

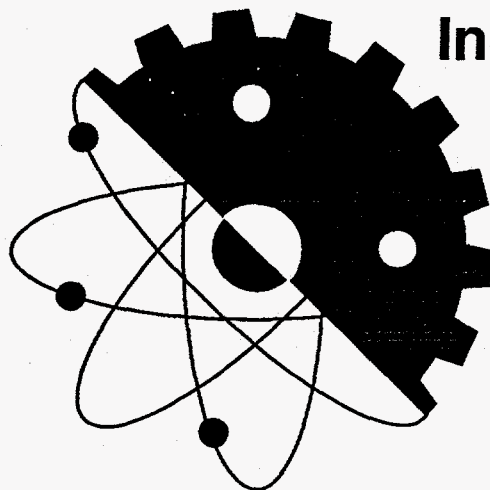
Title: FORGING STRATEGIC PARTNERSHIPS WITH INDUSTRY:  
THE INDUSTRIAL FELLOWS PROGRAM

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**Industrial Fellows  
Program**

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## **FORGING STRATEGIC PARTNERSHIPS WITH INDUSTRY: THE INDUSTRIAL FELLOWS PROGRAM**

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### **ABSTRACT**

Science, technology, and industrial policy are at an important nexus due to long developing trends in the national and international economy and recent events in national security affairs. The research and development assets built by the American taxpayer in response to the Cold War face a quest for relevance in the new era. National competitiveness in international markets has emerged as an important new priority. To better understand the perspective of US industry the management of the Los Alamos National Laboratory has initiated an Industrial Fellows Program which has placed six individuals at US corporations. Their goal is to create strategic partnerships through increased understanding of technical needs of industry and the technical capabilities of the Laboratory.

### **INTRODUCTION**

Evolutionary changes in the roots of economic competitiveness through technological innovation and

the rise of technological achievement in other countries have been a continuing motivation in the United States for enlightened science, technology, and industrial policy. A revolutionary change in national security

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<sup>8</sup> Dr. John Umbarger is a Los Alamos National Laboratory Industrial Fellow assigned to General Motors-AC Delco. In addition to being a well respected researcher, he has been a creative force in technology transfer at Los Alamos and in the State of New Mexico for many years.

<sup>9</sup> Dr. Mahlon Wilson is a Los Alamos National Laboratory Industrial Fellow assigned to the Association of American Railroads. He is an expert in many various technical fields.

affairs with the demise of the Soviet Union has brought the importance of these policies into sharp focus.

With the end of the Cold War many issues also confront science and technology assets so important in national laboratories. At the weapons laboratories of the DOE (Los Alamos, Livermore, and Sandia), this investment has created world renowned research teams in a wide array of basic and applied research fields and many unique research facilities including some of the most sophisticated computers available. The individuals at these laboratories are motivated by and tasked to accomplish issues and concerns of national importance. In this new era there is not a shortage of national concerns.

Among others, a new national concern has emerged--- global economic competitiveness. The terms economic competitiveness in the new global economy are commonly used to support a wide variety of policy and operational efforts relating to technology transfer. Yet what does "global economic competitiveness" truly mean?

An important economic problem in the United States is slow productivity growth. Slow productivity growth leads to an erosion of market position, a decline in the standard of living, a rise in income inequality, and an increase in the level of poverty. These are domestic problems, not international ones. These problems are associated with infrastructural change in the United States and above all in the education of our citizens. The only way a high-wage, high-tech workforce like that in the United States can continue to compete with overseas organizations is through productivity growth. Productivity growth can only be accelerated by significant and broad-based investment in education and research. The real route to economic competitiveness lies in increasing productivity growth through improvements in education at all levels and increased complementary research at our nation's universities, industries, and at the national laboratories.

The national laboratories have always maintained close connections with universities, and more distant relationships with industrial counterparts. In the emerging new era with productivity growth paramount,

that conflict. The American taxpayer has invested many hundreds of billions of dollars in building the research and development infrastructure at the nation's

these three members of the research effort in the United States must all become close partners in the enterprise.

