

# 14 Managing Defense Science and Technology in Today's Environment

**Anita Jones**

I want to start with a long perspective. The United States is between two eras in national security. The Cold War era is behind us, and we do not quite know what the essence of the next era will be. But we will know it when we see it. From the military point of view, we know that technology and its application will have changed. And we must prepare for that.

Andrew Marshall, who is responsible for planning and assessment in the Department of Defense (DoD), says that today is similar to the 1920s and 1930s, between World War I and World War II. During that time, nuclear weapons and ballistic missiles were being developed; communications platforms (particularly ground platforms) were knit together so they could be orchestrated in concert; and naval aviation was established.

If we are in a time like that, how must we press forward? This is a time to reconsider our agenda because what we are to do is never clear. We do not have crystal balls. In the 1920s, people argued about whether aviation would affect warfare. Today we look back on that with amusement.

This time between two eras is time to think, to invent, and to experiment. That implies doing some high-risk and long-term research, but we need to do that in this period. Some people lament, particularly in the Defense Department, that the United States does not have enough money to invest in as much research as some of us might like to see. The argument is that we must replace the aging systems. Although the United States is dominant in systems and military technology, this dominance

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is ours to lose. There is no law that guarantees that the United States will maintain technological dominance. A priority today is to prepare for the future. So we need to take action, particularly in this time that is not a time of crisis. We need to think, to invent, and to experiment.

Technological superiority remains an unquestioned premise for military planning. In the Cold War, technology enabled us to offset the larger numbers of forces that we might have faced from the former Soviet Union in a war of attrition. Now we need the technology that will protect the fighter in complex situations not entirely of our own management. These include urban situations in which you need to protect individuals in small units, and situations in which you cannot tell the difference between neutrals and potential adversaries or adversaries. We also need technology to combat terrorism. These are real challenges if, as the military assumes, we will have a technology-based advantage in the future. So this is a time to look forward to the kind of technologies that will make us the force we need to be.

The challenge to the research community is to find those technologies, as well as the advantages in a particular challenge. We need to find some new technology-based advantages that we can sustain for the U.S. military. Clearly the advantages we want are military advantages in this context. We have no lack of research to explore, and no lack of ideas. Research, development and acquisition (RDA) drives science and technology, as does opportunity, and opportunities abound. This is a very exciting time to be a researcher in science and engineering. The challenge is to decide in which of these technologies you can establish a sustainable military advantage, measured at least in years and preferably in decades. We have had decades of advantage in stealth, precision targeting, and night vision, and we used all of these to good effect in the Gulf War. Looking at what is going on in university research, we must decide what kinds of sustainable advantages we have the opportunity to achieve. That is the challenge.

Our present dominance, particularly in national security and technology, is a handicap because we lack a sense of urgency. It is a particularly difficult time to be managing Department of Defense science and technology programs. This is a time in which the services are rightly and deeply concerned with a budget to replace the aging systems. It is a time when even the definitions of the players in a military context are more fluid. In the Cold War, you could identify those nation states that were players. Today, military situations come from terrorism that is not necessarily born of the nation states. You can negotiate with nation

states, but not with terrorists. This makes for a more difficult arena, and it poses some different technology challenges.

The last challenge I would like to address involves how we thought in times past. We “thought stealth.” Science and technology was funded and essentially controlled by DoD, but today that is not the case. Many of the technologies of interest are predominately driven in the civil and commercial environment, even in the global environment. Certainly some of these technologies are funded by other agencies. The managers and the performers of science and technology in the agencies that serve national security now have a real challenge to monitor, to sample, and to react. They no longer have this almost unilateral control. It is a very different world and the processes have got to change.

I am co-chairing a study on defense science and technology. We are looking for not just the new technologies of the future but how the Department should do business so it can, for example, monitor, sample, and react when another nation surfaces a new idea. We are hoping that this will be a timely set of recommendations. We are also hoping that we can influence and help set the agenda for Secretary Donald Rumsfeld and the new DoD administration.

