OFFICE OF THE CHIEF OF NAVAL RESEARCH

DEPARTMENT OF THE NAVY EXPLORATORY DEVELOPMENT (6.2) INVESTMENT STRATEGY

OFFICE OF NAVAL TECHNOLOGY

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APPROVED FOR PUBLIC RELEASE

ONT MISSION

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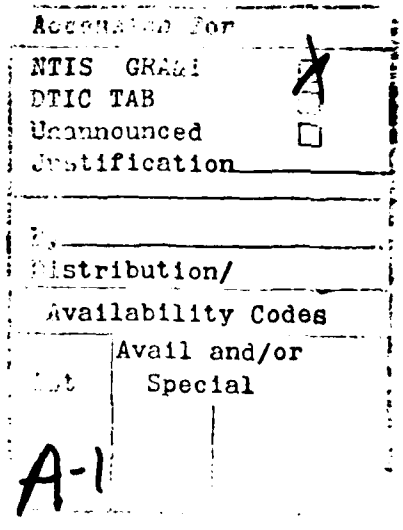
"...TO STRENGTHEN THE COORDINATION AND MANAGEMENT OF THE DON EXPLORATORY DEVELOPMENT (6.2) PROGRAM ... TO PROVIDE FOR A MORE CLEARLY DEFINED PROCESS OF PLANNING, EXECUTION, AND TRANSITION OF PROGRAMS WITHIN THE TECHNOLOGY BASE AND INTO ADVANCED DEVELOPMENT ..."



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I. Introduction

This document presents the Department of the Navy (DON) Exploratory Development (6.2) Investment Strategy, which establishes the focus and major thrusts of the 6.2 Program. The Navy's investment strategy for its exploratory development activities is derived from a national security strategy that mandates continued fulfillment of U.S. responsibilities in both Europe and Asia. In addition, the changing world environment will increase our responsibilities with respect to Third World nations. Successful implementation of U.S. strategy presumes that our naval forces will maintain technical superiority in their weaponry and platforms. As such, our warfighting strategy is achievable only if our nation maintains its current technological leadership. The Soviet Union's quantitative advantages and qualitative advances in space, submarine warfare, cruise missiles, and electronic warfare are tangible evidence that our ability to maintain a technological edge clearly is being challenged. Proliferation of high technology will continue to expand on the world arms market and will become prevalent in the Third World. Therefore, the requirement to maintain technological superiority remains absolutely essential.

The Navy's Exploratory Development Program plays a crucial role in maintaining this leadership. As part of the overall Navy annual budget and program development process, the Office of Naval Technology (ONT) establishes an investment strategy for each warfare mission area in terms of the potential for operational impact of the planned technology program on the warfighting capabilities of the Navy and Marine Corps. The 6.2 Mission Area Strategies, the FY 1991/POM-92 edition being the most recent version, reflect this investment strategy and provide guidance for the execution-program planners and performers; define and prioritize technology thrusts; provide the basis for 6.2 technology programs at Navy laboratories and R&D centers or, where appropriate, contractual technology development programs with U.S. industry or universities.

ONT will continue to ensure that the Navy's technology investment is positioned to address the changing National Security environment. The Navy 6.2 Program for FY 1991 carefully considers priorities and supports efforts vital to the efficient execution of the naval mission.

This Investment Strategy document is structured as follows. Section II briefly discusses key aspects of the geo-political environment, which will affect future 6.2 resource allocations. It also summarizes the threats and naval needs for which innovative technology options serve as a hedge against technological surprise and provide the underpinning for fielding future threat-responsive systems. Section III presents the thrusts and priorities of the 6.2 program, the relationship of the 6.2 Program mission areas to the Department of Defense Critical Technologies, and the 6.2 resource allocations among the program performers and across warfare mission areas.

II. Strategy Drivers

A. Geo-Political Environment

In the world of today, power and influence are becoming more diffuse and this trend is expected to continue. The bi-polar relationship and "cold war" environment are changing rapidly, with a resulting decrease in super-power dominance as their status becomes more that of "first among equals" and as regional centers of influence develop. This resulting rebalancing of power could result in multiple spheres of regional influence -- a situation that would present a far more complicated National Security environment as wars, contentions or national interests are much more likely to arise which could create a climate of shifting alliances and strategic uncertainty.

Economic power will gain in importance relative to military power. The U.S. economic status will continue to decrease as a percentage of world wealth and the centroid of economic power may shift from the European continent toward the Pacific Basin.

Potential scenarios which the U.S. could face include:

- an economically united Europe
- Japanese military power commensurate with economic power
- reunited Germany as a dominant European power
- India as a major military force
- Brazil as a major South American power
- reemergence of the Pacific as a troublesome area
- nuclear weapons in the Third World.

This economic/geo-political environment could result in a restructuring of the American military force to include:

- fewer overseas bases
- less forward presence
- greater emphasis on mobility
- more reliance on mobilization and reserves
- more dependence on Arms Control agreements.

Whichever scenario materializes, the world will press the U.S. to continue to offer leadership and balance in the international arena. It will be in our interest to do so and a strong maritime presence is and will remain necessary for the U.S. to accomplish that role.

B. Threats

In general, the threat of Global strategic nuclear warfare will be reduced. Nuclear weapons may become less significant in the global security environment, as their limitations as a usable weapon are recognized. While fewer nuclear weapons may be in the super-power arsenals, proliferation of such weapons is expected throughout the Third World.

For the foreseeable future, the USSR will remain the most challenging military threat to the U.S. Soviet strategy will retain its defensive orientation, but the USSR may continue selective exploitation of opportunities to gain access to seaports and expand basing facilities, particularly in developing nations.

The Soviet Navy will emphasize five key missions in support of the future Soviet defense doctrine:

- nullifying an enemy airborne threat, including space
- interrupting the military economic structure of the enemy
- destroying enemy convoys at sea
- defending strategic sea forces
- radio electronic battle management.

