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# TRI-SERVICE SCIENCE & TECHNOLOGY RELIANCE

## ANNUAL REPORT
## December 1992



**Prepared By:**
**JOINT DIRECTORS OF LABORATORIES**



**Approved for Public Release**

# FOREWORD

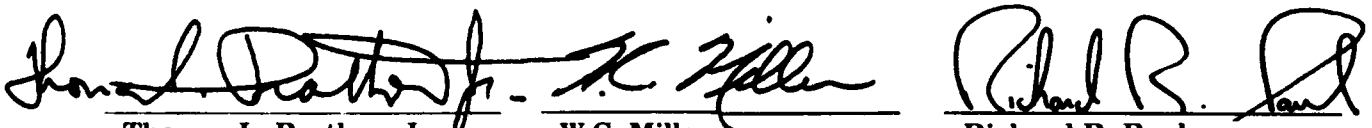
The National Security Strategy of the United States depends on technological superiority to counter the military numerical superiority of its potential adversaries. From World War II, through the depths of the Cold War and through Operation Desert Storm, Defense Science and Technology (S&T) has provided vital technology support to the men and women of our Armed Forces.

Achieving and maintaining technological superiority is the enduring mission of the S&T community of the Department of Defense. It is a demanding task: technology is rapidly changing and even relatively small technology advances can cause dramatic shifts in military effectiveness. The three Military Departments, working cooperatively, must vigorously pursue technology development to succeed in their respective missions and responsibilities.

Today, the Defense S&T community faces unprecedented challenges in fulfilling its mission. Not only has the rate of technology change continued to accelerate, but it also has proliferated internationally. And with victory achieved in the Cold War, the specific missions of the Military Departments themselves are undergoing realignment to better address the new world environment. The national security consequences of failing to adjust to these changes have never been greater.

These major geopolitical and technological changes required effective responses from the S&T community. In late 1989, the Military Departments, working with the Office of the Secretary of Defense, began designing the blueprints for the most comprehensive restructuring of Defense S&T management in their history. Called **Tri-Service S&T Reliance,** this restructuring established unprecedented levels of inter-Service cooperation in the development of Defense S&T (budget categories 6.1, 6.2, and 6.3A).

This report summarizes the findings and accomplishments of **Tri-Service S&T Reliance** in its first year of activity. As can be seen enormous strides have been achieved by Reliance in its short history. But this does not mean that Reliance is nearing completion. Far from it. Reliance is an ongoing process, one that will be managed to optimally meet the highly complex and changing geopolitical and technical environment. It is our strong belief that the Reliance process, as developed by the Military Departments, provides a model for effectively managing military S&T activity which can be used throughout the Department of Defense well into the 21st Century. With such a process, the entire Defense S&T community can better meet the formidable challenges to our national security.



**Thomas L. Prather, Jr.**
**Major General, USA**
**DCS/Research, Development, and Engineering**

**W.C. Miller**
**Rear Admiral, USN**
**Chief of Naval Research**

**Richard R. Paul**
**Brigadier General, USAF**
**DCS/Science & Technology**

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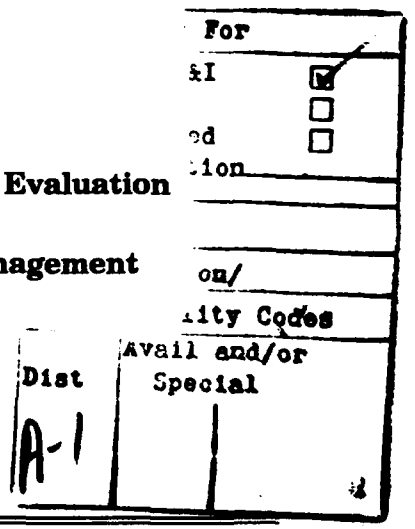

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# EXECUTIVE SUMMARY

Tri-Service Science and Technology (S&T) Reliance is a set of formal agreements among and implemented by the Military Departments for joint planning, collocated in-house work or lead Service assignment, which cover the bulk of non-Service-unique portions of the Service 6.1, 6.2, and 6.3A programs. Joint planning performed under Tri-Service S&T Reliance encompasses both in-house and related contract research and development in the Services. Reliance also is a formal process, authorized by each Service Acquisition Executive, and approved by the Deputy Secretary of Defense, that helps streamline the S&T programs of the Military Departments and which better positions the national Defense S&T investment to respond to the challenges of the future.

Responsibility for managing the Reliance implementation process was assigned to the Joint Directors of Laboratories (JDL).

Specifically, the JDL assumed the responsibility to:

- Define and approve areas for overseeing and planning Reliance cooperative programs,
- Establish cooperative programs through Technology Panels in designated areas, and
- Provide oversight for Services carrying out Reliance recommendations.

The goals of Tri-Service S&T Reliance are to:

- Enhance the quality of Defense S&T activities (defined as budget categories 6.1, 6.2, and 6.3A).
- Ensure the existence of a critical mass of resources that will develop "world class" products.
- Reduce redundant S&T capabilities and eliminate unwarranted duplication.
- Gain productivity efficiency through collocation and consolidation of in-house S&T work, when appropriate.
- Preserve the vital mission-essential capabilities of the Services throughout the process.

Tri-Service S&T Reliance develops joint Service planning through four major management oversight bodies: the Joint Directors of Laboratories (providing general oversight for Reliance as well as specific joint planning for Combat Materiel); the Armed Services Biomedical Research, Evaluation and Management Committee (ASBREM); the Training and Personnel Systems Science and Technology Evaluation and Management Committee (TAPSTEM); and the Joint Engineers (for Civil Engineering and Environmental Quality).

As shown in Figure ES-1, the S&T investments from the three Services comprise about $5.0 billion of the $11.7 billion total DoD S&T investment for Fiscal Year 1993. Of the total $5.0 billion Service S&T investment for FY93, approximately $3.0 billion of activities fall under the scope of the Reliance joint planning process.

Of the jointly planned programs under Reliance for FY93, approximately $2.4 billion are contained in jointly planned, jointly executed programs, with the remaining $0.6 billion comprising jointly planned programs that are being executed by a single Service. All Basic Research activities of the three Services are jointly planned under the Reliance process. Furthermore, over 1700 individual Service efforts involving 6.2 and 6.3A activities also are under the Reliance joint planning process.

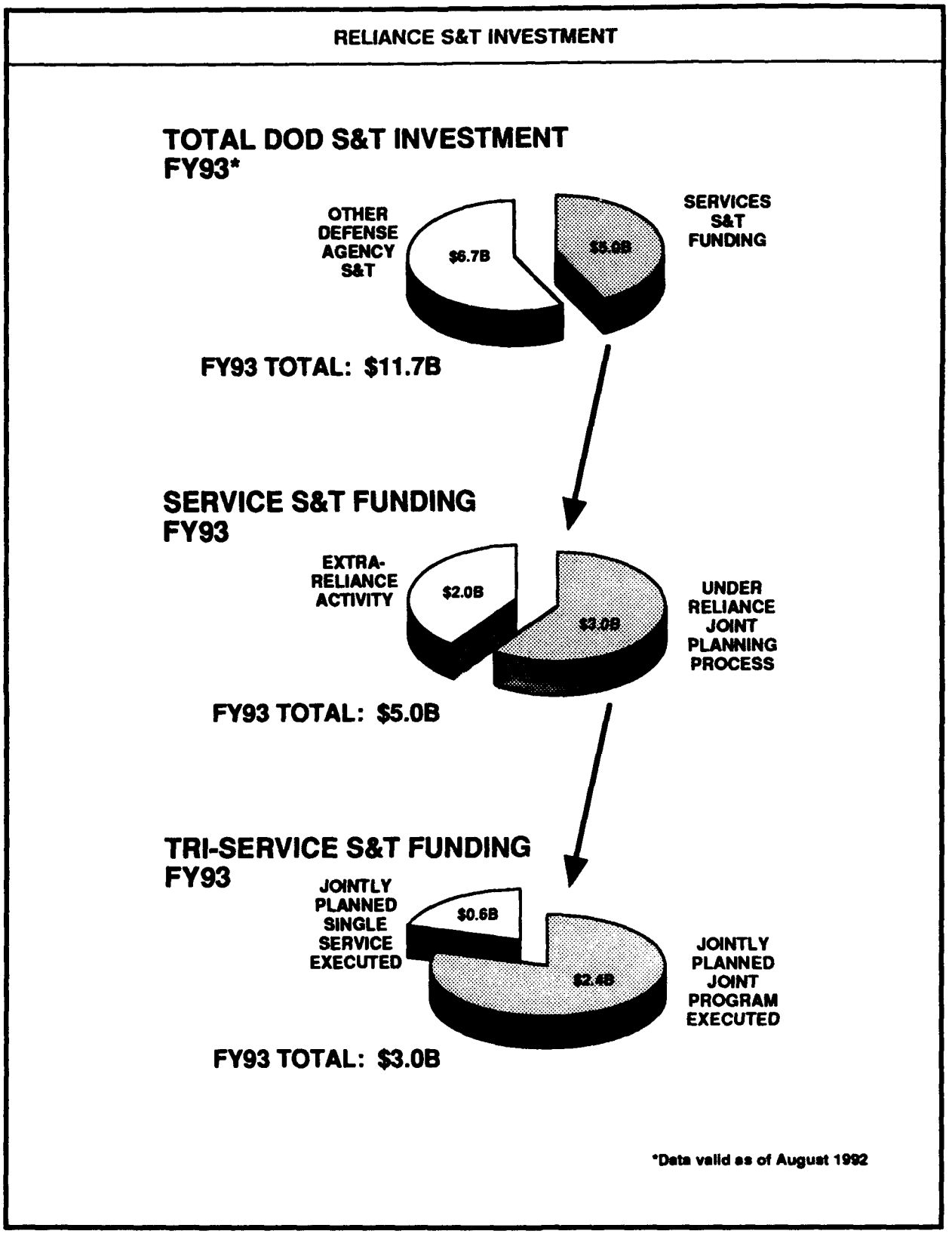
RELIANCE S&T INVESTMENT
TOTAL DOD S&T INVESTMENT
FY93*
OTHER DEFENSE AGENCY S&T
$6.7B
SERVICES S&T FUNDING
FY93 TOTAL: $11.7B
SERVICE S&T FUNDING
FY93
EXTRA-RELIANCE ACTIVITY
$2.0B
UNDER RELIANCE JOINT PLANNING PROCESS
FY93 TOTAL: $5.0B
TRI-SERVICE S&T FUNDING
FY93
JOINTLY PLANNED SINGLE SERVICE EXECUTED
$0.6B
JOINTLY PLANNED JOINT PROGRAM EXECUTED
FY93 TOTAL: $3.0B
*Data valid as of August 1992

Figure ES-1

Progress in Reliance for this year can be grouped into four important areas of achievement:

1. The creation of a common Tri-Service S&T management architecture.
2. The development of formal Tri-Service Agreements which span 311 technology topics.
3. The development and execution of Joint Service Program Plans.
4. The integration of the Reliance Process into the S&T Thrust Areas of the Office of the Secretary of Defense (OSD)

Next year the scope of Reliance will expand to include participation by the Strategic Defense Initiative Organization (SDIO). This expansion will substantially increase the amount of DoD S&T investment that falls under joint planning.

Reliance has created the framework needed to systematically develop joint program plans. The JDL will work to maintain the momentum already established and to further improve the joint planning process. Through its Management Panel, the JDL will:

- Review and update the reporting requirements of the Annual Reports and Joint Service Program Plans.
- Expand Tri-Service-wide data resources (and their availability) to ensure greater consistency among Reliance participants in their use of terms and to facilitate management data exchange.
- Continue to work with OSD and other organizations to increase the effectiveness and relevancy of Tri-Service S&T Reliance planning.

The JDL will ensure that the following events occur which will successfully incorporate SDIO into the Reliance family:

1. Conduct a review of the existing Reliance Technology Taxonomy to determine if any modifications will be required in order to support the creation of joint planning agreements between SDIO and the other Reliance participants.
2. Create new joint planning agreements that involve the technology areas relevant to SDIO and the Services.
3. Modify existing reporting and data dissemination practices to include SDIO-related information and joint program plans.
4. Create new administrative bodies, as needed, to implement joint planning that includes SDIO.

In addition to formally inviting SDIO into the Reliance joint planning process, the SAEs have also invited the Office of the Director for Defense Research & Engineering (ODDR&E), the Defense Advanced Research Projects Agency (DARPA), and the Defense Nuclear Agency (DNA) to participate. These invitations are in consonance with an ODDR&E recommendation approved by the Deputy Secretary of Defense on 1 October 1992.

Per instruction of the Deputy Secretary of Defense, the S&T Program will be developed as a joint effort with Service/Agency participation under the guidance of the Defense Technology Board. The output baseline is an integrated set of S&T POM inputs reflecting jointly developed S&T priorities by program element/project for incorporation into each Service's/Agency's respective POMs.

An overview of Tri-Service S&T Reliance may be found in Section A of this report. A discussion of Reliance effectiveness and general progress to date may be found in Section B (including selected examples of Reliance effectiveness). The JDL Management Action plan is described in Section C. The appendices provide substantial fiscal data and management accomplishments from the Reliance Oversight bodies.

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# OVERVIEW

## A. OVERVIEW OF TRI-SERVICE S&T RELIANCE

### 1. Objectives and Management Structure

Tri-Service S&T Reliance is a set of formal agreements among and implemented by the Military Departments for joint planning, collocated in-house work or lead Service assignment, which cover the bulk of non-Service-unique portions of the Service 6.1, 6.2, and 6.3A programs (Science and Technology). Joint planning performed under Tri-Service S&T Reliance encompasses both in-house and related contract research and development in the Services. Reliance also is a formal process, authorized by each Service Acquisition Executive, and approved by the Deputy Secretary of Defense, that helps streamline the S&T programs of the Military Departments and which better positions the national defense S&T investment to respond to the challenges of the future.

Tri-Service S&T Reliance is a response to concerns expressed by senior officials in the Department of Defense about the continued viability of maintaining a "business-as-usual" approach to S&T development in the defense technology base, given victory in the Cold War and the new international situation.

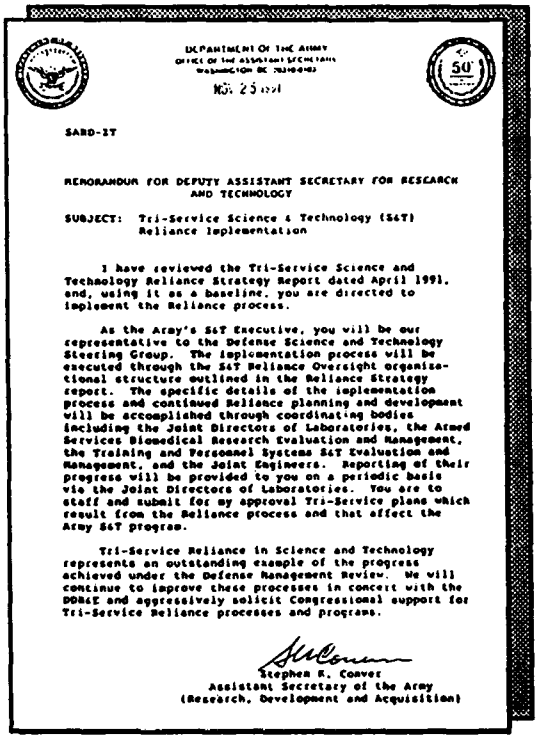
In October 1989, Deputy Secretary of Defense Donald Atwood issued a draft Defense Management Report Decision Initiative which challenged the Services to create a new approach to S&T management that would increase efficiency and reduce unwarranted overlap in the Research, Development, Test and Evaluation (RDT&E) activities of the Military Departments. By the summer of 1990, the three Services had jointly developed a coordinated proposal for the Deputy Secretary of Defense that further outlined approaches to RDT&E laboratory consolidation and inter-Service Reliance in S&T and Test and Evaluation (T&E). Mr. Atwood approved the Tri-Service coordinated proposal in concept and the Services began tasking individual groups to identify ways to achieve laboratory consolidation within the Services and to achieve greater inter-Service reliance for S&T and T&E. On 12 October 1990, the formal Tri-Service S&T Reliance study began, addressing the full range of the Services' S&T activities; namely, their 6.1, 6.2, and 6.3A programs. The Reliance Study Phase produced the blueprints for substantially greater joint planning in S&T. (The Study Phase was formally concluded in March 1991).

In November 1990, Mr. Atwood signed the final version of the DMR Initiative which formally adopted the inter-Service Reliance initiative, acknowledged the savings already achieved by the individual Service consolidation initiatives, and tasked the Services to proceed with plans for restructuring and streamlining their RDT&E activities.

In March 1991, the findings and agreements of the Reliance Study phase were accepted by the Executive Steering Committee and presented to the Service Acquisition Executives (SAE's). Subsequently, it was agreed that the Implementation Phase of Tri-Service S&T Reliance would be performed under the Defense Technology Working Group (DTWG) of the Defense Technology Board (DTB) through the Tri-Service S&T Executives.

By 25 November 1991, all three Service Assistant Secretaries for Research, Development and Acquisition had reviewed the Reliance process and had directed its full implementation in their respective Services. Figure 1 displays the three memoranda directing the implementation of the Reliance Process, with responsibility for managing the implementation process being assigned to the Joint Directors of Laboratories. Each Service retains its individual execution infrastructure.

## IMPLEMENTING LETTERS



DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON DC 20310-0103

NOV 25 1991

SARD-ZT

MEMORANDUM FOR DEPUTY ASSISTANT SECRETARY FOR RESEARCH AND TECHNOLOGY

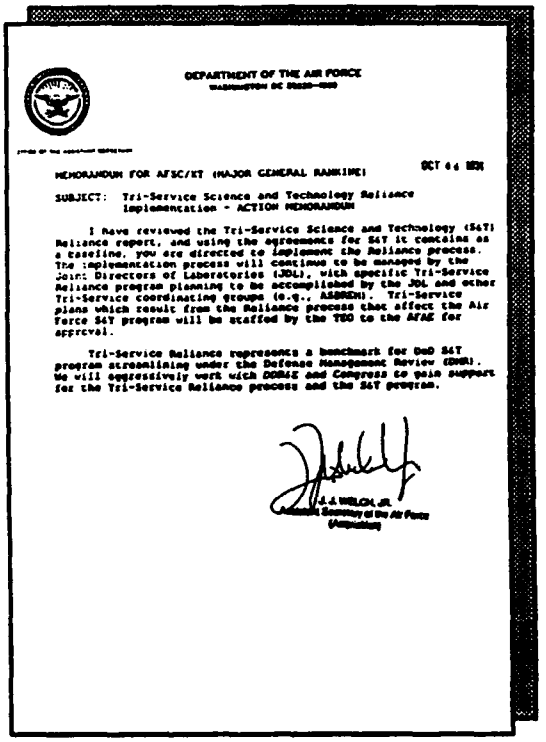
SUBJECT: Tri-Service Science & Technology (S&T) Reliance Implementation

I have reviewed the Tri-Service Science and Technology Reliance Strategy Report dated April 1991, and, using it as a baseline, you are directed to implement the Reliance process.

As the Army's S&T Executive, you will be our representative to the Defense Science and Technology Steering Group. The implementation process will be executed through the S&T Reliance Oversight organizational structure outlined in the Reliance Strategy report. The specific details of the implementation process and continued Reliance planning and development will be accomplished through coordinating bodies including the Joint Directors of Laboratories, the Armed Services Biomedical Research Evaluation and Management, the Training and Personnel Systems S&T Evaluation and Management, and the Joint Engineers. Reporting of their progress will be provided to you on a periodic basis via the Joint Directors of Laboratories. You are to staff and submit for my approval Tri-Service plans which result from the Reliance process and that affect the Army S&T program.

Tri-Service Reliance in Science and Technology represents an outstanding example of the progress achieved under the Defense Management Review. We will continue to improve these processes in concert with the DDR&E and aggressively solicit Congressional support for Tri-Service Reliance processes and programs.

Stephen K. Conver
Assistant Secretary of the Army
(Research, Development and Acquisition)



DEPARTMENT OF THE AIR FORCE
WASHINGTON DC 20330-1000

OCT 4 4 1991

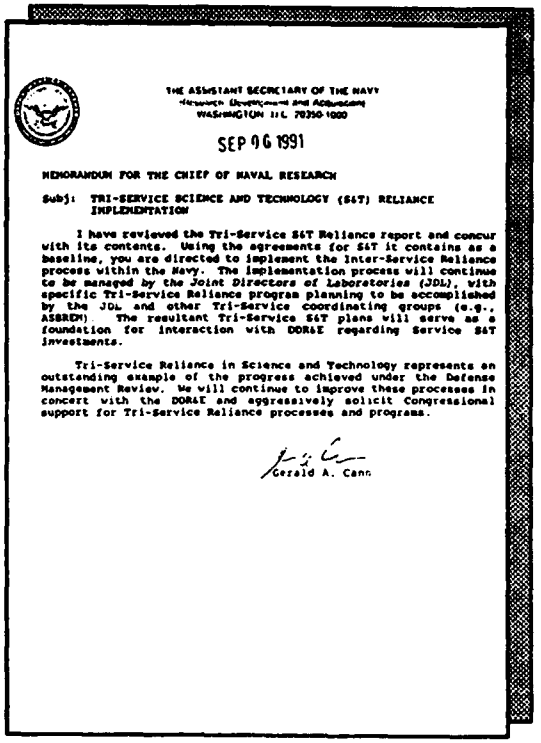
MEMORANDUM FOR AFSC/XT (MAJOR GENERAL RANKINE)

SUBJECT: Tri-Service Science and Technology Reliance Implementation - ACTION MEMORANDUM

I have reviewed the Tri-Service Science and Technology (S&T) Reliance report, and using the agreements for S&T it contains as a baseline, you are directed to implement the Reliance process. The implementation process will continue to be managed by the Joint Directors of Laboratories (JDL), with specific Tri-Service Reliance program planning to be accomplished by the JDL and other Tri-Service coordinating groups (e.g., ASBREM). Tri-Service plans which result from the Reliance process that affect the Air Force S&T program will be staffed by the TSO to the AFAE for approval.

Tri-Service Reliance represents a benchmark for DoD S&T program streamlining under the Defense Management Review (DMR). We will aggressively work with DDR&E and Congress to gain support for the Tri-Service Reliance process and the S&T program.

A. J. WELCH, JR.
Assistant Secretary of the Air Force
(Acquisition)



THE ASSISTANT SECRETARY OF THE NAVY
(Research, Development and Acquisition)
WASHINGTON D.C. 20350-1000

SEP 06 1991

MEMORANDUM FOR THE CHIEF OF NAVAL RESEARCH

Subj: TRI-SERVICE SCIENCE AND TECHNOLOGY (S&T) RELIANCE IMPLEMENTATION

I have reviewed the Tri-Service S&T Reliance report and concur with its contents. Using the agreements for S&T it contains as a baseline, you are directed to implement the Inter-Service Reliance process within the Navy. The implementation process will continue to be managed by the Joint Directors of Laboratories (JDL), with specific Tri-Service Reliance program planning to be accomplished by the JDL and other Tri-Service coordinating groups (e.g., ASBREM). The resultant Tri-Service S&T plans will serve as a foundation for interaction with DDR&E regarding Service S&T investments.

Tri-Service Reliance in Science and Technology represents an outstanding example of the progress achieved under the Defense Management Review. We will continue to improve these processes in concert with the DDR&E and aggressively solicit Congressional support for Tri-Service Reliance processes and programs.

Gerald A. Cann

Figure 1

Specifically, the JDL assumed the responsibility to:

- Define and approve areas for overseeing and planning Reliance cooperative programs,
- Establish cooperative programs through technical panels in designated areas, and
- Provide oversight for Services carrying out Reliance recommendations.

The formal objectives of Tri-Service S&T Reliance were developed by the Military Departments during the Reliance Study Phase. These objectives reflect the enduring challenges that face the Defense S&T Community. The goals of Tri-Service S&T Reliance are to:

- Enhance the quality of Defense S&T activities (defined as budget categories 6.1, 6.2, and 6.3A).
- Ensure the existence of a critical mass of resources that will develop "world class" products.
- Reduce redundant S&T capabilities and eliminate unwarranted duplication.
- Gain productivity efficiency through collocation and consolidation of in-house S&T work, when appropriate.
- Preserve the vital mission-essential capabilities of the Services throughout the process.

Tri-Service S&T Reliance develops joint Service planning through four major management oversight bodies: the Joint Directors of Laboratories (providing general oversight for Reliance as well as specific joint planning for Combat Materiel); the Armed Services Biomedical Research, Evaluation and Management Committee (ASBREM); the Training and Personnel Systems Science and Technology Evaluation and Management Committee (TAPSTEM); and the Joint Engineers (for Civil Engineering and Environmental Quality). The JDL was substantially reorganized in response to the Reliance process. The JDL created or modified 12 Technology Panels and a Basic Research Panel to provide the forum for developing joint plans in Combat Materiel. The Joint Engineers was newly created, explicitly to support the Reliance process. Both ASBREM and TAPSTEM existed prior to Reliance and remain viable management and coordination vehicles for their respective areas. (See Figure 2.)

**S&T RELIANCE OVERSIGHT BODIES**

- JDL PANELS
  - ADVANCED MATERIALS
  - BASIC RESEARCH
  - COMPUTER SCIENCES
  - DIRECTED ENERGY WEAPONS
  - ELECTRONIC WARFARE
  - SENSORS
  - CHEMICAL/BIOLOGICAL DEFENSE*
  - AIR VEHICLES
  - COMMAND, CONTROL, AND COMMUNICATIONS**
  - CONVENTIONAL AIR/SURFACE WEAPONRY
  - ELECTRONIC DEVICES
  - ENVIRONMENTAL SCIENCES
  - SPACE VEHICLES
  - MANAGEMENT PANEL***
- TAPSTEM PANELS
  - MANPOWER AND PERSONNEL
  - TRAINING SYSTEMS
- ASBREM PANELS
  - COMBAT CASUALTY CARE
  - HUMAN SYSTEMS TECHNOLOGY
  - INFECTIOUS DISEASE
  - IONIZING RADIATION
  - MEDICAL BIOLOGICAL DEFENSE
  - MEDICAL CHEMICAL DEFENSE
  - MILITARY DENTISTRY
- JOINT ENGINEERS PANELS
  - CIVIL ENGINEERING
  - ENVIRONMENTAL QUALITY

* Established October 1992
** Now includes Astrometry, previously under the JDL Management Panel
*** JDL Management Panel provides oversight to verify compliance with Reliance agreements in the following areas: clothing, textiles and food; fuels & lubes; unmanned ground vehicles; nuclear weapons effects; and ships and watercraft

**Figure 2**

The Reliance process obtains guidance from the Office of the Secretary of Defense (OSD) and OSD's policy formulation bodies. Strategic guidance from OSD, the Joint Chiefs of Staff (JCS), and the Services provides the mission statements, warfighting requirements, and rationale required by the S&T community for it to define and implement an effective Service S&T program.

## 2. The Scope of Reliance S&T Investment

Reliance currently has identified 31 technology areas, plus basic research, that are of importance to two or more Services, and has brought Service activities in each of these areas under joint planning. The 31 technologies are subdivided into 311 technology topics (arranged hierarchically by Technology Area, Subarea, and Sub-subarea, as shown in Appendix A). This common technology structure (referred to as the Reliance Technology Taxonomy) provides the framework used by the Services to create and implement the formal Reliance inter-Service agreements. Figure 3 lists the Reliance Technology Areas. Specific changes made to the Taxonomy since the January 1992 publication of the "White Paper on Tri-Service Reliance in Science and Technology" include the addition of Advanced Materials, Crew Systems, and Directed Energy Weaponry. The scope of Reliance expanded into these areas due to multi-service interests in these subjects. Furthermore, the Software Technology Area was expanded in scope to become the much broader Computer Sciences Technology Area so as to encompass software, hardware, and protocols between hardware. These changes clearly reflect the dynamic scope of the Reliance Taxonomy.

**RELIANCE TECHNOLOGY AREAS**

- ADVANCED MATERIALS
- AEROPROPULSION
- AIR VEHICLES (FIXED WING)
- AIR VEHICLES (ROTARY)
- ASTROMETRY
- CHEMICAL & BIOLOGICAL DEFENSE
- CIVIL ENGINEERING*
- CLOTHING, TEXTILES AND FOOD
- COMMUNICATIONS, COMMAND & CONTROL
- COMPUTER SCIENCES (FORMERLY SOFTWARE)
- CONVENTIONAL AIR/SURFACE WEAPONRY
- CREW SYSTEMS
- DIRECTED ENERGY WEAPONRY
- ELECTRO-OPTICS
- ELECTRONIC DEVICES
- ELECTRONIC WARFARE
- ENVIRONMENTAL QUALITY*
- ENVIRONMENTAL SCIENCES
- EXPLOSIVE ORDNANCE DISPOSAL
- FUELS AND LUBRICANTS
- GROUND VEHICLES
- INTEGRATED AVIONICS
- MANPOWER AND PERSONNEL**
- MEDICAL***
- NUCLEAR WEAPONS EFFECTS
- RADAR
- SHIPS/WATERCRAFT
- SMALL ARMS
- SPACE VEHICLES
- TRAINING SYSTEMS**
- UNMANNED GROUND VEHICLES

*and*

- BASIC RESEARCH

* Oversight by Joint Engineers
** Oversight by TAPSTEM
*** Oversight by ASBREM
Oversight for all others by JDL

**Figure 3**

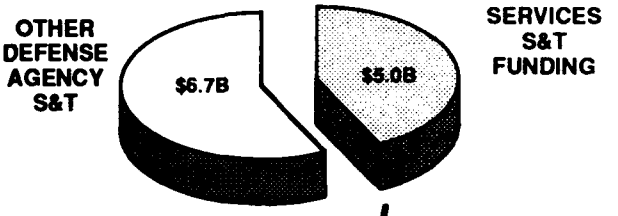
As shown in Figure 4, the S&T investments from the three Services comprise about $5.0 billion of the $11.7 billion total DoD S&T investment for Fiscal Year 1993. Of the total $5.0 billion Service S&T investment for FY93, approximately $3.0 billion of activities fall under the scope of the Reliance joint planning process, with the remaining $2.0 billion of FY93 Service S&T activity consisting of extra-Reliance efforts (i.e. efforts that are outside of the list of technology activities of benefit to more than one Service). Tri-Service S&T Reliance therefore leverages about 60% of the total FY93 Service S&T investment.

Of the jointly planned programs under Reliance for FY93, approximately $2.4 billion are contained in jointly planned, jointly executed programs, with the remaining $0.6 billion comprising jointly planned programs that are being executed by a single Service. All Basic Research activities of the three Services are jointly planned under the Reliance process. Furthermore, over 1700 individual Service efforts involving 6.2 and 6.3A activities also are under Reliance joint planning.

Next year the scope of Reliance will expand to include participation by SDIO. This expansion will substantially increase the amount of DoD S&T investment that falls under joint planning.

