Working Together:
Transportation Opportunities for Technology Reinvestment

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Summary of Proceedings

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MEETING SUMMARY

On May 10, 1993, nearly 100 representatives of the major defense companies, federal agencies, national laboratories, universities, and state governments met at the U.S. Department of Transportation's Volpe National Transportation Systems Center, Cambridge, Massachusetts, to explore defense-conversion opportunities in transportation. Called "Working Together: Transportation Opportunities for Technology Reinvestment," the meeting was the first of several that the Volpe Center has planned for the Federal Highway Administration to support the Secretary of Transportation's policy initiatives.

Participants were invited to the Volpe Center meeting with a challenge: to consider ways in which the defense research and industrial sector could work with the Department to improve government–industry cooperation in transportation research and development (R&D). Specific questions asked the participants were

- What are the market challenges in commercial transportation applications of dual-use technologies?
- What are the institutional, organizational, and cultural barriers to cooperative R&D?
- What could be DOT's role in fostering technology partnerships?
- What are the potential roles of the national laboratories, defense industry, and universities in fostering transportation advances and innovations?

Dr. Richard John, Volpe Center director, opened the meeting with a discussion of Clinton–Gore Administration policy directions and a charge to the defense sector to work with DOT to meet the nation's transportation needs. He emphasized that now that some federal R&D funding is being shifted to the commercial sector, it is imperative that these resources be mobilized effectively to make U.S. industry more competitive and to advance the transportation system. Defense sector representatives on three panels responded to Dr. John's charge: a federal laboratories panel, an industry panel, and a partnership panel. The panel members' views on defense conversion, and potential opportunities in transportation, echoed a number of shared concerns:

The Federal Government Is No Longer the Customer for New Technology Applications

In the U.S. economy that is emerging, the federal government will no longer be the major purchaser of transportation technology. The market for new transportation goods and services is extremely diffuse and complex, with customers that include thousands of state and local governments, commercial companies that sell directly to consumers, and consumers themselves. Thus far, the major defense companies have had mixed success in commercial transportation markets.

A Long-Range Vision Is Needed for Reinvesting in Transportation

It is DOT's role to define the nation's long-term transportation needs. Though industry may be the best "driver" of technology in the short term, the Department must lay the groundwork for the future transportation system.

Institutions, Not Technologies, Are the Primary Barriers to Successful Defense Conversion

Culture clashes are a major impediment to R&D partnerships and defense conversion. Defense companies, the national laboratories, and universities often view themselves as competitors for the same scarce federal dollars — and not as collaborators. Compounding these conflicts is a defense-industry culture of risk intolerance and inexperience in the commercial market. Moreover, there is a realization that some consolidation within the industry may be unavoidable. The defense companies and laboratories that survive may very well be those with the best track record for teaming.

Defense Companies and Laboratories Should Focus on Their Core Competencies

There are natural roles for all participants in cooperative R&D efforts. A representative of a top defense laboratory suggested that universities were best suited to research; the national laboratories, to development; and industry, to production. An aerospace company executive offered that defense contractors are uniquely qualified for transportation projects that require complex system engineering. And several panel members emphasized that each company, laboratory, and university should determine its own core competencies that it might bring to transportation R&D.

INTRODUCTION

There's a reservoir of technologies with us now and on the horizon, which you all represent, which might indeed be used for transportation.

Richard John, Volpe National Transportation Systems Center

Issued February 22, the Clinton–Gore technology policy, *Technology for America's Economic Growth, A New Direction to Build Economic Strength*, calls for a restructuring of the U.S. economy that goes beyond converting the nation's defense industries. The Administration's aim is an economic conversion, in which growth is led by a robust, innovative commercial sector rather than by defense contracts. However, revitalizing the commercial sector requires a major shift in the way the government allocates resources for R&D. Since World War II, federal policy has been to support basic science and mission-oriented R&D, such as space and defense, leaving these investments to trickle down to civilian industry. Although that approach to commercial technology may have made sense in an earlier era, when U.S. firms dominated the world market, it is no longer adequate. As stated in the Clinton–Gore policy, today "We cannot rely on the serendipitous application of defense technology to the private sector" (p. 1).