The Soviet naval threat will become increasingly more sophisticated. As arms treaties allow the Soviets to reduce inventories, older, less efficient systems will be removed from inventory, with the net result being a smaller, more modern force structure. Stealth technology will be employed on newly developed airborne systems, while their submarine quieting program will concentrate on further reducing signatures to deny the U.S. its current ASW advantage.

The Soviet space threat will become more severe as they maintain a strong anti-satellite capability while continuing to pursue a rapid reconstitution capability. Soviet sensor satellites will assure virtual real-time coverage of the World's oceans and increase the vulnerability of U.S. surface assets to detection and targeting.

While the threat of U.S.-Soviet war may recede and the central European front scenario may decline in importance, the probability of regional conflicts, driven by both economic (e.g., energy) and ideological differences, will rise in importance. Third World nations will have increasing accessibility to high-technology weaponry for force modernization and their military-eligible population will continue to expand, in sharp contrast to both the Soviet/Warsaw Pact and U.S./NATO projections. Regional conflicts and police actions will become more threatening in nature as the Third World nations continue to develop nuclear devices and proliferate chemical/biological systems due to the relative ease and cost effectiveness of such developments.

Low intensity conflicts will be characterized by the following parameters:

- enemy may not be well defined nor distinguishable from neutrals
- enemy C^3 will be distributed and the chain of command murky
- platforms will be small and/or indistinguishable from commercial platforms
- hostile intent will be difficult to discern
- situations will change rapidly.

These dynamics portray a continuing need for maritime forces which could be applied in three distinct situations: (1) War at Sea, (2) War Against the Land, and (3) War in the Third World.

War at Sea implies the threat of a long war and involves protection of Sea Lanes of Communication (SLOC's) for friendly use and denial to the enemy. Naval forces would be used to control, blockade, or destroy an opposing naval force and deny the enemy the ability to reinforce their troops or resupply their industrial base. War at Sea could involve objectives against sea, air, land, and space assets.

War Against the Land involves joint or combined force operations to deter war or end a conflict on favorable terms. Naval forces are utilized to project power or exert leverage against a land mass. This action could involve nuclear weapons, but non-nuclear alternatives will become more important in objectives such as protecting friendly populations and interdicting internal lines of communications. Marine Corps and Special Warfare forces are assets which may play an increasingly important role.

War in the Third World concerns the use of naval forces in Contingency and Limited Objective Warfare (CALOW) to control developing crises or resolve conflicts in regional disputes. The nature of CALOW is such that the vital interest of the superpowers is not directly threatened. The threat may involve a wide spectrum of weapons -- e.g., Soviet, Chinese, French, Brazilian, and U.S. -- and may possess a high potential for non-conventional weapons such as chemicals, toxins and Improvised Nuclear Devices. Political pressures will dictate minimum U.S. losses and no casualties to neutrals.

C. Naval Needs

Given the above background and the U.S. geographic position as an island nation, the requirement for Maritime Superiority will remain. The primary naval missions are expected not only to remain but to increase in importance with the loss of forward bases. Sea control will continue as a prerequisite to effect any maritime strategy. Accordingly, protection of the SLOC's and the ability to execute strategic sealift must receive high priority but also will be executed with reduced force levels.

Countering the quiet submarine in this role will be key to mission success, but will become increasingly difficult and will require a modernized ASW capability to perform effectively in a wider range of environments. Expanded use of active sonar and the emergence of nonacoustic ASW from R&D into operational use can be anticipated. Passive acoustic detection as we know it today will become even more difficult, but significant advances in sensors and signal processing and increased tactical exploitation of the ocean will keep passive acoustics in the picture.

Strategic nuclear deterrence will remain a prime naval mission. Strategic Arms Reduction Treaty (START) reductions plus the increasing threat to surface units from overhead surveillance may require expanded submarine missions and responsibilities to include power projection. Continued attention to signature control will be needed to permit operations in heavily defended forward areas and off-board sensors will be necessary to improve our surveillance capability. Increased connectivity with surface and air units will be desired, to provide timeliness in response to changing battlefield conditions.

The power projection mission will assure a continuing role for the carrier battle group and the surface fleet. There will be a decreased need for conventional power projection against the Soviet homeland, but the demands for U.S. power projection in lower-level conflict will increase. Even with an expanding emphasis on long-range standoff weapons, the requirement for mission presence will require the ability to project tangible evidence of power. In this role, no other platform provides the flexibility, sustainability, and endurance of the aircraft carrier. Thus, the relatively high probability of regional conflicts and the potential loss of overseas bases assures a continued role for the carrier battle group. This situation stresses the need for a mobile, flexible force that can operate globally without dependence on forward bases.

The most significant impact on future warfare will be brought about by stealth and counter-stealth development. Low-observable technology will make a dramatic impact on the offensive capability of both manned aircraft and missiles. Carrier-based aircraft need to employ extensive stealth technology, and be supported in surveillance and targeting by remotely piloted vehicles and in strike by long-range guided missiles. Thus, the number of sorties necessary to destroy a target can be reduced in addition to the aircraft attrition rate per mission.

On the other side of the coin, when our surface forces operate in an area of intense Soviet surveillance, they will be subject to early targeting and attack by long-range stealth weapons. Countering stealth vehicles of the adversary has two simultaneous effects. First, it expands the size of the battlefield for scouting and surveillance but, at the same time, point defense becomes crucial for every ship, as the size of the engagement battlefield will shrink and require quicker reaction times. Directed energy weapons can play an important role in meeting the quick-reaction requirement but must achieve ranges of more than a few kilometers.

The tactical air role will become comparably difficult in the face of improved Soviet air defenses. Even Third World air-defense capabilities will increase significantly through the purchase of commercially available western or Soviet technology. The mix of manned and unmanned vehicles will change -- the ratio of aircraft to long-range cruise missiles may shift, but man will need to remain in the loop as an essential decision maker. Unmanned vehicles will be needed for surveillance, communications, deception, and jamming and can serve as a means of reducing potential loss of U.S. lives.

The next needs driver is based on the ubiquitous surveillance capability, primarily from space-based sensors. The threat of early detection will significantly increase the vulnerability of surface units and militate for the distribution of fire power, including an emphasis on surface platforms that are minimally detectable.