In response to the policy issues, to the national concern with international economic competitiveness, and to the clear need to become closer partners with industrial researchers, the management at the Los Alamos National Laboratory has initiated the Industrial Fellows Program which places staff members at selected industries for a year or more. These individuals are charged with understanding the culture and technology needs of these industries and with imparting a knowledge of the capabilities of not only Los Alamos, but also of the other national laboratories in the DOE. The Industrial Fellows are also tasked with sharing their industry insight with their colleagues at the Laboratory.

In cooperation with the Industrial Research Institute whose membership represents companies that perform about 85% of R&D in the United States, the management at Los Alamos requested interested member corporations for their views on the value of placing a Los Alamos staff member at their corporation and if they were interested in such a program---the response was enthusiastic. The Los Alamos Industrial Fellows Program has placed six individuals at US industries as a result of this interaction. Their goal is to forge new industrial partnerships so that the American taxpayer and American industry can prosper, not just survive the coming decades.

After discussing the policy issues, the issues confronting industry and the national laboratories, and the strategic dimensions of industrial partnerships, we present in this article an overview of the Los Alamos Industrial Fellows Program and a brief account of the activities of the Fellows currently in the field. We conclude with an invitation to the research community at large to comment on our efforts so that we can strengthen and improve the Industrial Partnership Program.

## **POLICY ISSUES: SCIENCE TECHNOLOGY AND INDUSTRIAL**

Technological innovation is traditionally viewed as either a ladder process starting with basic research ending with manufacturing or a cycle process.[Gomory, 1990] Neither view in isolation is adequate to describe the competitive dimensions of the technological market place. Typically technological innovation is marked by periods of incrementalism and rapid product cycles punctuated with relatively brief episodes of truly revolutionary advances after which incrementalism reigns again. For the two decades of economic recovery fostered by the United States after 1945, all countries in the world assumed that major new ideas and innovations would come from the United States. Foreign firms became very good at incrementalism and product cycle planning. American firms simply wanted access to the foreign markets and planned to stay one step ahead. Most of our current science, technology, and industrial policy is based on this implicit business strategy. However, the pre-eminence of United States industry in dominance of world wide technology enjoyed during the early post WWII period has given way to more parity with countries that it aided in economic recovery during this era. This new parity in any number of economic indicators highlights concerns over United States weaknesses in R&D commitment. This weakness raises the possibility of the turning parity into superiority by Japan and Germany. Most of our current science, technology, and industrial policy is based on the dominance, not the parity model. Finally the global strategic posture of the United States is in flux. With the demise of the Soviet Union, the dissolution of the Warsaw pact, and the erosion of traditional political barriers in Europe and beyond, the national security underpinning for most of science and technology policy has disappeared [Bush, 1945]. Moreover, the overall defense budget will decrease reflecting the putative "peace dividend." These reductions will make United States defensive R&D investments less important nationally and internationally. However, technology leadership in defense will be increasingly more significant force in the expected encounters of the new era. The current science, technology, and industrial policy do not reflect these realities, yet they must.

Whereas the economic and political events of earlier eras that influenced science, technology, and industrial policy were evolutionary in nature, the Bush Administration saw a truly revolutionary event---the

demise of the Soviet Union. This single event has changed the underlying assumptions of United States defense planning.

The major components of the US defense budget will change as a result and most particularly the DoD support of R&D. It has been argued that support of technology is an important hedge against an uncertain future and support for R&D should expand. The tremendous successes of technological developments in the Gulf War of 1991 highlighted the veracity of this line of argument. Nevertheless, in the absence of an imminent threat of an East-West exchange, budgets will decrease.

The Bush Administration also saw the rise of new trading blocks and the general erosion of United States market share in the international economy as reflected in the trade deficit. The scale of the national debt also became an force in capital markets. These economic and political forces saw the rise of new initiatives in technology transfer again seeking to engage the assets of the government with industry in pursuit of economic competitiveness. The idea of dual-use technologies also arose in which a product has relevance to both defense and commercial markets. All departments and agencies of the government were directed to invest in technology transfer activities. This slowly emerged from continuous Congressional legislation in the 1980s, especially the Stevenson-Wydler Act of 1980, the Federal Technology Transfer Act of 1986, and the National Competitiveness Technology Transfer Act of 1989. However, the Bush Administration was insistent that significant government resources were not to be applied toward technologies aimed solely at economic competitiveness.

