

**Advanced Vehicle Development and State-Federal Cooperation:
A Study of Michigan and Indiana**

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EXECUTIVE SUMMARY

Innovation is the driving force behind technology-based economic development, and it is increasingly generated through partnerships and information networks. State and federal governments have an important role to play in cooperative technology programs that bring together and leverage the resources of government, university, industry, and non-governmental organizations.

The following paper looks at the Partnership for a New Generation of Vehicles (PNGV) and the United States Innovation Partnership (USIP), and identifies ways innovation can be promoted through state-federal cooperative technology programs. The impact of PNGV on the Great Lakes Region is examined through the examples of Michigan and Indiana. Currently, states have no coordinated way of preparing small to medium-sized manufacturers for rapid change, but through partnerships and information networks, states could find ways to help their manufacturing firms adapt. During the Clinton Administration, science, technology and engineering have been top issues and two programs that were initiated during the Clinton Administration include PNGV and USIP.

PNGV is a partnership between the United States Council for Automotive Research (USCAR); the Big Three (Chrysler, Ford, and General Motors); governmental labs; universities; and federal agencies aimed at developing 2004 prototype vehicles that will be three times more fuel efficient, and therefore cleaner, than today's mid-size sedans.

USIP's mission is to establish a new working relationship between the states and the federal government as an integral part of enhancing a national innovation system to promote economic growth. Its strategies include establishing strong government-industry-university partnerships; defining and expanding the role of states in the post-Cold War period; creating national excellence in manufacturing; and developing and commercializing new products and processes. All of these objectives can be met by assisting the Great Lakes Region with the changes due to PNGV and other advanced vehicle technology.

USIP should disseminate information to all the states affected (like Michigan and Indiana); establish federal-state-industry forums; create/utilize networks so that states are not left "out-of-the-loop" of information; and determine the compatibility between states' short-term goals and the federal government's long-term goals. USIP could provide assistance to states by determining the feasibility of new technologies moving to the Great Lakes Region; informing states about PNGV and other advanced vehicle technology projects; and encouraging states to meet with the Big Three, local auto manufacturers, and federal agencies to see what steps need to be taken to meet future goals and needs.

Long-term federal R&D policy should also encourage partnerships and state-federal cooperation. The Great Lakes Region will be able to survive changes due to advanced vehicle developments, but the cooperative technology programs, economic

initiatives, and collaboration need to begin now, and not when vehicle prototypes are coming off the assembly line in 2004. State-federal cooperation can help promote innovation and technology-based economic development while helping states and small to medium-sized businesses adapt to the rapid changes innovation brings.

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1 Issue Definition

Since 1993, the Partnership for a New Generation of Vehicles (PNGV) has promoted collaboration between industry and government on technological advances toward creating a more efficient and cleaner car. The Partnership is the result of joining the United States Council for Automotive Research (USCAR), the federal government, and the Big Three automakers (Chrysler, Ford, and General Motors) under the objective of advancing vehicle technology. By collaborating, cost and risk are reduced for all parties involved while ideas and new technology can be more readily exchanged¹. PNGV is showing some success: automotive technology is changing to make cleaner, more fuel efficient cars, and the Partnership has been proceeding very smoothly within its given timeline. By 2004, highly efficient prototype automobiles should be a reality. As PNGV moves forward, it is time to look at the outlying implications of advanced vehicle technology developments on the automotive manufacturing industry.

A key issue arising from PNGV is how certain states will be economically affected by large changes in automotive industry practices. In 1994, one out of seven Americans were employed by the automotive industry.² Almost every state in the U.S. has part of its economy dedicated to the auto industry, but the one area that has had a significant role in automotive manufacturing is the Great Lakes Region.³ PNGV, and the new vehicles that will be created because of it, will affect over 77 million people living in the Great Lakes Region either directly or indirectly. To date, the state governments in the Great Lakes Region have not had an active role in PNGV despite many local companies participating in some aspect of advanced vehicle development.

The major implication of PNGV is that states do not have any coordinated way of preparing small to medium-size manufacturers for large changes in the automotive industry. For example, the Office of Technology Policy (OTP) believes that the “effect on steel consumption [due to changes in the automotive industry] would be in

¹Branscomb, Lewis M. and Keller, James H., eds., Investing in Innovation: Creating a Research and Innovation Policy That Works, (Massachusetts: The MIT Press, 1998), 23.

²Sissine, Fred, *The Partnership for a New Generation of Vehicles (PNGV)*, (Congressional Research Service: Report for Congress, 28 February 1996).

