# Chapter 5

# The Management of Defense Department Laboratories

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## INTRODUCTION

Three problems—personnel, funding, and size—hinder virtually all of the laboratories operated by Department of Defense (DoD) employees in performing inherently governmental functions, acting as smart buyers, and incubating new concepts. The government's personnel system is too rigid because it makes it difficult for laboratories to compete with the private sector for professional staff, because pay scales are inflexible, and because of the obstacles it sets to rewarding performance. The laboratories find it difficult to get funds as and when they need them: They must spend their funds within the 12-month budgetary cycle, and they have limited authority to move money between accounts, approve start-ups, and target discretionary money to building their technology base. Finally, most labs often cannot deploy a critical mass of scientists and engineers into new areas that may be vital to the lab's mission.

Alternative models to the government-owned, government-operated laboratory exist, for example the facilities operated under contract to the Department of Energy (DOE). Such models have certain common features. They operate under the contractor's own management systems. Their personnel systems enable them to compete on almost equal terms with universities and industry for scientists and engineers. Their funds are often available until spent. And they have the size and depth of expertise to work in the various disciplines needed for technology development.

The question that DoD and its technical managers confront is whether to continue the current system or to restructure the laboratories. As grave as the labs' problems are, conversion to government-owned, contractor-operated facilities (GOCO) may not be the answer. A conversion to GOCO could improve the laboratory's operations in the short term, while leaving its basic problems unchanged. No institutional approach can be divorced from the ends the institution is supposed to serve. The military Services must first decide what purposes their laboratories serve before taking the next step of altering long-standing institutional arrangements.

This chapter describes, compares, and contrasts the basic management arrangements of DoD's government-owned and -operated laboratories with those of comparable facilities, whether government-owned and contractor-operated or federally funded research and development centers (FFRDCs). It also raises a fundamental question: Why does the government in general, and the DoD in particular, need to develop technology through its own laboratories?

The problems of DoD's in-house laboratories are well documented. The next, and more difficult, task is to take the argument a step further: to consider some alternative approaches to technology development. The Defense Science Board (DSB) did this in its 1987 summer study, recommending that under carefully specified conditions *some* labs consider converting to a GOCO model But the costs and benefits must be carefully weighed. After ail, a GOCO military lab would still be dealing with the same sponsor whose rigidity prompted the conversion in the first place. Additionally, no government-funded institution can escape oversight merely by converting to contract. The reason is simple: Whether government-operated or GOCO, operating funds ultimately derive from congressional appropriations, and Congress holds the senior officials of the sponsoring agencies accountable for their proper use.

Beginning with a look at the roles of in-house military laboratories, this chapter explores the systemic problems they face in getting work done—problems of personnel management and development, starting and completing work, relations with the sponsoring agency, and the like. The discussion then turns to an alternative model, the multiprogram laboratories operated under contract to the DOE. The DOE national laboratories merit close study, first, because the relations between what is now DOE and its contractors have endured over four decades; second, because these labs seem to have the "critical mass" needed to bring very large technol-

[1]Defense Science Board, "Report of the Defense Science Board 1987 Summer Study on Technology Base Management, " Washington, DC, December 1987.

ogy development programs to fruition; and third, because the labs and their sponsoring agency have used the concept of ''work for others" to redeploy professional staff as projects wind down, and to move into areas contiguous to their principal missions.

After outlining both approaches to technology development, this chapter assesses both kinds of institutions with respect to five topics: 1) management flexibility, 2) the extent to which GOCO institutions tend to become more like government labs over time, 3) the ability of both kinds of institutions to transfer the results of their 6.1-6.3 programs to user organizations, 4) their mechanisms for diversifying within their basic missions, and 5) the ability of government labs to assimilate the more successful features of GOCO institutions.

## GOVERNMENT-OWNED, GOVERNMENT-OPERATED LABORATORIES

### Justifications for In-house Work

Government-owned and operated facilities can be justified for many reasons. First, apart from the issue of whether such labs serve as smart buyers, perform inherently governmental functions, or provide technical assistance for fielded systems, the relation of laboratory to sponsor is more clear cut than it is for other arrangements. Government operation avoids the criticism sometimes made of GOCOs that the government does not know whether a lab's executives identify with the government or the contractor who pays their salaries. As one authority notes, ''in-house laboratories can be expected to share the sense of mission of their agency and to be responsive to their needs. " Such labs provide stability and continuity "by simply continuing arrangements that have evolved historically. "[2]

But such justifications skirt the important question: Why should technology for weapons systems, space exploration, or measurement protocols be developed out of government-staffed labs at all?

There are five principal justifications for such facilities:

- that certain functions are inherently governmental and may not be delegated to others,
- that the lab serves as a smart buyer, evaluating its contractors and keeping them at arm's length,
- that, through basic research, the lab can originate new concepts that, with support from its sponsors, may develop into fielded systems;
- that the lab can do special-purpose work for military customers that either is of no interest to industry or is kept from industry for security reasons, and
- that the lab can provide support to users once a weapons system has been successfully fielded.

Moreover, in-house laboratories can react quickly to military emergencies, as the Naval Research Laboratory's (NRL's) recent support for the fleet in the Persian Gulf shows.

#### Inherently Governmental Functions

The concept of 'inherently governmental" functions is perhaps the fundamental justification for technology development institutions run by civil servants. As Budget Director David Bell told Congress in 1962, there are certain functions that may not be contracted out, functions that include:

> the decisions on what work is to be done, what objectives are to be set for the work, what time period and what costs are to be associated with the work . . . the evaluation and responsibilities for knowing whether the work has gone as it was supposed to go, and if it has not, what went wrong, and how it can be corrected on subsequent occasions.[3]

This position has important implications for the conduct of research at military laboratories. In this view, a laboratory or research and development center should have the capability to conceive of weapons development projects, develop technical specifications for industrial contractors, and supervise contractor efforts to ensure the reliability of systems and components in the early stages of

[2]T.J. Wilbanks, ''Domestic Models for National Laboratory Utilization,'' in Energy Research Advisory Board, *Final Report of the Multiprogram Laboratory Panel, Vol. II: Support Studies* (Oak Ridge, TN: Oak Ridge National Laboratory, September 1982), p. 63.

[3] David Bell, Bureau of the Budget, *Systems Development and Management*, testimony at hearings before the House Committee on Government Operations, Military Operations Subcommittee, June 21, 1962, 87th Congress, 2nd Session, p. 44.

development, regardless of cost.[4] Carried to its logical conclusion, this view holds that government scientists and engineers are a national asset that, within broad limits, should be retained beyond the immediate programs for which they were hired; that the lab is a going concern, not a job shop; and that its professional staff must do basic and exploratory research, simply to evaluate work done outside its walls.

This basic philosophy is perfectly compatible with a number of arrangements. Government laboratories exist in every phase of dependence on their prime sponsor. A lab may: work exclusively for one sponsor or for several; perform reimbursable work for other organizations, as many service labs are doing for the Strategic Defense Initiative Organization (SDIO); serve as a corporate laboratory over and above its responsibilities to its parent agency; or (what often comes to the same thing) do work that is only loosely coupled to its sponsor's missions. There are even cases, like the optical facility at the Air Force Weapons Laboratory (Kirtland Air Force Base, New Mexico), of small GOCO units embedded in a government-run engineering center. Further, many military and civilian labs, particularly at the National Aeronautics and Space Administration (NASA), have chosen to contract out virtually all of their support functions-functions ranging from carting trash to managing the cafeteria to programming and operating tracking stations—without compromising their principal functions.

## Smart Buyer

The laboratory may also function as a smart buyer, a role that complements its mission to plan development projects. The lab acts as smart buyer when it develops a particular technology-say, a new kind of integrated circuit, wideband recording device, or fault-tolerant avionics—that it can hand over to a contractor for further development and production, or when it evaluates private sector developments. In effect, the lab's R&D work presupposes, and depends on, the existence of a strong private sector R&D infrastructure. At this level, the justification for research is that a lab cannot assess technology without being thoroughly knowledgeable. As one DoD engineer put it, with some exaggeration, 'if we go to a symposium and see something new, we're not doing our jobs. "

In another sense, the in-house lab serves as a smart buyer when it proves a concept that may lead to new technology. The job of an engineering center working on, for example, very-high-speed-integrated circuit (VHSIC) technology is not to make the systems work, but to show that they will work. Actual operational success is in the hands of the buying commands, systems developers, and production people. A military service will insert VHSIC or other technologies only where the technology can ''buy its way" into a weapons system.

Where a lab really acts as smart buyer is in bringing its expertise to bear in deciding when work in a certain area has gone as far as it should. As one technical director put it, his job "is to kill off projects that will not fly before costs get out of hand. "

## Long-term Research

The laboratory also serves as an incubator of new concepts. In fact, it is this role that serves as the principal justification for much 6.1 and 6.2 work carried out by DoD institutions. It is more obvious at NRL than at the other Navy R&D Centers—but nowhere is it insignificant. If NRL has become a corporate lab for all of DoD, it is because of its work in technologies that had no immediate application but that would ultimately define the technology for a new generation of weapons systems. NRL's work in a variety of fields-designing x-ray astronomy experiments, developing a unique class of electroactive polymers, perfecting ceramic-air composites for underwater sensors—positions the Navy to move into the development phase, confident that the technology to make systems work is available.

