Defense Horizons
Number 44
A publication of the
Center for Technology and National Security Policy
National Defense University
JULY 2004

Defense Laboratories and Military Capability: Headed for a BRACdown?

Michael L. Marshall

Overview

For 150 years, military laboratories have made vital contributions to national defense. In recent years, they have been significantly reduced in number by several rounds of base realignment and closure (BRAC). Even so, they remain the primary source of internal technical competence within the Department of Defense (DOD). Their capability in that role will depend on how DOD answers two questions. Is there excess laboratory capacity—too many laboratories relative to forecasts of future force structure? What is their military value—their likely contribution to the future operational needs of warfighters.

As required by law, DOD has publicly announced the criteria it will use in making BRAC 2005 decisions. None directly acknowledge the military value of research and development (R&D). Consequently, excess capacity and military value judgments about the labs will depend on metrics now being formulated and the subjective weights they are assigned in computations. This calculus will place greater weight on options that allow DOD to combine separate but similar functions, such as R&D, on single bases. This emphasis on jointness could lead to such recommendations as a single defense research laboratory or to approaches that would parse the current technical work of the labs into a number of bins and then assign responsibility for each to a single service. Experience suggests that reliance on overly-simplified "closure-by-arithmetic" decisions could lead to serious mistakes in deciding which laboratories to close and which to keep. America's ability to wage high-tech warfare depends on avoiding such mistakes.

An Illustrious History

There is a great deal in the news today about the impending round of base closures by the Department of Defense (DOD). Most of the coverage focuses on large military bases and major industrial facilities, such as shipyards and aircraft repair depots, and the economic impact of their closure on local and state economies. Lost in the debate is any meaningful discussion of what may become of military labs and test centers. These are the places that help develop and field weapons and other systems needed to ensure the continued superiority of our military forces. These labs and centers have a long and distinguished record of achievement. For example, their pioneering work in radar gave us that invaluable tool in time for widespread use in World War II. More recently, they invented and helped develop the Global Positioning System that enables the precision bombing so heavily relied on in Afghanistan and Iraq. Even today, their contributions are helping us win the global war on terrorism.

The utility of science and technology as a multiplier of military force was popularized by Thomas Edison as early as 1917, and demonstrated time and again during the Second World War, when academic and industrial laboratories across the country joined with those operated by the military to support what became the first truly technological conflict. The success of this partnership led to increasing reliance on federally-funded research and development (R&D) in the post-War period, and the strategy of technologically-based deterrence continued to gain importance as the Soviet Union exploded its first fission device (1949) and hydrogen bomb (1953) and launched SPUTNIK (1957). Indeed, maintaining a technological edge over the Soviet Union became a Cold War imperative for the United States.

Historically, the Navy was the first service to understand the importance of science and technology in the conduct of war, a point made in a recent article by Jim Colvard, a prominent former Navy lab director.[1] More importantly, Colvard points out that the Navy was the first Service to recognize "…that the nature of scientists and 'big science' requires institutional environments to foster creativity and support formulation of ideas and discovery." Accordingly, early on it began to create these environments by establishing a community of engineering centers, test stations, proving grounds, weapons labs, and similar facilities. In the ensuing years, the other services followed the Navy's lead.

How Much R & D is Enough?

There have been four previous BRAC rounds: 1988, 1991, 1993, and 1995. Collectively, they resulted in the elimination of nearly 100 major bases, including numerous labs and test centers. Many other bases were realigned.[2] Even so, the Department continues to argue that many more bases should be closed to eliminate what it calls "excess capacity" and free up billions of dollars for other uses, from new weapons systems to higher pay for the military.

In an April 1998 report to Congress, the Department claimed that, despite the four previous rounds of BRAC, it still has nearly 25 percent excess base capacity overall.[3] The Department has relied heavily on this report to argue to Congress that it needs closure authority to eliminate this excess capacity and achieve other strategic and financial goals. Some Pentagon insiders have indicated this could mean the closure of at least 100 and perhaps as many as 150 of the nation's 425 bases.