³Note: Throughout this report references will be made to both the Great Lakes Region and the Midwest since they both include Michigan and Indiana. For clarification, the Great Lakes Region, as defined by the Council of Great Lakes Governors (CGLG), includes: Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin and the Midwest, as defined by the Federal Reserve Bank of Chicago (FRBC), includes: Illinois, Indiana, Iowa, Michigan, and Wisconsin.

the range of a few million tons per year.”⁴ Yet, this blanket statement does not specify if small, medium or large-size manufacturers would be most effected or even how such a number can be determined. Large manufacturers will likely be able to adapt to most changes in the auto industry, but small and medium-size manufacturers may have difficulty maintaining a stable overhead. While most of these small to medium-size manufacturers may not be directly affected for several years, they have not yet been given the means to prepare for a change that will inevitably come. As a result of the Rust Belt era of the 1970s and ‘80s when the economy in the Great Lakes Region fell into decline, many states have created technology partnerships and networks between manufacturers located within their borders. It is these same partnerships and networks that can be used to prepare automotive manufacturers for changes in the marketplace in the near future. The Great Lakes Region is benefiting from the United States’ current economic boom, but in order for that prosperity to continue, it must have the means to adapt to changes in the automotive industry.

By using the pre-established partnerships and networks of each state within the Great Lakes Region, information networks can be established so that advanced vehicle developments and trends in the automotive industry can be more readily reported. However, a larger partnership is needed to oversee this new network. This is where the United States Innovation Partnership (USIP) will be a useful tool. USIP is a little over a year old although there is a six year history of federal-state partnerships behind it. USIP is a partnership between the National Governors’ Association (NGA) and the White House that seeks to make information and technology readily available and distributed between the federal government and the states. Since PNGV is partially a federal government program that will affect the states in which the automotive industry is most prevalent, USIP can have a powerful role in disseminating much-needed information to those states that are located in the Great Lakes Region.

This paper will focus on state-federal cooperation and the economic impact of advanced vehicle development in the Great Lakes Region, looking specifically at Michigan and Indiana. The time is approaching when these states need to be informed about the status of PNGV and other advanced vehicle developments, so they can prepare their small, medium, and large-size manufacturers for the changes ahead. This new way of adapting to change differs from past methods where the federal government passed down information to the states by “pushing” change onto them after a decision had already been made. The states now have an opportunity to “pull” at the federal government for a “seat at the table” during discussions and to ask for economic and/or infrastructure assistance in order to adapt to changes in the automotive industry.⁵

⁴Cyert, R.M. and Fruehan, R.J., *Meeting the Challenge: U.S. Industry Faces the 21st Century, The Basic Steel Industry*, (Sloan Steel Industry Competitiveness Study by Carnegie Mellon University, U.S. Department of Commerce, Office of Technology Policy, December 1996), 48.

⁵Interview with Pat Flaherty, U.S. Department of Commerce, 19 June 1998.

2 Background

2.1 Automotive Industry and the United States

According to the American Automobile Manufacturers Association (AAMA), the automotive industry is the largest manufacturing employer in the United States. The Big Three employ 700,000 Americans with a payroll of \$35 billion. When suppliers and dealers are also included, the number rises to 2.3 million - covering 4000 facilities and 18,000 dealerships. The United States automotive industry contributes \$260 billion per year to the U.S. economy or 4% of the Gross Domestic Product (GDP).⁶ The following table outlines the amount of cars sold in the United States that are domestic-made versus imported for the first quarter of 1998.

Table 1 - Retail Sales at Seasonally Adjusted Annual Rates⁷

Vehicle Type	Motor Vehicle Industry Statistics - 1 st Quarter 1998		
	North American Built	Total Built	Market Share of the United States
Cars	6,488,000	7,833,000	59.8%
Trucks	6,856,000	7,440,000	82.0%

Sixty percent of the cars purchased and 82% of the trucks purchased in the first quarter of 1998 were manufactured in North America. This is less than one percent lower than the last year's first quarter purchases.⁸ Although these numbers do not reflect the amount of North American-built cars made by the Big Three and in the Midwest, they do indicate how dependent automotive sales are on domestic versus imported vehicles.

Of all the raw materials produced and sold in the United States, the U.S. auto industry buys the largest percentage of most of them.

Table 2 - Percentage of Raw Materials Purchased by U.S. Auto Industry⁹

Material	Percentage	Material	Percentage
Natural rubber	79%	Glass	25%
Synthetic rubber	57%	Zinc	23%
Machine tools	40%	Steel	15%
Iron	34%	Copper	11%

⁶"Key Facts About America's Car Companies: Employment," 1996, <<http://www.aama.com/economic/amerocar2.html>> (6 July 1998).

⁷"Summary Statistics," 1996, <<http://www.aama.com/data/statistics.html>> (6 July 1998).

⁸Ibid.

⁹"Key Facts About America's Car Companies: Purchasing and Investment," 1996, <<http://www.aama.com/economic/amerocar3.html>> (6 July 1998).

Aluminum	27%	Plastic	4%
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The demand on these raw materials will change drastically with the implementation of PNGV and other advanced vehicle technology. Some materials will become more important while others that may have been a staple industry for one or more of the Midwestern states could disappear. For example, with the inception of more advanced vehicle technology, steel and iron purchases could decrease because future cars need to be made with lighter materials. Therefore, aluminum and plastics could increase and a whole new “raw material” could enter the market: composites. These changes will hurt the Great Lakes Region, especially if small to medium-size manufacturers cannot produce the raw material that is most in demand.

