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83 APR edition may be used until exhausted.
All other editions are obsolete.

INTERIM REPORT OF THE

DEFENSE SCIENCE BOARD

TASK FORCE

ON

DEFENSE LABORATORY

MANAGEMENT

APRIL 1994

OFFICE OF THE UNDER SECRETARY OF DEFENSE
FOR ACQUISITION & TECHNOLOGY
WASHINGTON, D.C. 20301-3140

This report is a product of the Defense Science Board (DSB). The DSB is a Federal Advisory Committee established to provide independent advice to the Secretary of Defense. Statements, opinions, conclusions and recommendations in this report do not necessarily represent the official position of the Department of Defense.

This document is UNCLASSIFIED.

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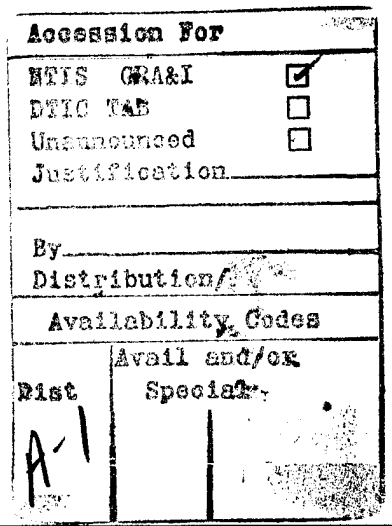

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-3140

DEFENSE SCIENCE
BOARD

MEMORANDUM FOR UNDER SECRETARY OF DEFENSE (ACQUISITION & TECHNOLOGY)

SUBJECT: Interim Report of the Defense Science Board Task Force on Defense Laboratory Management

I am forwarding the interim report of the Defense Science Board Task Force on Defense Laboratory Management. The Task Force, chaired by General Paul F. Gorman, U. S. Army (Retired), was chartered to develop a strategy for restructuring and reducing the size of the defense laboratory infrastructure.

This report provides recommendations to: resize the laboratory infrastructure, pursue outsourcing of some defense laboratory activities, and establish a process for improved OSD oversight of the laboratories. The Task Force developed actions to facilitate these recommendations as well as a set of criteria for judging defense laboratory effectiveness in the future.

The Task Force's interim report is a thoughtful point of departure from which to begin addressing the issue of restructuring the defense laboratory infrastructure.

Paul G. Kaminski
Chairman

From: Defense Science Board Task Force on Laboratory Management APR 1 4 1994

To: Secretary of Defense

Subject: Defense Laboratory Management

USD(AT) tasked us (Enclosure 1) to provide counsel on criteria for improving the quality of Defense laboratories* to modernize them, and to provide a common basis for the Services' BRAC 95 analyses of them. These activities infuse into U.S. forces the technology essential for readiness of the U.S. Combatant Commands. Through Reliance, Defense laboratories have undertaken responsibilities that extend across the Department. For both reasons, these are activities requiring OSD oversight.

The U.S. Combatant Commands are undergoing great change to reflect the fundamental change in the threats they face with the end of the Cold War and the dissolution of the Soviet Union. Forces are shrinking and their missions are evolving. The Defense laboratory system on which the combatant commands must rely for their technological edge has not kept pace. The laboratory system remains an obsolescent artifact of the Cold War.

The laboratory system also has not kept pace with the changing patterns of technology generation. No longer does the Defense Department drive all militarily critical, cutting edge technologies. American industry, universities, and other government agencies play significant roles.

The laboratory system must also develop a strategy for coping with fewer resources. While basic research is not a variable dependent on force size, much of the laboratory work load is directly linked with force size, procurement, and other variables that are being reduced. This will reduce the resources available to the system.

The laboratory system must change and modernize on a variety of fronts to provide the high-quality, cost-effective, agile system we need to tap the best work being done in industry, by entrepreneurs, by universities, in-house or by other government agencies.