The April 1998 BRAC report to Congress also contained detailed estimates of excess lab and test center capacity by service as follows: Army (39-62 percent), Navy (18 percent), and Air Force (24-38 percent). These estimates were recently updated in a second report required by Congress as part of the 2005 BRAC process.[4] Utilizing the same methodology for computing excess capacity, this report contained the following estimates: Army (62 percent), Navy (18 percent), and Air Force (18 percent).

The April 1998 report has been reviewed by others, including the United States General Accounting Office (GAO) and the Congressional Budget Office (CBO).[5] Both pointed out shortcomings in the analysis underpinning DOD estimates of savings from prior BRAC rounds and remaining excess capacity. The GAO noted that the analysis provided only a "rough measure of excess capacity," and did not report capacity "as a percentage of the total capacity by types of installations, such as the total capacity in all depots." The CBO found the DOD approach to estimating excess capacity was reasonable and would, at least in the aggregate, yield a credible estimate but worried that "it may not provide good estimates for particular categories of installations."

The concept of excess capacity is easy to understand. Fewer aircraft need fewer runways and hangars. Fewer ships need fewer piers. The difficulty comes in quantifying just how many runways or piers may be needed in 20 years, the time frame of BRAC 2005.

For the estimates in the April 1998 report, DOD defined a metric or family of metrics for each base category. Each metric was a ratio that expressed an indicator of capacity (maneuver base acres, facility square feet, etc.) with a relevant measure of force structure (maneuver brigades, personnel spaces assigned, etc.) in 1989, the year selected as a baseline. For some installation categories, the use of multiple metrics led to differing estimates of excess capacity, hence the use of a range, as in the case of labs and test centers.

Next, the department estimated future capacity needs by multiplying the 1989 metric value by an estimate of force structure needed in 2003. In essence, the product is the amount of capacity required for the future force structure, keeping constant the ratio of capacity to force structure that existed in 1989. Subtracting this estimate of capacity requirements from the amount of capacity following the completion of all BRAC 1995 realignments and closures yielded an estimate of excess capacity.

This approach seems reasonable if there is a linear relationship between force size and the infrastructure, such as piers and runways, needed to support it, and as long as estimates of future force structure needs are sound.

Estimating how many labs or test centers will be needed to support some level of future force structure is much more problematical. The DOD, in its report to Congress, used square feet as the metric by which to quantify the excess capacity of Army and Air Force labs and test centers, while the Navy used workload measured in work-years (one scientist or engineer working full-time on a project for one year equals one work-year).

A recent National Defense University publication discusses the dangers of using simple calculations in making decisions about the closure or realignment of military labs and test centers.[6] After pointing out that there is no direct relationship between force size and lab and test center infrastructure (buildings, roads, utilities, etc.), the author, who was a member of the Navy's BRAC 1995 analytical team, goes on to discuss three further difficulties with "closure by arithmetic."

> First, it unrealistically treated scientists and engineers as interchangeable, conveyable, replicable items—such as hospital beds and hangar space—regardless of their position, education, and professional accomplishment. Literally unable to distinguish between a technician and a Nobel laureate, the computer model moved scientists and engineers from one laboratory to another, much the way guests are assigned to hotel rooms.
>
> Second, the surrogate metric counted only in-house work-years, which means contractor work-years were excluded. This was not an oversight. Contractor numbers are notoriously hard to verify. With the high stakes of a BRAC, this raises the risk of fraud or, almost as bad, of rumors of fraud. Nevertheless, contractors perform about half of Navy research, development, test and evaluation (RDT&E), and a great many of them work at the laboratories and use their infrastructure. Therefore, the metric provided an incomplete picture and yielded inaccurate conclusions. Using the above hotel analogy, this is like counting only guests who occupy even-numbered rooms.
>
> Third, laboratories considered for closure were chosen by coupling the surrogate metric with military value, a metric heavily weighted in favor of sites with test ranges. Test ranges are critical assets, some irreplaceable—but so are laboratories performing high levels of basic and applied research, the work that creates tomorrow's warfighting capabilities, and the weights militated against them.