2.2 Great Lakes Region/Midwest

2.2.1 Small to Medium-Size Manufacturers

2.2.1.1 Great Lakes Region

In response to the Rust Belt era of the 1970s and ‘80s, the Council of Great Lakes Governors (CGLG) was created in 1983. The governors from eight Great Lake Region states, with over 77 million residents, are represented. Those states are: Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin. In 1993, Carnegie Mellon University conducted a study entitled, *Reinventing the Heartland*, on the request of CGLG. The report identified “strategic areas in which collaboration among businesses and government leaders could accelerate the economic revitalization that had begun.”¹⁰ The committee behind *Reinventing the Heartland* conducted extensive research on the industrial make-up of the Great Lakes Region. Of particular importance was the determination of what percentage of the Great Lakes Region has small and medium-size manufacturers. As defined in the report, medium-size manufacturing firms have 50 to 499 employees.

Table 3 - Distribution of Great Lakes Firms by Size in 1993¹¹

Number of Employees	Great Lakes Region	United States Total	Region’s Share of U.S. Total
0-49	78,258	293,543	26.7%
Total Small	78,258	293,543	26.7%

¹⁰“North America’s High Performance Heartland,” 18 August 1997, <<http://www.cglg.org/pub/heartland/intro.html>> (9 June 1998).

¹¹H. John Heinz III School of Public Policy and Management, *Reinventing the Heartland: A High Performance Strategy for the Great Lakes Region*, (Carnegie Mellon University, 1993), 46.

Number of Employees	Great Lakes Region	United States Total	Region's Share of U.S. Total
50-99	9,132	30,832	29.6%
100-249	6,965	24,347	28.6%
250-499	2,469	8,799	28.1%
Total Medium	18,566	63,978	29.0%
500-999	953	3,679	25.9%
1,000 +	98,386	363,166	27.1%
Total Large	99,339	366,845	27.1%

According to *Reinventing the Heartland*, the distribution of small, medium and large-size manufacturers in 1993 was fairly even, between 26 and 29 percent of the U.S. total. Changes in the automotive industry will affect small and medium-size manufacturers more than large manufacturers due to their inability to adapt quickly to changes in industry's demands. In the Great Lakes Region, there are 96,824 small and medium-size manufacturers compared to 99,339 large-size manufacturers. Almost half (49.4%) of all manufacturers in the Great Lakes Region are small to medium-size manufacturers with under 499 employees. If small and medium-size manufacturers cannot adapt, there could be a significant lost of companies and jobs due to advanced vehicle technology developments.

2.2.1.2 Midwest

Like the CGLG, the Federal Reserve Bank of Chicago (FRBC) looks closely at economic developments in the Midwest which includes the states of Illinois, Indiana, Michigan, Ohio, and Wisconsin. The FRBC's 1996 report, *The Evolving Geography of Production - Is Manufacturing Activity Moving out of the Midwest? Evidence from the Auto Industry*, argued that the Midwest was not losing as much of the auto industry as had been predicted in the 1980s. FRBC came to this conclusion by looking at many different economic factors relating the Midwest to the auto industry, but one interesting piece of proof was found by looking at the auto part supplier plants and where they are located in the United States.

Table 4 - Percentage of Supplier Plants by Region and Type of Product²

Region	Engine	Cooling	Electrical	Drive	Brake	Body	Interior	Trim	Tires
Midwest	71%	38%	54%	63%	78%	66%	39%	64%	9%

¹²Rubenstein, James M., *The Evolving Geography of Production - Is Manufacturing Activity Moving out of the Midwest? Evidence from the Auto Industry*, (Miami University (Ohio), 13 February 1996), 10.

Region	Engine	Cooling	Electrical	Drive	Brake	Body	Interior	Trim	Tires
Southeast	13%	32%	31%	21%	22%	18%	33%	25%	74%
West	10%	18%	9%	8%	0%	9%	22%	4%	13%
Northeast	6%	13%	6%	7%	0%	7%	6%	7%	4%

The Midwest has the highest percentage of auto part suppliers in the United States in every industry except tires. This helped prove the FRBC's theory that the Midwest has not lost its position as a manufacturing hub. It also reveals how much the Midwest's economy is tied to the auto industry. If the Midwest is affected by changes in the automotive industry due to advanced vehicle developments, much of the manufacturing base, from small to large companies, in the U.S. could also be affected.

2.2.2 Current Economy

In the early 1980s, the Midwest became known as the Rust Belt due to its large decline in manufacturing and industry. Now, economists and the Federal Reserve Bank of Chicago state that the former Rust Belt is having its longest and most stable economic boom. Unemployment is down to some of the lowest rates in the United States. New companies are springing up and old companies are being re-invented through "[d]ramatic restructuring by firms, heavy capital investment and consequent rises in productivity."¹³ Many economists in the 1980s - some of the same individuals who now applaud the Midwest's success - never would have predicted this strong economy occurring only a decade later. Recognizing it would not survive economically, the Midwest started changing its industrial practices when the early 1980s recession subsided. It is now enjoying new-found prosperity. This gives hope to the belief that if the Midwest is given the chance to inform and educate its small and medium-size firms, it will again be able to perform a "Midwest Miracle" and prosper in an era of change in the automotive industry.