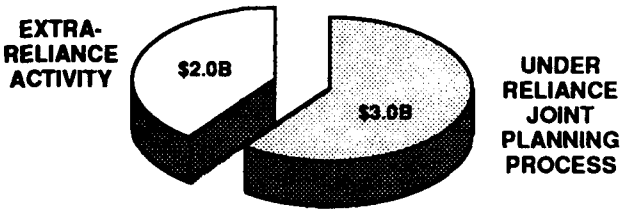
## RELIANCE S&T INVESTMENT

### TOTAL DOD S&T INVESTMENT FY93*



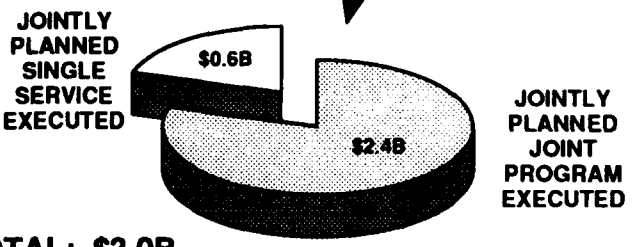

**FY93 TOTAL: $11.7B**

### SERVICE S&T FUNDING FY93




**FY93 TOTAL: $5.0B**

### TRI-SERVICE S&T FUNDING FY93




**FY93 TOTAL: $3.0B**

*Data valid as of August 1992

Figure 4

## 3. The Joint Planning Process

Joint planning is performed by the four Reliance Oversight bodies (the JDL, Joint Engineers, ASBREM, TAPSTEM and their subordinate organizations) and is scheduled in coordination with the PPBS and the program execution processes of the Military Departments and the OSD Planning process, as shown in Figure 5. After formulation by the individual Technology Panels and review by the individual Services, the joint plans are reviewed and approved by each cognizant oversight body. The joint plans are then executed by the individual Services with the joint aspects overseen by the appropriate Technology Panel.

In addition to overseeing the overall Reliance process, the JDL has direct responsibility for joint planning in the broad area of Combat Materiel (inclusive of 26 of the 31 total Reliance technology areas). Joint Planning in these 26 technology areas is performed through the 12 JDL Technology Panels shown in Figure 6. The Technology Panels focus primarily upon 6.2 and 6.3A budget activities, but may include some Basic Research (6.1) activities, if these activities are strongly linked to the technology areas of interest to the Panel. The Basic Research Panel focuses upon the bulk of Service 6.1 activities. The JDL Management Panel provides management oversight within the JDL and handles special cases of selected technology activities for which no Technology Panel was judged to be necessary. New Panels may be created as needed to effect joint planning.

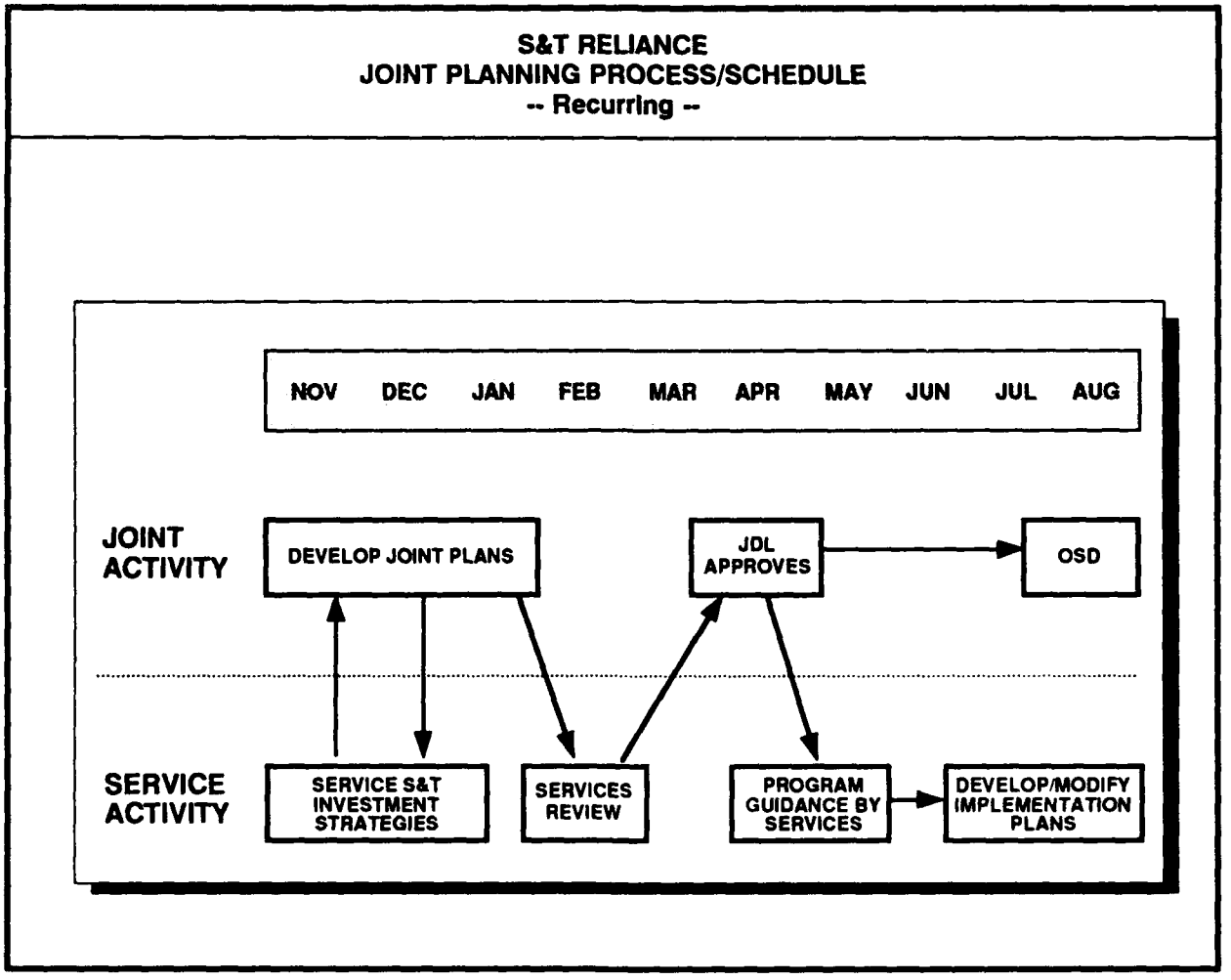



Figure 5

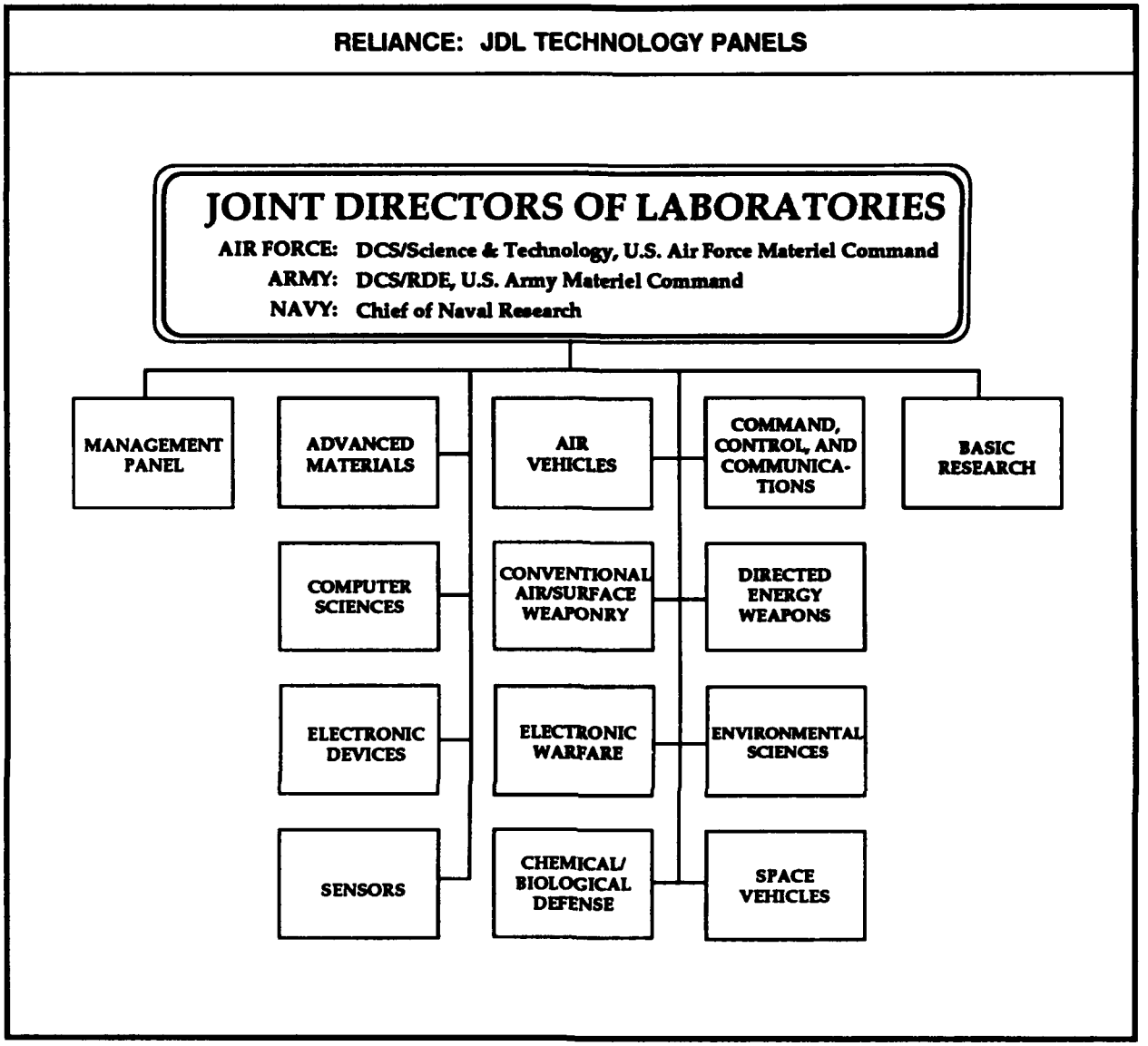



**Figure 6**

The 12 Technology Panels of the JDL are tasked each year to produce a Joint Service Program Plan (JSPP) which details the formal planning agreements for the individual technology programs under each Panel's jurisdiction. The Basic Research Panel produces an Annual Report of its joint activities.

Basic Research has a pervasive impact in development of Science and Technology. Basic Research (6.1) initiates the S&T development process and is closely followed by Exploratory Development (6.2) and Advanced Development (6.3A). Because of its pervasive influence, Basic Research must be closely coordinated with the work of the JDL Technology Panels and other Oversight bodies. To achieve this coordination, the JDL Basic Research Panel has created 12 Tri-Service Scientific Planning Groups (SPG's), each explicitly linked to the Reliance Oversight bodies (see Figure 7).

The FY93 JSPPs from the JDL Technology Panels (and Annual Report from the Basic Research Panel) were reviewed by the JDL in April 1992 and approved in June 1992. Summaries of these JSPPs may be found in the appendices of this Report.

## LINKAGES BETWEEN TRI-SERVICE SCIENTIFIC PLANNING GROUPS AND RELIANCE OVERSIGHT BODIES

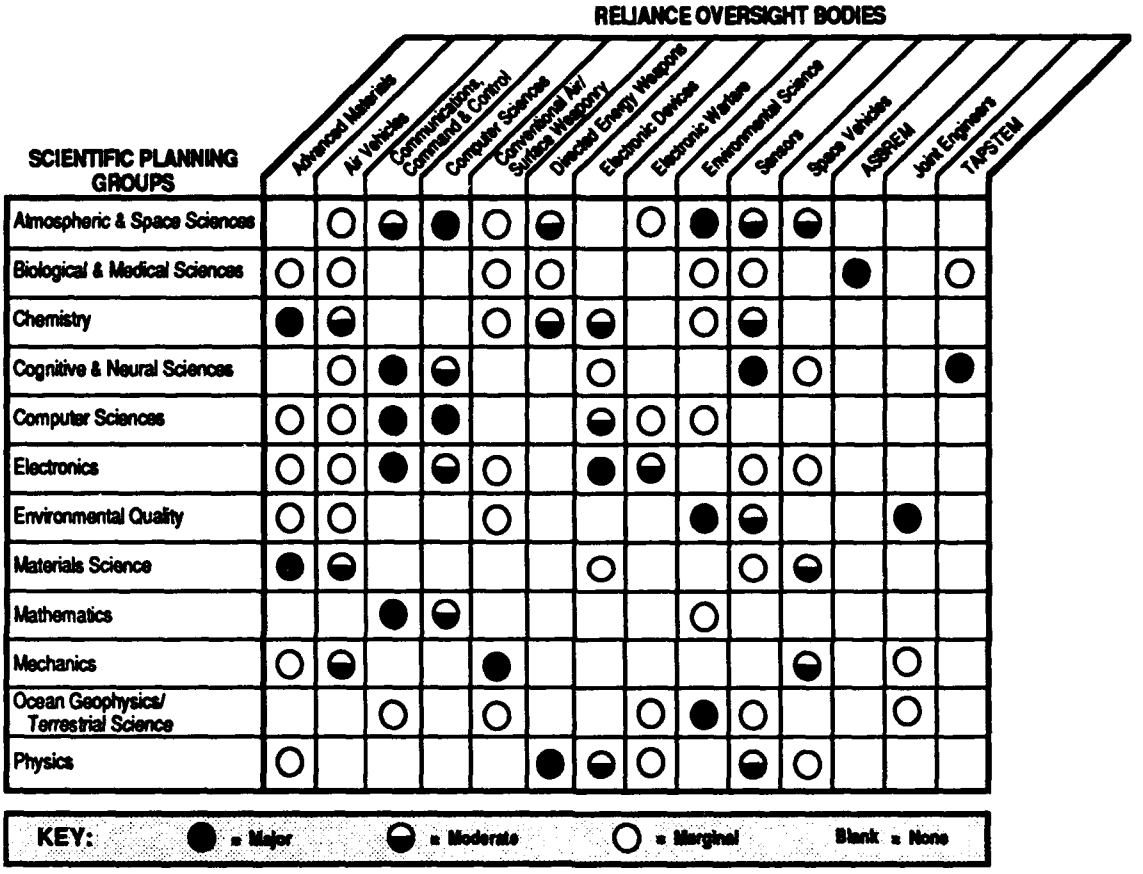



Figure 7

# HIGHLIGHTS

## B. HIGHLIGHTS OF RELIANCE EFFECTIVENESS

### 1. General Progress to Date

Defense S&T is an investment in the future, designed not only to provide the best warfighting technology in the world, but also to help maintain future force structure options while creating substantial "downstream" savings in the later, cost-intensive stages of the Defense Acquisition cycle.

The Reliance process has made substantial progress in its first year of implementation, permitting the three Services to enjoy the full benefits of Tri-Service S&T Reliance in FY93. And, while Reliance provides greater efficiency within today's Service S&T activities, its most important contributions to U.S. National Security will be seen in the long term.

Progress in Reliance for this year can be grouped into four important areas of achievement:

1. The creation of a common Tri-Service S&T Management Architecture.
2. The development of formal Tri-Service Agreements which span 311 technology topics.
3. The development and execution of Joint Service Program Plans.
4. The integration of the Reliance Process into the OSD S&T Thrust Areas.

### 1.a. Creation of a Common Tri-Service Management Architecture

The Reliance process coordinates the individual S&T management structures of each Service into a common Tri-Service management architecture (described above in Section A of this report). Each Service preserves its individual execution infrastructure in the Reliance process. Therefore, each Service (or any future Reliance participant) may better leverage the benefits of joint planning without unnecessarily disrupting program execution.

### 1.b. Creation of Formal Tri-Service Agreements

The Reliance process formally defines six categories of inter-Service cooperation, ranging from Category 1 (the baseline of coordination activity among the Services prior to the creation of the Reliance process), to higher categories of inter-Service Reliance, ending with Category 6, which recognizes that certain S&T programs will be unique to a given Service, having little or no applicability to the needs of the other Services (see Figure 8 for the definitions of the Reliance categories).

**TRI-SERVICE S&T RELIANCE CATEGORIES**

| CATEGORIES | DEFINITIONS |
|---|---|
| 1. Coordinated | Information Exchange, Separate Funds, Separate Sites |
| 2. Joint Efforts | Common/Linked Objectives, Joint Plans, Separate Funds, Multiple Sites |
| 3. Collocation | Separate Funds - Single In-house Site |
| 4. Consolidation | Lead Service Funded |
| 5. Competition | Separate Funds - Multiple Sites In-house Performer Decisions Made Competitively Across Services |
| 6. Service Unique | Funded By Affected Service |

**Figure 8**

An early goal of the Reliance process was to formally move Tri-Service coordination activities from their pre-Reliance baseline to higher categories of inter-Service S&T Reliance. Figure 9 shows the progress made toward that goal. Prior to Reliance, Tri-Service joint planning was predominantly a Category 1 endeavor, with only 6 Reliance Technology Topics falling under Category 2 (Joint Efforts), 13 Technology Topics falling under Category 3 (Collocation), and 9 Technology Topics falling under Category 4 (Consolidation).

By the end of 1991, the Reliance process had successfully moved Tri-Service cooperative activities to higher modes of Reliance, reducing Category 1 activities from its original 173 technology topics to just 1, increasing Category 2 activities to 71 technology topics, increasing Category 3 activities to 105 technology topics, and increasing Category 4 to 10 technology topics.

Since 1991, Reliance has continued to reach higher modes of Tri-Service cooperation. Reliance today spans 311 technology topics (compared to the original 220). To date the Services have formally agreed to:

- 150 technology topics that will implement Joint Efforts (Category 2).
- 130 technology topics that will implement Collocation (Category 3), and
- 12 technology topics that will implement Consolidation (Category 4).

Category 5 (Competition) is retained as an option for the future should higher modes of Reliance not be achieved.

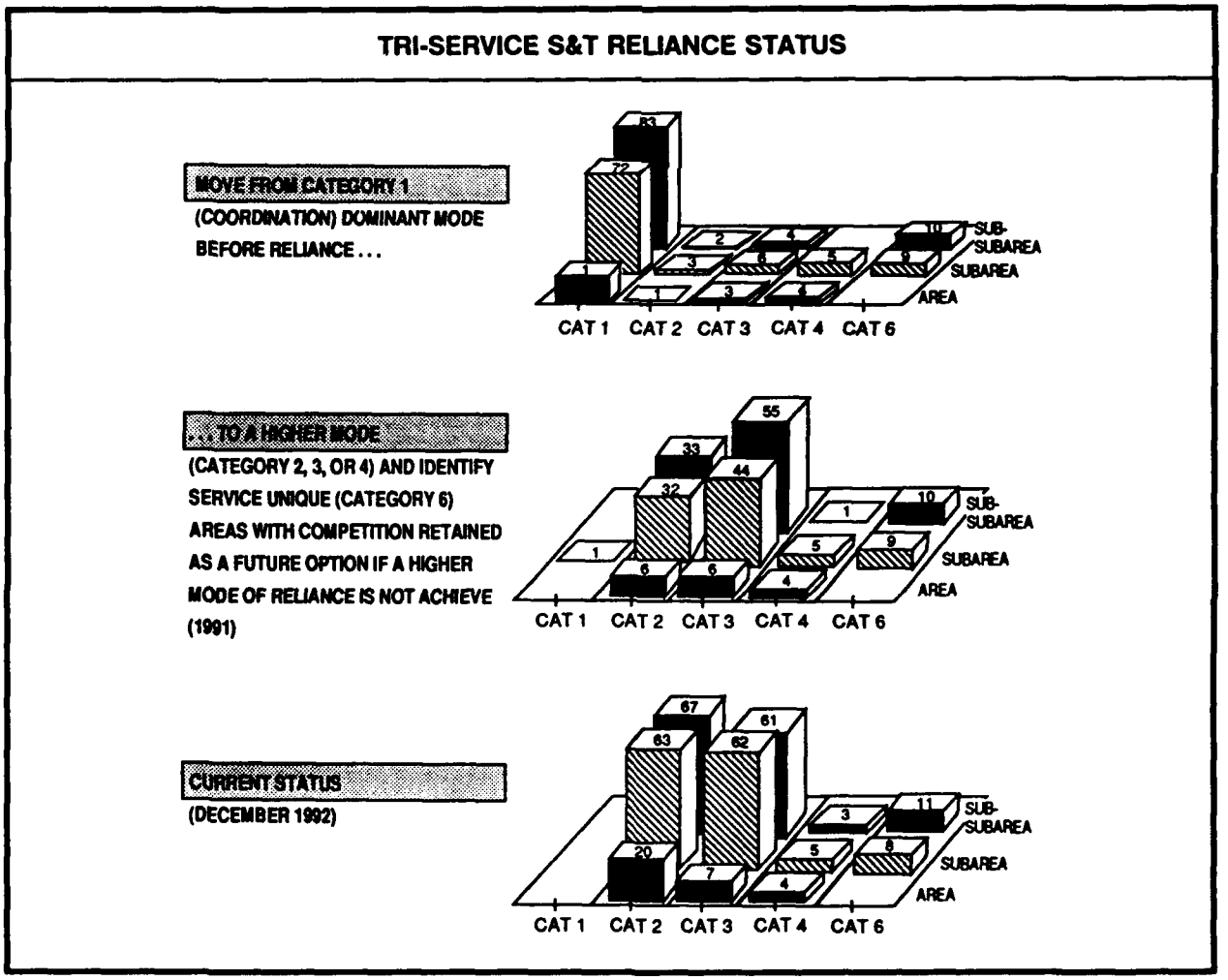



Figure 9

### 1.c. First Year Developments

The Reliance Oversight Bodies (the JDL, Joint Engineers, TAPSTEM and ASBREM) report the following developments in their first full year of activity:

- Collocations of Resources. Reliance has agreed to 130 technology topics for collocation, with many collocations already accomplished. (See Appendix A for the status of the collocation activities currently underway in Reliance.)
- Program Enhancements. In FY93, Reliance plans to substantially modify over 100 Service S&T efforts. Program enhancements can occur when jointly planned activities reduce unwarranted overlap of effort, or when the Services restructure their mutual activities for a more efficient mix of resources. Usually, it is more cost-effective to restructure an existing program than it is to terminate it, but the Reliance activity has resulted in program terminations in some cases.
- Creation of New Joint Programs. The Reliance process has created more than 30 new joint programs for FY93 (see Figure 10 for a selected list).

**SELECTED LIST OF JOINT PROGRAMS CREATED UNDER RELIANCE**

- JDL TECHNOLOGY PANEL SENSORS
  - TRI-SERVICE MULTICHANNEL AIRBORNE MEASUREMENTS AND ANALYSIS PROGRAM
  - JOINT USAF/USN NON-COOPERATIVE AIRCRAFT ID PROGRAM FOR ULTRA-HIGH RANGE RESOLUTION AND 2D IMAGING
  - JOINT USN/USAF WIDEBAND SHARED APERTURE PROGRAM
  - USN/USA SURFACE-BASED EO PROGRAM
- JDL TECHNOLOGY PANEL AIR VEHICLES
  - ELECTRICALLY POWERED ACTUATION DESIGN VALIDATION
  - FIBER OPTIC CONTROL SYSTEM INTEGRATION PROGRAM
  - POWER-BY-WIRE PROGRAM
  - HIGH POWER MICROWAVE EFFECTS ON FLIGHT CONTROL
- JDL TECHNOLOGY PANEL $C^3$
  - ADVANCED TECHNOLOGY TACTICAL RADIO (SPEAKEASY)
  - COOPERATIVE NETWORK MANAGEMENT PROGRAM
  - HF DATA NETWORK SIMULATION PROGRAM
- JDL TECHNOLOGY PANEL COMPUTER SCIENCES
  - TOUCHSTONE ALPHA PROGRAM
- JDL TECHNOLOGY PANEL DIRECTED ENERGY WEAPONS
  - HPM SOURCE DEVELOPMENT
  - SPLIT CAVITY OSCILLATORS
  - HPM HARDENING TECHNOLOGY
  - RELATIVISTIC KLYSTRON AMPLIFIER
- JDL TECHNOLOGY PANEL CONVENTIONAL AIR/SURFACE WEAPONRY
  - CONVENTIONAL GUN COLLOCATION AT ARMY ARDEC
  - DIAMOND IR TRANSPARENCIES PROGRAM

**Figure 10**

### 1.d. Integrating Reliance into the OSD S&T Thrust Areas and Key Technologies

All JDL Panels (Technology and Basic Research) incorporate the strategic guidance of OSD and other appropriate organizations directly into their joint planning process. Each Panel reports its achieved linkage to that guidance. During the course of FY92, two important new guidance documents were developed by OSD: The Defense S&T Strategy (which formulates the seven S&T Thrust Areas) and the OSD Key Technologies Plan. Reliance worked closely with all levels of OSD guidance contained in these documents in developing its joint program plans for FY93.

The seven S&T Thrust Areas (shaded grey in Figure 11) are supported, directly and indirectly, through the Tri-Service JDL Technology Panels (represented by the ovals surrounding the thrust areas in Figure 11). Some Panels have pervasive impact on the thrust areas, such as Advanced Materials, Computer Sciences, Electronic Devices and Environmental Sciences (shown at the bottom of Figure 11). Other Panels combine to support one or more Thrust Areas directly (as shown at the top of Figure 11). Of course, the S&T Thrusts have broader scope than obtained from a purely joint Service perspective. Each Service also contributes individually to the various Thrust Areas (such as the Navy supporting the Sea Control and

Undersea Superiority Thrusts independently of Tri-Service S&T Reliance). Figure 12 shows further elaboration of the effort provided by the JDL Technology Panels in support of the seven S&T Thrust Areas. The Reliance process also coordinates its planning with available Key Technologies guidance from OSD.

**RELIANCE SUPPORT FOR THE SEVEN S&T THRUSTS**

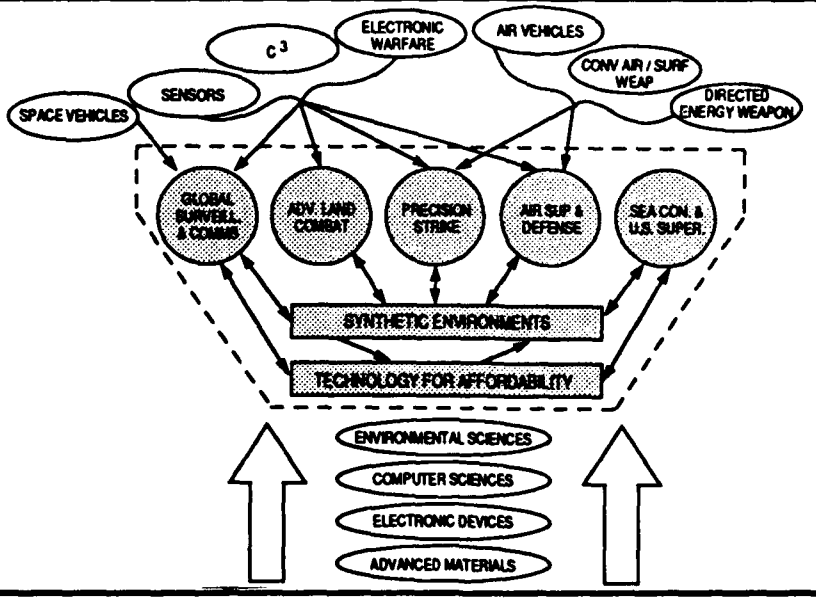



**Figure 11**

**TECHNOLOGY PANEL CONNECTIVITY TO DOD THRUST AREAS**

| DOD S&T THRUST AREA | SENSORS | C3 | ELECTRONIC WARFARE | SPACE VEHICLES | AIR VEHICLES | AIR / SURFACE WEAPONRY | DIRECTED ENERGY WEAPONS | ENVIRONMENTAL SCIENCES | COMPUTER SCIENCES | ELECTRONIC DEVICES | ADVANCED MATERIALS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. GLOBAL SURVEILLANCE AND COMMUNICATIONS | ● | ● | ● | ● | | | | ● | ● | ● | ○ |
| 2. PRECISION STRIKE | ● | ● | ● | | ● | ● | | ● | ● | ● | ● |
| 3. AIR SUPERIORITY / DEFENSE | ● | ● | ● | ○ | ● | ● | ● | ● | ● | ● | ● |
| 4. SEA CONTROL / UNDERSEA SUPERIORITY | ○ | ○ | | | | ○ | | ● | ● | ● | ● |
| 5. ADVANCED LAND COMBAT VEHICLES | ● | ● | ● | | | ○ | ○ | ○ | ● | ○ | ● |
| 6. TECHNOLOGY FOR TRAINING AND READINESS | ○ | ○ | ○ | | ○ | | | ● | ● | ○ | |
| 7. IMPROVED ACQUISITION TIME AND COST | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ● | ● | ● |

KEY: ● STRONGLY SUPPORTS ○ SOMEWHAT SUPPORTS — DOES NOT APPLY

**Figure 12**

## 2. Selected Examples of Reliance Accomplishments

The Plans and reports of the Reliance Oversight bodies contain hundreds of examples of the progress of Reliance to date. The appendices present summaries of the accomplishments reported for FY93 program execution. The following selected examples from Figure 10 provide insight concerning the benefits now being derived from the Reliance process.

Some of the major accomplishments are as follows:

1. Tri-Service S&T Reliance has established a Surface-Based Electro-Optics Program for the co-development (Army and Navy) of land- and sea-based dual-color Infrared Search and Track (IRST) sensor, algorithm, and processor technology. The program includes joint testing, data analysis, algorithm validation and establishment of a multi-color database leading to a common IRST system;
2. The Air Force and Navy, along with NASA, are developing affordable and reliable Power-By-Wire (PWB) flight control actuators for Tri-Service applications on tactical, transport, rotary wing and commercial aircraft. All three participants are making unique contributions to this coordinated effort;
3. The three Services, working together under Tri-Service S&T Reliance, have embarked on the Advanced Technology Tactical Radio (SPEAKEASY) program to develop a modular, multi-band, multi-function programmable radio system capable of operating in multiple frequency bands. Since the architecture is being specially designed to accommodate improvements in the device and signal processing areas, technology upgrades for improved performance will be accomplished easily and with minimal costs -- resulting in long-term efficiencies through the extended life cycle of the radio system;
4. Working with DARPA's High Performance Computing program, the JDL Computer Sciences Panel developed a Tri-Service initiative aimed at accelerating the insertion of modern architecture computer systems into DoD. Four 8-node Intel Touchstone computers were provided by DARPA to Ballistics Research Laboratory (Army), Naval Research Laboratory (Navy), and Wright and Phillips Laboratories (Air Force), with remote access to CalTech's 512-node machine, and are being used to increase understanding of the utility of the Touchstone's massively parallel architecture for solving important DoD problems such as weapons system simulations, electromagnetic field computations, computational fluid dynamics, and aerodynamic design;
5. Under S&T Reliance the Army has conducted the High Power Microwave (HPM) hardening technology program for the three Services, produced a Tri-Service hardening handbook, performed a demonstration of hardening of an aircraft transponder, and completed the development and evaluation of hardening devices for microwaves; and
6. The Tri-Service S&T Reliance program in Conventional Guns collocates Service conventional gun S&T efforts at the Army's Armament RDE Center (ARDEC). A Reliance agreement has been concluded which collocates Navy and Air Force conventional gun S&T efforts at ARDEC. The Navy and Air Force plan to complete and then terminate their S&T work in this area in FY93.

