NRAC

NAVAL RESEARCH ADVISORY COMMITTEE

DEFENSE CONVERSION

DECEMBER 1993

OFFICE OF THE ASSISTANT SECRETARY OF THE NAVY
(RESEARCH, DEVELOPMENT AND ACQUISITION)

NRAC 93-1

COPY NO. 181

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The sudden end of the Cold War created a new world order with the United States the only surviving Superpower. Within the United States, an immediate sense of increased security prevailed resulting in demands for heavy reductions in defense spending. The term "peace dividend" was coined and popularized. Thus was initiated an extraordinary period in this nation's history. The cutting of the defense budget and the defense drawdown which followed resulted in a depressed defense industry, marked by heavy job loss. A commercial economy in recession exacerbated the problem. It is this state of the nation's economy that the current Administration and Congress are committed to improve. It is within this context that the concept of Defense Conversion was promoted as a solution.

The concept had its roots in technology transfer legislation enacted as early as 1980. The most recent enabling legislation is the Defense Conversion, Reinvestment, and Transition Assistance Act of 1992. This legislation, coupled with the highly publicized Defense Conversion related policy position taken by the Administration, made the decision by the Assistant Secretary of the Navy (Research, Development and Acquisition) (ASN(RD&A)) to make Defense Conversion the subject of the 1993 NRAC Summer Study both timely and appropriate.

The Terms of Reference (TOR) used to task the 1993 Summer Study Panel scoped the subject of Defense Conversion to a manageable task. It focused the Panel's attention on the research and development (R&D) aspects of Defense Conversion. It, however, did not define Defense Conversion.

Critical to the conduct of the study was the derivation of a definition for Defense Conversion. Panel agreement was essential, as was consistency with the published intent of the Administration and Congress. Definition derivation was a particularly difficult task due to the highly publicized nature of Defense Conversion and the resulting wide array of perception this publicity created. A Panel consensus definition was ultimately derived and used to drive the rest of the study.

Early in the study, a mission alignment issue was identified. The mission of Defense Conversion, simply stated, is to produce jobs. The mission of the Department of the Navy (DON) is to provide an adequate maritime defense. An obvious lack of mission alignment exists and presents DON with a real dilemma. Resolving this dilemma is essential if the DON is to fully embrace Defense Conversion.

Key to resolving the mission alignment dilemma is a Defense Conversion paradigm shift. The existing paradigm is based on a "technology push" philosophy resulting in a uni-directional technology transfer paradigm (i.e., from defense to commercial markets). A new bi-directional technology transfer paradigm, introduced for the first time in ARPA's Technology Reinvestment Project, can provide the needed mission alignment breakthrough. The bi-directional paradigm recognizes that while defense technology "spin off" can benefit the commercial economy, commercial "spin on" and collaborative dual use technology development can be directly beneficial to the national defense. Thus, a degree of mission alignment can be achieved paving the

way for more enthusiastic DON support of the Administration's Defense Conversion Initiatives. It is precisely this aspect of Defense Conversion, the Panel recommends the DON place its emphasis.

The Panel received extensive briefings from Congressional, Department of Defense (DOD), Federal, university, industry, union, and state and local government sources. Response to the Administration's Defense Conversion initiatives by state and local government, as well as unions, is strong. Also supportive are the non-DOD agencies within the Federal Government. Support from DOD appears to be a real struggle. It, however, is understandable considering the mission alignment issue. The university community was found to be neutral in support, while the defense industry, in general, is a reluctant participant at best. It is within this response environment that the Panel attempted to address the objectives and specific tasking identified in the TOR.

After DON technologies were systematically identified, R&D investment strategies examined, defense industry drawdown strategies reviewed and potential partners/partnerships assessed, the Panel concluded its Summer Study with six primary findings and seven specific recommendations. In essence, the Panel believes DON's mission alignment dilemma can be satisfactorily addressed and the Administration's Defense Conversion policies more aggressively supported. Opportunities to develop a truly beneficial support methodology exist. The primary success limiters are commitment, imagination and persistence. The task will be difficult, but the potential benefits are well worth the effort.

PANEL MEMBERSHIP

CHAIRMAN
Mr. Reginald Low
Vice President, Mission Planning
GDE Systems, Inc.

VICE CHAIRMAN
Mr. Harvey Fromer
President
LORAL Electronic Systems

Mr. W. Grover Coors
Private Consultant

Mr. M. A. Cramer
Private Consultant

Dr. Delores M. Etter
Prof. of Electrical & Comp. Engineering
University of Colorado

Dr. R. Kenneth Lobb
Senior Scientist, Applied
Research Lab - Penn State University

Dr. Robert Porter
Chairman, Ocean Acoustics Dept.
Applied Physics Lab - University of Wash.

Mr. David A. Rossi
Principal Deputy ASN(RD&A) (Acting)
Office of the ASN(RD&A)

Mr. Thomas Saponas
General Manager, Colorado Springs Div.
Hewlett Packard

Dr. William J. Schmitz
Physical Oceanographer/Sr. Scientist
Woods Hole Oceanographic Inst.

Dr. Jerome A. Smith
Vice President, Technical Operations
Martin Marietta Information Systems

Prof. William F. Weldon
Josey Centennial Professor in Energy
Resources, University of Texas - Austin

Mr. Dennie Welsh
Chairman and CEO
Integrated Systems Solutions Corporation

ASN(RD&A) SPONSOR
RADM Eugene Harshbarger, USN
Competition Advocate General
of the Navy

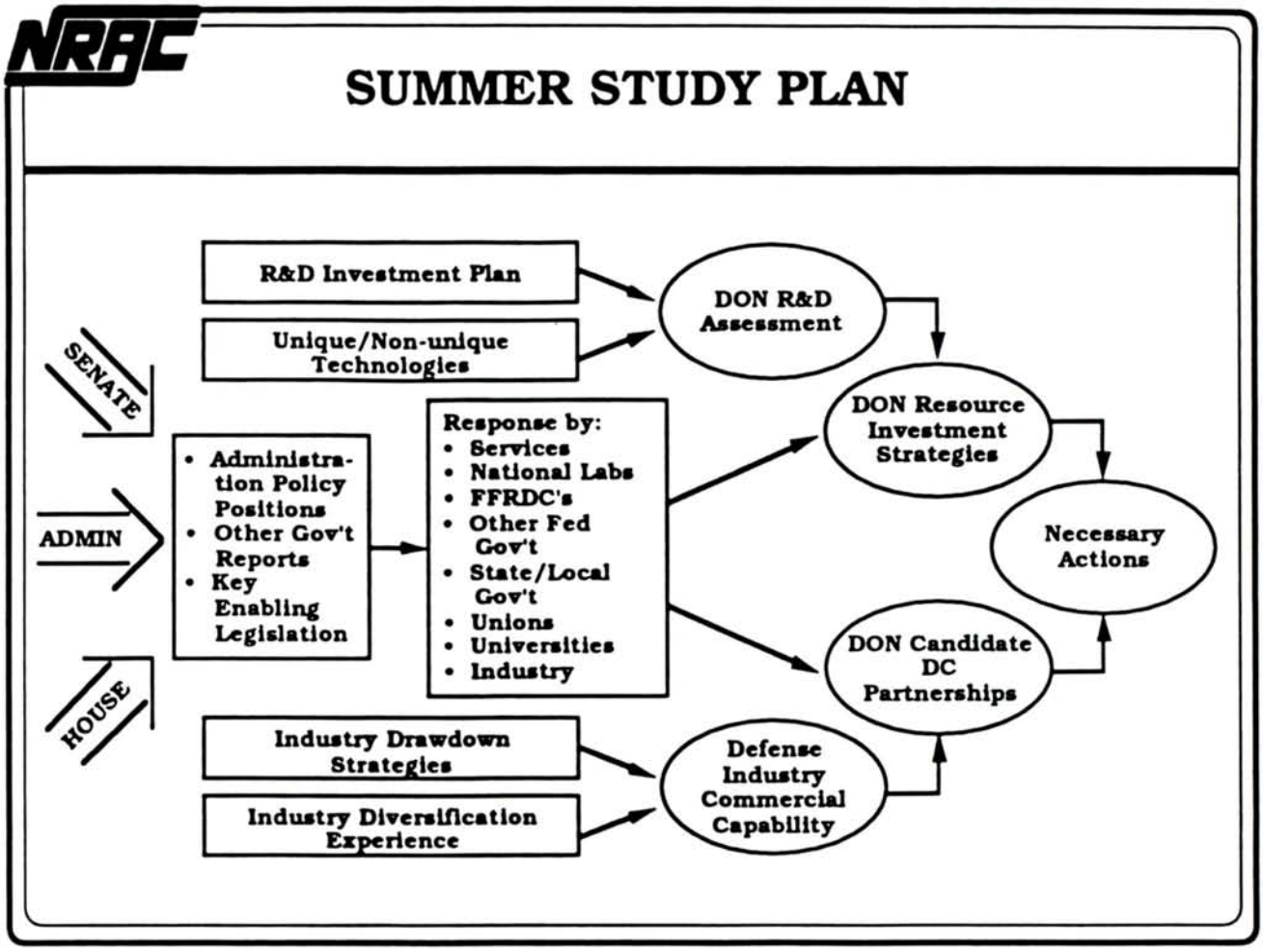
EXECUTIVE SECRETARY
CAPT Michael Brinkac, USN
Office of Naval Research

ASSOCIATE EXECUTIVE SECRETARY
LT Tracey A. Frampton, USN
Office of Naval Research

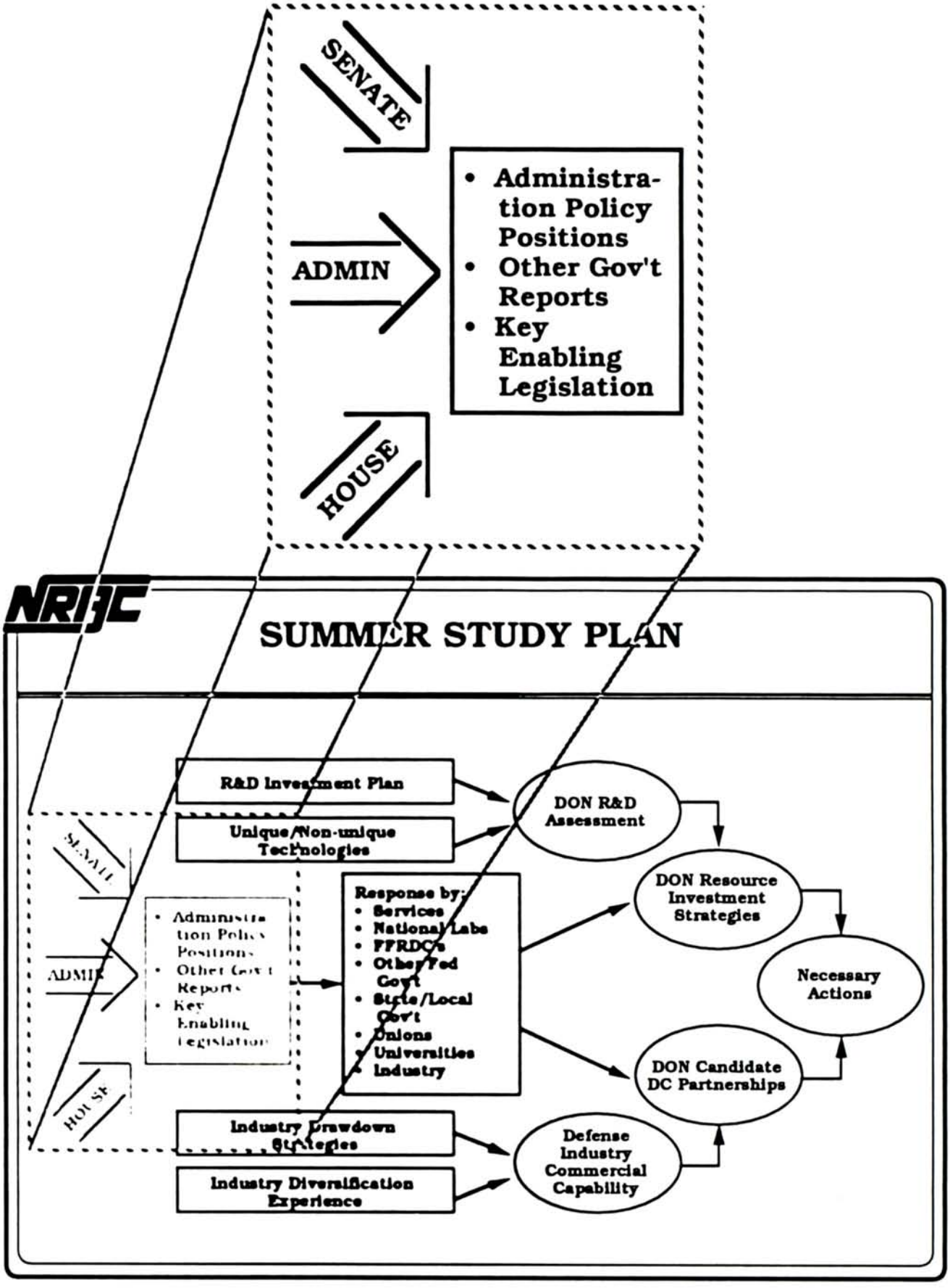
TERMS OF REFERENCE SYNOPSIS

- **GENERAL OBJECTIVE:**
  - **Assess the defense industry's capability to move into the commercial sector and**
  - **Assess the Navy's and industry's actions necessary to support the Defense Conversion, Reinvestment, and Transition Assistance Act of 1992.**
- **BACKGROUND:**
  - **The central theme of two Defense Conversion related documents released by the Administration is to use "savings" from downsizing the military to stimulate nearly every sector of the U.S. economy.**
  - **Six broad areas defined as Defense Conversion by Congress require cost sharing "partnerships" between government and industry.**
- **SPECIFIC TASKING:**
  - **Identify DON R&D which might best contribute to Defense Conversion.**
  - **Recommend alternative DON resource investment strategies which may produce dual benefits.**
  - **Recommend candidate Defense Conversion "partnerships" categories which maximize DON return on investment.**

Defense Conversion is a complex and multi-faceted topic. The TOR signed out by the ASN(RD&A) (acting) effectively scoped the topic to a manageable level. From the TOR a study plan was developed. A synopsis of the TOR is shown. Key words which drove the study plan development are underlined.