The federal government spends about $75 billion a year on R&D; about 40 percent is spent on the civilian sector (Executive Office of the President, 1993). Under the Administration's technology policy, R&D resources formerly devoted to defense are being freed up for commercial technology programs and strategic research aimed at meeting critical national needs. One pressing need is for technologies that could improve the safety, reliability, capacity, and energy efficiency of the nation's transportation system. The Clinton–Gore policy specifically identifies the importance of transportation, calling for increased R&D in a number of technology areas. This reinvestment in transportation technology will play a crucial role in stimulating and sustaining an economy that is competitive, that creates high-quality jobs, and that preserves the environment.

Now that some R&D funding is being shifted to transportation, it is imperative that these resources be mobilized effectively. The transportation opportunities for defense conversion were explored by about 100 representatives of defense companies, federal agencies, national laboratories, universities, and state governments at a May 10, 1993, meeting, "Working Together: Transportation Opportunities for Technology Reinvestment." Held at DOT's Volpe National Transportation Systems Center, Cambridge, Massachusetts, the meeting was the first of several planned for the Federal Highway Administration to support the Secretary of Transportation's technology policy initiatives.

The purpose of the May 10 meeting was fourfold: to define the needs of the nation's transportation system; to identify key priorities, capabilities, and resources; to explore the promise of technologies to meet transportation needs; and to initiate partnerships to perform transportation R&D and commercialize dual-use technologies. Participants were invited to the

meeting with this challenge: to consider ways in which defense industries, national laboratories, universities, and state and local governments could work with the Department to improve cooperation in transportation R&D and speed up transportation applications of dual-use technologies.

Dr. Richard John, Volpe Center director, opened the meeting with a summary of new Administration policies and a charge to the defense sector to work with DOT to meet the nation's transportation challenges. Dr. John emphasized that the forces impacting transportation have given rise to a number of often conflicting goals and values. Balancing the demands for increased capacity, greater mobility, and environmental quality will require innovation and investment in transportation R&D. Cooperative efforts are needed to apply new technologies to improvements in such areas as transportation vehicles, operations, infrastructure, and simulation and modeling. In this regard, the national laboratories and the defense industry represent resources of immense potential benefit to transportation technology reinvestment (see Office of Technology Assessment, May 1993).

To respond to Dr. John's charge, defense sector representatives spoke on three panels: a federal laboratories panel, an industry panel, and a partnership panel. Panel members' views on defense conversion, and potential opportunities in transportation, are presented below. Following these sections is a summary of the two luncheon talks given at the meeting.

FEDERAL LABORATORIES PANEL

Panel Members

Moderator:	Michael Rosenberg, Arthur D. Little, Inc.
Speakers:	Basil Barna, Idaho National Engineering Laboratory Timothy Coffey, Naval Research Laboratory William Schertz, Argonne National Laboratory Gerold Yonas, Sandia National Laboratories
Commentators:	Michael Bronzini, Oak Ridge National Laboratory Leon Petrakis, Brookhaven National Laboratory Robert L. Phen, Jet Propulsion Laboratory Stein Weissenberger, Lawrence Livermore National Laboratory Jerry Welch, MIT Lincoln Laboratory

Background

We're facing a situation where the industry is going to drive the car, but the government is going to steer.

Gerold Yonas, Sandia National Laboratories

In diverse fields such as high-energy physics, waste management, nuclear physics, materials science, and aeronautics, the national laboratories provide unique research and test facilities used by universities, government, and industry. In many fields, researchers at federal laboratories are national leaders. There are 726 federal laboratories, ranging from the large, multiprogram laboratories of the Department of Energy to smaller single-mission facilities. Some of the largest are those owned or funded by the Department of Energy, NASA, National Institutes of Health, Department of Defense, or Department of Commerce (National Institute of Standards and Technology). The total budget for all laboratories is about $21 billion a year (Fulghum, 1993). The Department of Energy (Lewis, 1993) reports that its laboratories alone perform $6.6 billion worth of R&D annually, with a staff of about 60,000 scientists, engineers, and technicians.

Traditionally, the federal laboratories' role has been to perform basic and applied research for long-term, mission-oriented projects, particularly space, defense, and medicine. As the nation turns its attention from the Cold War to new challenges, opportunities exist for the laboratories to apply their diverse talents to a quite different problem: creating and sustaining a healthy, growing, and competitive U.S. economy.

