DEPARTMENT OF THE ARMY
Headquarters, U.S. Army Materiel Command
5001 Eisenhower Avenue
Alexandria, VA 22333-0001

DEPARTMENT OF THE NAVY
Chief of Naval Research
800 North Quincy Street
Arlington, VA 22217-5000

DEPARTMENT OF THE AIR FORCE
Headquarters, Air Force Systems Command
Andrews AFB, Washington, D.C. 20334-0500

DEPARTMENT OF THE AIR FORCE
Headquarters, Air Force Logistics Command
Wright-Patterson AFB, OH 45433-5001

WHITE PAPER
ON
TRI-SERVICE RELIANCE
IN SCIENCE & TECHNOLOGY

January 1992

Prepared by:

Joint Directors of Laboratories

Approved for Public Release

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White Paper On
Tri-Service Reliance In Science & Technology

1. Introduction

The National Security Strategy of the United States has long depended upon technological superiority to counter the military numerical superiority of its potential adversaries. But carrying out this strategy has its price: the United States must stay technologically ahead of its potential adversaries. And it must do so during a time of unprecedented technology advances around the globe.

Since World War II, the Science and Technology (S&T) community of the Department of Defense has carried much of the burden of maintaining our vital technology advantage. In doing so, it also has carried an awesome level of responsibility for maintaining our long-term security.

The Cold War placed enormous demands upon the individual missions and military responsibilities of each Service. Fulfilling these individual Service missions, in turn, demanded support through science and technology efforts that are uniquely responsive to each Services' needs. Not surprisingly, the Department of Defense and the three Military Departments each created and maintained, over the years, sophisticated S&T development organizations that were tailored to support their individual challenges.

For almost half a century, through the depths of the Cold War -- from the Korean War to the War in the Gulf -- the Defense Science and Technology Base of the United States has met the challenge. Today, our military systems remain the envy of the world and are a persuasive deterrent to aggressors, both large and small.

But the world that shaped the Services' individual missions (and their science and technology activities) has changed radically: the rapid decline in tensions between the U.S. and the Soviets, the shift from a bipolar to a multipolar world, the loss of overseas bases, the proliferation of high-technology weaponry throughout the world, the increased recognition of the importance of economic security to overall national security, and the reduction in the size and budgets of the U.S. military. As the winds of change were growing more and more powerful, important questions were being formulated within the Department of Defense: Was the existing science and technology infrastructure, used so successfully during the Cold War, still appropriate for the new strategic environment emerging during the 1990s? And if it was not, what new organizational structure should replace it? Answering these questions was soon to have a profound influence on the future of science and technology development within the Department of Defense.

2. OSD Concerns and the Creation of Tri-Service S&T Reliance

By 1989, senior officials at the Department of Defense had become increasingly concerned about the viability of maintaining a "business-as-usual" approach to science and technology development in the defense technology base. 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.

The Services moved quickly to respond to the challenges of the draft DMR Initiative. In October 1989, just after issuance of the draft Initiative, the Services began formal discussions on ways to further strengthen inter-Service cooperation in their RDT&E programs and increase utilization of each other's facilities. One of these studies was called "Project Reliance," a study undertaken by the Army and Air Force to examine opportunities to consolidate and collocate their R&D efforts at single-site locations in selected technology areas. Project Reliance was ultimately expanded to include the Navy and became **Tri-Service S&T Reliance** -- one of the most comprehensive restructuring efforts involving the technology base in over 40 years. (The Services also initiated *intra*-Service Laboratory consolidation studies, i.e., the Army's Lab 21; the Navy's consolidation of its technical infrastructure into four Warfare Centers and a single Corporate Research Laboratory; and the Air Force's consolidation of its laboratories into four "Super Labs." The base closure and realignment actions associated with these laboratory consolidation actions ultimately were forwarded by Secretary of Defense Cheney to the Defense Base Closure and Realignment Committee on 12 April 1991.)

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 Science and Technology (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.

In November 1990, Mr. Atwood signed the final version of 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.

3. Tri-Service S&T Reliance: Findings and Accomplishments

Tri-Service S&T Reliance was effected in two major phases: the Study Phase and the Implementation Phase. Clearly, any undertaking as ambitious as Reliance required significant amounts of planning and issue preparation. This was the task performed by representatives of the three Military Departments during the Study Phase of the initiative.

The Study Phase spanned from September 1990 to March 1991 and involved dozens of Tri-Service working groups. It was during this time that the goals of S&T Reliance were formally stated to be:

- Enhance Science and Technology
- Ensure critical mass of resources to develop "world-class" products
- Reduce redundant capabilities and eliminate unwarranted duplication
- Gain efficiency through collocation and consolidation of in-house work when appropriate
- Preserve Services' mission-essential capabilities

These goals had to be accomplished in a new strategic environment, an environment that would demand closer coordination of Science and Technology resources and plans than had ever before been attempted by the Services. To help accomplish these goals, a new conceptual framework was developed to help manage the transition from the current state of extensive, but informal cooperation to an increasing level of mutual reliance among the Services. Understanding this conceptual framework is key to understanding the progress achieved by **Tri-Service S&T Reliance**.

The new framework consisted of defining a spectrum of six different categories of inter-Service Reliance for use in analyzing the Services' S&T programs:

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 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.

The objective of the **Tri-Service S&T Reliance** process was to move the S&T efforts of the three Services from the preponderance of Category 1 type of activities to Categories 2, 3, or 4, wherever it made good sense to do so. The services agreed at the outset to adopt Category 5 in those instances where they were unable to agree on one of the other modes of Reliance.

A total of 28 technology areas (shown in Figure 1) plus Basic Research were addressed during the Study Phase of Reliance. The 28 technology areas, all of which were of interest to two or more Services, were selected for examination based on findings of previous OSD-sponsored studies, which had indicated that there was potential for better coordination of effort among the Services in those areas.

Tri-Service Working Groups were established during the Study Phase to examine these different technology areas and develop recommendations for enhanced Reliance in each. One of the most formidable problems that each Working Group had to surmount involved the very different terminology used by the three Services, differences that reached to the often highly technical terms used to describe individual S&T activities. If the Services each spoke a different language, it would be difficult to impossible to achieve effective Tri-Service Reliance.