The Summer Study Plan was developed in direct response to the TOR. Note the correlation between the underlined words in the TOR and the words in the ellipses. Each ellipse represents a desired output from the study. The boxes represent the information required to develop the desired outputs. Successful execution of the study plan as shown will satisfy the intent of the TOR.


SENATE
ADMIN
HOUSE
• Administration Policy Positions
• Other Gov't Reports
• Key Enabling Legislation
NRIJC
SUMMER STUDY PLAN
R&D Investment Plan
Unique/Non-unique Technologies
DON R&D Assessment
DON Resource Investment Strategies
Necessary Actions
DON Candidate DC Partnerships
Response by:
• Services
• National Labs
• FFRDCs
• Other Fed Gov't
• State/Local Gov't
• Unions
• Universities
• Industry
Industry Drawdown Strategies
Industry Diversification Experience
Defense Industry Commercial Capability

THE FORCING FUNCTIONS

- **Clinton Administration policy positions**
  - **Technology: The Engine of Economic Growth, Sep 92**
  - **Technology for America's Economic Growth, Feb 93**
  - **Clinton-Gore on Defense Conversion**
- **Other government reports**
  - **OTA, Congressional testimony, commissions and panels**
- **Key enabling legislation**
  - **Stevenson-Wydler Technology Innovation Act of 1980**
  - **Federal Technology Transfer Act of 1986**
  - **National Competitiveness Technology Transfer Act of 1989**
  - **Defense Conversion, Reinvestment, and Transition Assistance Act of 1992**

Administration Policy:

Defense Conversion is best viewed in the broader context of the overarching Federal technology policy which is driving it. Under the Clinton Administration, technology policy has expanded well beyond the narrower confines set by previous administrations to encompass not only basic science and technology development, but technology deployment as well. In this setting, technology policy is viewed as the instrument of the government for distributing the national technological assets for the overall benefit of the country. If this new technology policy is successful, the traditional barriers between the public and private sectors will be reduced, and cooperation between state and local governments, industry, labor and educational institutions will be encouraged in order to pursue national economic objectives. The thrust of this policy is captured in the Administration white paper "Technology for America's Economic Growth, A New Direction to Build Economic Strength" (Feb. 22, 1993): "The best technology policy unleashes the creative energies of innovators throughout the economy by creating a market that rewards invention and enterprise."

The broad objectives of this new technology policy are to strengthen American industrial competitiveness and create high quality jobs, promote a business environment where technical innovation can flourish, ensure a coordinated management of

technology across all government agencies, forge working partnerships between public and private sectors, redirect the nation's technical resources toward new civilian initiatives, and reaffirm a commitment to basic science.

Other Government Reports:

Most reports dealing with Defense Conversion produced in the past few years concern the more general issue of defense *industrial* conversion as opposed to defense *technology* conversion. A notable exception has been a series of Office of Technology Assessment reports "Holding the Edge - Maintaining the Defense Technology Base" (1989); "Building Future Security - Strategies for Restructuring the Defense Technology and Industrial Base" (1992); and "Defense Conversion - Redirecting R&D" (1993). The latter report, in particular, supports the President's technology policy directives and makes the case for redeploying Federal technology resources formerly devoted to national defense (principally at Department of Energy (DOE) Defense Program Laboratories) to "new civilian initiatives" in environmental protection, renewable energy, non-polluting personal vehicles, and high-speed ground transportation.

Other important government studies which support the objectives of Defense Conversion deal with identifying critical pre-competitive technologies. "Streamlining Defense Acquisition Laws," a DOD advisory panel report released in March 1993, deals with the aspects of the Federal Acquisition Regulations (FAR) which disincentivize industry from participating in Defense Conversion activities.

Key Enabling Legislation:

The barriers to effective technology transfer between the public and private sectors have been recognized for many years. These barriers began to fall in 1980 with the enactment of the Stevenson-Wydler Technology Innovation Act. This bill and several subsequent laws constitute the body of Chapter 63 - Technology Innovation of the United States Commerce and Trade laws which enable fundamental changes in accessibility of technology developed in Federal laboratories for use in the private sector. Stevenson-Wydler requires government labs to take an active role in technical cooperation with industry. The Bayh-Dole Act of 1980 made it possible for the government to grant exclusive licenses to government-owned patents. The Cooperative Research Act of 1984 made government/industry consortia, such as SEMATECH (Semiconductor Manufacturing Technologies), possible. The Federal Technology Transfer Act of 1986 made technology transfer a statutory responsibility of all Federal laboratories and permitted Cooperative Research and Development Agreements (CRADAs) with industry. These laws and others laid the firm legal foundation for much greater government/industry cooperation in technology development and deployment, with the intent of enabling deep structural changes in the American economy.

In 1992, the Defense Conversion, Reinvestment, and Transition Act was passed. Title IV of this Act (Research, Development, Test and Evaluation (RDT&E) specific) provides substantial funding ($575M) for technology transfer activities in defense technology conversion, and its implementation is by means of the Technology Reinvestment Project (TRP) to be administered by the Advanced Research Projects Agency (ARPA).

TECHNOLOGY REINVESTMENT PROJECT

- "It is the mission of the Technology Reinvestment Project (TRP) to stimulate the transition to a growing, **integrated, national, industrial capability** which provides the most advanced, affordable, military systems and the most competitive commercial products."
- **Key characteristics**
  - Dual-Use technologies
  - Cost sharing government/industry partnerships
  - U.S. competitiveness
  - High quality employment

Introduces paradigm shift: uni- to bi-directional

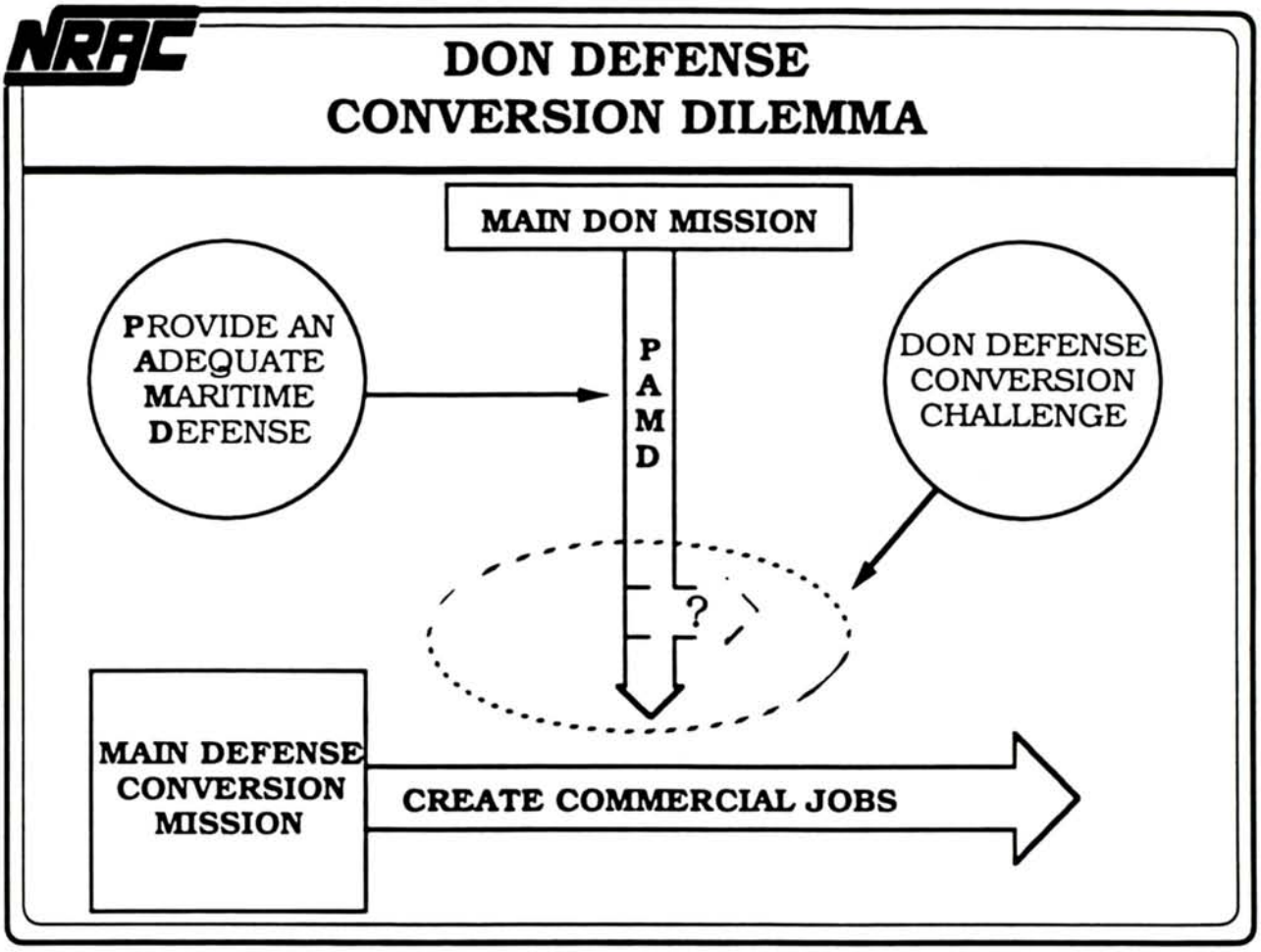
The TRP has become the focal point of the government's defense technology conversion strategy. The mission of the TRP is to encourage the consolidation of the defense and commercial industrial bases into a single, integrated, industrial base which can serve either sector. TRP has three activity areas; technology development, technology deployment, and manufacturing education and training. Proposed projects require government/industry partnerships in proposal submission and 50/50 cost sharing. TRP recognizes that technology transfer is a bi-directional process involving both "spin-off" of military technologies for commercial uses as well as "spin-on" of commercial technologies for military applications. TRP also recognizes that one key to an integrated industrial base is "dual-use" technologies which can be co-developed by a collaboration of industry and government for both commercial and military uses. It is intended that TRP will "demonstrably" enhance U.S. competitiveness while creating opportunities for high quality jobs for displaced defense workers.

POLICY THRUST

The fundamental premise behind Defense Conversion is that technologies can be pushed out of the Federal laboratories in such a way as to create jobs and improve industrial competitiveness in the commercial sector.

Represents Defense Conversion's Mission

The essence of the Administration's Defense Conversion policy thrust was derived from their published papers. Key words in the derived statement have been underlined for emphasis. The fundamental premise is clearly that "pushing" Federal laboratory technology into the commercial sector will improve its competitiveness thus creating more jobs. This premise can be interpreted as the mission of Defense Conversion.



Defense Conversion is an Administration/Congressional initiative aimed at softening the impact of a defense drawdown by creating high value jobs in the commercial sector and improving the competitiveness of U.S. industry. These objectives are not inherently aligned with the Navy's basic mission of providing an adequate maritime defense. This lack of mission alignment creates a real Defense Conversion dilemma for the DON. In order to generate more enthusiastic Defense Conversion support, the DON must find ways to gain mission alignment such that Defense Conversion participation will directly support the DON's own mission This is the DON's Defense Conversion challenge. The NRAC Summer Study Panel addressed this challenge.

DEFENSE CONVERSION DEFINED

"IT WAS MADE AT THE OLD TRIDENT MISSILE PLANT!"

Defense Conversion is a much publicized but not well understood topic. This Tampa Tribune cartoon is a typical example. While its intent is humor, it suggests a specific perception of Defense Conversion. Other publications have their own emphasis and consequently create other perceptions.

DEFENSE CONVERSION PERCEPTIONS

- **A way to convert military production facilities to produce commercial products**
- **A stimulus to the creation of new jobs**
- **An attempt to ease defense drawdown impacts**
- **An initiative to develop an integrated Commercial/Defense Technology Base**
- **An opportunity for industry to augment already planned investment**
- **A method to funnel resources to specific geographic areas**
- **An opportunity to focus additional R&D resources to "own" benefit**
- **A potential drain of already short R&D funds**
- **An inappropriate use of the country's resources**
- **An opportunity to re-invent the defense industry**

The Panel was struck by the diversity of views of Defense Conversion expressed in policy documents, public speeches, and briefings to the Panel. Members came to the Panel with a variety of views. A collection of the most frequently heard perceptions is shown here. The lack of a clear consensus on the meaning or intent of Defense Conversion is one of the obstacles to formulating an effective Navy response to the initiative by the Administration and the Congress. It, indeed, was the key obstacle the Panel had to overcome before proceeding with the study. After much debate, this was successfully accomplished and is documented as the Panel Macro Definition.