Therefore, we recommend that you:

(1) Resize and restructure the defense laboratories to enable them to respond to external changes and better use their resources. It will be necessary to make further reductions in

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* A term we understand as PBS Program 6 funded activities ranging from science and technology, through engineering development, to technological support of deployed materiel and its modernization. Each service organizes differently for such functions, but the term embraces the Army's laboratories, research institutes, and research, development and engineering centers; Navy laboratories, research institutes and centers, and warfare centers; and Air Force laboratories, and engineering and technical support activities.

the current laboratory structure to free resources, to recruit the highest quality personnel and to seek aggressively defense-relevant technology and technology support from the civil sector. The cuts directed by DPG 95-99, amounting to little more than 4% per annum, scarcely accommodate normal attrition, and foreclose enhancing personnel quality. As a necessary precondition to real progress in modernizing the laboratory system, we believe an additional 20% cut in defense laboratory Civil Service personnel is necessary. These cuts can be achieved through closures and realignments that have the additional effect of shifting work from in-house to productive areas in the civil sector; funds conserved through personnel reductions should remain with the Services to underwrite this modernization and outreach. As civil sector experiences have repeatedly demonstrated, these cuts will also have the effect of speeding other improvements by forcing reassessment of missions and structure.

(2) In line with the recommendation above, pursue a vigorous program of outsourcing of defense laboratory activities. This will help ensure that the laboratory system is serving as an effective agent for the combatant commands in providing the best available technology for U.S. forces. In this regard, laboratory directors should be made to justify decisions to conduct work in-house vice outsourcing.

(3) Establish continuing, long term managerial oversight by DDR&E. Improvements in Defense laboratories must be reviewed systematically and recurrently. We recommend a three-tier biennial or triennial scrutiny of each Defense laboratory as follows:

a) An Outside Technical Review by private experts.
b) A Customers' Review through a DDR&E survey.
c) A Management Review by OSD.

(4) Initiate the actions listed in Enclosure 2. These actions are intended to aid the Service Secretaries in modernizing their laboratories.

(5) Issue the criteria for judging modernization set forth in Enclosure 3 to the several services and agencies for their guidance in responding to BRAC 95, and in undertaking initiatives conducive to more efficient utilization of their Program 6 funds.

Gen Paul F. Gorman, USA (Ret)
Chairman

Adm Lee Baggett, Jr, USN (Ret)

Dr. Malcolm R. Currie

Dr. Robert Fossch

Dr. Donald A. Hicks

Maj Gen Jasper A. Welch, Jr., USAF (Ret)

THE UNDER SECRETARY OF DEFENSE

WASHINGTON, DC 20301-3000

ACQUISITION

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MEMORANDUM FOR CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Terms of Reference--Defense Science Board Task Force on Defense Laboratory Management

You are requested to form a Defense Science Board Task Force on defense laboratory management. The Task Force should develop a strategy for restructuring and substantially reducing the size of the defense laboratory infrastructure while simultaneously maintaining its generic capabilities and improving product quality.

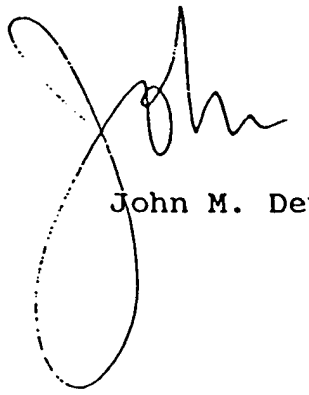
In this effort, the Task Force should consider all defense laboratories which perform work ranging from basic research, through technology development and acquisition support, to in-service engineering and maintenance support (essentially all DoD efforts funded under Category 6). This includes all DoD and Service owned, operated, or officially sponsored properties. There have been many studies about laboratory restructuring, modernization, and quality improvement. The Task Force should consider the findings and recommendations of these studies when developing its own independent restructuring strategy.

As part of its strategy, the Task Force should develop criteria by which the defense laboratories' effectiveness should be judged in the future. The Task Force should consider the following guiding factors as a basis when developing success criteria:

- Laboratories must continue to provide the full spectrum of complementary Category 6 activities;
- Laboratories should improve their responsiveness to war-time operational needs;
- The quality of all laboratory staff, and their work products, should improve;
- Products must be cost-effective and responsive to the CINC's warfighting requirements and defense priorities;
- OSD agencies and the Services should create and sustain long-term interdependence compacts;
- DoD in-house capabilities should be balanced against those available from industry, academia, other agencies, and our allies; and

- Laboratories must be sensibly reconfigured and consolidated, and remain effective during restructuring.