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# FUTURE

## C. MANAGEMENT ACTION PLAN

The Management Action Plan builds upon the progress of Reliance and incorporates new management initiatives that will leverage the lessons learned over the preceding 18 months as well as exploit new opportunities for enhancing the quality of defense-related S&T.

The JDL recognizes that **Tri-Service S&T Reliance** is an on-going process. In its first full year of implementation:

- A new Tri-Service management architecture has been created, is operational, and is fulfilling its mission.
- Joint Tri-Service Technology Areas have been identified with formal Tri-Service agreements constructed under them.
- The first Joint Service Program Plans (JSPPs) have been developed, approved, and are being executed.
- Tri-Service data resources have been created and distributed for planning support.

Fiscal Year 1993 will realize the full benefits inherent within the Reliance process as the JSPPs are executed within each Service.

### 1. Adapting to Change

Technologies will change, individual Service capabilities will evolve, and joint activities that make sense today may need substantial revision just a few years from now. While each Service will continue to adapt individually to the changing environment, it also is important for the Reliance process to adapt to that environment as well. **Tri-Service S&T Reliance** will be constantly reviewed in light of changing domestic and international conditions and must be modified as warranted by developments.

#### 1.a. Managing Technology Change

Each JDL Technology Panel monitors the technology situation, both domestically and internationally, in its respective areas. The Reliance process must occasionally be modified to reflect such change. For example, Reliance also must continue to adapt its Technology Taxonomy (and the formal agreements made possible through it) as new participants join **Tri-Service S&T Reliance** and as technology itself changes.

Appendix A details the current Reliance Taxonomy structure and highlights changes made to that structure since its publication by the JDL in "White Paper on Tri-Service Reliance in Science and Technology" in January 1992. These changes, and others made by the Reliance process, range from altering Panel assignments for individual technology topics, through the creation of special working groups to handle unique technology "niches," through the potential creation of entirely new Technology Panels. In particular, Reliance assessments of human factors and logistics technology have been initiated.

Reliance has created the framework needed to systematically develop joint program plans. The JDL will work to maintain the momentum already established and to further improve the joint planning process. Through its Management Panel, the JDL will:

- Review and update the reporting requirements of the Annual Reports and JSPPs.
- Expand Tri-Service-wide data resources (and their availability) to ensure greater consistency between Reliance participants in their use of terms and to facilitate management data exchange.
- Continue to work with OSD and other organizations to increase the effectiveness and relevancy of Tri-Service S&T Reliance planning.

### 1.b. Quickly Responding to Guidance

The Reliance process incorporates policy requirements as determined by OSD and other appropriate policy formulation bodies. Such policy requirements are likely to change over time in order to respond to a dynamic international situation; Reliance provides a means by which significant policy guidance and strategy (and changes therein) may be effectively communicated to the Services and successfully implemented. Through the Reliance process, each JDL Technology Panel is tasked with the responsibility to integrate this guidance directly into its joint planning process. In this way, the Reliance process will provide an effective mechanism that is capable of efficiently coordinating Service S&T responsiveness to evolving guidance.

### 1.c. Leveraging International Technology

Technology change today is international in character. Not only does Reliance optimally coordinate existing Service S&T resources, but it also works to identify opportunities for leveraging the technology resources of U.S. allies. Because the Reliance process incorporates the international program community of each Service, it is now possible to fully leverage existing Service international technology agreements (and help design new ones) from a Tri-Service perspective. The Reliance process thus enables the Services to manage change through their international programs, including Data Exchange Agreements (DEAs), International Exchange Programs (IEPs) and other international activities.

## 2. Exploiting New Opportunities

Reliance provides new opportunities for even better management of this nation's vital S&T resources. Realizing the new opportunities for improving the effectiveness of the nation's defense S&T investment is a continuing objective of the Reliance process and the JDL.

### 2.a. Expand the Planning Process

The inclusion next year of the SDIO is a major expansion of the Reliance process. The JDL will take the following steps to ensure the successful incorporation of SDIO into the Reliance family:

1. Conduct a review of the existing Reliance Technology Taxonomy to determine if any modifications are required to support the creation of Joint Planning agreements between SDIO and the other Reliance participants.
2. Create new joint planning agreements that involve the technology areas relevant to SDIO and the Services.
3. Modify existing reporting and data dissemination practices to include SDIO-related information and joint program plans.
4. Create new administrative bodies, as needed, to implement joint planning that includes SDIO.

In addition to securing SDIO's participation in the Reliance joint planning process, the JDL will explore expansion of Reliance to other Department of Defense agencies and organizations, as well as to selected non-DoD government agencies funding defense-related S&T programs.

# APPENDICES

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# APPENDIX A

# RELIANCE TAXONOMY CHANGES AND AGREEMENT SUMMARIES

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# APPENDIX A
# TRI-SERVICE S&T RELIANCE
# TECHNOLOGY TAXONOMY AND RELIANCE AGREEMENTS

[Parenthetical notations indicate Reliance Category Number (1,...,6) and participating Services (Army = A, Navy = N, Air Force = F). Also noted are the applicable oversight body (JDL, ASBREM, TAPSTEM, or Joint Engineers) and, in the case of the JDL, the applicable Panel.]

| CURRENT TAXONOMY | CHANGE FROM WHITE PAPER | COLLOCATED/ CONSOLIDATED S&T SITE |
|---|---|---|
| **Tech Area: Advanced Materials (2ANF) (Oversight Body: JDL - Advanced Materials Panel)** | New Topic | |
| ● Structural Materials (2ANF) | New Topic | |
| – Metallic Alloys & Composites (2ANF) | New Topic | |
| – Non-Metallic & Composite Materials (2ANF) | New Topic | |
| ● High Temperature Materials (2ANF) | New Topic | |
| – Metals & Intermetallics (2ANF) | New Topic | |
| – Ceramics (2ANF) | New Topic | |
| – Carbon-Carbon Composites (2NF) | New Topic | |
| ● Armor & Anti-Armor Materials (2AN) | New Topic | |
| – Armor Materials (3A) | New Topic | ARL, TACOM |
| – Anti-Armor Materials (2AN) | New Topic | |
| ● Electromagnetic Protection Materials (2ANF) | New Topic | |
| – Ground Based EM Protection Materials (2ANF) | New Topic | |
| – Space Based Hardened Materials (4F) | New Topic | WL |
| ● Electrical, Magnetic, & Optical Materials (2ANF) | New Topic | |
| – Superconductor Materials (2NF) | New Topic | |
| – Magnetic & Magnetorestrictive Materials (3N) | New Topic | NRL |
| – Electromagnetic Transp. Materials (2ANF) | New Topic | |
| – Nonlinear Optical Materials (2ANF) | New Topic | |
| – Electro-Ceramic Materials (3A) | New Topic | ARL |
| ● Special Function Materials (2ANF) | New Topic | |
| – Fire Retardant Materials (3N) | New Topic | NSWC/CD, NRL |
| – Paints, Coatings & Cleaning Materials (2ANF) | New Topic | |
| – Fluids & Lubricants (2ANF) | New Topic | |
| – Elastomers and Seal (2ANF) | New Topic | |
| – Chemical & Bio-Protection Materials (3A) | New Topic | CRDEC, NRDEC |
| – Thermal Management Materials (2NF) | New Topic | |
| ● Bio-Molecular Materials & Processes (2ANF) | New Topic | |
| ● Materials Processing/Manufacturing Research (2ANF) | New Topic | |
| – Process Modeling & Control (2ANF) | New Topic | |
| – Forming & Net Shape Processes (2ANF) | New Topic | |
| – Joining (2ANF) | New Topic | |
| ● Non-Destructive Inspection Evaluation (NDI/E) Technology (2ANF) | New Topic | |
| – Adv. Matls. & Processes Dev. NDE (2ANF) | New Topic | |
| – Manufacturing NDI/E (2ANF) | New Topic | |
| – In-Service Performance Integrity/Life Monitoring (2ANF) | New Topic | |

| CURRENT TAXONOMY | CHANGE FROM WHITE PAPER | COLLOCATED/ CONSOLIDATED S&T SITE |
|---|---|---|
| **Tech Area: Aeropropulsion (2ANF-Designated) (Oversight Body: JDL - Air Vehicles Panel)** | | |
| ● Turbine Engines (2ANF) | | |
| ● Rotorcraft Power Drive Systems (3A) | | AVRDEC |
| ● Hypersonic Propulsion (4F) | | WL |
| **Tech Area: Air Vehicles (Fixed Wing) (2NF-Designated) (Oversight Body: JDL - Air Vehicles Panel)** | | |
| ● Generic Structures Technology (3F) | | WL |
| ● Subsystems (3F) | | WL |
| ● Configuration Aerodynamic Research (6N, 6F) | Replaces Aerodynamics SubArea | |
| ● Aerothermodynamics (Hypersonics) (4F) | Replaces Aerodynamics SubArea | WL |
| ● Flight Controls (2NF) | Formerly "Flight Dynamics/Controls" | WL |
| ● Land-Based Support Systems (3F) | | WL |
| ● Life Support Systems (3F) | Moved to Crew Systems Tech Area | |
| ● Carrier Aircraft Unique (6N) | | |
| ● Aeromechanics (3F) | New Topic | WL |
| ● Crew Station (2NF) | Moved to Crew Systems Tech Area | |
| **Tech Area: Air Vehicles (Rotary) (3A-Designated) (Oversight Body: JDL - Air Vehicles Panel)** | | AVRDEC |
| ● Structures (3A) | | AVRDEC |
| ● Subsystems (3A) | | AVRDEC |
| ● Flight Controls (3A) | | AVRDEC |
| ● Aerodynamics (3A) | | AVRDEC |
| ● Crew Station (3A) | Moved to Crew Systems Tech Area | |
| **Tech Area: Astrometry (3N-Designated) (Oversight Body: JDL - $C^3$ Panel)** | Oversight Moved to $C^3$ Panel from Management Panel | |
| **Tech Area: Chemical/Biological Defense (4A) (Oversight Body: JDL - Chemical Biological Defense Panel-New Panel Recently Established)** | | CRDEC |
| **Tech Area: Civil Engineering (2ANF-Designated) (Oversight Body: Joint Engineers)** | | |
| ● Conventional Facilities (3A) | | CERL |
| ● Survivability and Protective Structures (3A) | | WES |
| ● Airfields and Pavements (3A) | | WES |
| ● Sustainment Engineering (3A) | | CERL |
| ● Ocean and Waterfront Facilities and Operations (3N) | | NCEL |
| ● Critical Air Base Facilities/Recovery (3F) | | |
| ● Firefighting (3F) | | AFCESA |

| CURRENT TAXONOMY | CHANGE FROM WHITE PAPER | COLLOCATED/ CONSOLIDATED S&T SITE |
|---|---|---|
| **Tech Area: Clothing, Textiles, & Food (3A) (Oversight Body: JDL - Management Panel)** | | NRDEC |
| ● Clothing and Textiles (3A) | New Topic | |
| ● Food (4A) | New Topic | |
| **Tech Area: Command, Control & Communications ($C^3$) (2ANF-Designated) (Oversight Body: JDL - $C^3$ Panel)** | | |
| ● Astrometry (3N) | This is a separate technology area which is overseen by the C3 Panel | NAVOBS |
| ● Communications Networks (2ANF) | | |
| ● Radios and Links (2ANF) | Sub-SubAreas Removed | |
| ● Submarine Communications (6N) | | |
| ● Distributed Processing (2ANF) | Formerly "Distributed Information Systems" | |
| ● Data Fusion (2ANF) | | |
| ● Decision Aids (2ANF) | | |
| **Tech Area: Computer Sciences (2ANF) (Oversight Body: JDL - Computer Sciences Panel)** | Formerly "Software" | |
| ● Software Engineering (2ANF) | Formerly "Software and System Engineering" | |
| ● AI (2ANF) | Formerly "AI (Neural Networks)" | |
| ● Human Computer Interaction (2NF) | | |
| ● High-Performance Computing (2ANF) | Formerly "Distributed Processing/High Performance Computing" | |
| ● Computer Security (2N) | Formerly "Trusted Systems and Computer Security" | |
| ● Information Engineering (2A) | New Topic | |
| ● System Oriented, Real-Time Fault Tolerance | Deleted | |
| **Tech Area: Conventional Air/Surface Weaponry (2ANF) (Oversight Body: JDL - Conventional Air/Surface Weaponry Panel)** | | |
| ● Guidance and Control (2ANF) | | |
| – Image/Signal Processing (2ANF) | New Topic | |
| – Launchers/Dispensers, and Air Frame Technology (2ANF) | New Topic | |
| – G&C Analysis, Modeling, Test and Simulation (2ANF) | New Topic | |
| – Ground/Helicopter-Launched Applications (3A) | New Topic | AVRDEC |
| – Radiation Guidance Systems (2ANF) | New Topic | |
| – GNC Components/Subsystems (2ANF) | New Topic | |
| – Airplane/Ship-Launched Applications (3N) | New Topic | NAWC-AD |
| – High Value Fixed Target Applications (3F) | New Topic | |
| ● Fuzing/Safe and Arm (2ANF) | | |
| – Missiles (2ANF) | Formerly "Anti-Air And Anti-Surface Missiles" | |
| – Bombs (3F) | | AFAL |
| – Hard Target Penetration (3F) | | AFAL |
| – Underwater (6N) | | |
| – Gun Munitions (3A) | | ARDEC |
| – Land Mines and Demolition (3A) | | ARDEC |

| CURRENT TAXONOMY | CHANGE FROM WHITE PAPER | COLLOCATED/ CONSOLIDATED S&T SITE |
|---|---|---|
| ● Warheads and Explosives (2ANF) | | |
| – Anti-Armor (3A) | New Topic | ARDEC |
| – TILV (2ANF) | New Topic | |
| – Land Mines, Countermines & Demolitions (3A) | New Topic | ARDEC |
| – Missiles (2ANF) | New Topic | |
| – Advanced Explosives (2ANF) | New Topic | |
| – Underwater (6N) | New Topic | |
| – Hard Target Penetration (3F) | New Topic | WL |
| – EOD (4N) | This is a separate technology area which is overseen by the Conventional Air/Surface Weaponry Panel | Navy EOD Tech Ctr |
| ● Missile Propulsion (2ANF) | | |
| – Liquid Fuel Ramjets (2NF) | | |
| – Solid Fuel Ramjets (2NF) | | |
| – Ducted Rocket Ramjets (3F) | | WL |
| – Solid Rockets (2AN) | | |
| – Liquid Rockets (3A) | | MICOM RDEC |
| – Hybrid Rockets (2AN) | | |
| ● Conventional Guns (3A) | | ARDEC |
| – Small Calibre Guns (4A) | This is the Small Arms technology area which is overseen by the Conventional Air/Surface Weaponry Panel | ARDEC |
| – Medium Calibre Guns (3A) | New Topic | ARDEC |
| – Large Calibre Guns (3A) | New Topic | ARDEC |
| – Fire Control (3A) | New Topic | ARDEC |
| – Gun Propulsion (3A) | New Topic | ARDEC |
| ● Electric Guns (2ANF) | New Topic | |
| **Tech Area: Crew Systems (2ANF-Designated) (Oversight Body: JDL - Air Vehicles Panel)** | New Topic | |
| ● Crew Station (2ANF) | Moved from Air Vehicles: Fixed Wing & Rotary | |
| ● Life Support (2ANF) | Moved from Air Vehicles: Fixed Wing | |
| **Tech Area: Directed Energy Weaponry (2ANF-Designated) (Oversight Body: JDL - Directed Energy Weaponry Panel)** | New Topic | |
| ● Charged Particle Beam Technology (3N) | New Topic | NRL, NSWC/DD |
| – Endoatmospheric CPB (3N) | New Topic | NRL, NSWC/DD |
| – Exoatmospheric CPB (3N) | New Topic | NRL, NWSC/DD |
| – CPB Spinoffs (3N) | New Topic | NRL, NSWC/DD |
| ● Laser Weapon Technology (2ANF) | New Topic | |
| – Source Technology (2ANF) | New Topic | |
| – Supporting Technology (2ANF) | New Topic | |
| – Effects, Vulnerability and Hardening (2ANF) | New Topic | |
| – Demonstrations (2ANF) | New Topic | |
| ● High Power Microwave Technology (2ANF) | New Topic | |
| – Effects and Susceptibility (2ANF) | New Topic | |
| – Hardening Technology (2ANF) | New Topic | |

| CURRENT TAXONOMY | CHANGE FROM WHITE PAPER | COLLOCATED/ CONSOLIDATED S&T SITE |
|---|---|---|
| – Components Technology (2ANF) | New Topic | |
| – Demonstrations (2ANF) | New Topic | |
| ● Neutral Particle Beam Technology (3A) | New Topic | SDC |
| – NPB Technology Development (3A) | New Topic | SDC |
| – Concept Development (3A) | New Topic | SDC |
| – Integrated Ground Projects (3A) | New Topic | SDC |
| – Integrated Space Projects (3A) | New Topic | SDC |
| **Tech Area: Electronic Devices (2ANF) (Oversight Body: JDL - Electronic Devices Panel)** | | |
| ● Microelectronics (2ANF) | | |
| – Devices and Processing (2ANF) | New Topic | |
| – Component Applications (2ANF) | New Topic | |
| – Support Infra-Structure (2ANF) | New Topic | |
| ● RF Components (2ANF) | | |
| – Solid-State (2ANF) | | |
| – Vacuum Electronics (3N) | | NRL |
| – Generic Antenna Technologies (3F) | | RL |
| – Frequency Control and Devices (3A) | | ARL |
| ● Electro-Optical Devices (2ANF) | | |
| – Lasers (2ANF) | | |
| – Focal Plane Arrays (2ANF) | | |
| – Display Components (3A) | | ARL |
| – Photonic/Fiber Optic Devices (2ANF) | | |
| ● Electronic Materials (2ANF) | Replaces Specifications and Standards Subarea | |
| ● Superconductivity (2ANF) | Deleted | |
| **Tech Area: Electro-Optics (2ANF-Designated) (Oversight Body: JDL - Sensors Panel)** | | |
| ● Wide-Area Surveillance (Space-Based IR) (3N) | | NRL |
| ● Battlefield (3A) | | |
| ● Intercept (2NF) | Replaces Aircraft Fixed Wing Subarea | |
| ● Anti-Surface (2ANF) | Replaces Aircraft Fixed Wing Subarea | |
| ● ASW Undersea Mine Periscope (6N) | Formerly called "Aircraft (ASW, Undersea)" | |
| ● Sea Based (3N) | New Topic | NRaD, NSWC/DD, NRL |
| ● Nap of the Earth (3A) | New Topic | CNVEO |
| **Tech Area: Electronic Warfare (2ANF) Oversight Body: JDI – Electronic Warfare Panel)** | | |
| ● Radio Frequency Countermeasures (2ANF) | New Topic | |
| – RF Threat Warning (2ANF) | New Topic | |
| – RF Self-Protection (2ANF) | New Topic | |
| – RF Mission Support (2ANF) | New Topic | |
| ● EO/IR Countermeasures (2ANF) | New Topic | |
| – EO/IR Threat Warning (2ANF) | New Topic | |
| – EO/IR Self-Protection (2ANF) | New Topic | |
| ● C3 Countermeasures (2ANF) | New Topic | |
| ● Simulation (2ANF) | New Topic | |
| ● Electronic Counter Countermeasures (2AF) | New Topic | |

| CURRENT TAXONOMY | CHANGE FROM WHITE PAPER | COLLOCATED/ CONSOLIDATED S&T SITE |
|---|---|---|
| **Tech Area: Environmental Sciences (2ANF-Designated ) (Oversight Body: JDL - Environmental Sciences Panel)** | | |
| ● Space Upper Atmospheric Sciences (2NF) | New Topic | |
| – Celestial Backgrounds/Astronomical Reference Sources (2NF) | New Topic | |
| – Neutral Density Effects (2NF) | New Topic | |
| – Solar Impacts (2NF) | New Topic | |
| – Ionospheric Effects (2NF) | New Topic | |
| – Space Effects (2NF) | New Topic | |
| – Strategic/Theater Backgrounds (2NF) | New Topic | |
| ● Lower Atmospheric Sciences (2ANF) | Category Changed From 2NF | |
| – Global Numerical Prediction Systems (3N) | Formally "Numerical Weather Prediction and Modeling" | NRL |
| – Atmospheric Effects Assessment (2ANF) | New Topic | |
| – Boundary Layer Processes and Interactions (2ANF) | New Topic | |
| – Theater Data Fusion and Prediction (2ANF) | New Topic | |
| – Central Site Satellite Data Interpretation (3F) | Formerly "Central Site Satellite Interpretation" | PL |
| – Local Site Satellite Interpretation (2NF) | Deleted | |
| – Statistical Climatology (3F) | Deleted | |
| ● Ocean Sciences (6N) | | |
| – Oceanography (6N) | New Topic | |
| – Ocean Acoustics (6N) | New Topic | |
| – Ocean Geophysics and Geology (6N) | New Topic | |
| – Oceanographic Tactical Applications (6N) | New Topic | |
| ● Terrestrial Sciences (2AF) | Category Changed From 3A | |
| – Topography (3A) | New Topic | |
| – Battlefield Environment Effects (3A) | New Topic | |
| – Cold Regions (3A) | New Topic | CRREL |
| – Seismology (6F) | New Topic | |

| | | |
|---|---|---|
| **Tech Area: Environmental Quality (2ANF-Designated) (Oversight Body: Joint Engineers)** | | |
| ● Installation Restoration (2AF) | | |
| – Site Investigation/Characterization (3A) | | WES |
| – Explosives, Metals, and other Organic Contamination Treatment (3A) | | WES |
| – Fuels, Solvents, Site Contamination Treatment (3F) | | AFCESA |
| ● Noise Abatement (2AF) | | |
| – Impulse Noise (3A) | | CERL |
| – Continuous Wave Noise (3F) | | AL |
| ● Pollution Prevention (2AF) | | |
| – Explosives Manufacturing and Demilitarization (6A) | | ARDEC |
| – Aeronautical Systems (3F) | | AFCESA |
| – Nautical Systems (6N) | | |
| – Ground Equipment Systems (6A) | | |
| ● Terrestrial and Aquatic Assessment (3A) | | BRDL |
| ● Global Marine Compliance (6N) | | |
| ● Atmospheric Compliance (2ANF) | | |
| ● Base Support (3A) | Formerly "Base Support Operations" | CERL |

| CURRENT TAXONOMY | CHANGE FROM WHITE PAPER | COLLOCATED/ CONSOLIDATED S&T SITE |
|---|---|---|
| **Tech Area: Explosive Ordnance Disposal (4N) (Oversight Body: JDL Conventional Air/Surface Weaponry Panel)** | This is a separate technology area which is overseen by the Warheads and Explosives Sub-Panel of the Conventional Air/Surface Weaponry Panel | |
| **Tech Area: Fuels and Lubricants (3F) (Oversight Body: JDL - Management Panel)** | | WL |
| **Tech Area: Ground Vehicles (3A) (Oversight Body: JDL - Management Panel)** | | TACOM RDEC |
| ● Combat Vehicles (3A) | | TACOM RDEC |
| ● Material Handling Equipment (3A) | | BRDEC |
| ● Ramps and Bridging (3A) | | BRDEC |
| ● Countermine Equipment (3A) | | BRDEC |
| ● Mobile Electric Power (3A) | | BRDEC |
| **Tech Area: Integrated Avionics (2ANF) (Oversight Body: JDL - Air Vehicles Panel)** | | |
| ● Navigation Technology (2ANF) | New Topic | |
| ● Communications (2ANF) | New Topic | |
| ● Functional Integration (2ANF) | New Topic | |
| **Tech Area: Manpower and Personnel (2ANF-Designated) (Oversight Body: TAPSTEM)** | | |
| ● Force Management and Modeling (3N) | | NPRDC |
| ● Selection and Classification (2ANF) | | |
| – Basic Abilities Testing (3F) | | AL |
| – Computer-Based Entrance Testing (3N) | | NPRDC |
| – Job Structures and Requirements (3F) | | AL |
| – Service Unique Applications (6A, 6F, 6N) | | |
| ● Productivity Measurement/Enhancement (3N) | | NPRDC |
| ● Human Resources Development (3A) | | ARI |
| **Tech Area: Medical (2ANF) (Oversight Body: ASBREM)** | | |
| ● Infectious Disease (3A) | | WRAIR |
| ● Chemical Defense (4A) | | AIMCD (lead lab) |
| ● Biological Defense (4A) | | AMRID (lead lab) |
| ● Combat Casualty Care (3A) | | |
| – Blood Research (3N) | | NMRI |
| – Trauma/Burns (3A) | | AISR |
| ● Human Systems Technology (2ANF) | | |
| – Directed Energy Bioeffects (3F) | | AL |
| – Biodynamics (3F) | | WL |
| – Environmental and Occupations Toxicology (3F) | | WL |
| – Environmental Medicine (2ANF) | | |
| ● Combat Dentistry (3A) | | NDRI |

| CURRENT TAXONOMY | CHANGE FROM WHITE PAPER | COLLOCATED/ CONSOLIDATED S&T SITE |
|---|---|---|
| **Tech Area: Nuclear Weapons Effects (2ANF-Designated) (Oversight Body: JDL - Management Panel)** | | |
| ● Basic Radiation Effects Hardening (2AN) | | |
| – Electronic Materials (2ANF) | Category Changed From 2AN | |
| – Non-electronic Materials (3A) | | ARL |
| – SREMP, SGEMP, IEMP Protection (3A) | | ARL |
| ● Radiation Hardened Applied Technology (3F) | | PL |
| ● Atmospheric Effects (3N) | | ARL |
| ● Blast/Shock/Thermal Hardening (3A) | | ARL |
| ● Missiles/Aircraft EMP Hardening (3F) | | PL |
| ● Land Mobile/Fixed Facilities EMP Hardening (3A) | | ARL |
| ● Nuclear Weapons Effects Simulation Technology (2AN) | | |
| – EMP (3A) | | ARL |
| – Blast/Thermal (3A) | | ARL |
| – Gamma Radiation (3A) | | ARL |
| – X-Radiation (3N) | | NRL |
| **Tech Area: Radar (2ANF-Designated) (Oversight Body: JDL - Sensors Panel)** | | |
| ● Airborne Wide-Area Surveillance (2ANF) | Combines Airborne and Wide-Area Surveillance Topics | |
| ● Space-Based AAW (3F) | Raised Topic to Subarea Level | PL |
| ● Space-Based ASUW (3N) | Raised Topic to Subarea Level | NAWC/AD |
| ● Over-the-Horizon Land-Based (3F) | Raised Topic to Subarea Level | PL |
| ● Battlefield (3A) | Formerly "Battlefield (Line-of-Sight Land Clutter)" | ARL |
| ● Sea Based (3N) | Formerly "Shipboard (Long-Range Sea Clutter)" | NRL, NOSC |
| ● Nap-of-the-Earth (3A) | New Topic | ARL |
| ● Intercept (2NF) | Raised Topic to Subarea Level | |
| ● ASUW (3N) | Raised Topic to Subarea Level | NAWC, NRL |
| ● Strike (2ANF) | Formerly "Strategic Strike" and "Tactical Strike" Topics | |
| ● Aircraft Fixed Wing (3A) | Deleted | |
| ● Aircraft Rotary Wing (Unique Aspects) (3A) | Deleted | |
| ● ASW (6N) | Formerly "Aircraft (ASW)" | |
| **Tech Area: Ships/Watercraft (3N) (Oversight Body: JDL - Management Panel)** | | |
| ● Ships (6N) | | |
| ● Watercraft (3N) | | NSWC/CD |
| **Tech Area: Small Arms (4A) (Oversight Body: JDL Conventional Air/Surface Weaponry Panel)** | Renamed "Small Caliber Guns" and moved to Conventional Guns | |

| CURRENT TAXONOMY | CHANGE FROM WHITE PAPER | COLLOCATED/ CONSOLIDATED S&T SITE |
|---|---|---|
| **Tech Area: Space (2ANF-Designated) (Oversight Body: JDL - Space Vehicles Panel)** | | |
| ● Propulsion (3F) | | PL |
| ● Power (3F) | | PL |
| ● Thermal Control (3F) | | PL |
| ● Structures (3F) | | PL |
| ● Guidance, Navigation, and Control Positioning (2NF) | | |
| – Positioning (3N) | New Topic | NRL |
| – Active Control (2NF) | New Topic | |
| ● Survivability (2ANF) | | |
| – Laser (2AF) | | |
| – HPM (2NF) | | |
| – Kinetics and Debris (3F) | | PL |
| – Operational S/V (3F) | | PL |
| – Neutral Particle Beam (3N) | | |
| – Natural Particle Effects (3N) | | |
| ● Flight Experiments (2ANF) | | |

| | | |
|---|---|---|
| **Tech Area: Training Systems (3ANF-Designated) (Oversight Body: TAPSTEM)** | | |
| ● Unit Collective Training (3A) | | ARI |
| ● Land Warfare/Rotary Wing Training (3A) | | ARI |
| ● Training Devices and Features (3N) | | NPRDC |
| ● Sea Warfare Training (3N) | | NPRDC |
| ● Classroom Instruction (3N) | | NPRDC |
| ● Intelligent Computer-Aided Training (3F) | | AL |
| ● Air Crew Training Effectiveness (3F) | | AL |

| | | |
|---|---|---|
| **Tech Area: Unmanned Ground Vehicles (4A) (Oversight Body: JDL - Management Panel)** | | MICOM RDEC |

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# APPENDIX B.1

# JDL TECHNOLOGY PANEL JSPP SUMMARIES AND BASIC RESEARCH PANEL FUNDING

**Contents:**

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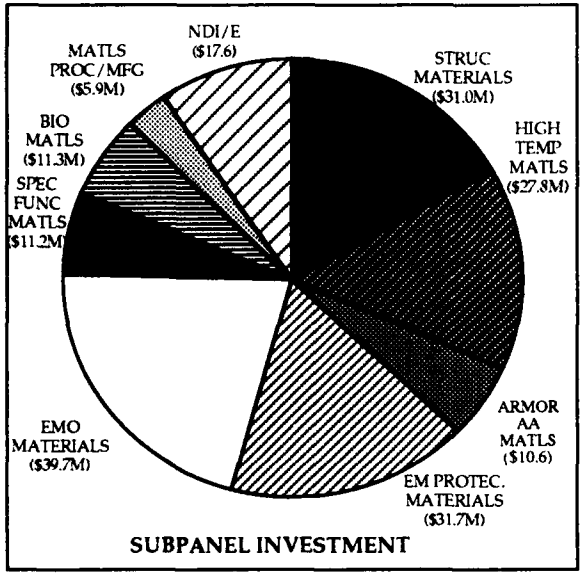
**JDL TECHNOLOGY PANEL:** ADVANCED MATERIALS

