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Working Within the New National Security Environment

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I have been asked countless times, in countless ways, during my 23 years of working at Lawrence Livermore National Laboratory, "just exactly what do you do there?" It is likely that none of these innumerable questions can compare to the question/comment posed by my father, rather tongue in cheek, when I decided to accept the offer from the Lab in 1977, upon completing my degree at MIT. "What, you're going to work at the 'bomb factory? Just what will you do there?" But in amongst those comments was a note of pride as well. After all, I hadn't sold out to the highest bidder, nor had I been forced to compromise my principles by working for a company I didn't respect. And, best of all I had the opportunity to not only do great science and work with world class scientists, but I was given the chance to work on projects and programs supporting US national security. As a side benefit, the Lab would send me to graduate school, and afforded me a great number of opportunities to work with my colleagues both inside and outside of government., domestically as well as internationally.

After 23 years, there was very little, until the last 18 months, to change these initial impressions. The programs I have been involved with have provided significant support, and I believe value, to promoting US national security. The scientists I have worked with have been among the best in the world and have come from throughout the world. Best of all, I personally have felt that the work I have been involved with was and is important, whether it was through the work we did support of the TTBT, JVE (which was one of the first opportunities many of us had to work with our colleagues in the FSU) and

CTBT, or as head of the Laboratory's education outreach programs, or as a science advisor for the State Department as part of the Science Centers Program, or through the exciting, and timely cutting edge projects that we have conducted at the Center for Global Security Research (CGSR). All of these opportunities blossomed successfully in an environment where excellence, teamwork, initiative, collaboration with our colleagues worldwide, and creativity were highly valued and encouraged, and trust, openness, flexibility and professionalism were the norm.

But things have changed. The cold war is ended, and the national labs, once highly valued for their contribution to US national security, are under regular attack. Mission's once well supported and clear, are now murky. Budget's remain uncertain, research and development funds have been cut to critically low levels and continue to fall under attack, negative publicity has become the rule rather than the exception, and staff are subjected to regular, and seemingly increasing draconian restrictions and regulations. Most painful of all for those of us who chose to work at the national labs because of our belief that we can do good science in support of US national security, are the accusations ranging from irresponsibility, to impropriety, and in the worst cases criminal intent. Our professionalism and professional integrity are questioned and it appears that there is a general belief that we cannot be trusted with our country's secrets. And yet I remain hopeful. I continue to believe that the national labs have a unique role to play by assembling multidisciplinary teams, and working in partnership with universities and industry, and their scientific colleagues both nationally and internationally, to develop scientific and technical solutions to issues of critical importance to US national security.

I am clearly not alone in my concern for this issue. There have been congressional hearings and this meeting hosted by the National Academy clearly highlights the issue. As previously highligted a recent study completed by former US representative Lee Hamilton and former senator Howard Baker for Secretary of Energy Richardson,, concluded "Once issues of management oversight give way to criminal investigation, and lab employees fear that committing a security error may expose them not just to management discipline but to prosecution and imprisonment, any hope that individuals will volunteer information that could reflect security lapses is annihilated." "Ultimately, they concluded, "This will erode both the security surrounding our nuclear secrets and the ability of independent oversight organizations to discover them."

The directors from Los Alamos, Livermore and Sandia at last months congressional hearing were emphatic in highlighted the need for focused national security work, comprised of excellent and challenging science as the cornerstone to attracting, recruiting and retaining the best and the brightest scientists at the nation's national laboratories. According to Los Alamos Director, John Browne, "To be able to get people to our laboratories, we need challenging science and technology programs. This is why people come to our laboratories. They can make more money elsewhere, perhaps in industry, but they come to the laboratories to do public service for the nation and the challenge is what they're looking for."

Scientific challenge however is not sufficient to attract and retain the excellent scientific staff however. At LLNL, the attrition rate among our scientists and engineers has tripled in the last couple of years, from 2 percent to about 7 percent. In computation, electrical engineering and other areas, the numbers are much higher, ranging between 15 and 20 percent. At Sandia the rate of job offer acceptance has plummeted from over 90 percent to 55 percent, and at all three labs the average age of the workforce has risen steadily in recent years. At LLNL exit interviews have been conducted and according to Deputy Director Jeff Wadworth, those leaving "don't see a strong commitment to the national security mission like they used to. They are worried about the completion of major scientific facilities. They are worried about foreign national issues, about R&D cuts and the increased bureaucracy. Where we need strategic help is in reaffirming the mission of the laboratories and we need to make sure we have flexibility in our work and R&D funding at appropriate levels. It is also important that the Laboratory remain a full member of the scientific community and can have appropriate interactions with scientists outside the Labs."