The Task Force will be sponsored by the Director, Defense Research and Engineering. The Task Force will be chaired by General Paul F. Gorman, USA (Ret). The Office of the Director, Defense Research and Engineering will provide the necessary funding and support contractor arrangements. The Deputy Director, Defense Research and Engineering for Laboratory Management will be the Task Force Executive Secretary. Commander Robert C. Hardee, USN will be the Defense Science Board Secretariat representative. It is anticipated that this Task Force will not need to go into any "particular matters" within the meaning of Section 208 of Title 18, U.S. Code, nor will it cause any member to be placed in the position of acting as a procurement official.



John M. Deutch

Actions to Facilitate Laboratory Modernization

1. **Improve Management** . DDR&E currently lacks both an information base and control mechanisms to assure the Secretary of Defense or Congress that the armed services manage and maintain their labs to maintain the readiness of the U.S. Combatant Commands, or to support the inter-service RELIANCE process. Neither can DDR&E assess adequately service POMs and MILCON requests for laboratory modernization, nor evaluate measures to broaden dependence on the civil industrial base. Therefore, OSD must issue the following four directives:

a. Extend GPRA. Each Defense laboratory, including each Federally Funded Research and Development Center (FFRDC), DoD-supported University Laboratory, and any other DoD agency involved in RDT&E, shall promptly comply with the provisions of the Government Performance and Results Act (GPRA) with respect to drawing up strategy, plans, criteria for performance assessment, revised personnel policies, and other measures to enhance quality. Annually thereafter, each organization shall measure its performance against plan, using a wide range of assessment techniques.

b. Maintain Open MIS. Each Defense laboratory, including each Federally Funded Research and Development Center (FFRDC), DoD-supported University Laboratory, and any other DoD agency involved in RDT&E, shall maintain current an automated Management Information System (MIS) that shall be accessible to OSD and to qualified users within any other laboratory. That MIS shall proceed from the BRAC 95 data-call to provide authoritative information about laboratory organization, including statistics on personnel, capabilities, facilities, funding, workload, projects, and such other categories as may from time to time be specified by the DDR&E. **When implemented to the satisfaction of the DDR&E, the annual data call for the annual In-House RDT&E activities Report shall be canceled.**

c. Transmit Enclosure 3 to the Secretaries of the military departments, and to the presidents and directors of FFRDC and non-Service defense RDT&E activities, informing them that these criteria must form the basis for GPRA plans and reviews, and that these will be used by the DDR&E to assess for the Secretary of Defense actions they may take on modernizing their laboratories.

d. Broaden Outreach. DDR&E shall present to the Secretary of Defense and the Under Secretary for Acquisition and Technology an annual report on "outreach" as defined Enclosure 3, commencing at the end of Fiscal Year 1994.

2. **Improve Quality**. Consistent with the foregoing, issue directives as follows:

a. Scientific & Professional (ST) positions. DDR&E shall expeditiously review the qualifications of ST appointees. DDR&E shall employ ST's within a "Defense Senior Scientists Council", that through DoD-level seminars. informs them of significant DoD concerns and issues, tasks them to contribute to formulation of S&T policy, exposes them to eminent S&T leaders, offers them opportunities to interact with eminent academicians or scientists in their field, and elicits their cooperation in cross-lab and cross-service exchanges.

b. National Research Council. The DDR&E shall recommend representatives from the labs for participation on NRC Boards, Committees, and Panels.

c. External Audit of Performance. In addition to the GPRA assessment prescribed in para 1a above, the DDR&E shall provide to the Acquisition Executive of each military Department, and to the Under Secretary of Defense for Acquisition & Technology, results from an external review process that provides information on progress toward improved quality of personnel, and on allocation of workload to outsourcing. That process shall encompass three perspectives, accompanied in each instance by appropriate recommendations:

(1) OSD Management Review. As often as useful, DDR&E shall compare the metrics provided by the MIS against each laboratory or agency's GPRA plans and reports. Where the latter involve other organizations (e.g., facilities sharing, contractual strategies), DDR&E should conduct selected evaluations.