The author argued that these difficulties combined to yield what would have been a grave mistake: "The process led to considering closure of the Indian Head Laboratory, an East coast site, to move its workload to a West coast site with a test range. Since most scien-

Michael L. Marshall is an assistant to the Director of the Applied Research Laboratory at Pennsylvania State University. He is currently supporting the Office of Naval Research and the Naval Research Laboratory on an Intergovernmental Personnel Act assignment. He may be reached at (202) 767-2880.

tists and engineers do not relocate with the work, closing it would have devastated a center of critical expertise. That would have cost lives. Only Indian Head had the ability to develop the thermobaric warhead, sparing U.S. troops the bloody prospect of tunnel-to-tunnel combat in Afghanistan.

What is the Future Worth of R&D Capability?

The concept of military value is critical in deciding which bases to close or realign. As in past rounds, BRAC 2005 will give priority consideration to keeping those bases considered to have the highest military value to the force of the future. Indeed, the legislation drawn up by Congress to authorize the next round mandates that military value will have primary consideration among the selection criteria.

As is the case with excess capacity, the concept of military value seems simple enough. In essence, it "represents the ability of the installation to contribute to DOD future mission capabilities and operational readiness," according to Philip Grone, principal assistant deputy undersecretary of defense for installations and environment.[7] The real question is how do you measure the future worth of labs and test centers? How many and what kinds will we need in 20 years? In this regard, it should be noted that our record of predicting technologies and their impact is dismal.

As required by law, the department has tried to define military value by drawing up a set of criteria for closing and realigning military bases within the continental United States. They contain a number of considerations that must be weighed. In December 2003, the department published these criteria in the *Federal Register*.[8] Despite receiving more than 200 letters from Congress and community leaders during the public comment period, the department's final criteria published in February were identical to the original.[9] They are as follows:

- current and future mission capabilities and the impact on operational readiness of the total military force, including joint warfighting, training, and readiness.

- availability and condition of land, facilities, and associated airspace (including training areas suitable for maneuver by ground, naval, or air forces throughout diverse climate, terrain, and staging areas for the use of the Armed Forces in homeland defense missions) at existing and potential receiving locations.

- ability to accommodate contingency, mobilization, and future total force requirements at existing and potential receiving locations to support operations and training.

- The cost of operations and the manpower implications

Many of those who offered comments on the criteria argued that such considerations are so broad they could justify any DOD decision on which bases to close. Senators Mike DeWine and George Voinovich of Ohio voiced concern that the criteria did not acknowledge the military value of such functions as R&D.[10]

The DOD addressed these public comments in a February 12, 2003, Federal Register announcement of the final criteria, including those directed at concerns about how labs and test center would be treated in military value rankings. Here, the department noted simply:

> DOD highly values its research, development, test and evaluation, engineering, procurement, and technical facilities. Research, development, engineering, procurement and other technical capabilities are elements of military value captured within criteria one through four. The Department will consider military value in a way that incorporates these elements.

In fact, the details of how DOD will rank labs and test centers in terms of military value are up to one of seven DOD joint cross-service groups or JCSGs composed of representatives from each service and the Office of the Secretary of Defense (OSD). Each group is assigned to study a functional area in which the services might jointly share work. These groups are intelligence, industrial, technical, medical, education, headquarters and support activities, and supply and storage.[11] The technical JCSG is charged with developing a detailed set of metrics for ranking the military value of the labs and test centers.

In carrying out its work, the technical JCSG receives top-level guidance from the Secretary of Defense and the two groups he has established to oversee the BRAC process.[12] The Infrastructure Executive Council (IEC) will provide policy and oversight. Chaired by the Deputy Secretary of Defense, its membership includes the service secretaries and chiefs of staffs of each service, the chairman of the Joint Chiefs of Staff, and the Undersecretary of Defense for Acquisition, Technology, and Logistics, (USD (AT&L)). The Infrastructure Steering Group (ISG) will manage the efforts of the seven JCSGs. It is headed by the USD (AT&L), and includes the vice chairman of the Joint Chiefs, the assistant service secretaries for installations and environment, and others.