Thus the first order of business facing each group was to agree upon a technology "taxonomy" which described the content of their technology area. These taxonomies were structured hierarchically into "Areas" (the top level of aggregation), "Subareas" (the next level of aggregation), and "Sub-subareas" (lowest, most detailed level of aggregation) within which it was possible to relate the individual S&T activities of each Service. In addition to the original 28 Technology Areas, the Working

TECHNOLOGY AREAS

- AEROPROPULSION
- AIR VEHICLES (FIXED WING)
- AIR VEHICLES (ROTARY)
- ASTROMETRY
- CHEMICAL & BIOLOGICAL DEFENSE
- CIVIL ENGINEERING
- CLOTHING, TEXTILES AND FOOD
- COMMUNICATIONS, COMMAND & CONTROL
- CONVENTIONAL AIR/SURFACE WEAPONRY
- ELECTRO-OPTICS
- ELECTRONIC DEVICES
- ELECTRONIC WARFARE
- ENVIRONMENTAL QUALITY
- ENVIRONMENTAL SCIENCES
- ADVANCED MATERIALS[1]
- EXPLOSIVE ORDNANCE DISPOSAL
- FUELS AND LUBES
- GROUND VEHICLES
- INTEGRATED AVIONICS
- MANPOWER AND PERSONNEL
- MEDICAL
- NUCLEAR WEAPONS EFFECTS
- RADAR
- SHIPS/WATERCRAFT
- SMALL ARMS
- SOFTWARE
- SPACE
- TRAINING SYSTEMS
- UNMANNED GROUND VEHICLES
- DIRECTED ENERGY WEAPONRY[1]

1. ADDED DURING RELIANCE IMPLEMENTATION PHASE.

Figure 1

Groups ultimately identified 195 Subareas/Sub-subareas -- 223 technology topics in all -- of importance to **Tri-Service S&T Reliance**. The complete Reliance taxonomies are provided in the Appendix to this paper.

The Working Groups next had to assess which of the 223 technology topics were in need of higher levels of inter-Service Reliance, propose an appropriate Reliance Category (2, 3, 4 or 6 initially) for each topic, and develop specific plans for achieving the proposed level of Reliance. After review and iteration by the Reliance Integration Team, the Reliance Executive Steering Group, and the individual Service chains of command, the proposals solidified into firm agreements. The Study Phase of Reliance resulted in formal Service agreements for joint planning, collocated research, or consolidation under a lead Service for each of the technologies that were not Service unique.

Reaching these agreements was a major milestone of the Study Phase. Just how much of a change the agreements represent can be seen in Figure 2, which graphically portrays the difference between the state of coordination among the Service S&T programs that existed pre-Reliance, and the new levels of interaction achieved as a result of Reliance. The top of the figure shows the pre-Reliance relationships to have been dominated by Category 1 type coordination activities, with joint programs, collocations, and consolidations being the exceptions to the rule. The bottom of the figure shows the dramatic movement to higher modes of Tri-Service Reliance, particularly Category 2 (Joint) and Category 3 (Collocation).

As a result of these agreements (delineated in the Appendix to this paper):

- There are 71 technology areas/subareas/sub-subareas where the Services are jointly planning the work to be conducted at separate Service locations (Reliance Category 2), as contrasted with the 6 such cases that existed previously.

- There are 105 technology areas/subareas/sub-subareas where work will be collocated to various single-Service sites for program execution (Reliance Category 3), as contrasted with the 13 such cases that existed previously.

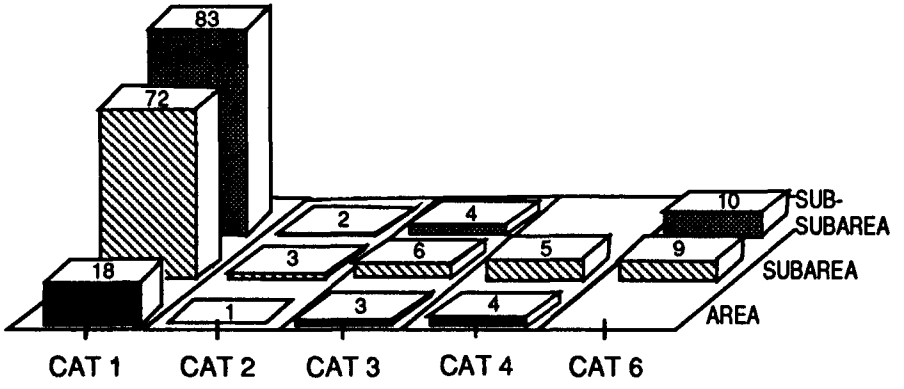
- Service management leads are designated for 10 technology areas, subareas, and sub-subareas (Reliance Category 4), an increase of 1 over the previous situation.

- There is a new management and planning structure to implement and verify compliance with Reliance agreements through the Joint Directors of Laboratories (JDL), the Armed Services Biomedical Research, Evaluation and Management (ASBREM) Committee, the Training and Personnel Systems Science and Technology Evaluation and Management (TAPSTEM) Committee, and the Joint Engineers.

S&T RELIANCE OBJECTIVE

MOVE FROM CATEGORY 1

(COORDINATION) DOMINANT MODE BEFORE RELIANCE . . .



. . . TO A HIGHER MODE

(CATEGORY 2, 3, OR 4) AND IDENTIFY SERVICE UNIQUE (CATEGORY 6) AREAS WITH COMPETITION RETAINED AS A FUTURE OPTION IF A HIGHER MODE OF RELIANCE IS NOT ACHIEVED

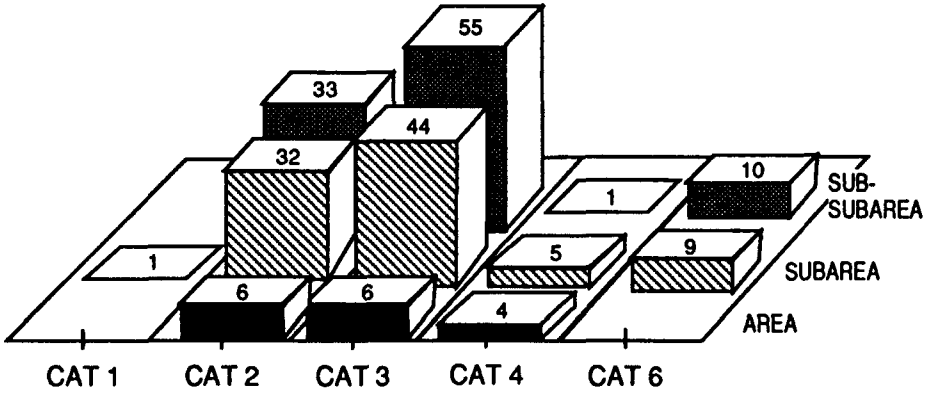


Figure 2

The Study Phase provided a blueprint for implementing greater Tri-Service Reliance. Its findings and agreements were accepted by the Executive Steering Committee and presented to the Service Acquisition Executives (SAEs) in March 1991. It was subsequently agreed that the Implementation Phase of the initiative would be performed under the Defense Technology Working Group (DTWG) of the Defense Technology Board (DTB) through the Tri-Service S&T Executives.

4. Implementation of Reliance

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 3 displays the three memoranda directing the implementation of the Reliance Process, with responsibility for managing the implementation *process* being assigned to the JDL.