2.3 Focus States

2.3.1 Michigan

With 9.5 million residents, Michigan is the second largest state in the Midwest. When Michigan's automotive manufacturing industry is doing well, the rest of the Midwest's economy reflects it. The Big Three have their headquarters and many of their assembly plants located in Michigan. In 1996, 234 of the 881 (or 27%) of the motor vehicle component plants in the United States were located in Michigan.¹⁴ A total of 56 % of the 881 motor vehicle component plants are located in the Midwest

¹³"A Test of Mid-west Mettle," *The Economist*, 19 April 1997.

¹⁴Rubenstein, *The Evolving Geography of Production*, 6.

itself.¹⁵ Approximately 1.87 million cars and 1.24 million trucks are produced in Michigan per year. There are 1,870 automotive supply and motor vehicle and equipment manufacturing establishments in Michigan which employ 192,000 people.¹⁶

¹⁵Ibid.

¹⁶"The auto industry in Michigan," 1996, <<http://www.aama.com/economic/michigan.html>> (6 July 1998).

2.3.1.1 Business Improvement Programs

Michigan has benefited greatly from the recent economic growth in the United States. The unemployment rate in Michigan reached 4.1% in 1997 which was the lowest since 1969 and has been lower than the United States' unemployment rate since 1994.¹⁷ With low unemployment and a stable economy, Michigan's state government has been able to devote more time to creating programs to help those industries that have in the past been left to fend for themselves.

One successful program has been the Michigan Manufacturing Technology Center's Small Business Development Center (MMTC-SMDC). Small businesses with less than 20 employees can take advantage of the assistance that MMTC-SMDC offers, including planning for future changes in industry, improving manufacturing processes, and marketing products and services.¹⁸ Through this program, Michigan is able to help those companies that may not have the physical or financial means to deal with large changes in manufacturing and industry.

Another successful program has been the Renaissance Zones. There are 54 projects in eleven urban areas that are being sponsored privately to create up to 4,000 new jobs. Out of the 54 projects, six are related to the automotive industry.

Table 5 - 1997 Renaissance Zones¹⁹

Company	Industry	New Jobs	Investment
SBF Automotive	seat mechanisms for Ford	10 - 20	\$700,000
Delphi	auto supplier	0	\$150,000,000
Fab Tool	specialty tooling for auto industry	5 - 7	\$50,000
Paulstra CRC Corporation	auto component supplier	100 - 115	\$24,000,000
Gallade Technologies	automotive chassis components	30	\$9,000,000

Without private funding, the Renaissance Zones would not exist. State public-private partnerships help industries adapt to change by giving them the resources to educate their employees and update their facilities for new demands.

2.3.1.2 FutureCar Challenge

Michigan has also indirectly worked with USCAR and PNGV through the FutureCar Challenge. The FutureCar Challenge is sponsored by the Department of Energy (DOE) and USCAR. It is also sponsored by the National Science Foundation

¹⁷Engler Record 1991-1998, "Jobs and the Economy," (January 1998), 1-2.

¹⁸Small Business Development Center, n.d., <<http://www.iti.org/mmtc/sbdc.htm>> (22 July 1998).

¹⁹Engler Record, 6.

(NSF), Department of Commerce (DOC), Environmental Protection Agency (EPA), Natural Resources Canada, Aluminum Association, and the American Iron and Steel Institute. "The primary objectives are to provide opportunities for universities and engineering students to join the national challenge to develop fuel-efficient technologies and, at the same time, create a valuable pool of future engineers with hands-on experience in advanced automotive technologies."²⁰ In 1998, three Michigan universities participated in the FutureCar Challenge: Michigan Technology University, Lawrence Technological University, and the University of Michigan at Ann Arbor. Lawrence Technological University and Michigan Technology University won third and fourth place respectively. All three of these universities received their financial and technological support from engineering, science and technology companies throughout the Midwest.

2.3.2 Indiana

There are 5.75 million people in Indiana, making it one of the smaller states in the Midwest. Like Michigan, Indiana's economy has been doing very well during the 1990s. Its unemployment rate was 3.1% in May of 1997; almost 2% lower than the United States' unemployment rate. In 1996, 11% of the 881 motor vehicle component plants in the United States were located in Indiana. There are 81,000 cars and 330,500 trucks produced in Indiana per year. There are 1,300 automotive supply and motor vehicle and equipment manufacturing establishments in Indiana which employ 81,200 people.²¹ Although Indiana is less reliant on the automotive industry than Michigan, future changes will still greatly affect Indiana's manufacturing economy.