**FY93 PROGRAM TOTAL:** $186.5M

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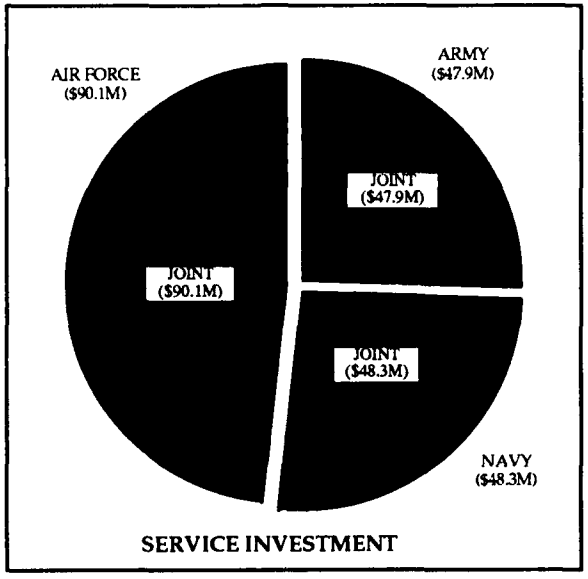


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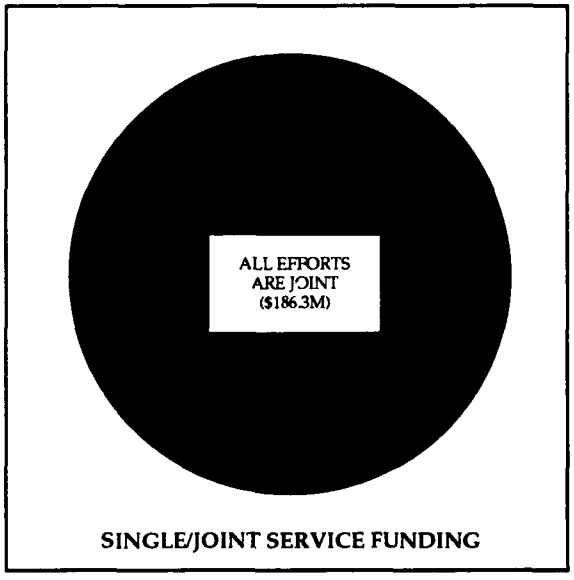


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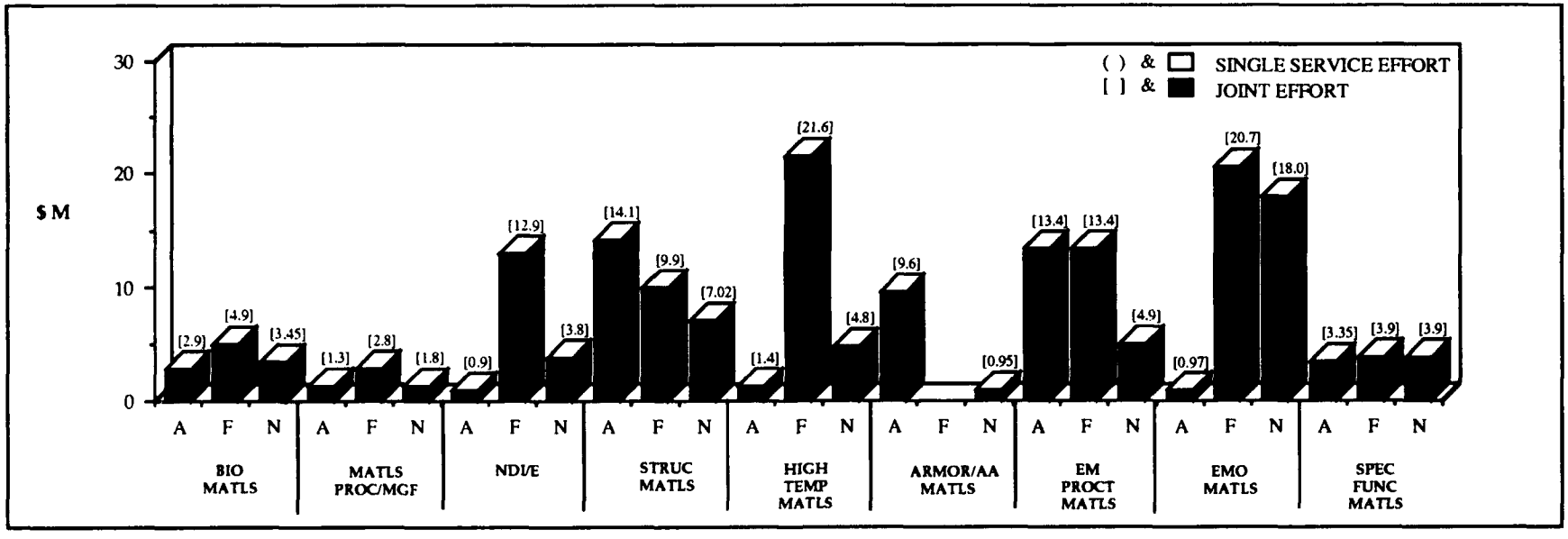
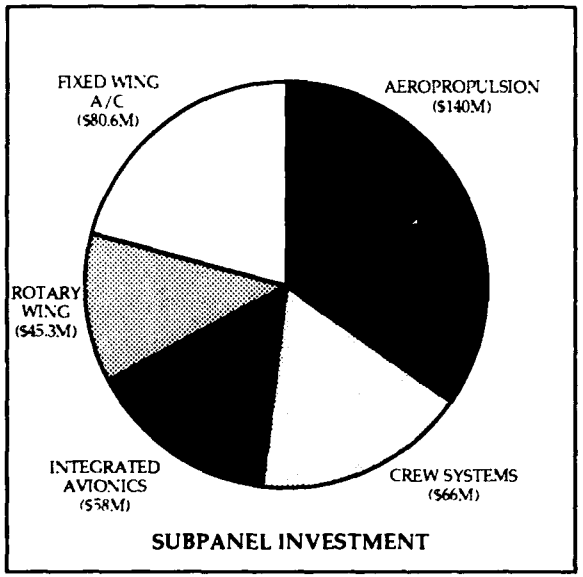



SERVICE FUNDING PER SUBPANEL

**JDL TECHNOLOGY PANEL:** AIR VEHICLES

**FY93 PROGRAM TOTAL:** $389.8M (EXCLUDES OTHER NON-SERVICE SOURCES WHICH TOTAL $25.5M)

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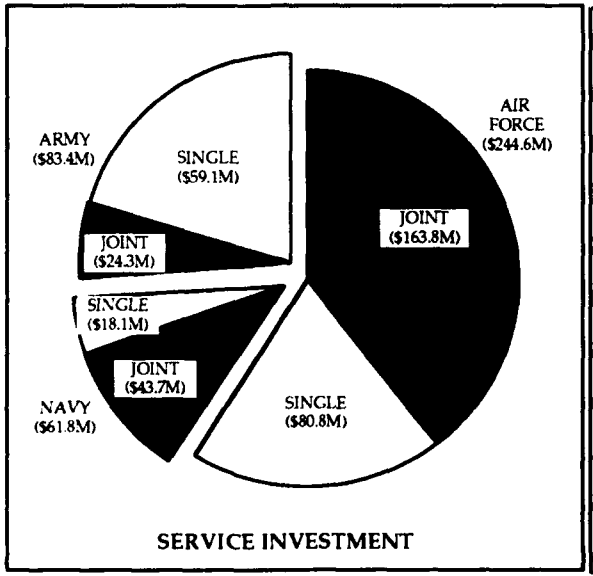


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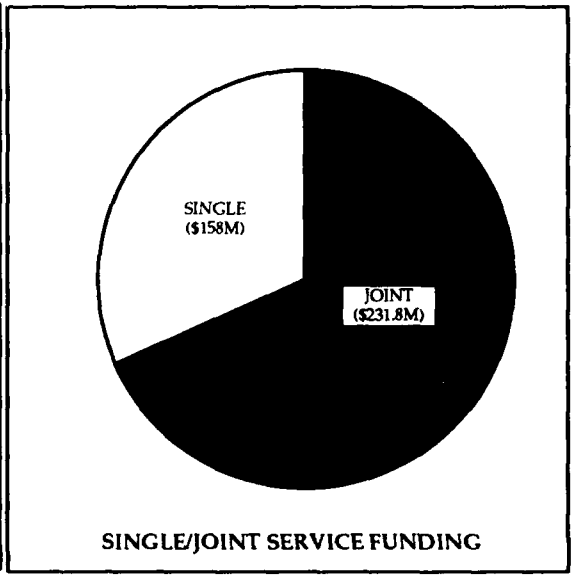


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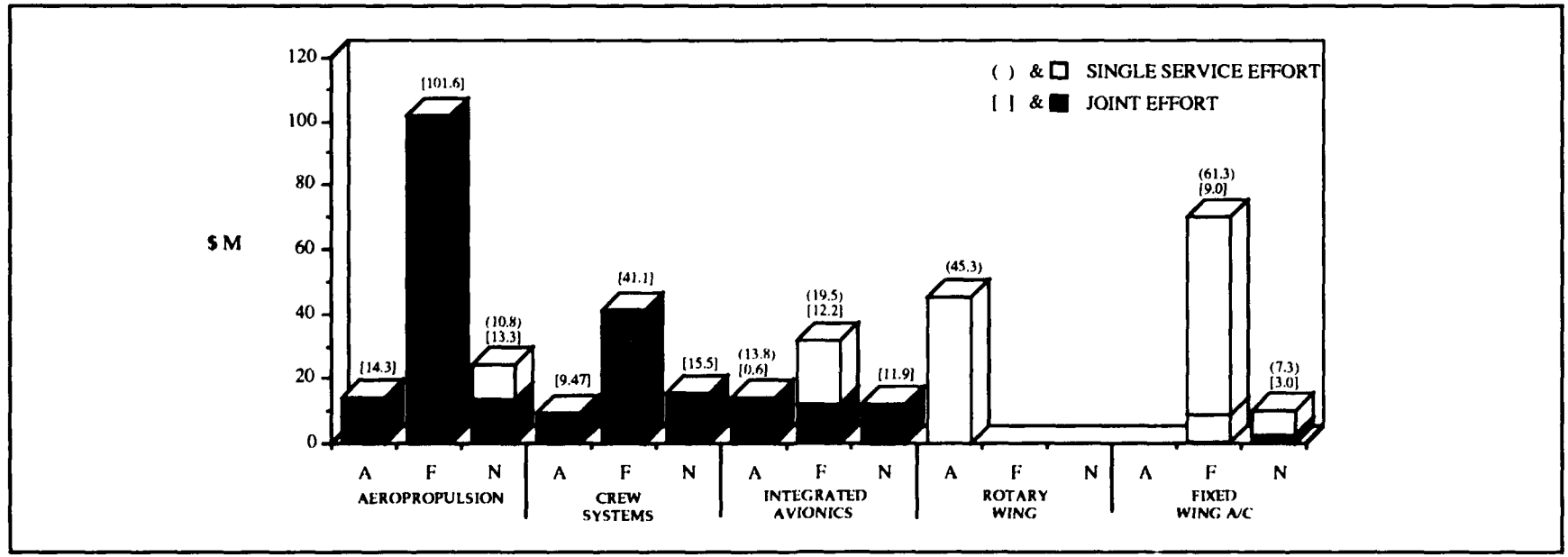
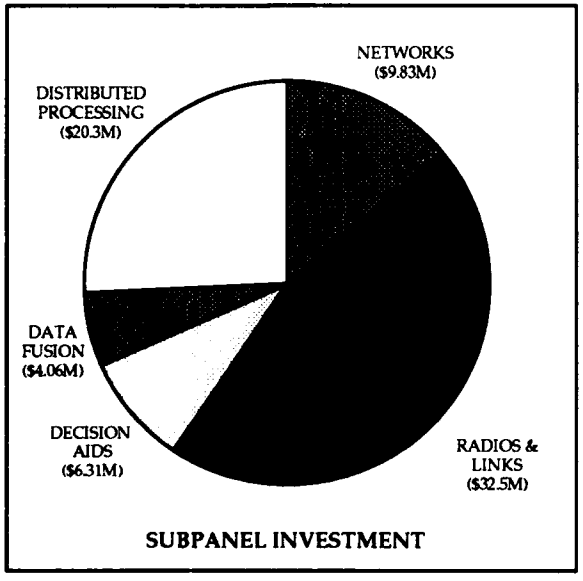



SERVICE FUNDING PER SUBPANEL

**JDL TECHNOLOGY PANEL:** COMMAND, CONTROL, AND COMMUNICATIONS
**FY93 PROGRAM TOTAL:** $73.0M



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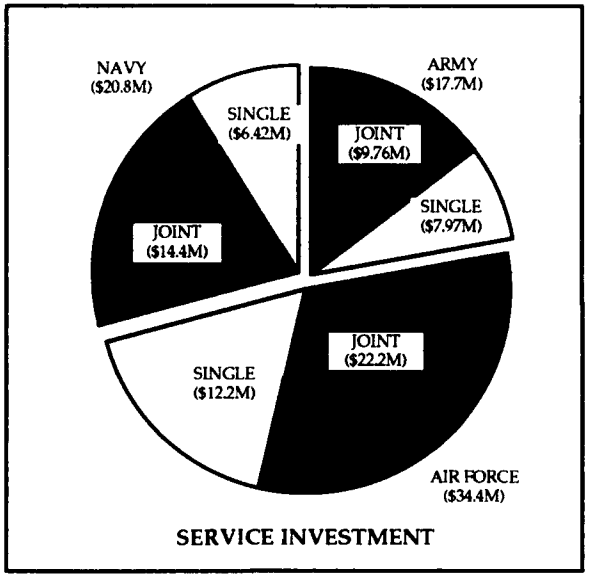

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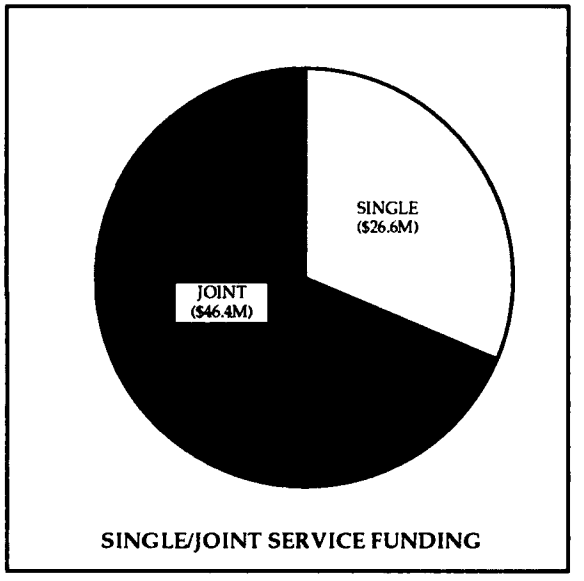

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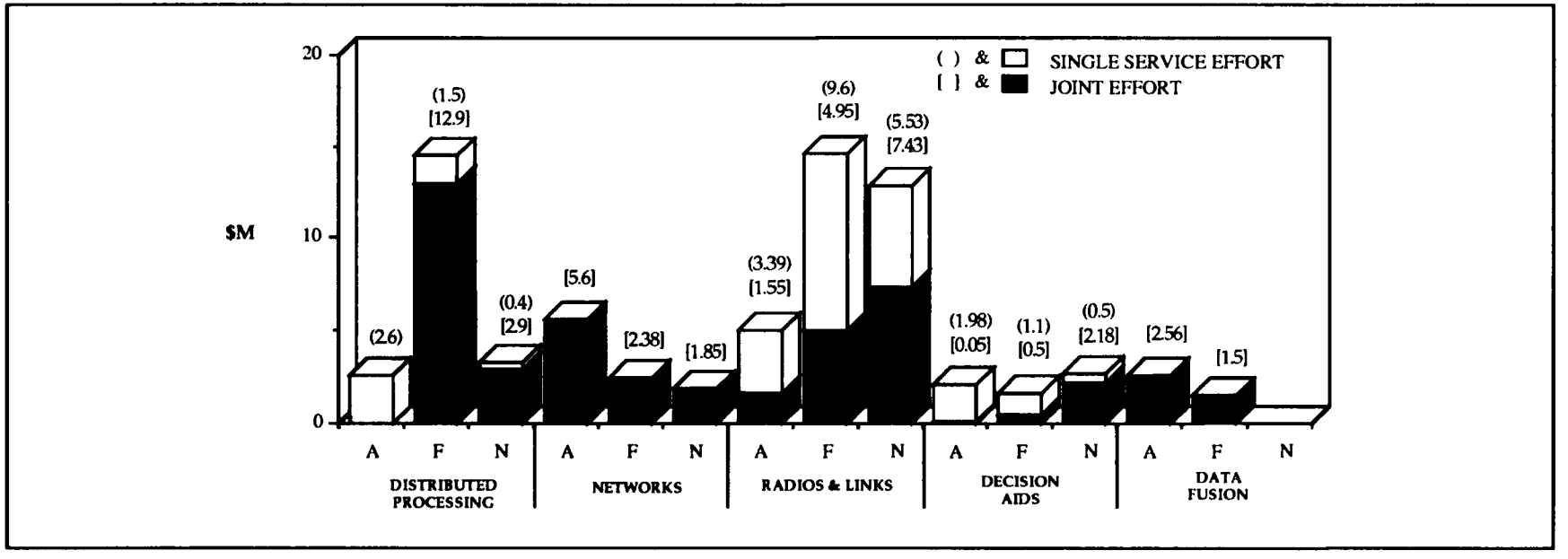
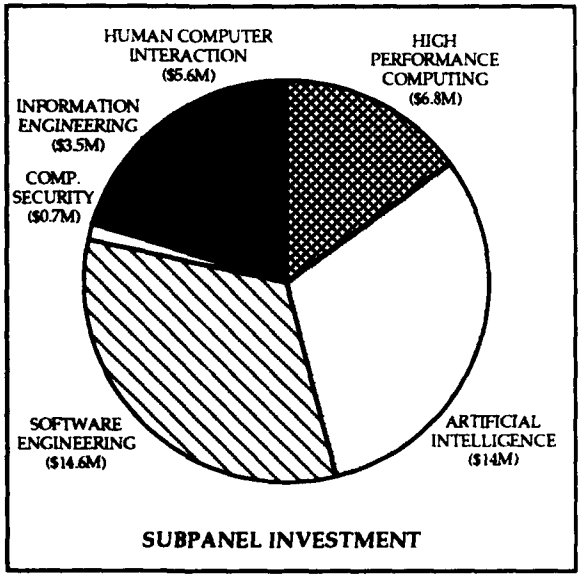


SERVICE FUNDING PER SUBPANEL

**JDL TECHNOLOGY PANEL:** COMPUTER SCIENCES
**FY93 PROGRAM TOTAL:** $45.1M

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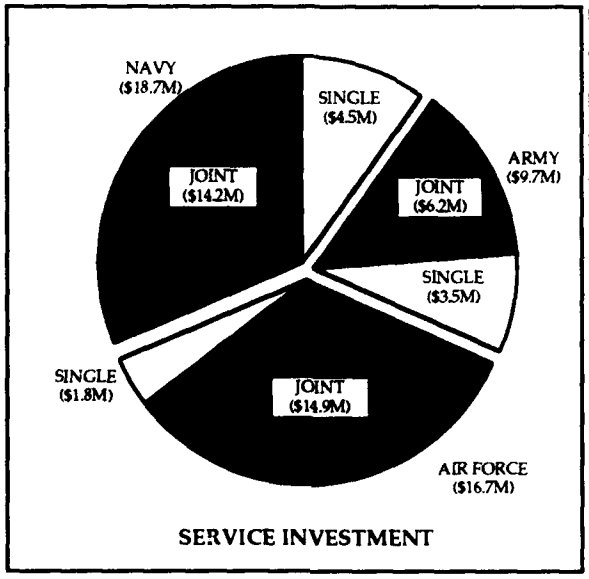


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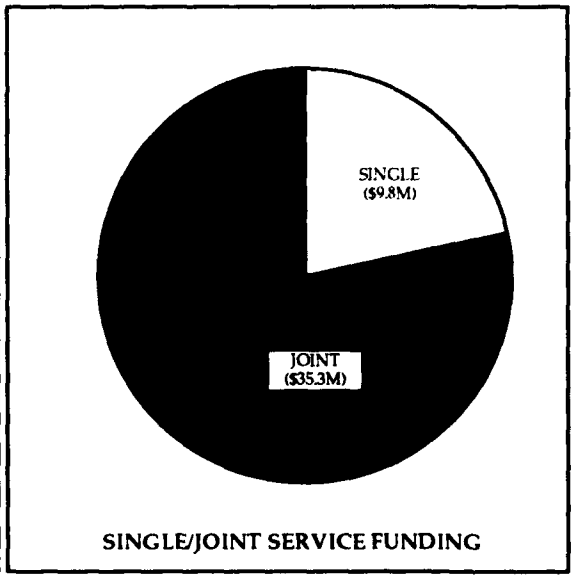
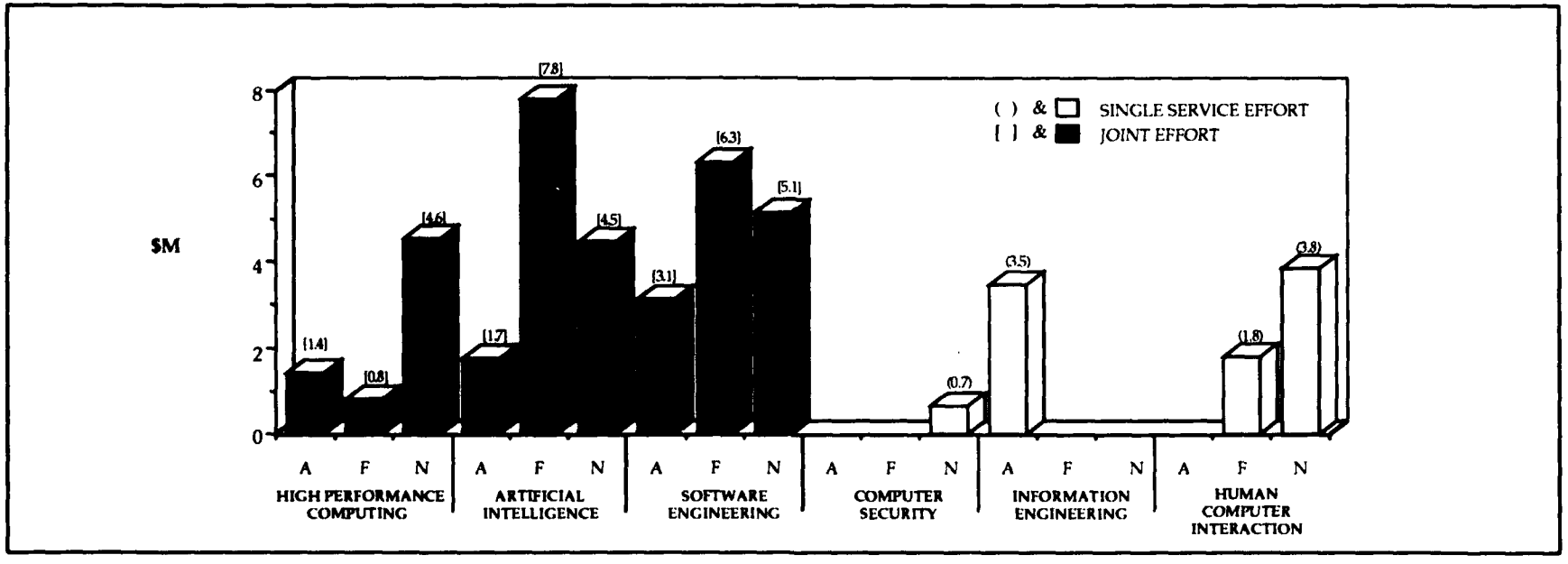
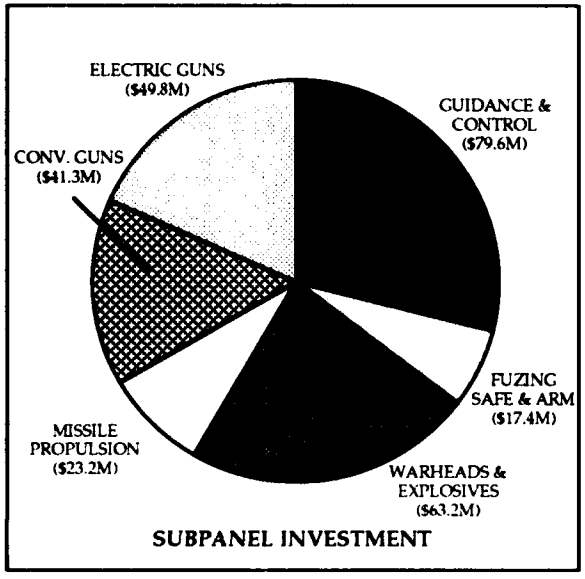



**SINGLE/JOINT SERVICE FUNDING**




**SERVICE FUNDING PER SUBPANEL**

**JDL TECHNOLOGY PANEL:** CONVENTIONAL AIR/SURFACE WEAPONRY
**FY93 PROGRAM TOTAL:** $274.5M (EXCLUDES NON-SERVICE FUNDING)



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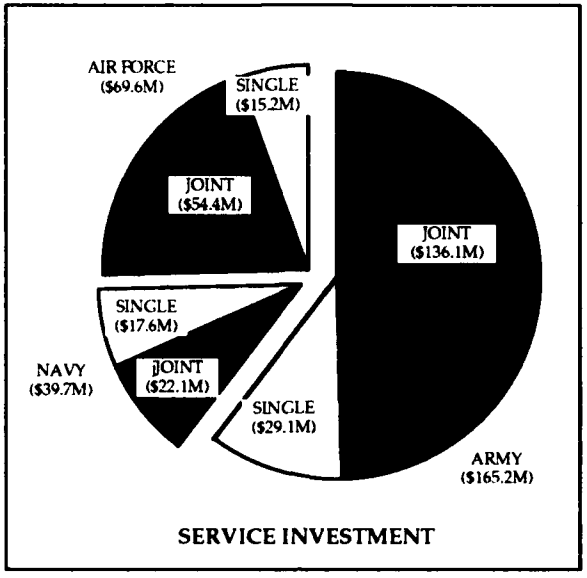
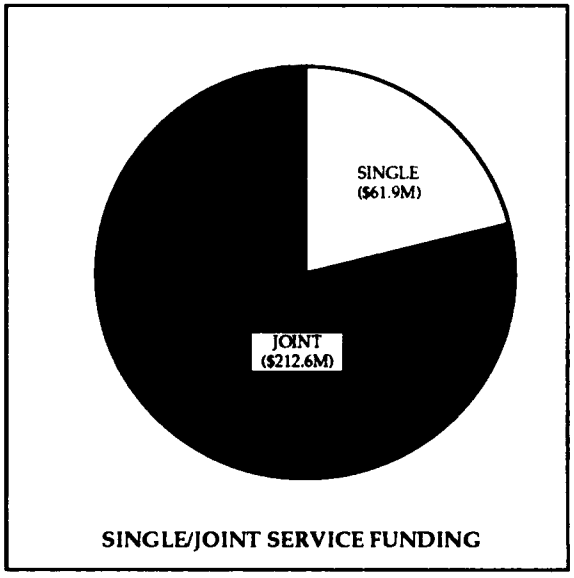


SERVICE INVESTMENT



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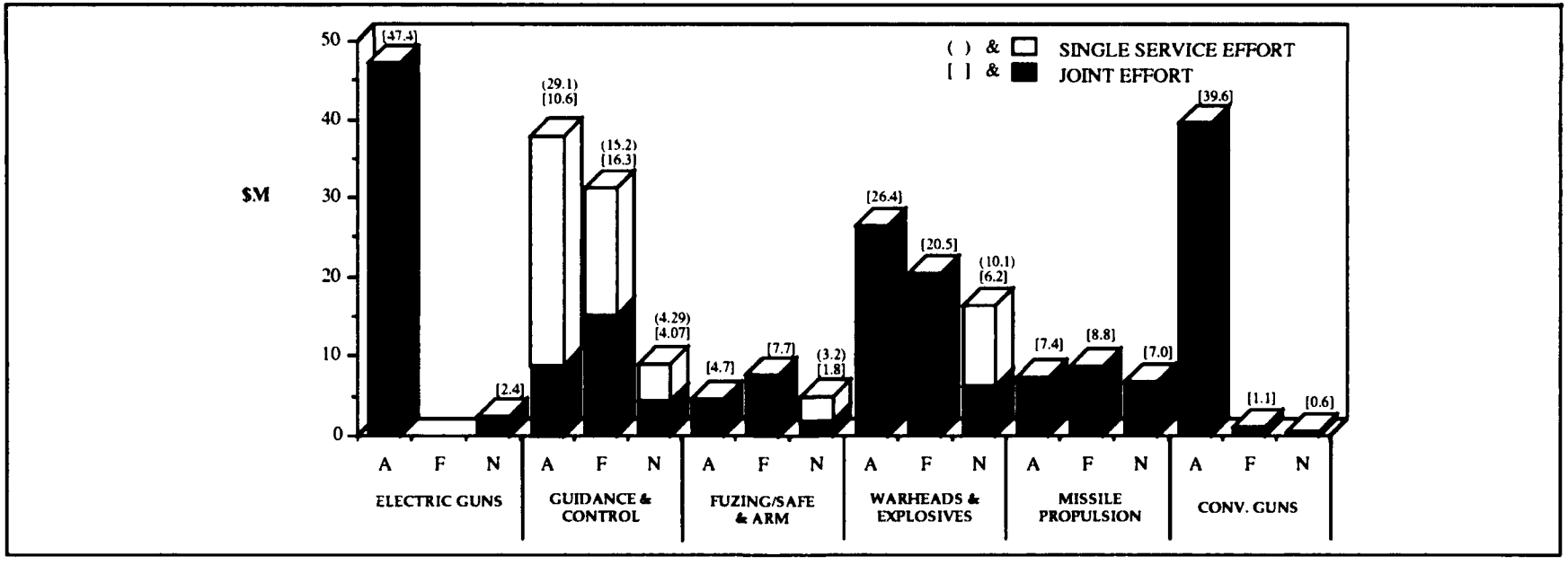
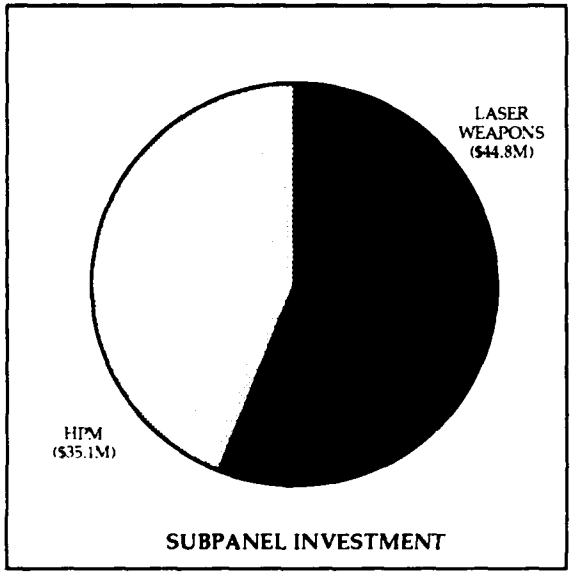
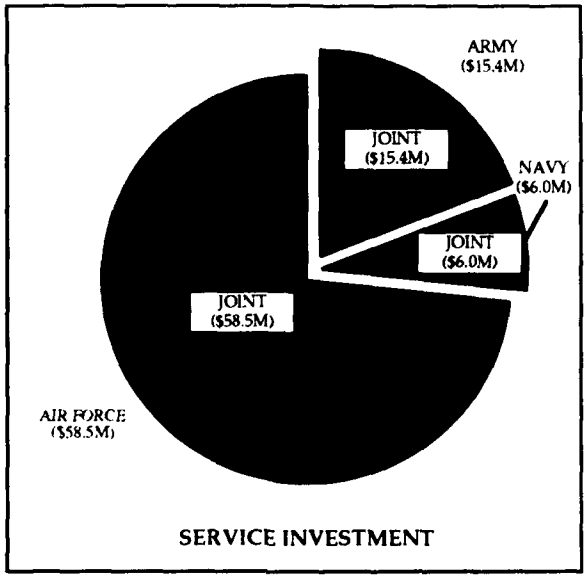


