significant persons, places, and events in Air Force history. Many of the items that are located in the Air Force Museum System are one-of-a-kind, prototype or products developed by Research, Development, Test and Evaluation programs. As a result of paper items or less significant items being transferred to the control of Air Force major commands, many items were deleted. The overall condition of the collections is good. Items are displayed and protected in accordance with the standards in Air Force Instruction 84-103, USAF Museum System and other applicable federal guidelines. In FY 1998, the Air Force reported these historical artifacts under the category of Classic Weapon Systems.

Information reported for Air Force archeological sites reflects the total Air Force inventory as governed by the National Historical Preservation Act. Of the total 6,000 archeological sites, 13 sites are listed on the National Register of Historical Places. The remaining sites are eligible for listing. Examples include a "Mound," referred to as the Wright-Patterson Air Force Base Mound, constructed between 500 BC and 400 AD by the Adena people and is 8.2' high and 86' in diameter. Another example is Pre-Columbian (1000-1499 AD) petroglyphs and pictographs found on canyon walls and large rocks, consisting of bighorn sheep, deer and various figures and other symbols. These archeological sites are located within the Desert National Wildlife Range and the Nellis Range. The Air Force archeological sites are in good condition. Each Major Command is responsible for the care and maintenance of the archeological resources under their care and must comply with the requirements of the National Historic Preservation Act and the Archeological Resources Protection Act. The Air Force Archeological Resources inventory is in compliance with both laws.

In FY 1998, the Air Force reported only buildings and structures listed on the National Register as heritage assets. However, for FY 1999, the Air Force also included those buildings and facilities eligible for the listing. This reporting difference accounts for the majority of the 2,954 increase in this category. Most of the buildings and structures reported as noncollection assets are considered to be multi-use heritage assets, and as such, also are capitalized, depreciated and reported as General PP&E.

The Air Force has administrative and curator responsibilities for 27 cemeteries, which are regularly maintained and are in acceptable condition as determined by visual inspection.

Except for 28 memorials located on various Air Force bases throughout the United States, all are located at the Air Force Academy in the Air Gardens and Honor Court. Most of these monuments and memorials honor specific individuals or cadet wings for various accomplishments. All Air Force memorials and monuments are in acceptable condition.

STEWARDSHIP LAND
For Fiscal Year Ended September 30, 1999
(Acres in Thousands)

	As of 10/1/98	Additions	Deletions	As of 9/30/99
Land Use:				
Mission	16,365	379	69	16,675
Parks & Historic Sites	1	0	0	1
Wildlife Preserves	0	0	0	0
Totals	16,366	379	69	16,676

Narrative Statement

The majority of DoD land is Stewardship Land and is used for mission-essential purposes (military bases, installations and training ranges). A very minimal amount of DoD Stewardship Land has been designated for parks or historic sites.

The beginning balances do not correspond to the FY 1998 ending balances reported in the FY 1998 report due to reclassifications by each of the Military Departments. All Stewardship Land is in acceptable condition.

NON-FEDERAL PHYSICAL PROPERTY
Yearly Investment in State and Local Governments
For FY 1995 though FY 1999
(In Thousands of Dollars)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999
Categories:					
Transferred Assets:					
National Defense Mission Related*	$45,131	$61,984	$37,881	$34,406	$20,229

*Only the Department of the Army incurred expenses (investments) in Non-Federal Physical Property.

Narrative Statement

Investments in Non-Federal Physical Property are those expenses incurred to purchase, construct or renovate physical property owned by a state or local government. These investments include additions, alterations and replacements; the purchase of equipment; and the purchase or improvement of other physical assets. The amount reported was primarily for investments in Armories for the National Guard.

INVESTMENTS IN RESEARCH AND DEVELOPMENT

Yearly Investment in Research and Development
For FY 1995 through FY 1999
(In Millions of Dollars)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999
Categories:					
Basic Research	$3,666	$3,755	$1,479	$1,258	$1,115
Applied Research	$1,763	$1,768	$2,617	$2,756	$2,985
Development					
Advanced Technology Development	$4,726	$2,729	$4,227	$3,861	$4,444
Demonstration and Validation	7,896	5,822	5,698	6,762	6,564
Engineering and Manufacturing Development	6,057	9,178	8,435	8,336	7,934
Research, Development, Test and Evaluation Management Support	3,575	3,515	3,409	3,331	3,146
Operational Systems Development	3,980	7,428	9,724	9,850	9,801
Other	$1,712	$1,900	$1,732	$1,585	$1,636
Total	$33,376	$36,095	$37,322	$37,740	$37,625

Narrative Statement

Investment values included in the report are based on Research, Development, Test and Evaluation (RDT&E) outlays (expenditures). Outlays are reported because current DoD systems are unable to capture and summarize costs in accordance with the accounting standards. Descriptions of Department of Defense RDT&E programs are presented below by major category of RDT&E.

BASIC RESEARCH – Basic Research is the systematic study to gain knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind.

Department of the Army: Army basic research leverages research in the private sector through Federated laboratories, Centers of Excellence, and the University Affiliated Research Center. It includes:

- The dynamic behavior and defeat mechanisms of conceptual armor materials subjected to multiple external excitations
- Coupled computation fluid dynamics and rigid body computation techniques to compute flight aerodynamics and aerodynamic forces
- Generated synthetic aperture radar images in three-dimensions
- Aeroacoustic prediction code using a parallel computer
- Anode material for higher energy rechargeable batteries for reduced weight and cost
- Microarray gene analysis methods to assess cytokine contribution to secondary tissue damage that occurs after trauma.