PANEL MACRO DEFINITION

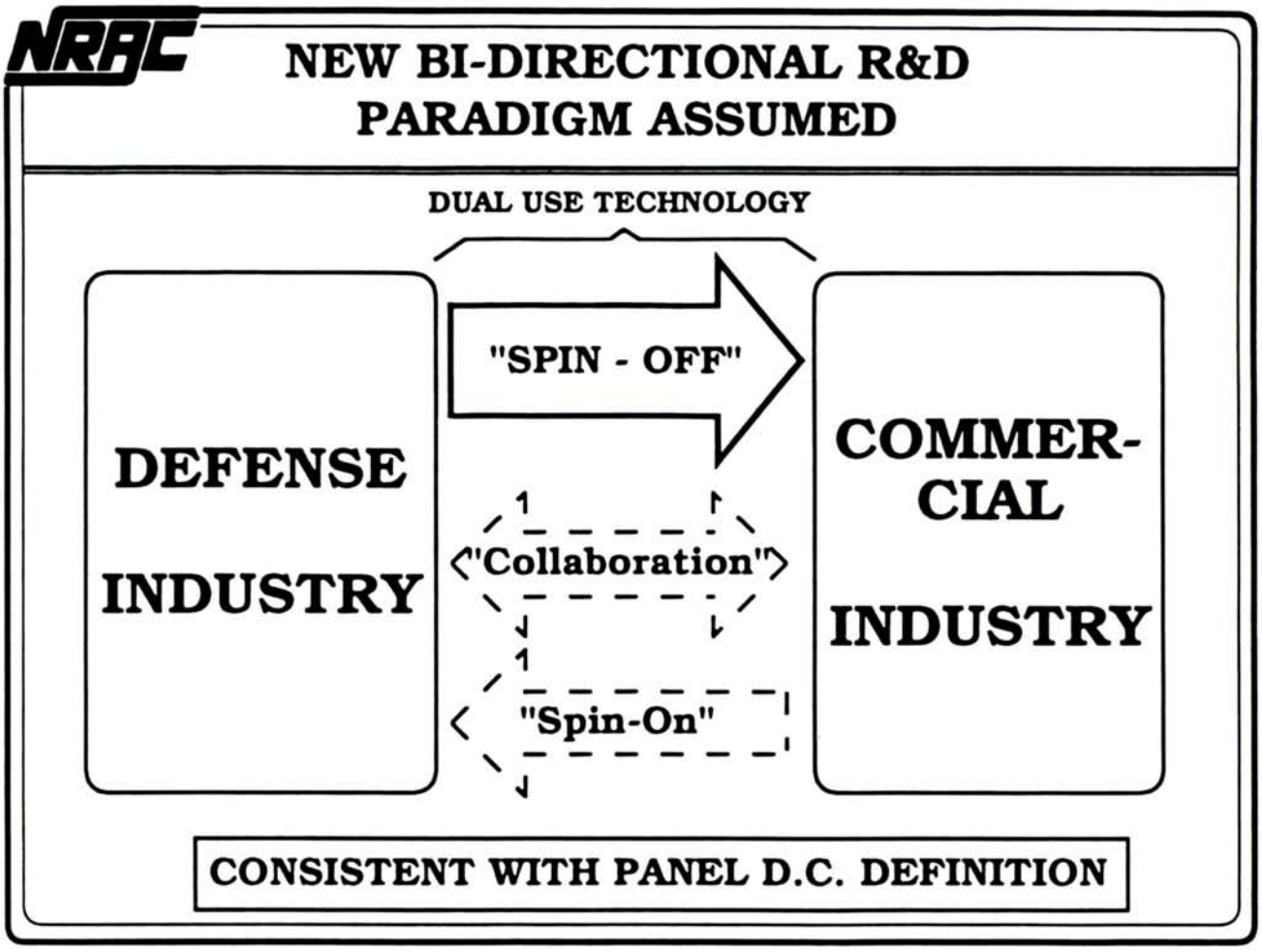
Defense Conversion means finding productive civilian uses for...*some of*...the resources and people formerly devoted to the national defense...*while maintaining an adequate defense.*

PANEL FOCUS IS R&D

This definition of Defense Conversion is a modified version (changes in italics) of the definition given in "Defense Conversion - Redirecting R&D" (OTA, May 1993). Unmodified, the definition states the most commonly perceived view of Defense Conversion. This re-direction of defense-related resources to address other national goals associated with improving economic competitiveness and creating jobs is the "swords into plowshares" or "peace dividend" dimension of Defense Conversion. It represents a uni-directional technology transfer philosophy.

Equally important in the conversion process is the transformation of the remaining defense establishment to provide for an adequate national defense in the 21st century. This transformation is more complex than simply decreasing the size of the existing base. New operating models and new investment strategies are required to meet new defense requirements. The recognition that technology transfer can be bi-directional is the single most important philosophical change required.

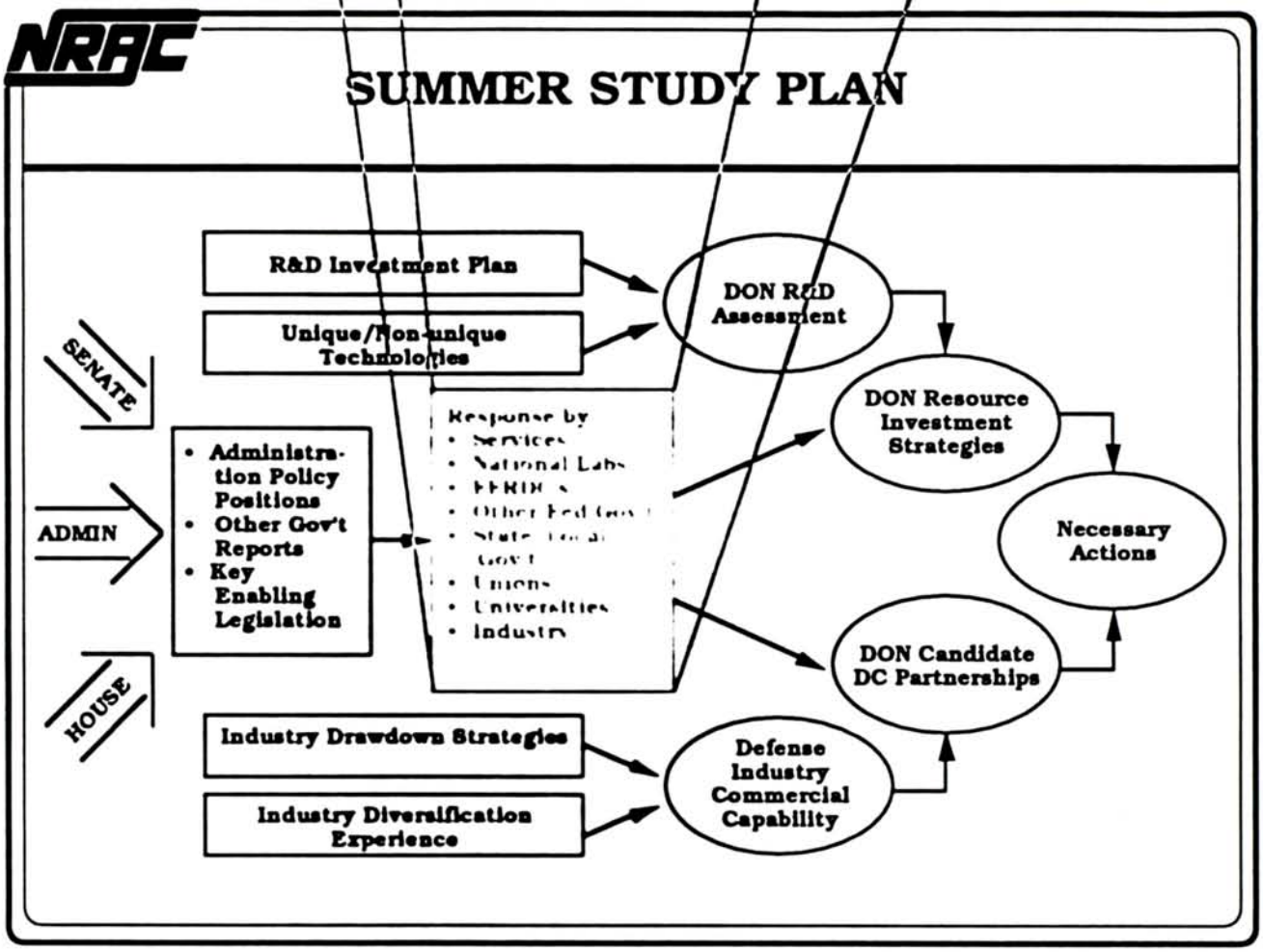
The Panel recognizes that there are many facets to Defense Conversion. However, the TOR focused the Panel on the Navy's R&D efforts. Therefore, only the R&D aspects of Defense Conversion are considered.



Prior to the TRP, technology transfer, in the eyes of most government policy-makers, was generally viewed as a uni-directional process of redeploying technology developed in the Federal labs into commercial applications. This is what is inferred by "spin-off." This mode of technology transfer suffers from the shortcoming of too much "technology push" with little regard to "market pull" on the part of those who will deploy the technology in the commercial sector. TRP recognizes that the mode of "spin-on" is also of considerable importance to defense technology conversion because best commercial technology can be adapted or adopted for military uses without the need to develop it in-house. TRP does not, however, adequately consider the cultural barriers within DOD to "spinning on" commercially developed technology. TRP also recognizes the mutual advantages of collaborative development of dual-use technologies where the combined pull of both military and commercial markets is needed for technology development. Of the three technology deployment modes, the Panel believes collaborative dual-use development and "spin-on" hold the greatest potential benefit for the DON. By including the Bi-Directional R&D Paradigm as inherent in DON's Defense Conversion definition, the challenge of mission alignment can be satisfactorily addressed.

Response by:

- **Services**
- **National Labs**
- **FFRDC's**
- **Other Fed Gov't**
- **State/Local Gov't**
- **Unions**
- **Universities**
- **Industry**



DEFENSE CONVERSION RESPONSE TECHNIQUES

- **Technology Reinvestment Project**
- **Cooperative Research and Development Agreements (CRADAs)**
- **Patent and technology licenses**
- **Manufacturing Technology Centers of Excellence (Navy unique)**
- **Federal Laboratory Consortium for Technology Transfer**
- **National Technology Transfer Center**
- **Advanced Technology Program**
- **Small Business Innovative Research contracts**
- **Industrial consortia**
- **Reimbursable work for others**
- **Shared facilities**
- **Personnel exchange**
- **Cooperative Agreements (USC 10, Sec. 2371)**
- **Award fees for commercialization**

Several mechanisms, some pre-existing and others newly created, have potential for Defense Conversion. The TRP is a collaborative program including ARPA, DOE defense programs, Department of Commerce's National Institute of Standards and Technology (NIST), the National Science Foundation and the National Aeronautics and Space Administration (NASA). TRP is the largest Defense Conversion effort to date. Its mission is to stimulate the transition to a growing, integrated, national industrial capability which provides the most advanced, affordable, military systems and the most competitive commercial products. The 1993 TRP budget is $575M, including $305M for technology and new product creation.

Currently, the most popular activity in Defense Conversion is the CRADA authorized under the Federal Technology Transfer Act of 1986. A CRADA is an agreement between one or more Federal laboratories and one or more non-federal parties such as private companies, designed to encourage and facilitate cooperative R&D. CRADAs do not permit Federal laboratories to contribute funds, but resources such as personnel, facilities and equipment may be contributed to the joint R&D effort. Commercially valuable data developed under a CRADA can be protected as a trade secret for up to five years. Intellectual property issues such as data rights, property ownership, and rights to future inventions can be negotiated as part of the CRADA process.

Prior to the Bayh-Dole Act of 1980, Federally owned patents were considered to be in the public domain. This act empowered Federal agencies to license inventions to industry, retaining only a non-exclusive, royalty-free license for government use. The Navy generates more new patents each year than any other Federal agency, currently holding 4,600 active patents. The Naval Research Laboratory (NRL) has taken an active role in licensing patents, tracking citations of NRL patents by later patentees to determine those most suitable for licensing and to identify potential licensees. They now have 80 royalty bearing licenses which will produce over $800K in license fees in 1993.

The Navy's six Manufacturing Technology (MANTECH) Centers of Excellence represent excellent opportunities for Defense Conversion since they already exist as focal points for development and deployment of emerging manufacturing technologies.

The Federal Laboratory Consortium for Technology Transfer (FLC) is composed of approximately 600 Federal R&D laboratories, centers, and their parent agencies. The FLC promotes and facilitates the transfer of R&D results from Federal laboratories into applications in the private and public sectors, as well as cooperative technology development by industry, member laboratories, and universities. The Consortium operates a laboratory locator network that matches technical need with Federal laboratory expertise, facilities, and technologies. The National Technology Transfer Center, sponsored by NASA, serves as a national clearinghouse for Federal technology and provides services and assistance in the areas of training and outreach. In conjunction with the six Regional Technology Transfer Centers, it is intended to provide a national framework for the public and private sectors to work together productively to enhance the economic competitiveness of the United States.

The Department of Commerce's NIST Advanced Technology Program offers opportunities to "spin-off" DOD technologies to the commercial sector. Examples include micro-electronics, communications and fiber optics technologies.

Small Business Innovative Research (SBIR) contracts have been useful for a number of purposes, but clearly offer opportunities to "spin-on" commercial technologies from small innovative businesses. Industrial consortia such as the Microelectronics and Computer Consortium have become an increasingly popular way to focus resources on pre-competitive technology development. Recently, attention has been directed towards other ways to share resources, including reimbursable work by Federal laboratories for other Federal and private sponsors, access to Federal facilities and equipment, and visiting scientist and engineer programs. These approaches offer opportunities to minimize cost of technology development and speed technology transfer between the public and private sectors under certain conditions.