SERVICE FUNDING PER SUBPANEL

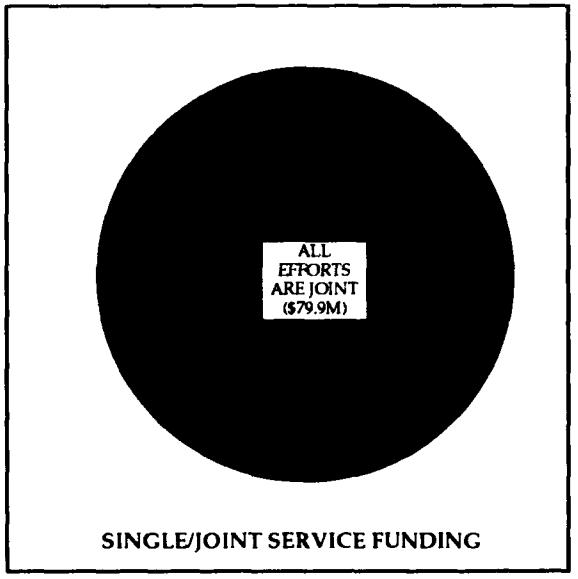
**JDL TECHNOLOGY PANEL:** DIRECTED ENERGY WEAPONRY
**FY93PROGRAM TOTAL:** S79.9M (EXCLUDES NON-SERVICE FUNDING WHICH TOTALS S363.7M)



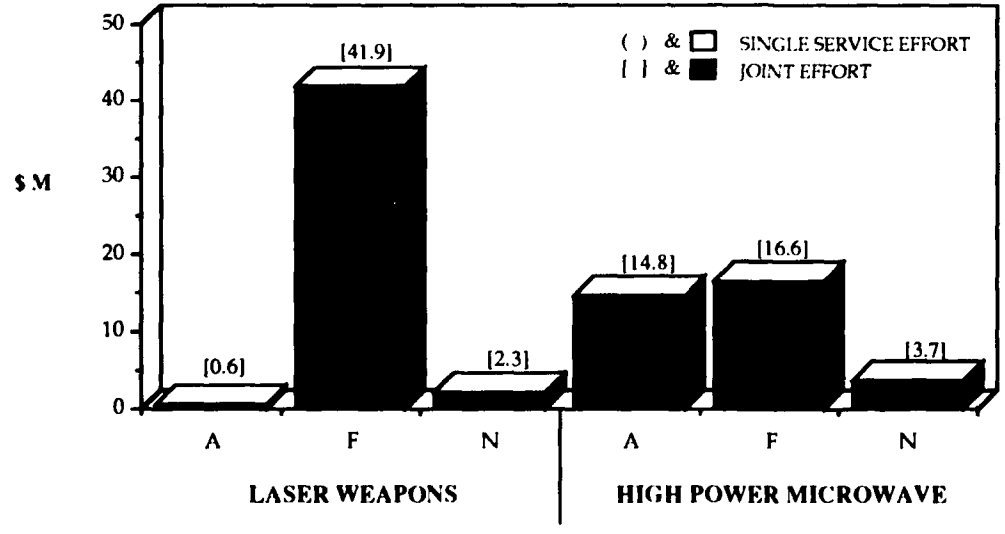

SUBPANEL INVESTMENT




SERVICE INVESTMENT




SINGLE/JOINT SERVICE FUNDING

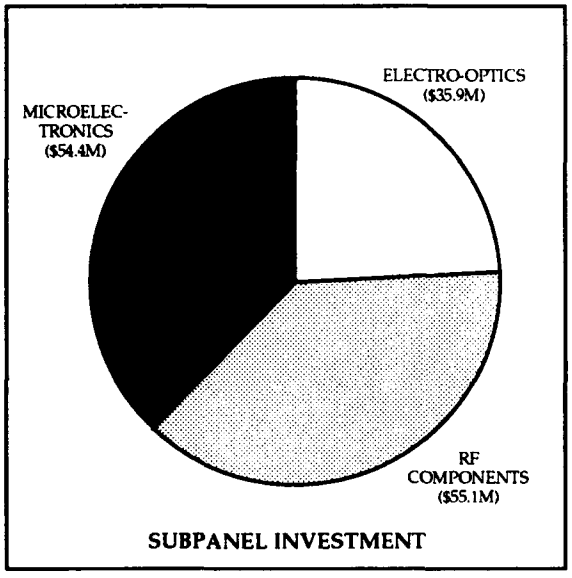



CHARGED PARTICLE BEAM TECHNOLOGY NOT FUNDED FOR FY93 IN 6.2 OR 6.3A

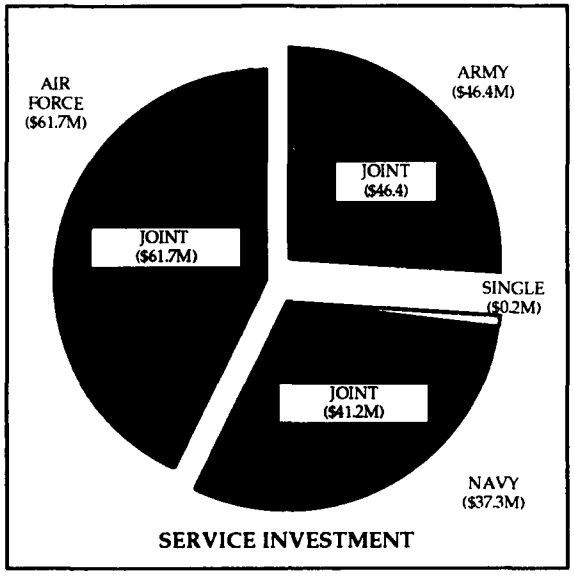
NEUTRAL PARTICLE BEAMS TECHNOLOGY FUNDED BY SDIO ONLY

SERVICE FUNDING PER SUBPANEL

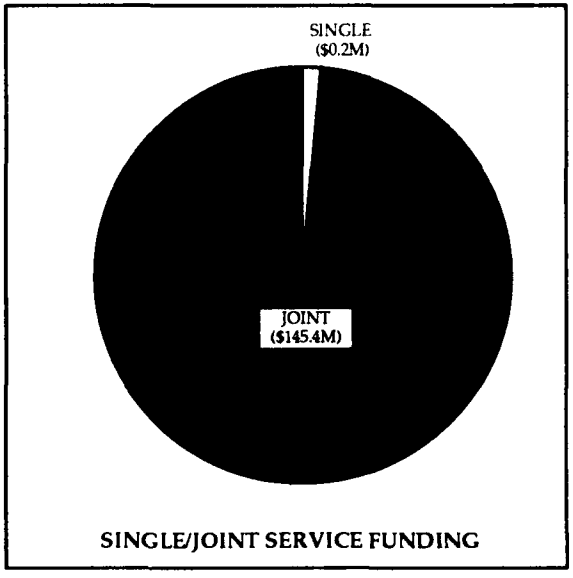
**JDL TECHNOLOGY PANEL:** ELECTRONIC DEVICES
**FY93 PROGRAM TOTAL:** $145.6M (EXCLUDES NON-SERVICE FUNDING)



SUBPANEL INVESTMENT



SERVICE INVESTMENT



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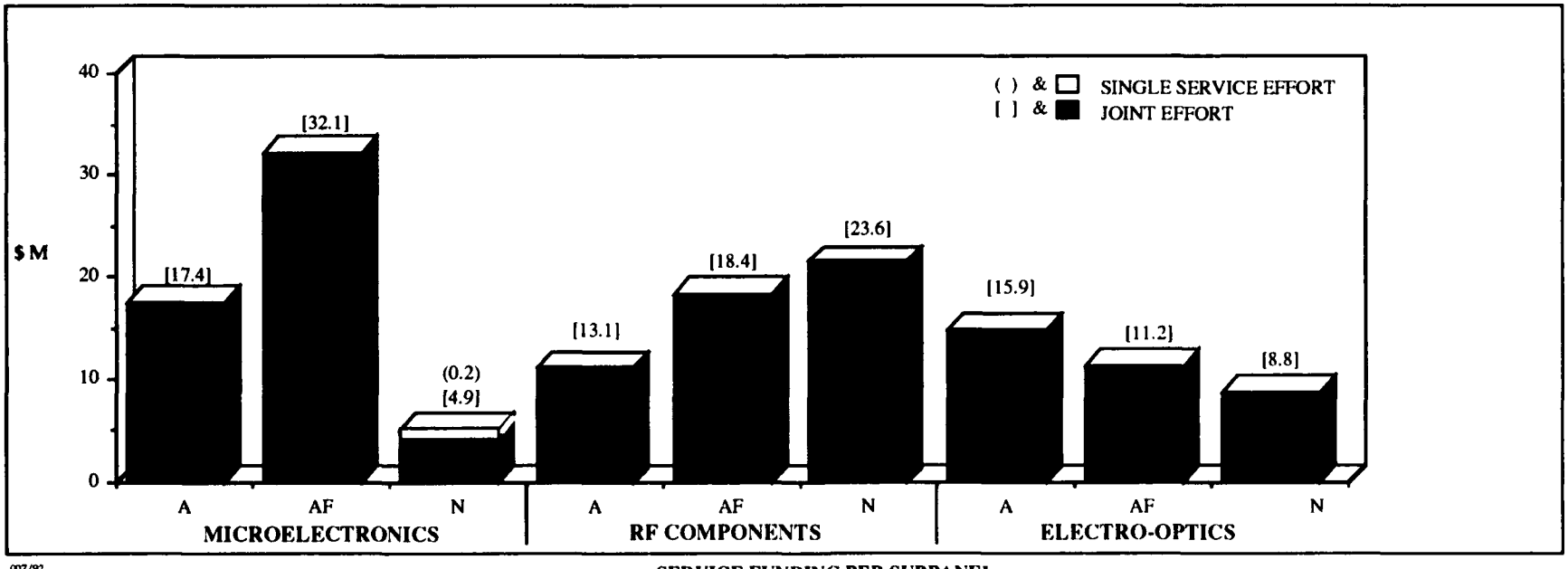
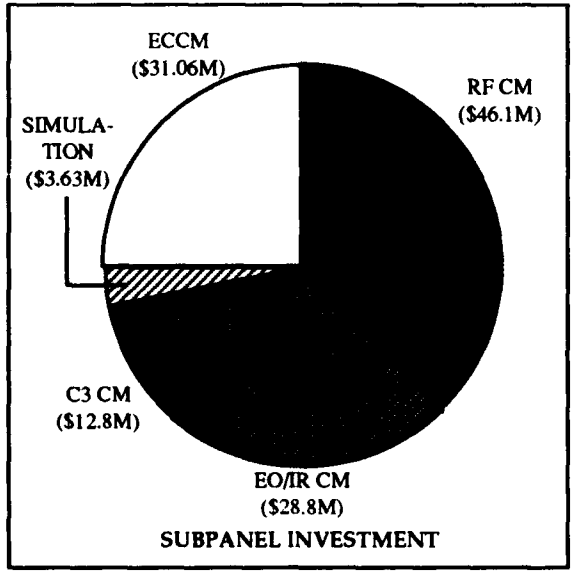


007/92

SERVICE FUNDING PER SUBPANEL

JDL TECHNOLOGY PANEL: ELECTRONIC WARFARE

FY93 PROGRAM TOTAL: $122.4M (EXCLUDES NON-SERVICE FUNDING WHICH TOTALS $0.91M))



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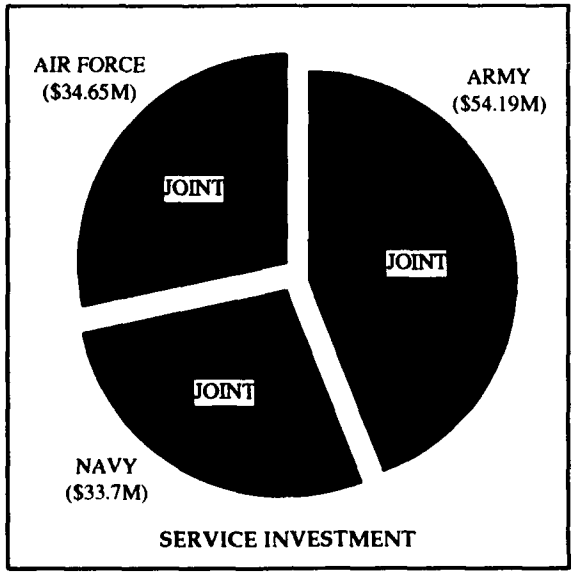

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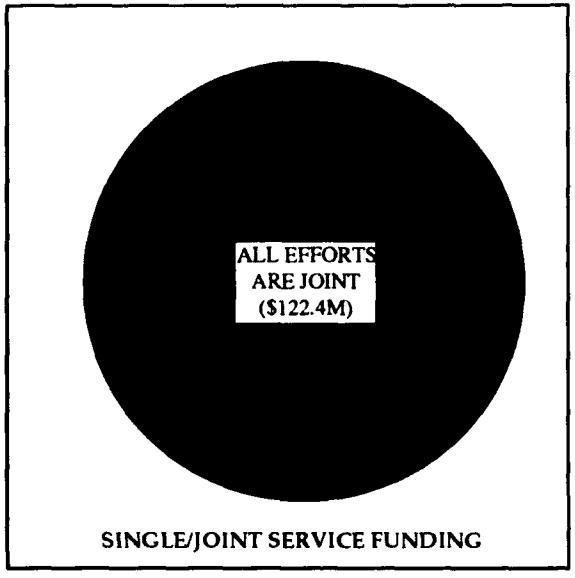

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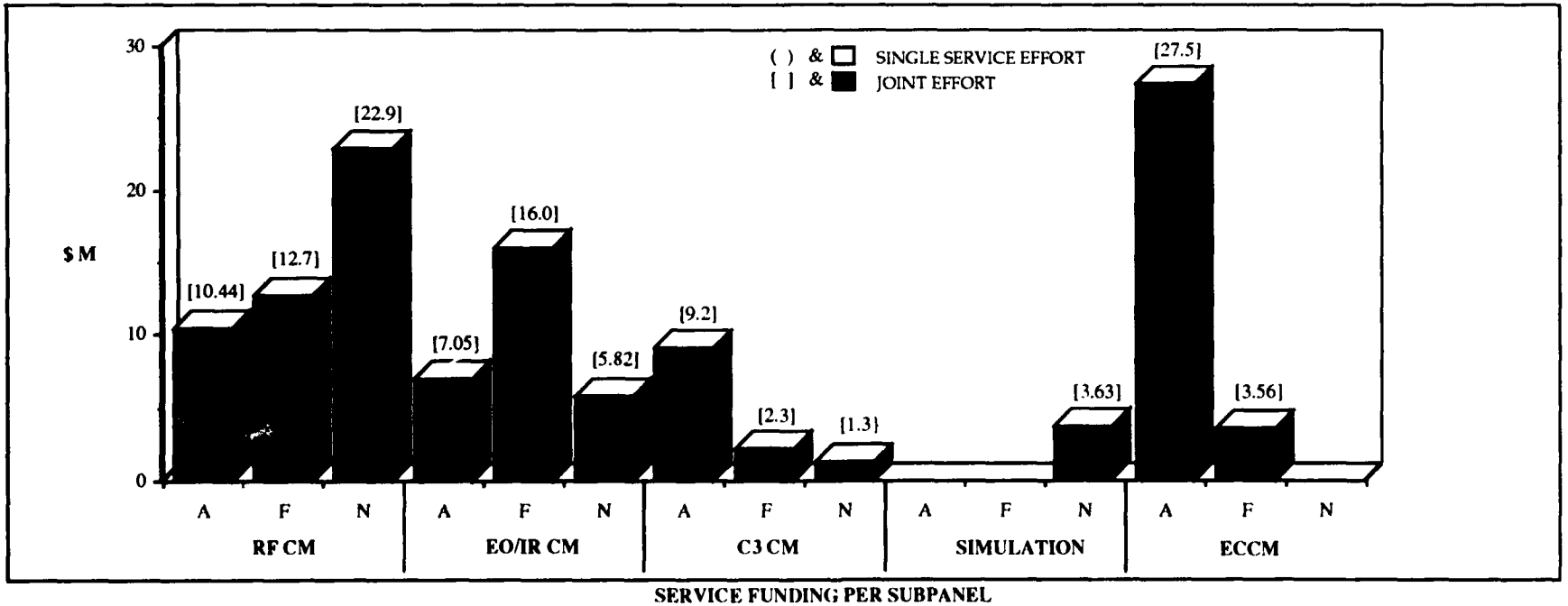
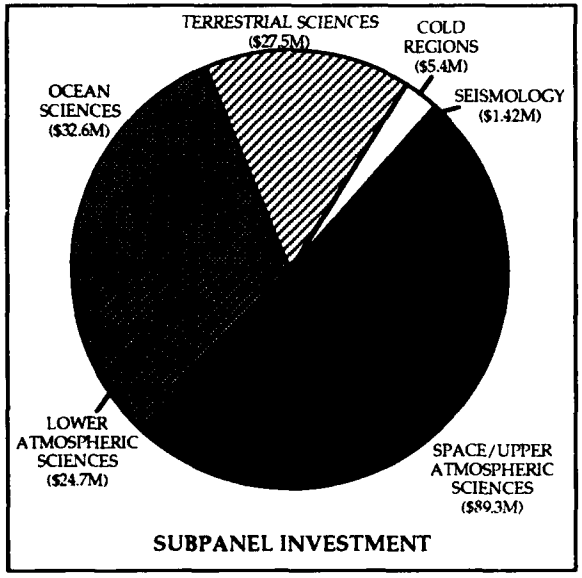


SERVICE FUNDING PER SUBPANEL

**JDL TECHNOLOGY PANEL:** ENVIRONMENTAL SCIENCES

**FY93 PROGRAM TOTAL:** $180.9M

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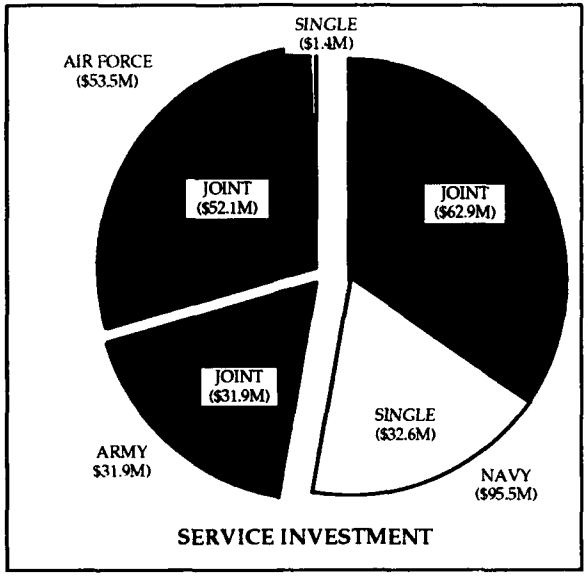


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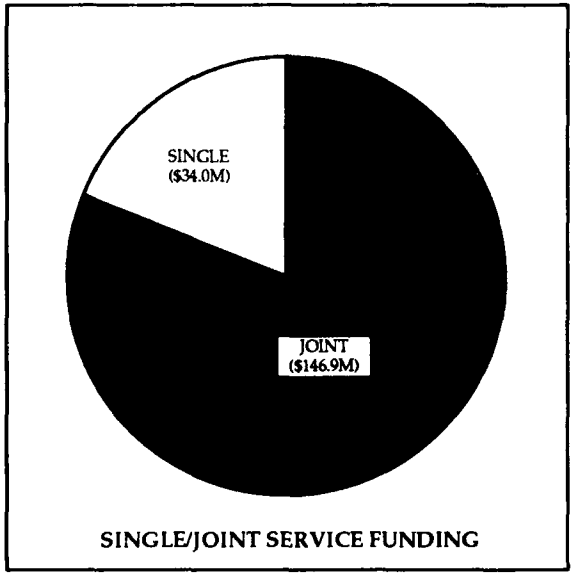


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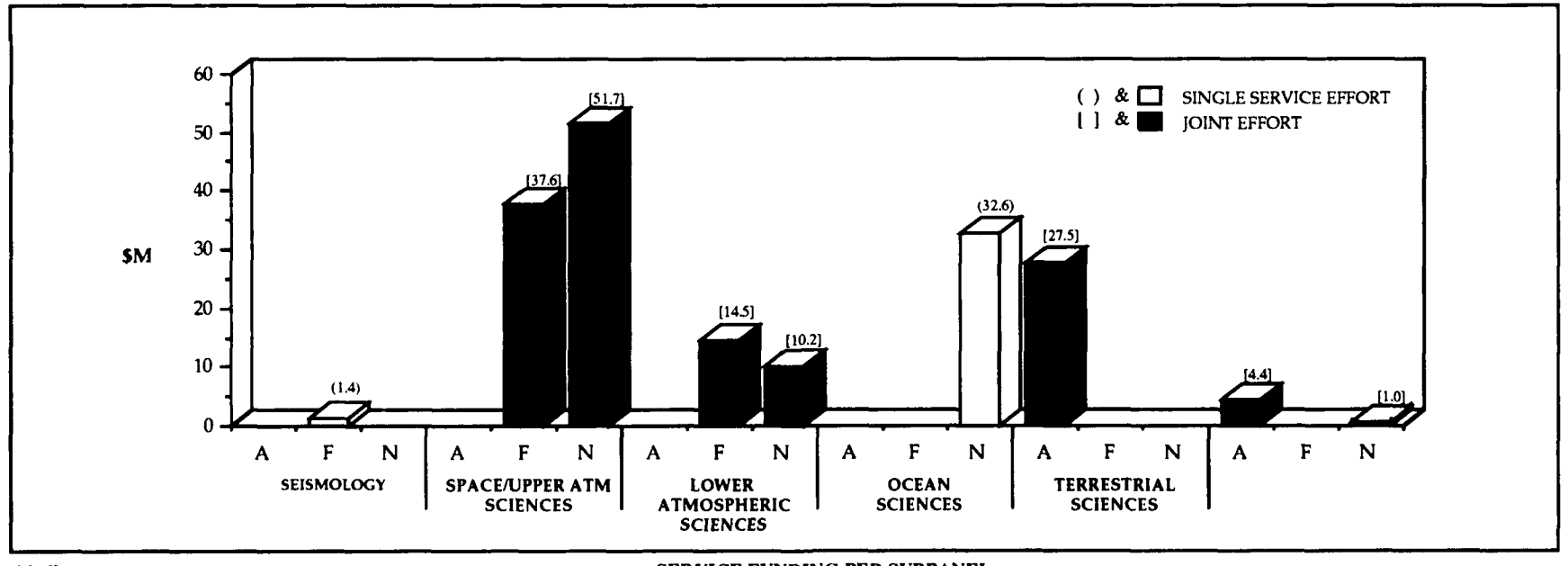
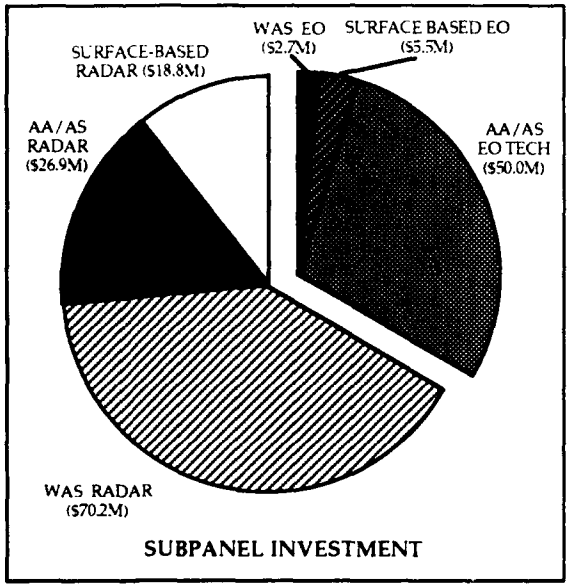



013A/92

SERVICE FUNDING PER SUBPANEL

**JDL TECHNOLOGY PANEL:** SENSORS

**FY93 PROGRAM TOTAL:** S174.1M (INVESTMENTS FOR AI/S RADAR COMBINED WITH AA/AS RADAR)

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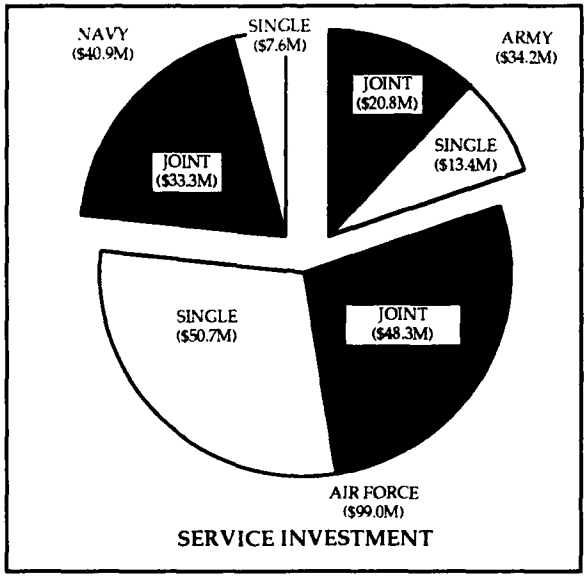


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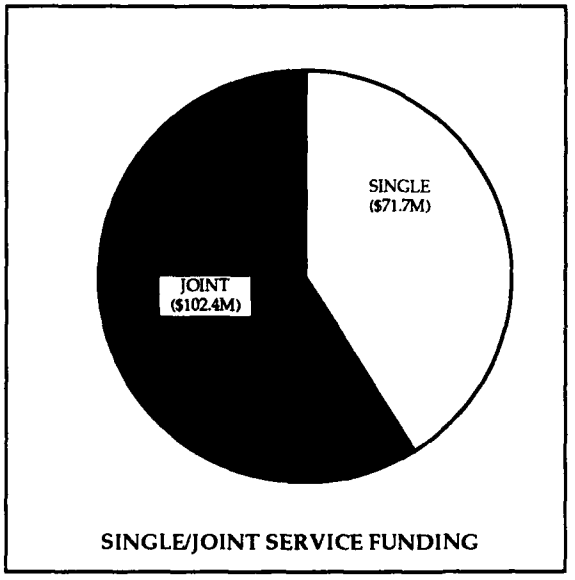


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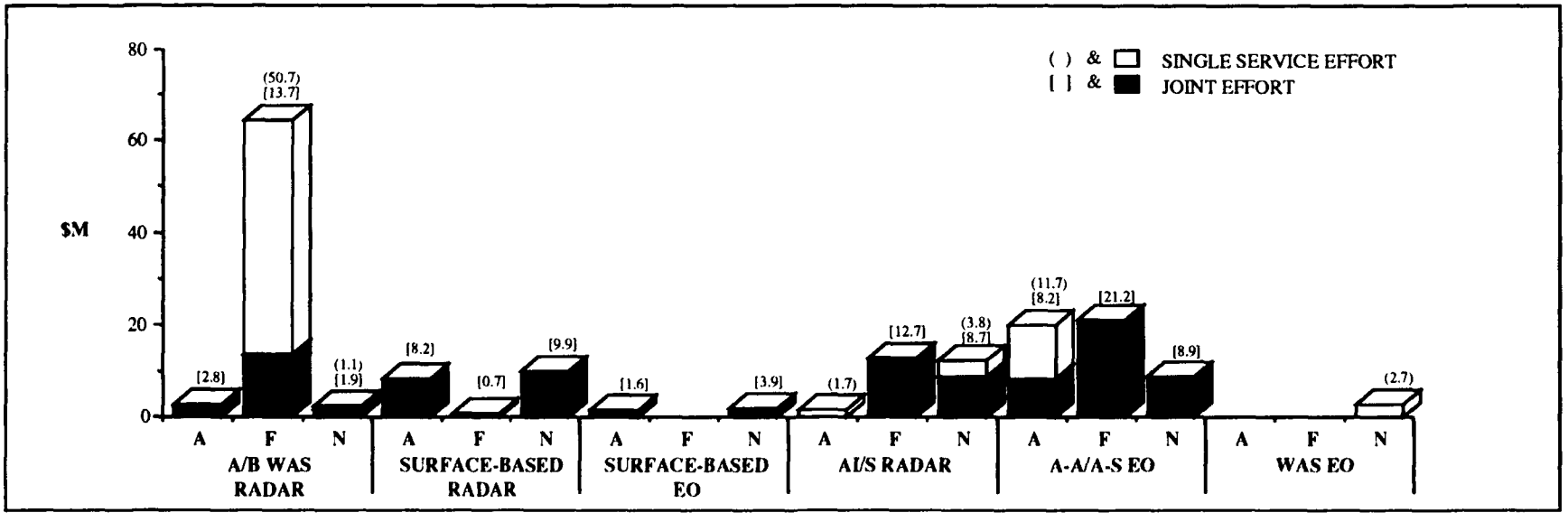
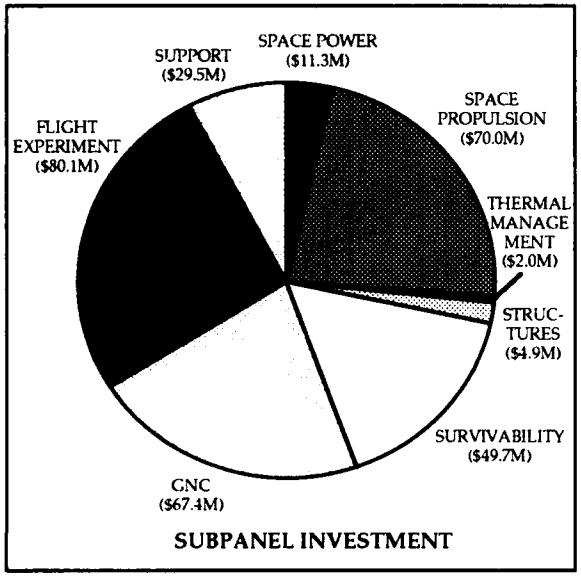