The development of highly accurate, long-range tactical missiles can complement plans to disperse surface units and could inaugurate the Navy triad concept of long-range fire power distributed among surface, air and submerged platforms. Desirable missile characteristics include stealth design, long-range endurance, affordable guidance with back-up to the global positioning system, and advanced conventional warheads.

In the battle space of the future, data gathering, processing, and information dissemination become paramount. Cooperative engagements and intra-force coordination exert unprecedented demands upon the C^3 systems. At the same time, because remaining undetected and achieving surprise become more and more difficult, ship commanding officers will go to extreme measures to deny information about their movements, capability, and intentions. Interconnectivity, with the capability for access from any node or platform, is imperative. That demand requires reconstitutable networks, automated inter-network accessibility and interfaces, improved connectivity below the surface, low-probability-of-intercept (LPI) communications, and reconstitutable satellites.

Third World threats will increase rapidly in sophistication as access to western and Soviet technology expands. This threat will include advanced, non-nuclear submarines and supersonic sea-skimmer missiles for certain, and potentially could include tactical ballistic missiles. Nuclear weapons proliferation will continue and the Biological Warfare/Chemical Warfare threat will expand in scope and severity as the biotechnology revolution materializes.

In addition, Third World nations may be more willing to use weapons of mass effect in what the superpowers have always regarded as limited conflicts. Third World operations differ from global warfare and place demands on forces which include: more stringent Rules of Engagement; greater ambiguity about the adversary's objectives, location, and identification; more restrictive criteria for U.S. losses; and the need to minimize collateral damage. These factors drive system requirements in a similar direction to stealth. Close-range defensive systems for both combatants and non-combatants assume an increasing priority within the Navy's traditional longer-range, defense-in-depth approach to the Soviet threat. Quick response and decision making under stress are crucial factors.

Energy resources, although plentiful and relatively cheap at the present time, have finite reserves. Shortages of world supplies will assuredly recur, limiting operational deployments and restricting training exercises. This factor, when coupled with the shrinking manpower base, will require a paradigm shift in training philosophy. Embedded training and simulation technology offer the potential to reduce the required number of at-sea exercises.

Environmental quality and pollution concerns can be expected to escalate within the U.S. and expand on a worldwide basis. The recent proclamation of the International Convention for the Prevention of Pollution from Ships, banning plastic disposal at sea, is an indication of continuing constraints which will place limitations on military systems and operations. Environmental pollutants can be measured easily and without abatement equipment/procedures, restrictions will be enforced in peacetime denying Naval forces access to overseas bases and training areas.

Numerous studies project a decline in the number of young entrants into the work force and the number of people seeking science and technology degrees. Simultaneously, the continual introduction of high-technology equipment will demand higher skill levels. Competition with industry for a declining number of S&T personnel will intensify pressure on pay comparability. The necessity to strike a balance between manpower and platform costs will drive the Navy of tomorrow to one of smaller numbers, with higher skill levels, longer retention rates, and higher grade levels.

In summary, the naval needs for the future will change in response to a changing threat. Three potential war scenarios were presented -- War at Sea, War Against the Land, and War in the Third World. Naval forces must be structured to respond to all three of these scenarios without concentration to the exclusion of any one. Table 1 summarizes the tasks and dominant forces.

Table 1

NAVAL FORCE REQUIREMENTS

Warfare Category	War at Sea	War Against the Land	War in the Third World
Mission/Task	Sea Denial and Control	Power Projection and Strategic Sea Lift	Presence and Crisis Control
Dominant Forces	CVBG AEGIS MPA SSN SPACE ASW	CVBG MEF (Heavy) Long Range Missiles (C) SSBN SPACE ASW	CVBG MEF (light) Spec/War INTEL SPACE ASW

III. Investments and Rationale

A. Thrusts and Priorities

The Navy's Exploratory Development program is designed to develop new technology both for future-generation systems and for pre-planned product improvement (P^3I) to upgrade current systems which will allow the U.S. Navy to meet the projected threats for the next 15-25 years. At the top level, the program responds to the broad goals and objectives of the Department of Defense (DOD). The DOD long-term goals, listed in Table 2, are derived from the National Defense Strategy which stresses three elements: deterrence, military superiority, and affordability. Two elements of this strategy, deterrence and military superiority, have long been cornerstones of the Defense strategy. Affordability is receiving increased emphasis in view of projected constraints on manpower and funding.

Table 2

DOD LONG-TERM GOALS

DETERRENCE
Goal 1. Weapon systems that can locate, identify, track, and target strategically relocatable targets.
Goal 2. Worldwide, all-weather force projection capability to conduct limited warfare operations (including special operations forces and low intensity conflict) without the requirement for main operating bases, including a rapid deployment force that is logistically independent for 30 days.
Goal 3. Defense against ballistic missiles of all ranges through non-nuclear methods and in compliance with all existing treaties.
MILITARY SUPERIORITY
Goal 4. Affordable, on-demand launch and orbit transfer capabilities for space-deployed assets with robust, survivable command and control links.
Goal 5. Substantial antisubmarine warfare advantages the United States enjoyed until recent years.
Goal 6. Worldwide, instantaneous, secure, survivable, and robust command, control, communications, and intelligence (C3I) capabilities within 20 years, to include: (a) on-demand surveillance of selected geographical areas; (b) real-time information transfer to command and control authority; and (c) responsive, secure communications from decision makers for operational implementation.
Goal 7. Weapon systems and platforms that deny enemy targeting and allow penetration of enemy defenses by taking full advantage of signature management and electronic warfare.
Goal 8. Enhanced, affordable close combat and air defense systems to overmatch threat systems.
Goal 9. Affordable "brilliant weapons" which can autonomously acquire, classify, track, and destroy a broad spectrum of targets (hard fixed, hard mobile, communications nodes, etc.).
AFFORDABILITY
Goal 10. Operations and support resource requirements reduced by 50 percent without imparing combat capability.
Goal 11. Manpower requirements reduced for a given military capability by 10 percent or more by 2010.
Goal 12. Enhanced affordability, producibility, and availability of future weapons systems.