From various comments in the press, it is clear that Secretary Rumsfeld plans to run BRAC 2005 as a top-down process, unlike his predecessors who mostly accepted closure recommendations developed by the services and forwarded them to the BRAC Commission. Indeed, the Secretary plans to use this BRAC to accomplish one of his top goals: transforming the way the DOD fights wars, buys weapons, and manages its personnel. Simply put, his plan is to use this round of BRAC to totally overhaul how the department bases and houses military forces. The idea is to create joint bases that will allow the services to combine separate but similar functions—precisely the kinds being studied by the seven JCSGs. The emphasis on this approach was recently underscored by Philip Grone, who noted that "enormously significant emphasis" will be placed on jointness in developing closure and realignment recommendations. Interestingly, Grone downplayed the importance of excess capacity as a driver for BRAC 2005 recommendations, commenting, "We are not talking about a capacity-reduction exercise—that's how we implemented BRAC in the past." [13]

Effect on Labs and Test Centers

From the foregoing, several points emerge. First, excess capacity within the laboratory and test center infrastructure will be a consideration, but not the significant driver of closure decisions it was in the previous four BRAC rounds. To the contrary, in this round a base with large excess capacity may be at an advantage inasmuch as it could facilitate consolidation of joint functions at that site. Second, the definition of military value, focused as it is on mission capability and operational readiness of the forces, is hard to apply to labs and centers. Moreover, the recently published criteria seem of little help in assigning an objectively-based military value to labs and test centers. The real decision on military value will flow from the metrics being devised by the technical JCSG and the weights they will be accorded in the BRAC analysis process. Third, the real emphasis in BRAC 2005 will be on achieving closures and realignments that will support the Secretary's goal of military transformation through creation of joint bases and functions, including such technical functions as RDT&E.

The notion of jointness as applied to military RDT&E is not new. For example, as a result of the Defense Management Review undertaken in February 1989 at the direction of the President, the DOD comptroller issued several budget decisions aimed at savings in the 1990 and later budgets. In October 1989, Defense Management Review Decision 922 proposed a significant savings in the budget over the years 1991-1995 by consolidating the service labs and test centers to reduce overhead, streamline operations, and centralize professional staff associated with specific technology areas.[14]

Because of the enormity of the issues implicated in the comptroller recommendation of a consolidated RDT&E infrastructure, then Deputy Secretary of Defense Donald J. Atwood held off implementing the comptroller-recommended actions until they could be studied in detail. Teams were established to carry out the studies and report back with an implementation plan by May 1, 1990. They were directed to focus on inter-service consolidations rather than the intra-service consolidation already underway.

Although the recommendation eventually was withdrawn, it served to generate significant discussion on ways to strengthen inter-service cooperation in the DOD science and technology planning process. One of the approaches considered, called Project Reliance, examined opportunities to consolidate and collocate service efforts at single-site locations in selected technology areas. It also led to the joint planning process in use today in DOD science and technology programs.

Another effort to foster jointness in the RDT&E infrastructure was based on presidential direction and a provision in the National Defense Authorization Act for Fiscal Year 1996. The goal was the development of a plan for DOD laboratories and test centers for the 21st century. This plan, called *Vision 21*, was developed but never implemented, as it was subsumed into the Department's failed effort to win congressional approval for a much broader BRAC round. [15]

The only serious BRAC effort to develop joint, cross-service plans for the labs and test centers occurred as part of the 1995 round. This effort was chaired by Dr. Anita Jones, then Director, Defense Research and Engineering (DDR&E). It produced a number of so-called laboratory alternatives for the services to consider for inclusion in their individual BRAC 1995 efforts.[16] In the end, the services resisted incorporation of these joint, cross-service plans in their recommendations, with the result that only intra-service consolidations of the labs and test centers emerged from BRAC 95.

Given the overwhelming emphasis on jointness in BRAC 2005, and the fact that the crucial metrics that will determine the ranking of military value for the labs and test centers are being devised by a JCSG focused on RDT&E as a common support function, cross-service consolidation options are all but certain to predominate. But what might they be?

Some idea of the range of options that could be considered may be found in study recommendations and other pronouncements by past and current BRAC players. Consider, for example, the recommendations of a 2001 Defense Science Board (DSB) Summer Study on Defense science and technology.[17] The DSB is a federal advisory panel whose members, drawn from the private sector, are selected by the USD(AT&L). Their job is to provide high-level scientific and technical advice to the Secretary of Defense, the Chairman of the Joint Chiefs of Staff, and other senior members of the Department.