SERVICE FUNDING PER SUBPANEL

**JDL TECHNOLOGY PANEL:** SPACE VEHICLES

**FY93 PROGRAM TOTAL:** $315M (EXCLUDES NON-SERVICE FUNDING WHICH TOTALS $325.9M)

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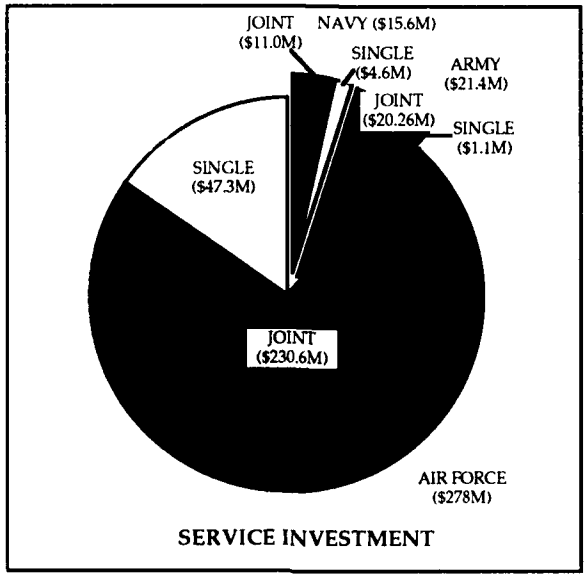


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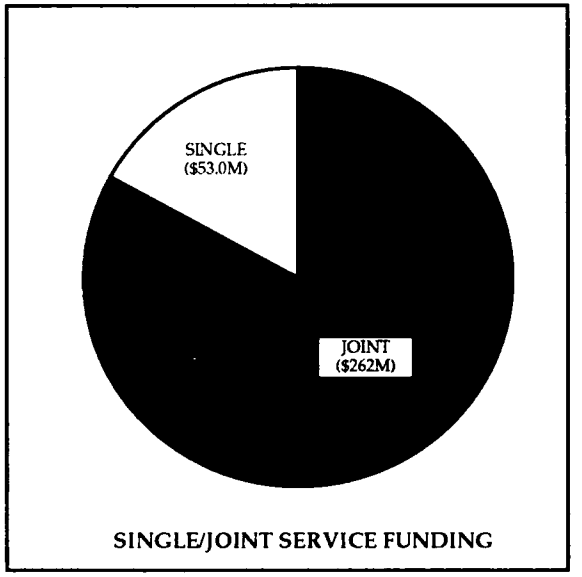
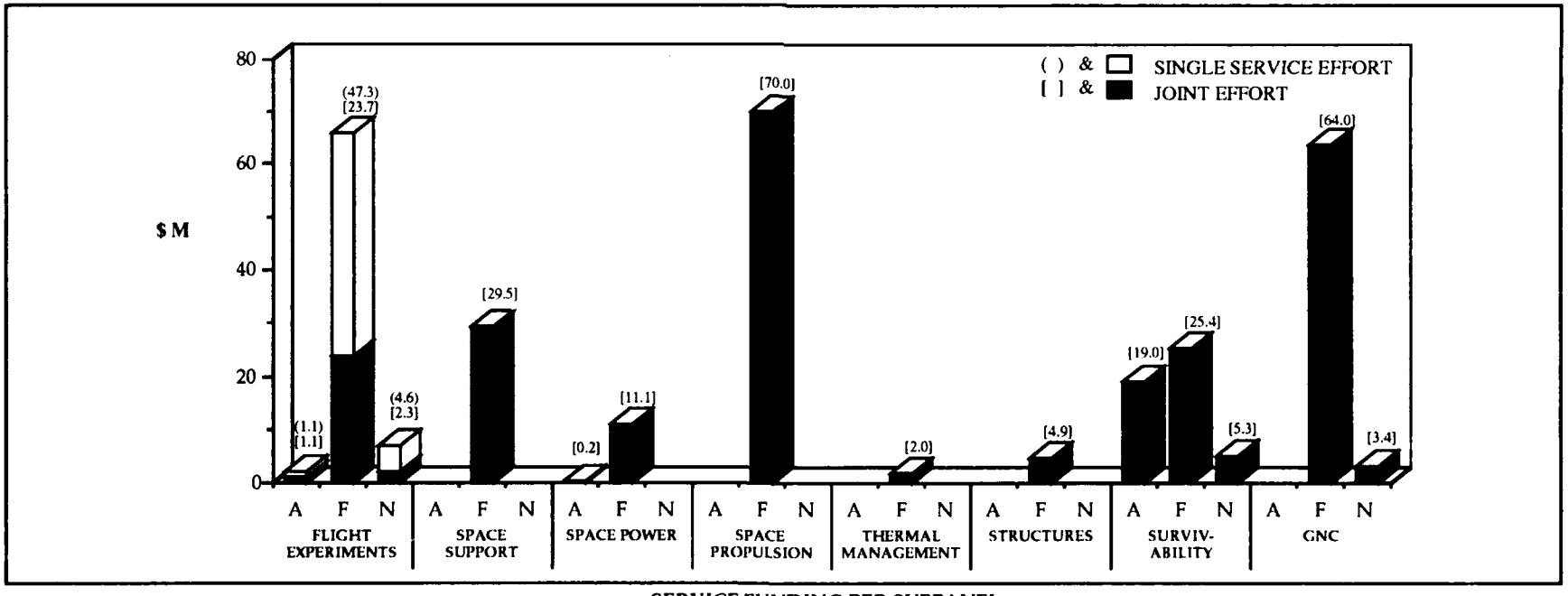


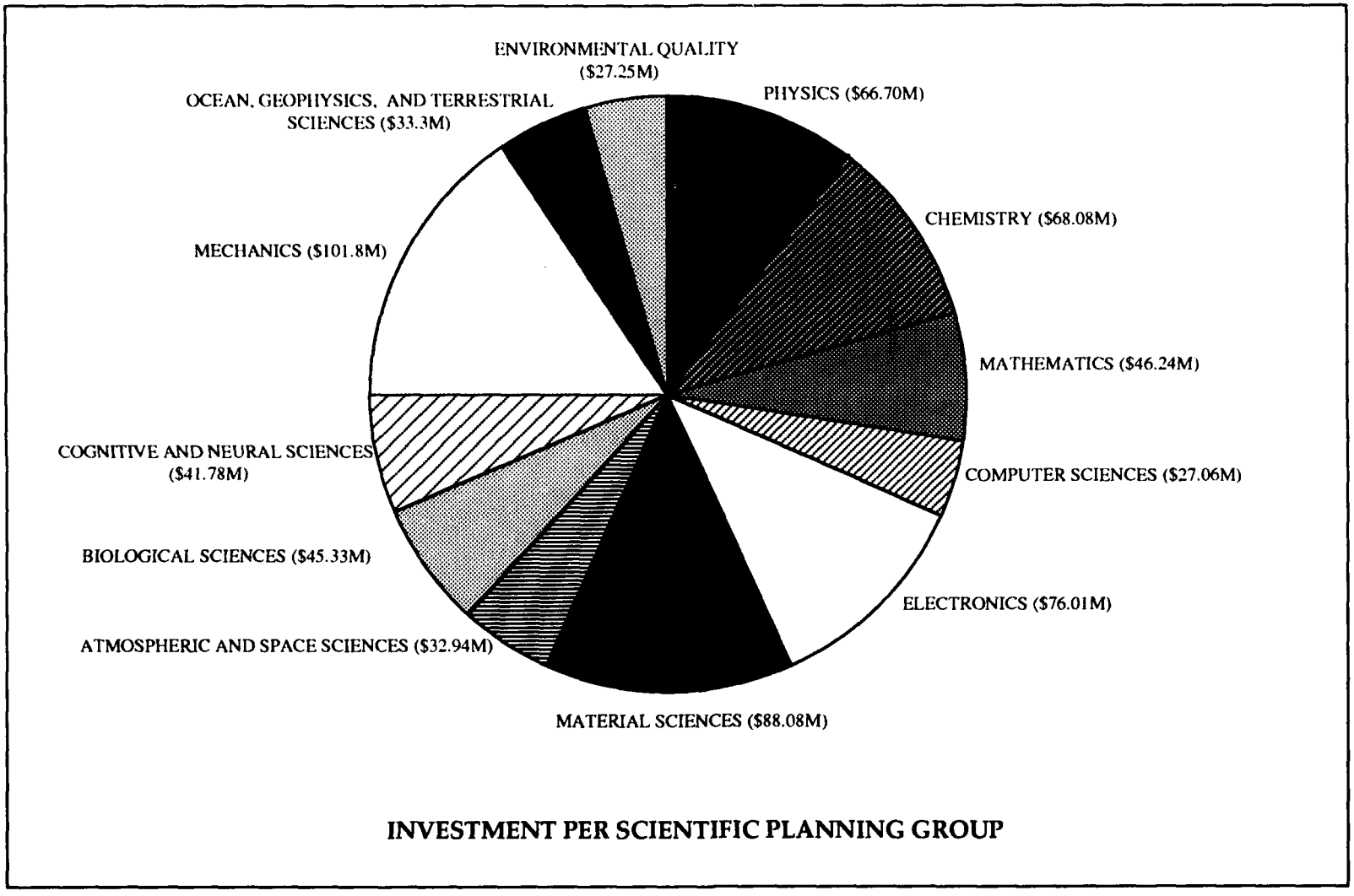

SINGLE/JOINT SERVICE FUNDING




SERVICE FUNDING PER SUBPANEL

JDL BASIC RESEARCH PANEL

FY93 PLANNED PROGRAM TOTAL: $654.28 M




**INVESTMENT PER SCIENTIFIC PLANNING GROUP**

# APPENDIX B.2

# JDL TECHNOLOGY PANEL AND BASIC RESEARCH PANEL ACCOMPLISHMENTS

**Contents:**

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# ADVANCED MATERIALS PANEL

## Air Force 700 High Temperature Resin

The Navy canceled its plans to undertake a new program to develop a high temperature thermosetting resin based upon results of a just-completed Air Force program. Information exchanged and evaluated during joint planning interactions established a strong basis of confidence in Reliance leading the Navy to adopt the Air Force developed strategy.

## Constitutive Materials Models

The Navy avoided undertaking its own constitutive modeling program for shock absorbing elastomeric materials by adopting an Army model, complete with relevant elastomeric materials property data. Navy awareness and confidence in adopting the Army model originated in joint planning interactions. The Navy avoided two or three years of development time already expended by the Army.

## Diamond Dome Development

The Technology Panel for Advanced Materials has established the Diamond Dome Development program for infrared transparencies on missiles, aircraft etc. It has established new joint planning of the Tri-Service "Diamond" Transparencies Program. It has initiated joint Service (in-house and contracted) program reviews and technical evaluations. The Navy focuses on bulk diamond material development, and the Air Force on thin film development. The panel is initiating efforts to bring SDIO funded activities into true joint planning mode.

## Eye and Visual/Near IR Sensor Protection

There has been a significant additional increase in magnitude and effectiveness of Tri-Service joint program planning and coordination, both in-house and contracted efforts. It includes: a) push for single contracting agent for all Services, b) Tri-Service increase of 15 to 40 percent in joint planning of the FY93 JSPP areas over FY92, and d) aggressive joint identification and analysis of further Reliance category upgrade options. This results in shortening of Service lead times for technology availability, and avoidance of costly duplication of both in-house and contractor efforts.

## High Temperature Composites

The Navy and Air Force are both pursuing and developing advanced carbon-carbon for space applications due to the composite unique properties and characteristics which make it extremely attractive for advanced space systems applications. Because of common goals and limited funding, joint planning was undertaken in 1989 through the JDL Carbon-Carbon Group. A ten-year technical requirements definition and plan for the development of carbon-carbon composites for space applications was developed. The Air Force developed low cost carbon-carbon composite tubes and panels. The Navy developed a truss structure and joining technology for the Military Strategic/Tactical and Relay Satellite (MILSTAR). The Air Force tubes and multifunctional coating were integrated into the Navy truss structure program. Both Air Force technologies were successfully scaled-up and demonstrated in a truss structure by the Navy.

As a result of this Reliance activity there is no need for the Air Force to have a follow-on survivable coating program. In addition, Navy truss assessment alleviates the need for an Air Force/Navy assessment program. Joint Air Force and Navy program development, program management and source selection will continue to eliminate duplicative programs.

# AIR VEHICLES PANEL

## Aircrew Escape Group

Both the Air Force and the Navy have technology development programs to develop a controlled propulsion system for the next generation aircraft ejection seat. The propulsion system will be used to steer the seat away from the ground in adverse attitude escape attempts. The Services have established a joint working group that is defining propulsion and control system requirements, coordinating analytical techniques, modeling results, and evaluating data from track and flight test programs. The joint effort will be funded by Armstrong Lab, Wright Lab, and the Naval Air Systems Command (NAVAIR). In addition NAVAIR has provided a full-time liaison person at Wright Lab to assist in the coordination and development of the program. This unified program in escape system technology has been organized, planned and is being implemented by the JDL Air Vehicles Panel.

Under this program, the Joint Primary Aircraft Training System (JPATS) Escape Working Group is defining common requirements, with a coordinated trajectory-controlled energy management system being developed for a common seat. Coordinated programs have been established in computational fluid dynamics modeling of separation dynamics, and common instrumentation requirements are defined to share test data.

A JDL memorandum of agreement has been established for unified escape system technology development. A Wright Labs analysis of USAF/Navy out-of-the-envelope accident data is being tried out to define common fourth-generation requirements. A Navy liaison is located at Wright-Patterson AFB to work joint program issues.

## Electrically Powered Actuation Design (EPAD) Validation

The EPAD program seeks to establish credibility of electric actuation as a primary method of control for flight critical control surfaces on tactical aircraft. Flight tests are conducted to validate several advanced flight control actuators in F-18 aircraft (at NASA Dryden). The equipment tested includes a "smart actuator" developed by HR Textron for the Naval Air Development Center (NADC), an electrohydrostatic actuator (EHA), and an electromechanical actuator (EMA).

Under Reliance, each participant makes a contribution to the effort. The Air Force provides funding, direction, integration, tech support, and in-house lab/test facilities. The Navy provides a smart actuator, F/A-18 technology and hardware support. NASA instrumented the aircraft for all flight test safety issues.

## Fly-By-Light Program Called FOCSI (Fiber Optic Control System Integration)

The FOCSI program seeks to improve the reliability of flight control systems, increase the safety of aircraft, and reduce the weight and volume required for electrical harnesses. There have been recent breakthroughs in the areas of passive optical sensors qualified for aircraft environment and high temperature optical fibers. Critical technology demonstrations include the piggyback of 10 flight and nine engine passive optical control sensors on F-18 aircraft. A closed loop follow-on flight demonstration of FOCSI is also planned.

Under Reliance, a feasibility study identified potential benefits of optical technology for aircraft systems (NASA/Tri-Service Joint Program). FOCSI is a joint NASA/Navy program and feeds into NASA's fly-by-light/power-by-wire program.

Power-By-Wire (PBW)

The Air Force and Navy, along with NASA under Tri-Service S&T Reliance, are also developing affordable and reliable PBW flight control actuators for Tri-Service applications on tactical, transport, rotary wing and commercial aircraft. The Air Force and Navy as well as NASA each make unique contributions to this coordinated effort.

The Air Force is the lead Service in this program and provides engineering personnel, test articles and funding. The Navy contributes engineering and other personnel, test aircraft support, test units, and funding. NASA provides test and evaluation services and equipment. This development program under Reliance addresses the needs of both the Air Force and Navy for affordable PBW systems, and eliminates duplication of effort.

Both the Air Force and the Navy are interested in advanced control surface actuation and in the incorporation of artificial intelligence into the actuator. Synergistically combining the strengths and expertise of each Service results in obtaining the technology more quickly at reduced costs. NASA's participation provides access to a design inventory for its fly-by-light/power-by-wire program geared to commercial applications.

The Tri-Service program leverages Independent Research and Development (IRAD) technology. Equally important, flight testing of three PBW systems for the Air Force, Navy and NASA can be combined into one program.

High Power Microwave (HPM) Effects on Flight Controls

The potential HPM threat to fly-by-wire systems was quantified by researching available intelligence data and engineering data from our own HPM weapon development efforts. This effort resulted in a Threat Definition document quantifying the HPM environment likely to be encountered by Navy aircraft in the conduct of their normal sea control and land/sea attack missions. The Threat Definition was used as a baseline in the analysis of the adverse effects of HPM on fly-by-wire systems.

Because of the very complex interaction of microwave energy with spatially distributed and redundant fly-by-wire systems, testing is needed to validate analytical results. Low and high power testing was performed in 1992 using an early fly-by-wire systems from the advanced Fighter Technology Integration/F-16 program. Major funding and control for this effort was provided by the Joint Technical Coordination Group on Aircraft Survivability (JTCG/AS) and the Air Force Wright Laboratory. While not representative of current hardware (particularly Navy hardware), this test provided some of the needed correlation of analysis and experiment.

# COMMAND, CONTROL, AND COMMUNICATIONS PANEL

## Advanced Technology Tactical Radio (SPEAKEASY)

The three Services, working together under Tri-Service S&T Reliance, have embarked on the development of a modular, multiband, multifunction programmable radio system capable of operating in multiple frequency bands. This program, managed by the Air Force at Rome Laboratory, will provide the architecture for the DoD multi-purpose tactical radio of the future. With the programmatic and financial commitments under Tri-Service S&T Reliance, the three Services ensure that the needs of all warfighters, current and future, will be addressed through this single development program.

This program has substantial benefits, both in terms of cost and technology. Because of the versatility of its design and the open modular architecture being developed, this radio will be useful as an interoperable replacement radio for all combat scenarios involving highly mobile forces--a key supporting technology for the anticipated warfare requirements of the future. Since the architecture is being designed especially to accommodate improvements in the device and signal processing areas, technology upgrades for improved performance will be accomplished easily and with minimal costs--resulting in long-term efficiencies through the extended life cycle of the radio system. The program also offers long-term improvements in use of resources through reducing training requirements, improved interoperability, superior communications, multi-platform implementation, reduced maintenance requirements, lower power use, and reduced size and weight.

## Automated Network Management (ANM)

The ANM program has combined research efforts in network management between the Air Force and the Army. This work which encompassed previous Army and DARPA work was continued by integrating RL/CECOM network management research. By using the combined ANM program, the Services avoided duplication and improved the product.

Addressing this research area jointly resulted in direct savings of funds. Each user also benefits through increased rationality of the system. The Automated Network Management system which is a product of this program, is a common system between the two Services, providing a single management entity, with corresponding savings in implementation, fielding, training and maintenance costs.

## Communications Network Interoperability

For the first time, a jointly funded initiative has begun to address interoperability issues during the formative 6.2/6.3 phases of research. Realizing that impediments to achieving seamless interoperability among future Service communications could arise during the early development phases, the communications networking panels established this joint program which will be led by the Navy. Under this initiative a single, independent integration contractor, operating under the direction of the panel, will provide the panel members with oversight into each Service's major initiative that is leading to the tactical communications networks of the future.

As these programs transition to further stages of development and eventual employment, interoperability will have been designed from the ground up. This will avoid costly retrofits or the additions of "black boxes" in the future.

High Frequency (HF) Data Network Simulation

The Air Force provided the Improved HF Data Network Simulation (DNS) program to CECOM for their further research. DNS is a PC-based simulation 6.2 program that allows for Distributed HF Network Management. The tool allows for the analysis of Automatic HF Link/Network Establishment algorithms.

The joint use of this tool will assure the development of common control algorithms suited to the operational needs of both Services and guarantee Service interoperability. The Defense Information Services Agency (DISA) has also requested use of the simulation to support the National Command Authority (NCA) sponsored program involving multiple government agencies. This development has eliminated the need for the Army and other members of the government community to perform much of the research and development needed to develop interservice HF network control algorithms.

Distributed Data Fusion

Under NRaD management, the three Service laboratories have initiated research in the area of distributed data fusion. This program will address the problem of providing a consistent tactical picture through the factoring of the central algorithm, and distribution of the factored parts throughout the community of remote sites. In support of this research, the Data Fusion Subpanel has established a session on distributed data fusion at the Sixth Joint Service Data Fusion Symposium to be held 14-18 June 1993. The session will address architecture and techniques for fusing information across distributed information nodes, including support to distributed decision making.

The generic approach being taken in this research project permits the results to be applied not only to Naval battle group assets, but also to other Service warfare areas. The benefits to be derived from this effort include: (1) True all source multiple hypothesis data fusion at all sites, (2) Common scene tailored to each site's role or responsibility, (3) Reduced communications bandwidth requirements, (4) Global/local arbitration for utilization of resource, (5) Increased system survivability.

Data Fusion Infrastructure and Technology Transition Initiatives

The most recent in-depth and authoritative technology assessment in Data Fusion was conducted by a Government-industry panel of experts with the support of the Office of Naval Research (ONR). This panel produced a "Data Fusion Development Strategy" document which summarized their findings, assessments, and recommendations to provide guidance for future planning relative to data fusion technology. One of the higher priority recommendations of this study had to do with recommending newer-term investment in the improvement of what the study group called "Infrastructure Technologies and Capabilities." Two key components identified in this area are: (1) the development of a standard approach to and the installation of education in the data fusion process and its "science" in both civilian and military university-level programs, and (2) the establishment of a Data Fusion Information Analysis Center (DFIAC).

In support of these recommendations, the three Services are jointly funding an effort to conduct a survey of the state of education in data fusion and identify the shortfalls. In addition, as part of this task, a requirements analysis for a DFIAC is being undertaken.

Tri-Service Distributed Computing Program

The Tri-Service Distributed Computing Program is a current joint effort for the development, evaluation and transition of distributed information systems technology. It is

comprised of a three cluster testbed, consisting of computing clusters at RL, NCCOSC, and CECOM, interconnected by the Defense Research Internet and integrated through the Cronus distributed computing environment. It utilizes the Cronus Distributed Computing Environment and is investigating distributed Tri-Service proof of concept applications development, fault tolerance and recover mechanisms, user interfaces and database management. During the last year the user interface has been significantly improved and transitioned to the X-Windows standard, which greatly enhanced the application interoperability. Also, the ability to simultaneously support heterogeneous Database Management Systems (DBMS) was demonstrated. The individual DBMS's were hosted at RL, CECOM, and NCCOSC with the access, update and interoperability prided through the Cronus distributed computing environment. The activities pursued under this joint program have contributed to the successful transition of the Cronus technology to operational Navy use.

# COMPUTER SCIENCES PANEL

## Artificial Intelligence Centers of Excellence

The JDL principals signed a Memorandum of Agreement in August 1991 to establish a pilot program offering access to three Service Artificial Intelligence (AI) centers of excellence:

Army Aviation Systems Command,
Aeroflight Dynamics Directorate, Moffett Field, CA
Focus: Intelligent Simulation

Naval Research Laboratory, Washington, DC.
Focus: Machine Learning and Natural Language Understanding

Air Force Rome Laboratory, Rome, NY
Focus: Intelligent Planning and Reasoning Methods

The objective of this program is to concentrate a critical mass of technical expertise and specialized equipment, in designated subject areas, at specific locations for the benefit of the entire DoD community. Researchers in one Service can work and study at any Service center, bringing with them a Service-specific problem and returning to their home organization with problem-specific solutions. In FY92, four assignments were made: U.S. Army Aviation Systems Command (AVSCOM) accepted one engineer from the Naval Undersea Warfare Center (NUWC); NRL accepted one engineer from Harry Diamond Laboratories (HDL); Rome Lab accepted one engineer from the U.S. Army Tank Command (TACOM) and another from the Naval Surface Weapons Center (NSWC).

## Software Life Cycle Support Environment (SLCSE)

The Air Force (U.S. Air Force Materiel Command Rome Laboratory and Electronic Systems Center joint sponsorship) is committed to attain a production-quality environment for the development of software. This collection of tools and processes, termed ProSLCSE, is based on a 1989 advanced development prototype. The environment supports a total life cycle concept where an integrated toolset is applied during software development activities within the system life cycle phases, with a repository accumulating information that can then be passed to the post-deployment software support activity. The intent is to increase productivity and product quality while containing costs and maintaining a predictable schedule. The Navy (NRaD) and DARPA (Software Technology for Adaptable, Reliable Systems Project) will be Beta test sites for the merging products in FY93 and intend to be early users of the technology. The Army, SDIO, the Office of the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (OASD(C3I)), the National Institute of Standards and Technology (NIST), and the Software Engineering Institute (SEI) are reviewing the effort and are candidates for adoption as soon as the results are acceptable.

## DoD Modernization Program

During late FY91 and FY92, JDL members approached DARPA on entering a joint program to accelerate the insertion of modern architecture computer systems into DoD at key research sites. It was agreed that an experiment would be useful. A solicitation for proposals was issued for the insertion of Intel Touchstone computers. As a result, four sites were selected by a JDL/DARPA panel and DARPA provided 8 node systems per site; some of these sites have grown

to 32 nodes. This insertion has led to significant advancements in the understanding of the utility of the Touchstone architecture and direct advancements in areas of scientific investigations for:

Army: a finite difference time domain code - an explicit, initial value, multizone Maxwell's equations solver that can handle inhomogeneous materials; ray tracing based electromagnetic methods; Monte Carlo methods for producing a cumulative total engagement timeline distribution of a tactical weapon system;

Navy: a large blast simulation, 3-D multi-zone Navier-Stokes solve in generalized coordinates; hexahedral (six-sided) block-structured computational flow dynamics; globally structured rectilinear computational flow dynamics; unstructured (tetrahedral) finite element computational flow dynamics;

Air Force: Geometry optimizations, transition state searches, intrinsic reaction coordinates, and numerical hessians in their electronic structure program. Other investigations include interdisciplinary computational aerodynamics for air vehicle technology; dynamic molecular modeling of laser hardening material research; atomic and molecular electronic structure of polymer; and auditory system modeling and neural networks.

This dual purpose (computer and science advancement) program has been so successful that a larger scale program has been initiated under the title "Department of Defense High Performance Computing Modernization Plan" issued 31 March 1992 "to provide the rationale, process, timetable, and funding requirements for high performance computing modernization in DoD Research, Development, Test, and Evaluation (RDT&E)." This program is being run in the Reliance tradition of joint Service planning and will fill a critical user-driven need.

DoD Software Technology Strategy

In 1992, JDL Computer Science Panel members served as the key contributors to the development of a draft document outlining the current investment in software technology, how that investment relates to a couple of application areas (Command and Control, and Corporate Information) and identified unfulfilled technology needs that are required to meet software needs by the year 2000. Technology road maps, shortfalls, and a possible improvement program were identified and widely distributed, including opening up the issues to a public forum. Results from this effort have been fed back into the JDL planning process with three new initiatives under investigation for a possible FY94 start.

# CONVENTIONAL AIR/SURFACE WEAPONRY PANEL

## Collocation of Conventional Guns at Army ARDEC

This Tri-Service S&T Reliance program collocates Service conventional guns at the Army's Armament RDE Center (ARDEC). A Reliance agreement has been concluded which collocated Navy/Air Force conventional gun S&T efforts at ARDEC. The Navy and Air Force plan to complete and then terminate S&T work in this area in FY93. Army ARDEC will then provide the S&T effort under category 3A. Significant benefits will accrue from this collocation, since technology will be available faster at lower risk. One USAF position (engineer) will be relocated to ARDEC under this agreement. Actions are in progress to fill this position.

## Diamond IR Transparencies Program

The Diamond Infrared (IR) Transparencies Program develops free standing diamond domes and diamond coatings for advanced missile and aircraft systems. Diamond has excellent particle erosion resistance, high thermal conductivity, long wavelength IR transparency, and is a potential dual mode (infrared millimeter-wave (IR/MMW)) material. The Navy is the lead Service and is producing free-standing optical quality flats, will fabricate a 2.5" dome, determine anti-reflection treatment and test for radio frequency (RF) transmission. The Army is interested in free standing dual mode (IR/MMW) diamond domes. The Air Force supports programs to develop erosion resistant diamond coatings for forward looking infrared (FLIR) windows and builds on Navy efforts. Reliance conducts joint program planning and technology reviews, and a bi-annual Electromagnetic Window Conference hosted in turn by each Service.

## Advanced High Explosives

The objective of this joint program is to develop explosives for warheads with high performance and improved survivability characteristics. Work-sharing arrangements within the program have provided increased leverage for technology efforts. As an example, Navy agreed to focus on synthesis/evaluation of trinitroazetidine (TNAZ). Direction for this program is provided by the Warheads & Explosives Sub-Panel which also provides joint members to the Joint Ordnance Commanders Sub-Group for Explosives and Propellants. Noteworthy accomplishments in Advanced High Explosives are:

- Advancement of the potential of fumarates as melt cast energetic binders (of interest to Army/Navy/Air Force). The Air Force-funded work at NSWC indicated that this (dinitropropyl) fumarate is impact insensitive and not initiated by a number 8 blasting cap. Problems were identified with the castability of the fumarate. These will be addressed in FY93.

- Development of thermoplastic elastomers for explosives (Army/Navy/Air Force). A new semicrystalline thermoplastic elastomer was used with CL-20 to make a molding powder. The response of the molding powder to cook-off was much milder than that of several other explosives with other binders and similar solids loadings. A mild burn rather than detonation or explosion was observed.

- Evaluation and scale up of TNAZ (Army/Navy/Air Force). During FY92 approximately 80 lbs of TNAZ have been produced in a pilot plant. This material will be used for testing in warheads. A new laboratory process to prepare TNAZ without the use of organic solvents was developed. This new process more than doubled the yields over the current process.

TNAZ was also tested in a Stand-Off Land Attack Missile (SLAM) warhead and showed significant performance increases over LX-14.

- Improved processibility of CL-20 (Army/Navy/Air Force). Conditions were established for the production of two different particle sizes of CL-20, which are needed to get high solids loading in a plastic banded explosive (PBX). It was also shown that the desired polymorph of CL-20 was stable in several explosive compositions and did not change under temperature and humidity cycling.

- Development of bombfill for the Joint Direct Attack Missile (JDAM) (Air Force/Navy). Standard performance and sensitivity testing of the type done by the Navy 6.3B Insensitive Munitions Advanced Development (IMAD) Program was conducted on several Air Force candidates for bombfill for JDAM. This provided a basis for comparison with the Navy's bombfill candidates developed from the Insensitive Munitions Advanced Development (IMAD) program.

- Acceptance of new test methods as standards for joint use (Navy/Air Force). Two tests that have been exercised by the Navy in its IMAD program and the Air Force in its insensitive PBX program for evaluating explosives performance (naturally fragmenting test unit) and sensitivity (8" Gap Test) have been accepted by both Services as baselines for comparing new explosives.

- Demonstration of shock insensitivity in a high performance explosive (Army/Navy). The survival of a new Navy explosively driven deformation test was demonstrated. The explosive is based on fine particle size solids in an inert binder and is being considered for use in the Navy Deformable Ordnance System and the Army Patriot Missile Upgrade.