As early as 1980, the Stevenson-Wydler Technology Innovation Act provided incentives for laboratories to form R&D partnerships with commercial firms. The Federal Technology Transfer Act of 1986, followed by the National Competitiveness Technology Transfer Act of 1989, directed the laboratories to form alliances with private companies in the form of Cooperative Research and Development Agreements, or CRADAs. A CRADA may be any agreement between one or more laboratories and one or more companies that calls for each side to contribute personnel, services, facilities, and equipment, on a cost-shared basis, toward specific R&D efforts. The only limitation is that while companies and some federal agencies can contribute funds to a project, the laboratories themselves cannot. It is expected that there will be more than 1,700 nondefense CRADAs by 1994 (Executive Office of the President, 1993).

The Clinton–Gore technology policy takes the requirements of the technology transfer acts one step further: It proposes that at least 10 to 20 percent of the total budgets of the national laboratories be devoted to cooperative R&D with commercial businesses. Moreover, bills recently introduced in both the House of Representatives (H.R. 1432) and the Senate (S-473) give the laboratories administrative authority to accelerate this process and broaden the scope of their missions.

Given the recent changes in the world, the Administration's charge to the federal laboratories poses a critical challenge: to broaden their scope to support new missions in industrial competitiveness and commercial technology, including transportation, while preserving their defense research capabilities. Key questions addressed by federal laboratory panelists at the Volpe Center meeting included the following:

- What is DOT's role in fostering technology partnerships?
- What is the role of the national laboratories in transportation advances and innovation?
- What do the laboratories see as the institutional, organizational, and cultural barriers to cooperative R&D?
- What technologies and research are the laboratories pursuing right now that have transportation applications?

Major Issues

DOT Needs a Vision of the Future

> **If the federal government really wants to do something...it's got somehow to define a focus of what it wants to do. You've got to take the responsibility for posing the problems and let people come in and bring in solutions, rather than having us bring in solutions that are looking for problems.**
>
> Timothy Coffey, Naval Research Laboratory

For the federal laboratories to contribute effectively to transportation technology reinvestment, they must be presented with a clear vision of the future transportation system. Though not all participants agreed that it is government's role to articulate that vision, many felt that the executive branch, namely DOT, should take the lead in defining the nation's long-term transportation needs. While industry may be the best "driver" of transportation technology in the short term, because the market will focus only on the immediate survival of companies, it is up to DOT to lay the groundwork for transportation in the future.

One panel member offered that a first step could be to divide the time horizon for system improvements over the next 15 years into three 5-year segments. DOT could then lay out a plan, or "technology road map," for each of these periods, setting goals, developing architectures, and estimating social and economic impacts. After defining the technology road maps, DOT could organize the laboratories and other participants, work with Congress to obtain funding for required programs, and manage the programs over time. However, it was

noted that, unlike planning for defense, transportation technology planning must consider the ever-changing, evolving demands of the marketplace. The process of defining national transportation needs must therefore involve as many stakeholders in the transportation system as possible.

Laboratories Must Match Up Core Competencies with Real Transportation Needs

> **As one pundit observed, we discovered from those early efforts that it was a lot easier to put a man on the moon than it was to solve urban mobility problems.**
>
> Michael Bronzini, Oak Ridge National Laboratory

As federal laboratories divert a portion of their resources from defense to transportation, their biggest challenge will be to find matches between their technological competencies and real transportation applications. As one panel member pointed out, the true test for the laboratories will be not to develop new technologies, but to match people and technologies with problems. This process will be complicated by the fact that most laboratory work in transportation will be market-driven — not government-funded. To respond effectively to the needs of the market, the laboratories must produce the technologies that industry — that is, the market — actually wants.

Several participants felt that there were natural, distinct roles for each of the participants in transportation R&D. A representative of one laboratory suggested that while universities were most suited for research and industry best equipped for production, the federal laboratories' natural role was technology development. He also suggested that laboratories could make the most substantial contribution to commercial R&D during its precompetitive phase, when the technical feasibility of technology applications is the principal issue. In this sense, the laboratories could bridge the gap between the immediate demands of the market and the long-term needs of the transportation system.

Yet another role for the national laboratories could be as an impetus, or catalyst, for the formation of large-scale development programs such as Sematech, the semiconductor technology consortium. One panel member suggested that, with their system engineering and technology integration capabilities, the laboratories could make vital contributions to these large-scale partnerships.

