

# Executive Summary

## Science and Technology (S&T)

### Community In Crisis

This study was conducted under the leadership of the Naval Research Advisory Committee (NRAC) with participation by the Army Science Board and the Air Force Scientific Advisory Board. Panel membership is shown in Appendix A. The study was requested by the Director, Defense Research and Engineering (DDR&E), and was motivated by concerns over the continuing difficulties the Department of Defense (DoD) laboratories<sup>[1]</sup> are experiencing in recruiting and retaining world-class scientists and engineers (S&Es). The problem has been worsened by reduced personnel recruitment in the 1990s, which has resulted in a significant increase in the average age of the technical workforce at these organizations. In addition, most of these laboratories now have significantly fewer S&Es under 30 years of age, thereby creating a worrisome demographic gap in their staffs. The growing number of retirements that are expected in the coming decade will further exacerbate this problem to the level of a crisis.

The DoD laboratories and centers have been the subject of many earlier studies, some dating back to the 1950s and 60s. In recognition of this, the study Terms of Reference (TOR) did not call for an entirely new study of the issues. Rather, the TOR tasked the NRAC Panel with reviewing the conclusions of the most important past studies and identifying what actions should be taken to ensure the excellence of these laboratories. After reviewing the results of past studies, the Panel agreed that this subject area has been exhaustively investigated by a long series of blue-ribbon panels and that most of their findings were still valid. The complete TOR is attached as Appendix B.

During the course of the study, the Panel was briefed by a variety of experts in the field of S&E recruitment, reward, and retention, as well as laboratory directors from academia, industry, other government, and Federally Funded Research and Development Centers (FFRDCs). In accordance with the TOR, the Panel considered at some length what the mission of the laboratories should be in the 21st Century, given their status today and the likely future threat environment.

### Findings

Based on its analysis, the Panel formulated a series of findings and associated recommendations summarized as follows:

#### **Role of the DoD laboratories in the future: essential and critical**

- Most of industry invests little in basic research.
- At the same time, the diversity and number of future threats is increasing, ranging from sophisticated "Axis of Evil" countries to independent terrorist cells; from intercontinental ballistic missiles to chemical and biological agents.

- Industry will pursue high-profit major weapons systems -- but the laboratories are crucial to address high-risk, low-volume Science and Technology (S&T) projects, like those that developed the atomic clocks that enabled the development of the Global Positioning System, the explosive chemistry that resulted in the thermobaric bomb, and countless others.
- It is crucial that the focus on defense-unique technologies be continued: the ability to see inside buildings and caves; remotely detect and identify threats; neutralize mines and chemical and biological agents.
- Also, as the technological sophistication of defense systems continues to increase, so too does the requirement for in-house technical experts who can advise acquisition program managers (PMs) on technical feasibility, affordability, etc. of proposed solutions.

### **The characteristics of a world-class laboratory: the highest quality scientists and engineers**

- Highest quality staff -- smart, creative, challenged, dedicated S&Es
- Strong leadership
- Adequate facilities and equipment
- Good support services responsive to laboratory needs

### **Past studies of the laboratories: mostly well done, but few of their recommendations implemented**

More than 100 studies of the laboratories have been conducted over the past 30 years. They generally endorsed the requirement for world-class in-house laboratories, and made remarkably consistent recommendations for reforms:

- The laboratories are an essential component of the war-fighting machine of the United States (U.S.).
- Unless they receive help soon (at the Service, Office of the Secretary of Defense (OSD), and congressional levels), they will no longer be able to recruit and retain the high quality, dedicated scientists and engineers required to perform the research necessary to preserve our military's technological superiority.

**Regrettably, the fate of recommendations from past studies has been uniformly consistent in that little effective action has been taken to implement them.** Although several ambitious "demonstration" programs were established, they encountered significant organizational resistance that hindered reform. Consequently, the negative consequences of inaction predicted by past studies are now beginning to appear at most laboratories.