The importance of such advanced work may be gauged by the efforts of lab technical directors to increase their pot of 6.1 and discretionary funds—though it should be noted that the two are by no means the same. Most of them would agree, in the words of one of them, that the government 'should support some tech base work that is independent of

@n this point, see Federal Coordinating Council for Science, Engineering and Technology, ''A Research and Development Management Approach: Report of the Committee on Application of OMB Circular A-76 (o R& D," Washington, DC, Oct. 31, 1979, pp. VI-VII, any particular program, because otherwise you may shut out some technologies that could become very important. ”

The sponsoring of basic research at military laboratories serves a number of ends. Basic research can be justified as a means of enhancing the lab's reputation; indeed, most facilities try to hire the best science and engineering graduates by holding out the possibility of their doing some basic research. Such research makes scientists available to engineers to work on serious technical problems, without going into development work full time. Finally, basic research allows an engineering-oriented facility to develop a few special applications to military technology.

Yet the laboratory executives are caught on the horns of a dilemma. To try to justify basic research on the ground that it will lead to some definite payoff is self-defeating, especially in an environment where everything militates against risk-taking. Basic research *can* be justified because it helps to define the technology out of which weapons systems may develop; *new* defense systems are made up of fragments of new defense technologies coupled to an existing base. According to this view, 6.1 work is the "push" that really changes the technology base, with 6.2 and beyond as the "pull." Nor need basic research always precede the product development cycle; a military microelectronics facility producing customized chips for military customers, for example, may do fundamental research into the properties of matter as part of its design program.

## Special-purpose Work

The in-house laboratory also exists to do work that is not of interest to commercial industry but is of interest to the military. A case in point is the kind of small-batch production of radiation-hardened chips done at a few labs. Such R&D serves two related purposes: it produces highly specialized chips in small runs for military customers and, more important, it leads to new technology for subsequent insertion into existing systems. The drafting of new specifications can, by itself, lead to new development projects. What is more, the effort to improve production cycles can itself lead to new technology: in areas like silicon-on-sapphire microelectronics technology, military labs are far ahead of industry.

Such special-purpose facilities help to tie industry to the work that is being carried on at military facilities. By pushing the state of the art, these facilities force industry to focus on applications of military interest, such as the radiation hardening of integrated circuits and the applications of iridium phosphide and gallium arsenide technologies. By doing very advanced research, these small, specialized production facilities stimulate the *right* kind of work, so that it becomes available for industrial production.

### User Support

For many labs, work does not end when they hand over technology to the buying organization. In this context, the term "laboratory " is something of a misnomer, applying as it does to the NRL and a few smaller institutions. The preponderance of service R&D facilities are product development or engineering centers, whose staff will often continue work to the fielding of a new system and beyond.

Viewed in this light, much of the research at the Naval Weapons Center (NWC), the Naval Ocean Systems Center (NOSC), and even NRL is done the better to support their principal customers or, as necessary, to provide quality control support to the contractor. Thus NWC was brought in by the Naval Air Systems Command to assist in redesigning the Sparrow-a medium-range, air-to-air guided missile that had run into serious problems when deployed in Vietnam; NRL has consistently sent its scientists and engineers in to support the fleet; and many Air Force R&D centers have sophisticated approaches to inserting new technologies in existing systems. Indeed, much of this technology insertion can occur indirectly: for example, a company may do development work under contract to an engineering center, adapt the new technology and sell it back to the military.

If stress has been laid on the role of Navy centers in supporting the fleet, it is because this is one of the features that most distinguish them from the other Services, especially the Air Force. Compared to the Navy, the Air Force uses its labs more exclusively for technology exploration and component work, and uses industry for bringing technology to production. The Navy, on the other hand, uses its labs in "full spectrum mode" for 6.1 through 6.4 (engineering development) work, and acquisition support and fleet support thereafter. The reason, as one Navy official explained, is that the Navy's mission 'makes continuous support for industry necessary, because [otherwise] a contractor might have to go out on a carrier for six months. "

Still, it must be said that much of the justification for military work conducted out of military facilities is somewhat after the fact. The current institutional arrangement of military R&D is more a matter of history than of cold logic. In fact, the two alternative models for technology development within the government were generated outside DoD, by NASA and the Atomic Energy Commission (AEC). Each model embodied a philosophy of how different research and engineering centers could be grouped in related fashion.

In each case, the critical decisions on how the agencies would operate were taken right at the beginning. NASA would operate through a network of field centers staffed by government employees who would define the work to be done, select the prime contractors, evaluate the work done and, if necessary, be prepared to go into the contractor's plant and take over.[5] By contrast, the AEC chose to work through a network of multiprogram laboratories operated under contract; in the case of the weapons laboratories, they would be part of a vertically integrated system combining research, weapons design, and production.

The important point is this: the institutional arrangements at NASA and AEC were matters of deliberate policy. By contrast, the military R&D establishment has grown haphazardly without the kind of fundamental decisions that NASA or AEC took. Unlike those agencies, the Services and the Office of the Secretary of Defense (OSD) have vacillated among a number of approaches: between building up labs as full-spectrum organizations, or separating generic technology base work from engineering and development; or between doing research loosely coupled to service missions and pressuring the labs to work only in mission-related areas. While DoD's stated policy is that its in-house labs shall maintain "a level of technological leadership that shall enable the United States to develop, acquire, and maintain military capabilities needed for national security," the actual policies of OSD and the services are somewhat less consistent.[6]

This inconsistency shows itself in organizational arrangements that (so to speak) require one part of the organization to work around the rest. Despite everything that militates against it (see ch. 4), some good work manages to get done. The problems that afflict military tech base work are those that afflict all very large organizations. In general terms, bureaucracies are "tentacular"; that is, if you make a mistake, be very sure that every hole is plugged so that it will never happen again. One official put it this way, tongue firmly in cheek: "Central is better. If you want to buy furniture, have one guy in charge of buying for the entire organization, even if you can go across the street and get the item at a much lower price. "

In fact, that remark identifies one of the key flaws in the entire DoD technology development organization. At many labs, the technical director has no control over the most important support elements of his or her organization—the personnel office, the general counsel, the procurement people, possibly even computing services, all of whom report to the buying commands or headquarters.

But this is to anticipate the ensuing analysis of operations at military R&D centers. While one can generalize about the problems of the military labs, a better approach is to begin with specific issues and, in the light of those analyses, to derive some useful conclusions.

## Personnel Management

Virtually every study of military laboratories has noted critical deficiencies in the way they recruit, train, and manage their professional staffs:

- Most of the larger laboratories experience difficulty in hiring and retaining qualified scientific and engineering personnel, especially highly qualified senior staff.

[5] On the decision to create centers staffed by government employees, see Arnold S. Levine, *Managing NASA in the Apollo Era,* SP-4102 (Washington, DC: NASA Scientific & Technical Information Branch, 1982).

[6] U.S. Department of Defense, Under Secretary of Defense for Research and Engineering, Department of Defense Instruction 3201.3, Mar. 31, 1981, p. 2. Cited in Library of Congress, Congressional Research Service, "Science Support by the Department of Defense," December 1986, pp. 178-179.

- The government is at a major disadvantage in competing with industry and the universities for the best technical and engineering graduates.
- The job classification system requires elaborate position descriptions that have little or nothing to do with the positions being filled.
- The system makes it difficult to reward the good performers or remove the poor ones.
- Inflexibility in setting salaries means that pay is seldom commensurate with performance:

Lab directors do have some discretion to work within the system. Thus the Navy uses ''managing to payroll" (MTP) as a discipline to keep from hiring too many people, while allowing trade-offs. MTP allows the naval centers to keep their dollars constant while changing the number of slots. From the Navy's perspective, the advantages of MTP are, first, that it gives technical directors flexibility in distributing work among different center employees and contractors; and second, that it helps to "cleanse" the centers by shedding work that they should not have taken on in the first place. Under MTP, centers can maintain a stable work force either by cutting back on contractors, or by carrying their people on overhead.

Most military R&D facilities have tried to make similar, piecemeal improvements within the current system. But two R&D centers have successfully attempted a more comprehensive approach, within the terms blessed by Title VI of the 1978 Civil Service Reform Act. Since 1980 the NWC (China Lake, CA) and the NOSC (San Diego, CA) have participated in a personnel experiment, with two other Navy centers as controls.

The China Lake experiment, as it is generally known, breaks with the standard Federal personnel system in four ways: 1) separate career paths, with distinct paths for scientists and engineers on the one hand and technical or administrative specialists on the other; 2) the consolidation of 15 General Schedule (GS) grade classifications into no more than 5 broad "pay bands" corresponding to career paths (professional, technical, administrative, technical specialists, clerical/assistant); 3) abbreviated position descriptions and standards; and 4) a much closer linking of pay to performance. Although the Office of Personnel Management (OPM), which oversees the project, originally designed it to run 5 years, Congress has extended it to 1990.[7]

Differences in the ways the two centers have implemented the China Lake experiment are minor compared to the similarities. At both NOSC and China Lake, pay is linked to the GS scheme of classification, There is a set formula for hiring junior professionals determined by each center's personnel office; at higher levels, supervisors set salaries according to the pay bands, with salary tables based on government-wide changes in GS pay scales. Each career path is a separate competitive path: if reductions in force occur at a center, they can occur only within specified career paths.

China Lake has been one of the most closely followed demonstration projects ever sponsored by the Federal Government. OPM has monitored the project since its inception, issuing annual progress reports and a comprehensive evaluation in 1986. In that report, OPM found that the project had largely succeeded in doing what it was intended to do. Compared to the control sites, personnel at the demonstration labs-employees and supervisors—perceived the system to be more flexible than the Navy's conventional performance appraisal system. In reviewing compensation systems, OPM concluded that the positive results it found seemed to have been "strongly influenced by the introduction of broad pay ranges corresponding to the new classification levels . . . broader pay ranges provide greater latitude in making performance-based pay distinctions."8

OPM identified other elements that, in the opinion of its staff, helped account for the project's

[7]There have been many descriptions of the China Lake experiment. This account draws on several, including: U.S. Office of Personnel Management, Research and Demonstration Staff, Office of Performance Management, ''Status of the Evaluation of the Navy Personnel Management Demonstration Project: Management Report I," March 1984 and (same source) "A Summary Assessment of the Navy Demonstration Project: Management Report IX," February 1986. The original OPM proposal is in *Federal Register*, Vol. 45, No. 77, Apr. 18, 1980, pp. 26504-26543. A good summary account may be found in Larry Wilson, ' 'The Navy's Experiment with Pay, Performance and Appraisal," *Defense Management Journal*, Vol. 21, No. 3, 3rd quarter 1985, pp. 30-40.