The Clinton Administration engaged in a return to more direct grants to industry through an expanded Technology Reinvestment Program (TRP) and the Advanced Technology Program (ATP). At the end of the 103rd Congress the first glimmerings of a new approach was emerging---Partnerships. In the Defense Appropriations Bill, the Department of Energy was directed to foster the exchange of staff to better understand the needs of industry and the capabilities of the DOE national laboratories. For the first time since the Kennedy Administration there was a recognition that the government should foster less of the government-push of technology assistance and more of an industry-pull orientation.

This brings us to the present. The TRP and ATP programs both are being curtailed and the balance

between market forces versus government intervention are being realigned. Regulation versus nurture is being argued in the context of government regulation role-back and cost-benefit issues and many of the Cold War assets are in search of relevance in the new world order. However, changes in science and technology policy are only a component in the true challenge to the United States in the coming decades---low productivity growth. Changes in macroeconomic policies, education, production methods and quality, and managerial abilities are also required.

Government support of the development of science and technology is not an entitlement program. The American public expects government-supported efforts in science and technology to be directly related to the needs of society. No longer is there wide spread confidence in the beneficial nature of unbounded scientific and technological development and the Nation's ability to mitigate any harmful side effects. The American Public has conveyed to Congress the message that government support for basic research, mission research, and industrial research must be incorporated in a coherent system responsive to their needs. This view harks back to the mid-1960's which saw the publication of Rachel Carson's *Silent Spring* in 1962 and Ralph Nader's *Unsafe at Any Speed* which criticized the earlier view of technology and linked unbounded science and technology development with corporate economic interests. This developing concern also has profound effects on science, technology, and industrial policy.

As these tensions in science, technology, and industrial policy are argued, one thing remains clear---United States Industry must play a role. If economic competitiveness is to be a major theme in formulating these policies, why not ask those organizations that are operationally responsible for such effects. The Industrial Fellows Program at Los Alamos National Laboratory is an effort to discover what industry wants from government R&D assets.

## INDUSTRIAL ISSUES

There are two major areas of industrial issues which are segmented along the line of the market---those industries that sell to the government and those that sell to the commercial sector. The economic forces that drive these two industry segments are very different in both degree and kind. Industries in the government sector are undergoing a significant consolidation incéntivized by the DoD and face reduced defense budgets and other government

expenditures. Industries in the commercial sector face increased overseas competition, and shorter product lifetimes requiring rapid innovation and commercialization.

The United States is a strong exporter of technology. US receipts for intellectual property from overseas excluding intracompany transfers were about four times the US payments in 1990 [Board of Economic Advisors, 1994]. This is essentially the same ration as in the 1970's. In many industries investments in the rapid commercialization of new technologies has been the key to retaining competitive advantage in the overseas markets. Moreover, the US manufacturing base is not declining as held by some studies. Manufacturing output has always been a relative constant fraction of total GNP since 1947. Except for market sectors involving tobacco manufacturers, leather products, primary metals, and motor vehicles and equipment the growth in real output has increased in all other categories of durable and non-durable goods [Board of Economic Advisors, 1994].

There is no broad based erosion of US industry's ability to compete effectively in international markets or to manufacture goods and market them internationally [Board of Economic Advisors, 1994]. Much of the concern over US competitiveness in the recent era arises from the US trade balance in manufactured goods. Macroeconomic forces in the 1980s had the largest impact in this area. The recent era has seen a decline in personal savings and an increase in consumption. Moreover, during the 1980s the dollar appreciated in value thus making US goods and services more expensive overseas and imports less expensive in the US. Nevertheless, consumer patterns both domestically and abroad changed permanently. Consumers world-wide have been exposed to less expensive and often higher quality products from sources other than United States manufacturers.