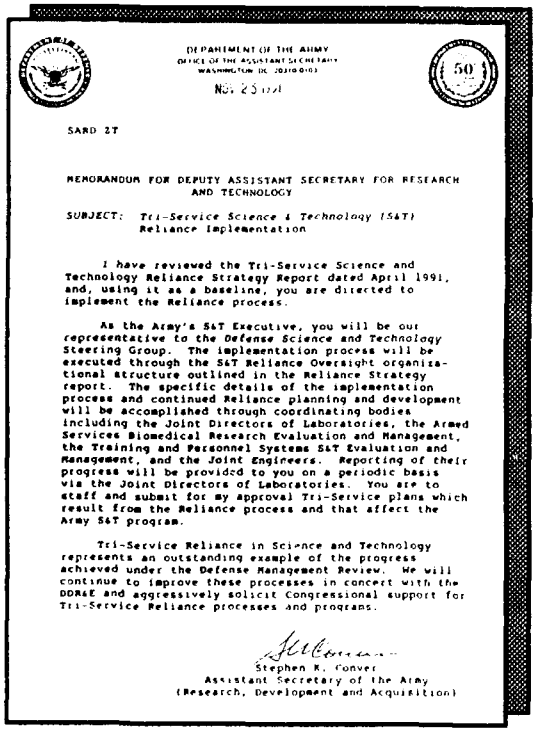
As indicated above, responsibility for carrying out the implementation and verification of compliance with Reliance has been assigned to the JDL, ASBREM, TAPSTEM, and Joint Engineers. Figure 4 displays how responsibility for the individual Reliance technologies has been partitioned among these four bodies.

ASBREM existed before the beginning of **Tri-Service S&T Reliance** and was deemed still to be a viable management and coordination vehicle for the medical area. TAPSTEM was in the process of being formed during the Reliance initiative and was therefore easily incorporated into it. The Joint Engineers did not exist, but has now been established.

The JDL also existed prior to Reliance but its charter needed to be expanded by its parent body, the Joint Logistics Commanders, to enable the JDL to carry out its new role (see Figure 5). In addition, its supporting infrastructure had to be substantially enlarged and reorganized in order to better manage the 25 Reliance Technology Areas assigned to it -- which collectively can be described as Combat Materiel. Figure 6 shows the current JDL organization chart, comprised of 11 Technology Panels (which focus on 6.2 and 6.3A programs but include 6.1 work where it is closely tied to the higher category programs), the Basic Research Panel (which addresses all Service-supported 6.1 work), and the Management Panel. The mapping of responsibility for the 25 JDL Technology Areas to the various JDL Panels is provided in the Appendix to this paper.

The JDL issued a formal JDL Instruction to the implementing Panels in September 1991. This instruction provided the schedule and the format for the Joint Service Program Plans (to be produced by the 11 Technology Panels), the charter for the Panels (including their general areas of responsibility), and other important guidance.

IMPLEMENTING LETTERS



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

NOV 25 1991

SARD 2T

MEMORANDUM FOR DEPUTY ASSISTANT SECRETARY FOR RESEARCH AND TECHNOLOGY

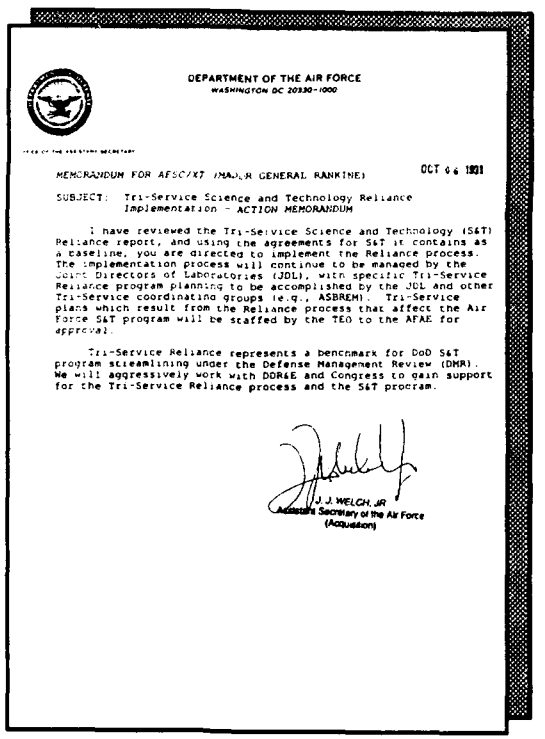
SUBJECT: *Tri-Service Science & Technology (S&T)* Reliance Implementation

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



DEPARTMENT OF THE AIR FORCE
WASHINGTON DC 20330-1000

OCT 06 1991

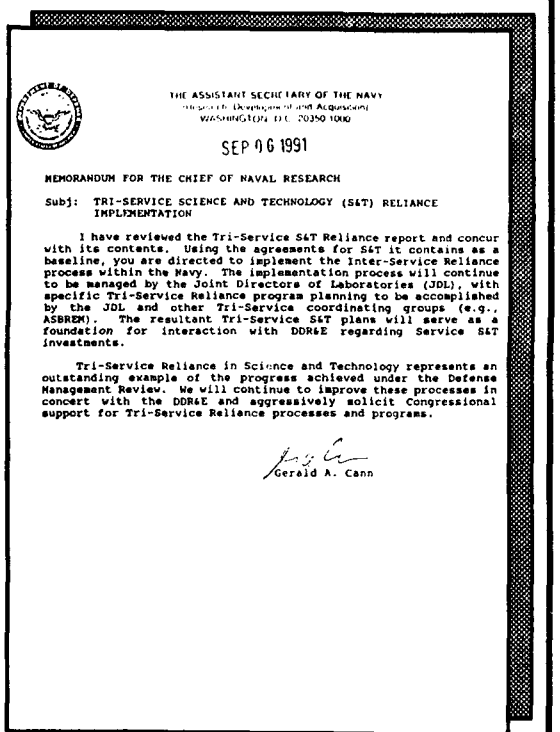
MEMORANDUM FOR AFSC/XT (MAJOR GENERAL RANKINE)

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 TEO 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.

J. 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 3

TECHNOLOGY AREA RESPONSIBILITIES OF THE OVERSIGHT BODIES

JOINT DIRECTORS OF LABORATORIES

AEROPROPULSION
AIR VEHICLES (FIXED WING)
AIR VEHICLES (ROTARY)
ASTROMETRY
CHEMICAL/BIOLOGICAL DEFENSE
CLOTHING, TEXTILES, AND FOOD
COMMUNICATIONS, COMMAND, AND CONTROL
CONVENTIONAL AIR / SURFACE WEAPONRY
ELECTRO-OPTICS
ELECTRONIC DEVICES
ELECTRONIC WARFARE
ENVIRONMENTAL SCIENCE
EXPLOSIVE ORDNANCE DISPOSAL
FUELS AND LUBES
GROUND VEHICLES
INTEGRATED AVIONICS
NUCLEAR WEAPONS EFFECTS
RADAR
SHIPS / WATERCRAFT
SMALL ARMS
SOFTWARE
SPACE
UNMANNED GROUND VEHICLES
ADVANCED MATERIALS*
DIRECTED ENERGY WEAPONRY*

ASBREM	TAPSTEM	JOINT ENGINEERS
MEDICAL	MANPOWER AND PERSONNEL TRAINING SYSTEM	CIVIL ENGINEERING ENVIRONMENTAL QUALITY

* ADDED DURING RELIANCE IMPLEMENTATION PHASE

Figure 4

DEPARTMENT OF THE ARMY
HEADQUARTERS US ARMY MATERIEL COMMAND
5001 EISENHOWER AVE., ALEXANDRIA, VA 22333-0001

DEPARTMENT OF THE NAVY
DEPUTY CHIEF OF NAVAL OPERATIONS (LOGISTICS)
WASHINGTON, DC 20350-2000

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE LOGISTICS COMMAND
WRIGHT-PATTERSON AFB, OHIO 45433-5001

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE SYSTEMS COMMAND
ANDREWS AFB, WASHINGTON, DC 20334-5000

JOINT LOGISTICS COMMANDERS

MEMORANDUM FOR THE JOINT DIRECTORS OF LABORATORIES

SUBJECT: Expanded Role and Responsibilities for the Joint Directors of Laboratories