[8]U.S. Office of Personnel Management, "A Summary Assessment, " op. cit., footnote 7, P. VII.

relative success. One of these was the labs' involvement in developing their system. Another was that the system covered employees at a wide range of work levels, and a third was the protection of employees from any initial adverse impact, by a ''buy-out" feature written into the project plan.

The China Lake experiment was not designed to be cost neutral. That is, the Navy recognized that there would be certain start-up costs in moving to the new system. Once the system was in place, average salary differences between demonstration and control labs tended to flatten out, to the point that the difference among scientists and engineers diminished greatly or even disappeared after they had been on board 3 or 4 years.[9] But the ways in which the same pot of money was distributed were quite different. As OPM put it, "the initial salary gap is great enough that in any year the remaining demonstration v. control difference in the salaries of new and recent hires accounts for about 2 percent to 3 percent in additional demonstration payroll costs."

One of OPM's most significant conclusions about China Lake was that although costs are controllable, "the decision to limit costs can substantially alter the results achieved. Unless organizations are willing to make some investment in the new systems, employees are likely to perceive they will gain no benefit from the systems, or that they will actually be penalized under the systems."[11] In fact, OPM concluded, total salary costs had risen by 6.0 percent (as of January 1986) over those of the control sites as a direct result of the project. Costs rose because the demonstration labs were offering to scientists and engineers starting salaries that were 17.5 percent higher than at the control labs, and because China Lake permitted greater salary increases within pay bands than would have been possible under the General Schedule.[12]

A May 1988 report by the General Accounting Office (GAO) confirmed many of these findings. GAO's general conclusion was that the project demonstrated that a pay-for-performance system could be implemented to the general satisfaction of many supervisors and their employees. Despite this qualified approval, GAO found that the OPM evaluation left many questions unanswered. In GAO's view, "the overall weakness of the China Lake evaluation was that when all is said and done, the volume of data that were either missing or non-comparable was quite large. " Although GAO did not know the reasons behind the data problems, it determined that 'they were of such magnitude that firm conclusions about project effectiveness cannot be drawn."[13]

The problems GAO cited included the noncomparability of the test and control sites and a lack of information on how and to what extent the project was implemented at the test sites.[14]

But this begs the question. Underlying the GAO analysis is the assumption that one is comparing a tentative demonstration with a system that is internally coherent and designed to address the same issues (but in a different way) which the China Lake demonstration was created to address. Leaving to one side the difficulty of evaluating so complex a program, the existing government personnel system is even more vulnerable to criticism. Speaking only of current hiring procedures, former OPM Director Constance Homer said that the system "is slow; it is legally trammeled and intellectually confused, and it is impossible to explain to potential candidates."' China Lake and a comparable demonstra-

[9]Ibid., pp. 51-52.

[10]Ibid., p. 52.

[11] Ibid., p. VIII.

[12]In an update of its 1986 report, OPM concluded that the average salaries of demonstration lab scientists and engineers continued to grow relative to those of their control lab counterparts. This difference could *not be* explained by the effects of salary increases, since these were virtually identical at both kinds of site. Higher starting salaries for scientists and engineers, which were 18.7 to 29.1 percent greater at the demonstration sites, seemed to account for much of the differential. U.S. Office of Personnel Management, ' 'Salary Costs and Pcrfcmnance-Based Pay Under the Navy Personnel Management Demonstration Project: 1986 Update: Management Report X," December 1987, pp. 3-6.

[13]U.S. General Amounting Office, "Observations on the Navy's Personnel Management Demonstration Project," GGD-88-79, May 1988, p. 29. These remarks were included in a letter from GAO to Senator Sam Nunn, Chairman of the Senate Armed Services Committee.

[14]In light of its findings, it is worth noting that GA() has instituted its own pay. for-performance system, with three pay binds corresponding to Grades 7 through 12, "leadership" positions at GS-13/14, and "managerial" posts at GS-15.

[15]Constance Homer, ''Address to Career Entry Recruitment Conference," Washington, DC, June 23,1988, p. 4.

tion project at the National Institute of Standards and Technology (NIST) (formerly the National Bureau of Standards) have a coherence and logic that the current system altogether lacks.[16]

What has the China Lake experiment really achieved? In one sense, it "demonstrates" just how inadequate the current personnel system is. Note that the experiment is now into its ninth year, with no immediate prospect of extending it to other government laboratories. A program that began under Carter and continued under Reagan awaits the Bush Administration for extension or termination. The Civil Service Reform Act that authorized the project provided no mechanism for extending it beyond its test sites. Assuming that the project is extended beyond 1990, the government may be faced with a successful experiment that will have no ramifications, unless Congress enacts proposals to extend the project to Federal laboratories generally .17

But if one concedes—as even GAO has done—that the China Lake experiment did what it was meant to do, its success is somewhat irrelevant to the problems of DoD laboratories. One could conceive of small-scale improvements to the current system even without instituting performance-based pay. After all, OPM has in place mechanisms that make it easier for agencies to hire qualified professional staff. Thus, agencies can now apply to OPM for authority to hire engineers directly, without an initial screening by OPM. OPM has delegated to agencies the authority to negotiate starting salaries with top-quality candidates for jobs at grades GS-11 and higher. On a pilot basis, OPM is drafting simpler standards that agencies can use to classify positions, including engineering positions, These new standards, OPM says, ''will give agencies more flexibility to redesign work, to classify jobs and to write agency specific guides if needed. " *[8]

But the ultimate limitation of China Lake and similar proposals is that they simply divide up pieces of a pie whose overall size remains about the same. Salaries are adjusted within narrow parameters; despite increases at demonstration sites, OPM found that salaries for nearly all the occupations compared grew 5 to 19 percent less at those sites than did salaries for the same occupations in the private sector. [19]

In this respect, the NIST project is superior because it has the authority to adjust the salaries it pays its scientists and engineers to match those paid by the private sector for comparable work. And while its demonstration project is supposed to be cost neutral during the first of its 5 years, NIST can use the surveys as a device to narrow (if not close) the salary gap between itself—NIST salaries are already among the highest at Federal laboratories—and industry by work force attrition.

Even if the China Lake experiment were extended government-wide, it would take a long time to undo the damage wrought by the current system. Personnel issues cannot be isolated from other issues—funding, research planning, the acquisition of major systems, and the like. Among the elements not yet mentioned that affect the labs' ability to hire, promote, and retain are the periodic hiring freezes that affect most government institutions; the new Federal Employees Retirement System, which makes it easier for government workers with portable benefits to leave the government earlier; and cutbacks in travel budgets, which make it harder for lab officials to recruit. Compared to the larger DOE laboratories, which recruit from the top 10 percent of graduates from the major national technical schools, most DoD managers tend to hire locally-partly because of small travel budgets, partly because they are resigned to the unavailability of top graduates.

[16]There are major differences in the design of the NIST and China Lake projects. Although it incorporates such concepts as pay bands and career paths, NIST has certain special features: direct-hire authority for all professional employees, an annual comparability survey of *total* compensation of NIST positions to similar positions in the private sector, cost neutrality, and recruiting allowances for professionals that NIST particularly wants to hire.

[17]There have been a number of legislative proposals to reform the Federal personnel system. OPM twice unsuccessfully introduced its own proposal for a "Simplified Personnel System, " most recently in January 1987. A bill, S. 2530, introduced by Senator Jeff Bingaman (D-New Mexico) in June 1988 would extend the China Lake experiment beyond the two naval centers currently involved. S. 2530 would authorize between six and ten personnel demonstrations, of which four would be instituted at DoD and onc at NASA. The bill would establish higher minimum rates of pay and an alternative compensation system based on comparable rates for comparable private-sector work.

[18]U.S. Office of Personnel Management, "Simplifying the Federal Manager's Job" (n.d.), p. 3.

[19]U.S. Office of Personnel Management, op. cit., footnote 12, p. II. OPM derived its salary-comparison figures from data provided by the Bureau of Labor Statistics.

But personnel issues extend beyond competing with the private sector for new hires. Retaining good employees in an environment where the work force is overgraded but underpaid is just as formidable a problem. Technical directors stressed the nature of the work itself as one of the strongest attractions for their best and brightest. Good people stay if the work is challenging, if they have the opportunity to do some basic research and publish their findings, if discretionary funding is available to start new work, and if the laboratory gives equal recognition to separate career tracks for researchers and managers.

Although many lab officials spoke of having "two-track" systems, the evidence for such is ambiguous. According to a survey by the Army Laboratory Command, lower-level engineers believed "that a scientist had to become a manager in order to get ahead in a government laboratory. "[20] From the lab director's perspective, someone has to take on the responsibilities with which external organizations task the lab, as well as manage the larger programs that constitute its mission. Thus, inevitably, many scientists and engineers come under pressure from their superiors to take on work outside the disciplines in which they were trained. Sometimes, scientists and engineers make a successful transition into management. Other times, as one former government official said, "you take good engineers and turn them into lousy managers. "

There is also a more insidious threat to the integrity of the professional work force. Throughout DoD laboratories, the increase in congressional oversight has gradually transformed the role of research executives, such as division heads and branch chiefs. Rather than managing projects or ensuring their technical quality, one of their principal jobs is now to insulate their bench-level people from the requirements with which Congress tasks the labs and their sponsors. In particular, the amount of oversight and paperwork appears to have increased the most at those laboratories where the bulk of the work is contracted out—thus forcing managers and other senior professionals into contract administration.