Department of the Navy: The Navy's Defense Research Sciences program funds work across a broad spectrum of disciplines focusing on four major thrust areas: Ocean Sciences, Advanced Materials, Information Sciences and Sustaining Programs. Among hundreds of research projects undertaken were:

- Development of fouling-release coatings for marine applications
- Synthesis and processing of nanostructured materials
- Validation of maneuvering predictions for submarine configurations
- Brain circuit methods for real-time field applications
- Auroral and ionospheric research.

Department of the Air Force: This Basic Research program comprises research activities in academia and industry and in Air Force laboratories. The technologies include:

- Aerospace structures
- Aerodynamics
- Propulsion
- Electronics

- Computer science
- Directed energy
- Conventional weapons
- Life sciences
- Atmospheric and space sciences

Defense Advanced Research Projects Agency (DARPA): DARPA funds a variety of research areas that include:

- Biological and information sciences that evaluate DNA- based computing and investigates real- time biological instrumentation in support of interactive biology
- Amorphous and optical computing identifies alternative optical buffering technologies through the use of game theory, probabilistic methods, and amorphous computing in Information Technology
- Human computer interfaces and information technology expeditions will design and implement a prototype interactive programming language

Chemical and Biological (CB) Defense: The Joint Service core research program is aimed at expanding knowledge in militarily relevant fields for CB defense. The program promotes theoretical and experimental research in the chemical, biological and medical sciences. Areas of research include biosensors, aerosol science, and chemistry and toxic bioactive compounds.

Office of the Secretary of Defense/Washington Headquarters Services: Supports basic research in a wide range of scientific and engineering disciplines, contributes to the education of scientists and engineers, and builds and maintains infrastructure needs to improve the quality of defense research performed at universities.

APPLIED RESEARCH – Applied Research is the systematic study to gain knowledge or understanding necessary for determining the means by which a recognized and specific need may be met. This includes the systematic application of knowledge toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.

Department of the Army:

- Medical research provides protection against naturally occurring diseases, combat dentistry, combat casualties, and health hazard assessment of military materiel. Technology areas include infectious disease prevention and treatment, vaccines, prophylactic and therapeutic drugs, insect repellents, methods of diagnosis and identification of diseases, dental treatment, trauma and burns due to weapons, organ system survival, shock resulting from blood loss and infection, and blood preservation and blood substitutes.
- Night vision research develops focal plane arrays and mega-pixel infrared and multispectral, cooled, and uncooled sensors.
- Research provides ballistic technologies required for armaments and armor across a full spectrum of threats in a global context. Projects include pulsed power technologies for

electric armaments offering leap-ahead capability in hypervelocity and hyperenergy launch. It also includes work in hypervelocity penetrator effectiveness and electrothermal chemical technology that will greatly increase anti-armor capabilities. Focus areas include advanced solid propellants, launch and flight dynamics, weapons concepts for light forces, warheads and projectiles, armor and munition-target interactions.

- Research investigates new missile, rocket, and unmanned vehicle technologies to increase the survivability of launch systems, provide greater effectiveness under adverse battlefield conditions, increase kill probabilities against diverse targets, and provide powerful new simulation and virtual prototyping analysis tools.
- Research in rotary wing vehicle technologies including developments in capabilities to take-off and land vertically, and the efficient and effective flying at or below tree-top level for nap-of-the-earth missions.

Department of the Navy: Ongoing Navy efforts focused on the areas of propulsion and power, integrated avionics including cockpit technologies, and Naval air vehicle technology. Examples of specific programs include:

- Investigated feasibility of a flight control system capable of providing assisted or automated maneuvering for Naval mission tasks.
- Development of a Fight/Attack Phase III fan for the Joint Technology Demonstrator Engine. In addition to increasing engine efficiency, the fan promises to reduce risks to engines associated with foreign object damage.
- Demonstration of an intelligent crew station concept capable of unobtrusively monitoring and assessing aircrew physiological functions, while assessing aircraft condition relative to escape envelopes.

Department of the Air Force: The Air Force focuses on a wide range of mission needs concerning management and control of atmospheric and space. This research includes:

- Structural, propulsion, and subsystems materials and processes are developed for aircraft, missile, space, satellite, and launch systems applications. Electronic and optical, advanced electromagnetic, and laser protection materials and processes are developed for Air Force aircraft, missile, space, and personnel protection systems. Advanced nondestructive materials evaluation methods, materials design data, materials failure analysis, and materials repair methods are developed to improve the sustainment of Air Force systems.
- Aerospace propulsion and power technologies include turbine engines, dual-mode ramjets, rocket propulsion, combined cycle engines, fuels, lubricants, and aerospace power technologies. Technology advances will increase engine performance, increase reliability, reduce specific fuel consumption, and lower cost of ownership.
- The geophysics, space, and directed energy technologies programs develop technologies to understand, mitigate, and exploit effects of weather and geophysics environments on the design and operation of Air Force systems. This includes defining, modeling, and developing techniques to predict the phenomena of solar and space environments.

Defense Advanced Research Projects Agency (DARPA): DARPA contributes various technology efforts, some of which include:

- Computing Systems and Communications Technology, which focuses on the development of new information processing technology concepts that lead to fundamentally new software and intelligent system capabilities. Technology areas include High Performance and Global Scale Systems, Software Engineering Technology, The Information Survivability, and Asymmetric Threats.
- Extensible Information Systems which is part of a multi- agency initiative to greatly extend the reach and effectiveness of networked computation. It is pursuing network and software research to facilitate the "deep networking" of computers. It will also conduct research to increase the autonomy of those systems and promote the human role. Projects include the Deeply Networked Systems, the Software for Autonomous Systems, and the Gigabyte Applications.
- Biological Warfare Defense program focused on the underlying technologies associated with pathogen detection and remediation. Projects include pathogen countermeasures.
- Tactical Technology supports the advancement of concepts and technologies to enhance the next generation of tactical systems in the areas of Naval Warfare Technology, Advanced Land Systems, and Aeronautics Technology.