(2) Technical Review. DDR&E shall officially appoint a Lab Technical Peer Review Group composed of eminent and knowledgeable representatives from industry, academia, and other agencies as well as the services and DSB. Members should serve once-renewable five year terms. The group shall designate small task teams from their membership as a Visiting Committee to each significant laboratory or agency at least once every two or three years. Task teams would provide the DDR&E with an assessment of the technical excellence of the lab's program, the quality and use of its facilities, its internal professional quality and growth, and the cogency and quality of its outreach programs.

(3) Customer Review. Concurrent with the Technical Review, DDR&E shall survey the customers of the laboratory/agency: Program Managers, U.S. Combatant Commanders, other commanders and agencies to whom the lab provides support, and its industrial and academic partners, regarding product relevance and effective outreach.

d. LDP/LQI: DDR&E shall re-charter the Laboratory Demonstration Program as the Laboratory Quality Initiative Program to follow closely undertakings to provide appropriate regulatory relief, and to implement the initiatives of the National and Defense Performance Reviews throughout the Defense laboratory system.

3. **Improve Outreach.**

a. RELIANCE. DDR&E shall reevaluate the Reliance process and its associated expenses and workload, and present a recommendation to the Under Secretary of Defense for Acquisition & Technology concerning its future. DDR&E shall consider assuming responsibility for the program through the Joint Directors of Laboratories, and expanding its scope to include ARPA, the Federally Funded Research and Development Centers (FFRDC), DoD-supported University Laboratories, and any other DoD agencies involved in RDT&E.

b. CINCs. DDR&E shall coordinate with the Vice Chairman of the JCS, and work with him to improve communications between the Defense labs and the U.S. Combatant commands, and to enhance the responsiveness of the labs to the CINCs' requirements. USACOM is designated a pilot for these undertakings.

c. Industrial Fora. DDR&E shall convene a continuing series of science and technology meetings that expose academia and industry — especially firms that have not been defense suppliers in the past — to defense thinking on needs and applications, to acquisition reform, and to open Defense labs, and encourage them to offer greater access to their facilities, capabilities and procedures to Defense laboratories. These fora can also be used as opportunities to identify new technologies and scientific research, to expand interpersonal contacts, to conduct training and recruiting, to discuss mechanisms and procedures for increased interaction, to explore common concerns, and to develop ideas for model contract relationships.

d. Technology Plan. OSD shall prepare a biennial DoD Technology Plan addressing the 21 key technology areas, and identifying for each area the distribution of effort between DoD and outside activities.

e. Facility Review. Each military department shall provide the DDR&E, not later than end FY1994, a laboratory facility status review. This shall include a site-by-site description of MILCON underway, planned, and completed in the past five years; a lab-by-lab assessment of backlog of maintenance and repair; and an assessment of the adequacy of existing facilities and major equipment.

f. National Reviews. DDR&E shall participate actively in such interagency efforts as the National Facilities Review, and the potential Office of Science and Technology Policy study of DoD/DoE/NASA laboratories with a view to identifying for the Department of Defense additional opportunities for outsourcing.

CRITERIA

FOR

LABORATORY MODERNIZATION

A DoD laboratory should be judged by its **quality, outreach,** and **size**. **Quality** encompasses the contribution of a laboratory to the readiness of U.S. forces by orchestration of extramural and in-house resources to deliver capabilities and systems to U.S. Combatant Commands as well as the technical aspects of a particular laboratory's in-house work, its personnel, and its facilities and equipment. **Outreach** entails intellectual and contractual interactions with other scientific and engineering organizations, such as other labs, universities, and industrial enterprises, and with users of the laboratory's products. **Size** refers to authorized end strength and funding, and the facilities supported thereby.