The 2001 DSB study was co-chaired by Dr. Anita Jones, who oversaw the BRAC 1995 laboratory JCSG effort. It makes several recommendations with regard to the DOD labs and test centers including the following:

- Administratively transfer personnel not involved in science and technology to acquisition organizations
- Move to university management those [labs] doing significant in-house research or technology development
- Privatize, consolidate, or close the others.

These recommendations could be carried out in any number of ways, such as by privatizing the services' corporate research labs or putting major universities in charge of their management. The Lawrence Livermore and Los Alamos National Laboratories, for example, are managed for the Department of Energy by the University of California.

Another idea has been advanced by Michael Wynne, who has been nominated to the position of USD (AT&L).[18] While his Senate confirmation is pending, Mr. Wynne is acting in that position, which makes him a member of the Secretary's BRAC IEC as well as the chairman of the ISG. In an October 29, 2002, memorandum, Mr. Wynne recommended a commission to:

- Identify those labs that are imperative for defense to retain
- Propose the organization of a defense research lab (DRL) combining the remnants of the service laboratories
- Recommend, for those lab functions not deemed critical, appropriate academic or commercial outsourcing candidates.

The notion of depending on the private sector to perform more DOD RDT&E has gained acceptance in recent years. For example, Raymond DuBois, who as Deputy Undersecretary of Defense for Installations and Environment is the DOD point man for BRAC, says that the technical experts have not reviewed how the services manage their various research efforts and how that work could be com-

bined across the services or with non-military research organizations and industry efforts. "We have arguably the greatest research institutions in the world in this country—the universities, the corporations and think tanks," DuBois says. "To what extent does the military truly take advantage of that?" [19]

While it is true that much of the nation's R&D is performed in the private sector, a substantial portion is federally funded, especially in basic research. The President's Council of Advisors on Science and Technology made this point in a recent report: "While strong support of R&D by private industry is to be commended, this source of funding cycles with business patterns and focuses on short term results by emphasizing development of existing technology rather than establishing new frontiers."[20] That patterns of R&D spending do indeed cycle with economic conditions is confirmed by a January 2004 study of R&D funding by Battelle, which found that industrial R&D spending (in constant 1996 U.S. dollars) has declined for three years (2001-2003).[21]

Each service has a corporate research laboratory that focuses primarily on science and technology. These include the Army Research Laboratory, headquartered in Adelphi, Maryland; the Naval Research Laboratory, headquartered in Washington, D.C.; and the Air Force Research Laboratory, headquartered in Dayton, Ohio. The Wynne suggestion would seem to encourage the idea of a single research lab, belonging to OSD. Presumably, the DRL could be operated within the current government-owned-government-operated framework or be converted to some alternative form of governance, such as a government-owned-contractor-operated entity, a federally-funded R&D center, or some form of government-owned corporation. A number of these alternative governance models are discussed in detail in a recent paper by the National Defense University's Center for Technology and National Security Policy, which recommends a government-owned corporation model based on a public university analogy.[22] Creation of such a model would, however, require congressional action.

A more recent study also recommends, as one option, the creation of a DRL.[23] Chartered by the Secretary of Defense in March 2003, this effort—formally named the Joint Defense Capabilities Study—examined how the DOD could be reorganized to enable it to field a more effective, joint force. The study, chaired by Pete Aldridge, former USD(AT&L), offers a range of alternative management structures for more effective and efficient end-to-end planning and execution of the Department's RDT&E investment. Alternatives discussed include a coordinated investment approach, centralized funding and centers of excellence, and a central DOD lab system (DRL).

The BRAC 2005 technical JCSG could also opt for a *Project Reliance* approach in its lab and test center closure and consolidation recommendations. Simply put, it could recommend parsing the technical work currently done by the service labs and centers into a number of bins and then assigning responsibility for each execution to a service. For purposes of illustration, the group could recommend collocating all DOD in-house nanoscience work at the Army Research Lab, materials research at the Air Force Research Lab, and so on. Such an approach overlooks numerous difficulties, including the fact that not all technical work fits neatly into such bins. Moreover, many of the scientific breakthroughs today come from interdisciplinary and multidisciplinary research—nanoscience being a good example. Research benefits from the collocation of multiple disciplines at the same geographic location. A *Project Reliance* approach could undercut work in frontier areas of cross-disciplinary research.