In addition, the Chief of Naval Operations provides guidance which conveys both the technology needs for each area of naval warfare and the relative priorities across these warfare areas. It states that ASW remains the Navy's number-one priority. However, radio electronic battle management and CALOW are areas of increasing importance. The historical preference to utilize naval forces for crisis control and the projected high probability of occurrence of such situations is expected to maintain an operational tempo which will severely stress future naval forces.

The Office of Naval Technology's overall goal is to provide the Navy and Marine Corps with new and improved fleet operational capabilities in the most cost-effective and timely manner possible. This goal is achieved by developing technology to:

- keep ahead of the projected threat
- provide affordable system options
- reduce fleet operating costs
- avoid technological surprise.

Establishing a coherent investment strategy is particularly difficult in the present environment of uncertainty. However uncertain the dynamics and however varied the tasks, certain aspects of warfare that impact the technology base are evident in all scenarios:

- A common thread is conventional weapons with greater precision, longer range and more lethality.
- There will be a need for increased attention to our own signature management and self defense.
- The dimensions of the battlefield will change. The expansion of the ASW region is indicative of this change.
- Technology offers a potential for dramatic change, particularly in sensors and weapons.
- Availability of space assets is becoming more crucial.
- C^3I is pervasive and interconnectivity is more critical for timely response.
- Counter-C^3I is increasing in importance.
- Sustainability in forward areas becomes crucial.

In addition to the threat, the technology base investment strategy must also take into consideration the Navy's acquisition strategy. Two distinct acquisition strategies are possible in the projected environment of "peace" and declining budgets. First, the service-life-extension program could be expanded with the objective of deferring new systems development in order to maintain larger force inventories. Second, emphasis could be placed on retirement of old systems and replacement with new upgraded developments which employ the latest technology and respond to the latest threats.

Since uncertainty in acquisition strategy can be expected to remain with us for several years, during this period of rapid change, the Exploratory Development Program's overarching goal is to develop and maintain a robust technology base which will provide the Navy and the Marine Corps the flexibility to respond to changes in both the threat environment and the acquisition policy, once the specific needs and goals become more crystallized. Thus, the 6.2 program investment objectives are to target resources so as to achieve the following three purposes:

- Ensure the availability of technology needed for identified system developments and product improvements (Systems requirements pull).
- Advance the state-of-the-art in technologies that enable warfighting capabilities needed across the full spectrum of potential naval conflicts (Capabilities pull).
- Establish a technology base for revolutionary new military capabilities (Technology push).

In the present defense atmosphere, we expect the overall need for investment driven by near-term system requirements pull to decrease, but a more concerted effort will be required to deliver the supporting technology base products in a timely manner for the surviving development programs. The capabilities-pull portion of the 6.2 program will receive increased emphasis. The specific timing regarding implementation of needed capabilities may be uncertain, but the technology community cannot afford to wait for definitization of system needs before beginning exploratory development, if the needed technology is to be mature when ultimately required for acquisition programs. Technology push will remain a key element in the 6.2 portfolio, with emphasis commensurate with technological progress in the basic research community.

In more specific terms, the corporate investment strategy for the DON 6.2 Program is to:

- o Ensure that, within available resources, the technology needs for each naval warfare area are met, balancing the portfolio over short-, mid-, and long-term needs, generally emphasizing weapons and surveillance technologies, and their related countermeasures and environmental support factors.
  - Reflect Navy's commitment to ASW as its number-one priority in the 6.2 investment posture.
  - Consider other-service investments in areas of common interest.

- o Provide moderate, sustained support for platform technologies that meet unique Navy and/or Marine Corps needs.
  - Consider DARPA investments in submarine technology.
  - Consider Air Force, industry investments in aerospace technologies.

- o Provide stable, sustained support for mission support areas, such as personnel/training, logistics, biomedical, naval oceanography, environmental protection and chemical/biological (CB) defense, with additional targeted investment in selected high-payoff areas.
  - Coordinate investment with other services in areas of common interest, e.g., biomedical and CB defense.

- o Ensure a stable technology base in core technology areas such as electronic devices, advanced materials, human factors and computer technology, with special emphasis on growing the latter based on a Navy-unique niche investment strategy.
  - Maintain present investment level in DOD critical technologies ($\sim 30\%$).

- o Rebuild/maintain the Independent Exploratory Development (IED) Program at a level equal to 5% of the 6.2 funds managed by those laboratories participating in the IED program.

Specific priorities targeted for special emphasis within the current investment strategy are:

- o ASW and tactical oceanography investments stabilized at FY-90 level of effort, reflecting the $36.8M FY90 Congressional plus-up in those areas.

- o Counterstealth/point defense, concentrating on the integration of weapons and sensors to effectively gain, identify, track, and kill high-speed, low-observable platforms and weapons, and do so affordably.

- o Low Intensity Conflict to include new initiatives in MARCORPS/Amphibious, CB Defense, Special Warfare, Tactical Decision Making Under Stress, Combat Tolerant Ships, Electronic Warfare, and Shallow-water ASW and Mine Countermeasures.

- o Affordability Initiatives aimed directly at the development of technology geared to cost reduction. Emphasis areas include Autonomous Guidance & Control, Manufacturing Technology, Sea Launch and Recovery (SEALAR), Aviation Test & Evaluation technology, and development of a new integrated approach to software system engineering appropriate to the design of complex real-time mission-critical naval systems.

- o Technology push. Targeted investments in key technologies of importance to the Navy: e.g., Solid State Lasers for Submarine Communications, ASW, and Infrared Countermeasures; Superconducting DC Electric Drive for ship propulsion; Biomaterials.

The investment strategy described above, is depicted in Figure 1, which displays the relative resource allocations among the 14 DON 6.2 Program Elements within the FY 1991 President's Budget. Because the changing world environment carries with it investment implications within each warfare mission area, as summarized in previous sections, the programmatic balance across warfare areas that is reflected in this figure is essentially preserved over the next several years.