1. QUALITY

a. Mission. The Government Performance and Results Act (GPRA) of 1993 requires each laboratory to prepare a strategic plan. That plan must describe the strengths and deficiencies, and the intended use of personnel and facilities in conjunction with outside resources (other labs, industry, universities) to bring the total national and allied capacity to bear on each of its assigned disciplines, capabilities, or systems. The laboratory's mission must be clearly stated, and should be well known to all its personnel and understood by its "customers," the end-users of its services. Laboratories should aim at finding science and technology to aid the U.S. Combatant Commands and the armed services in the performance of their missions; since the latter will procure fewer new weapon systems, laboratories will be increasingly challenged to insert advanced technology into existing platforms. For science and technology (S&T), a lab's mission must focus on a limited number of closely related key disciplines, for each of which it has a specified critical mass of funds and people. For acquisition and modernization of fielded systems (A&M), a lab's mission must explicitly seek system improvements from technologies and concepts beyond the lab's own competencies. The statement of mission should be complemented by a vision statement that explains how the lab views itself in relation to its tasks, customers, and peers.

b. Products. The products of a laboratory's S&T and A&M activities, achieved through a combination of in-house work and outsourcing must be world-class in quality, cost effective, and delivered in time to be responsive to the needs of the CINCs and Chiefs of Service. Each laboratory director must be able to trace his lab's activities from identifying its customer's requirements to performance of its products in service with U.S. Combatant Commands.

c. Leadership. Lab directors and their senior deputies, whether civilian or military, must have the competence and sufficient continuity to develop, implement, and exploit significant improvements in their lab's operations. They must be students of modern management techniques, focused on quality. Their personal leadership attainments must suit their lab's mission: S&T demands academic skills and reputation, as well as the ability to direct inspired researchers; A&M

requires greater strength in operations, management, and business. Whether for missions related to S&T or to A&M, senior personnel must recruit and develop subordinates deserving of respect both within the Department of Defense and nationally. Most scientists and engineers (S&E's) should have advanced degrees — as a goal, at least 80% for S&T functions , 60% for A&M. The permanent S&E staff should be enthusiastic, innovative, merit-oriented, and mobile. Directors must aim at an annual turnover of at least 10% via retirement, transfer, and culling of low performers. A laboratory director's core responsibility includes the following:

(1) Making available the best technology to all U.S. Combatant Commands (regardless of service).

(2) Do this in the most effective, efficient manner.

(3) Assist acquisition, logistic and other system support organizations in the execution of their missions.

To that end a laboratory director must, in order of preference: First, import into DoD proven technology, products, and processes from domestic sources or allies abroad. Second, collaborate with other services and agencies within DoD to assure his service access to advanced technology. Third, contract for development of needed technology, products or processes. Fourth, carry out development of the latter within his own activity.

d. Functional Balance. While labs function best when their mission and identity are clear and tightly focused, selective participation in the full spectrum of weapon system life cycle activities helps overcome intellectual isolation and increase motivation. S&T more closely supports a U.S. Combatant Command when the laboratory itself is directly involved in fielding and operating some system or providing technical services; and A&M benefits from the stimulation and intellectual relationships associated with fundamental research in a niche important to its product lines. The goal must be balance, not purity.

e. Facilities and Equipment. State of the art working spaces maintained in first class condition are essential for quality work, and are indicative of a lab's pride. Service labs must meet all environmental, safety, health and similar standards for the work in which they are involved. Facilities should be added only when the capability they would provide is (1)unavailable elsewhere, (2) critical to the lab's mission, and (3) designed to meet the needs of multiple users. **Before building new laboratory facilities, or investing significant funds in modernizing old facilities, laboratory directors should rigorously inquire into the availability of buildings or equipment excess to the needs of defense industry for purchase or lease, possibly at depreciated value.** Facility maintenance and repair plans should be included in strategy and annual performance documents. If a service or lab can not afford to maintain a facility in the condition required for top quality RDT&E, that facility should be closed and its work assigned to another lab within DoD or outsourced.

f. Information Infrastructure. Labs must have a modern information infrastructure which provides for e-mail, teleconferencing, distributed interactive simulation, virtual prototyping, distributed fabrication, and wide band local area connectivity as well as DREN/HPC/DSI access for

all who can use them. Full use of such an infrastructure must be integral to both managerial and technical aspects of a lab's work ethic.

g. Support Functions. Lab management should have reasonable control over essential support functions, and must know their costs. Support functions range from those that are intrinsically government, such as procurement, to those which can and often should be contracted; and labs operate under a wide range of accounting procedures and host/tenant relationships. While each lab has unique needs and arrangements, the essential point is that each laboratory director must be held accountable for the full performance of his organization, manage to minimize total costs, and be able to describe and to compare total actual costs to the taxpayer irrespective of how services are obtained.