Indiana has a large amount of small-size manufacturers. There are over 10,000 manufacturers in Indiana and 84% have fewer than 100 employees while 37% have fewer than ten. Less than 2% of the 10,000 manufacturers have more than 500 workers.²² Indiana's small-size industries will be the most affected by large changes in vehicle development and will also have the hardest time adapting.

2.3.2.1 Business Improvement Programs

Like Michigan, Indiana has been working towards helping its manufacturing industries. One program is the Indiana Business Modernization and Technology Corporation (BMT). It has Manufacturing Extension Centers that are used as a networking system in order to send out information to various industries. It also helps to disseminate information on issues such as the Clean Air Act or other environmental laws that might require changes in manufacturing processes. BMT could be a useful

²⁰"About the FutureCar Challenge," n.d., <<http://members.aol.com/FuturCar/about.html>> (31 July 1998).

²¹"The auto industry in Indiana," 1996, <<http://www.aama.com/economic/indiana.html>> (6 July 1998).

²²Indiana Business Modernization and Technology Corporation, 1997, <<http://www.bmtadvantage.org/addlserv.htm>> (6 July 1998).

tool for Indiana’s industries when PNGV and other advanced vehicle development information is released.

Indiana has been successful in retaining large-size businesses and attracting new ones within the last couple of years. There is no structured program like Michigan’s Renaissance Zones, but new jobs are being created by encouraging large industry to invest in modernization, expansion, and education.

Table 6 - 1997 New Job Creation in Indiana²³

Company	New Jobs	Investment
Chrysler Corporation	800	N/A
Heartland Steel	175	\$200,000,000
Visteon (Ford Motor Company)	256	\$111,000,000

These large-size business will help keep the small-size businesses that are the basis of Indiana’s economy afloat. If large-size businesses are retaining their employee base or even expanding, small-businesses will see a larger demand for their products and services.

2.4 Federal Government

2.4.1 Clinton Administration Policies

Since taking office, the Clinton administration has been very supportive of science and technology. In 1993, President Clinton established the National Science and Technology Council (NSTC). The NSTC helps to establish clear goals for investment and research in new science, technology, and engineering initiatives. When the Republican majority 104th Congress came into office in 1994, it was feared that research and development (R&D) spending would be frozen. Many of the members of Congress were against an increase in R&D spending, calling it “corporate welfare.”²⁴ Yet the 105th Congress, elected in 1996, seems to have a different view of R&D spending. As the Washington Post reported in June 1998, “House Speaker Newt Gingrich (R-GA) has vowed to double science founding over eight years...that would boost funding from almost \$16 billion to \$32 billion” a year.²⁵ There is now a bi-partisan consensus on the importance of federal investment in research an development.

2.4.2 Partnership for a New Generation of Vehicles

²³“A Strong Economy: The Record,” n.d., <<http://www.ai.org/gov/sos/5.htm>> (22 June 1998).

²⁴Branscomb et al., *Investing in Innovation*, 5.

²⁵Eilperin, Juliet. “The Reappropriator,” *The Washington Post*, The Federal Page, 18 June 1998.

The Partnership for a New Generation of Vehicles (PNGV) was formed in 1993 from three major groups: the U.S. Council for Automotive Research (USCAR) which includes the Big Three car manufacturers of Chrysler, Ford, and General Motors; seven federal agencies, including the Department of Commerce (DOC), Department of Defense (DOD), Department of Energy (DOE), Department of Transportation (DOT), Environmental Protection Agency (EPA), National Aeronautics and Space Administration (NASA), and National Science Foundation (NSF); and a third group, including universities, federal labs, and small manufacturers. Its goal is to develop a vehicle that is three times more fuel efficient than the current mid-size sedans, such as the Ford Taurus. These new vehicles would have to maintain the same relative size, comfort, cost, and safety as the current automobiles in service in the United States.

The project goals established in the 1995 PNGV Program Plan included the following:

Goal 1: Significantly improve national competitiveness in manufacturing for a future generation of vehicles.

The United States' manufacturing processes need to be modernized and made more efficient so that resources and funding are properly used. Ways also need to be found to make manufacturing processes more environmentally sound.

Goal 2: Implement commercially viable innovations from ongoing research in conventional vehicles.

Look at technology that will increase fuel efficiency and reduce toxic emissions while maintaining the current comfort and safety levels of today's cars, and implement this technology as soon as it is economically possible to do so.

Goal 3: Develop vehicles to achieve up to three times the fuel efficiency of comparable 1994 family sedans.

Increase fuel efficiency to three times the level of a 1994 Concorde, Taurus, or Lumina while maintaining an equivalent low-level cost.²⁶

PNGV plans to have concept vehicles by 2000 and production prototypes by 2004. By 1997, PNGV was supposed to have narrowed down what technology would best suit the three goals outlined above. Instead, PNGV narrowed down those technologies that have the highest potential for concept and prototype vehicles. Some of these technologies have the potential for meeting PNGV's goals but are not feasible within the current timeline. If a technology is developed after the first prototype is used, it will try to be added to secondary prototypes if it improves efficiency with little additional cost. Therefore, few advanced vehicle technology developments have been absolutely eliminated: it all depends on timing and cost.