Laboratories Are Eager to Be Partners, but Barriers to Cooperation Remain

> **If we're going to have a defense capability in the country over the next 10 to 20 years, we have to break down these barriers and integrate the military and the civilian.**
>
> Gerold Yonas, Sandia National Laboratories

Encouraged by their management and by recent Administration policy, the federal laboratories are eagerly seeking to enter into partnerships with industry. However, a number of barriers, both internal and external, have hampered cooperation. Many participants felt that the major impediment to R&D partnerships was the "culture clash" that exists between the laboratories and defense companies. One panelist argued that a knee-jerk reaction of "turf protectionism" has prevented industry and the laboratories from working together: Instead of blending their talents to tackle major problems, companies and laboratories struggle independently to expand their work into limited new areas. Only by blending the laboratories' experience with the defense companies' enthusiasm, this panelist concluded, can the defense sector effectively meet today's challenges.

Another barrier to industry–laboratory cooperation may be a lack of interest on the part of some defense companies. One laboratory representative stated that, on the one hand, larger companies don't need the technologies resident in the laboratories, while, on the other, smaller ones can't afford the cost-sharing arrangements that would grant access to them. Poor communication, delays and difficulties in forming CRADAs, and a lack of public funding are yet other reasons why industry is often hesitant to enter into R&D partnerships with the laboratories.

Competition among the laboratories themselves also prohibits broader cooperation. One panel member said that it was difficult to distinguish the work of one laboratory from that of another and that, as a result, consolidation would be inevitable. Since the laboratories all possess the same technical capabilities, he argued, the ones that survive will be those with the most effective process for teamwork.

Technology Reinvestment in Transportation Is Already Under Way

Each of the panel members emphasized that the national laboratories are actively involved in technology reinvestment activities. The Department of Energy has designated a group of several laboratories to work on the "Clean Car Initiative": development of a no- or low-emission vehicle made of recyclable materials, built in the United States in an energy-efficient plant. Cooperative efforts are under way to develop technologies for Intelligent Vehicle Highway Systems (IVHS) and for the electric car. Numerous other transportation technology projects are ongoing, including maglev and high-speed rail; next-generation propulsion systems (fuel cells, advanced batteries); alternative fuels storage; vehicle recycling; advanced materials and manufacturing; environmental sensing; system modeling and simulation; nondestructive infrastructure evaluation; and human factors research.

INDUSTRY PANEL

Panel Members

Moderator:	Dennis Judycki, Federal Highway Administration
Speakers:	Robert Kohler, TRW Avionics and Surveillance Group Edward Locke, Thermotrex Edith Page, Bechtel Group, Inc.
Commentators:	Brian Etheridge, Martin Marietta Air Traffic Systems Richard Gran, Grumman Joseph Hoffman, Westinghouse Electric Harry Voccola, Lockheed

Background

From our perspective, how it really works is that the market steers. We have our foot in industry on the accelerator and the government has their foot on the brake.

Robert Kohler, TRW Avionics and Surveillance Group

Shifting some resources from defense to civilian uses ultimately will make it easier for the economy to grow and generate high-wage, high-skill jobs. But the downsizing of defense will not come about without some pain to the industry. For most of the 1980s, the Pentagon's budget grew an average of 5 percent a year, peaking in 1986 at $371 billion (Smith, 1993); since then, real military spending has fallen 26 percent — down to $276 billion for FY 1993. Deeper cuts are planned. As reported in *Fortune* (Perry, 1993), Booz Allen & Hamilton estimates that 75 to 80 percent of the top 100 defense companies or divisions that remain could be gone by 2000. From 1991 to 1997, an estimated 960,000 defense-related jobs will have been lost (Defense Conversion Commission, 1992).

The President's Defense Reinvestment and Conversion Initiative is aimed at easing the transition to a more civilian-oriented economy. The program distributes $1.4 billion that Congress appropriated last year for assistance to defense workers and companies. In terms of technology development, the program's emphasis is on three areas: commercial–military integration, dual-use technologies, and new commercial technology investments. As emphasized by the initiative, investing more in civilian technologies will create new opportunities for defense workers and firms, enhance U.S. competitiveness, and tackle unmet domestic needs.