A further problem with the *Project Reliance* approach is that it assumes you can move highly educated scientists and engineers around like so many pieces on a chess board. As noted in the discussion of "closure by arithmetic," it is unrealistic to treat them this way, regardless of their position, education, and professional accomplishment. Indeed, although the data vary from place to place, it appears that only about 25 percent of scientists and engineers relocated after the last BRAC round, and many of those who did relocate subsequently left the government.[24] This roughly parallels experience in the private sector, where more than 35 percent of employees who were relocated left the company within three years. These losses could be further exacerbated by the fact that a significant portion of the DOD scientific and engineering workforce is at or nearing retirement age. An even higher percentage of them may retire rather than relocate as part of a BRAC 2005 realignment action. Given current national trends, there may not be enough new graduates to replace them, because few young Americans are pursuing science and engineering degrees today, and United States citizenship is a prerequisite for employment for nearly all technical positions in the military labs and test centers. Unlike the case with industry, the extent to which DOD can turn to an off-shore solution to satisfy its future technical needs is unclear.

Conclusion

Since the end of World War II, the military labs and test centers have been important to the internal technical competence of the DOD. Historically, they provided this competence by performing three roles: performer of long-term, high-risk projects, quick responder in times of crisis, and yardstick for external work.

As DOD moves to further outsource its technical work, this need for a yardstick to assess whether that work is technically competent will be even more important. Ironically, increased outsourcing will make it more difficult for the military labs and test centers to perform their yardstick role, because to do so they must first be knowledgeable performers of hands-on technical work themselves. Therefore, the question of how to retain internal technical competence should be of serious concern to BRAC decisionmakers.

Since the end of the Cold War, the military labs and test centers have undergone nearly 15 years of personnel and infrastructure cuts as DOD management focus shifted from strengthening them to making them less expensive to operate. In the years since BRAC 1995, most management cost-cutting at the labs and centers have focused on actions that could be implemented without congressional authority, mostly personnel reductions. Some of these labs and centers have seen overall civilian staff reductions of 40 percent or more since the end of the Cold War, and further reductions are budgeted.

In examining the April 1998 BRAC report to Congress, the GAO found that personnel reductions accounted for more than 80 percent of BRAC savings. With the Pentagon claiming it will achieve savings from BRAC 2005 as great as in all four previous rounds combined, the

burden of cuts will fall heavily on civilian personnel at the labs and test centers once again.

With industry cutting back on R&D investment, especially in basic research and areas with little or no commercial payoff, can the private sector be depended upon to fund and perform the technical work needed to transform warfighting capability away from Cold War legacy systems and toward the high-tech solutions needed to combat terrorism? This is a debate that deserves a long and thoughtful discussion, but time is running out . In a matter of months, the Department will begin to refine its plans for the remaining military labs, and the die will be cast.

Notes

[1]James E. Colvard, "Closing the Sailor," U.S. Naval Institute *Proceedings*, June 2002.

[2] These actions are detailed in Appendix G of the report: "Vision 21: The Plan for 21st Century Laboratories and Test and Evaluation Centers of the Department of Defense: Report to the President and Congress." Accessed at http://www.dtic.mil/labman/vision21/appg.html.

[3] "The Report of the Department of Defense on Base Realignment and Closure," April 1998. Accessed at http://www.defenselink.mil/brac/docs/98dodbrac.pdf.

[4] "Report Required by Section 2912 of the Defense Base Closure and Realignment Act of 1990, as amended through the National Defense Authorization Act for Fiscal Year 2003," March 2004. Accessed at http://www.defenselink.mil/brac/docs/04_0_body032403.pdf.

[5] "Military Bases: Review of DOD's 1998 Report on Base Realignment and Closure," GAO/NSIAD-00-17, November 1998; "Review of The Report of the Department of Defense on Base Realignment and Closure," Congressional Budget Office, July 1998.

[6] Don J. DeYoung, "The Silence of the Labs," *Defense Horizons* 21,(Washington, DC: National Defense University Press, January 2003). Accessed at http://www.ndu.edu/inss/press/nduphp.html

[7] "BRAC Criteria Focus on "Military Value," American Forces Information Service News Articles, February 28, 2004. Accessed at http://www.defenselink.mil/news/Feb2004/n02282004_200402281.html.