In sum, the personnel problems that afflict most DoD laboratories are not personnel issues in the narrow sense. They flow, rather, from the total environment within which professional staff and managers try to get their jobs done. Even where a center can attract the top graduates, it has to contend with problems that are not ''personnel" at all: uncertain budgets, long lead times in building new facilities and procuring new equipment, and limits on the pot of discretionary funds available to start new work. The incentives for a new hire to remain permanently depend more on the total environment of his or her institution than on personnel management practices in the narrow sense.

Two more points deserve emphasis. The first is that the Federal personnel system creates some perverse incentives for retaining employees. Under the Federal Employees Retirement System, the better employees can take their retirement benefits and leave for industry and universities with many of their more productive years still ahead. At the same time, mediocre performers remain; under the China Lake system or Managing to Payroll, they can expect no major salary increases, but they also stand little risk of being terminated. Thus, a low turnover rate at a laboratory can be a sign of health or a portent of institutional decline.

The other point has to do with the optimal size of laboratories, an issue discussed later in connection with GOCO facilities. It may well be that there are too many DoD laboratories, and that many of them are too small ever to achieve critical mass. If an institution is too small, there will be too little flexibility for a few people to strike out into new territory, or for new ideas to spill over into research work. At smaller facilities, there may not be enough groups of two or three or four people delving into areas unconnected with their current missions but that might lead to new missions. Government institutions seemingly must have more than about 1,000 people before the kind of flexibility that makes for their survival exists.[21] Additionally, as weapons systems grow ever more sophisticated, the number of disciplines that a lab needs under one roof will increase.

[20] U.S. Army Laboratory Command, ''Innovative Personnel Practices, " March 1988, p. 4.

[21] Hans Mark and Arnold Levine, *The Management of Research Institutions: A Look at Government Laboratories*, SP-481 (Washington, DC: NASA Scientific & Technical Information Branch, 1984), p. 70.

The question of a lab's optimal size bears directly on the retention of quality staff. Unless a lab is assigned a mission in one narrowly defined area-the Army's Night Vision Laboratory (Ft. Belvoir, VA) might be an example-it must have scientists and engineers drawn from a variety of disciplines. Even in that case, as a 1979 government report noted, ''the development and enhancement of modem technologies is an inherently multidiscipline endeavor. The most narrowly focused of research activities today involve several professional disciplines as well as highly skilled technical support personnel. "[22]

The DOE's weapons laboratories have become adept at instituting a matrix structure, whereby money is pulled away from divisions and moved into programs. The result is that there is more mobility within Energy labs like Sandia and Los Alamos than at most DoD labs. With some exceptions, a new professional hired at a DoD lab is likely to spend his or her career within the same research division or directorate. In contrast, professionals at DOE labs have more options: beginning their careers at (say) the lab's research division, they may move into mission-related areas, return to research, or move into management.

In fact, the DOE labs have done more to control personnel problems than virtually any DoD facility. For one thing, they have bypassed the entire issue of salaries comparable to those of the private sector. As a rule, salaries and personnel systems correspond closely to those of the contractor who operates the lab: the personnel system at Sandia National Laboratories is modeled on AT&T's Bell Labs, while those at Los Alamos and Lawrence Livermore National Laboratories are modeled on that of the University of California system. For another, the DOE laboratories tend not to hire for specific jobs. Their size and multidisciplinary capabilities make it easier for lab executives to move people to where they are needed and redeploy people as projects wind down.

## Laboratory Management Issues: Funding

The ability of a government laboratory to accomplish its mission depends on the ways it is funded. The amount of funding obviously matters, but so does its predictability, flexibility, and the ability of lab managers to disburse funds once they become available. Laboratory executives say they prefer funding that is tight but predictable over larger but unpredictable funds.

At DoD labs, funding problems are at least as numerous as the personnel problems they aggravate. Funding is unstable, making planning and staff continuity on projects difficult; it is inflexible, in that most funds cannot easily be transferred to other accounts where they might be needed more; and monies must be spent during the fiscal year for which Congress appropriated them, preventing the buildup of contingency funds. This requirement affects DoD's ability to sustain long-term work.

Nevertheless, there are important differences in the way the services do their getting and spending—with the Navy centers obtaining their funding from the Naval Industrial Fund (NIF) and the Army and Air Force receiving money through line-item appropriations.

NIF is a shorthand way of saying that naval centers must recover the full cost of their operations. Industrial funding provides working capital for industrial-type activities, such as shipyards, the overhaul of aircraft, or running a laboratory, Under this approach, the activity pays all its expenses out of working capital and charges its customer the full cost of its products and services. Each industrial fund activity group has a cost accounting system specifically designed for its operations, to identify and accumulate the costs of their products or services.

This approach has important implications for the conduct of naval research, development, test and evaluation. First, because the NIF is a revolving fund, payments that naval centers receive from their customers should do no more than replenish the working capital fund that finances operations until payments are received. Second, in relation to their "buying" commands, naval centers are contractors *de facto* and *de jure.* A Naval center undertakes work for (say) the Naval Sea Systems Command on the basis of a contractual agreement that obligates both parties until work is completed. A facility like the NWC at China Lake has virtually no line-item

[22] Federal Coordinating Council for Science, Engineering and Technology, op. cit., footnote 4, P. 35.

budget authority. Instead, it operates like a Battelle or SRI International, which would go out of business if it had no customers.

A third, very important, feature of NIF is the asset capitalization program (ACP).[23] Effective fiscal year 1983, the Deputy Secretary of Defense approved asset capitalization as a way to fund the modernizing of industrial fund equipment. Under the program, equipment costs are recovered over the life of the asset by including depreciation costs in the rates charged to customers, The availability of ACP money strengthens the cash position of industrial fund, and helps fund managers avoid shortages.

Thus, naval engineering centers obtain work quite differently than a NASA research center or an Army laboratory-although Army research, development, test, and evaluation (RDT&E) was funded industrially at one time. At a facility like the NWC, the program offices serve as "shadow offices" to their counterparts in the prime sponsoring organization, which in their case is the Space and Naval Warfare Systems Command (SPAWAR). Note that this is *not the* principal buying organization for the center; its principal customer, accounting for more than half of its total obligational authority, is the Naval Air Systems Command. Although there are something like 3,000 customer orders in the system at a given time, some two dozen cover most of NWC's work.

In the view of managers at the Navy centers, industrial funding is an effective way of getting work done. Among its advantages are that it provides limited authority to start work on a sponsor's order prior to the receipt of funds, assists managers to control their resources better, enables the facility to finance and carry inventories of non-standard materials, permits the use of working capital for initially charging all costs, including 6.1 and 6.2 work, and serves to develop total costs for each task, including overhead.

Most Navy lab managers consider a recent OSD proposal to terminate NIF over the next two fiscal years potentially disastrous. DoD contends that industrial funds are more costly to operate than other systems, that their advantages have not been demonstrated, that industrial fund clients are not bona fide customers who can take their business elsewhere, and that as structured, the system makes DoD and congressional oversight difficult. The Navy, supported by GAO, disputes these assertions, chiming that NIF meets the criteria under which the Navy's research and engineering activities are financed.[24]

If NIF were terminated, the Navy would have several options. One would be to convert to a resource management system that combined customer-funded direct labor with Navy-funded overhead under an appropriate budget line item. This could be disastrous, in the view of some officials, because overhead becomes very difficult to defend in a competitive budget preparation environment. Alternatively, the Navy could adopt a resource management system with "applied overhead," which is identical to NIF at the macro level, except that it has no asset capitalization program. While the Navy could live with this arrangement, it would incur sizable one-time costs to convert its financial systems.

Compared to Army and Air Force labs, industrial funding gives the Navy a certain flexibility in starting and accounting for work. But it is still firmly part of the appropriations process, although at one remove. The start of work at a Navy lab still depends on its customers having the necessary obligational authority-and, if that money comes in late in the fiscal year, that it remains available to complete the work it is funding. Further, there are important areas of naval lab operations not covered by industrial funding, such as military salaries, non-appropriated funds, and military construction.

Military construction deserves special mention, since delays in new construction are one of the major obstacles to lab performance. This is the case for several reasons: as with other functional areas, those responsible for facilities management do not report to the lab technical director; lab requests for new facilities are thrown into one "pot" with other construction requests, and new facilities for labs generally have rather low priority. At some DoD

[23] On the asset capitalization program, see U.S. General Accounting Office, "Industrial Funds: DoD Should Improve Its Accounting for Asset Capitalization Program Funds," NSIAD-86-1 12, May 1986.

[24] U.S. General Accounting Office, "Proposal to Change From Industrial Funding to Another Method," NSIAD-89-47, December 1988, pp. 1-3.

laboratories, many facilities are 40 years or even older.

This is doubly unfortunate, because good facilities not only drive a lab's mission, but also attract good people. In turn, an excellent staff will, to a degree, generate good facilities, The process is self-perpetuating; people tend to generate new programs around the facilities, so that when an RDT&E organization matures, its roles and missions depend primarily on the facilities available: wind tunnels, clean rooms, anechoic chambers, simulators, and the like. As other authors have noted, "facilities have a longer 'half life' than people. A facility like the 40-by-80-foot wind tunnel at [NASA'S Ames Research Center] might be used for forty years, while an individual researcher will change his interests every three or four years and move on to something new. Thus a vigorous research and development program demands an efficient facilities development staff, more particularly where one facility serves a number of projects. "[25] By this criterion, few DoD laboratories have the power to develop facilities to keep pace with either the equipment that they will house or the missions they are designed to support.