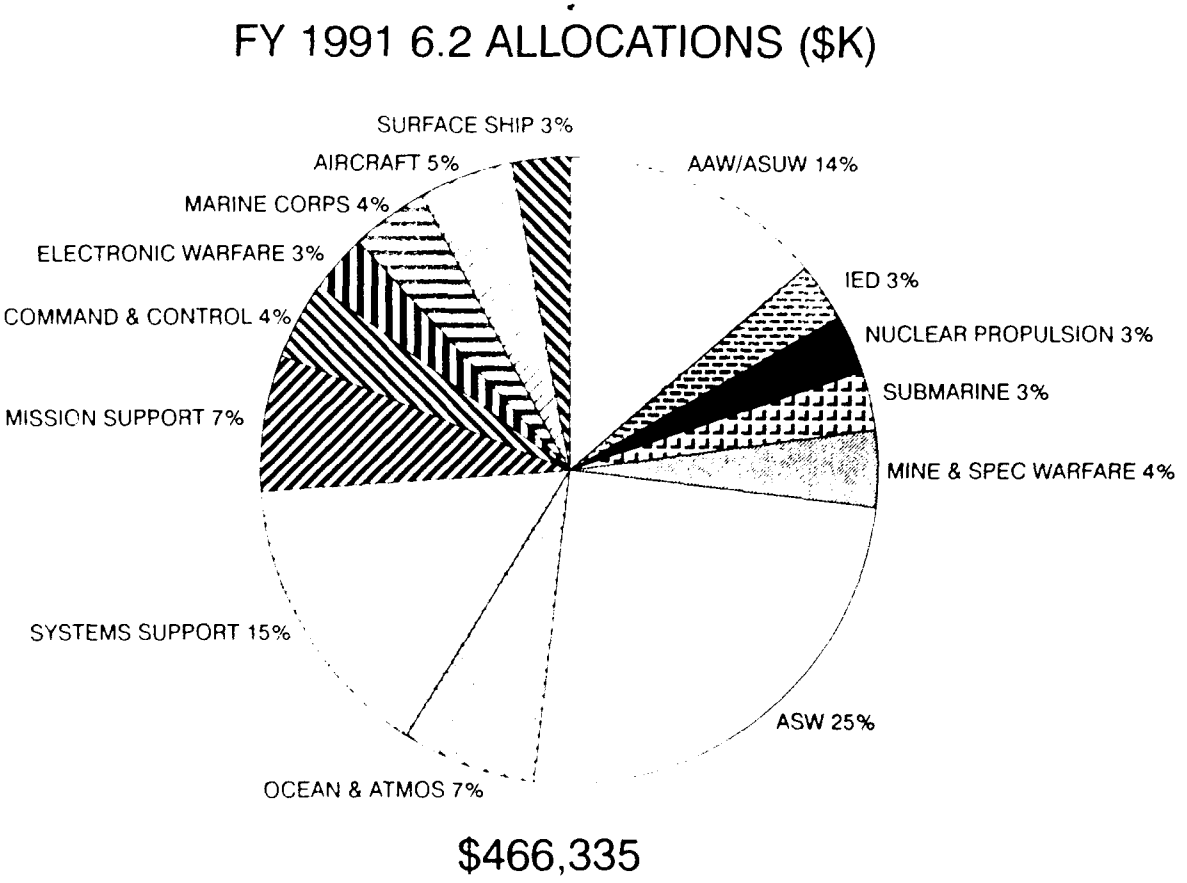


Figure 1

In the context of a changing world environment, projections of expanding Navy and Marine Corps missions and a possible drawdown in force structures require a strong technology base investment and underscore the need for maintaining state-of-the-art technology options critical to supporting the Navy of the 1990's and beyond.

B. Critical Technologies

Public Law 101-189 of November 1989 requires that the Secretary of Defense submit to Congress an annual plan for developing the technologies considered by DOD and DOE to be the most critical to ensuring the long-term qualitative superiority of U.S. weapon systems. The 1990 plan identifies 20 critical technologies. The Navy was an active player in the development of the DOD Critical Technologies Plan. ONT fully supports the plan and is presently investing approximately one-third of its 6.2 program resources in those technologies indicated in Table 3. The Navy also maintains a list of critical technologies which is shown along side the DOD list in Table 4. The similarities between the two lists are apparent but some subtle, yet significant, differences appear upon closer examination. For example, DOD includes only air-breathing propulsion, whereas the Navy emphasis is much broader and includes advanced underwater propulsion concepts. In addition, the DOD list excludes any reference to active sonars -- a Navy-unique technology area whose priority is driven by the number-one priority the Navy has assigned to ASW.

One of the essential elements in ONT's approach to the management of technology is the recognition that achievement of mission-oriented technology objectives normally requires the orchestrated exploration, development, and maturation of a diverse collection of individual technologies. Pursued separately, those same technologies would generally evolve at their own different rates, focus on different research issues, or maybe not be developed at all, because their criticality might be obscured in the absence of central mission-oriented goals and an integrated approach to management. The key to success in the military high-technology arena is to couple the foundational technologies highlighted in the DOD Critical Technologies Plan with Service-managed technology programs supporting specific mission areas and needs. Accordingly, the DON 6.2 program has been and will continue to be developed under a management philosophy that stresses focusing on achieving a mission capability vice focusing on discrete technologies.