Chemical and Biological Defense: Research reduces the danger of a chemical and/or biological (CB) attack and enables U.S. forces to survive, and continue operations in a CB environment.

- Medical program focuses on development of antidotes and drug treatments and on casualty diagnosis, decontamination and medical management.
- Non-medical program emphasizes continuing improvements in CB defense materiel, including contamination avoidance, decontamination, and protection systems.

Office of the Secretary of Defense/Washington Headquarters Services:

- A part of OSD’s research efforts include Lincoln Lab which funds research in target surveillance and recognition, high-connectivity, low-cost military global defense network and communications systems, advanced combat support technologies for active hyperspectral sensing systems and compact biological agent detection systems, and advanced electronic/optical technology emphasizing optical sampling.
- Historically Black Colleges and Universities provides infrastructure support in fields of science and engineering through grants or contracts for research, collaborative research, education assistance, instrumentation purchases, and technical assistance.

Defense Threat Reduction Agency:

- Research efforts under the nuclear sustainment program develop and support the National Nuclear Mission Management Plan, nuclear and Weapons of Mass Destruction (WMD) emergency response capability, nuclear and WMD training expertise for DoD, nuclear weapon systems safety assessments, nuclear planning systems, nuclear deterrent option analyses, technical support for C4I requirements, and WMD threat mitigation analyses.

- Research supports innovative counterproliferation programs and enabling technologies to respond to the full spectrum of crises and prepare now for an uncertain future. Research efforts include:

    - Vulnerability assessments of strategic U.S./Allied systems leading to strategies for improved survivability
    - Development of WMD analysis and simulation tools for the warfighter including target planning and assessment; hazardous materials transport and collateral effects prediction; consequence assessment; and anti-terrorism/force protection
    - Development and application of state-of-the-art nuclear weapons effects models to support nuclear weapon stewardship and system hardness design
    - Development, maintenance and use of unique DoD test and simulation facilities and enabling technologies that are used to evaluate the impact of hostile environments from conventional, nuclear, and other special weapons on military or civilian systems or targets
    - Examination of existing U.S./Allied capabilities to hold hardened, deeply buried targets at risk; evaluation of capabilities against known or projected potential targets; and evaluation of new technologies for possible application against known shortfalls.
    - Targeting and intelligence community support to warfighters that provides functional vulnerability assessments of hostile foreign systems.

- Counterproliferation (CP) development efforts focus on improving CP capabilities by:

    - Building upon ongoing programs in the Services, DoD agencies, Department of Energy and U.S. intelligence community
    - Focusing on the most critical CP shortfalls to address major gaps in deployed capabilities
    - Leveraging existing program funding to accelerate the deliverables of DoD programs
    - Identifying and enhancing development of high payoff technologies to accelerate capabilities that complement technological advances

- Research in technology requirements supports implementation, compliance, monitoring and inspection for existing and emerging arms control treaties and agreements. Programs conform to the Administration's research and development priorities as related to both conventional arms control and weapons of mass destruction arms control and disarmament.

DEVELOPMENT – Development is the systematic use of the knowledge and understanding gained from research for the production of useful materials, devices, system or methods, including the design and development of prototypes and processes.

Within this category are five subcategories – A. Advanced Technology Development; B. Demonstration and Validation; C. Engineering and Manufacturing Development; D. Research, Development, Test and Evaluation Management Support; and E. Operational Systems Development.

A. Advanced Technology Development – Advanced Technology Development includes all efforts that have moved into the development and integration of hardware, for field experiments and tests. Projects have direct relevance to identified military needs and are used to demonstrate the general military utility or cost reduction potential of technology when applied to different types of military equipment or techniques.

Department of the Army:

- Develops and demonstrates technologies that provide solutions to command and control, data correlation, tactical surveillance, and combat identification problems. Specifically, technologies will provide integrated battlefield situation awareness, synchronization of combined arms forces, synchronization of joint forces, correlation of intelligence data from airborne and space based sensors, battlefield combat identification, point of engagement identification approaches, unmanned air vehicle surveillance, and hostile weapons location.
- Demonstrates mature advanced missile technologies with work addressing the full spectrum of missile tactical missile roles and missions.
- Demonstrates the operational potential of advanced combat vehicle component technologies that can contribute to upgrades of fielded combat vehicles and advanced ground combat vehicle systems. Emphasis is on solutions to post-Cold War deficiencies providing opportunities for more affordable, deployable, survivable, horizontally integrated and lethal power projection capabilities than are currently available. The technology areas include vehicle survivability, mobility, intra-vehicular digital electronics, and integration of diverse vehicle technologies.

Department of the Navy: Three examples of the Navy's Advanced Technology demonstration efforts are:

- Continued development of DNA vaccines for complex multistage organisms and other organisms
- Continued demonstration of the use of plasma-arc pyrolysis as a method for destroying shipboard waste
- Reducing ship crew size by demonstrating an automated system capable of providing environmental, machinery, structural, and personnel situational awareness (reduced ships' crew by Virtual Presence)

Department of the Air Force:

- Aerospace propulsion subsystems integration develops and demonstrates gas turbine propulsion system technologies applicable to a broad range of aircraft. This program also focuses on system integration aspects of inlets, nozzles, engine/airframe compatibility, and low-observable technologies.
- Aerospace propulsion technology develops and demonstrates affordable turbine engine high pressure core components, advanced airbreathing engine concepts, high heat sink and thermally stable fuels, and power technology for air, space, and weapon power applications.
- Advanced spacecraft technology develops advanced spacecraft technologies, such as structures, electronics, thermal management systems, power, and sensors and demonstrates them in an appropriate fashion. Goals are to decrease the time for innovative space technology to be transitioned to the war fighter and to reduce the associated development costs and risks of future Air Force space-based systems.
- The Space Based Laser (SBL) program provides a continuous, global boost phase intercept option for both theater and national missile defense. An SBL system could defend against missiles because the possible speed of light defense allows for boost phase intercept at the earliest possible moment and offers the highest probability that intercepted missile fragments will fall within the attacker's territory, rather than defended territory.