None of the macro or micro economic indicators point to significant erosion of US competitiveness. However, they do point to the increasing overseas capability to compete effectively with US manufacturers. There are many areas that need to be strengthened from technology creation, innovation and adoption to higher quality and a firmer grip on incremental improvements of existing products. This is a continuous spectrum of areas to which government support can contribute. The question again can be asked---why not ask industry how to contribute? The Los Alamos Industrial Fellows Program is an attempt to do just that.

## LOS ALAMOS NATIONAL LABORATORY ISSUES

An important issue at the Los Alamos National Laboratory is the quest for relevance in the new Post Cold War era. In the era of the Cold War one issue motivated everyone at Los Alamos and others in the national laboratories of the Department of Energy---enhancing national security through superiority in nuclear weapons technology. Achieving this primary mission required the laboratories to surround the central core of weapons design and test with the full array of other technical specialties required to fulfill that mission. Basic and applied research in many fields were required for excellence. It was commonplace at Los Alamos to address in very short order very large multidisciplinary projects. The idea of big science was invented at Los Alamos. The Manhattan Project was the first such enterprise in the world. These large, very complex, and high risk projects are where the labs excel. Los Alamos Director, Sigfried Hecker, believes that the laboratories will now "become truly *National Laboratories* by solving important societal problems using strong scientific underpinnings that provide fundamentally new information...become partners with US Industry by helping to extend the time and risk horizons of industrial research through technological innovation...(and) continue to pursue their central mission in national security" [Hecker, 1994].

The Los Alamos Industrial Fellows Program is an attempt to find out first hand where and how the DOE laboratories can contribute their technological resources in assisting industry in the commercialization and adoption of new technology.. However, there is a considerable challenge. These contributions to industry are usually provided at the end of a long-time research pipeline. For this to work requires the laboratories to have an over riding mission which fills the pipeline at the front end. Otherwise the pipeline is sure to go dry in the near future. Collaborating with industry is not a suitable primary mission for the laboratories because it does not allow for the creation of the relevant technology base. However, building technology partnerships with industry can be a strong and supporting mission for the laboratories.

The recent Galvin Report [Galvin, 1995] has emphasized that there is plenty to do in the original mission areas of the Labs--energy research and all the related specialties that surround that mission. In particular the report emphasizes -national security,

energy, environmental science and technology, and industrial technologies. The industrial technologies which it emphasizes are those that grow directly from the primary mission areas and not ones that are developed with the sole customer being private industry.

The relevance and importance of the Los Alamos Industrial Fellows Program is further highlighted by these recommendations. How better to understand what industry needs and what we can supply than by placing staff with industries which have technical needs in areas relating to Laboratory mission oriented research.

## THE INDUSTRIAL FELLOWS PROGRAM

Los Alamos National Laboratory, a Department of Energy (DOE) facility, initiated a new industrial collaboration program in FY95. The program resulted from discussions between Laboratory management and members of the Industrial Research Institute (IRI) regarding difficulties associated with technology utilization and cooperation between US industry and the DOE laboratories. The membership of IRI represents companies that perform over 85% of industrial R&D in the US. Industry felt that a major obstacle was the Laboratories' lack of understanding of the technical issues, business challenges, and major market drivers confronting the private sector. The IRI members challenged Los Alamos to address that obstacle and the result was the Industrial Fellows Program. Under the Industrial Fellows Program, Laboratory staff are assigned to selected industries for approximately twelve months. The long term goal is to construct strategic partnerships with private industry. In the short term, the program will allow Los Alamos to gain a better understanding of the technical issues and challenges confronting the company/industry and the host company will gain a better appreciation of the skills, talents and technologies available at the DOE laboratories.