# DIRECTED ENERGY WEAPONRY PANEL

High Energy Microwave Laboratory (HEML) and High Energy Research and Technology Facility (HERTF) at Phillips Laboratory

The USAF Phillips Laboratory has taken on the Reliance task of developing and building the facilities and radio frequency (RF) source/diagnostics technology for testing the susceptibility of tactical aircraft to high power RF. The new (FY92 completion) High Energy Microwave Laboratory (HEML) and High Energy Research and Technology Facility (HERTF) at Kirtland Air Force Base, Albuquerque, NM, eliminate the need for the Army and Navy to develop similar facilities, freeing up scarce resources for other requirements.

The HEML facility permits classified testing of tactical aircraft systems against high power microwave and ultra wideband RF radiation. The anechoic chamber can accommodate military aircraft such as a tactical fighter or large helicopter. Characterization of the anechoic chamber is being carried out in FY92.

The HERTF, which is located in a remote area of the base, allows testing using RF systems and test assets with explosive potential. Acceptance tests have begun with an anticipated initial operational capability (IOC) for explosive testing in FY93. A narrowband and wideband antenna range near HERTF is scheduled for IOC in FY93. This effort is resulting in a substantial acceleration in the availability of test facilities, which take significant effort to design, fund and build.

High Powered Microwave (HPM) Hardening Technology

The Army has conducted the HPM hardening technology program for the three Services, producing a Tri-Service hardening handbook, a demonstration of hardening of an aircraft transponder, and the development and evaluation of hardening devices for microwaves. This has had the effect of allowing the Navy, for example, to focus their limited funding on a few problems like anti-ship missile defense and has enabled them to achieve critical mass within a small program.

Mid Infrared Advanced Chemical Laser/Sea Lite Beam Director (MIRACL/SLBD) High Energy Laser (HEL)

The Navy and Army, supported by Navy, DARPA and SDIO funding, have completed development, integration and checkout of the MIRACL/SLBD High Energy Laser (HEL) system at White Sands Missile Range. This is the only operating integrated (laser and beam director working together) HEL system in the country. Most recently, the tracking system was upgraded to permit tracking targets through the full aperture of the HEL telescope, which is essential to achieving the stability needed for long range applications such as anti-satellite (ASAT) use. The MIRACL/SLBD system has been invaluable as a source of empirical data to develop technologies and demonstrate DoD's understanding of the performance and potential of laser weapons for tactical and strategic missions. A test facility and system of this size could only be assembled by combining the resources (dollars and expert personnel) of the noted participants. The result is an "enabling" technical capability that opens doors to a variety of military applications and benefits all three Services.

Split Cavity Oscillator

Joint development of the split cavity oscillator by the Army, Air Force and the Department of Energy (DOE) at the USAF Phillips Laboratory has enabled the development of a source with potential for Army applications like countermine and Air Force array high energy systems with a single development program. Progress has been rapid due to the ability to have a single program with a critical mass effort.

Relativistic Klystron Amplifier

The Navy development of the relativistic klystron amplifier (RKA) at NRL has achieved one kilojoule of RF energy in a long term SDIO-funded research effort. This program by the Navy relieved the USAF and Army of the need to do the development to show feasibility of very high energy RKA sources. The other Services are now picking up the technology for tailoring to meet specific Service applications without having to do the research program.

# ELECTRONIC DEVICES PANEL

Displays Collocation Center

CECOM/ETDL at Fort Monmouth has been designated by Reliance as the single collocation center for Tri-Service in-house Display Components basic research (6.1) and exploratory development (6.2).

The Display Components activity has established a Tri-Service Characterization and Analysis Laboratory and shares results from the DARPA-funded High Definition Systems (HDS) Program. It also shares results in stereoscopic and large area displays R&D.

The activity manages a DARPA/Tri-Service funded effort on helmet-mounted displays, and has conducted Joint Program Reviews of Displays Technology at ETDL, Fort Monmouth. It has also conducted a Joint High Definition Display Users Workshop at Fort Monmouth.

Vacuum Electronics

The Naval Research Laboratory (NRL) has been designated as the single collocation center for Tri-Service in-house vacuum electronics basic research. The DoD Vacuum Electronics Program focuses on five high impact areas to meet the requirements of all three Services and NASA. This Tri-Service effort supports DoD's need for microwave tubes and the need to revitalize the U.S. microwave tube industry. Its major thrusts are: Microwave Power Module, Design for Low Cost, Microwave-Millimeter Wave Advanced Computational Environment (MMACE), High-Performance Microwave-Millimeter Wave, and Vacuum Microelectronics.

The program leverages common technology-base interests of Services, DARPA, and NASA. NASA participates in this Tri-Service/DARPA program. A joint program review of vacuum electronics/tubes conducted at NRL reaffirmed the need for further intensive work in this vital area.

Under this program, duplication of efforts as well as facilities have been avoided through Tri-Service joint planning, a unified management approach and total oversight of the U.S. Vacuum Electronics Program.

# ELECTRONIC WARFARE PANEL

## Joint Expendable Decoy Development

The joint expendable decoy development activity develops next generation radio frequency (RF) and Infrared (IR) decoy technology for fixed and rotary wing aircraft. It provides cost effective aircraft survivability against newer weapon system threats. Joint efforts include: IR chaff which is in production for certain aircraft and under joint 6.3 development for other aircraft; pyrotechnic IR decoys with a cooperative Electromagnetic Decoy (EMD) program underway following joint pursuit at the 6.2 and 6.3; a next generation RF and millimeter-wave (MMW) decoys in a joint 6.3 program following a successful joint 6.2 program; and a joint multi-spectral decoy effort based on technology from the above programs. This program has resulted in one in-house research and test facility instead of three, with joint contractual efforts.

## Airborne Radar Electronic Counter Countermeasures (ECCM) Techniques Development

ECCM technique developments have been completed by the Wright Laboratory Radar Branch, against the following electronic counter measures (ECM) threats: non-uniform noise; escort or standoff noise jammers; blinking noise jammers; cross polarization; and cross eye. These techniques have been successfully verified in laboratory tests/simulations and are now being readied for flight demonstration and verification, these techniques will be ready for transition to users. New technique developments have been initiated which are addressing terrain bounce jamming, coordinated range and velocity gate stealers, towed decoy, smart noise, anti-radiation missile (ARM), and synthetic aperture radar (SAR) threats. Joint Service ECCM development programs are being planned for smart noise towed decoy and ARM threats.

## Electronic Warfare (EW) Visualization Technology

Ongoing developments in the application of the computer-based field of visualization in scientific computing (VISC) to electronic warfare (EW) is providing insight into the complex processes which result from the introduction of electronic countermeasures (ECM) into the tactical engagement arena. Displays have been developed for presentation of simulation-generated and laboratory-collected data and to augment analysis of these data. A 3D display depicts anti-shipping and anti-air engagements as conducted in a hardware-in-the-loop facility. This display exists in real-time and post-run versions and has supported NATO/HAWk simulations, USN EW test planning and laboratory pre-runs, as well as their ECM testing. Displays were also developed to present data collected for cross-polarization, anti-monopulse and blinking jamming ECM techniques investigation. These displays visually represent many megabytes of collected data and enable an analyst to rapidly select the most effective parameters for further experiments. The JDL TPEW Simulation Committee is forming an ad hoc Panel on EW Visualization to serve as a Tri-Service forum to exchange ideas and information for this emerging technology.

## Joint EW Receiver Technology

A concentrated review of Services' EW receiver technology development programs has laid the foundation for a collaborative joint planning initiative, currently underway, which is concentrating not only on future cooperative programs, but also, and uniquely, on generating a set of common, Tri-Service receiver test standards. This initiative will map the most promising of receiver architectures and algorithms into future retrofit improvements of existing radar warning receivers and electronic support measure systems. The review has resulted in a joint 6.2, comparative test program plan which will rationalize the extremes of digital receiver approaches

which are under investigation. This digital architecture joint analysis has spawned a joint 6.3/6.3A advanced channelized receiver program in which the Services have appropriately divided the work effort into more manageable tasks, yet with a view towards a common set of EW receiver requirements. These latter two technology areas have also benefited greatly from the recent addition of an National Security Agency (NSA) observer member to the JDL Technology Panel for EW, bringing to bear the wealth of exacting intelligence collection technology.

# ENVIRONMENTAL SCIENCES PANEL

Environmental Design Guidance for Evaluation (EDGE) Program

EDGE is a 6.2 software effort that is being developed by the Environmental Effects Branch, U.S. Army Topographic Engineering Center (TEC), Fort Belvoir, VA. Its goal is to provide environmental information, data and guidance to personnel in the U.S. Army's materiel acquisition cycle. EDGE would assist the materiel designer and developer during preparation of the environmental portions of acquisition documents, during cost vs. operational trade-off analyses, and in the evaluation of environmental restrictions on materiel in anticipated deployment areas. Just recently, the EDGE Beta Test Site Program was completed. EDGE was installed at the Combat Developments Directorate, U.S. Army Transportation Center and School, Fort Eustis, VA. The Testbed supported these combat developers for such materiel as wheeled vehicles, hovercraft and watercraft.

Part of the development of the EDGE prototype involved the implementation of extensive and detailed environmental data sets and the integration of algorithms that could accurately approximate environmental conditions where actual data were lacking. High quality data were obtained from the U.S. Air Force's Environmental Technical Application Center (ETAC), at Scott Air Force Base, IL, as well as ETAC's OL-A Detachment at Asheville, NC. Algorithms to approximate the frequency distribution of several environmental elements were extracted from technical reports produced by the Air Force's Phillips Laboratory, Hanscom AFB, MA. Additional climatological data, for both land and sea areas, were obtained from the U.S. Navy's Oceanographic Command Detachment at Asheville, NC. Environmental design information was obtained from both the Navy and Air Force for supplementing the Army's own climatic design criteria. In addition, for the generation of daylight and illumination products, the Naval Observatory supported the TEC by providing highly accurate computational algorithms. Part of the success of the EDGE Testbed program can be directly attributed to the information and support provided by the Navy and the Air Force.

Joint Planning for Air Force/Navy Research in the Lower Atmosphere

A joint planning process has been developed to accelerate R&D and related transitions to Tri-Service joint operational weather prediction systems. A roadmap of various components of a modern numerical weather prediction system (similar to that for the Navy Tactical Meteorological Program) has been developed and the R&D Tri-Service activities have been mapped into it. Examples of adjustments of R&D programs include Air Force reliance on Army research for transport of gases and chemicals in the planetary boundary layer (PBL). Another example is the new Army and Air Force support to the Navy for theater scale weather prediction model development. Plans are to use a common DoD system for forecasting and simulations. There is an alignment of R&D efforts for eventual support of new Tri-Service operational plans for weather center support of theater operations.

Recent Reliance panel activities to achieve better planning include joint workshops in simulation and visualization requirements, testing Army battlefield data sets with fine scale prediction models, mapping Service R&D activities into a roadmap, and the review of Army capabilities in simulation and visualization from a topographic sciences perspective.

Joint Planning for Air Force/Navy Research in Space and Upper Atmosphere

A new program has been developed under Reliance with the Air Force funding the Navy stratospheric sound unit instrument (SSULI ) aboard the four Defense Meteorological Satellite Program (DMSP) Block 5 Subdivision 3 satellites to be launched in the late 1990's. The instrument is an ultraviolet limb-scanning device that can measure neutral and ion density profiles in the upper atmosphere. Information derived from this instrument wiil improve the global performance of high level density models that run operationally at the Air Force Space Forecast Center. These improved density estimates are critical to the accuracy of satellite drag models.

This work borrows heavily from current Navy and Air Force satellite programs to improve instrument calibration and performance. All efforts will be guided by science steering groups consisting of members from the Air Weather Service, the Phillips Lab, the Naval Research Lab, and the Applied Physics Lab at Johns Hopkins University.

# SENSORS PANEL

## Air Intercept Radar

The Air Force and the Navy maintain a joint program under Tri-Service S&T Reliance to achieve all-aspect air-target identification capability (noncooperative target recognition) for fighter airborne interceptor radars. The Air Force is developing one-dimensional ultra-high range resolution (UHRR) radar technology (ARTI Program) with greater than one gigahertz bandwidth and 6 inch range resolution, which requires a library of data from many aspect angles. The Air Force has developed a one-dimensional air target classifier as well as automation technology for a two-dimensional classifier. The latter is the approach pursued by the Navy.

The Navy is developing steeped frequency techniques both for one-dimensional and two-dimensional classifiers. Stepped frequency technique permits conventional airborne tactical radars with modest bandwidth to synthesize range and cross range resolution in the two-dimensional case. It is also developing an imaging two-dimensional inverse synthetic aperture radar with aircraft profile generation. The classification algorithm uses dimensional feature extraction and uses such ratios as wing to tail, inlet to nose, etc.

The APG-71 Full Scale Engineering Development radar will serve as demo radar for both one-dimensional and two-dimensional approaches. Jointly-planned tests, demonstrations, collaborative data collections, data base sharing and archiving will be followed by Air Force/Navy down selection of technology to be pursued. The resultant joint selection of advanced radar technology and advanced signal processing technology will provide an all-aspect air target identification capability sensor (radar-noncooperative target recognition) suitable for F-15, F-16, F-14, F/A-18, F-22, AX aircraft radars.

## Surface-Based Electro-Optics

Tri-Service S&T Reliance has established a Surface-Based Electro-Optics Program for the co-development (Army and Navy) of land- and sea-based dual color infrared search and track (IRST) sensor, algorithms, and processor technology. The program includes joint testing, data analysis, algorithm validation and establishment of a multicolor data base leading to a common IRST system.

The Army provided a two-color, lightweight IRST for data collection, while the Navy provides a two-color, highly stabilized, high resolution shipboard IRST. Algorithm and software development is jointly funded. The program uses DARPA's High Performance Computing Programmable Processor Program and IR Focal Plane Array Producibility Program.

As a result of Reliance, this joint program avoids duplication of effort, and provides the potential for major savings in acquisition costs. As a result of this program, the two Services now maintain a common multicolor data base and are in a position to build on DARPA processor developments.

## Joint Airborne Wide Area Surveillance Radar: Tri-Service Multi-Channel Airborne Program

The primary technological challenge in advanced airborne surveillance radar is adaptive multi-domain (spatial, temporal, range, and polarization) processing. This radar technology is required to resolve targets form interference thus allowing detection, tracking, and identification of advanced targets, in a complex electronic countermeasures environment. In addition, the radar

must have emissions that do not offer a predictable stable emitter source for anti-radiation missile (ARM) homing.

The Joint Air Force/Navy Program focuses on common technology in the area of clutter and signal processing: The Multichannel Airborne Radar Measurement/Analysis Program. The objective is to develop and implement a multichannel airborne data collection capability for development of advanced target detection algorithms and architectures including those for look down geometries. Targets in clutter measurements collected from an airborne radar platform can provide a critical assessment of advanced algorithms for high subclutter visibility using high fidelity, high dynamic range multichannel radar. Detection of advanced targets in a clutter and electronic warfare environment is currently limited due to single channel data collection capabilities. Current programs in fully adaptive array processing (space/time processing) for algorithm and architecture development require real world measurement data from a moving platform. Such data is required to fully assess performance improvements of advanced technology developments over presently fielded techniques.

The joint effort is co-funded with the Army, Navy, and Air Force. The Army is providing testbed aircraft and ARM Emulator (advanced flyable generic ARM seeker). The Navy provides wideband technology and High Altitude Remotely Piloted Surveillance System (HARPSS) Radar. The Air Force provides multichannel airborne radar with advanced signal and clutter rejection processing.

The significant accomplishment is that the Tri-Service savings will be realized from conducting a single airborne measurements program (instead of three), a single centralized database, and the use of Tri-Service test assets. Also, significant savings are realized by the Services' shared analysis effort (i.e., three needs - one analysis). Cost savings and efficiencies will be gained through evolution of common systems technologies. Data transfers and consolidation, where practical, are occurring in parallel with the development of measurement assets. Sharing of analysis is also occurring and duplication eliminated.

USN/USAF Wide Band Shared Aperture Program

The Naval Air Warfare Center (NAWC) and Wright Laboratory (WL) have jointly planned and managed the wideband shared aperture technology program. The multi-function, multi-mission requirements of current and future USN and USAF fighter, attack, and bomber aircraft when coupled with the severe weight, volume, power, and environmental constraints of such high performance aircraft create serious problems for the avionics systems/sensors. As a result, combat system performance requirements must be addressed to defeat evolving threats by developing the technologies to integrate and share microwave frequency apertures for radar, and selected electronic countermeasures (ECM), electronic support measures (ESM), and communications functions.

During the FY92 JDL planning cycle, NAWC and WL jointly developed a roadmap of all of the USN and USAF ongoing and planned wideband microwave shared aperture technology and planned wideband microwave shared aperture technology development efforts. The roadmap included supporting microwave component and integrated avionics architecture programs within both Services. As a result of the JDL roadmapping activity, the decision was jointly made to restructure two parallel ongoing programs: the Navy Airborne Shared Aperture Program (ASAP) and the Air Force Electronic Combat Multifunction Radar Technology Program (EMRT)). Both Services agreed to technically support the planned follow-on phase to the USN-led ASAP program as the key technology brassboard demonstration since the effort was descoped to a smaller scale, longer term technology effort that will develop fully simultaneous transmit-while-receive, frequency multiplexed RF devices. These devices will be used for future integrated avionics architectures, such as those being investigated in the Wright Laboratory PAVE PACE studies.

As indicated in the joint plan, the USAF provided technical support to the USN-led ASAP program and participated fully in the source selection for the recently initiated ASAP follow-on demonstration phase. As the USAF-led EMRT program is being closed out in FY93, all technical results and fallout resources are being made available to the USN ASAP program. The USAF continues to provide engineering support to the ASAP program, jointly works with the USN to specify data feeds between the ASAP program and USAF integrated avionics architecture investigations (PAVE PACE), and to identify and focus longer term component technology efforts.

In addition, the descoped USAF brassboard demonstration has allowed the Air Force to cope with severe FY93 funding reductions by relying, even more heavily than first planned, on the USN-led ASAP demonstration program as the vehicle to provide technology feeds to guide future technology developments needed by both Services. The results from the initial phases of both the ASAP and EMRT programs indicate that continued joint planning in the shared aperture area will provide the integrated RF sensor capabilities needed to meet future needs of high performance, airborne air combat and attack aircraft at much reduced cost and development time.

# SPACE VEHICLES PANEL

## AFR700B Resin Development

The recognized upper surface temperature for current state-of-the-art organic matrix composites (OMC) is limited to 500° F for 100 hours due to oxidation and microcracking of the organic matrix. Research to improve the performance of OMC's into the 700° F limit has been conducted within the Materials Directorate at Wright-Patterson AFB. This research has resulted in the development of a new thermoset polymide material which possesses excellent thermal stability and which can structurally survive in environments once reserved for metals. The AFR700B resin composition of nadic ester, diester and diamine monomers requires an oxidation cure and a post cure to achieve its high temperature thermoset characteristics.

The AFR700B resin has been combined with fiber reinforcements to achieve the mechanical, physical, and electrical properties necessary for military and commercial applications. AFR700B offers processing comparable to the state-of-the-art resin system PMR-15, but AFR700B offers a glass transition temperature greater than 750°, therm-oxidative stability at 700° with less than two percent weight loss after 100 hours, low toxicity, and low dielectric properties.

Current materials programs are reviewing the current applications available to a 700° capable OMC composite system and conducting necessary cost/weight benefits analyses based upon existing vehicles performance requirements, developing engineering databases on both graphite and non-graphite reinforced high-temperature OMCs based on the AFR700B resin, and conducting critical environmental conditioning on these composites to determine if any premature failure occurs. The effects of processing (cure and post-cure) on the basic materials database will also be included in these developed databases.

Current structural programs are developing advanced technology demonstration components utilizing AFR700B, while folding in all of the maintainability and supportability requirements needed to offer a procuring organization a viable alternative organic composite structure. Each structural program effort has a baseline comparison system to compare against each design parameter of the developed organic matrix advanced technology demonstration component. Benefits of an organic matrix high temperature structural component include lower life cycle costs, lighter weight, and the ability to design low observability into the structure by avoiding parasitic coatings.

## Hercules

Hercules (Hand held, Earth oriented, Real time, Cooperative, User friendly, Location targeting, and Environmental System) is an astronaut-held camera used to take images from the Space Shuttle. It provides real-time geolocation of imaged targets to two nautical miles, with attitude and position determined and maintained independently of the space shuttle. Hercules incorporates a state-of-the-art ring laser gyro and a charge-coupled device (CCD) camera with multi-spectral response and a night-vision image intensifier lens. Hercules provides real-time downlink capability of digital images and geolocation solution.

Under Reliance, the Navy provides program management and geolocation hardware and software. The Army provides an image intensifier, the Air Force provides shuttle integration, and NASA provides an electronic still camera.

# BASIC RESEARCH PANEL

Coordination of London Foreign Field Offices

There has been increased interaction among the staffs of the three Services in the operation of the London Foreign Field Office. This interaction is resulting in joint funding of visits by scientists to the U.S. and joint organizations of workshops in areas of common interest. Staffing plans have been developed and implemented to assure broadest coverage of scientific areas with no duplication. Reliance Technical Area Committees (RTACs) were established to assure coverage of technology areas of interest to the JDL Panels, such as, Air Vehicles, Advanced Materials, Sensors, Computer Science, Electronic Devices, and Environmental Sciences.

A travel coordination program was developed for coordination and dissemination of travel information by the Foreign Field Office staff. As a result of Reliance there has also been an increase in electronics services at the Information Resource Center. The ONR Distinguished Lecturer Program has become a Reliance activity with the Air Force contributing resources to it. In addition, the administration and business operation has been centralized.

Coordination of Tokyo Foreign Field Office

As a result of Tri-Service Reliance, there has been increased coordination in the operation of the Tokyo Foreign Field Office. The Services are jointly planning staffing requirements; areas of coverage have been extended to materials science (Army), computer science (Navy), and manufacturing science and photonics (Air Force). A Memorandum of Understanding for the Tri-Service Tokyo Office to support the Defense Technology Office was signed; Tri-Service technology assessments were initiated.

Tri-Service 6.1 Program

The entire Tri-Service Research Program was jointly planned at the level 2ANF Reliance category, joint planning being carried down to the sub sub-area level before Service-specific tasks were determined. This is the level at which specific Tri-Service decisions are made. There are 281 Service-specific tasks, each featuring coordination in several topical subareas.

For instance, in order to accommodate a decreasing extramural research budget in chemistry, the Army dropped its extramural emphasis on classical electrochemistry and instead relies upon Navy and Air Force research. As a result of reliance on Navy and Air Force research, the Army also dropped its emphasis on biomaterials and funded optimization of physical principles in biological systems (reverse engineering).

Based on the strong Army program in elastomers, the Navy eliminated its research in that area and redirected resources to initiate research in polymer surface chemistry. Also, as a result of reliance on Army research, the Navy dropped its emphasis on reverse engineering and funded biofabrication.

As a result of Navy research efforts, the Air Force eliminated its research in organometallic compounds, primarily semiconductor precursors, and redirected funding toward biotechnology relating to new materials. Also, based on research directions taken by the Army and Navy, the Air Force was able to focus resources onto a new complementary energetic materials initiative that highlights shock-induced chemical explosions.

# APPENDIX C.1

# JOINT ENGINEERS S&T PROGRAM PLAN SUMMARY

**Contents:**

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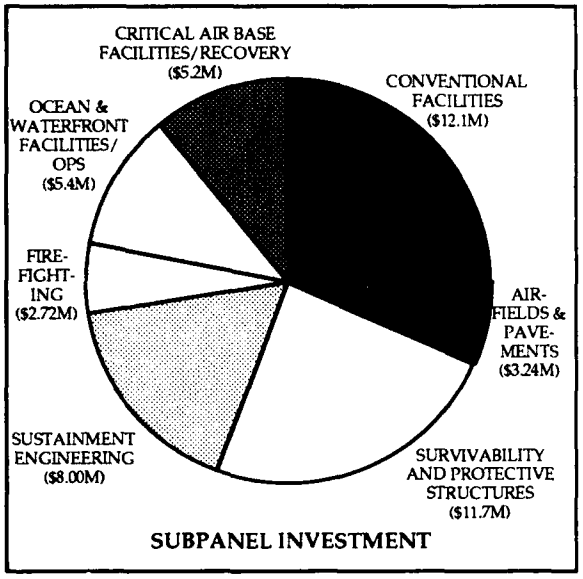
**JOINT ENGINEERS PANEL:** CIVIL ENGINEERING
**FY93 PROGRAM TOTAL:** $48.3M



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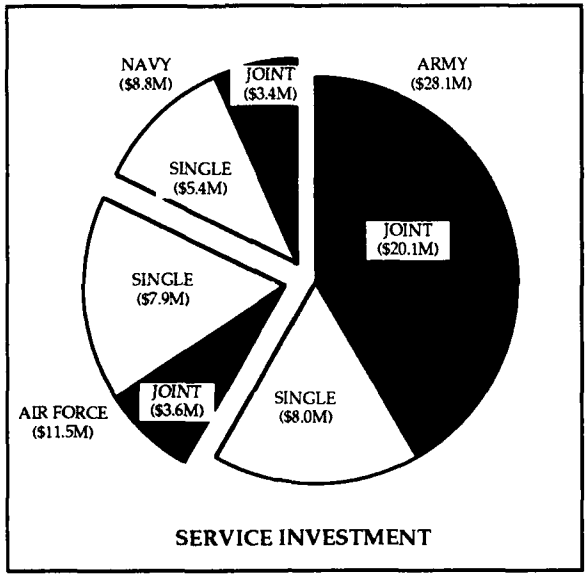

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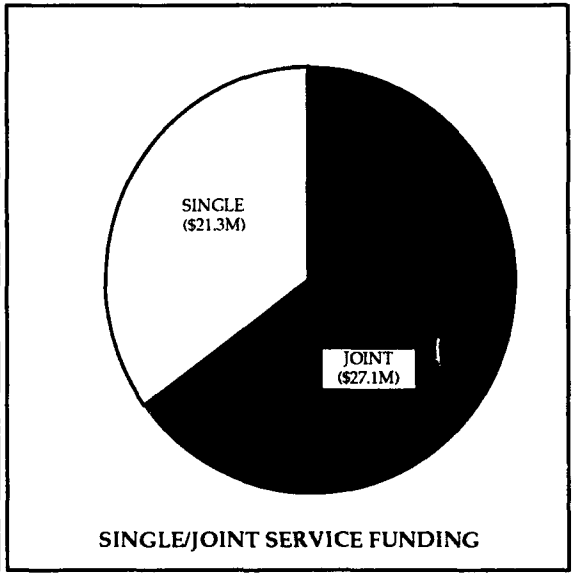

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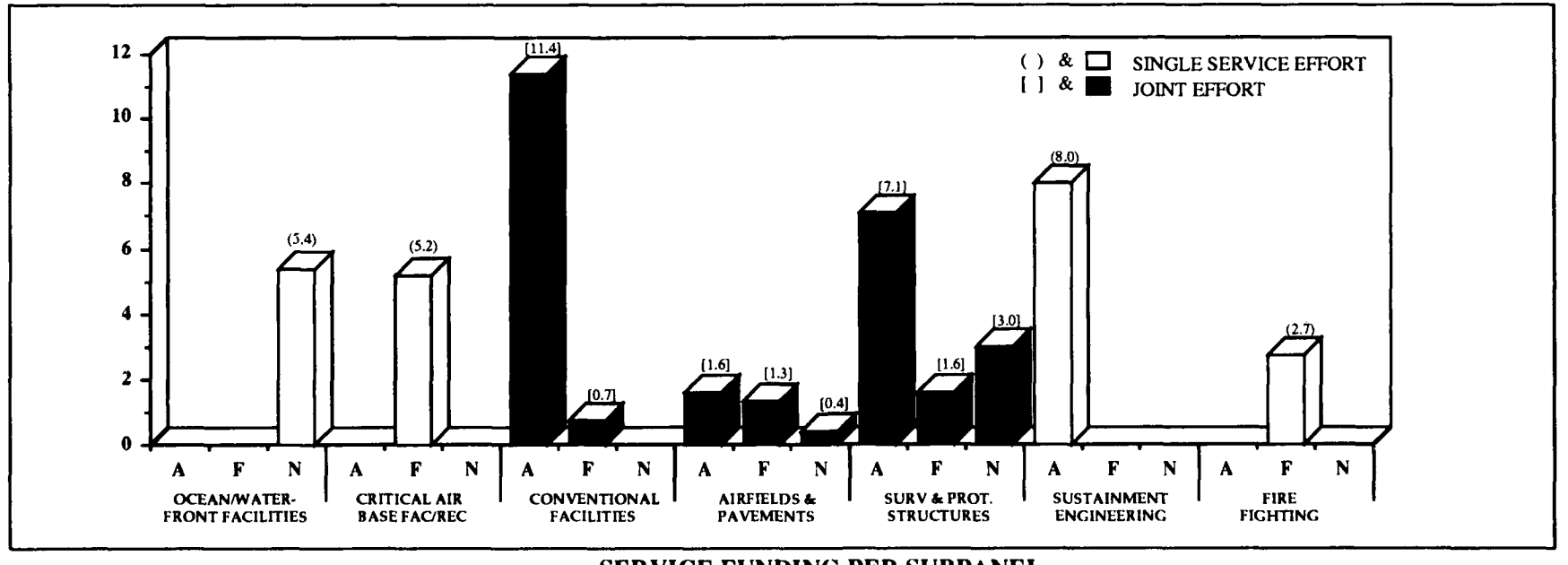
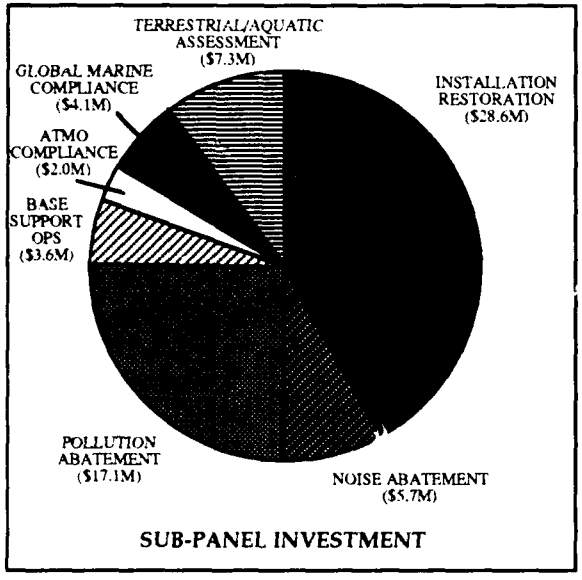