Defense Advanced Research Projects Agency (DARPA):

- Advanced aerospace systems develops advanced aeronautical systems or provides revolutionary new system capabilities for satisfying current and projected military mission requirements. Projects include Supersonic Miniature Air-Launched Interceptor, vertical take-off and landing unmanned air vehicles, and the Orbital Express Space Operations Architecture.
- Advanced electronics technology seeks to design and demonstrate state-of-the-art manufacturing and process technologies for the production of various electronics and microelectronic devices, sensor systems, actuators and gear drives that have both commercial and military applications. Projects include Uncooled Integrated Sensors, Electronic Module Technology, Tactical Information Systems, Advanced Lithography Technology, Microelectromechanical Systems, and Mixed Technology Integration.
- Sensors and guidance technology program develops enhancements to sensor and weapon system accuracy and capability. Projects include Guidance Technology, Aerospace Surveillance Technology programs, and Air Defense Initiative.
- Marine technology will identify, develop, and rapidly mature critical advanced technologies and system concepts for maritime applications. Projects include Undersea Littoral Warfare, a standoff mine neutralization system, Buoyant Cable Array Antenna, Robust Passive Sonar, and the Fast Multimission Ship.
- Land warfare technology will address the mission requirements of the 21st Century land warrior to include Rapid Strike Force Technology and the Small Unit Operations.

Chemical and Biological Defense: Funding demonstrates technologies that enhance U.S. forces' ability to deter, defend against, and survive chemical and biological (CB) warfare.

- The medical program aims to produce drugs, vaccines, and medical devices as countermeasures against CB threat agents. Specific areas of medical investigation include: prophylaxis, pretreatment, antidotes and therapeutics, personnel and patient decontamination and medical management of casualties.
- In the non-medical area, the focus is on demonstrations of CB defense technologies, including biological detection, chemical detection and decontamination.

Office of the Secretary of Defense/Washington Headquarters Services: The OSD development efforts consume a wide range of programs, some of which include:

- Counter-Terror Technical Support, which develops technology and prototype equipment that addresses combat terrorism
- The Strategic Environmental Research and Development Program, which improves DoD mission readiness by providing new knowledge, cost-effective technologies, and demonstrations in the areas of environmental cleanup, compliance, conservation, and pollution prevention
- Advanced Concept Technology Demonstrations, which are capability demonstration and evaluation programs which provide combat commanders an opportunity to develop operational concepts and operational requirements and allow users an opportunity to assess the military utility of the proposed capability
- The High Performance Computing Modernization Program, which provides the highest computational power available to U.S. weapons system scientists and engineers. By exploiting continuous advances in high performance computing technology, critical scientific and engineering problems are solved quicker and with more precision.
- The Defense Modeling and Simulation Office, which has corporate-level responsibility for the cooperation and synergism of modeling and simulation activities within the DoD

B. <u>Demonstration and Validation</u> – Demonstration and Validation includes all efforts necessary to evaluate integrated technologies in a realistic operating environment to assess the performance or cost reduction potential of advanced technology. This phase is system-specific and includes advanced technology demonstrations that help expedite technology transitions from the laboratory to operational use.

Department of the Army:

- Capitalize on emerging, advanced technologies to increase Crusader capabilities in the areas of lethality, mobility, survivability, re-supply, command and control, and sustainability. The Crusader system is the Army’s next generation artillery system consisting of a self-propelled howitzer (SPH) and a resupply vehicle (RSV).
- Develop improvements for the next upgrade to the Abrams tank, the Future Scout and Cavalry System, and/or other direct fire weapon system platforms.

- Continue the comprehensive development of the Tank and Medium Caliber Ammunition (TMA). TMA is an effort to rapidly field advanced tank and medium caliber ammunition and ensure the continued overmatch lethality of the U.S. armor fleet, despite rapid worldwide development of armored vehicle protection technology. Current developments are in the areas of kinetic energy, training ammunition, and smart extended range tank cartridges.
- Provide for advanced development of new mine and countermine systems by prototyping modern munitions technology, advanced development sensors, logic networks, fuzes, power sources, warhead components and modules into complete systems. Provides for advanced development of the Intelligent Combat Outpost (Raptor).

Department of the Navy:

- Joint Strike Fighter Program - Concept Demonstration efforts are ongoing, including company-unique technology demonstrations, completed final design and continued to build Concept Demonstrator Aircraft, and continued refinement for a tri-service family of aircraft.

- Environmental Protection–Shipboard Waste Management:
  - Evaluated Ozone Depleting Substances of submarine refrigeration plants
  - Developed backfit modification fits for surface ship 125-ton and 150-ton air-conditioning plant designs
  - Developed alternative solvents and processes for oxygen systems cleaning applications
  - Developed alternative firefighting agent delivery system for new ship construction

- Integrated Liquid Wastes:
  - With the Environmental Protection Agency, developed Uniform National Discharge Standards for liquid waste discharges from Navy vessels
  - Developed integrated liquid waste treatment system
  - Developed non-oily wastewater treatment system and advanced Oil Content Monitor
  - Test and evaluation of upgraded shipboard vortex sewage incinerator with emphasis on evaporation/incineration of all concentrated ship liquid wastes
  - Developed design fixes for compensated fuel ballast systems
  - Tested Non-Seeping Grease Seal on submarine dive and steering gear.