h. Personnel Systems. Personnel systems must reward performance, encourage quality, and facilitate merit-based turnover at all levels. Services and their laboratories must take full advantage of National Performance Review/Defense Performance Review reforms and flexibilities, and of augmenting procedures wherever possible, including requirements for quality management and merit-based retention, pay, and promotion, both for their own organization and in technical and support contracts. ST billets should be used as a quality building tool; personnel in such billets should have national reputations, concentrate on technical work, be assured adequate staff, facility and funding support to maintain an effective research program, and be involved in mentoring and educational efforts.

i. Independent Research. A lab should invest 5-10% of available funds in processes, equipment, people and projects it deems most important to its mission. Since Independent Laboratory In-house Research (ILIR) funding rarely approaches this proportion, labs must urge customers to support ILIR projects, or contract for such research. The lab's priorities for unfettered investigation should be explicit in its plans.

2. OUTREACH

a. Intra-mural vs. Extra-mural Research. In realms of science or technology where the long term needs of the Department of Defense are unlikely to be met by ongoing research in the civil sector, DoD laboratories should foster requisite intramural inquiry and experimentation. However, in fields where the Department of Defense is recognizably a follower of science or technology being thrust forward by other governmental departments, by academia, or by industry, they should ensure that the Department of Defense remains reliably informed of that progress, and able to access what it needs.

b. Outsourcing. For the present and the foreseeable future, laboratory functions other than science and technology should be regarded as compressible: forces are being reduced in size, procurement has been severely constrained, and readiness and mobilization are arguably better served by a basically commercial infrastructure. Moreover, the Cold War past has encumbered Defense laboratories with such dysfunctional undertakings as development and enforcement of detailed specifications, support for obsolete materiel, and utilization of outmoded technology.

We estimate that in any of the military departments, the overall ratio of funds for laboratories spent intra-mural to extra-mural (funds for grants and contracts to academia, industry, and labs of other agencies) should be 20/80 for S&T (6.1-6.3) and 30/70 for A&M (6.4-6.7) activities. In-house expenditures should be restricted to work that is inherently governmental, that compensates for industrial under -investment, that provides non-procurable support to approved facilities, and that provides performance, cost and schedule assessments to departmental Acquisition Executives and their PEOs/PMs. Functions and funding retained in-house at any specific laboratory depend upon the nature of assigned disciplines and product areas, facilities and property, multi-service or agency commitments, contractual requirements, directions from a program manager or fund sponsor, and support arrangements. Each director's GPRA strategy and performance documents must explicitly describe assigned responsibilities and requirements; set rationale and goals for, and specify the type, nature, magnitude and funding source of support contracts and arrangements (managerial, operational and technical). For each assigned S&T and A&M undertaking, plans must describe in-house/outsourcing strategy (with rationale based on the ability and interest of outside activities), together with assignments of responsibility and funding, and provisions to measure performance. Laboratory directors must justify all decisions to conduct work in-house vice outsourcing, and demonstrate an aggressive program for seeking defense-relevant technology support from the civil sector. Contracting strategies and measures must include leveraging quality in personnel and facilities.

c. Acquisition Reform. The DoD can not, and need not, pursue in its laboratories science and technology for their own sakes, but it must be clear with Congress and the American people that those laboratories continue to play a vital role in deciding what materiel is needed for national defense. Defense laboratories, in the interests of making the services smart buyers of technology, can aid in fulfilling the vision of the Packard Commission:

> *A better job of determining requirements and estimating costs ... at the outset of weapon development. More money and better engineering invested at the front end will get more reliable and better performing weapons into the field more quickly and cheaply ... All too often requirements for new weapon systems have been overstated. This has led to overstated specifications, which has led to higher cost ... A high priority should be given to building and testing systems and subsystems before proceeding with full scale development. This early phase of R&D should employ extensive informal competition and use streamlined procurement processes. It should demonstrate that the new technology under test can substantially improve military capability, and should as well provide a basis for making realistic cost estimates...*