²⁶*PNGV Program Plan*, 29 November 1995, 3-1 to 5-1.

Table 7 - Most Promising Technologies Selected by PNGV in 1997²⁷

Category	Technical Area and/or Technology
Power trains	Parallel hybrid electric drive
Energy converters	Compression ignition direct injection (CIDI) engine Fuel cells
Energy storage	Nickel metal hydride batteries Lithium batteries
Emission controls	Lean NO _x catalyst Exhaust gas recirculation Particulate traps
Fuels	Fuel with less than 50 ppm sulfur Fischer-Tropsch fuel Dimethyl ether fuel
Electrical systems and electronics	Induction, reluctance, permanent magnet motors Power electronic building block (PEBB), insulated gate bipolar transistor (IGBT), metal oxide semiconductor field effect transistor (MOSFET), metal oxide semiconductor (MOS) controlled thyristor (MCT) semiconductors Ultracapacitors
Materials	Aluminum and/or reinforced polymer body-in-white
Reduced energy losses	Low rolling resistance tires Reduced heating, ventilation, and air conditioning (HVAC) requirements and more efficient components

This extensive table is the result of four years of research and development (R&D). A list of approximately fifty different types of technology was narrowed down based on cost and production feasibility. The final concept cars of 2004 may see even fewer of these technologies as a part of their components. Most of the technology is so new that there is no industry yet created to produce it. If small to medium-size manufacturers cannot change their plants to make one of these technologies, they will be left out of the next generation of vehicle production.

²⁷National Research Council, *Review of the Research Program of the Partnership for a New Generation of Vehicles*, (4th Report, 1998), 6.

2.5 State-Federal Cooperation

2.5.1 History of State-Federal Partnerships

The United States Innovation Partnership (USIP) was officially established with a 1997 memorandum of understanding between the National Governors Association (NGA), the White House Office of Science and Technology Policy (OSTP), and the U.S. Department of Commerce (DOC). USIP is creating a new “national” innovation system - one that focuses more towards domestic concerns than defense. There is a extensive history that led to its final inception.

When President Nixon addressed Congress in 1972, he called for “new ‘partnerships’ between federal institutions, private industry, state and local governments, universities, and research organizations to adapt R&D to civilian needs” in order to “improve the Nation’s economy and its quality of life.”²⁸ Through the 1980s, most of the state-federal relationships were technology transfer from the federal departments (such as the Department of Defense) to the states’ industries. Yet, beginning in the 1980s, governors of various manufacturing states realized that their industries needed to be modernized in order to remain competitive. These states began to create partnerships that joined state governments, industry, and universities.²⁹ With the end of the Cold War, the federal government began to focus more on state-federal partnerships where there could be an exchange of technology rather than simply a “spin-off” of defense research.

In 1992, the Carnegie Commission on Science, Technology, and Government released a report entitled *Science, Technology, and the States in America’s Third Century*. This report outlined three major trends:

1. Growth in national importance of science and technology
2. Increased strength of the states in managing science and technology
3. End of the Cold War and release of resources once devoted to defense³⁰

From the Carnegie Commission’s Report, the State-Federal Technology Partnership and Task Force were formed. The Partnership began holding colloquiums in 1993 in order to bring federal officials and governors to one table. The American Society of Mechanical Engineers (ASME) has been a major contributor to these colloquiums, conferences and forums as a non-governmental organization (NGO) that can sit at the table and give additional perspectives. A product of the Partnership was a 1995 book entitled Partnerships: A Compendium of State and Federal Cooperative Technology Programs profiling all of the various cooperative technology programs in all 50 states as well as research and development initiatives in federal agencies. Partnerships

²⁸Schact, Wendy H. *Technology Development: Federal-State Issues* , (Congressional Research Service: Report for Congress, 22 November 1996).

²⁹The State-Federal Technology Partnership Task Force, Final Report, 5 September 1995, 6.

³⁰Carnegie Commission on Science,Technology, and Government. *Science, Technology, and the States in America’s Third Century*, September 1992, 9.

outlined the wide variety of state-industry partnerships existing in the United States and further showed that there was a demand for the federal government to be involved in some if not all of the these programs and initiatives.

3 Key Concerns

3.1 “Midwest Miracle”

Site Selection, the official publication of the International Development Research Council (IDRC), included both Michigan and Indiana in its February 1998 top ten list for having the largest number of new or expanded factories in the United States. Michigan ranked at the very top with 1,285 new or expanded factories while Indiana came in ninth place with 345.³¹ The Midwest also continues to have low unemployment rates. With so many signs pointing to the Midwest’s economic growth and stability, it might seem inappropriate to say that in the near future all of this could be lost due to a large and unplanned-for change in the automotive industry. Yet, this is the best time to approach a future issue such as advanced vehicle development. If change begins now, the Midwest will have more opportunities to adapt and more options to choose from. In order to begin to assess how the Midwest will adapt to advance vehicle technology and its implications, it is necessary to look at how the Midwest has reacted to other industry changes in the past.