Given this record, several recent Defense Science Board (DSB) studies made the *a priori* assumption that the Federal "system" can't be reformed and, therefore, recommended staffing the laboratories with contingent personnel [e.g. limited-term appointments or academics brought in under the Intergovernmental Personnel Act (IPA)], or converting

the laboratories to alternative governance systems, such as Government-Owned, Contractor-Operated (GOCO) activities. While these remain options that could be considered, the Panel felt that there are others that could really solve most of the problems identified. The Panel considers it imperative that the DoD and Service leadership recognize the unique requirements confronting the laboratories, and implement real reforms to address them.

**Legislative initiatives: Congress recognizes the problems and has tried to help**

Congress has repeatedly given DoD the tools to fix many of the problems confronting the laboratories! Without a sustained, high-level, commitment in OSD and the Services to see that these tools are used aggressively, most have languished unused or underutilized.

**Strategy: Immediate action and sustained commitment from OSD and Service leadership is required, both now and in the future**

OSD must take measures to make maximum use of the Section 1114 of the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2001 authorities granted by Congress, and also develop/propose additional legislation to resolve other problems not addressed by Section 1114, and do both as quickly as possible. Specific actions to be taken have been adequately documented in the past and are summarized in the body of this report. Again, Congress has already provided many of the necessary authorities to begin the job.

**Responsibility: Inaction would be irresponsible**

The time has come to listen to the conclusions of the many distinguished people who have served on past studies of the laboratories, and to implement the actions they have recommended to remove the burdens of an unresponsive bureaucratic system from one of the most important components of US military superiority. What is needed now is a sustained commitment to fix the problem.

**Recommendations**

**Recommendation 1: The Panel recommends that the Director, Defense Research and Engineering obtain the commitment of the Secretary of Defense and the Service Secretaries to the need for, and the importance and value of, the Service Corporate Research Laboratories by their demonstrating continuing support for the implementation of Recommendations #2 and #3 listed below.**

Leadership commitment at the highest possible levels is essential to preserve the critically needed S&E staffs in the DoD research laboratories. In carrying out its work, the Panel focused on the three Service corporate laboratories: Air Force Research Laboratory (AFRL), Army Research Laboratory (ARL), and the Naval Research Laboratory (NRL), because they are the primary source of discovery and invention for their respective Services. Without new breakthroughs in science and engineering, there will be no

advances in such critical defense areas as sensors, weapons, and propulsion. There are no commercial or industrial requirements to locate mines or submarines or to see into mountain caves -- so industry will not invest in such high-risk, low-profit areas for commercial purposes. Nor are universities likely to fill this gap because of reluctance to undertake classified work, and/or make necessary investments in equipment and facilities, etc. The important role of the DoD laboratories must be recognized and endorsed by the senior leadership of the DoD and Services -- **to do otherwise is to guarantee future failure.**

**Recommendation 2: The Panel recommends that the Secretary of Defense fully utilize the authority granted him by Section 1114 of the National Defense Authorization Act (NDAA) of Fiscal Year 2001, and any other authorities granted by Congress, to establish a separate personnel system for the scientists and engineers in the Services' corporate laboratories.**

Congress has recognized the criticality of this issue and, in FY 01 NDAA Sec 1114, provided the Secretary of Defense (SECDEF) with the Office of Personnel Management's authorities for personnel demos in the DoD laboratories. OSD and the Services must take action to use what has already been given to them -- or the Office of Personnel Management (OPM) will (as they are trying to do) get this authority rescinded. This is an opportunity that must be acted upon now. It is an immediately available stopgap measure.

**Recommendation 3: The Panel recommends that the Director, Defense Research and Engineering develop and propose to Congress additional legislation that would enable the Services to experiment with alternative governance structures that would address additional laboratory issues such as salary caps, facility and equipment renewal, and laboratory director authority.**

OSD and the Services should immediately take action to develop and propose additional legislation to comprehensively address the issues confronting the laboratories -- salary caps, burdensome procedures, inability to renew facilities and equipment, lack of laboratory director authority, and poor support services.

---

[1] The focus of this report is on the laboratories and technical centers owned and operated by the Department of Defense and staffed with Federal Government employees. These are sometimes called "in-house" laboratories or centers to distinguish them from other DoD-funded technical activities such as Federally Funded Research and Development Centers.