The most compelling argument for outreach by DoD laboratories is that it offers a way to foreshorten development cycles, both in the interests of conserving public funds, and of increasing national preparedness.

d. Professional Interactions. Labs, particularly for S&T functions, must maximize opportunities for collaborative interaction of government staff with their counterparts in other labs (e.g. NASA, DOE, DoC), industry, and academia. In addition to extensive use of their information infrastructure to integrate their activities with outside organizations, labs should encourage their

staff to participate actively in professional societies, trade groups, and scientific and technical fora in their specialties, and should sponsor open houses, technology fairs, and similar opportunities for technical interchange with outside organizations. Labs should have formal, widely advertised programs to encourage IPA's, post-doctoral investigators, interns, visitors, etc., both to and from the lab. Such programs should include provisions in contracts and agreements for personnel exchanges and use of both partners' facilities by mixed teams. Since the government can often maintain facilities far beyond the capacity of other organizations, labs should maximize the opportunities for collaborative or mutually supportive access. Innovative programs to stimulate tacit intellectual exchange through an open environment are particularly important in the face of hiring and grade restrictions.

e. Intellectual Openness. Laboratory directors must continuously and aggressively search for technological, intellectual, and operational solutions outside the confines of their lab's mission and technical competence. One component of this search must be close ties to the CINCs and their forces, and to Service training, operational simulation, and doctrinal organizations, for the purpose of insuring that each lab understands operational needs in addition to the formally stated requirements for which they are funded. Scientists and Engineers (S&Es) should spend a minimum of 2 weeks per year in the field, in operational training or simulations, or on staff work at departmental level; lab directors should offer S&E's on temporary duty to CINCs, JCS staff, and the Office of DDR&E. A second component of the search for openness must be emphasis upon open architectures for software, virtual prototyping, interactive simulation, concurrent practices, and similar design principles and techniques to provide for maximum flexibility in weapon system development and upgrade. A third must be close ties to other S&T centers throughout the federal laboratory system to insure maximum access to alternate approaches.

f. Cooperative Agreements and Executive Service Relationships. Each laboratory director must seek through the Reliance process, and through direct open interchange, either to divest or to accept disciplinary and functional responsibilities in support of joint and multi-service developments. Lab directors must establish goals and measures to integrate multiple service and agency personnel in relevant programs, and to assign the lab's own personnel to other labs and organizations.

g. Management Information. Lab directors shall maintain an open Management Information System (MIS) that contains information, prescribed by OSD for consistency, describing their organization, personnel, capabilities, facilities, funding, workload, projects, etc. The initial format for that MIS will be that for the BRAC 95 data-call. The intent is a MIS continuously accessible through each lab's information infrastructure to stimulate and to encourage interaction among all Defense laboratories in support of Reliance and other forms of outreach, and to enable bench marking across the Department.

h. Education. Virtually all lab staff must be involved in education and mentoring throughout their careers, both within the lab and with outside organizations. In addition to training required under the Defense Workforce Improvement Act, labs should offer incentives for participation in technical skill improvement programs and formal education. Staff should be encouraged to teach, either through lab programs or at local schools and universities. Recruiting

programs must stress internships and post-doctoral scholarships, offered directly, or through NRC or other nonprofit organizations. Labs should also should employ their information infrastructure and other facilities, on a "not to interfere" basis, in educational outreach. The exposure to new minds and ideas, and the discipline involved in identifying and training new staff, are essential to excellence.

i. Technology Transfer. Each laboratory director's plans must include an analysis of the dual use potential and market applicability of their major disciplines and products. Labs should have a formal program to exploit all available mechanisms for S&T "spin-out, spin-in, and spin-up" in appropriate areas. Such mechanisms include CRADAs, grants and cooperative agreements, collaborative proposals to funding agencies, TRP partnerships, Federal Defense Laboratory Diversification Program awards, contractual provisions for joint research and development, and facility sharing, as well as the personnel interactions essential to the transfer of tacit technology. To make such programs effective, Defense labs must earn the trust and respect of university and industrial partners; labs are a sponsor and collaborator, and should neither be, nor be seen, as a competitor. Labs also must promote the transfer to industry of their codified technology through patents, copyrights and licenses.