Budget issues also make it challenging to manage DoD science and technology today. We must pay attention to the fact that the DoD budget is decided by Congress. It is a placeholder budget. It lists numbers that are appropriated for FY 2001 plus 2.1 percent inflation. I spent over four years inside the Pentagon, during a time of declining DoD budgets. The pressure on the science and technology program was fierce. We are now in a time when the budget is rising slightly, but I remain vigilant. And yet today we still have no Undersecretary for Acquisition in Technology and no Director of Defense Research and Engineering (DDR&E).

The DDR&E's number one job is to justify and defend the science and technology program. There is a time when the budget is created outside the very well defined Planning, Programming and Budgeting System (PPBS) process. It is a very painful process to go through, but you know the timing. There is a time when the DDR&E can inject himself or herself. But this process is compressed and not necessarily entrenched in the bureaucracy, so I remain vigilant. I would not go so far as to “trust but verify.” I am nervous because I see no diminution in the Services' propensity to say, “We've got to cut science and technolo-

gy now because we've got to. But we can put it back later. We can come back to stability later."

The budget on the Hill looks like it will be somewhere around \$9 billion. But I suspect that it will come out shy of \$8 billion. That would be a nine percent decrease from last year's appropriation. But Congress has been very supportive of science and technology, including long-term basic research, and we may need to rely on them for this budget.

The Administration has sustained initiatives in the areas of information technology, nanoscale science and engineering, and the life sciences. In none of these three areas is DoD the lead player, but DoD is a major player and it has an opportunity. One thing that comes out of these initiatives is the resulting interagency cooperation by midlevel science and technology (S&T) planners, the people who make the decisions of what to fund, what partnerships to support, and what gets done.

I am concerned that we will have a decrease in the stability of funding. Universities have no alternative to the federal investment. There may be other agencies but they do not substitute well for one another. Educating someone at the graduate level is a commitment of five or six years (or more) and you cannot do that in a budget that fluctuates year by year. Stability is crucial.

I am likewise concerned about the balance of funding across different areas. The federal government has provided very healthy funding for the life sciences, which is now larger than the funding of most everything else. But we live in an interdisciplinary world. You cannot make progress in one field without concomitant progress in other fields. The pairing and matching is different in every case, but it is absolutely crucial.

My deepest concern on this balance issue is that in this country we have a very effective scheme in which we generally fund graduate students through their research projects. That means if the balance of funding in the different fields gets out of kilter, you then differentially produce students in different areas. For example, we are dramatically increasing the number of life science graduate students. If we continue on this path I foresee a shortfall in other areas. We need to increase what we are doing in engineering, physical sciences, and some other areas in order to maintain the balance we need for integrative science.

Today, biology Ph.D.'s, who in times past would have gone into professorial positions, cannot get university jobs. If they want to stay in university research they must put in seven to ten years of postdoctoral training as a right of passage before they even get into the university. At the same time, we see a decline in the production of graduate Ph.D.

and master's degrees in engineering. This imbalance is not just in research, but also in education.

I will conclude this point by citing the report of the Hart-Rudman Commission on National Security/21st Century, *Road Map for National Security: Imperative for Change*. (See Chapter 34 in this volume.) It said that nothing is so dangerous as not managing S&T to ensure that we have the human capital in science and engineering that we need in the future, particularly for national security.

The Bush Administration documents presented with the budget to Congress highlighted different categories for basic and applied research. One of these categories was research performed at congressional direction. By that they meant earmarks, but those kinds of earmarks that dictate the one site or the several sites at which some work is to be done. It is perfectly reasonable for Congress to authorize more work in general field X, but in this category Congress directs the work to be done at a particular site, thus circumventing merit competition to a great extent. The Bush Administration tells us that out of a basic and applied research budget of \$46 billion, \$2.2 billion is in this category. Fifty-four percent of that is in the Department of Defense science and technology budgets. It is not 6.1, 6.2 and 6.3, this is just 6.1, 6.2. The long-term investment from DoD is only 12 percent of basic and applied research. It is carrying this 56 percent of research performed at congressional direction.

This sidesteps one of the basic premises of doing the best science, which is competitive awarding to fund the most meritorious ideas that directly contribute to the quality of technology that will be delivered into the national security milieu and support armed forces in the future. We cannot afford to do this.