Thus, DoD laboratories are subject to all the disadvantages and few of the advantages of facilities owned and operated by the government. But it is important to understand that these problems do not flow automatically from the status of these facilities as government-owned, government-operated institutions. Both the NASA centers and NIST have shown greater flexibility: NIST, because its role as lead agency in measurement science is highly valued by its government customers; NASA, because of the much stronger ties between the centers and their principal buyer, the headquarters program offices, than in the DoD system. At NASA, the centers largely define the programs that the agency funds. At DoD, by contrast, the relation of the R&D infrastructure to the buying commands is much less certain.

The next section describes alternative approaches to developing technology—those represented by GOCO facilities of the DOE and the somewhat similar FFRDCs under DoD.

## GOVERNMENT-OWNED, CONTRACTOR-OPERATED FACILITIES: AN ALTERNATIVE MODEL

### Introduction

The GOCO facilities are an unparalleled resource for the United States. In particular, the nine multiprogram, or ''national" laboratories represent one of the heaviest investments in basic and applied research made by the United States or any other country. Besides conducting about 70 percent of the DOE's weapons development and a quarter of its energy-related research, the national labs have other roles. As systems engineers for DOE, as consultants to State and local governments, and as stewards of unique facilities, the labs contribute in many ways to the Nation's technology base.

From their inception, all the multiprogram laboratories have been government-owned and contractor-operated. The Atomic Energy Commissioners chose this course, although they were not barred from operating their own laboratories; indeed, the Atomic Energy Act of 1946 authorized "a program of federally conducted research and development. " According to Harold Orlans, the AEC contracted with private organizations as the principal means of ''retaining a degree of normalcy and freedom in the evolving system of nuclear science and industry. "[26] By contracting with outside groups, AEC could keep them informed about highly classified activities that would normally be confined to official circles, and bring to the government experience and advice not normally available to it. Orlans concluded that this decision helped, as much as anything, "to keep the AEC more alive and alert, administratively and technically. "[27] The result was an arrangement that has no counterpart in the Federal Government, save for the contract between NASA and the California Institute of Technology to operate the Jet Propulsion Laboratory.

[25] Mark and Levine, op. cit., footnote 21, pp. 83-84.

[26] Harold Orlans, *Contracting for Atoms* (Washington, DC: Brookings institution, 1967), P. 6.

[27] 1 bid., p. 8.

Before turning to the applicability of the Energy model to DoD institutions, something should be added about FFRDCs like Lincoln Laboratory and university-affiliated research centers like the Applied Physics Laboratory (APL) of The Johns Hopkins University.[28] DOD sponsored these centers for much the same reasons that DOE chose to operate its national labs through contractors: the Services sought independent outside expertise from organizations unfettered by many Federal regulations; they wanted to develop long-term relations with such organizations; and they specifically wanted to deal with institutions tied to the university community. The 30-year collaboration between the Navy and the Applied Physics Laboratory on the Fleet Ballistic Missile Program shows how effective such a special relationship can be.

The main difference between contract centers like APL and a DOE laboratory is that the former are privately owned organizations working for a primary sponsor. At APL, for example, Johns Hopkins owns the land and the buildings—although the Navy, APL's prime sponsor, furnishes the equipment. There are other differences of degree rather than kind. Compared to the DOE weapons labs, which have their own audit organizations, FFRDCs are audited regularly by the Defense Contract Audit Agency (DCAA). Additionally, many centers have to go through special procedures to avoid the full weight of Federal regulations. For APL to avoid the broad mandate of the Competition in Contracting Act for competitive procurement, the Navy's SPAWAR must draft a "justification and approval," which the Assistant Secretary of the Navy for Shipbuilding and Logistics ultimately signs,[29]

Although these contract research centers perform some of the functions of DOE's national laboratories, there are significant differences. One difference has to do with areas of emphasis: Compared to the many functions of the larger national laboratories, the FFRDCs and university affiliates tend to concentrate on systems integration and engineering services. They are more likely to work almost entirely for one sponsor, and to devote most of their resources to a few programs, than the national laboratories are. While the same could be said of DOE's weapons laboratories, their size, their diversity, and their capacities for advanced research make them a more appropriate model for DoD's consideration.

## The GOCO Relationship at the Department of Energy: Contractual Arrangements

The organization and operation of the multiprogram DOE labs' are in dramatic contrast to those of labs operated by DoD employees. In the former, we find the vertical integration of research, development, and operations; a long-term relationship with the sponsoring agency; a critical mass of scientific and technical disciplines; and (compared to DoD) much greater flexibility in moving people between divisions and projects.

Although superficially complex, the administrative relations between the labs and DOE are actually much simpler than those at DoD. Through its staff and program offices, DOE headquarters in Washington sets broad policy and develops the overall budget out of which funds to operate the labs will come.[30] Eight field operations offices monitor the operating contracts, although their roles encompass much more. Finally, the labs carry out broad programs of research and technology development within the guidelines approved by headquarters.

Arrangements between DOE and its contractors vary within narrow limits. Management and Operating contracts normally run for 5 years, with the cognizant operations office performing a' 'compete-extend" analysis before the contract expires. Compared to standard commercial contracts between a Federal agency and vendors, the terms are more general and until recently were based mainly on

[28]U.S. General Accounting Office, "Competition: Issues on Establishing and Using Federally Funded Research and Development Centers, " NSIAD-88-22, March 1988.

[29]Johns Hopkins University, Applied Physics Laboratory, "Report to The Johns Hopkins University Trustees Committee on the Applied Physics Laboratory," March 1988, p. 2.

[30]For purposes of contract administration, the field operations offices located close to thc labs oversee them. For purposes of program planning and institutional management, the nine multiprogram laboratories are ''administmuvely assigned" to two cognizant program offices, The Assistant Secretary for Defense Programs oversees the Idaho National Engineering, Lawrence Livermore, Los Alamos, and Sandia National Laboratories. The Director of Energy Research is the "cognizant secretarial officer" for the Argonne, Brookhaven, Lawrence Berkeley, Oak Ridge, and Pacific Northwest National Laboratories.

reimbursable costs. Thus, AT&T manages Sandia on a no-profit, no-loss basis; the contracts for Los Alamos and Lawrence Livermore National Laboratories reimburse the University of California for operating costs and award it a management fee. More recently, at Oak Ridge National Laboratory, DOE has instituted a cost-plus-award-fee arrangement, in which the contractor, Martin Marietta Corp., receives a special fee based on performance.

If one looks at these contracts after reviewing a standard contract between DoD and one of its commercial suppliers, they seem extraordinarily broad. Here is virtually the entire scope of work in the contract for managing Los Alamos National Laboratory:

> Work under this contract shall, in general, comprise research, development and educational activities related to the nuclear sciences and the use of energy in mutually selected military and peaceful applications, engineering services, and such other activities as the parties may agree upon from time to time . . .
>
> Due to the critical character of the work from the standpoint of the national defense and security, it is understood . . . that very close collaboration will be required between the University and DOE with respect to direction, emphasis, trends and adequacy of the total program.

How can anything so vague serve as the basis for operating a laboratory with an annual budget of $900 million? There is no single answer; instead, there are several reasons that this contract is a successful instrument for managing a national laboratory. One is that there is much more to the contract than the statement of work just cited; there are, in fact, numerous powers, especially the power of the purse, by which DOE fleshes out the very broad mandate just cited. Another reason is that after 40 years' experience of working together, both parties understand the terms very well. By itself, the GOCO contract does not lead to a long-term relationship: it presupposes it.

A special feature of the contracts between the University of California and DOE is the provision that work shall be set by mutual agreement. These "mutuality clauses" are unique, although at one time NASA had such a clause in its contract with CalTech to operate the Jet Propulsion Laboratory. (CalTech has an R&D contract with NASA, not an operating contract for administrative services.) To a degree, the mutuality clause gives a false impression, since it implies that DOE may unilaterally task other laboratories that do not have such a clause. There is actually a very complex give-and-take between all of the multiprogram laboratories, their sponsors, their clients (including DoD), and the universities. The mutuality clause simply affirms the understanding that runs through all of these contracts: that DOE is tapping the expertise of outside organizations to run the labs; that this expertise cannot be used effectively if DOE elects to micromanage the contractor; and that the contractor must have freedom to select the technical approach most effective in carrying out the lab's mission.

In this system, the operations offices are much more than contract administrators. This is why DOE rejected a 1981 recommendation by the GAO that the operations offices report directly to each lab's cognizant program office, rather than to the Department's Under Secretary. DOE officials contended that such a proposal would not only require a huge increase in Federal staffing, but would lead to "the balkanization of the field structure."[31] A more compelling justification for leaving the field structure intact—as DOE did—is that the structure of the operations offices mirrors the vertical integration of the Department as a whole. For example, besides overseeing the Sandia and Los Alamos laboratories, the Albuquerque Operations Office administers 7 widely scattered weapons production facilities and the system for transporting all government-owned special nuclear materials.

## The GOCO Relationship at the Department of Energy: Complying With Federal Norms

How far are the GOCO laboratories bound by Federal policies? There is no simple answer, perhaps because neither DOE nor its contractors wish to be locked into anything too definitive. Yet there has been a gradual shift over the past decade, with DOE

[31] U.S. General Accounting Office, "A New Headquarters/Field Structure Could Provide a Better Framework for Improving Department of Energy Operations," EMD-81-97, Sept. 3, 1981, See especially the comments of Assistant Secretary for Management and Administration William Heffelfinger at pp. 48-49.

trying to get the labs to conform more closely to legislation and regulations.