Title 10 U.S. Code, Section 2371 provides that ARPA and the military department secretaries, "in carrying out advanced research projects, may enter into cooperative agreements and other transactions with any person, any agency or instrumentality of the U.S., any unit of state or local government, any educational institution, and any other entity." Approval is required at the Secretary of Defense

(SECDEF) or Deputy SECDEF levels, and only ARPA presently has authority to enter into Section 2371 arrangements. Whereas the government may not provide funds under a CRADA, it may do so under Section 2371 agreements. The government is not required to receive intellectual property rights under Section 2371, and requirements for mission relatedness are less strict.

The Air Force has included in its Defense Conversion strategy the use of award fees as incentives for commercialization of technology.

CHARACTER OF NON-DON FEDERAL RESPONSE TO DATE

Army	**- 253 CRADAs; Mostly medical and civil engineering (market pull)**
Air Force	**- Strategy formulated; Active in TRP**
DOE Labs	**- Focus on CRADAs; Sandia has 100; 75% in advanced manufacturing technology**
FFRDCs	**- Just starting up; Focus on industrial consortia**
DOC/NIST	**- Advanced Technology Program**

Responses of the Federal agencies to the Defense Conversion initiative have been varied and are driven by the nature of the technology available for transfer, the level of commercial sector interest in the technology, the availability of funding to stimulate the transfer, and the compatibility with the agencies' other missions. The Army has established 48 Offices of Research and Technology Application (ORTAs) located at labs and RDT&E facilities. CRADAs have been the primary mechanism employed by the Army which has in place the most of any service (253 in 1992). However, sixty percent of Army CRADAs represent a consolidation of Air Force, Navy and Army common research in areas of medical technology and civil engineering which are areas with significant commercial sector interest (market pull). The Army also generated $190K in patent licensing fees in 1992.

The Air Force has been less active than the Army in terms of CRADAs (80), or patent licensing ($50K/yr), but they have recently formulated an aggressive Defense Conversion strategy to:

- Identify and invest in Air Force-required technologies not addressed commercially.

- Cooperate with industry to support commercialization of generic technologies and dual-use products that reduce Air Force investment.

- Develop a second dimension to reliance through links to Department of Commerce (DOC), DOE, NASA, Federal Aviation Administration (FAA) and others.

As a part of this strategy, the Air Force has assumed an active role in the ARPA TRP, supplying staff to aid in proposal evaluation and actively encouraging proposal submissions.

The DOE Defense Program laboratories have been actively pursuing technology transfer for a longer period of time than the DOD laboratories. CRADAs are the primary mechanism used by the DOE labs, at least partially because DOE has set aside funding for CRADAs. Sandia has executed over 100 CRADAs in the past two years, with an aggregate value of $373M. Forty-eight percent of the funding has been supplied by DOE. Sandia has identified four effective ways to communicate opportunities for technology transfer:

(1) News letters

(2) Technical publications, talks, patents

(3) Laboratory visits

(4) National Technology Initiative meetings, work shops, and conferences

The Federally Funded Research and Development Centers (FFRDCs) are just getting started in Defense Conversion. Lincoln Laboratory has been most successful in creating dual-use technology consortia. They initiated a Consortium for Superconducting Electronics in 1990 that includes the Massachusetts Institute of Technology (MIT) and Lincoln Laboratory, AT&T Bell Laboratories, IBM, Boston University, Cornell University, and State University of New York at Stony Brook. In 1993, Lincoln Laboratory started a Consortium on Wide-band All-optical Networks with AT&T, DEC and MIT.

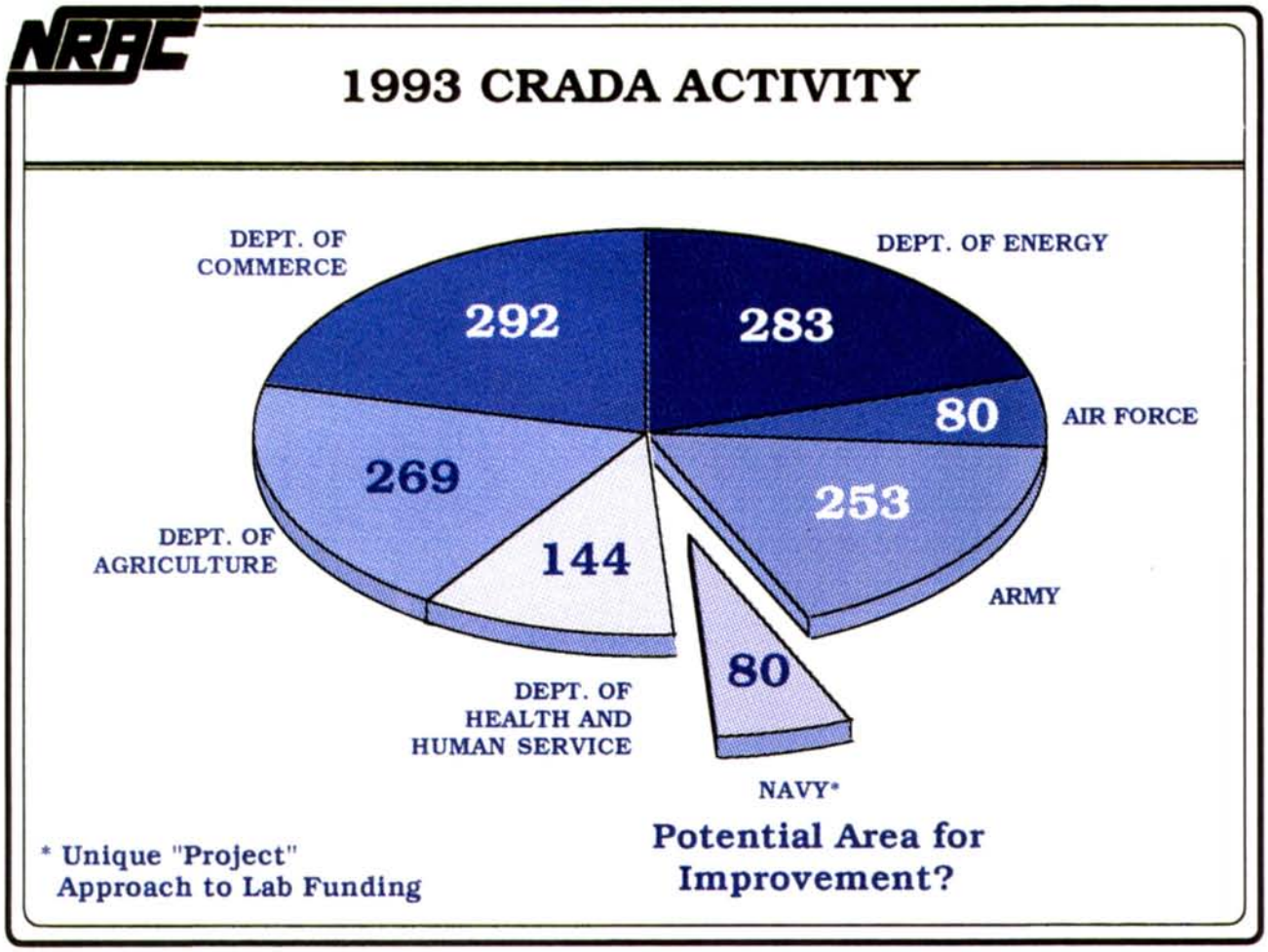
NIST is pursuing an ATP intended to assist U.S. businesses in creating and applying pre-competitive technologies to:

(1) Commercialize significant new scientific discoveries and technologies rapidly and

(2) Refine manufacturing technologies.

The NIST ATP is funded at a level of $68M this year and is planned to rise to $459M by 1995. The ATP has been existent for three years, funding 60 projects out of 660 proposals. Total ATP funds committed are $187M, and estimated cost sharing from industry is $210M.

Note that the majority of the response activity to date falls into the unidirectional technology transfer category. The ARPA TRP, if successful, will begin to change that.



With the exception of the Army, the services have not made extensive use of CRADAs. Two primary reasons for this are the lack of set-aside funding for CRADAs within DOD and the lack of alignment between the DOD mission and the primary Defense Conversion mission. Army response may appear disproportionate because a majority of DOD medical and civil engineering R&D has been consolidated under the Army. Another impediment appears to be the lack of focus for CRADA activities within DON. CRADAs do, however, represent a promising mechanism for accomplishing Defense Conversion that is beneficial to DON.

DON 1992 DEFENSE CONVERSION ACTIVITIES

	RDT&E BUDGET (MILLIONS)*	COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS	PATENT & TECHNOLOGY LICENSES	
NRL	$495	13	$107K/yr**	→ Market Pull
Warfare Centers	$2,094	30	$86K/yr	← Tech Push
Medical R&D	$49	23	0	→ Market Pull
Other	$120	12	$13K/yr	
DON Total	$2,758	78	$206K/yr	

* Source: Office of Technology Assessement 1993, based on data supplied by U.S. Navy Office of Legislative Liaison, 1992

**$800K in 1993

Response Can Improve with Focus and Funding

19

In order to understand how DON response to Defense Conversion can be improved, it is useful to examine, in more detail, the response of the various DON RDT&E elements to date. The Navy now has ORTAs at 47 facilities, including NRL, the four Naval Warfare Centers (including some of the test facilities), the Naval Academy and the Naval Postgraduate School, but only 15 of these ORTAs are full time.

NRL has found patent and technology licensing to be the most effective technology transfer mechanism. NRL licensing income has increased from $30K in 1991 to $800K in 1993. NRL has been, by far, the most aggressive DON facility in pursuing intellectual property licenses, initiating a program of tracking the number of times NRL patents are cited in later patents. This helps them to identify the most appropriate patents for licensing as well as to identify licensees. This technique should prove useful in other DON areas with relatively high patent activity. The benefit to date has accrued from licensing only 80 of DON's over 4600 patents.

The warfare centers have participated in Defense Conversion, primarily through CRADAs, but have been relatively less successful than other Navy laboratories. This is thought to be due primarily to the many fewer potential commercial applications of technologies associated with advanced weapon system development. However, lack of funding may be the real cause. Industrially funded Navy laboratories have a

significantly greater problem participating in Defense Conversion than other Federal laboratories.

NRL has not made extensive use of CRADAs. This is at least partially due to the lack of funding to support CRADA activities. Success may also have been limited by the rather broad focus of NRL's technology transfer activities encompassing seven broad fields as compared with Sandia's focus in fewer, more specific areas.

By contrast, the Navy medical R&D sector has not yet begun to produce royalty income, but has been disproportionately successful in establishing CRADAs, in view of its relatively modest R&D budget. This high level of activity reflects the dual-use nature of medical technology and clearly illustrates the importance of "market pull" in technology transfer.

Overall, the Navy RDT&E activities are participating in Defense Conversion, each according to its own motivations and resources. By directing and focusing these activities, DON should derive greater benefit from participation in the Defense Conversion process.

EXISTING STATE - INDUSTRY COOPERATION

- **Diversification programs designed to maintain & augment job base**
- **State task forces help companies through grants and incentives**

	Funding ($M)	Jobs Lost (000)
California	**66**	**178**
Connecticut	**22**	**37**
New York	**15**	**62**

- **Localities with programs: Long Island, Los Angeles, San Diego, St. Louis**
- **DON does not participate now but opportunities exist through partnerships**

Some states and localities have established successful programs with many companies creating jobs with contract wins and new product successes. Many states have established task forces and agencies which have helped individual companies define markets that meet needs of the specific state or locality. California and Connecticut, for example, have implemented programs that would be useful to the DON and its contractors. New York has begun a defense diversification program. Other states, including Washington and North Carolina, promote application of technology to new industry. A number of localities with major defense employment have developed separate programs. States are helping to educate companies in non-DOD market differences which include operating practices, organizational structure, and customer service requirements of commercial markets. Further, many states have coordinated their agencies to allow for regulatory, tax, and export incentives to companies bringing new technology and jobs to their localities.

A key to DON Defense Conversion success may be partnership with state and local governments. The proactive states and localities desire close cooperation with the DON, but currently, the Navy does not have involvement with state or local diversification programs.

STATES ARE ANXIOUS PARTNERS

Possible areas of cooperation include:

- **Identifying industry contractors supporting DON-unique technologies for state focus**
- **Utilizing state diversification programs to support Navy diversification objectives and communication networks**
- **Supporting states in matching funds for grants to support key technology oriented diversification projects**
- **Participating in cooperative technology plans with universities and state diversification program offices**
- **Establishing processes to allow for special Defense Conversion projects for technology support**

The DON is strongly welcomed to become a partner in the California, Connecticut and New York State Diversification Programs. Areas of partnership include identification of contractors and lower-tier subcontractors and vendors located in the specific states which are supporting DON-unique technologies, participation on planning committees and technology task forces, and being electronically connected to the State Defense Information and Service Network which is being prototyped in California. It is clear that state and local governments want to be active Defense Conversion participants. Ample opportunity for creative partnering exists.

UNIONS' ROLE IN DEFENSE CONVERSION

- **Unions are motivated to find a way to participate in Defense Conversion**
- **Current union activities include**
  - **Cataloging existing skills**
  - **Encouraging and coordinating retraining**
  - **Partnering with industry in specific markets**
- **Potential benefit to DON**
  - **Union partnership with industrial efforts can strengthen success of joint ventures**
  - **Changes in union contracts may allow more freedom for people to meet the needs of the business**

Unions have strong motivation to aid in the Defense Conversion process because of their exposure to the defense draw down. As a result, they are anxious to participate. The International Association of Machinists (IAM) has been working with state and Federal agencies to categorize skills and coordinate retraining of displaced members. They have also been active in partnerships with industry in specific markets. For example, Westech Gear Corporation and the IAM have worked together in pursuing the growing natural gas transportation market, as well as light rail fabrication and assembly.