j. Development Partnerships. Technology transfer initiatives are oriented principally to S&T, and encourage dissemination of pre-competitive information while preserving intellectual property rights. A&M interactions with industry are of necessity more arms-length, but nevertheless must involve mutual respect and proper functional relationships. National initiatives to integrate the defense and civilian industrial bases, acquisition reform, and the shift of RDT&E funding from new systems to in-service engineering, mandate that labs focus on top level (A) specifications and performance, and upon cost and schedule trades, to advise program offices on uncertainties to be accommodated in contracts. Labs therefore must emphasize analytical, simulation, and test and evaluation skills, and contribute to the development of industrial standards. Industry should develop detailed (B) specifications, as well as hardware and software.

k. Federated Laboratories and Model Contracts. To integrate military and civilian industrial bases argues for new relationships that avoid the inefficiencies of the sequential Defense approach to technology development and transfer, and encourage early involvement of industry's technical, business, and production skills. Where long-term relationships are important (as opposed to the single-product orientation of TRP, CRADAs, and most development contracts), a lab should consider (in lieu of developing or maintaining an in-house capability) extended (5-10 year) contractual arrangements with industry or university labs that provide for direct Defense lab employee-participation at the contractor's site, and for payment for the Defense lab's thus taking advantage of the contractor's facilities and technology, IR&D, merit-oriented personnel management, and shared rights. The intent is to form distributed, or federated, public-private teams that together "spin-up" new technology and product/system/capability ideas, rather than *a-posteriori* transfer (spin-in or out) from one sector to the other.

3. SIZE

a. Capability. A laboratory director should not accept responsibility for a discipline or function unless his laboratory's funding, its personnel authorizations, and its facilities are adequate for quality performance. If a service or lab is unable with internal resources to master a discipline or function, these should be reassigned or outsourced. A laboratory's strategy must describe what it believes to be the essential requirements for its assigned missions, and establish performance measures to demonstrate that it can achieve its objectives.

b. Shared Resources. The objectives of Reliance and BRAC cross-servicing analyses are to eliminate excess and redundant infrastructure, to make most efficient use of public funds. Each laboratory director must regard his lab's facilities as a resource for use by multiple services, and by industrial and university partners. Facilities not thus shared, unless demonstrably fully utilized, a unique national asset, and essential to a single-service discipline or function for which the lab has been assigned the lead, should be closed. Lab directors must discuss and justify their facilities in comparison to the national inventory, and provide measures for shared use in their performance plans.

c. Overall Lab Inventory. Defense labs have been significantly reorganized, but remain in the aggregate at roughly the same size they had been at the mid-80's cold war peak. Workload is expected to decline further due to dramatic (60%) reductions in procurement, significant (30%) reductions in overall force structure, cancellation and elimination of many previously planned weapon systems, acquisition reform, quality and productivity improvements, and significant shifts to modernization of current inventory — with an emphasis upon insertion of information technologies, in which industry leads. Lab inventory requirement is further influenced by FY94 PBD 755 infrastructure reductions, the directed additional 4% per year reduction in RDT&E manpower commencing in FY95, and the outsourcing and sharing criteria outlined above. Other major considerations include the age and condition of lab facilities, the extensive backlog of maintenance and repair, reflecting differing patterns of investment by the military departments in MILCON and equipment for RDT&E. Significant differences exist among labs and among Services, but the facilities of DoD labs overall are not being maintained to the quality required to support first class in-house RDT&E. Overall, all such activities should be required to reduce Civil Service personnel 20% beyond the reductions called for in DPG 95-99, via closures and realignments that shift workload outside the Department of Defense, to enable services to operate and to maintain plant for the long run at required quality levels.

d. Geographic Dispersion. Co-location without an information infrastructure, and without deliberate efforts at outreach, is dysfunctional. So are small, geographically separated, insular elements of a laboratory. To the degree that a laboratory's being spread among several sites serves the objectives of infusing into DoD exogenous technology, and is compensated for by modern information infrastructure, dispersion is an advantage; to the degree it leads to fragmented effort, it is disadvantageous and ought to be eliminated through closures or consolidations.