- Ship Concept Advance Design-Design Tools, Plans & Concepts:
  - Developed ship concepts and performed mission area analysis for potential ships 5-10 years out including ship size, configuration, capabilities and ship costs
  - Conducted ship concept studies for joint command ship, medical capabilities afloat and alternative potential ship concepts
  - Conducted joint command ship versus shore basis mission need analysis
  - Developed options study for replacement of large deck amphibious assault ship
  - Developed future surface warfare vision including mission needs and concepts

- Total Ship Technology Assessment:
  - Analyzed the benefits and impacts of new ship and hull, mechanical and electrical (HM&E) concepts and technologies, and updated the HM&E technology database
  - Supported integration and transition of new technologies in total ship concepts
  - Established baseline ship concepts and technology characterization process for use in technology assessments

Department of the Air Force:

- The Airborne Laser (ABL) Program will design, build and test a laser weapon system to acquire, track and kill Theater Ballistic Missiles in the boost phase. This weapon system integrates three major subsystems (Laser, Beam Control and Battle Management Command, Control, Communications, Computers and Intelligence) into a modified commercial Boeing 747-400F aircraft. It also includes ABL-specific ground support.
- The National Polar-orbiting Operational Environmental Satellite System is a DoD, Department of Commerce, and National Aeronautics and Space Administration program which will provide timely, quality weather and environmental information to effectively employ weapon systems, protect national resources, and will be the nation's single source of global weather and environmental data. It will provide visible and infrared cloud cover imagery and other atmospheric, oceanographic, terrestrial, and solar-geophysical information.
- The Joint Strike Fighter Program will develop and field an affordable, highly common family of next generation strike fighter aircraft for the United States Navy, United States Marine Corps, United States Air Force and allies. Current program emphasis is on facilitating the evolution of fully validated and affordable joint operational requirements, and demonstrating cost leveraging technologies and concepts to lower risk.
- Global Broadcast Service will provide efficient, high data rate broadcast capability between many distributed information sources and warfighters who receive the broadcast directly on small, inexpensive user terminals. Broadcast data includes digitized imagery, logistics and weather data, maps, operational orders and video.

Chemical and Biological Defense: This program supports the need to safely operate, survive and sustain operations in a CB agent threat environment across the continuum of global, contingency, special operations/low intensity conflict, counternarcotics, and other high-risk missions.

Office of the Secretary of Defense/Washington Headquarters Services:

- Physical security equipment safeguards DoD acquisition information for all DoD components. This program supports the protection of nuclear weapons, tactical and nuclear weapons systems, DoD personnel and DoD weapon systems.
- Environmental Security Technology Certification Program demonstrates and validates promising innovative environmental technologies that target environmental needs.

Ballistic Missile Defense Organization:

- Develops the requirement for the Navy Theater Wide (NTW) Theater Ballistic Missile Defense (TBMD) system which provides protection to U.S. and allied forces against medium to long range theater ballistic missiles (TBMs). The NTW will provide an effective defense when the ship is positioned near the enemy TBM launcher to effect ascent phase intercepts; along the TBM trajectory as the TBM passes over water, or inland along the coast to effect midcourse intercepts; and, near the defended area to provide descent phase intercepts and achieve an additional layer of defense for lower-tier TBMD systems.

- Develops the National Missile Defense (NMD) Program, which demonstrates and maintains an option to deploy a national missile defense system to defend the United States against a limited strategic ballistic missile threat by a rouge nation. The NMD system consists of:
  - Interceptors, which consist of an Exoatmospheric Kill Vehicle atop a booster stack
  - Ground-based sensors and radars, which include the development of an X-band radar and the upgrade of existing early warning radars
  - The Battle Management Command, Control, and Communication (BM/C3) system, which includes integration with existing national command and control systems, a ground communication network, and a communication system to transmit data to and from the interceptor while in flight. In the future the NMD system will also use space-based assets for threat launch detection and tracking**.**
  - Sensor technology, which includes research and development efforts for critical sensor components that support infrared surveillance, acquisition, tracking, and discrimination functions. Projects in radiation hardened electronics and spacecraft computers, focal plane arrays, long-life cryogenic coolers, signal/data processing and optics are developing state-of-the-art technologies essential to operating in a space environment and viewing targets against the earth limb and space backgrounds.
  - Ground based interceptor will demonstrate an intercept capability with successful completion of the NMD integrated system test in FY 2000.
  - Upgraded Early Warning Radars (UEWR) develops, tests, and demonstrates prototype software upgrades and hardware changes to existing Early Warning Radars required to support the NMD mission. The UEWRs will detect, count and track the individual objects in a ballistic missile attack early in their trajectory. The UEWR data will be used for interceptor commit and other X-band radar cueing.

- Develops the Theater Missile Defense (TMD) program. The TMD program's goal is to develop, maintain and deploy a cost-effective, Anti-Ballistic Missil Treaty compliant system designed to protect the United States and its Allies against the immediate and growing threat from shorter range theater ballistic missiles. The TMD core programs are:
  - Patriot Advanced Capability
  - Theater High Altitude Area Defense System
  - Navy Area Theater Ballistic Missile Defense (TBMD) formerly (Lower Tier)
  - Navy Theater-Wide TBMD formerly (Upper Tier)

C. **Engineering and Manufacturing Development –** Development includes projects for Service use which have not received approval for full-rate production. This phase is characterized by major line-item projects. Program control is exercised by individual project review.