Partnerships between unions and industry have improved chances of success in competition for defense conversion funds. Also, the competitiveness of the work force is essential to the success of Defense Conversion in global commercial markets. Therefore, an important aspect of the interaction with unions has been the encouragement of High Performance Work Organizations (HPWO) which allow more flexibility with greater worker participation.

Unions should not be ignored as a potential DON partner.

CURRENT UNIVERSITY/DON PARTNERSHIPS

- **Current partnership through DOD 6.1 research**

	University $
Navy	$216M
Air Force	$111M
Army	$55M

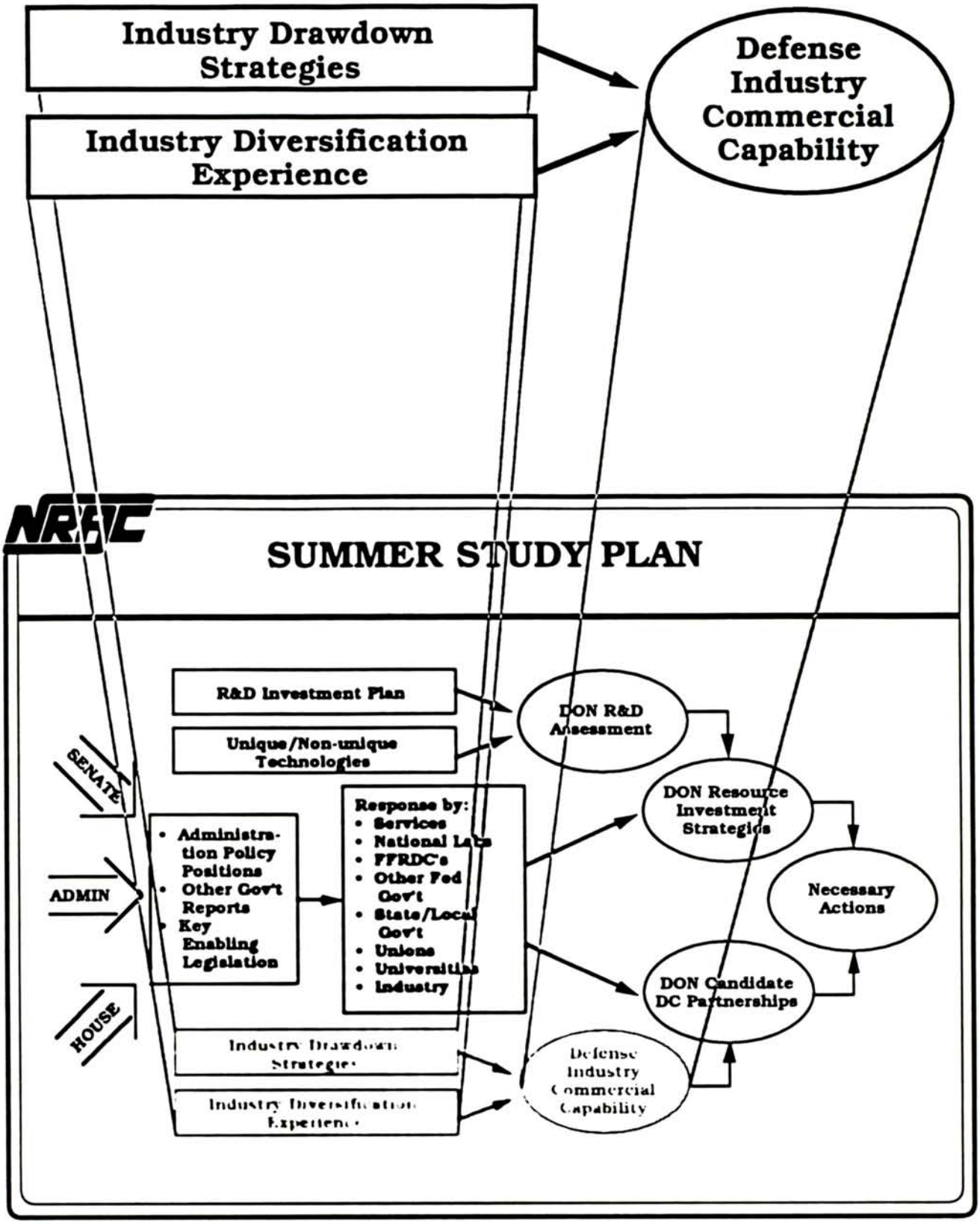
  - **Majority of DON 6.1 is already at universities**
  - **Provides access to new technology**
  - **Infrastructure exists**
- **Potential new role for university/DON partnerships**
  - **Use university/local industry/state partnerships to identify new markets**
  - **Use business schools to perform market potential and market strategy research**

The Navy has well developed partnerships with universities that can be used to promote Defense Conversion. Most of the Navy's 6.1 research is already performed in universities as is shown for FY 91 DOD research. The Navy conducts more university research than the other two services combined. The Navy benefits through these strong links with universities, which provide access to emerging technologies. Also, many engineers and scientists have been educated in Navy needs and applications.

The Navy can use the cooperative partnerships established with universities to promote Defense Conversion. For example, many states have developed organizations and centers to encourage industry/state/university initiatives to promote commercial development and create high skill jobs. The industry/state/university partnership is best at identifying the market, and the Navy can foster those programs that support Navy Defense Conversion objectives. Market research can be augmented by providing some funding to business schools in states where these partnerships are active.

As an example of an existing industrial/state/university partnership, Washington state funds the Washington Technology Center to bring together industry and academia in areas such as computer technology, materials development, biotechnol-

ogy, and semiconductor technology. The state provides matching funds to complement Federal and industrial funding. Funding is highly competitive with identification of markets with job potential being a major criteria.


Industry Drawdown Strategies
Industry Diversification Experience
Defense Industry Commercial Capability
NRAC
SUMMER STUDY PLAN
R&D Investment Plan
Unique/Non-unique Technologies
DON R&D Assessment
SENATE
ADMIN
HOUSE
• Administration Policy Positions
• Other Gov't Reports
• Key Enabling Legislation
Response by:
• Services
• National Labs
• FFRDC's
• Other Fed Gov't
• State/Local Gov't
• Unions
• Universities
• Industry
DON Resource Investment Strategies
Necessary Actions
DON Candidate DC Partnerships
Industry Drawdown Strategies
Industry Diversification Experience
Defense Industry Commercial Capability

In general, defense industry executives have identified five strategies for their companies to follow in response to the defense drawdown and the resulting decline in defense spending.

(1) Diversification: Shift the products and market focus away from defense and toward commercial or government, non-defense (e.g. NASA). The problem with diversification is that the defense firms lack expertise outside of the defense market niche, and the non-defense markets are already adequately served by other companies.

(2) Liquidation: Reduce non-essential spending (e.g. R&D and capital) and promote generation of cash. This strategy may be perceived to be in the best interest of the stockholders, but results in dislocation of the work force and weakening of critical elements of the defense industrial base.

(3) Evaporation: Stay the course in the hopes that sooner or later defense procurement will rebound, or otherwise slowly go out of business as contract backlog shrinks.

(4) Consolidation: Reduce scale and scope of company operations by combining related business units to create critical mass, reducing overhead, and pooling technology resources.

(5) Rationalization: Simultaneously downsize and consolidate the defense industrial base. Individual companies downsize in order to match the supply with the reduced demand, while the defense industry as a whole consolidates by reducing the total number of companies in order to achieve critical mass for those that remain.

Overall, defense industry executives are skeptical about the prospects for defense "conversion". They are less concerned with their abilities to adjust to the adverse business conditions in the defense sector than they are with the consequences of structural changes which may permanently jeopardize vital elements of the defense industrial base, especially among lower tier subcontractors. Among the most conscientious defense industry leaders, consolidation and rationalization are viewed as the best strategies for retaining critical infrastructure in a smaller, leaner and more efficient overall industry.

U.S. DEFENSE INDUSTRY CONVERSION EXPERIENCE

NEW BUSINESS VENTURE	SUCCESS RATE
Aerostructures Subcontracting	71%
Civil Government Information Systems	67%
Commercial Communications	33%
Commercial Information Systems	25%
Education	25%
Energy	14%
Ground Transportation	0%
Medical	0%
Shipbuilding	0%
Environment	?%

15 Successes Out of 47 Ventures

Source: Martin Marietta Study

The data from a study by Paul Blumhardt, Martin Marietta, show that recent (last 20 years) defense industry conversion attempts have had a low success rate. Another study by McKinsey comes to the same conclusion, which also coincides with widely held beliefs in the management of large defense contractors. Furthermore, the successes are all in areas that were directly related to specific technologies already in place where the market was somewhat similar to the defense market (e.g., aerostructures). These data clearly contribute to industry's reluctance to participate in Defense Conversion.

INDUSTRY REACTION TO THE DEFENSE DRAWDOWN

- **Large companies with low commercial content are focused on consolidation** (e.g. Martin Marietta, LORAL, GD)
- **Large companies with high commercial content are actively divesting defense segments** (e.g. General Electric, LTV)
- **CEO's of large/low commercial content companies are not very interested in Defense Conversion**
  - **Very poor track record in diversification**
  - **Inadequate understanding of the commercial market place**
  - **Incompatible business practices**
  - **No commercial marketing infrastructure**
  - **No commercial distribution system**

Recent large company actions within the defense industry, coupled with statements and speeches made by their CEOs, are real indicators of industry reaction to defense draw down. Defense Conversion is clearly not a strategy being embraced by large companies due to high perceived risk. They, at best, will be reluctant Defense Conversion participants. Strong incentives will be necessary to stimulate any interest on their part.

IMPACT OF VULNERABILITY

- **Vulnerability to the defense drawdown is directly related to company size and defense content**
- **Highest vulnerability is small and mid-size companies with high and medium dependency on defense**
- **Lowest vulnerability is with small, medium and large companies with low dependency**

Vulnerability will influence a company's motivation to participate in Defense Conversion

A firm's product lines, size and dependence upon DOD contracts are important factors in determining its vulnerability to the defense drawdown. Basically, the industry can be segmented into three levels of vulnerability:

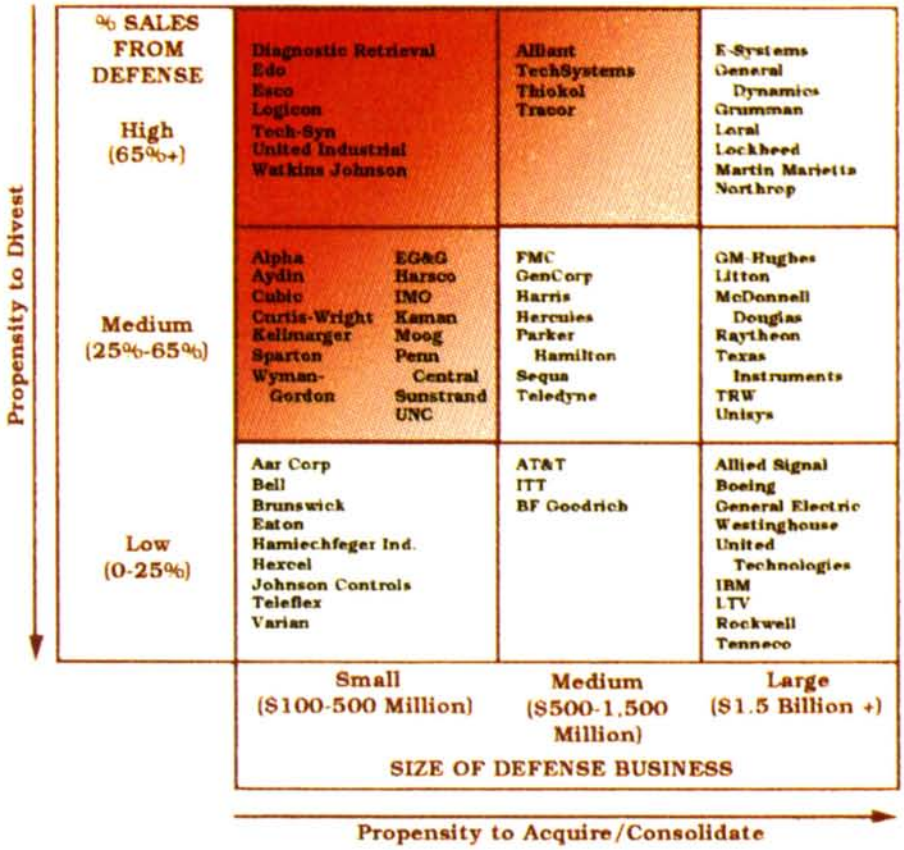
(1) Low - those firms which are, regardless of their size, only minimally reliant on DOD contracts (less than 25%).

(2) Medium - large (>$1.5B) companies with high degree (>66%) of defense contracting and large and mid-sized ($.5-1.5B) firms with medium (25-65%) dependency on DOD.

(3) High - small ($100-500M) and mid-size with a high degree of dependency on DOD.

Large defense dependent companies may be able to "hunker down" and survive the defense drawdown, and low-dependency firms are already well diversified and will not be greatly impacted. Therefore, the areas of critical vulnerability reside in the small and medium sized companies that are heavily dependent upon DOD. These companies may be increasingly motivated to participate in Defense Conversion.