This is not to say that the critiques and concerns we face are without some merit. We do live in an increasingly technologic society and the diffusion of technology can indeed pose a risk to US national security, and ultimately global stability. Having said this, however this risk, has not been quantified, nor balanced against the inherent benefits of diffusion. Thus at CGSR we are taking a broad look at technology diffusion, where we are examining a wide number of pathways and mechanisms, to attempt to examine the ramifications, mitigate the risks, and maximize the benefits. This is a very broad and

unwieldy problem to tackle without boundary conditions. We are taking several critical pathways towards addressing this issue. Through our "Futures" program we are attempting to project approximately 15 years into the future: first assessing the technology-based threats against the US and our allies; secondly identifying the mitigating actions or technologies; and then finally discussing the technologies, and attempting to identify what is most uncertain, as well as how we can resolve this uncertainty.

However given the recent security constraints and rules, we felt it important to look at diffusion on a shorter time-scale than 15 years, attempting to define diffusion and then, through a focussed study, examine the impact using LLNL as a case study. We have assembled a group representing a wide range of disciplines, experiences and programs from throughout the Lab. We agreed that in the broadest definition technology diffusion refers to the flow of technology (including, but not limited to hardware, software, publications, as well as ideas, intellectual property, knowledge, scientific findings, etc.) either out of or through LLNL, both directly as well as indirectly. While we are fundamentally concerned with any negative impact to US national security that is a direct result of diffusion from the Laboratory, we all recognize that there are indirect pathways that could inadvertently lead to increased risk to US national security.

There is general consensus that the benefits from our interactions outside the Lab (both domestic and international, in a broad range of areas, including, but not limited to scientific, industrial, national security, good-will, openness, transparency, confidence building) outweigh the risks. However this has not been quantified, and quantification is

essential. A fundamental question for example is how do we ensure that we can maintain transparency and openness while still protecting critical information and technologies? We are also attempting to differentiate between perceived and actual risk. For example, while for the most part we agree that due to the recent visibility of this issue that the perceived risk is as real and in some ways much more troublesome that the actual risk (i.e., perception is reality when dealing with inquiries). This issue of increased "perceived" risk is most especially prominent with regard to interactions with sensitive countries. Additionally while each individual effort and restriction is evaluated individually, there is not a systematic evaluation of the activities and restrictions that allows us to claim incontrovertibly that we have the risks are fully minimized and the benefits fully maximized. Thus we have undertaken this effort to look at ourselves, our interactions, both formal and informal, as well as our collaborations, examine the value, and benefit as well as pursue ways in which we can leverage and maximize the benefits while minimizing the risks.

The number of interactions with sensitive counties have increased substantially since the fall of the former Soviet Union, due in large part to focussed government programs to limit the proliferation of materials, knowledge and misuse of facilities by countries of concern. In 1997, I did a small study looking at the scientific value of a subset of these interactions, specifically examining the Lab-to-Lab program, which continues to be a valuable program for building trust and cooperation with our colleagues in the FSU. With more than 250 responses from principal investigators (PIs) tallied, the findings were most illuminating. In general, the PIs reported satisfaction with the partnerships and felt

that US scientific knowledge was substantially advanced because of them. The general consensus was that were this work done in the US the costs would be nearly 12 times higher. Fewer than 10% of the respondents believed the projects were of little or no value to them. In addition, more than 40% of the PIs indicated in 1997 that they planned to continue their collaborations due to the highly successful nature of their work. In fact, even the 20% of respondents whose projects were completed successfully and were not being continued were satisfied with the outcomes. Many of these projects provided information or experimental results that allowed the LLNL programs, for a rather small investment, to investigate and evaluate alternative technologies or techniques and either incorporate them, or eliminate them as an option. Value was achieved through these investments, both scientifically as well as commercially. Though not all projects lead to commercialization, many of the Lab-to-Lab initiatives provided us enormous gain in other venues. In particular, many of these projects not only lead to experimental breakthroughs, but for a rather small investment provided us with a mechanism to explore new and/or alternative technologies and techniques without having to replicate facilities or expertise currently available in the FSU. Ultimately this synergistic relationship was valuable not only to the US research community, but to that in the FSU as well.

We are continuing this process of evaluation by examining two other possible pathways for diffusion: examining foreign interactions (both formal and informal); as well as through the spin-off and spin-on of technology breakthroughs. The examination of the latter pathway is only in it's initial stages, for example while many of the technology breakthroughs at LLNL have been a direct result of investment in the weapons program,

the spinoffs have been far reaching and have seen great commercial success in areas such as high performance computing, microsensor technology, biotechnology, and then these commercial successes have been brought back into the Laboratory and have spurred a new series of breakthroughs, in programs such as ASCI, Human Genome, laser optics, BW defense, and nonproliferation. I will not spend any more time on this today as this evaluation is in it's early phase, however suffice it to say that we believe the benefits to the Laboratory national security and science program of these spin-on, spin-off, spin-back efforts are significant and we will be pursuing more detailed examination of this in the months to come. Rather I will spend the remaining time discussing whether the benefits from our interactions (in a broad range of areas including, but not limited to scientific meetings and collaborations, national security programs, good-will efforts, programs for openness, transparency, and confidence building) out-weigh the potential associated risks.