1. The JDL process has already achieved considerable success in identifying, establishing and coordinating joint service programs in key technology areas such as Electronic Warfare and Communications, Command and Control. These achievements demonstrate that the JDL process works and provides a viable structure for accomplishing joint service initiatives. Tri-Service Reliance, established in response to DMR 922, will achieve improved productivity and enhanced quality of products through increased inter-service S&T reliance. In support of the Reliance initiatives and in accordance with the scope and mission stated in the charter for the Joint Directors of Laboratories (JDL), the roles and responsibilities of the JDL are expanded to include oversight for the planning of candidate Tri-Service Reliance cooperative programs.

2. To support Reliance initiatives, the JDL role and responsibilities are designated as follows:

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

WILLIAM G.T. TUTTLE, JR.
General, USA
Commander
U.S. Army Materiel Command

STEPHEN T. LOFTUS
Vice Admiral, USN
Deputy Chief of Naval Operations
(Logistics)

CHARLES C. McDONALD
General, USAF
Commander
Air Force Logistics Command

RONALD W. YATES
General, USAF
Commander
Air Force Systems Command

DATE: December 5, 1990

Figure 5

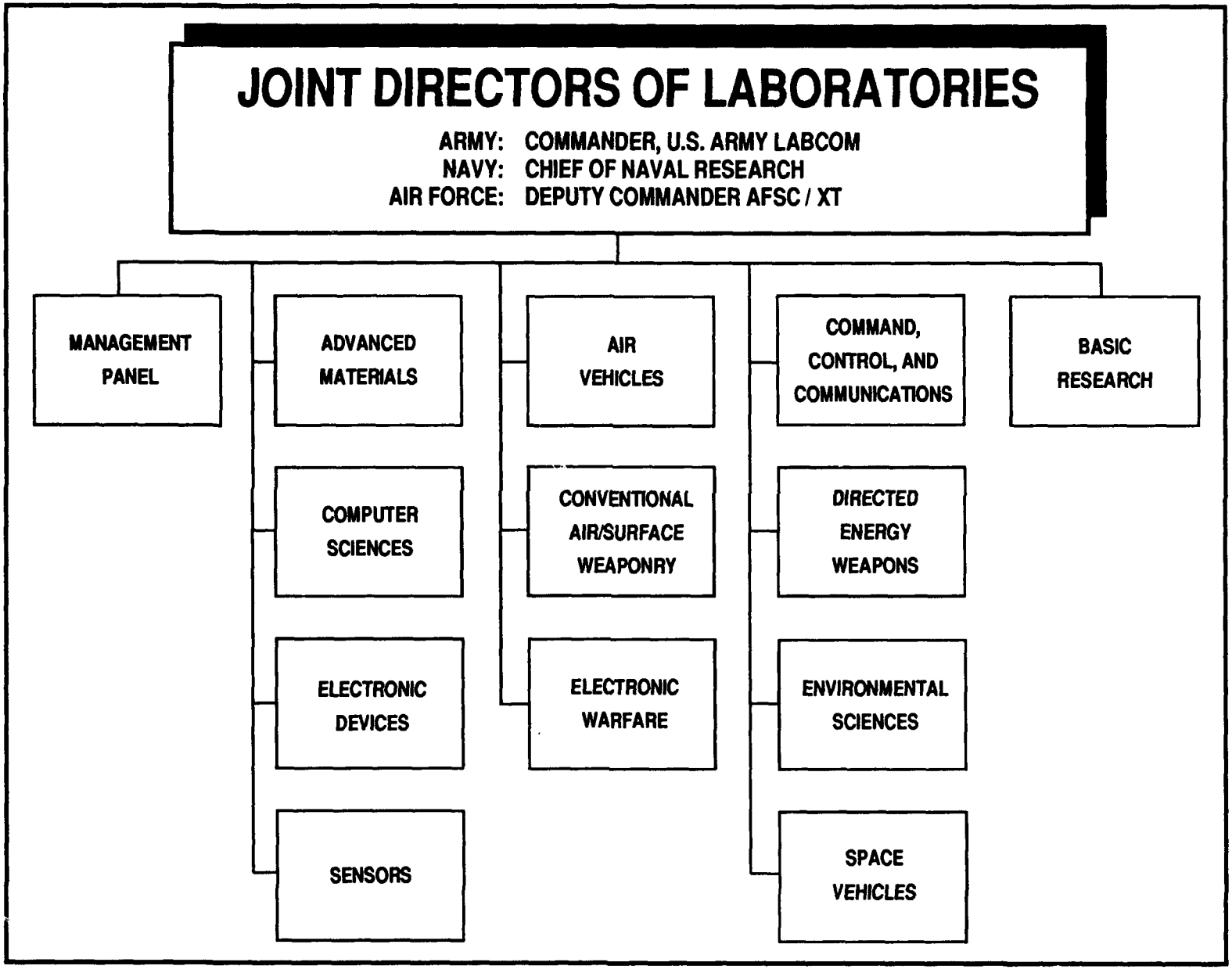

JOINT DIRECTORS OF LABORATORIES
ARMY: COMMANDER, U.S. ARMY LABCOM
NAVY: CHIEF OF NAVAL RESEARCH
AIR FORCE: DEPUTY COMMANDER AFSC / XT
MANAGEMENT PANEL
ADVANCED MATERIALS
COMPUTER SCIENCES
ELECTRONIC DEVICES
SENSORS
AIR VEHICLES
CONVENTIONAL AIR/SURFACE WEAPONRY
ELECTRONIC WARFARE
COMMAND, CONTROL, AND COMMUNICATIONS
DIRECTED ENERGY WEAPONS
ENVIRONMENTAL SCIENCES
SPACE VEHICLES
BASIC RESEARCH

Figure 6

The JDL Panels provide the necessary supporting infrastructure for implementing **Tri-Service S&T Reliance** by assuming the following important functions:

- Develop Joint Program Plans for and oversee execution of integrated S&T programs in those areas designated as "Joint" (Category 2) and, where appropriate, for "Collocated" (Category 3) and "Consolidation" (Category 4)

- Monitor implementation of other Reliance agreements and ensure appropriate coordination

- Conduct inter-Service competitions for S&T task execution as directed by the JDL

- Recommend additional areas of advanced technology warranting multi-Service attention

- Develop and maintain a data base of on-going work and make it available to the Defense Technology Information Center (DTIC)

- Assess the state of independent industrial research and development (IR&D) and international R&D in pertinent areas

- Interface with cognizant DDR&E staff on a continuing basis and other organizations as appropriate

- Promote transition of advanced technologies

- Maintain cognizance of operational/technical multi-Service issues

- Issue an annual report of Panel activities

Each JDL Technology Panel has tri-Service representation, with the Panel Chairman rotating among the Services at two-year intervals.