Department of the Army:

- Develops mine and countermine systems. Projects include a minefield command and control system for the Wide Area Mine, the Intelligent Combat Outpost (Raptor), Non-Self-Destructing Anti-Personnel Landmine Alternatives, the Airborne Standoff Minefield Detection System, Ground Standoff Mine Detection System, and Handheld Stand-off Mine Detection System.
- Develops Brilliant Anti-Armor Submunition which is a dual-sensor (acoustic and infrared) submunition that autonomously seeks out and destroys moving armored vehicles without human interaction.
- Develops Non-System Training Devices to support force-on-force training at the Combat Training Centers, general military training and training on more than one item/system
- Develops and tests the RAH-66 Comanche and the T800 growth engine. The Comanche is a multi-mission aircraft optimized for the critical battlefield mission of tactical armed reconnaissance. It provides a globally self-deployable attack platform.

Department of the Navy:

- Develops T-45 Training System Navy-unique courseware and courseware conversion.
- Develops Joint Standoff Weapon (JSOW) captive flight testing and qualification of the Low Cost Guidance Electronics common to all variants of the JSOW missile.
- Develops V-22 including flight test, logistics efforts, Power-by-the-Hour support of the engine, support equipment procurements, and repairable efforts. Develop Weapons Replaceable Assembly/Test Program Sets and bean CV-22 modifications for the flight simulator and Naval Air Maintenance Trainer Suite.
- Develops Advanced Electronic Guided Intercept System (AEGIS) Combat System Engineering Surface Combatant Combat System Improvements to allow incorporation of Anti-Aircraft Warfare capability into the Standard Missile 2 Block IVA missile. Other accomplishments included operational evaluation, computer program code, debugging, and testing, advanced upgrades into new construction AEGIS Combat System in Baseline, system definition and engineering for the AEGIS cruiser conversion program, and risk reduction testing in an operational environment employing the prototype shore capability
- Conducts engineering and scientific studies to minimize the risk in the introduction of increased war fighting capability including Evolved SEASPARROW Missile System and Advanced Integrated Electronic Warfare System into the AEGIS Combat System. Studies ensured effective introduction of Commercial Off-the-Shelf-Technology.

- Developed Virginia Class Submarine Design
  - Continued design, manufacturing, and qualification testing of prototype technologies and components such as ship service turbine generator, weapons stowage, handling and launch systems, propulsion, main thrust bearing; electromagnetic signature reduction, special hull treatments; integrated low pressure electrolyzer system; ship control system; and reverse osmosis desalination unit.
  - Continued system verification studies, tests, and analyses in support of ship design including signature, hydrodynamics, materials, and survivability analyses and tests.
  - Supported ship design and construction efforts with engineering evaluations and ship integration assessments for emergent ship design and systems development issues.
  - Initiated transition from advanced research and development projects and engineering developments of new technologies for potential insertion in the Virginia class submarine including High Frequency Remote Ahead Profiling, Conformal Acoustic Velocity Sensor, Accelerated Electromagnetic Silencing and additional Advanced Sail Development.
  - Continued effectiveness analysis and evaluations relating to force effectiveness.
  - Continued environmental compliance and pollution prevention efforts.

Department of the Air Force:

- Developed the F-22, which is designed to penetrate enemy airspace and achieve a first look, first kill capability against multiple targets. A low observable, highly maneuverable airframe, advanced integrated avionics, and aerodynamic performance that allows supersonic cruise without the use of afterburner characterize the F-22.
- Developed the B-2 SPIRIT which is an advanced long-range strike aircraft with twin weapons bays. Development includes employment of a wide array of signature reduction technologies to greatly enhance its ability to penetrate enemy defenses.
- Developed the Space-Based Infrared System's (SBIRS) which is to provide initial warning of a ballistic missile attack on the United States, its deployed forces or its allies. SBIRS will incorporate new technologies to enhance detection; improve reporting of ICBM, SLBM and tactical ballistic missiles; and provide critical midcourse tracking and discrimination data for national and theater missile defense.
- Developed the Military Strategic Tactical and Relay, which is a joint service program to develop and acquire extremely high frequency satellites; a satellite mission control segment; and new or modified Army, Navy, and Air Force communication terminals for survivable, jam-resistant, worldwide, secure communications to strategic and tactical warfighters.
- Developed the Evolved Expendable Launch Vehicle program which is a space launch system development program to include launch vehicles, infrastructure, support systems, and interfaces.

Defense Information Systems Agency: The Advance Information Technology Services Joint Program Office facilitates the transition of DARPA's substantial information systems technology research into DISA's operational support of the warfighter. Efforts include the provision of advanced technology demonstrations, engineering and reinforcing components

of the Defense Information Infrastructure (DII), and augmenting products for inclusion into the DII that have improved security, scalability and DII compliance. Products include deployment data and an operational readiness assessment capability for the Global Command and Control System. Other outputs are a joint logistics advanced concept technology demonstration supporting the Global Combat Support System Infrastructure and the development of an advanced information environment for the DII which permits plug and play introduction of new capabilities and information sharing across diverse networks that support joint planning and execution.

Chemical and Biological Defense: Supports medical and non-medical issues structured to consolidate Joint and Service unique tasks within the following commodity areas:

- Contamination Avoidance - provides real-time hazard assessment capabilities.
- Force Protection - increases protection levels while decreasing physical and psychological burdens imposed by protective equipment.
- Medical Chemical Defense - improves medical equipment and drugs essential to counteracting lethal and performance-degrading effects of chemical threats, and medical equipment essential to meeting medical requirements.