However, of the three primary strategies that defense companies are pursuing in response to the downsizing — consolidating, increasing exports, and diversifying — diversification into commercial markets may be the most difficult. According to the Defense Conversion Commission's 1992 report, companies seeking to expand into nondefense markets perceive several barriers to diversification, many of them related to the differences between commercial and federal purchasing practices. Moreover, moving to the production of commercial goods and services means that defense companies must find new markets that are not yet saturated. Many firms see prospects for only a few growing markets and doubt their abilities to reach them.

Despite such obstacles, transportation is one sector that holds promise for defense companies looking for new markets. There is a long history of successful commercial transportation applications of defense technologies, including the jet engine and radar. Currently, two top aerospace manufacturers are teaming up to develop a high-technology train for Los Angeles County, while several companies are competing for Federal Transit Administration work to design a clean-bus prototype (Adam, 1992). The California Council on Science and Technology's Project California (1993) has identified six transportation technology areas wherein that state's businesses have notable capabilities: IVHS, telecommunications, mass transit, electric vehicles, fuel cells, and maglev. As quoted in *Fortune* (Smith, 1993), Project California head Malcolm Currie predicts that IVHS could employ up to 20,000 people in California alone. Other transportation markets that companies are pursuing are air traffic control, commercial radar and navigation, and flight control systems.

Many of the issues related to defense firms moving into commercial transportation were addressed by the industry panel. Some of the questions panelists considered were

- What are the market challenges in commercial transportation applications of dual-use technologies?
- What is the role of the defense industry in transportation technology development?
- From the defense industry's perspective, what are the barriers to greater government–industry cooperation?

Major Issues

Transportation Opportunities Will Be Market-Driven, Not Technology-Driven

We think solutions will sell, not technology.

Harry Voccola, Lockheed

For the defense industry panelists, market pull, not technology push, should be the principle guiding reinvestment in transportation technology. Technologies should be viewed as market enablers, they said, instead of market drivers. As one panelist put it, it will be the traveling public, and not the federal government, who will decide which technologies will be winners and which will be losers. Another went so far as to argue that companies find it "obnoxious" that the government would consider having any input at all as to which transportation technologies should be promoted in the commercial marketplace.

Because market needs are the force driving the development of new technologies, panelists said, getting products to market in a timely manner is critical to their commercial success. Companies will miss their mark should it take years to develop new products that the market needs immediately. For this reason, it was suggested, the most effective partnerships would be those in which the laboratories work on precompetitive technologies — leaving industry to draw on the technologies and turn them quickly into products.

Technology Is Not the Barrier to Going Commercial

> **I don't want to say that the aerospace community is a protected species relative to the commercial world. But in many respects, it is.**
>
> Brian Etheridge, Martin Marietta Air Traffic Systems

Defense industry participants were practically unanimous in their feeling that technology is not the bottleneck in defense conversion. Rather, they stressed that the biggest barrier was the difference in outlook between the defense and commercial sectors. As one panelist put it, "knowing how to do business with the United States government" was perhaps the greatest obstruction to going commercial. Several panel members pointed out that the accounting practices and controls that have evolved over many years within defense companies to accommodate government requirements put them at a competitive disadvantage in the commercial, nongovernment market. Compounding this problem, argued one participant, is the risk-averse management culture of the defense industries.

Panelists pointed out another crucial difference between defense and commercial work: While a defense contractor responds to Pentagon requests for bids on a product, a commercial company must go out and look for applications of its product in the market. Defense companies' lack of understanding of the commercial market, and of what is commercially viable, is another obstacle to successful defense conversion. One panelist felt that many of defense companies' earlier failures in the commercial market, particularly in transportation, could be attributed to their unwillingness to understand it. Instead of backing away from commercial ventures, he emphasized, companies should learn from their past mistakes and try again.

Competition Is an Obstacle to Partnerships

> **There is an unspoken agenda going on here between our friends from the national labs this morning and ourselves, and it is how do we all stay in business when in point of fact we all can't.**
>
> Robert Kohler, TRW Avionics and Surveillance Group

Competition within the defense industry and between the industry and the federal laboratories presents a major obstacle to R&D partnerships. One panel member stated that defense companies and laboratories view themselves as competitors for federal dollars — and not as collaborators. He argued that defense companies and laboratories will never be partners unless they recognize that they in fact compete with one another.