MOST LIKELY CANDIDATES FOR DEFENSE CONVERSION



In the matrix above, the most likely candidates to participate in Defense Conversion are highlighted. This analysis is based on the combination of vulnerability and agility of each cell of the matrix. Other firms are also possible partners, but in all cases the ownership of the companies will make independent decisions based on their own self-interest. The Navy can only look for ways to influence this decision process to support its needs and the policies of the administration.

ACQUISITION REFORM SUPPORTS DEFENSE CONVERSION

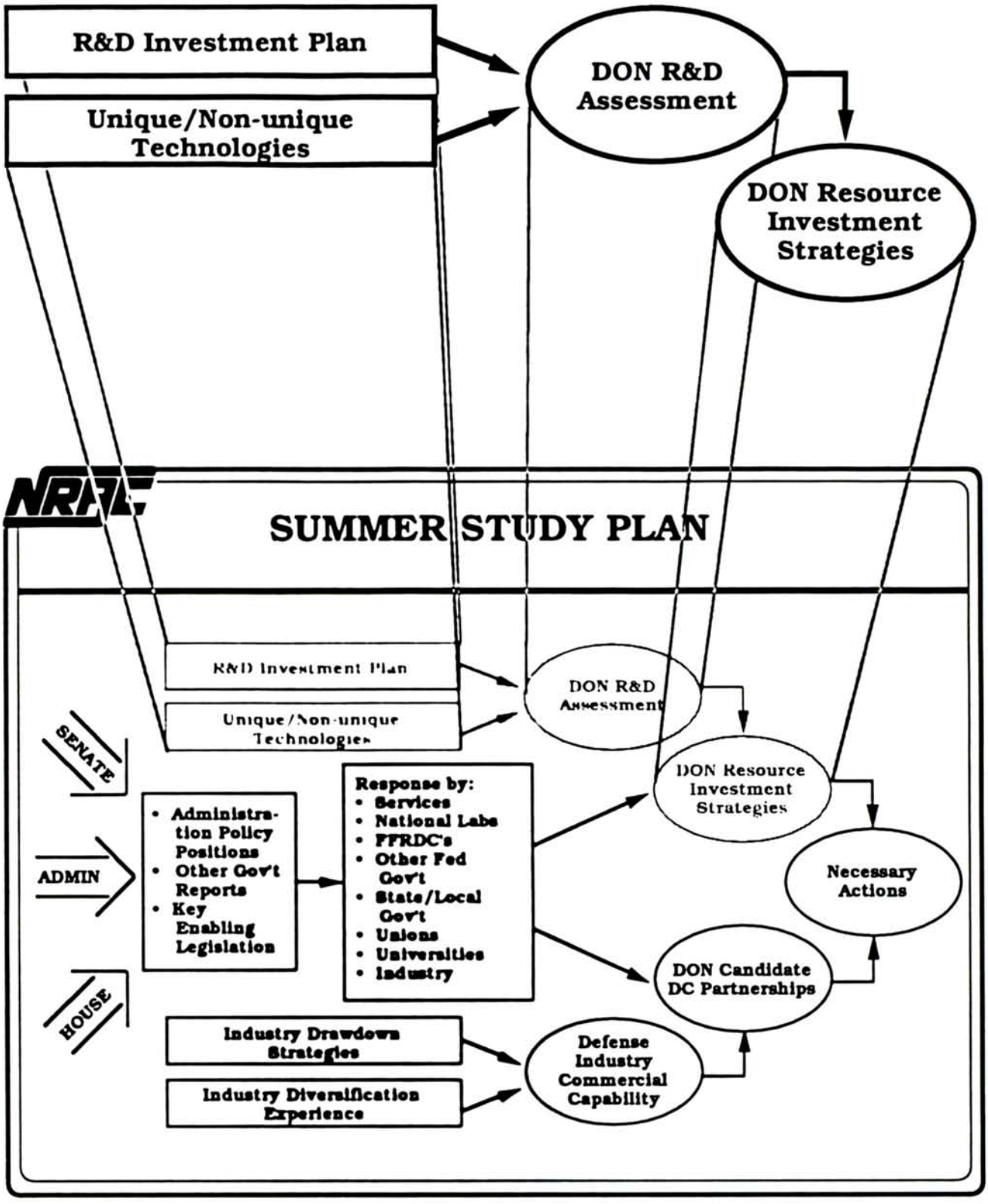
- **Removes barriers caused by MILSPECs**
- **Encourages Generally Accepted Accounting Principles**
- **Uses best commercial quality standards (ISO 9000)**
- **Simplifies procurement and subcontracting**
- **Provides rewards for spin-ons**
- **Expedites contracting procedures for small business awards**
- **Reduces oversight on contracts**
- **Enables shared manufacturing facilities for commercial and military**

Aligns DOD with commercial practices to encourage industry participation and facilitate "spin-on"

Federal Acquisition Regulations (FAR) are major roadblocks to Defense Conversion. They have driven companies to practices which are non-competitive in the commercial market. Companies with both commercial and military business have been forced to erect significant organizational and financial barriers between the two business sectors.

These roadblocks can be removed through alterations to the FAR; making use of commercial "off the shelf" (COTS) products the norm and allowing the requirement to use only products with military specifications (MILSPEC) through a waiver; aligning DOD auditing and accounting procedures with existing commercial practices; and altering procurement and subcontracting regulations to reflect the commercial marketplace. The International Standards Organization's quality procedures (ISO 9000) should replace the outdated, expensive and intrusive inspection process currently used to assure quality on defense contracts. In addition, financial incentives should be available for companies that utilize "spin-on" technology. Small businesses can be aided by changing the acquisition regulations to reduce oversight on contracts under $100K and to expedite the contracting process for these businesses.

Acquisition reform which more closely aligns the defense industry to commercial practices can significantly remove roadblocks to Defense Conversion, as well as decrease the cost of future Navy programs, by allowing more efficient use of industrial resources for both military and commercial purposes.


R&D Investment Plan
Unique/Non-unique Technologies
DON R&D Assessment
DON Resource Investment Strategies
NRAD
SUMMER STUDY PLAN
R&D Investment Plan
Unique/Non-unique Technologies
DON R&D Assessment
SENATE
ADMIN
HOUSE
• Administration Policy Positions
• Other Gov't Reports
• Key Enabling Legislation
Response by:
• Services
• National Labs
• FFRDC's
• Other Fed Gov't
• State/Local Gov't
• Unions
• Universities
• Industry
DON Resource Investment Strategies
Necessary Actions
DON Candidate DC Partnerships
Industry Drawdown Strategies
Industry Diversification Experience
Defense Industry Commercial Capability

DON R&D ASSESSMENT

- **DON Unique**
  - **Submarine technology**
  - **Underseas weapons technology**
  - **Maritime sensors/signal processing**
  - **Oceanography**
  - **Combatant ship technology**
  - **Amphibious vehicle technology**
- **DON Non-unique**
  - **High performance aircraft**
  - **Sensor/signal processing**
  - **Signature control/management**
  - **Weapons/weapons effects**
  - **Mapping/navigation/geodesy/weather**
  - **Training/mission planning - rehearsal**
  - **Complex system integration**

As part of this Defense Conversion study, it is important to highlight those technologies which are unique to the DON, as well as those that are critical to its war fighting mission but appropriate for shared R&D efforts with other military services (DON non-unique). This chart shows the technologies grouped into these two R&D areas. Clearly, submarine and combatant ship technologies are unique to the DON, while aircraft and air-to-air weapons technologies also have an application in the Air Force.

A more detailed breakout of the technologies which this panel has included under DON unique is listed below:

1. **SUBMARINE TECHNOLOGY**

- **Design and Fabrication**

- **Hull Mechanical and Engineering**
  - Signature Management/Control
  - Nuclear Propulsion/Integration
  - Environmental Systems
  - Crew Survive/Escape/Rescue
  - Propulsors

- **Combat Systems**
  - Information Processing
  - Data Correlation/Fusion
  - Weapon Launch Systems
  - Countermeasure Management Systems
  - Situational Awareness Suite

- Electrical Plant
- Auxiliary Equipment
- Hydrodynamics/Ship Control
- Damage Tolerance

2. UNDERSEAS WEAPONS TECHNOLOGY

- **Torpedoes**
  - Sensors
  - Propulsion
  - Warhead
  - Fuzing
  - Guidance
- **Mines**
  - Sensors
  - Propulsion
  - Warhead
  - Fuze
  - Guidance
  - Mission Planning
- **Mine Countermeasures**
  - Sensors
  - Neutralization
  - Mission Planning
- **Countermeasures**
  - Signature
  - Propulsion
  - Mission Payload
  - Mission Planning
- **Unmanned Underwater Vehicles**
  - Sensors
  - Propulsion
  - Mission Payload
  - Mission Planning
- **Missiles**
  - Containers/ Canisters
  - Mission Planning

3. MARITIME SENSOR TECHNOLOGY

- **SONAR**
  - Transducers
  - Signal Processors
  - Signature Comparitors
- **Synthetic Aperture Radar/Inverse Synthetic Aperture Radar**
  - Transmitters
  - Receivers
  - Signal Processors
  - Signal Comparison
- **Magnetic Anomaly Detection**
  - Transducers
  - Signal Processors
- **Signature Measurement**
  - Acoustic, Passive
  - Magnetic
  - Pressure
  - Acoustic, Cross Section
- **LIDAR**
  - Transducers
  - Signal Processors
- **Radar**
  - Transmitters
  - Receivers
  - Signal Processors
  - Antennae
  - Propagation
- **Electro-optic/Laser**
  - Transmitters
  - Receivers
  - Adaptive Optics
  - Signal Processors
  - Propagation

4. OCEANOGRAPHIC TECHNOLOGY

- **Environmental Measurement**

- **Environment Prediction**

- **Tactical Applications**
  - Prediction/Measurement of Sensor Performance
  - Tactical Routing
  - Ocean Bottom Characterization/Mapping
  - Biological Life Characterization/Mapping

5. COMBATANT SURFACE SHIP TECHNOLOGY

- **Design**

- **Fabrication**

- **Hull Mechanical and Engineering**
  - Propulsion
  - Environmental Systems
  - Electrical Plant
  - Propulsors
  - Signature Control
  - Damage Tolerance

- **Aircraft Interface**
  - Environmental Compatibility
  - Launch and Recovery

- **Combat Systems**
  - Sensors/Signal Processing
  - Information Processing
  - System Integration
  - Weapon Environ. Capability
  - Weapon Launchers
  - Battle Management
  - Signature Management

6. AMPHIBIOUS VEHICLE TECHNOLOGY

(Hovercraft; Planning Hull and Displacement Hull Amphibians)

- **Design**

- **Fabrication**

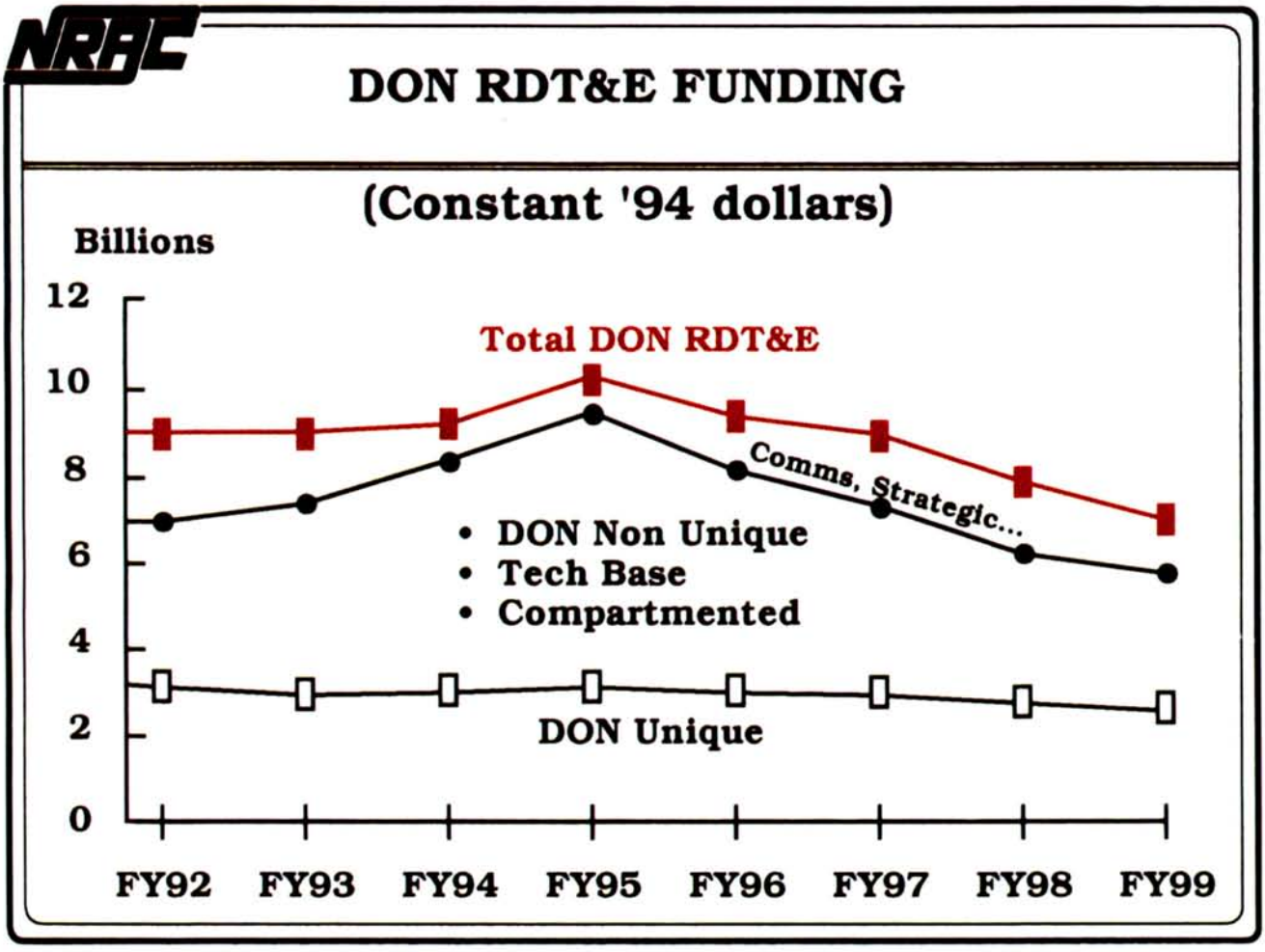
- **Hull Mechanical and Engineering**
  - Propulsion
  - Propulsors
  - Electrical System
  - Environmental System
  - Signature Control
  - Damage Tolerance