Table 3

DOD CRITICAL TECHNOLOGIES VERSUS DON 6.2 PROGRAM MISSION AREAS

DOD CRITICAL TECHNOLOGY	DON 6.2 PROGRAM MISSION AREAS											
	AAW	ASUW	USMC	EW	SHIP	A/C	C^3I	MSN SUPT	SYS SUPT	ASW	SUB	MINE/ SPW
1. SEMICONDUCTOR MATERIALS AND MICROELECTRONIC CIRCUITS				●	●	●	●		●			
2. SOFTWARE PRODUCIBILITY									●			
3. PARALLEL COMPUTER ARCHITECTURES				●		●	●	●	●	●		
4. MACHINE INTELLIGENCE/ROBOTICS		●	●		●	●			●	●		●
5. SIMULATION AND MODELING	●	●	●	●	●	●	●	●	●	●		
6. PHOTONICS	●	●			●	●	●	●	●	●		
7. SENSITIVE RADARS	●	●							●			
8. PASSIVE SENSORS	●	●	●	●		●	●		●	●	●	●
9. SIGNAL PROCESSING	●	●	●	●			●		●	●		●
10. SIGNATURE CONTROL	●	●	●	●	●	●	●		●	●	●	
11. WEAPON SYSTEM ENVIRONMENT	●	●	●					●		●		●
12. DATA FUSION	●	●	●	●		●	●		●	●		
13. COMPUTATIONAL FLUID DYNAMICS	●				●	●				●	●	
14. AIR-BREATHING PROPULSION	●	●				●			●			
15. PULSED POWER	●				●					●		
16. HYPERVELOCITY PROJECTILES	●		●							●		
17. HIGH-ENERGY DENSITY MATERIALS	●	●	●						●	●		
18. COMPOSITE MATERIALS	●	●	●		●	●			●	●	●	
19. SUPERCONDUCTIVITY					●			●	●	●		●
20. BIOTECHNOLOGY MATERIALS/PROCESSES			●					●	●			

Table 4
CRITICAL TECHNOLOGIES LISTS

DOD	NAVY
Semiconductor Materials & Microelectronics Circuits	Advanced Microelectronics
Simulation and Modeling	Human Factors and Training
Photonics	Lasers Electro-Optics Advanced Optical Technology
Passive Sensors	Acoustics
Sensitive Radars	Radar Technology
Signature Control	
Weapon System Environment	Ocean Sciences
Data Fusion Signal Processing Software Producibility Parallel Computer Architectures Machine Intelligence/Robotics	Information Technology
Computational Fluid Dynamics	Hydrodynamics and Control
Air-Breathing Propulsion	Propulsion
Pulsed Power	Directed Energy
Hypervelocity Projectiles	
High-Energy Density Materials	Power Sources
Composite Materials	Advanced Materials and Structures
Superconductivity	Superconductivity
Biotechnology Materials & Processes	Biotechnology

C. Program Execution

The Navy's Exploratory Development Program is managed by the Office of Naval Technology, reporting directly to the Chief of Naval Research (CNR), the Navy's Science and Technology Executive. The 6.2 Program draws upon DON and industrial expertise and the best science emerging from basic research to address current and projected fleet and expeditionary force problems and needs. It emphasizes those areas which offer the greatest potential payoff and are most consistent with DON and DOD warfare requirements.

Figure 2 shows the allocation of funds to the ultimate performers of DON exploratory development. Half of the program is conducted in Navy laboratories and R&D centers and other government organizations. The other half is contracted out to the industrial R&D sector and universities.

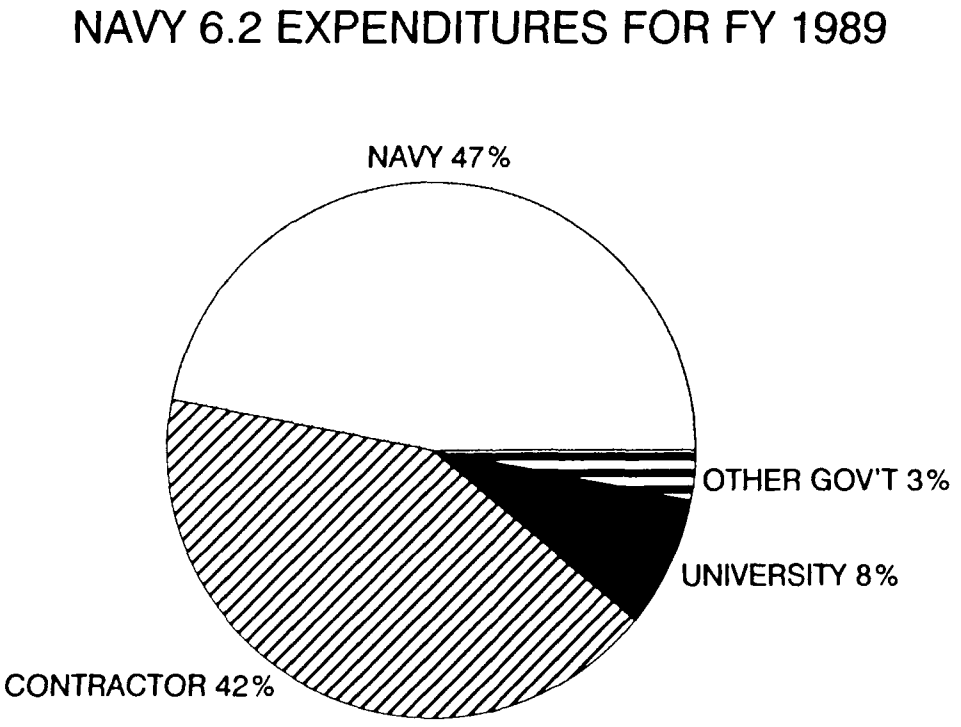


Figure 2

Figure 3 shows the distribution of funds to a wide variety of claimants, including the Navy laboratories and R&D centers, the Systems Commands, the Marine Corps Research, Development and Acquisition Command (MCRDAC), the Naval Medical R&D Command (NMRDC), the Applied Research Laboratory of Penn State University (ARL/PSU), the Naval Observatory (NAVOBS), the Office of Naval Research (ONR), and to ONT itself.