The competition that naturally exists among the defense companies themselves also makes partnerships problematic. Companies are reluctant to form partnerships because they fear sharing what they perceive to be their industrial secrets. One industry representative even contended that the Administration's emphasis on R&D consortia as a mechanism for defense conversion was "anti-American." Others stated that consortia are proving to be beneficial to participating companies, with Calstart — the California consortium of aerospace companies, high-technology firms, universities, public agencies, and labor groups — given as one example.

Defense Companies, Too, Must Find Their Core Competencies

Several panelists emphasized that building on core competencies is key to defense companies' success in commercial transportation: Companies should define their core capabilities and then apply them to market needs. One company executive offered that defense contractors are uniquely qualified for transportation projects requiring complex system engineering, such as IVHS and maglev. Another pointed out the expertise that many companies have in high-tech electronics and in information and communications technology. Other basic competencies that defense companies could bring to transportation R&D are command and control systems, remote sensing, and complicated modeling and simulation.

PARTNERSHIP PANEL

Panel Members

Moderator:	Dennis Murphy, U.S. Department of Transportation
Speakers:	Tom Chmura, University of Massachusetts David Herrelko, Wright Laboratory Patrick Larkin, Massachusetts Executive Office of Economic Affairs Frank Tokarz, Lawrence Livermore National Laboratory
Commentators:	Eli Gai, Charles Stark Draper Laboratory Jeffrey Grogan, The Monitor Company Joseph Sussman, Massachusetts Institute of Technology

Background

> **For us to accomplish our vision, we need to do that in partnership with industry, government, federal labs, and so on....That's the only way...to deal with the kind of challenges that we're all facing in this whole defense conversion area.**
>
> Tom Chmura, University of Massachusetts

The Clinton–Gore technology policy affirms the importance of cooperation in commercial R&D:

> The nation urgently needs improved strategies for government/industry cooperation in the support of industrial technology. These new approaches need not jeopardize agency missions: In many technology areas, missions of the agencies coincide with commercial interests or can be accomplished better through close cooperation with industry (p. 7).

To encourage government–industry cooperation in areas of mutual interest, the Administration will modify the ways that federal agencies do business. All federal support for technology development is being reviewed to make sure that research priorities are in line with industry's needs and that strategies for working with industry are consistent.

As proposed in the Clinton–Gore policy, "the fundamental mechanism for carrying out this new approach is the cost-shared R&D partnership between government and industry" (p. 8). All federal R&D agencies, including the laboratories, are being encouraged to act as

partners with industry wherever possible. Agencies are making it a priority to remove obstacles to CRADAs and to facilitate industry–laboratory cooperation through other means.

The cooperation of the entire defense research and industrial sector will be required to realize technology's full potential for improving the transportation system. Productive collaboration is needed among all levels of government, private industry, the national laboratories, and universities. Several partnerships in transportation technology have already been formed. Calstart, for example, is applying aerospace technologies to the electric car.

If industry, government, the laboratories, and universities are to cooperate successfully in transportation R&D, a number of pressing issues will need to be addressed. Questions discussed by participants on the partnership panel included

- In what ways can DOT support transportation technology partnerships, given that it commands just 1 percent of the federal R&D budget?
- What is the role of universities and state governments in transportation R&D?
- How can barriers to cooperation be overcome?

Major Issues

Partners Must Break Old Patterns

> **Like us, industry cannot continue to say, "I'm not changing what I'm doing. I'm just going to fight for my piece of the shrinking pie." It's really time to break the old patterns and do something new.**
>
> David Herrelko, Wright Laboratory

Participants on the partnership panel agreed that what's needed for successful economic conversion is not new technology, but new ways of working together. If the nation's transportation needs are to be met, technology partners must break old patterns and overcome obstacles to cooperation. The challenges of conversion are so great, panelists explained, that they are not likely to be met without strong working relationships among the defense industries, the national laboratories, universities, and all levels of government.

One laboratory representative on the panel emphasized the need for a proactive approach to technology reinvestment. It is "inefficient and stupid," he said, to rely on commercial spinoffs of existing military technologies. What is needed is a long-term commitment to the development of dual-use technologies that go beyond spinoffs. Moreover, he argued, laboratories and defense companies must move quickly to enter into R&D partnerships: "If you're here wondering if you want to get in the game, you're too late."