Because the implementation process provides substantial integration of Service S&T activities, it is now possible for **Tri-Service S&T Reliance** to provide the foundation for OSD review of these activities, thereby streamlining for OSD a formerly cumbersome S&T review process.

Implementation of **Tri-Service S&T Reliance** also responds to (and provides inputs for) a number of important management functions and planning processes. The budget planning process, the development and update of technology investment plans, the updates of the Defense Science and Technology Strategy and the Defense Critical Technologies Plan, and other important management thrusts are more

effectively accounted for by the Reliance implementation process. Figure 7 shows the recurring Reliance Planning Process and Schedule. The figure shows how important annual events under JDL auspices relate to other important events occurring in the individual Military Departments, the budget system, the Defense Technology Working Group (DTWG), and the DDR&E.

As seen in the schedule, the various Joint Plans of the JDL Technology Panels are developed each year during the November to January time frame, with appropriate JDL review and approval scheduled for March. The Panels issue their annual reports in June and brief Reliance progress to OSD during the DDR&E-sponsored S&T reviews in July and August.

Tri-Service S&T Reliance has also had a major influence upon the basic research (6.1) community, represented by the Basic Research Panel of the JDL. Because basic research is pervasive in its impact, but very early in the S&T development process, it was important for it to be closely coordinated with work of the Technology Panels. In order to achieve this coordination, the Basic Research Panel has created 12 Tri-Service Scientific Planning Groups (SPGs). These SPGs are explicitly linked for coordination purposes with the appropriate JDL Technology Panels and other DoD management committees. Figure 8 illustrates how the Tri-Service SPGs relate to the JDL Technology Panels, ASBREM, TAPSTEM and the Joint Engineers.

5. Early Accomplishments of Tri-Service S&T Reliance

The Reliance process is now operational with fundamental changes being implemented throughout the Services. Joint planning for the FY 1993 program is well underway. **Tri-Service S&T Reliance** has opened channels of inter-Service communication at all management and technical levels in the S&T community. We have already described some of the initial cost savings and organizational benefits resulting from the Study Phase of the initiative, and more benefits are being generated each day of the continuing process. Full benefits of the initiative will be realized in FY 1993, and substantial increases in Tri-Service Reliance have already been attained. Following is a list of some major accomplishments already achieved by **Tri-Service S&T Reliance**:

- Collocation (Category 3) of all Training Devices and Aircrew Training S&T in Orlando, Florida. This increase in Tri-Service Reliance created a Tri-Service Center of Excellence and eliminates multiple sites performing similar work.

- Collocation (Category 3) of all S&T activity in Survivability and Protective Structures at a single site, the Army Waterways Experiment Station (WES), Vicksburg, Mississippi. This increase

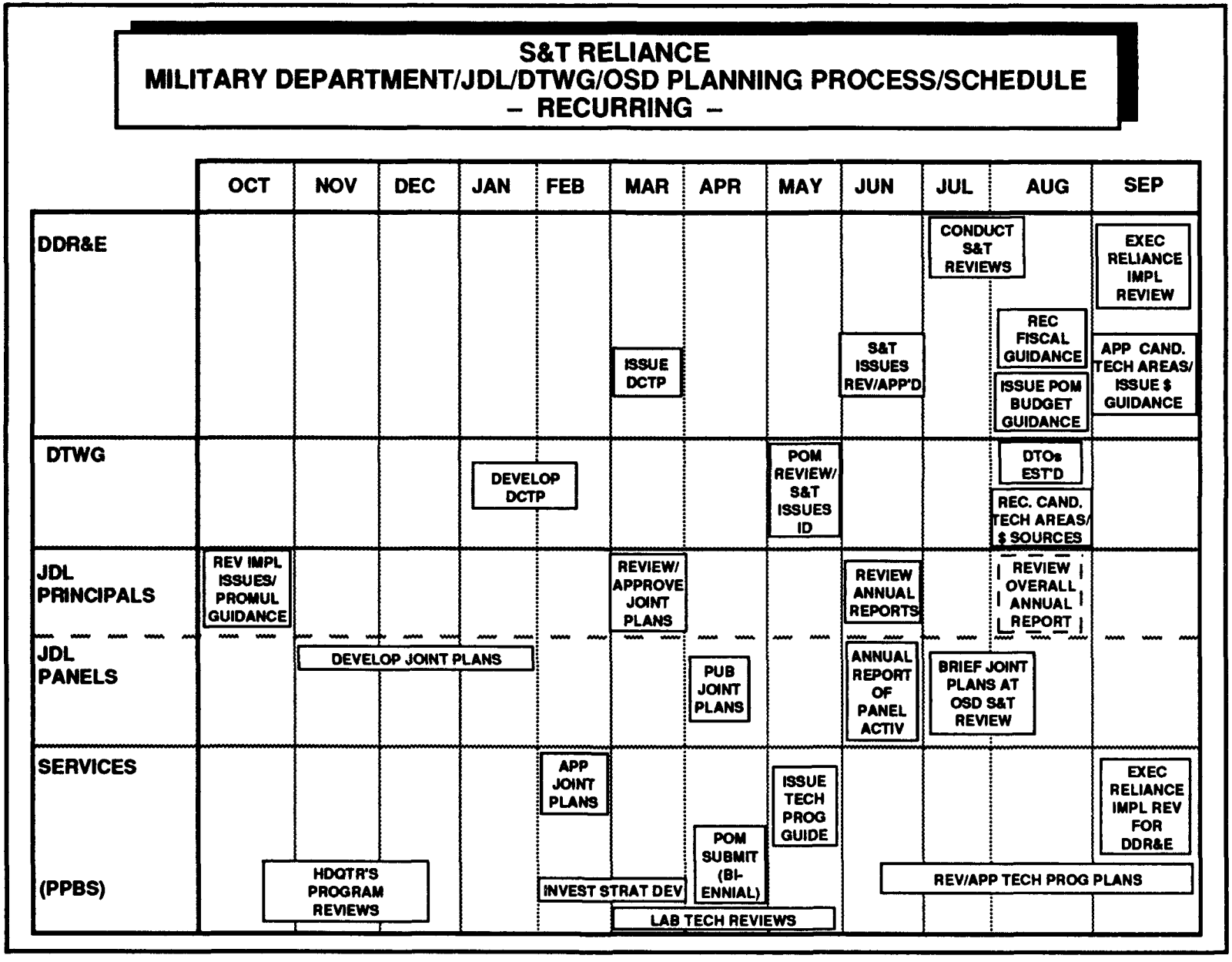

S&T RELIANCE
MILITARY DEPARTMENT/JDL/DTWG/OSD PLANNING PROCESS/SCHEDULE
– RECURRING –
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
DDR&E
CONDUCT S&T REVIEWS
EXEC RELIANCE IMPL REVIEW
REC FISCAL GUIDANCE
ISSUE DCTP
S&T ISSUES REV/APP'D
APP CAND. TECH AREAS/ ISSUE $ GUIDANCE
ISSUE POM BUDGET GUIDANCE
DTWG
DTOs EST'D
DEVELOP DCTP
POM REVIEW/ S&T ISSUES ID
REC. CAND. TECH AREAS/ $ SOURCES
JDL PRINCIPALS
REV IMPL ISSUES/ PROMUL GUIDANCE
REVIEW/ APPROVE JOINT PLANS
REVIEW ANNUAL REPORTS
REVIEW OVERALL ANNUAL REPORT
JDL PANELS
DEVELOP JOINT PLANS
PUB JOINT PLANS
ANNUAL REPORT OF PANEL ACTIV
BRIEF JOINT PLANS AT OSD S&T REVIEW
SERVICES
APP JOINT PLANS
ISSUE TECH PROG GUIDE
EXEC RELIANCE IMPL REV FOR DDR&E
POM SUBMIT (BI-ENNIAL)
(PPBS)
HDQTR'S PROGRAM REVIEWS
INVEST STRAT DEV
REV/APP TECH PROG PLANS
LAB TECH REVIEWS