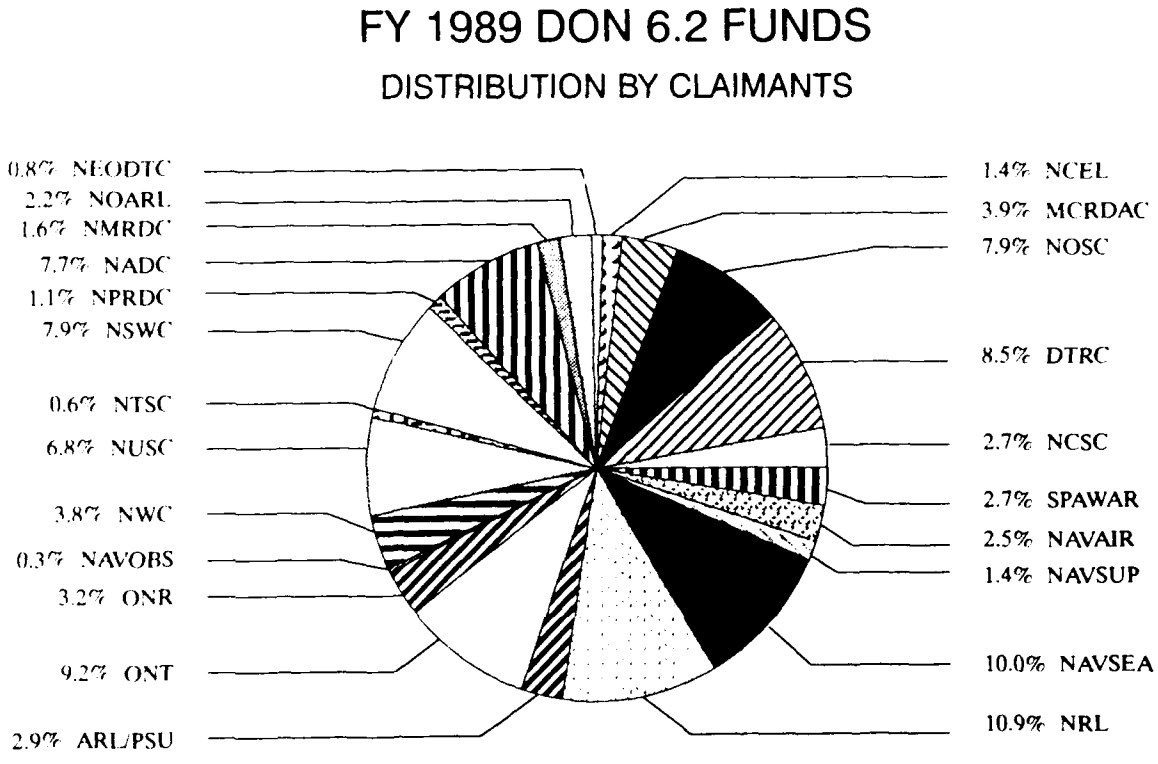
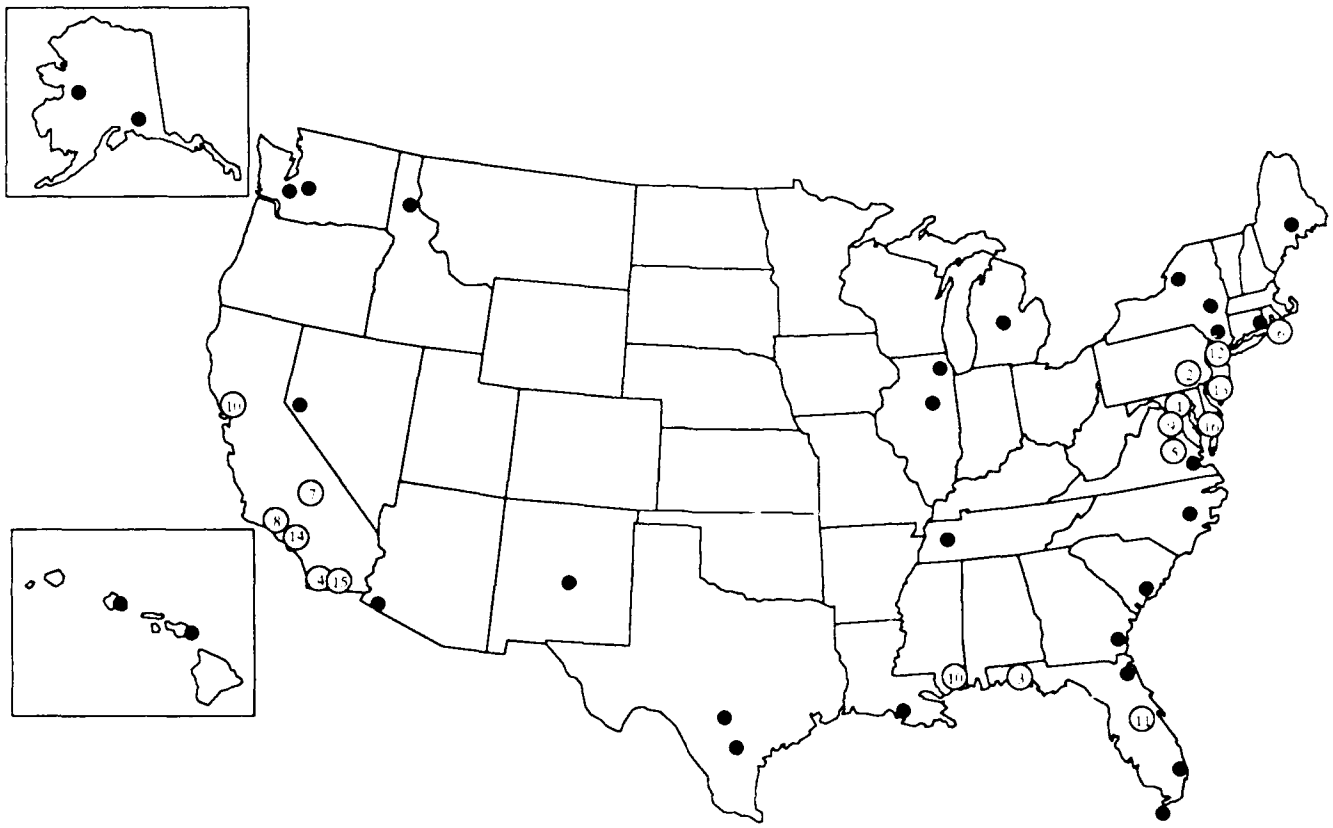


Figure 3

Nationwide, in-house Navy laboratories and R&D centers constitute a base of scientific knowledge and talent tailored to Navy needs (Figure 4). These full-spectrum laboratories and R&D centers play many crucial roles in support of the Navy technology base, the weapons system buyer, and the operational Navy as a whole.