Technology Transfer Is Not Enough

> **Technology transfer is short-term....The big payoff is going to be on the grand challenges.**
>
> Frank Tokarz, Lawrence Livermore National Laboratory

As it moves into the commercial transportation arena, the defense sector will have needs far beyond the transfer of existing technologies. To commercialize successfully, defense industries will require marketing expertise, venture capital, financing, worker retraining and education, flexible CRADAs and other R&D partnerships, and effective industry–government communication. Commercialization also may require a change in the way that our society views the proper relationship between government and business.

One panelist suggested that a "grand challenge" in transportation is needed that would replace the Cold War as a motivating force for cooperation: a problem so great that neither government nor industry alone could solve it. Although CRADAs and technology transfer are short-term solutions to the problem of economic conversion, he argued, what is really needed is a long-term challenge defined by DOT. The role of industry, the national laboratories, and universities would be to work together to meet the Department's grand challenge.

Since DOT receives very little actual funding for R&D, the defense sector must identify alternative ways in which the Department can facilitate industry–laboratory collaboration in transportation technology. A DOT representative on the panel suggested that, in addition to articulating a vision for the future transportation system, the Department could become involved in an expert advisory capacity to help make that vision a reality.

States and Universities Have Important Roles to Play

> **Competition is a local phenomenon....It's a lot easier to effect change at the state level than it is at the federal level.**
>
> Jeffrey Grogan, The Monitor Company

For the participants on the partnership panel, the most important thing that state governments and universities can do to support technology reinvestment is to provide an environment for cooperation that allows their states' industries to be competitive.

A key role for state governments is to facilitate partnerships through information-sharing, financial backing, and the formation of regional technology alliances. States also can work with area financial institutions to enlist their support for ideas that companies want to introduce into the marketplace. One panel member noted that the Technology Reinvestment Project (TRP), administered by the Advanced Research Projects Agency, has created an excellent opportunity for states to support industry partnerships within their borders. For

example, the Commonwealth of Massachusetts has set up a Technology Development Partnering Program intended to give companies a competitive edge by providing matching grants to TRP proposers.

Panelists felt that universities could make both immediate and long-term contributions to transportation technology reinvestment. Worker education and retraining is, of course, their most pressing mission. But there are other ways in which universities could help to meet the defense sector's immediate needs, for instance, by participating in regional technology alliances, supporting extension centers, and offering other outreach services to public and private groups. Over the longer term, universities can contribute their expertise through joint research projects with federal laboratories and defense companies. It also will be the universities' role to create a skilled work force in emerging technology areas such as information management, environmental products and services, and advanced materials. However, as one panel member put it, universities will have an even more ambitious task: the creation of a "transportation literate society" that recognizes the importance of transportation to the nation.

LUNCHEON PRESENTATIONS

Speakers: Anthony Marolda, The Winbridge Group, Inc.
Christopher Coburn, Battelle Memorial Institute

Addressing the question "Is defense conversion possible?," Anthony Marolda answered "yes," but with some qualifications. Citing two national surveys conducted by The Winbridge Group, Marolda stated that many defense companies have already had success with commercializing technology. For example, of the 148 companies responding to a 1991 survey, 25 percent said that they had successfully commercialized a product. These companies felt that the key factors in their success were strong support from top management, a "commercializable" technology base, a well-balanced task force, and a differentiated product. However, Marolda cautioned that developing a nondefense business takes time: at least 2 to 3 years to bring a product to market and several more years before the product becomes a significant part of the company's total business. Moreover, he pointed out that only very rarely is a company able to convert from all-defense to all-commercial products.

Christopher Coburn talked about Project California's efforts to build a cluster of companies in that state with a competitive advantage in commercial transportation products. Following a detailed market analysis of 24 transportation technology areas, the consortium selected 6 to pursue aggressively: electric vehicles, IVHS technologies, telecommunications, mass transit rail system components, maglev, and fuel cells. As explained by Coburn, these technology areas are considered to be outstanding candidates for growth in California — both in terms of world market demand and of California's capabilities to be home to a strong cluster of companies to meet that demand. While other transportation-related businesses may

also be worthwhile, said Coburn, these six are the ones in which Project California state–industry partnerships could make the biggest impact.

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