For this pilot program, the IRI agreed to serve as a "broker" between the Laboratory and IRI member companies, facilitating the matching process between Laboratory staff and host companies. IRI notified its membership of the program, noting that "the purpose of this industrial partnership program is to provide LANL with a better understanding of industry's needs and thus be in a better position to couple its R&D capabilities with these needs through the establishment of close linkages through their technical managers." Several firms responded with proposals to host an

Industrial Fellow indicating their areas of technical interest. For the pilot FY95 program, 14 of these companies were selected for further consideration based on mutual benefit as indicated in their proposals. These 14 companies comprised the short-list of host firms. The short-list candidates were asked to complete a brief proposal providing further detail on their plan for utilizing a Fellow. In cooperation with IRI, an evaluation procedure was established and implemented. Key criteria for evaluation of the proposals were:-- 1). Match of firm's interests with Laboratory/DOE strategic directions; 2). Opportunity for Lab-Industry programs; 3). Interests of firm in addressing emerging technology areas; 4). Proposal indication of an understanding of the program (not a bench scientist, rather a broad view of industry direction; and 5). Correlation of firm's interest with a Laboratory area of expertise.

Managers of the Industrial Fellows Program met with each of the short-list firms to review assignment expectations, agreements regarding intellectual property, proprietary information, and mutual areas of technical interest. This further assured that the final selections would have the highest possibility for a successful outcome. These discussions and evaluations of the proposals were the basis for the selection of the host firms.

During this time, the Los Alamos Director, Sig Hecker, announced an internal competition for Los Alamos participants. Thirty-one staff entered the Lab-wide competition with qualifications compared to predefined criteria. In personal interviews candidates were evaluated and a short-list of 16 was created. Selection was based on the following weighted criteria:-- Management Experience (20%); Lab Overview (10%); Technical Qualifications (15%); Corporate Adaptability (15%); Relevant Work Experience (15%); Level of Interest (10%); and Long Term Lab Impact (15%). Resumes of these short-list candidates were provided to the selected host firms who requested up to three candidates for interviews. Final selection of the Industrial Fellows was based on input from the host firms, candidates, and Los Alamos.

A three week training seminar was required for each of the Fellows; to ensure they were familiar with Los Alamos and other DOE laboratories' expertise, State of New Mexico economic development activities, relevant processes and procedures, as well as the DOE's strategic direction for industrial interactions. Then the Fellows joined their host firms, generally located at corporate headquarters.

The Fellows work closely with each other and their Los Alamos support team. Constant communication allows them to share insight and address common concerns. Every three months they return to Los Alamos to brief Laboratory management and staff on their activities, to maintain and update their ties with the Laboratory, and to discuss issues, opportunities, and plans relative to the Industrial fellows Program. The Los Alamos support team communicates directly with the industry host to assure that any concerns are resolved with deliberate speed.

The program supports the Los Alamos and DOE desire to increase our contribution to US industry by concentrating on customer requirements and on core technical competencies. Los Alamos is especially interested in identifying ways to more effectively couple R&D capabilities with the needs of industry. The program also enhances the current efforts at Los Alamos to create a research and development environment in which quality principles, learned from the best in the business world, are made central to our operations (oh really??).

In addition to the firms who are hosting Fellows, discussions are ongoing with those firms who were not selected, to identify possible areas of collaboration and cooperation and to establish long-term relationships. The program endeavors to connect US industry with the DOE laboratory which can best meet the technical needs as defined by the company. This pilot program offers US industry, the laboratories, and the DOE a new and potentially valuable mechanism for communication and positive interaction.

The mission of the Los Alamos Industrial Fellows Program is to forge strategic partnerships with industry. The importance of being strategic rests with building long term relationships between the national labs and industry. In the coming decades US industry, US universities, and the national labs will all have to work collaboratively to maximize the output of the US research effort. Such an effort requires the development of a long term relationship in which the capabilities of each participant is clearly understood by all parties. Such understanding will arise from a clear perspective on the technological needs and capabilities of industry as well as the needs and capabilities of the national laboratories. The importance of industrial interactions is emphasized by Los Alamos Director, Sig Hecker, who says "At Los Alamos I view working with industry not as an option but as a business necessity. Working with industry allows us to stay



sharp technologically and to provide leverage for the federal research investment in our programs and institutions." [Hecker, 1995].