[8] *Federal Register*, Vol. 68, No. 246, December 23, 2003.

[9] *Federal Register*, Vol. 69, No. 29, February 12, 2004.

[10] "Senators ask Pentagon to use criteria in deciding bases' fate," Associated Press, Wednesday, January 28, 2004.

[11] George Cahlink, "Pentagon sees base closings as critical to larger strategy," *GovExec*.com, January 30, 2004. Accessed at http://www.govexec.com/dailyfed/0104/013004g1.htm.

[12] Statement of H.T. Johnson, Assistant Secretary of the Navy for Installations and Environment before the Subcommittee on Military Construction of the House Appropriations Committee on BRAC 2005 Selection Process, February 12, 2004. Accessed at http://www.chinfo.navy.mil/navpalib/testimony/facilities/johnson040212.txt.

[13] George Cahlink, "Pentagon sees base closings as critical to larger strategy," *GovExec*.com, January 30, 2004. Accessed at http://www.govexec.com/dailyfed/0104/013004g1.htm.

[14] Rodney P. Carlisle, "Navy RDT&E Planning in an Age of Transition: A Survey Guide to Contemporary Literature," Navy Laboratory/Center Coordinating Group, Naval Historical Center, 1997.

[15] "Vision 21, The Plan for 21st Century Laboratories and Test and Evaluation Centers of the Department of Defense: Report to the President and Congress." Accessed at http://www.dtic.mil/labman/vision21/index.html.

[16] See, for example, Director, Defense Research and Engineering Memorandum of November 29, 1994. Subject: Additional BRAC 95 Laboratory Alternatives for Military Department Consideration (#4). Accessed at http://www.dtic.mil/labman/projects/brac/appendixg.html.

[17] The Defense Science Board *2001 Summer Study on Defense Science and Technology* (Washington, DC: Department of Defense, May 2002). Accessed at http://www.acq.osd.mil/dsb/sandt.pdf.

[18] Rowan Scarborough, "Lab-closings defense memo seen as breaking Bush pact," *The Washington Times*, November 15, 2002, A3.

[19] George Cahlink, "Erasing Bases," *GovExec*.com, October 17, 2003. Accessed at http://www.govexec.com/features/1003/1003s2.htm.

[20] Letter of October 16, 2002 from G. Wayne Clough, Chair, PCAST Panel on Federal Investment in Science and Technology and Its National Benefits to the Honorable John M. Marburger III and Mr. E. Floyd Kvamme, transmitting the panel's final report: "Assessing the U.S. R&D Investment: Findings and Proposed Actions." Accessed at http://www.ostp.gov/PCAST/FINAL%20R&D%20REPORT%20WITH%20LETTERS.pdf.

[21] "R&D Funding Forecast: Upturns and Defense Drive R&D in 2004," editorial, *R&D Magazine*, January 2004.

[22] Timothy Coffey, Kenneth W. Lackie, and Michael L. Marshall, "Alternative Governance: A Tool for Military Laboratory Reform," *Defense Horizons* 34 (Washington, DC: National Defense University Press, November 2003). Accessed at http://www.ndu.edu/ctnsp/publications.html

[23] "Joint Defense Capabilities Study, Final Report," December 2003. Accessed at http://www.paxriver.org/files/JointDefCapabilitiesStudy.pdf.

[24] Michael L. Marshall and J. Eric Hazell, "Private Sector Downsizing: Implications for DOD," *Acquisition Review Quarterly*, vol. 7, no. 2, spring 2000.

[25] "A Study in Employee Turnover Rates," *Mobility* magazine, March 1998, cited in Relocation Trends 2001. Accessed at http://www.rriworld.com/myrriworld/whitepapers/pdfs/Trends2001.pdf.

Defense Horizons *is published by the Center for Technology and National Security Policy. CTNSP publications are available online at http://www.ndu.edu/ctnsp/publications.html.*

The opinions, conclusions, and recommendations expressed or implied within are those of the contributors and do not necessarily reflect the views of the Department of Defense or any other department or agency of the Federal Government.

Center for Technology and National Security Policy

Hans Binnendijk
Director