Figure 7

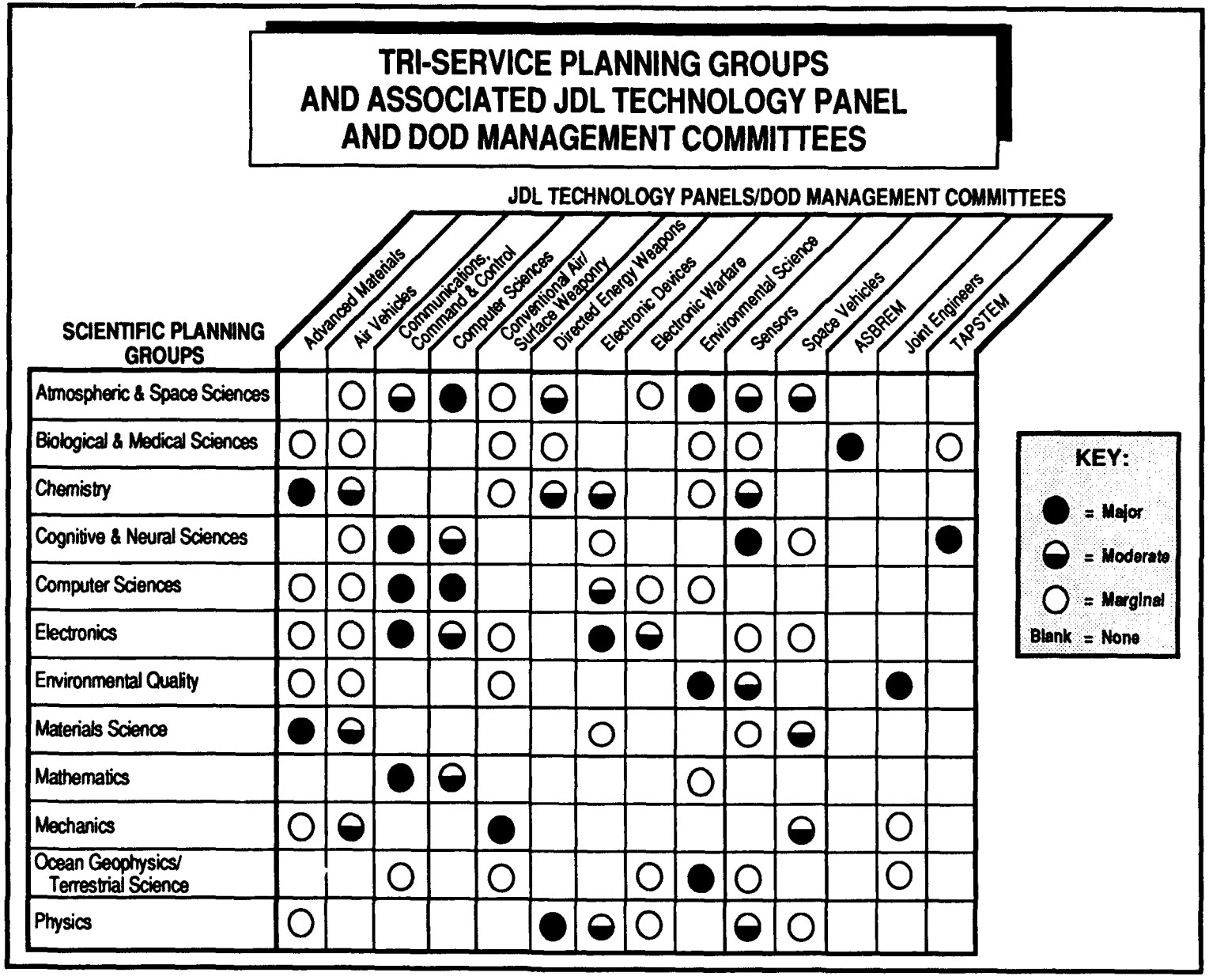

TRI-SERVICE PLANNING GROUPS
AND ASSOCIATED JDL TECHNOLOGY PANEL
AND DOD MANAGEMENT COMMITTEES
JDL TECHNOLOGY PANELS/DOD MANAGEMENT COMMITTEES
SCIENTIFIC PLANNING GROUPS
Advanced Materials
Air Vehicles
Communications, Command & Control
Computer Sciences
Conventional Air/ Surface Weaponry
Directed Energy Weapons
Electronic Devices
Electronic Warfare
Environmental Science
Sensors
Space Vehicles
ASBREM
Joint Engineers
TAPSTEM
Atmospheric & Space Sciences
Biological & Medical Sciences
Chemistry
Cognitive & Neural Sciences
Computer Sciences
Electronics
Environmental Quality
Materials Science
Mathematics
Mechanics
Ocean Geophysics/ Terrestrial Science
Physics
KEY:
= Major
= Moderate
= Marginal
Blank = None

Figure 8

in Tri-Service Reliance eliminated redundant capabilities and permitted the reinvestment of resources to strengthen other important S&T areas.

- Collocation (Category 3) of all Conventional Guns S&T within the Army at the Armament Research Development and Engineering Center (ARDEC), Picatinny Arsenal, Dover, New Jersey.

- Collocation (Category 3) of all Fuels and Lubes S&T to Wright Laboratory at Wright-Patterson Air Force Base, Ohio. This increase in Tri-Service Reliance involves the Army collocating its Fuels and Lubes program from Belvoir Research Development and Engineering Center (BRDEC) in order to strengthen the Tri-Service Program while still meeting the enduring mission-essential requirements of the Services.

- Collocation (Category 3) of Army Health Effects research with the Air Force and Navy Toxicology Programs to Armstrong Laboratory at Wright-Patterson Air Force Base, Ohio. This increase in Tri-Service Reliance consolidates major portions of medical S&T through collocation at single sites and creates Tri-Service Centers of Excellence.

- Collocation (Category 3) of in-house S&T work addressing Space-Based Wide-Area Surveillance Radar at the Air Force Rome Laboratory, Rome, New York.

- Collocation (Category 3) of in-house S&T work addressing Space-Based Infrared Sensors for Wide-Area Surveillance at the Naval Research Laboratory, Washington, D.C.