Ballistic Missile Defense Organization (BMDO): The Navy Area Theater Ballistic Missile Defense (TBMD) project builds on the national Investment in AEGIS ships, AEGIS Weapon Systems (AWS), and Navy Standard Missile II (SM-2) Block IV missiles. Navy TBMD will take advantage of the attributes of naval forces including overseas presence, mobility, flexibility, and sustainability in order to provide protection to debarkation ports, coastal airfields, amphibious objective areas, Allied forces ashore, and other high value sites. Two classes of ships continue to be deployed with the AEGIS combat system:

- CG-47 Ticonderoga-class cruisers
- DDG-51 Burke-class destroyers

D. <u>RDT&E Management Support</u> – Includes Research and Development efforts directed toward support of installations or operations required for general research and development use. Included would be test ranges, military construction, maintenance support of laboratories, operation and maintenance of test aircraft and ships, and studies and analysis in support of the research and development program.

Department of the Army:

- Funds the continued operation of management and administrative functions at U.S. Army centers and facilities throughout the world.
- Provides standard and specialized weather forecasts and data for test reports to satisfy unique test requirements for modern weaponry. Examples include, atmospheric analysis and sampling to include atmospheric transmittance, extinction, optical scintillation,

infrared temperature, aerosol/smoke cloud dispersion characteristics, ballistic meteorological measurements, snow characterization and crystal structure, sound propagation for ballistic tests, specialized prediction of light level and target to background predictions for electro-optical testing and ballistic meteorology, and advisory and warning products such as go-no-go advisories for ballistic and atmospheric probe missiles, smoke obscurant tests, hazard predictions for chemical agent munitions disposal, simulated nuclear blasts, and weather warnings for range/test safety.

- Support test and evaluation of major Army and DoD missile systems, Army Space surveillance and object identification, and National Aeronautics and Space Administration scientific and space programs at the U.S. Army Kwajalein Atoll/Kwajalein Missile Range.

Department of the Navy: The Navy operated core Major Range Test Facility Base capabilities required to meet acquisition program and fleet test workload. The Navy also supports essential components of indirect civilian salary and contractor costs required to manage, operate, and maintain the Pacific Range's Sea, Air, Ground, Electronic, Combat, Propulsion, Warhead and Environmental test facilities, operational target vehicle launch functions and aircraft maintenance.

Department of the Air Force:

- Provides planning, improvements, and modernization for test capabilities at four Air Force test organizations – the 46 Test Wing of the Air Armament Center, Arnold Engineering Development Center, Air Force Flight Test Center, and the Space and Missile Systems Center's Test and Evaluation Directorate.
- Supports the DoD space research community by centrally financing acquisition of a host satellite or launch vehicle, the launch, and initial operations costs for experiments with military relevance whose scope ranges from basic research to advanced development through the Space Test Program. The Space Test Program conducts space test missions to fly the maximum number of DoD experiments consistent with priority, opportunity, and funding.

Defense Information Systems Agency: The Defense Technical Information Services Program provides for the centralized operation of DoD's acquisition, storage, retrieval, and dissemination of Scientific and Technical Information (STI). This program provides timely and effective exchange of information by conserving resources devoted to DoD research and helps to prevent duplication of DoD research effort. Work focuses on the collection, analysis, and dissemination of STI in specialized fields to prevent reinventing research and to promote standardization within these fields. Examples are:

- Electronically collected and disseminated the DoD's Annual In-House RDT&E Activities Report and reengineered the Research and Development Descriptive Summary website to provide a streamlined and improved search capability

- Enhanced the Electronic Document Management System's capabilities to include electronic input and delivery, and completed the integration effort for conversion from microfiche/microfilm formats to digital image
- Expanded the Defense Virtual Library to include sound/video using national standards for cataloging and resource identification, and the incorporation of multimedia objects into information products in video streaming, teleconferencing and distance learning areas.

Office of the Secretary of Defense/Washington Headquarters Services

- The DoD Foreign Material Program acquires and exploits foreign materiel systems, subsystems, components, commercial items with military applications, and technologies, as well as related technical and operational documents.
- Technical Studies, Support and Analysis is the primary source of funding for the Office of the Secretary of Defense and the Joint Staff for studies, analyses, management, and technical support efforts to improve and support policy development, decision making, management and administration of DoD programs and activities.

E. Operational System Development – Includes those development projects in support of development acquisition programs or upgrades still in engineering and manufacturing development, but which have received Defense Acquisition Board or other approval for production, or production funds have been included in the DoD budget submission for the budget or subsequent fiscal year.

Department of the Army:

- A digital information system will provide mounted tactical combat, combat support, and combat service support commanders, leaders and soldiers, integrated, on-the-move, real-time/near real-time, battle command and information and situation awareness. This capability will be fielded from brigade down to the soldier/platform level across all Battlefield Functional Areas.
- The UH-60 Black Hawk includes air assault, general support, aeromedical evacuation (MEDEVAC) and command and control. The UH-60L+ is the near-term evolutionary development of the UH-60X, buying back lift and providing digitization while reducing Operation and Support costs and increasing readiness rates of the aging fleet.
- Improvements to the Abrams Main Battle Tank (M1 series) consist of the M1A2 System Enhancement Program which is a block of improvements to the computer core, better microprocessors, color flat panel displays, more memory capacity, better Soldier-Machine Interface, and a new open operating system. A new thermal management system dissipates the heat generated by the electronic components. The M1A2's formidable target acquisition capabilities will also be significantly enhanced with the 2nd Generation Forward Looking Infra-Red technology. Both the Gunner's Primary Sight (GPS) and the Commander's Independent Thermal Viewer include the improved thermal imaging capabilities of the new FLIR technology.