SERVICE FUNDING PER SUBPANEL

**JOINT ENGINEERS PANEL:** ENVIRONMENTAL QUALITY

**FY93 PROGRAM TOTAL:** $68.4 M

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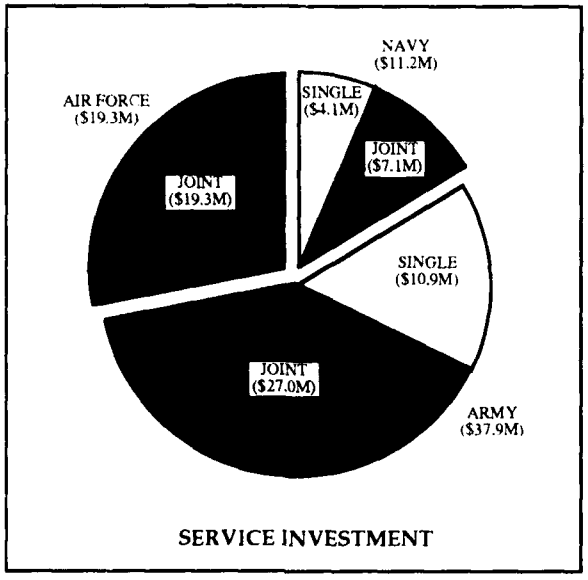


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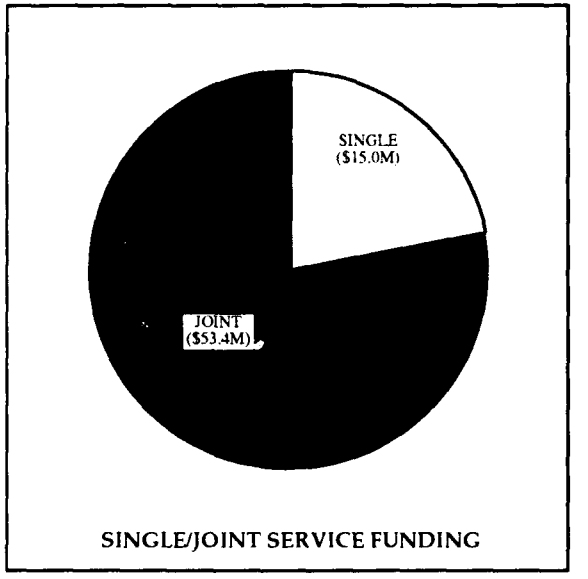


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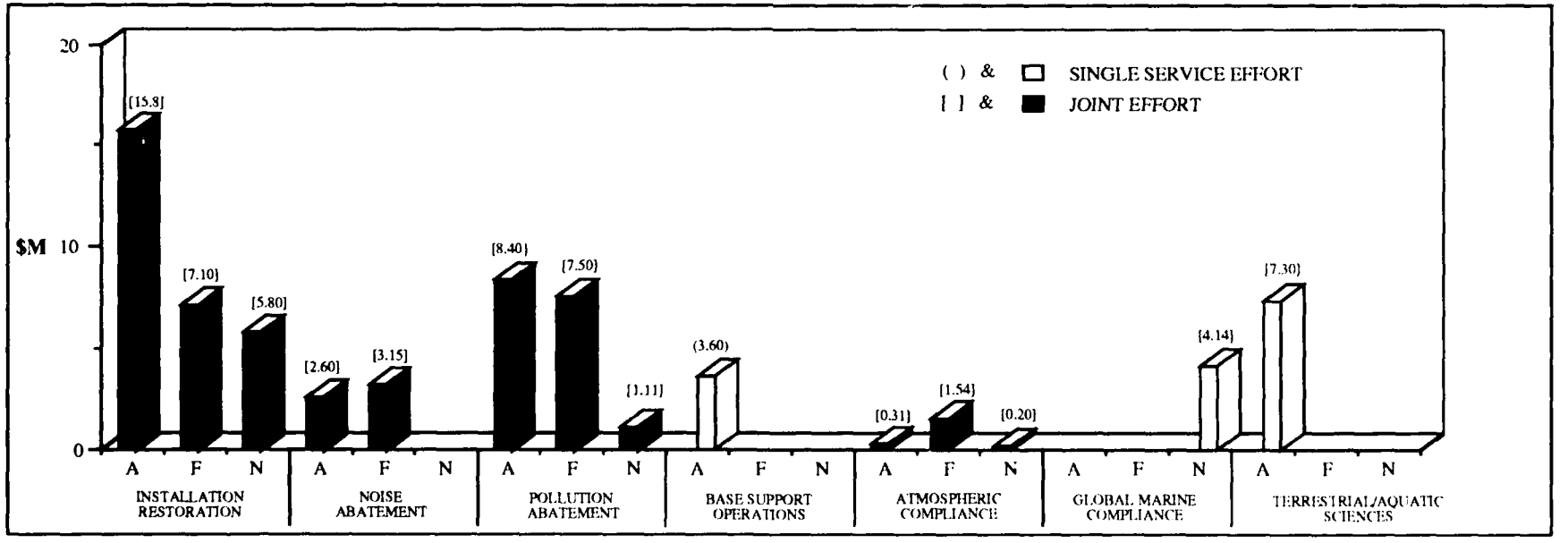


**SERVICE FUNDING PER SUB-PANEL**

# APPENDIX C.2

# JOINT ENGINEERS ACCOMPLISHMENT SUMMARIES

**Contents:**

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# CIVIL ENGINEERING

- ***Execution Achievements***
  - Collocation of survivability and protective structures S&T at Army's Waterways Experiment Station (WES)
    - Disestablished Air Force Shock Physics Laboratory
    - Allowed savings of 85 Air Force manpower spaces and associated facilities capital outlay
  - Relinquishment of Army S&T efforts in large space structures to the Air Force providing a savings of 3 Army manyears and corresponding facility capital outlay
  - Collocation of all S&T efforts in airfields and pavements at WES with reliance in the area of rapid runway repair providing savings of 2 Air Force and 4 Army manyears and associated capital outlays

- ***Planning Achievements***
  - Development of Tri-Service R&D programs in the following areas:
    - Mobiles generators
    - Seismic modeling
    - Terrorist threat protection
    - Heads up display/voice activated fire fighting support systems
    - Multispectral camouflage
    - Concealment and deception
    - Projectile penetration modeling
    - Amphibious logistics
  - Development of a Tri-Service R&D program database for R&D program plan information using a common format applicable to all Services

# ENVIRONMENTAL QUALITY

- ***Planning Achievements***
  - Development of Tri-Service efforts in the following areas:
    - Alternate solvents, paint strippers, and paint removing processes
    - Propellants, explosives, and other hazardous/toxic waste demilitarization, site decontamination/detection, and treatment
    - Tri-Service requirements based Cone Penetrator work for site assessment and monitoring and airborne/space borne monitoring
    - Air emissions studies of control and monitoring in the areas of firefighting, rocket and missile firing
    - Noise impact assessment on shrinking habitat and endangered species
  - Development of a Tri-Service R&D program database for R&D program plan information using a common format applicable to all Services

- ***Other Panel Achievements***
  - Panel expansion in the environmental quality area in response to the Congressionally initiated development of a Tri-Service requirements driven Environmental Quality R&D Strategic Plan
    - Plan requires the establishment of a comprehensive Tri-Service environmental quality R&D program
    - Will consist of discrete programs addressing the R&D solution from inception to implementation to meet user requirements and provide investment returns and cost/benefit analyses of each program

# APPENDIX D.1

# TAPSTEM S&T PROGRAM PLAN SUMMARY

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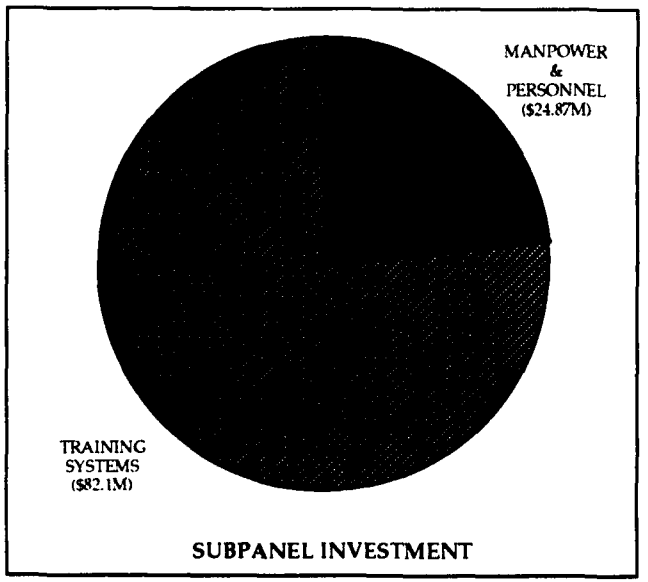
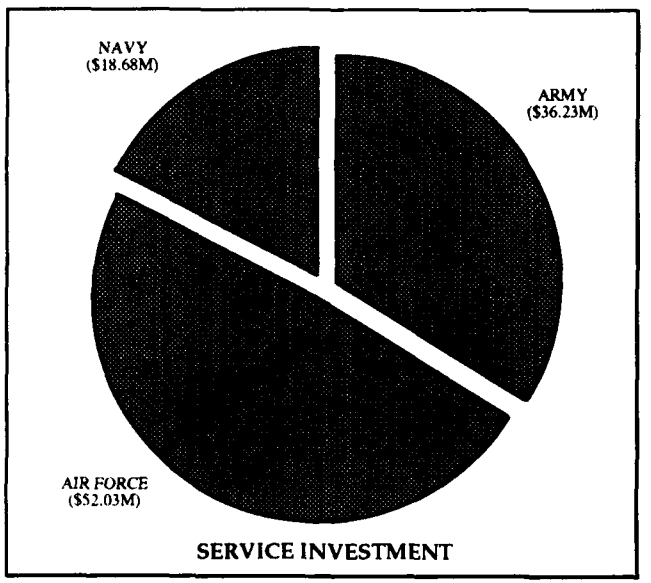
**S&T RELIANCE OVERSIGHT BODY:** TAPSTEM

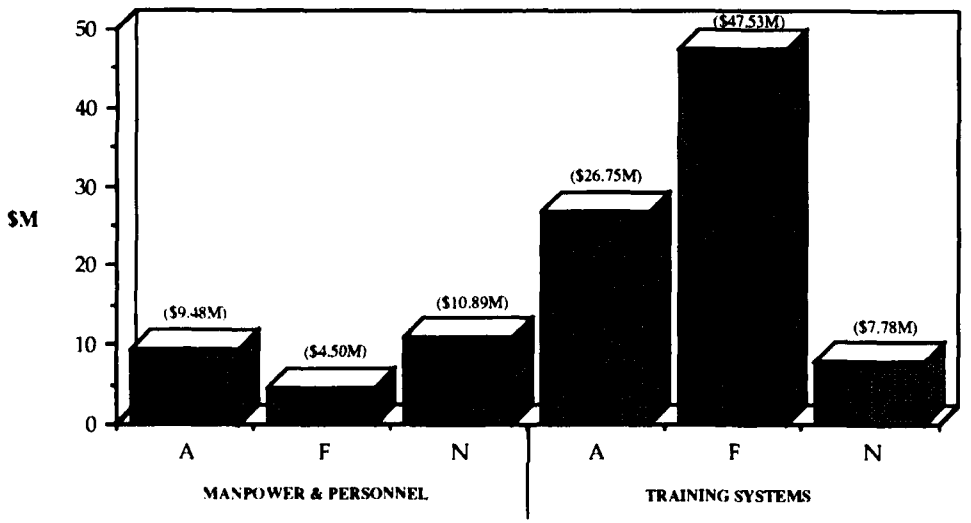
**FY93 PROGRAM TOTAL:** $106.9M (TRAINING SYSTEMS INCLUDES PARTIAL FUNDING OF HUMAN FACTORS S&T)




SUBPANEL INVESTMENT




SERVICE INVESTMENT




NOTE: BAR GRAPH REFLECTS COMBINED JOINT EFFORTS AND SINGLE SERVICE EFFORTS

**SERVICE FUNDING PER SUBPANEL**

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# APPENDIX D.2

# TAPSTEM ACCOMPLISHMENT SUMMARIES

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# Training and Personnel Systems Science and Technology Evaluation and Management (TAPSTEM) Committee Accomplishments

- **Initiatives**
  - Ensure full representation of human performance R&D and better coordination, resource allocation, oversight, and program justification
  - Included Naval Training Systems Center and Simulation Training and Instrumentation Command in the Training Systems Joint Technology Coordinating Group (JTCG)
  - Included the Joint Logistics Commanders JTCG on Training Devices and Simulation through the TAPSTEM JTCG on Training Systems
  - Involved 6.1 Service project managers
- **Joint Proposals**
  - Assessment of joint training strategies—originated by Army and Air Force. Intent is to develop mechanisms to determine whether the training strategies developed through joint programs are effective from a human performance standpoint.
  - Virtual environments for military training applications and virtual environments interface standards—proposal to determine what virtual environment systems to allow in order to be useful in military training applications.
  - Operational utility simulation testbed—proposal to develop a testbed which would encourage the development of measurement metrics related to "operational utility" of proposed simulation programs.
  - Air-land battle collective database development—proposal to develop a database for assessing and developing collective training. Initial effort focuses on air-land battle efforts at the National Training Center.
  - Distributed interactive simulation (DIS) communications/signal intelligence/electronic warfare, DIS dead reckoning, and DIS networking—these three proposals are directed toward support of the DIS program.

- **Lead Service Assignments**
  - Army—Selection and Classification (service unique applications); Human Resources Development; Land Warfare/Rotary Wing Training; and Unit Collective Training.
  - Navy—Selection and Classification (Computer-based Entrance Testing and service unique applications); Force Management and Modeling; Sea Warfare Training; Training Devices and Instructional Features; Classroom Training; and Productivity Measurement and Enhancement.
  - Air Force—Selection and Classification (Basic Abilities Testing, Job Structures and Requirements, and service unique requirements); Air Warfare Training; and Intelligent Computer-aided Training.
- **Discontinued Research Programs**
  - Human Resources Development and Classroom/Team Training (Air Force)
  - Force Management and Modeling and Intelligent Computer-Aided Training (Army)
  - Intelligent Computer-Aided Training (Navy)
- **Collocated Centers**
  - Pilot Selection—Fixed Wing (Armstrong Laboratory/Human Resources Directorate (AL/HR), San Antonio, TX)
  - Pilot Selection—Rotary Wing (Army Research Institute (ARI), Ft. Rucker)
  - Classroom Instruction (Navy Personnel Research and Development Center (NPRDC), San Diego)
  - Artificial Intelligence-Based Training Systems (AL/HR, San Antonio, TX)
  - Collective Training (planned, ARI Field Unit, Monterey, CA)
  - Virtual Environment Technology (Tri-Service, Orlando, FL)
  - Job Structures (AL/HR, San Antonio, TX)
- **Personnel Collocations**
  - 17 personnel moves completed and underway:

    Air Force (5 to Navy and 1 to Army)

    Navy (5 to Air Force and 2 to Army)

    Army (2 to Air Force and 2 to Navy)

# APPENDIX E.1

# ASBREM S&T PROGRAM PLAN SUMMARY

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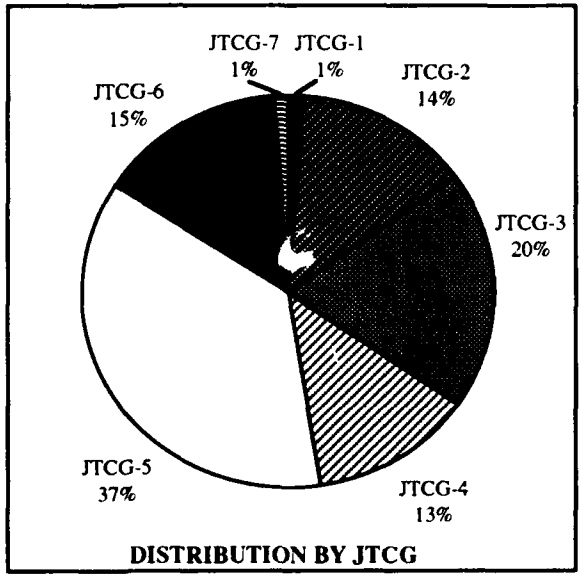
**S&T RELIANCE OVERSIGHT BODY:** ASBREM
**FY93 PROGRAM TOTAL:** $282.2M




**DISTRIBUTION BY JTCG**

**JOINT TECHNOLOGY COORDINATING GROUPS**

JTCG-1 - Combat Dentistry

JTCG-2 - Infectious Diseases of Military Significance

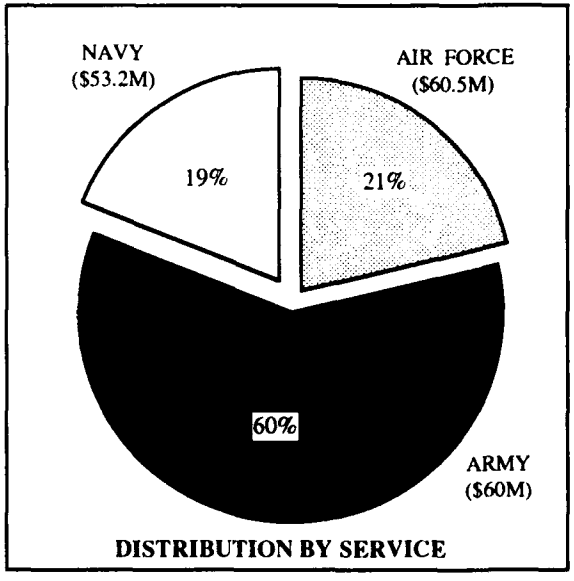
JTCG-3 - Medical Chemical Defense

JTCG-4 - Medical Biological Defense

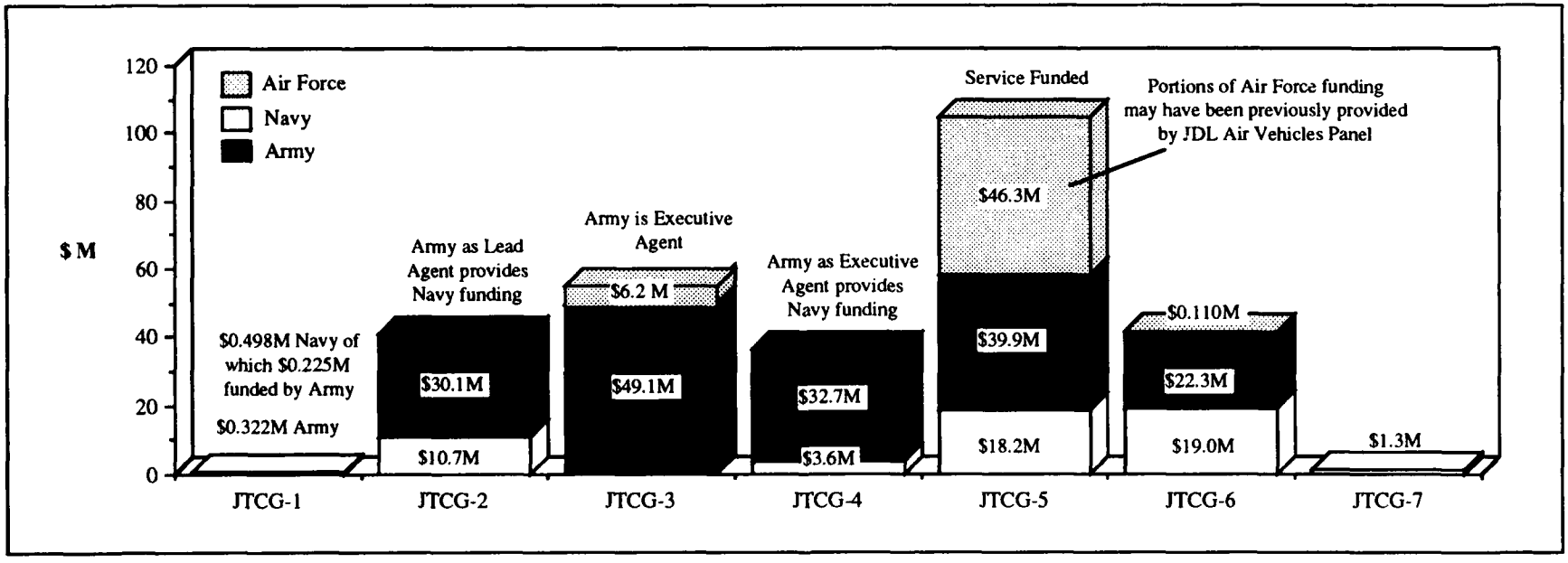
JTCG-5 - Human Systems Technology

JTCG-6 - Combat Casualty Care

JTCG-7 - Ionizing Radiation Bioeffects




**DISTRIBUTION BY SERVICE**




**PROGRAM EXECUTION BY JTCG AND SERVICE**

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# APPENDIX E.2

# ASBREM S&T ACCOMPLISHMENT SUMMARY

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# Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee Accomplishments

- ***Planning Accomplishments***
  - Blood Research Collocation
    - Disestablish Letterman Army Institute of Research (LAIR)
    - Collocate LAIR Blood Research with Navy and Naval Medical Research Institute by FY93
  - Trauma Research Collocation
    - Disestablish Letterman Army Institute of Research (LAIR)
    - Consolidate Army trauma research at Institute of Surgical Research at Fort Sam Houston
  - Dentistry Research Collocation
    - Disestablish the Army Institute of Dental Research
    - Collocate with the Naval Dental Research Institute by FY93
  - Biodynamics Research Collocation
    - Disestablish the Navy Biodynamics Laboratory and the Army biodynamics program (vibration) at Fort Rucker, AL.
    - Collocate at Wright Laboratory by FY93
  - Heat Physiology Program Collocation
    - Terminate Air Force heat physiology program at Armstrong Laboratory
    - Collocate all S&T work at Army's Research Institute of Environmental Medicine
  - Infectious Disease Program Collocation
    - Collocate Infectious Disease Program at Walter Reed Army Institute
    - Navy Infectious Disease Program at NMRI and Annex in Rockville, MD to be included
  - Electromagnetic Radiation Bioeffects Program Collocation
    - Electromagnetic Radiation Bioeffects Program to collocate at Armstrong Laboratory and will include:
      - -- Navy EMR Program at NAMRL (14 personnel to transfer)
      - -- Army Directed Energy Bioeffects Research at WRAIR (8 personnel to transfer)

- Toxicology Program Collocation
  - All S&T work to be collocated at Wright Patterson AFB
    - -- Navy already in place
    - -- Army to collocate FY92

# APPENDIX F

# GLOSSARY OF TERMS AND ACRONYMS

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# GLOSSARY OF TERMS

**Terms**
6.1: Funding category for basic research
6.2: Funding category for exploratory development
6.3A: Funding category for advanced development

**ASBREM**: Armed Services Biomedical Research, Evaluation and Management Committee. A management oversight body which is part of Reliance but not the JDL. Has responsibility for the Medical area.

**Cost Savings/Avoidance**: Cost savings are funds which become available for reinvestment in the S&T base as a result of Reliance activities. Cost avoidance is the process of generating future cost savings.

**Effort**: The most basic level at which Reliance manages research activity. An effort is roughly equivalent to a work package in the Army or a task in the Navy.

**JDL**: The Joint Directors of Laboratories. The management oversight body which provides general oversight for Reliance as well as specific joint planning for Combat Materiel.

**JDL Technology Panel**: A component of the JDL which has the responsibility for developing joint plans and overseeing implementation of joint plans in a specific technology area.

**Joint Engineers**: A management oversight body which is part of Reliance but not the JDL. Has responsibility for the areas of Civil Engineering and Environmental Quality.

**Joint Planning**: Refers to the **coordinated process** by which the Services and participating Defense agencies plan their S&T programs (both in-house and contract) in **areas, subareas, and sub-subareas** defined in the Reliance taxonomies, leading to the preparation and publication of Joint Service Program Plans (JSPPs). Taxonomy elements designated Reliance Category 2, 3, or 4 will be jointly planned and described within the applicable JSPP. Individual efforts within a jointly planned taxonomy element, however, may be executed either jointly or by a single Service. Taxonomy elements designated Reliance Category 6 (Service-unique) normally will not be jointly planned, but will be synopsized and included in the applicable financial summaries within the appropriate JSPP.

**Joint Service Program Plan (JSPP)**: The published product of the Reliance joint planning process. A JSPP describes the tri-Service/Defense Agency S&T program in the one or more Reliance areas that have been assigned to a JDL Technology panel; documents the specific responsibilities the Services/Agencies have agreed

to in the execution of joint efforts which will ultimately be reflected in the operating plans that the individual Services/Agencies use to execute their programs; and provides a basis for management accountability. Within a JSPP, jointly planned taxonomy elements are comprised of Joint Efforts, Single-Service Efforts, and, occasionally, service-Unique efforts.

**Joint Efforts:** Discrete programmatic entities, **documented** within a JSPP, in which two or more Services/Agencies are co-investing or co-participating to achieve common or linked objectives. Funds may or may not pass among the Services/Agencies during program execution. Joint efforts are of two types: **integrated** or **federated**.

**Integrated Joint Effort:** A joint effort involving tightly coordinated management of the different Service's/Agencies' activities to achieve the stated objectives.

**Federated Joint Effort:** A joint effort involving planned partitioning of the work into portions that can be carried out largely independently of each other but which, when taken as a whole, constitute a joint attack on a larger problem. Coordinated agreements for different Services to pursue different technical approaches to a problem would be an example of a federated joint program.

**Oversight Bodies**: Management and coordination organizations which constitute the highest level of management review within Reliance. Oversight bodies directly or through Technology Panels approve and oversee the implementation by the three Services of joint planning.

**Reliance Categories**:

*Category 1*: Coordination. This category represents the type of interaction most frequently used among the Services prior to Reliance. For example, it would describe the literally hundreds of DoD-sponsored S&T coordination bodies that had successfully supported S&T coordination for the past several decades.

*Category 2*: Joint Efforts. This category includes programs that will be planned and conducted jointly, but task execution can be at separate Service locations and all Services retain separate funding control.

*Category 3:* Collocation. This category includes programs for which in-house task execution will be collocated at a single Service's activities, with all Services retaining separate funding control. Each Service, at its option, may maintain its own in-house effort of up to 2 work-years per year, in order to ensure Service awareness of the major activity on going at the collocated site. Collocated programs may also be "joint," but there is no requirement that be the case.

*Category 4*: Consolidation. This category includes programs that will be consolidated under a lead Service for management. For programs so designated, all related S&T funds will be transferred to the designated lead Service, and work will be carried out at that Service's activities.

*Category 5*: Competition. This category includes programs for which in-house task execution will be competed among the Service performers, with all Services retaining separate funding and performer-decision control.

*Category 6:* Service Unique. This category recognizes that certain S&T programs will be unique to a given Service, for which the other two Services have no need to rely on that Service.

**Reliance/Reliance Process:** One of the most comprehensive restructuring efforts involving the technology base in over 40 years, addressing the full range of the Services' S&T activities; namely, their 6.1, 6.2 and 6.3 A programs.

**Reliance Technology Taxonomy**: A hierarchical structure describing the contents of the S&T program and relating the activities of each Service.

- Technology Area: The topmost level of aggregation. Each technology area is assigned to a single Technology Panel.
- Technology Subarea: The next lower level of aggregation.
- Technology Sub-subarea: The lowest, most detailed level of aggregation.

**Reliance Taxonomy Element:** A technology area, sub-area, or sub-subarea contained within a Reliance Taxonomy. Each taxonomy element is assigned a Reliance Category reflecting the S&T Reliance agreement reached by the three Services.

**Single Service Effort:** A discrete programmatic entity included within a JSPP, which is not duplicative of other Service S&T efforts and which, at the time the plan was prepared, is programmatically of interest to and supported by only one Service.

**Science & Technology Thrust Area**: One of a set of seven defense planning areas for which the Office of the Secretary of Defense seeks to produce warfighting systems.

**Service-Unique:** Refers both to Reliance areas, sub-areas, or sub-subareas and to discrete programmatic efforts which have been judged to be permanently within the unique province of one Service. For purposes of financial summaries within a JSPP, Service-Unique efforts are combined with jointly planned Single-

Service efforts in reporting the dollar value of Single-Service efforts within the JSPP.

**TAPSTEM**: The Training and Personnel Systems Science and Technology Evaluation and Management Committee. A management oversight body which is part of Reliance but not the JDL. Has responsibility for the areas of Manpower and Personnel and Training Systems.

**Technology Topic**: Any one of three discrete levels of the Reliance Technology Taxonomy (see above).

# ACRONYMS

| | |
|---|---|
| **AFAL** | Air Force Armament Laboratory |
| **AFCESA** | Air Force Civil Engineering and Support Activity |
| **AL** | Air Force Armstrong Laboratory |
| **ARDEC** | Armament Research, Development and Engineering Center |
| **ARI** | U.S. Army Research Institute |
| **ARL** | Army Research Laboratory |
| **ATCOM** | U.S. Army Aviation and Troop Transportation Command |
| **AVRDEC** | U.S. Army Aviation Research, Development and Engineering Center |
| **BRDEC** | U.S. Army Belvoir RDEC |
| **CECOM/ETDL** | U.S. Army Communications and Electronics Command/Electronic Technology Development Lab |
| **CERL** | U.S. Army Civil Engineering Research Laboratory |
| **CNVEO** | U.S. Army Center for Night Vision & Electro-Optics |
| **CRDEC** | U.S. Army Chemical Research, Development and Engineering Center |
| **CRREL** | U.S. Army Cold Region Research & Engineering Laboratory |
| **DARPA** | Defense Advanced Research Projects Agency |
| **DNA** | Defense Nuclear Agency |
| **EOD** | Explosive Ordnance Disposal |
| **IMCD** | U.S. Army Institute of Medical Chemical Defense |
| **ISR** | U.S. Army Institute of Surgical Research |
| **JCS** | Joint Chiefs of Staff |
| **JSPP** | Joint Service Program Plan |
| **MICOM** | U.S. Army Missile Command |
| **MRID** | U.S. Army Medical Research Institute for Diseases |
| **NASA** | National Aeronautics and Space Administration |
| **NAVOBS** | U.S. Naval Observatory |
| **NAWC** | Naval Air Warfare Center |
| **NCEL** | Naval Civil Engineering Lab |
| **NDRI** | Naval Dental Research Institute |
| **NMRI** | Naval Medical Research Institute |

| | |
|---|---|
| **NCCOSC** | Naval Command, Control, and Ocean Surveillance Center |
| **NPRDC** | Naval Personnel R&D Center |
| **NRaD** | Naval Command and Control Ocean Systems Command Research and Development Division |
| **NRDEC** | U.S. Army Natick Research and Development Center |
| **NRL** | Naval Research Laboratory |
| **NSWC/CD** | Naval Surface Warfare Center/Carderock Division |
| **NSWC/DD** | Naval Surface Warfare Center/Dahlgren Division |
| **ODDR&E** | Office of the Director of Defense Research & Engineering |
| **OSD** | Office of the Secretary of Defense |
| **PL** | Air Force Phillips Laboratory |
| **POM** | Program Objectives Memorandum |
| **PPBS** | Planning, Programming, and Budgeting Systems |
| **RDEC** | U.S. Army Research, Development, & Engineering Center |
| **RL** | Air Force Rome Laboratory |
| **S&T** | Science and Technology |
| **SDC** | U.S. Army Strategic Defense Command |
| **SDIO** | Strategic Defense Initiative |
| **TACOM/RDEC** | U.S. Army Tank Command Research, Development and Engineering Center |
| **WES** | U.S. Army Waterways Experiment Station |
| **WL** | Air Force Wright Laboratory |
| **WRAIR** | U.S. Army Walter Reed Army Institute for Research |