- Collocation (Category 3) of all Directed Energy Bioeffects S&T of the Army and Navy to Armstrong Laboratory at Brooks Air Force Base, Texas.

- Collocation (Category 3) of all Biodynamics S&T of the Army and Navy to Armstrong Laboratory at Wright-Patterson Air Force Base, Ohio.

- Collocation (Category 3) of all Army Combat Dentistry S&T with the Navy in Great Lakes, Illinois.

- Collocation (Category 3) of Army, Navy, and Air Force 6.1 Foreign Field offices and the development of coordinated science monitoring programs.

Further accomplishments of implementing **Tri-Service S&T Reliance** have included:

- Expanding the original 28 technology areas into 30 (by adding Advanced Materials and Directed Energy Weaponry)

- Establishing JDL Centers of Excellence in Artificial Intelligence

- Conducting inter-Service competition for DARPA Supercomputer hardware
- Providing an effective Service focal point for developing the DoD Software Technology Plan
- Providing effective Tri-Service coordination with NASA, the Federal Aviation Authority, and the National Security Agency
- Conducting the 1991 OSD Science and Technology Reviews using the Reliance infrastructure

6. Reliance in the Future

Clearly, **Tri-Service S&T Reliance** has made enormous strides in a short time. It has fundamentally reshaped the management of the Science and Technology activities within the Services and is profoundly influencing specific programs, organizations, and management decisions in each of the Services. It already has strengthened S&T coordination across the board and substantially contributed to resource streamlining, cost reduction, and management integration of the S&T community, so necessary in the emerging strategic environment. These processes will continue to improve the management of S&T in the Services for years to come.

Managing technology development is a dynamic process and the S&T activities of the three Services are not islands unto themselves. Defense Agencies, such as DARPA, also substantially contribute to the defense technology of the United States as does the Strategic Defense Initiative Organization. Other U.S. Government agencies, such as the Department of Energy, NASA, and the Department of Commerce, each contribute not only to the defense technology base but also to the industrial technology base. Furthermore, international research and development may provide substantial means to leverage the U.S. defense-related S&T investment. **Tri-Service S&T Reliance** will continue to reach out and tap those sources of technology it needs to fulfill its mission, whether those technology sources are within the Services, Defense Agencies, other government organizations, or abroad.

Tri-Service S&T Reliance will continue to grow and adapt as needed to the ever-changing technology and strategic environment. As it does so, **Reliance** can be counted upon to remain a cornerstone of the DoD S&T community's response to the DMR and a key vehicle for tackling the very difficult DoD-wide issues the Department will be facing during these challenging times. One such issue where **Reliance** will need to play an essential role is in the implementation of new initiatives emerging from the recently formulated DDR&E S&T Thrusts. The degree of focus and jointness these initiatives will require to succeed will demand an extraordinary level of cooperation among the Services and other DoD R&D organizations. The Services stand ready to assist in this critical undertaking and **Tri-Service S&T Reliance** provides the means by which this support can be accomplished.

APPENDIX

TRI-SERVICE S&T RELIANCE

TECHNOLOGY TAXONOMY AND RELIANCE AGREEMENTS

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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.]

Tech Area: Aeropropulsion (Oversight Body: JDL - Air Vehicles Panel)

- Turbine Engines (2ANF)
- Rotorcraft Power Drive Systems (3A)
- Hypersonic Propulsion (4F)

Tech Area: Air Vehicles (Fixed Wing) (Oversight Body: JDL - Air Vehicles Panel)

- Crew Station (2NF)
- Generic Structures Technology (3F)
- Subsystems (3F)
- Aerodynamics
  - Configuration Aerodynamic Research (6N, 6F)
  - Aerothermodynamics (Hypersonics) (4F)
- Life Support Systems (2NF)
- Flight Dynamics/Controls (2NF)
- Land-Based Support Systems (3F)
- Carrier Aircraft Unique (6N)

Tech Area: Air Vehicles (Rotary) (3A) (Oversight Body: JDL - Air Vehicles Panel)

- Structure (3A)
- Subsystems (3A)
- Flight Controls (3A)
- Aerodynamics (3A)
- Crew Station (3A)

Tech Area: Astrometry (3N) (Oversight Body: JDL - Management Panel)

Tech Area: Chemical/Biological Defense (4A) (Oversight Body: JDL - Management Panel)

Tech Area: Civil Engineering (Oversight Body: Joint Engineers)

- Conventional Facilities (3A)
- Survivability and Protective Structures (3A)
- Airfields and Pavements (3A)
- Sustainment Engineering (3A)
- Ocean and Waterfront Facilities and Operations (3N)
- Critical Air Base Facilities/Recovery (3F)
- Fire Fighting (3F)

Tech Area: Clothing, Textiles & Food (3A) (Oversight Body: JDL - Management Panel)

Tech Area: Communications, Command & Control (C^3) (Oversight Body: JDL - C^3 Panel)

- Networks (2ANF)
- Radios and Links (2ANF)
  - Radio Technologies (2ANF)
  - Space Segment (2ANF)
  - Comm. Sig. Processors (3F)
  - Dynamic Spectrum Management (3A)
- Submarine Communication (6N)
- Distributed Information Systems (2ANF)
- Data Fusion (2ANF)
- Decision Aids (2ANF)

Tech Area: Conventional Air/Surface Weaponry (2ANF) (Oversight Body: JDL - Conventional Air/Surface Weaponry Panel)

- Guidance and Control (2ANF)
  - Anti-Air Missiles (2ANF)
  - Anti-Surface Air-Launched (2ANF)
  - Anti-Surface Surface-Launched (2AN)
- Fuzing/Safe and Arm (2ANF)
  - Anti-Air Missiles (2ANF)
  - Anti-Surface Missiles (2ANF)
  - Bombs (3F)

  - Hard Target Penetration (3F)
  - Underwater (6N)
  - Gun Munitions (3A)
  - Land Mines and Demolition (3A)
- Warheads and Explosives (2ANF)
  - Anti-Air Missiles (2ANF)
  - Anti-Surface Missiles (2ANF)
  - Bombs (3F)
  - Hard Target Penetration (3F)
  - Underwater (6N)
  - Anti-Armor (3A)
  - Land Mines and Demolition (3A)
- Missile Propulsion (2ANF)
  - Liquid Fuel Ramjets (2NF)
  - Solid Fuel Ramjets (2NF)
  - Ducted Rocket Ramjets (3F)
  - Solid Rockets (2AN)
  - Liquid Rockets (3A)
  - Hybrid Rockets (2AN)
- Conventional Guns (3A)

Tech Area: Electro-Optics (Oversight Body: JDL - Sensors Panel)

- Wide-Area Surveillance (Space-Based IR) (3N)
- Battlefield (3A)
- Shipboard (Low Elevation, Horizontal Search) (6N)
- Aircraft Fixed Wing (2ANF)
  - Intercept (2NF)
  - Anti-Surface (2ANF)
- Aircraft Rotary Wing (3A)
- Aircraft (ASW, Undersea) (6N)

Tech Area: Electronic Devices (2ANF) (Oversight Body: JDL - Electronic Devices Panel)