Department of the Navy:

- Tested F/A-18 Hornet
- Continued Tactical Tomahawk Engineering and Manufacturing Development including mission planning and weapon control development.
- Developed system design specification for the Multi-Function Towed Array (MFTA) and processor.
- Analyzed data from Towed Active Receive System FY 1998 sea tests.
- Developed Guidance and Control Software Block Upgrade IV in preparation for Operational Testing of MK48 Advanced Capability in FY 2000.
- Supported the Navy's Meteorological and Oceanographic Sensors-Space program. Ongoing efforts included development and demonstration of technologies for Navy-unique sensors to be deployed under the Defense Meteorological Satellite and National Polar-Orbiting Operational Environment Satellite System programs.

Department of the Air Force:

- The F-16C/D program develops, integrates, and qualifies systems to enhance the overall performance of the F-16 mission. Modifications include:
  - Link 16, which is a data link that connects main components of a battle arena to maintain awareness and to share battle management data
  - Replacement of the Modular Mission Computer
  - The Joint Helmet Mounted Cueing System
  - Advanced Weapons Integration, which will integrate smart weapons
  - The addition of Global Positioning System capability
  - Integration of a targeting pod and transition of ha targeting system pod
  - The Mark XII IFF system (Air-to-Air Interrogator)
  - Structural modifications, as appropriate for each F-16 Block of aircraft

- Improvement to the F-15E's avionics, armament, airframe, and engines, which include avionics updates that will be incorporated into the electronic warfare suite
- The Aircraft Engine Component Improvement Program, which provides support for in-service Air Force engines throughout their service life
- Joint Air to Surface Standoff Missile, which is a joint Air Force/Navy program to provide an affordable long range, conventional air-to-surface, autonomous, precision guided, standoff cruise missile compatible with fighter and bomber aircraft able to attack a variety of fixed or relocatable targets
- Joint Surveillance Target Attack Radar System, a program that will provide the Air Force and Army near-real time surveillance and targeting information on moving and stationary ground targets, slow moving rotary and fixed wing aircraft, and rotating antennas
- Other efforts to develop advanced defense airborne reconnaissance technologies
- C-17 efforts, which support producibility enhancements and product improvements, including correction of Operational Test & Evaluation deficiencies

U. S. Special Operations Command: Operational Systems Development provides for development, testing and integration of specialized equipment to meet the unique requirements of Special Operations Forces (SOF). Specialized equipment will permit small, highly trained forces to conduct required operations across the entire spectrum of conflict. These operations are generally conducted in harsh environments, for unspecified periods, and in locations requiring small unit autonomy. SOF must infiltrate by land, sea, and air to conduct unconventional warfare, direct action, or deep reconnaissance operations in denied areas against insurgent units, terrorists, or highly sophisticated threat forces. The requirement to operate in denied areas controlled by a sophisticated threat mandates that SOF systems remain technologically superior to threat forces to ensure mission success.

Defense Information Systems Agency:

- In the C3 Interoperability program, work was directed toward ensuring that systems and subsystems implemented under the Defense Information Infrastructure (DII) are technically sound and interoperable. Operational effectiveness is pursued through a process of Compatibility, Interoperability, and Integration certification. The emphasis in performing DII test and evaluation is to determine the extent and success of full compatibility and standards compliance of systems supporting the DII framework. This testing is performed throughout the life cycle of a system and includes proof-of-concept, system development, deployment, and upgrade. Accomplishments include:

    - Performed Operational Test and Evaluation of major Command, Control, Communications, Computers and Intelligence programs such as the Global Command and Control System (GCCS), the Defense Information Systems Network, and the Defense Message System (DMS)
    - Performed Modified Development Test of GCCS and completed risk assessment plans for various GCCS software applications
    - Tested and implemented the Navy's Message Conversion System, thereby reducing the Navy's reliance on the Automated Digital Network
    - Tested and evaluated the commercial Defense Message Distribution System for economical/effective implementation of the DMS
    - Provided interoperability technical advice to CINCs, Services, and Joint Agencies during real world contingencies and exercises

- In the Defense Information Infrastructure Engineering and Integration program, efforts supported the DoD's communications planning strategy for the successful deployment of information systems by performing a broad range of activities involving C4I systems. These services provide modeling and analysis for key programs such as the DMS, the Defense Information System Network, and for Electronic Commerce.

- In the Long Haul Communications program, efforts are focused in two areas that supported the Defense Information Systems Network.
  - Information Dissemination Management and Satellite Communications which is a subset of Information Management that includes information awareness, access, and delivery services.
  - Defense Information Infrastructure certification as well as developmental and operational testing. The RDT&E funding is used for a multitude of Satellite Communications issues such as the Gapfiller satellite system, the National Command Authority Voice Conferencing Enhancement Program, and loss of MILSTAR Flight 3.

- In the National Communications System program, effort is focused on ensuring continuity of telecommunications for the federal government during all situations including crises. Several initiatives include:
  - New telecommunications technologies and their effects on interoperability of government communications and conducts related technical evaluations. Examples are the analysis of network management and congestion control of emerging high-speed digital networks, and the support of the development of standards for video teleconferencing, as well as other multimedia applications.
  - Employment of newly developed processing capabilities to use the existing public networks to enhance the connectivity and survivability of service during emergencies. Work involves conducting network interoperability testing across multiple carriers for the purpose of configuring network components most effectively.

- In the Joint Spectrum arena, DISA's Joint Spectrum Center provided analytical support to elements of the OSD and Joint Staffs related to the upcoming World Radio communications Conference and to the Military-to-Military Outreach Program. Support included spectrum requirements analyses, band studies and information papers all directed towards ensuring continued DoD access to the spectrum.

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