The official view reflected in DOE directives and in congressional legislation is that the labs' status does not exempt them from complying with the spirit of Federal policies. As stated in an opinion of the Deputy Comptroller General, the labs must comply with "the Federal norm":

> It is our view that while Federal statutes and regulations which apply to direct procurement by Federal agencies may not apply *per se* to procurement by prime operating contractors . . . the prime contractor's procurements must be consistent with and achieve the same policy objectives as the Federal statutes and regulations. This, we believe, is what is meant by the "Federal norm. "[32]

While a laboratory like Sandia follows AT&T procurement and personnel management policies, it is also bound by a variety of regulatory constraints. These include DOE acquisition regulations and directives that apply the Federal Acquisition Regulation to departmental entities, the Buy American Act, and prevailing-wage legislation on Federally subsidized construction contracts. As Federal contractors, the national labs also come under the supervision of the Labor Department's Office of Federal Contract Compliance Programs,[33]

On the other hand, the labs are exempt from a number of requirements that bind Federal agencies, among them formal advertising, set-aside programs, and the Competition in Contracting Act. Although major purchasers of supercomputers, the national laboratories are also exempt from complying with the Brooks Act, which governs the acquisition of computers and telecommunications equipment, at least as it applies to scientific computing. The situation is less clear for administrative and general-purpose computers; the consensus at the labs is that they must sponsor full and open competition for these machines. Finally, because Sandia and other facilities have their own audit capabilities, they do not require the services of the Defense Contract Audit Agency in monitoring their own contracts. Lab officials believe that they can handle small and medium-sized procurements much faster than DCAA can, although there is evidence (see below) that procurement lead times have increased substantially at the national labs.

These exemptions affect the labs' operations in many ways. First, they enable the labs to build long-term relations with industry in a way not possible for Federal agencies bound by the Competition in Contracting Act. Second, the labs find it expedient to comply with the spirit of the law, even when they are not bound by the letter. Thus the weapons laboratories set aside a substantial number of smaller procurements for minority-owned small businesses. For example, under pressure from GAO, Oak Ridge National Laboratory dropped its percentage of sole-source procurements from 50 to 20 percent. Third, these exemptions make it possible for the labs to function; to impose the full weight of Federal regulations would undermine the rationale for having them run by contract.

One area where the labs are free to set their course is in personnel management. The personnel system at each laboratory corresponds to that of the prime contractor because, as one official explained, "in a GOCO you have not only the people, but also the organization's management system. " There are no assigned slots at DOE labs, and the very best technical people can make as much as $95,000, although a lower figure is more usual. The most senior executives at the weapons labs earn between $100,000 and $150,000, roughly twice what their counterparts at the military labs earn.

The principal constraint on the willingness of a laboratory's prime contractor to set the highest salaries is the DOE review triggered at the $60,000 threshold; the local operations office has approval authority up to $70,000, and DOE's Office of Administration up to $80,000, with higher salaries requiring the Director of Administration's approval. Additionally, at some laboratories, DOE approves the appointments of the most senior executives.

DOE also approves facility-wide salary increases, based on cost-of-living adjustments, recruitment and retention rates, and the like. The facility proposes an increase to the cognizant operations office, which forwards the proposal with its recom-

[32] Decision of Deputy Comptroller General in protest of Piasecki Aircraft Corp. (B-190178, July 6,1978), p. 10.

33 Alone among DOE labs, Sandia has to file its accounting system with the government's Cost Accounting Standards Board.

mendations to headquarters. For its part, the Office of Administration sponsors generic surveys of scientific and technical salaries. DoE is now developing criteria to remove individual salary reviews and convert to more "systemic" approaches to determining appropriate levels.

Although practice varies from lab to lab, there is a certain uniformity in their hiring and promotion policies. When officials say that "there are no assigned slots at DOE laboratories," they do not mean that people move randomly from assignment to assignment. What they mean is that laboratories do not hire for specific jobs. Instead, they hire people with the technical disciplines that fit the laboratory's mission, and who give promise of performing well in a number of environments. Again, many labs like to move their "high-potential performers" within and between program divisions, especially those individuals with management potential.

The laboratories can hire and move around the best people because of their sheer size. Each of the weapons labs has about 8,000 employees and, while this creates problems of its own, the number and diversity of projects does make it easier to attract and retain the top engineering and scientific graduates—some of whom the labs hire on the spot. In particular, lab officials note that facilities are a key selling point in hiring and promotions. Although layoffs do occur, the labs can keep them fairly small, since they have other options not available to DoD laboratories, such as finding slots at production centers for lab employees no longer needed at the main facility.

The personnel practices that DOE ratifies have made the national labs far more competitive than most of those staffed by government employees. Thus, salaries are far more in line with industry and the universities; the surveys sponsored by DOE help to keep salaries realistic. Moreover, the labs recruit aggressively. Most of the larger ones recruit nationally and hire directly—something government labs are only beginning to do-and can attract the top 10 percent of graduates from the best engineering and technical schools.

## Funding Arrangements and Work for Others

**The** three weapons labs receive level-of-effort funding for Defense programs. DOE allocates funds to each institution annually, based on its mission and the size of its staff. When the money becomes available to the laboratory, each program or division director negotiates with the lab director for a portion of the funds. But unlike many government labs, DOE facilities do not obtain their funds in one lump sum. Instead, they receive money from hundreds of separate contracts with other DOE components—the headquarters program offices-each of which specifies the task covered by its agreement. In this respect, the closest government analog is the NIF described earlier.

DOE-sponsored work is funded with "no-year" monies, available until spent. This does not mean that the labs have complete discretion in scheduling outlays. DOE provides budget outlay guidance on when money shall be spent during the fiscal year, and DOE weapons labs must obligate DOE funds to within 1 percent of allocation. But as one DOE laboratory executive observed, "it is the technical discretion of the lab management (not *accounting* discretion) which is crucial."

Other funds are obligated on a project basis by the end of the fiscal year, like those for DoD non-nuclear programs, although some DoD money for R&D is 2-year funding.

Consider how this system works at one weapons facility, Sandia National Laboratories. Its principal mission is research, development and engineering of the components of nuclear weapons (other than the nuclear explosive). In light of this mission, Sandia executives regard their technical programs as having two components: a technology base (basic and applied research, computing, analytic techniques, advanced components) and deliverables (materials fabrication, system design, quality assurance, stockpile surveillance, nuclear safety). It is this twofold mission that drives the program and determines the kinds of work Sandia will take on, particularly from non-DOE organizations.

For its purposes, Sandia's no-year budget authority has two advantages. First, it enables the lab to let contracts beyond the current fiscal year; and second, it allows long-term planning, even though DOE will direct the lab through budget outlay guidance on what may be spent in a given year. Beyond that, Sandia officials can view their funding in different ways. In terms of sponsorship, DOE defense-related funding in fiscal year 1987 accounted for 60 percent of total operating funds, with other energy-related work accounting for between 9 and 10 percent. The remainder of Sandia's funds came from reimbursable work from outside organizations—the important category of "work for others."

Sandia's policies on work for others follow DOE guidelines. Briefly, Sandia will not undertake work if it interferes with DOE weapons programs. Even if resources are available, Sandia will not commence work unless it meets several criteria: The work must be of national and technical importance, match the lab's mission and capabilities, avoid competition with the private sector, and complement existing DOE programs with integrally related work. Where Sandia participates in reimbursable programs, it incorporates DOE's policy of full cost recovery. Sandia will seek to recover all costs including labor, direct charges, overhead (the lab charges the same rates to DOE and outside organizations), and general purpose equipment.

Like the other two weapons laboratories, Sandia also applies a surcharge-a tech base ''tax" on all work for others—that it uses to fund new, long-range research. At Sandia the tech base tax currently supports 70 people, most of whose work runs for up to 3 years. Note that this taxis only a portion of what Sandia spends on tech base work. According to DoD funding categories, approximately 8.4 percent of Sandia's 1988 budget went for 6.1 work and another 17.4 percent for 6.2, or exploratory development.[34] Thus, Sandia is effectively spending just over a quarter of its $1.1 billion budget on tech base-a far higher amount than any DoD laboratory or engineering center, save the Naval Research Laboratory, spends.

The major difference between DOE and DoD policy on work for others is that the DOE multiprogram laboratories consider it a normal and desirable part of their missions, while the latter does not. For DoD, work for others—primarily non-defense work for civilian agencies—is a distraction from the labs' missions and to be confined within narrow limits. For many years, DoD has had a policy of limiting such work to 3 percent of professional staff-years at individual laboratories. Since DoD labs are constrained by total personnel ceilings and are not allowed to keep revenues for work for others, any work done for external users comes directly at the expense of their DoD clients. At the DOE labs, by contrast, work for external agencies is much more open-ended: up to 20 percent of operating budget for Energy Research labs, and as much as 30 percent for the weapons labs.

This raises a fundamental question about the missions of the multiprogram labs: Why are they so eager to diversify? The easy answer is that as self-consciously "national" facilities, the laboratories regard diversification as an essential part of their mission. But there is more to it than that. These facilities have the preconditions for successful diversification. The first is the presence of second parties willing to sponsor a laboratory's venture into new fields, just as industry sponsored Sandia's work in drilling technologies, or Du Pent worked with Argonne National Laboratory on neutron diffraction studies of catalysts, or SDIO funded work at Los Alamos in directed-energy weapons.