The Industrial Fellows Program has placed six individuals at US industries and one individual in a related activity with a consortium:-

Dr. Kay Adams is working with Allied Signal. She has participated in several Total Quality training sessions and discussed Allied Signal's technological needs with their Research and Technology business unit liaisons. While developing an understanding of Allied Signal's key business, she has been working toward three collaborations with the Defense Program Laboratories which will benefit potential Allied Signal products and DOE missions.

Dr. Ralph Castain is working with Eaton Corporation. At Eaton Ralph has spent several months becoming knowledgeable of the very diverse activities of the Corporation. Currently Ralph is touring several groups of individuals from Easton around Los Alamos. In the next few months Ralph will be developing several new areas of collaboration.

Dr. Michael V. Hynes is working at the Lockheed-Martin Corporation. The recent merger of Lockheed and Martin Marietta has created a new and very powerful force in industrial research. To date, Dr. Hynes' efforts have focused on building a portfolio of interactions from the technical staff level to the management level and from the rapid response consultation level to long term major projects level. He has focused on projects that Lockheed-Martin and the Laboratory can conduct jointly in a non-competitive environment through a teamed approach to government sponsors.

Dr. Virgil Sanders is working at the AMTEX industry program office. The AMTEX consortium is a three-way partnership between DOE, eleven national laboratories, and an integrated textile industry. The textile industry is integrated through four nonprofit, industry-government financed research institutions, and a university consortium. The textile industry is perhaps the best example of a US industry that must compete with offshore competition. This team effort focuses on long-range, high-risk, technically-complex industry objectives which can only be reached through the linking of capabilities of industry, universities, and the national laboratories. Over 100 companies are participating.

Dr. Richard Siemon is working at Dow Chemical on specifically fuel cell development. Dow felt that the only way he could gain an understanding of their unique culture was through hands-on bench work. To date he has been working on several bench-science projects and has hosted several visits of Dow Chemical personnel at Los Alamos.

Dr. John Umbarger is working at General Motors, Delphi Automotive Systems (formerly, AC Delco Systems). He has joined the Delphi National Technology Leveraging Program headed by Dr. Carl Miller who is also Chairman of the Engine Support Systems Technology (EEST) Consortium under USCAR and its Low Emissions Partnership (LEP). John is working at the heart of the PINGV/USCAR/EEST national laboratory CRADA agreement process and works daily with GM partners Ford and Chrysler as well as most of the other DOE national laboratories. John also works on GM/Delphi specific technology leveraging partnerships being established with the laboratories.

Dr. Mahlon Wilson is working at the Research and Test Department of the American Association of Railroads (AAR). He is becoming familiar with the research and testing interests and capability of the whole industry. To date he has toured the AAR laboratories in Chicago, IL, and Pueblo CO, as well as the railroad activities of the University of Illinois at Champaign-Urbana, Texas A&M University at College Station TX, and Pennsylvania State University Transportation Institute and Applied Research Laboratory at University Park, PA.

## SYNOPSIS

Through many approaches the government has sought effective mechanisms to work with industry in maintaining and enhancing economic competitiveness through technological hegemony.

Most of these efforts have been oriented as government technology-push. In our new Los Alamos Industrial Fellows Program we are attempting an industry-pull orientation by placing Laboratory technical staff with industries to better understand industrial needs and to communicate DOE laboratory capabilities. Although a Los Alamos Program, the fellows are fostering relationships for their host firms with other labs in the DOE complex. The detailed results to date indicate that this pooling of industry and Laboratory resources is an effective way to leverage the Nation's R&D investment.

The Industrial Fellows Program supports the partnership of the Laboratories and US Industry to benefit the country. This vision was articulated by President Clinton who stated during a 1993 visit to Los Alamos, "If we are going to march confidently into the 21st century, we will have to do it with the minds, the creativity, and the investment represented here in this Laboratory and in others like it around the country, and with the spirit of partnership between government and the private sector that pervades so many of the efforts now underway here."

We invite everyone in the technology transfer community to contact our Industrial Fellows Program Office for more details. We also invite your comments and suggestions to strengthen and improve the Industrial Fellows Program.

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