- **Combat Systems**
  - Sensors & Signal Processing
  - Information Processing
  - Combat System Integration
  - Signature Management
  - Weapon Compatibility
  - Weapon Launchers

The non-unique technologies, while not uniquely critical to the Navy, are generally unique to DOD, as opposed to being driven by the private sector. For example, while the performance profiles of Navy aircraft may vary in some respects

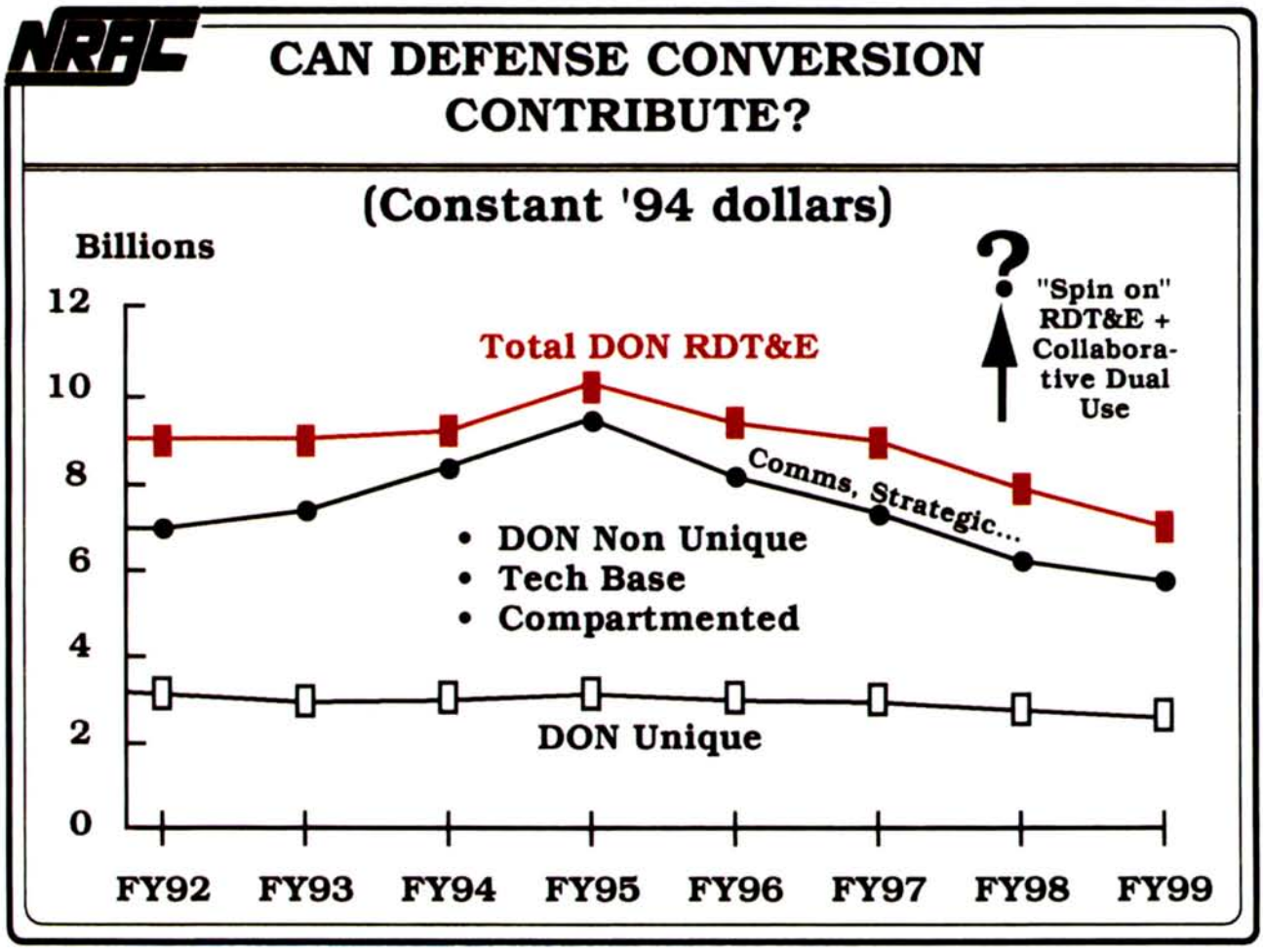
from those of the Air Force, largely due to the demands of carrier aviation, the fundamental technologies involved in high performance aircraft design and fabrication are basically the same. It is still true, however, that maintaining and advancing the "state of the art" in high performance aircraft design and fabrication will not be driven by the private sector without "market pull" from the DOD.

Sensor and signal processing technologies required in performing many DOD missions such as aircraft missile and defense avionics, AEGIS radar, and IR all weather day/night sensors will not be advanced by private sector "market pull." Similarly, signature control/management technologies required for stealth aircraft and other DOD platforms are unique to DOD and would not normally be pursued by the private sector without DOD funding support.



Based on the list of DON unique and non-unique technologies, the DON proposed funding for each category is presented. All of the data used to develop the curves in this chart were obtained from the 1993 President's budget. Due to time constraints and security limitations, the Navy Tech Base and compartmented programs (each funded roughly at a constant $1B level of the budget years shown) were not included in the DON unique totals. The funding peak in 1995 is largely the result of a peak in the budgeted AFX R&D dollars which by this Panel's definition are included in the DON non-unique totals.

As can be seen, the DON unique technologies (as identified in this study) seem to be receiving steady funding support throughout the budget years in spite of the reductions in the total RDT&E account. The issue is with support of and DON non-unique technologies. With the high likelihood of even greater defense budget cuts, the pressure for further reductions in non-unique technology funding support will increase.



The Panel believes that Defense Conversion can contribute to mitigating the impact of a declining RDT&E budget on DON non-unique technologies. Real DON benefits can be realized from "Spin-On" and collaborative dual use technology investment by commercial industry. Both are consistent with the bi-directional definition of Defense Conversion. The arrow and question mark shown on the graph are intended to focus attention on this potential of Defense Conversion to mitigate the budget decline.

"SPIN ON" AND COLLABORATIVE DUAL-USE TECHNOLOGIES

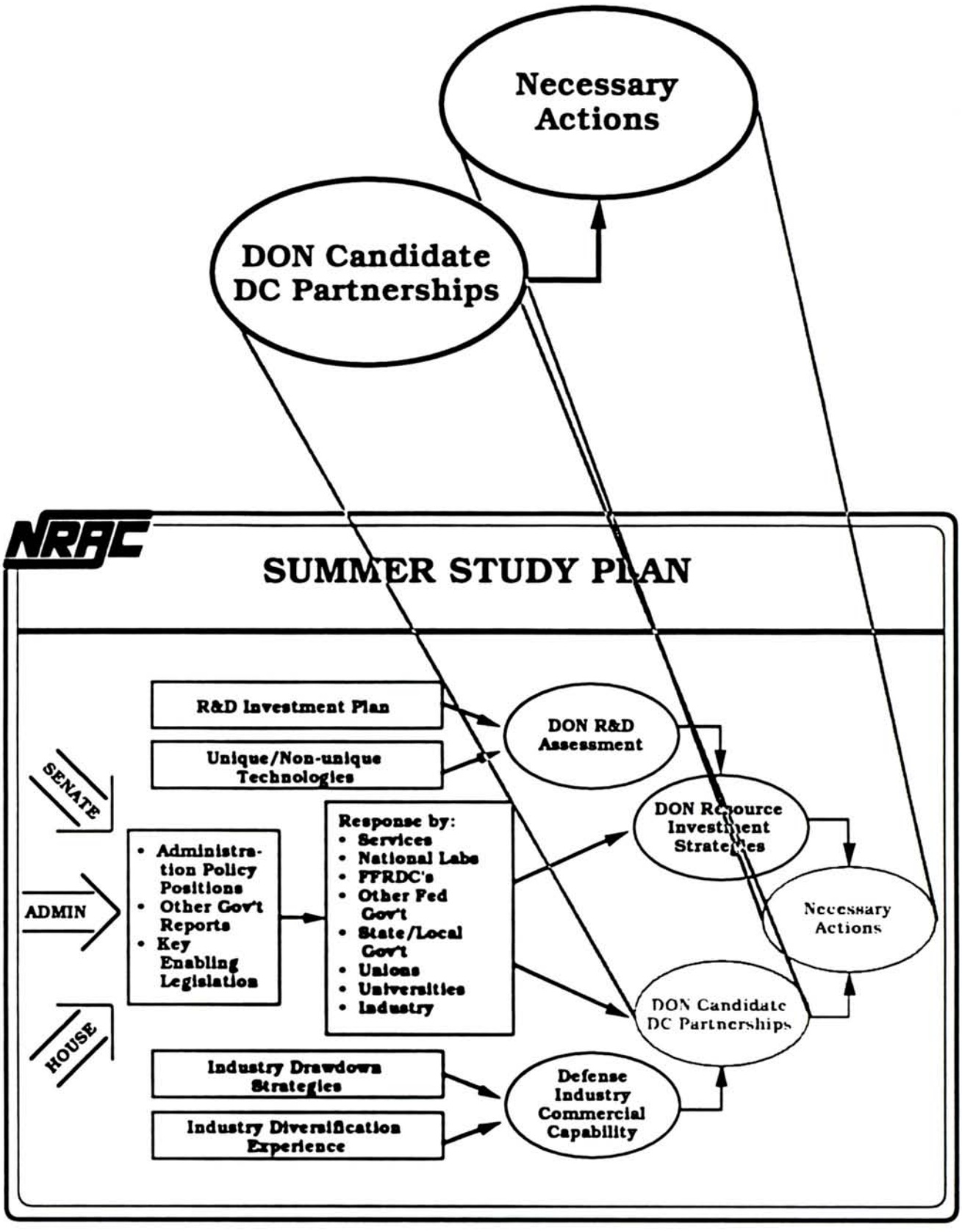
Technologies	Examples
• Commercial aircraft	• 707 TACAMO; KC-10...
• Space systems	
• Communications	• Marine wide area network - in Desert Storm used commercial PCs and software
• Commercial ground vehicle	
• Commercial shipping	• European cellular phones spread spectrum/CDMA
• Materials	
• Fabrication manufacturing	• Iridium - mobile phone to satellite
• Robotics/teleoperations	• TAC-3
• Information processing	• 3D displays
	• MPP - supercomputing

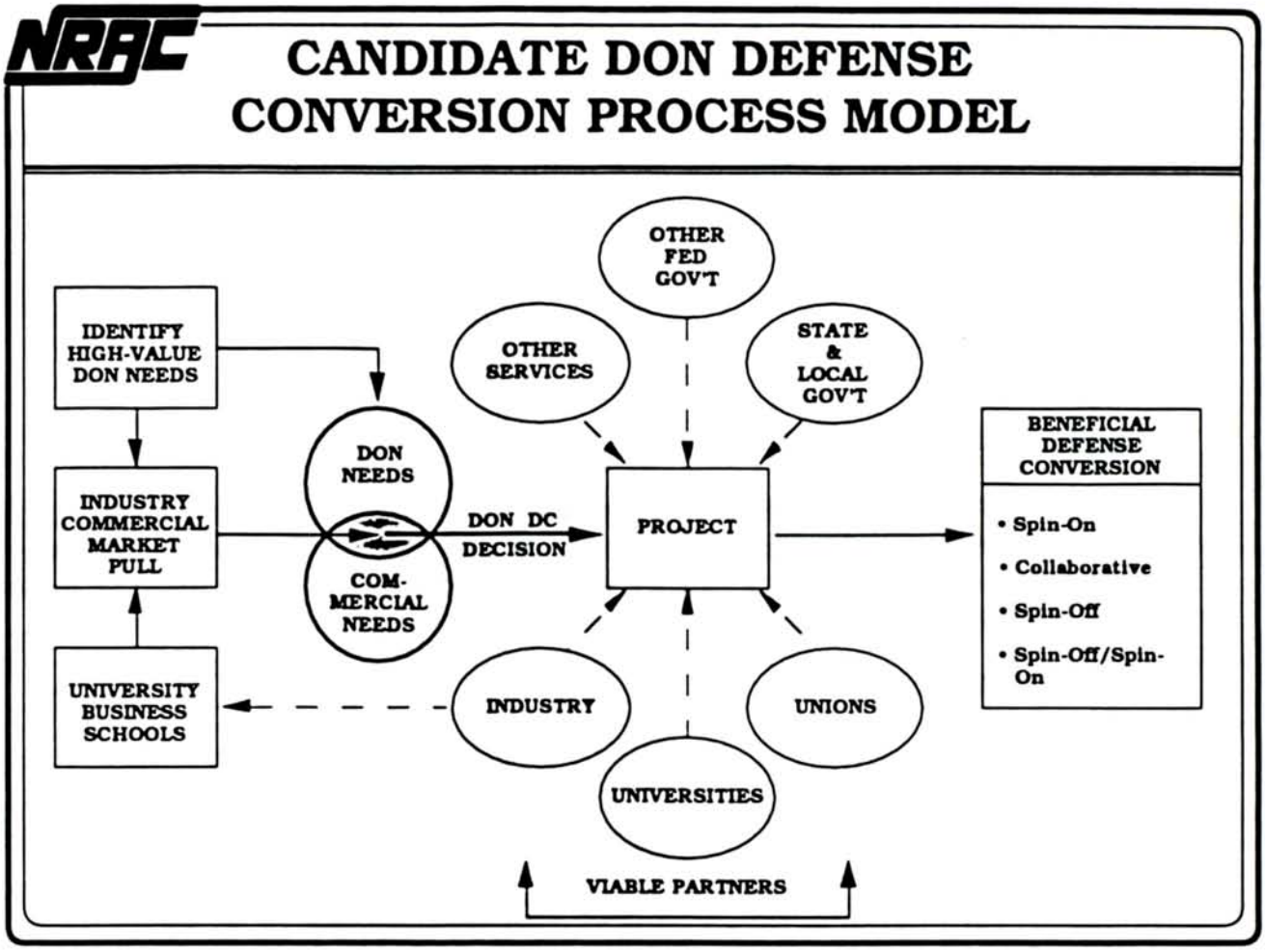
Provides DON Defense Conversion R&D Benefits