Next, lab executives believe that while their organization's mission remains relevant, current programs do not exhaust the organization's capacity to carry it out. And not least, there are few institutional barriers to prevent laboratories from taking abroad view of their missions. Here, DOE has played an important part by its policy of permitting work for others, bringing in outside scientists and engineers for advice and joint ventures, and improving conditions for cooperative work. Indeed, the removal of obstacles may accomplish more than well-intentioned, but largely fruitless, efforts to stimulate two-party ventures.

This philosophy has implications for the defense tech base. As funding for nuclear weapons shrinks, DOE laboratory executives want to involve their organizations more closely in nonnuclear defense work. Diversification protects existing jobs and the ability to hire fresh graduates. Their laboratories, so their argument would run, are already working in these areas and have the experience to move into related fields. DoD funding for nonnuclear work is actually growing much faster than DOE funding is; at Lawrence Livermore, DOE funding between fiscal years 1982 and 1986 increased by 34 percent—

[34]Information supplied by Sandia budget and program officers.

a real annual growth rate of 1 percent—DoD funding, by 256 percent.[35]

The labs can bring their enormous resources to bear on the most important technical problems; their nondefense work often has defense applications; and much of the technology that the weapons labs have developed for SDI can be transferred to tactical battlefield problems. Further, the enormous computing power at the labs—Los Alamos alone has computer power equivalent to 60 Cray-ls—is a resource for expanding the defense tech base in a much more sophisticated way.

In sum, the DOE's multiprogram laboratories may serve as one (not "the") alternative model to facilities owned by the government and operated by its own employees. They have avoided the rigidity of government personnel classifications and much (though not all) of its regulatory apparatus, and they have benefited from DOE's level-of-effort funding. They have the critical mass to move on several fronts simultaneously—although their size, as will be seen, may be a double-edged sword. The final section of this chapter examines the relevance of the DOE's GOCO facilities, and comparable federally funded R&D centers, to the problems of military laboratories.

## SUMMARY AND CONCLUSIONS

Growing dissatisfaction with the operations of DoD labs has led to proposals that some of them convert to a GOCO status. In substance, this is what the DSB tentatively proposed for some labs in its 1987 summer study.[36] And in one sense, certain parts of DoD might accept such a transition. The Services have long relied on outside laboratories for sophisticated exploratory work. One thinks of the establishment of the Aerospace Corporation and Lincoln Laboratory as contract research centers for the Air Force, and the reluctance of the Navy's Strategic Systems Program Office to use naval laboratories in developing the Fleet Ballistic Missile in the 1950s and 1960s. Since the early 1970s, DoD in general and the Air Force in particular have moved to reduce the proportion of basic and exploratory research carried out by government employees, with the results noted in OTA's earlier Special Report on the Defense Technology Base.[37] To a degree, Service skepticism about the value of their own laboratories becomes a self-fulfilling prophecy.

The ultimate justification for converting a government facility to contractor operation is that it more effectively provides the government with a product or service, while ensuring that inherently governmental functions are carried out by civil servants. The remaining sections of this chapter weigh the virtues and drawbacks of this approach, in light of what is known about the operation of DOE's national laboratories.

Do **contractor-operated facilities have greater management flexibility than in-house** government facilities? What are the advantages and disadvantages, to the government and its operating contractors, of GOCO arrangements?

The evidence is unequivocal in personnel management but ambiguous elsewhere. Clearly, the DOE laboratories have much greater freedom than DoD facilities to hire directly from the universities, to pay salaries comparable to what industry and the universities pay for comparable positions, and to move people through the organization with relative freedom. Because the laboratories' personnel systems reflect those of their operating organizations, they tend to be less bureaucratic and more attuned to market conditions than the generality of government centers.

Some of this flexibility carries over into budgeting and program management. It should be noted that a significant portion of the labs' funding is for tech base work and that, within broad guidelines, much of their manpower is earmarked for work for others. Much of this work is, in a sense, diversification *within* the laboratory's primary mission, rather than *outside* it. Thus at Los Alamos a large proportion of work for others is sponsored by DoD, although some of it, as in laser technology, may have

35U.S. General Accounting Office, op. cit., footnote 28, p. 13.

36Defense Science Board, op. cit., footnote 1.

37U.S. Congress, Office of Technology Assessment, "Ch. 4—Managing Department of Defense Technology Base Programs," in *The Defense Technology Base: Introduction and Overview—A Special Report, OTA-* ISC-374 (Washington, DC: U.S. Government Printing Office, March 1988).

important commercial applications. There are also programs, like Lawrence Livermore's work on in *situ* coal gasification, which grew out of AEC research into the peaceful uses of nuclear explosives.

Clearly, the labs benefit from a management structure that enables the government to achieve its ends through a quasi-industrial system. What the operating contactors derive from this arrangement is less clear. At one extreme, AT&T, in running Sandia, and Du Pent, in operating the Savannah River Plant, are essentially working *pro bono.*[38] At the other, Martin Marietta is operating Oak Ridge National Laboratory for commercial reasons. It wants the award fee, it wants access to Oak Ridge personnel, and it wants access to technology—although Martin Marietta gains access to technology developed at Oak Ridge on terms no better than other corporations receive.

In an intermediate category are the labs operated by universities: Los Alamos, Lawrence Livermore and Lawrence Berkeley by the University of California; Argonne by the University of Chicago; and Brookhaven by Associated Universities, Inc. Although the University of California receives a management fee for operating its laboratories, this is not the main reason for the long-term relationship it has had with AEC and DOE. From the University's perspective, the laboratories enable it to do one of the things it exists to do-research. The laboratories offer matchless opportunities to do "big science, " to use unique facilities, and to develop research ideas. At some university-operated laboratories, a sizable number of professional staff hold joint appointments, while many graduate students take summer jobs that ultimately lead to full-time positions. In these and numerous other ways, the universities gain at least as much as they put into running the laboratories.

There are, however, three disadvantages to the GOCO arrangement as DOE has adopted it. The first, the sheer size of the Energy weapons laboratories, was not inherent in the GOCO status. Rather, it stemmed from the Atomic Energy Commissioners' decision to make the laboratories full-spectrum institutions tied to the production facilities. Although this arrangement worked well for many years, it became more and more difficult for management to stay intellectually on top of institutions of the size of the weapons labs. All of them have now placed their own ceilings on institutional size, although this owes as much to the constraints of Gramm-Rudman-Hollings, and the likelihood that arms negotiations will lead to major changes in programs, as it does to a belief that a given laboratory has reached its natural limit.

Another problem with GOCOs is a certain lack of accountability. True, the operations offices are supposed to oversee the labs and production facilities, but evidence is mounting that the oversight has not gone far enough. Perhaps the evidence is stronger at production facilities, like the problems with reactors and nuclear wastes at the Savannah River and Rocky Flats Plants, than at the laboratories themselves. Weapons labs like Lawrence Livermore and Los Alamos oversee each other to some extent; this competition does not exist in the production sector. What seems to have developed over many years is a relationship between the government and the operating contractor, with virtually no continuing external oversight since the demise of the congressional Joint Committee on Atomic Energy in the mid-1970s.

This leads to the third problem, the abdication of technical responsibility by the government. Because the AEC elected to contract out almost all of its technology development, it happened that virtually all of the scientific and engineering expertise resided in the laboratories, with the headquarters organization at a real disadvantage in evaluating the laboratories' technical programs. This did not mean that headquarters or the operations offices could not overrule something the labs wanted. They could—but for administrative, financial, and political reasons, not technical ones. Just as AEC turned over research and development to outside organizations, so it also turned over much of its evaluation to

[38] In light of Du Pont's decision to withdraw as operating contractor, the DOE has awarded a contract 10 Westinghouse to operate Savannah River when Du Pent's contract expires in 1989.

outside advisory panels. In this respect, DOE is a lineal descendant of the AEC.[39]

The experience of the DOE weapons laboratories confirms the thesis that "the technical capability to do something is often the trigger that causes the establishment of a national policy based upon that capability. "[40] This is true of the DOE weapons labs in a way that it is not of any DoD lab, except for the Naval Research Laboratory and a few engineering centers. And yet, because neither AEC nor DOE had any independent technical organization of their own, they had to defer to the labs on the technical merits of strategic weapons. It may well be that the development of many weapons programs or the creation of a civilian nuclear power industry would have occurred very differently had AEC sponsored an in-house organization to evaluate its contractors' proposals.

**Do GOCOs tend** to become more like government labs, since they face the same pressures to account for the use of public funds? To put it differently, do GOCOs develop analogs to Federal policies in acquisition, information management, and personnel, thus losing the flexibility that contractual status confers?

There does indeed seem to be a rule that, with time, contractor-operated and government-operated laboratories tend to become more like each other, because both are accountable for their use of public funds. In practice, no Federal agency has been willing or able to give its contractor-operated facilities complete independence to set policies within the framework of their missions, even when there were no specific regulations to prevent this. Nor does DOE's delegation of "inherently governmental functions" to the national laboratories contradict this. An agency can delegate those functions, while micromanaging its facilities in every other respect.

As asserted by the Deputy Comptroller General (quoted earlier), the government's position is that even when a contractor-operated facility is exempt from certain regulations, it must still comply with the "Federal norm. " For instance, the national labs may not be directly subject to the Federal Acquisition Regulation; indirectly, they comply with it through regulations that DOE, their prime sponsor, imposes, Again, independent centers like APL need special waivers exempting them from full and open competition; must be prepared to respond to outside audits from different agencies; and must fine-tune their accounting systems to reflect the separate types of appropriations from which their funding originates. All of this adds to administrative overhead and to the demands on technical staff to shield bench-level workers from government paperwork.