In an absolute sense I am not sure how to quantify this. But I have begun by qualitatively examining the value of specific interactions, as well as examining the impact of the recent restrictions and oversight, both towards ensuring security, as well as limiting and discouraging the interactions. I have gathered information from a significant number of LLNL researchers over the last months and I will now discuss the preliminary findings.

The interactions range from informal, including occasional email contact, dinners and discussions at professional meetings, to more formal visits to facilities, as well as formal collaborations through Lab-to-Lab contracts (which I previously discussed), government

programs such as ISTC, IPP, and CTR, and finally formal bilateral and multilateral cooperation in support of arms control treaties. Almost universally, the respondents expressed support and enthusiasm for collaborations with foreign scientists. Indeed nearly all respondents felt these interactions were extremely valuable, not only scientifically, but as a mechanism for building trust and long term collaborations leading to advanced scientific breakthroughs, as well as an excellent way to promote broader political and scientific cooperation in support of US national security policy. Indeed one researcher stated that "The US will not be a leader in future nuclear energy development without knowledge of and involvement in the international arena. We cannot advance the non-proliferation agenda without engagement with foreign organizations."

Perhaps most telling of all are the responses from those collaborators involved in the most formal of the interactions. Universally the value of the interactions is recognized and the loss, if curtailed is best illustrated through the following comments "They have provided very valuable insights. They have had some very good ideas, which we hadn't considered and have approached some outstanding problems from a very different perspective."

Another collaborator stated "It is very difficult to put a measure to the value of repeated human interaction over a period of several years with the same group of people. I think the interactions we have had with the Russians on treaty implementation issues has really led to the development of an atmosphere of mutual respect and understanding. Rather

than being an adversary in implementing the treaty provisions, we have often found the RF representatives to be allies. This is probably the most important outcome of all."

Unfortunately since the inception of the new rules and regulations the enthusiasm for maintaining these interactions has waned. Many researchers felt "the government is discouraging these interactions", or that "the hassle factor is such that forming new relationships is not worth it", or that the support "from DOE and other federal institutions both financially and administratively for the work being performed has been less than ideal and in some cases counterproductive." Indeed one of the many researchers, who has been collaborating successfully with his colleagues in the FSU, on an effort where they have achieved a major scientific breakthrough that they are in the process of publishing stated that "The new rules make most meaningful scientific collaboration practically impossible. You cannot have true scientific collaborators that you cannot invite or visit. In addition - it is discouraging and demoralizing to be constantly presented with obstacles and road blocks."

More than one colleague lamented that the restrictions have become a major impediment to progress in his scientific program. Both he and his group have been actively working with colleagues from around the world, on projects ranging from informal sharing of scientific results, to more formal contracts and formal government-to-government collaboration for many years. Overall they praised the value of these interactions stating that "These are some of the brightest people in the world and we learn a great deal by working with them. These [interactions] have been invaluable. We have learned more

about the science and through their expertise they have helped to guide us as advisors, helping us decide which experiments would be most useful in furthering the science."

Yet this same group was most emphatic about the negative impact the new rules have had on, in particular, the informal collaborations. While they (as did many others) praised the enhanced security awareness training as a valuable mechanism to remind the Lab employees about the need to be vigilant in protecting national security information, they remain most disturbed that even benign interactions, for example inviting a foreign visitor to the Lab to present his/her scientific research, has become nearly impossible. Even meeting with these colleagues at an offsite facility (such as a hotel or restaurant) is nearly impossible, requiring the same level of approval as a Laboratory visit.

Nearly all respondents felt that the new rules have inhibited and in some cases severely damaged their current collaborations. Many of the respondents noted that it takes many years to establish these relationships and build trust, and with the inception of the new rules and restrictions, visits and travel have been cancelled, communication has been curtailed and this has significantly damaged otherwise healthy and productive relationships. Perhaps the most telling comment comes from a colleague who has been involved in collaborations for many years, who noted that the rules "have made a significant difference to myself and my colleagues here at the Lab. We feel highly repressed and discouraged as scientists."

I find this to be the most discouraging and disturbing outcome of all, and unfortunately do not find this to be an isolated response. While it is an extreme view, it is one me must address and consider seriously. Many of the respondents noted with concern that these controls and rules were especially discouraging for new staff and recruits, as both scientific advances and successful scientific support enhancing UC policy objectives are dependent upon strong collaborations and openness. Indeed one long time colleague lamented "We had a job candidate with a foreign national spouse who turned down our job offer feeling that the negative impacts would be too great." As we compete for the best and the brightest at our labs we can ill afford to ignore these issues.

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