LOCATION OF IN-HOUSE NAVY LABORATORIES AND R&D CENTERS RECEIVING NAVY 6.2 FUNDS



① David Taylor Research Center (DTRC)
② Naval Air Development Center (NADC)
③ Naval Coastal Systems Center (NCSC)
④ Naval Ocean Systems Center (NOSC)
⑤ Naval Surface Warfare Center (NSWC)
⑥ Naval Underwater Systems Center (NUSC)
⑦ Naval Weapons Center, China Lake (NWC)
⑧ Naval Civil Engineering Laboratory (NCEL)
⑨ Naval Research Laboratory (NRL)
⑩ Naval Oceanographic & Atmospheric Research Laboratory (NOARL)
⑪ Naval Training Systems Center (NTSC)
⑫ Naval Air Engineering Center (NAEC)
⑬ Naval Air Propulsion Center (NAPC)
⑭ Pacific Missile Test Center (PMTC)
⑮ Navy Personnel Research and Development Center (NPRDC)
⑰ Naval Explosive Ordnance Disposal Technology Center (NEODTC)

● Detachments

Figure 4

Table 5 illustrates the correspondence of the ONT technology mission areas to the Naval warfare mission areas. These technology mission areas have been defined to be compatible with the major divisions of technology, while still maximizing identification with operational mission areas. Also shown in Table 5 is the relationship between ONT mission areas and the 6.2 Program Element structure. The 6.2 program is organized into 14 program elements keyed to the Naval warfare mission areas.

Table 5

NAVAL WARFARE MISSION AREAS AND CORRESPONDING EXPLORATORY DEVELOPMENT MISSION AREAS AND PROGRAM ELEMENTS

NAVAL WARFARE MISSION AREA	ONT MISSION AREA	PROGRAM ELEMENT
AAW - ANTI-AIR WARFARE	AAW*	62111N
ASU - ANTI-SURFACE SHIP WARFARE STW - STRIKE WARFARE	ASUW*	62111N
ELW - ELECTRONIC WARFARE	EW	62270N
ASW - ANTI-SUBMARINE WARFARE	ASW*	62314N
MIW - MINE WARFARE	MIW*	62315N
NSW - NAVAL SPECIAL WARFARE	SPW	62315N
AMW - AMPHIBIOUS WARFARE	AMW	62131M
MOB - MOBILITY	SHIPS AIRCRAFT SUBMARINES NUCLEAR PROPULSION	62121N 62122N 62323N 62324N
CCC - COMMAND, CONTROL AND COMMUNICATIONS INT - INTELLIGENCE	C^3I*	62232N
CON -CONSTRUCTION FSO - FLEET SUPPORT OPERATIONS LOG - LOGISTICS NCO - NONCOMBAT OPERATIONS STS - STRATEGIC SEALIFT	MISSION SUPPORT**	62233N
MULTI-MISSION	SYSTEMS SUPPORT*** LABORATORY INDEPENDENT EXPLORATORY DEVELOPMENT	62234N 62936N

* INCLUDES OCEAN AND ATMOSPHERIC SUPPORT (P.E. 62435N).

** INCLUDES OCEAN AND ATMOSPHERIC SUPPORT (P.E. 62435N), PERSONNEL, TRAINING AND SIMULATION, CB DEFENSE, LOGISTICS, BIOMEDICAL, AND ENVIRONMENTAL PROTECTION TECHNOLOGY.

*** INCLUDES ELECTRONIC DEVICES, MATERIALS, HUMAN FACTORS AND COMPUTER TECHNOLOGY.

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AAW/ASUW/SURFACE-AEROSPACE TECHNOLOGY DIRECTORATE

DIRECTOR: DR. ELI ZIMET 696-4771

PROGRAM ELEMENT	62111N:	ANTI-AIR/ANTI-SURFACE WARFARE TECHNOLOGY SURFACE AEROSPACE WEAPONRY SURFACE AEROSPACE TARGET SURVEILLANCE MISSILE PROPULSION TACTICAL DIRECTED ENERGY
	62270N:	ELECTRONIC WARFARE TECHNOLOGY
	62121N:	SHIP TECHNOLOGY
	62122N:	AIRCRAFT TECHNOLOGY
	62131M:	MARCORPS LANDING FORCE TECHNOLOGY

SUPPORT TECHNOLOGIES DIRECTORATE

DIRECTOR: MR. JAMES CAUFFMAN 696-4791

PROGRAM ELEMENT	62232N:	COMMAND, CONTROL, COMMUNICATIONS & INTELLIGENCE TECHNOLOGY
	62233N:	MISSION SUPPORT TECHNOLOGY
	62234N:	SYSTEMS SUPPORT TECHNOLOGY

ANTI-SUBMARINE WARFARE/UNDERSEA TECHNOLOGY DIRECTORATE

DIRECTOR: DR. ALBERT J. FAULSTICH 696-5120

PROGRAM ELEMENT	62314N:	ANTI-SUBMARINE WARFARE TECHNOLOGY UNDERSEA TARGET SURVEILLANCE UNDERSEA WARFARE WEAPONRY
	62315N:	MINE & SPECIAL WARFARE TECHNOLOGY
	62323N:	SUBMARINE TECHNOLOGY
	62324N:	NUCLEAR PROPULSION
	62435N:	OCEAN AND ATMOSPHERIC SUPPORT TECHNOLOGY

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PROGRAM ELEMENT	62936N:	LABORATORY INDEPENDENT EXPLORATORY DEVELOPMENT

THE CHALLENGE ... FOR DON 6.2

IDENTIFY THE OPPORTUNITIES,
FOCUS THE RESOURCES,
MATURE THE TECHNOLOGIES ...
THAT WILL TAKE THE NAVY AND MARINE CORPS INTO THE 21ST CENTURY ...

AND DO THIS IN AN EVER MORE CONSTRAINED FISCAL ENVIRONMENT

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