GOCO facilities react to these demands in several ways. One is to comply with the spirit of government policy without being bound by its letter. This is why some DOE labs voluntarily synopsize their procurements in the *Commerce Business Daily*, reserve procurements for small businesses, and try to limit the number of sole-source contract awards. Another approach is to justify a deviation from Federal policy for special reasons, as the Energy labs do when they apply for authorization to purchase supercomputers.

For all that is known about the GOCO facilities, it is surprisingly difficult to acquire quantitative information about their operations, partly because DOE laboratory contractors are reluctant to supply the information, and partly because DOE tends to treat it as proprietary. The little that is known suggests that the advantages of a GOCO operation may be overrated. True, at Los Alamos, according to a government source, the contract staff can annually handle some 45,000 small purchases—those under $5000----over the phone. However, anecdotal evidence suggests that lead times at some of the Energy labs are at least as great as those at the larger military labs, and in some cases greater. To the extent that this is true, a GOCO institution is no guarantee against micromanagement and the kind of inflexibility found in government organizations.

[39] Some observers have noted that DoD suffers from the same problem, in that [he headquarters organizations that sponsor the work of in-house laboratories may also lack the technical expertise to judge the performance of those labs. The difference is that DoD executives did not deliberately turn over almost all of the military laboratories and related R&D operations to outside organizations, as the Atomic Energy Commission did with its labs, which were contractor-operated from the start.

[40] Mark and Levine, op. cit., footnote 21, p. 221.

**How and** in what ways do GOCOs differ from government-operated laboratories in their ability to transfer the results of their 6.1,6.2, and 6.3 programs to user agencies?

Again, the GOCO DOE laboratories show a much greater ability to move from basic research down the spectrum of technology development. DOE GOCOs are closer to the ultimate application than DoD labs are. Specifically, the weapons labs' responsibility extends from basic research to the retirement of weapons in the national nuclear stockpile. As mentioned above, the labs are only part of a vertically integrated complex that extends from basic research through the production of weapons-grade materials to the assembly of the weapon itself. In DoD, by contrast, the process by which technical work at the laboratories eventuates in operating systems is much harder to trace.

The very depth of expertise at the DOE weapons laboratories has two notable effects. The first is their commitment to a substantial amount of basic research and advanced exploratory work. Where a DoD facility might do only enough exploratory research to keep abreast of technology—keeping, as it were, a window on the world—the national laboratories tend to be more aggressive. They can afford to be: Where expertise at a DoD lab might go to a depth of two or three persons, at the national labs it can encompass an entire branch working in leading-edge technologies. Second, weapons-related work and nondefense programs cannot be segregated in terms of research. There is a constant give-and-take in these areas that leads to new ideas and new applications. Thus, the Los Alamos Meson Physics Facility (LAMPF) was originally designed in 1967 for research into the structure of the atomic nucleus. That research led, a decade later, to the spinning off of a separate group, leading in turn to neutral particle beam work that became a core technology for SDI.

In sum, the national laboratories have the resources to develop aggressively their portion of the defense technology base. In their operating agreements, DOE specifically recognizes basic research as a function that needs no extraneous justification. Beyond that, the interplay of technologies, the respect the university community has for the laboratories, and the tech base tax that the labs place on work for others, give them a marked advantage over the DoD labs in technology development.

What mechanisms can both kinds of institutions use to diversify within their basic missions?

Because the DOE laboratories have construed their missions in the broadest way, they have managed to diversify within, rather than outside, those missions. A more fundamental difference between Energy and Defense laboratories is that the former consider such diversification an integral part of their missions. The latter have diversified in response to directives from organizations external to the laboratories-the Service commands or OSD. Thus, the Army Laboratory Command developed a strategy for investing in next-generation and "notional" systems; and the Air Force sponsored Project Forecast 11 as part of its tech base strategy. Much of the military's tech base work will occur outside its own laboratories, while the reverse is true for the DOE.

Given the capabilities of the DOE weapons labs, it would be surprising if their primary mission did not spill over into related areas. Siegfried Hecker, Director of the Los Alamos National Laboratory, has put it succinctly. At the weapons labs, "nondefense basic and applied work is done in an environment oriented toward national defense. Thus, multiple payoffs are common and occur quite naturally. While contributions are made to the solution of nondefense problems and significant additions are made to the international scientific knowledge base, considerations of potential defense applications of research results come as a natural by-product. "[41]

This approach has led the DOE laboratories to move increasingly into nonnuclear defense work. Although the DOE technology base developed separately from that of DoD, the two are converging. Here, too, Los Alamos has moved aggressively: applying (as mentioned before) LAMPF to the neutral particle beam program for SDI; working with the Army, the Marine Corps, and DARPA on the

[41] Sigfried Hecker, Los Alamos National Laboratory, "Review of Management of the Nation's Defense Technology Base, " testimony at hearings before the Subcommittee on Defense Industry and Technology, Senate Armed Services Committee, Mar. 18, 1988, p. 15.

armor/anti-armor program; and investigating the uses of free-electron lasers for ground- and space-based weapons. Given the Energy labs' computing power, they can apply sophisticated modeling to the problems they choose to attack.

If the experience of the DOE laboratories demonstrates anything, it is that the greater the depth of expertise, the greater the ability to apply it to problems pertinent to the organization's mission. Most DoD laboratories lack this ability to move quickly into new areas, first, because most military "laboratories" are really engineering centers; second, because their charters restrict their freedom of action in any case; and third, because they lack staff and facilities comparable to those of the national laboratories. It will take fundamental changes before DoD laboratories can make greater contributions to the defense technology base. Such changes could include closing some facilities, consolidating others into weapons development centers, or converting some laboratories to GOCO facilities. This third option is considered below.[42]

Can the relations of government laboratories to their sponsor agencies be placed on a quasi-contractual basis comparable to those of GOCOs? Are any government labs considering such arrangements?

It is possible to imagine an arrangement under which government laboratories could take on the flexibility of GOCOs while remaining government-operated. For the sake of argument, a laboratory could combine the China Lake personnel system with the freedom NIST has to seek support from Federal customers, an NIF-style funding scheme, and an approach like NASA's effort to turn over its support functions to contractors-in fact, just what the DSB had in mind when it recommended that DoD sponsor a laboratory management demonstration. An organization run along those lines would have a degree of freedom that few government facilities now enjoy.

But such incremental improvements might not go nearly far enough, The China Lake system does not make government salaries more competitive with those of the private sector. Demonstration projects rarely have unambiguous results; and as China Lake shows, they tend to remain insulated from other government establishments, perhaps out of fear that their example might metastasize through the system.

Similarly, NIST's freedom to take on work for other agencies or the standards community results from its unique mission to support the U.S. technical infrastructure. And the contracting-out of support services raises legal and political issues, such as how one distinguishes between services like running a cafeteria and providing scientific computing services, which is more mission-related. In other words, when do such services impinge on governmental functions? How can one avoid the on-site supervision by government employees of contractors, which is illegal? And how can an agency avoid the inefficiency of converting base operations, function by function? In any case, such hybrid facilities would remain bound by government policies in procurement and accounting that would attenuate the freedom gained in other areas.

A single-step conversion to GOCO status could avoid these problems while bringing others in their train. However, all the GOCO institutions described earlier have enjoyed that status since their inception. If a Defense laboratory were to convert to GOCO, it would be the first instance of an existing facility taking that route. Because it would be unprecedented, a changeover would be very complex. There would be numerous issues to be resolved along the way: changeovers in employee benefits, relations with the Office of Federal Contract Compliance Programs, the need to restructure its procurement authorities, and the like. But the main issue confronting such an institution would be the nature of its relationship with its sponsoring agency. Under the new arrangement, the laboratory might be operated by an industrial contractor, a university, or even the lab's senior managers acting as a corporate body.

Alternatively, a laboratory could elect a hybrid status-contracting out all support functions, while conducting R&D as a Federal entity. A few NASA facilities, like the Johnson Space Center, have adopted such a mixed system, with all support functions turned over to a prime base support contractor. This has several advantages: for example, the contractor has direct-hire authority for

[42] On the first two options, see ch. 7 below.

professional staff if their work falls within the contract's scope, and it can pay them market rates. But the legal questions—the demarcation between commercial and inherently governmental functions—remain exceptionally complex.

What kind of DoD laboratory is the best candidate for conversion to GOCO? While any federally operated laboratory would benefit from fewer restrictions on operations, it seems that only a certain kind of institution is a suitable candidate for GOCO status. It should already have a substantial investment in tech base work; it should be able to demonstrate that its operating problems cannot be solved by minor variances from regulations; and its importance to its DoD customers should be such that they have a stake in improving its operations. In this light, NRL and some of the larger naval R&D centers would appear to be suitable candidates for GOCO status.[43]

A military laboratory taking this route would have problems to resolve that the DOE laboratories have never faced. One would be determining the organization for which it would be working. It might be one of the Services, a Service command, or even OSD, as is the case with some FFRDCs. Another consideration is that such a conversion could well be irreversible. Because conversion to GOCO could not easily be undone, making the transition successfully would require a strong commitment on the part of laboratory employees as well as DoD. Conversion to GOCO could not occur without the full support of the relevant Service, as well as OSD.

Finally, in return for the benefits of GOCO, the laboratories would also give up something. The new status would mean weaker ties with Defense organizations, and perhaps a tendency on DoD's part to treat the reorganized institution as simply another contractor. Further, the preceding analysis of DOE laboratories suggests that the benefits from a GOCO operation tend to diminish over time. In short, everything would depend on the sponsor's willingness to give the laboratory the freedom to strike out in new directions, and to take on work for others that drew on its capabilities. Whatever organization assumed the operation of the laboratory would have to have specialized management skills that would justify turning the lab over to an outside contractor.

[43] On the circumstances that might justify conversion to GOCO, see ch. 7 below.