- Microelectronics (2ANF)
- RF Components (2ANF)
  - Solid-State (2ANF)
  - Vacuum Electronics (3N)
  - Generic Antenna Technologies (3F)
  - Frequency Control and Devices (3A)
- Electro-Optical Devices (2ANF)
  - Lasers (2ANF)
  - Focal Plane Arrays (2ANF)

  - Display Components (3A)
  - Photonic Devices (2ANF)
- Specifications and Standards Technology (3F)
- Superconductivity (2ANF)

Tech Area: Electronic Warfare (2ANF) (Oversight Body: JDL - Electronic Warfare Panel)

- Combat Support (2ANF)
  - Ground (3A)
  - Air (2NF)
- Maritime (3N)
- Ground Vehicles (3A)
- Aircraft (2ANF)
  - Tactical (2NF)
  - Strategic (3F)
  - Rotary Wing (3A)

Tech Area: Environmental Quality (Oversight Body: Joint Engineers)

- Installation Restoration
  - Site Investigation/Characterization (3A)
  - Explosives, Metals, and other Organics Contamination Treatment (3A)
  - Fuels, Solvents, Site Contamination Treatment (3F)
- Noise Abatement
  - Impulse Noise (3A)
  - Continuous Wave Noise (3F)
- Pollution Prevention
  - Explosives Manufacturing and Demilitarization (6A)
  - Aeronautical Systems (3F)
  - Nautical Systems (6N)
  - Ground Equipment Systems (6A)
- Terrestrial and Aquatic Assessment (3A)
- Global Marine Compliance (6N)
- Atmospheric Compliance (2ANF)
- Base Support Operations (3A)

Tech Area: Environmental Sciences (Oversight Body: JDL - Environmental Sciences Panel)

- Space/Upper Atmosphere Sciences (2NF)
  - Astrophysics and Astronomy (3N)
  - Atmospheric Density (3F)

  - Solar Physics (2NF)
  - Ionosphere (2NF)
  - Space Physics (2NF)
  - Strategic Backgrounds (3F)
  - Spacecraft Environment Interactions (3F)
  - Middle Atmosphere (3N)
- Lower Atmosphere Sciences (2NF)
  - Numerical Weather Prediction and Modeling (3N)
  - Central Site Satellite Interpretation (3F)
  - Local Site Satellite Interpretation (2NF)
  - Statistical Climatology (3F)
- Ocean Sciences (6N)
- Terrestrial Sciences (3A)
- Cold Regions Sciences (3A)
- Seismology (6F)

Tech Area: Explosive Ordnance Disposal (4N) (Oversight Body: JDL - Conventional Air/Surface Weaponry Panel)

Tech Area: Fuels and Lubricants (3F) (Oversight Body: JDL - Management Panel)

Tech Area: Ground Vehicles (3A) (Oversight Body: JDL - Management Panel)

- Combat Vehicles (3A)
- Material Handling Equipment (3A)
- Ramps and Bridging (3A)
- Countermine Equipment (3A)
- Power (3A)

Tech Area: Integrated Avionics (2ANF) (Oversight Body: JDL - Air Vehicles Panel)

- System Integration
  - Architecture (2ANF)
  - Data Buses/Fiber Optics (2ANF)
  - Packaging/Cooling/Interconnect (2ANF)
  - Multiplexer (2ANF)
  - Integration Software (2ANF)

Tech Area: Manpower and Personnel (Oversight Body: TAPSTEM)

- Force Management and Modeling (3N)
- Selection and Classification (2ANF)
  - Basic Abilities Testing (3F)
  - Computer-Based Entrance Testing (3N)
  - Job Structures and Requirements (3F)
  - Service Unique Applications (6A, 6F, 6N)
- Productivity Measurement/Enhancement (3N)
- Human Resources Development (3A)

Tech Area: Medical (2ANF) (Oversight Body: ASBREM)

- Infectious Disease (4A)
- Chemical Defense (4A)
- Biological Defense (4A)
- Combat Casualty Care (2AN)
  - Blood Research (3N)
  - Trauma/Burns (2AN)
- Human Systems Technology (2ANF)
  - Directed Energy Bioeffects (3F)
  - Biodynamics (3F)
  - Environmental and Occupational Toxicology (3F)
  - Environmental Medicine (2ANF)
- Combat Dentistry (4A)

Tech Area: Nuclear Weapons Effects (Oversight Body: JDL - Management Panel)

- Basic Radiation Effects Hardening (2AN)
  - Electronic Materials (2AN)
  - Non-electronic Materials (3A)
  - SREMP, SGEMP, IEMP Protection (3A)
- Radiation Hardened Applied Technology (3F)
- Atmospheric Effects (3N)
- Blast/Shock/Thermal Hardening (3A)
- Missiles/Aircraft EMP Hardening (3F)
- Land Mobile/Fixed Facilities EMP Hardening (3A)
- Nuclear Weapons Effects Simulation Technology (2AN)
  - EMP (3A)
  - Blast/Thermal (3A)
  - Gamma Radiation (3A)
  - X-Radiation (3N)

Tech Area: Radar (Oversight Body: JDL - Sensors Panel)

- Wide-Area Surveillance (2NF)
  - Space-Based AAW Radar (3F)
  - Space-Based ASUW (3N)
  - Airborne AEW (2NF)
  - Land-Based OTH (3F)
- Battlefield (Line-of-Sight Land Clutter) (3A)
- Shipboard (Long-Range Sea Clutter) (3N)
- Aircraft Fixed Wing (2NF)
  - Intercept (2NF)
  - ASUW (3N)
  - Strategic Strike (3F)
  - Tactical Strike (2NF)
- Aircraft Rotary Wing (Unique Aspects) (3A)
- Aircraft (ASW) (6N)

Tech Area: Ships/Watercraft (3N) (Oversight Body: JDL - Management Panel)

- Ships (6N)
- Watercraft (3N)

Tech Area: Small Arms (4A) (Oversight Body: JDL - Conventional Air/Surface Weaponry Panel)

Tech Area: Software (2ANF) (Oversight Body: JDL - Computer Sciences Panel)

- Software and System Engineering
- AI/Neural Networks
- HCI
- Distributed Processing/High-Performance Computing
- System-Oriented, Real-Time Fault Tolerance
- Trusted Systems and Computer Security

Tech Area: Space (Oversight Body: JDL - Space Vehicles Panel)

- Propulsion (3F)
- Power (3F)
- Thermal Control (3F)
- Structures (3F)

- Guidance, Navigation, and Control (2NF)
- Survivability (2ANF)
  - Laser (2FA)
  - HPM (2NF)
  - Kinetics and Debris (3F)
  - Operational S/V (3F)
  - Neutral Particle Beam (3N)
  - Natural Particle Effects (3N)
- Flight Experiments (1ANF)

Tech Area: Training Systems (Oversight Body: TAPSTEM)

- Unit Collective Training (3A)
- Land Warfare/Rotary Wing Training (3A)
- Training Devices and Features (3N)
- Sea Warfare Training (3N)
- Classroom Instruction (3N)
- Intelligent Computer-Aided Training (3F)
- Air Crew Training Effectiveness (3F)

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