Parts of the Midwest have been taking large steps toward bringing their industries into the next millennium. Even though Michigan and Indiana have yet to actively participate in advanced vehicle development initiatives, they both have looked at different means to make sure their industries remain viable and competitive in today’s market.

3.1.1 Michigan

Michigan established a Governmental Task Force on Alternative Fueled Vehicles in 1996. This Task Force examined the role Michigan’s state government should take on the possible introduction of alternative fuel as a result of the Clean Air Act. In the end, the Task Force determined that the government would remain neutral on which fuel is best and let the marketplace decide. Yet, it also wanted to reduce market barriers by introducing short-term financial incentives so that a strong alternative fuel infrastructure might be put into place. This is an example of how a state could find the means to address a larger question given by the federal government. In 1996, it was alternative fuels. In 1998, it could be advanced vehicle development and its implications.

³¹Lyne, Jack. “Michigan, Midwest Set Fast-Track Pace in 1997’s Record U.S. Race for Corporate Facilities,” February 1998, <<http://www.conway.com/sshighlites/0298/9802p034.htm>> (30 June 1998).

3.1.2 Indiana

Indiana's industries have found ways of approaching the challenges of maintaining competitive manufacturing plants. The collaboration between Inland Steel and Nippon Steel (I/N Tek) is a new venture between two steel companies. When both of those plants use to manufacture cold-rolled steel separately, it would take up to twelve days to complete. Due to working as partners, the time has been reduced to under an hour. The large change in production time came about by encouraging the workers, engineers, and R&D scientists to combine formerly separate batch processes into one. It is a way of creating high-performance manufacturing by looking within at "workplace restructuring, total quality management, and supplier modernization."³² These three steps have been the most crucial when any plant in the Midwest has decided to look at changing its current productivity. The most difficult part is convincing those who might have done a manufacturing process the same way for 20 or 30 years that the new way is better and more efficient than what they have been doing. Indiana's state government could intervene with tax-incentives, technology education and R&D financial backing to encourage those industries that are not initiating their own recovery like I/N Tek.

3.1.3 Automotive Network Exchange

There are other steps that are being taken by the automotive industry to make their own manufacturing more efficient. The Big Three have established an Automotive Network Exchange which began as a pilot program in January 1998 and will be put into full operation over the summer. It uses the Internet to directly connect any and all suppliers working within the automotive industry. Ideas, drawings and negotiated prices will be transferred immediately: "Any company wishing to sell to the Big Three will then have to get on-line, and be ready to settle down to some serious electronic bargaining."³³ This new network will be very helpful to the Big Three since they will be able to get the most efficient and cost-effective components in a shorter period of time. Yet, it could also lead to problems with small to medium-size manufacturers that may not have the means or the budget to join such a network. Those problems cannot be fully assessed until the network has been working for a more extended period of time. This is another opportunity for the Midwestern state governments to step in and assist those companies that do not have the technological or financial means to join an important network such as the Automotive Network Exchange.

³²"North America's High Performance Heartland," 17 August 1997, <<http://www.cglg.org/pub/heartlan/chapter1.html>> (9 June 1998).

³³"The way it was," *The Economist*, 20 June 1998.

3.2 United States Innovation Partnership

USIP Mission

The United States Innovation Partnership (USIP) establishes a new working relationship between the states and the federal government as an integral part of enhancing a national innovation system to promote economic growth.

Although the Midwest and the Great Lakes Region have been making large strides towards modernizing and expanding their manufacturing base, the effects of advanced vehicle development has not been fully realized across all of the states. For example, Michigan has 150 different companies involved in some way with USCAR while Indiana has fifteen. Therefore, there is a good possibility that someone in Michigan's state government has heard about USCAR and/or PNGV, but there is also the same possibility that no one in Indiana's state government has heard anything. The U.S. Innovation Partnership could help to encourage the Great Lakes governors to meet and discuss future changes to their economy due to advanced vehicle technology. USIP has four strategies that pertain to the effects of PNGV and advanced vehicle technology:

1. Establish strong government-industry-university partnerships including non-governmental organizations (NGOs).

NGOs such as the American Society of Mechanical Engineers (ASME) can be used to establish contacts and sponsor conferences that bring together the state and federal governments, various industries, and universities.

2. Define and expand role of states.

The state role in more domestically focused innovation needs to be clearly defined in order for change to proceed smoothly.

3. Create national excellence in manufacturing.

Since World War II, the United States has been a world leader in research, design, manufacturing, and innovation. In order to maintain that status, the U.S. must make sure that its manufacturing processes are as modern and/or advanced as possible.

4. Develop and commercialize new products and processes.

Although it is healthy for a country to have numerous research projects going on, the results of this research needs to be properly commercialized so that people and the economy can benefit by the discovery and so that future research will occur.