In addition to the DON unique and DON non-unique technologies, there are a number of programs which can be grouped under the heading "spin-on and dual use technologies." These are R&D areas where the dominant strengths lie in the commercial sector and where the Navy, in turn, should keep its R&D investments to a minimum. If the Navy develops a solid strategy to implement the use of these commercial technologies, then there could be many opportunities for benefits that effectively "fill in" or counter the loss of RDT&E dollars in the out years of the budget.

Some examples of "spin-on" and dual use technologies are given in this chart. The TAC-3 computer is an example of DON standardization on a state of the art commercial work station as a platform for future command and control applications. The resulting combination of low price and high performance computation and graphics processing exceeded the price/performance ratio of the MILSPEC equivalents by a factor of more than 100. It has also allowed DON to take advantage of further advances with minimal investment. The KC-10 and AWACS are other "spin-on" examples. In still another example, the Marine Wide-area Network (WAN) hardware and software technology employed in Desert Storm used commercial PCs and software.

An example of "spin-off" technology is the Navy's work on conduction cooling for electronic equipment. The Navy has made a sizable investment in this type of cooling for electronic equipment on submarines, where the use of convection cooling fans has been prohibited. This technology has been successfully "spun-off" to the commercial sector whereby an nCube Massively Parallel Processor (MPP) has been repackaged for rugged field use (i.e., oil exploration, resource mapping, etc.) using the packaging technology developed under a CRADA between MicroLithics and the Naval Surface Warfare Center, Crane together with the commercially developed MPP architecture. The repackaged MPP is currently being "spun-on" back into DOD for applications ranging from target acquisition and recognition to general purpose, high performance tactical computing.


Necessary Actions
DON Candidate DC Partnerships
NRAC
SUMMER STUDY PLAN
R&D Investment Plan
Unique/Non-unique Technologies
DON R&D Assessment
SENATE
ADMIN
HOUSE
• Administration Policy Positions
• Other Gov't Reports
• Key Enabling Legislation
Response by:
• Services
• National Labs
• FFRDC's
• Other Fed Gov't
• State/Local Gov't
• Unions
• Universities
• Industry
DON Resource Investment Strategies
Necessary Actions
DON Candidate DC Partnerships
Industry Drawdown Strategies
Industry Diversification Experience
Defense Industry Commercial Capability



The steps necessary for effective Defense Conversion that are beneficial to DON must be addressed for each opportunity. This is essential to maximize the potential for success and avoid wasting resources.

The first step, critical to any R&D investment strategy in a period of declining resources, is the sector-by-sector review of DON needs to identify those of high value to the Navy mission. The next step is to identify which of these high value needs may have a commercial market with the potential for adequate returns to justify commercial sector investment in the necessary RDT&E. This identification of "market pull" is essential to successful dual-use technology development. One avenue to identifying "market pull" is to utilize university business schools which already have strong ties to the commercial sector.

The identification of market pull for a particular DON high value need is essential before proceeding with the establishment of a Defense Conversion project. In order to maximize the impact of DON resources, all funding must be identified for each project. In addition to DON, potential funding sources include other DOD agencies, other Federal government agencies, state and local governments and industry. Similarly, it is important to marshal all resources that can strengthen the

project team. In addition to the funding sources mentioned above, other viable partners include universities and labor unions.

Using this approach, Defense Conversion may have several outcomes in which the DON can participate beneficially, including:

- Spin-on
- Spin-off
- Collaborative Dual-use
- Spin-off (and then) Spin-on

The DON must increase their involvement in "spin-on" opportunities to utilize technologies in the commercial market to meet its needs. These opportunities will replace DON in-house efforts due to budget constraints. Examples of "spin-on" technologies available to DON are:

- Communications
- Commercial aircraft
- Information processing
- Microelectronic components

The DON has technologies today that are in the "spin-off" category, i.e., that could be utilized in the commercial world. The National Shipbuilding Initiative appears to have the elements defined in the "Candidate Defense Conversion Model" and could provide the key technologies to the U.S. commercial shipbuilding industry and revitalize it to become competitive world-wide. MPP super computers utilize DON conduction cooling for electronic equipment which has been "spun-off" to the commercial sector and is currently being used for oil exploration, resource mapping, etc. Other technologies exist within the Navy such as navigation, communication, etc., that also can be "spun-off" to the commercial sector.

"Collaborative" opportunities such as the V-22 aircraft exist and have technologies that are directly related to a new commercial aircraft market. The benefit to the DON will be reduced cost in the future as a commercial market develops which will support the technology base. "Collaborative" efforts for a number of sub-systems that could have DON benefit should be readily identifiable.

Lastly, the DON can benefit from "spin-off" and then "spin-on" technologies. An example of this could be a "spin-off" technology (like 3-D displays) that, if successful in the commercial marketplace, could result in a "spin-on" by DON to meet its future display needs. A small initial DON investment in such a technology early in the R&D cycle, followed by aggressive development for the commercial market, would permit purchase of these products with no further DON R&D investment.

MODEL BENEFITS

- **Provides DON with disciplined Defense Conversion approach**
- **Focuses DON attention on "high value" needs**
- **Addresses "market pull" as key driver**
- **Maximizes DON R&D investment leverage thru partnerships**

Understanding of current partner motivation essential

PARTNER	WILLINGNESS	MOTIVATION
State and Local Gov'ts	High	Local Jobs
Unions	High	Jobs
Universities	Medium	Funding/Technology
Other Federal Gov't Agencies	Medium	Funding/Programs
DOD (Military Services)	Low	Support Mission
Industry	Low	Profit/Market Pull

The candidate Defense Conversion Model benefits the DON by providing a disciplined approach to addressing "high value" needs that satisfy dual-use applications. "Market pull" is the key driver in obtaining industry support and increasing the probability of positive project outcomes.

The direct benefit to the DON is the investment leverage obtained in Defense Conversion projects that are successful and contribute to its mission.

The understanding of partner motivation and the ability to maximize participation in selected projects increases the likelihood of a win-win outcome.

FINDINGS/CONCLUSIONS

1. **Defense Conversion is a "technology push" concept. "Market pull," the key industry driver, is noticeably missing.**
2. **The DON's defense mission and Defense Conversion's job creation mission are not aligned.**
3. **Any direct Defense Conversion benefits to the DON must be created.**
4. **"Spin On" and Collaborative Dual Use Technologies must be included in DON's Defense Conversion strategy.**
5. **Opportunities to develop beneficial Defense Conversion partnerships exist.**
6. **Focused participation in Defense Conversion can produce real DON benefit.**

The Panel converged on six primary study findings. The first finding addresses the underlying philosophy of the Administration's Defense Conversion policy, "technology push." "Technology push" represents the supply side of the supply and demand equation, only. "Market pull," the demand side of the equation, is not considered. The Panel believes that "market pull," the key industry driver, must be considered if Defense Conversion is to be successful. The second finding identifies DON's Defense Conversion dilemma, mission alignment. To more fully embrace Defense Conversion, the DON must satisfactorily address the mission alignment challenge. The third finding is a recognition by the Panel that even if the alignment challenge is met, gaining real benefit from Defense Conversion won't be easy. It will take DON commitment, persistence and imagination. The fourth finding represents what the Panel believes will be the primary sources of Defense Conversion benefit for the DON and is where the DON should place its emphasis. The fifth finding makes the observation that opportunities to establish beneficial partnerships exist. Potential partners vary in desire from the anxious to the reluctant. But given the right circumstances, all would participate. The sixth and final finding states the Panel's belief that focused participation has real value to the extent that it may be essential to a successful DON Defense Conversion thrust.

RECOMMENDATIONS

1. **Focus responsibility for directing all DON Defense Conversion related activities in a "flag rank" position reporting to the ASN(RD&A) with the mandate to derive real benefit from any DON Defense Conversion activity.**

2. **Establish a DON Defense Conversion process model and utilize it to address relevant high value technology needs.**

3. **Develop process to facilitate "spin-on."**

The Panel makes seven specific recommendations, consistent with its findings, for ASN(RD&A) consideration. The first recommendation is to focus responsibility for Defense Conversion in a "flag rank" officer reporting to the ASN(RD&A). This will provide DON Defense Conversion activities with focused leadership from a level with sufficient stature to make success more probable. The "real benefit" mandate provides a clear success metric for the leadership.

The second recommendation is to address high value technology needs through the use of a well defined process model. The application of this process model will provide a degree of discipline and consistency across the DON. A candidate process model was presented in the body of this study report.

The third recommendation recognizes the need for "spin-on" facilitation and recommends development of a process to accomplish it. "Spin-on" is potentially DONs greatest source of real benefit from Defense Conversion and should be pursued vigorously.

RECOMMENDATIONS (cont.)

4. **Actively support ARPA's TRP as a DON Defense Conversion activity.**

5. **Aggressively support acquisition reform and apply as soon as practicable.**

6. **Network with other services, labs and agencies to derive synergistic Defense Conversion benefits.**

The fourth recommendation is to actively support ARPA's TRP. Over 500 million FY 1993 dollars will be spent on TRP. At least that amount will likely be spent annually in subsequent years. Only through participation can the DON have any influence on how that money gets spent.

The fifth recommendation recognizes the need for Defense Conversion partners from industry and addresses their reluctance to participate by recommending active support of acquisition reform. Acquisition reform, if successful, should remove perceived roadblocks, thus encouraging industry participation.

The sixth recommendation is to derive synergistic Defense Conversion benefits through networking with other services, laboratories and agencies. All are under similar budget pressures. All share the need for a solution. All should be more interested, now more than ever, in making networking a success.

RECOMMENDATIONS (cont.)

7. Revise DON R&D investment strategy to:

- **Protect funding for DON-unique technologies**
- **Pay fair share of DOD-unique/DON non-unique technologies**
- **Invest selectively in Collaborative Dual-Use projects**
- **Pursue "spin-on" technologies aggressively.**

The seventh and final recommendation specifically addresses DON R&D investment strategy revision. It divides the strategy into four parts. First, continue to protect funding for DON-unique technologies. Without DON funding these technologies will probably go unfunded. Second, reserve some DON funds to support DOD unique/DON non-unique technologies. DON will be expected to pay their fair share in any joint technology development activity. Third, selective investment in collaborative dual use technology development can leverage industry investment and should be undertaken. Fourth, "spin-on" can provide the DON with technology at almost zero investment. Its the highest leverage source of all. Aggressive pursuit can be extremely beneficial.

APPENDIX A - GLOSSARY OF TERMS

AFX	Advanced Fighter Experimental
ARPA	Advanced Research Projects Agency
ASN(RD&A)	Assistant Secretary of the Navy (Research, Development and Aquisition)
ATP	Advanced Technology Program
COTS	Commercial "off the shelf"
CRADA	Cooperative Research and Development Aggreements
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DON	Department of Navy
FAA	Federal Aviation Administration
FAR	Federal Acquisition Regulations
FFRDCs	Federally Funded Research and Development Centers
FLC	Federal Laboratory Consortium for Technology Transfer
HPWO	High Performance Work Organizations
IAM	International Association of Machinists
ISO	International Standards Organization
MANTECH	Manufacturing Technology
MILSPEC	Military Specifications
MIT	Massachusetts Institute of Technology
MPP	Massively Parallel Processor
NASA	National Aeronautics and Space Administration
NIST	National Institute of Standards and Technology
NRL	Naval Research Laboratory
ORTAs	Offices of Research and Technology Application

OTA	Office of Technology Policy
R&D	Research and Development
RDT&E	Research, Development, Technology and Engineering
SBIR	Small Business Innovative Research
SECDEF	Secretary of Defense
SEMATECH	Semiconductor Manufacturing Technologies
TOR	Terms of Reference
TRP	Technology Reinvestment Project
WAN	Wide Area Network