3.2.1 USIP's Role in PNGV

Although USIP was originally defined as a program to be implemented at the start of new innovation projects, it still can have a significant impact on how to inform states about PNGV. USIP can be used as a mediator or facilitator. USIP can disseminate information about to the states through the governors' offices, and due to its contacts within the NGA and federal government, information can be more readily exchanged. Four additional roles USIP could take on include:

1. Disseminating information to the states most affected
2. Establishing a federal-state-industry forum
3. Creating/utilizing networks so that states are not left "out-of-the-loop"
4. Determining compatibility between states' short-term goals and nation's long-term goals

All four of these roles are equally important and build on one another. The hardest step is determining which states could be most affected by advanced vehicle technology and deciding what information they need to know. Once that step is accomplished, hopefully states will want to hold forums with the federal government and industry to determine what they should do in order to secure the future of their small to medium-size industries. Networks such as the Automotive Network Exchange that the Big Three have been working on need to be established for the Midwestern states as well so that they can always have a means to find out what changes are occurring that could affect their industries. Redundancy costs time and money that regions like the Midwest cannot afford. Another difficult step is to find a middle ground between the states' short-term goals and the nation's long-term goals. States do not often plan beyond the next decade due to the short-term focus of their government and budget. The United States, of course, plans for many years into the future, sometimes up to four or five decades.

3.2.2 Current USIP Projects

USIP has begun work on a number of projects that can be used as models for future communication between the Great Lakes Region and PNGV. One project is the next generation of the Manufacturing Extension Partnership (MEP). MEP centers exist in every state in the U.S. and are linked via the National Institute of Standards and Technology (NIST). Over 14% of NIST's budget is dedicated in MEP activities.³⁴ Through MEP, small to medium-size manufacturing companies that need to adapt to meet the demands of the 21st century can take advantage of many resources, including the "ability to assess where your company stands today, to provide technical and business solutions, to help you create successful partnerships, and to help you keep learning through seminars and training programs."³⁵ Ultimately the states are suppose

³⁴Talk by Marc G. Stanley, Associate Director for Policy and Operations, NIST. "Public-Private Partnerships, is this a Proper Role for Government?", 29 July 1998.

³⁵"MEP Definition/What is MEP?," n.d., <<http://www.mep.nist.gov/whatis/>> (28 July 1998).

to take over the MEP centers, and USIP will be a part of that federal-to-state power transition.

There is also ACE-Net which is the collaboration between the Angel Capital Electronic Network and the Small Business Association (SBA). ACE-Net, started in 1996, joins venture “angel” investors with small business entrepreneurs for financing in the amounts of \$250,000 to \$5 million, leading to the realization and commercialization of new innovations. It is the first network of its kind and “until ACE-Net, there had been no nationwide, centralized listing service identifying small, dynamic, growing companies for angel investors to investigate and examine.”³⁶ Many of ACE-Net’s system administrators and contacts are state-federal partnerships, and USIP will be a helpful member of this new network.

Another USIP project that should be closely observed is Florida’s upcoming forum between the space industry, “space states” and federal government. Parts of the space industry need to be or are ready to be developed for commercialization. It is one of the first instances where a state has invited the U.S. government to a forum on the future of a program formerly dominated by the federal government.

USIP has the most potential for helping the Midwest become informed about advanced vehicle development. The objectives and goals and the means to accomplish these have already been established. It is now a matter of finding the best way to approach those states that will be most affected by PNGV and inspiring them to take approach the federal government so that changes in their small and medium-size industries can begin.

4 Policy Issues/Alternatives

4.1 Reinventing the Heartland

In order for the Great Lakes Region to survive as an future high-performance region, four goals must be met as described in the 1993 Carnegie Mellon Report, *Reinventing the Heartland*. The Great Lakes Region must have:

1. A manufacturing infrastructure of interconnected vendors and suppliers
2. A human infrastructure of qualified workers, engineers, and researchers
3. A communications and transportation infrastructure which facilitates constant sharing of information and just-in-time delivery of goods and services
4. A capital allocation and financing system attuned to the needs of high-performance manufacturers³⁷

³⁶“Angel Capital Electronic Network (ACE-Net),” n.d., <<https://ace-net.sr.unh.edu/what/>> (28 July 1998).

³⁷*Reinventing the Heartland*, 73.

The need for strong infrastructure was emphasized throughout the entire report. The Great Lakes Region needs an infrastructure that would cover transportation, information technology, and intellectual needs. This infrastructure would work best with the establishment of an information network so that information can be more readily exchanged amongst all of the states.

The report also addressed the need for a new high-performance policy agenda, yet the report did point out that the “Region’s innovations in public policy have occurred with little help from the federal government. In fact, the Region’s relative independence from Washington, D.C. has helped position it for future economic growth. The Great Lakes Region demonstrates a remarkably low level of dependence upon federal spending.”³⁸ In the past, when the Great Lakes Region observed changes in federal policy such as the Clean Air Act, it was the states themselves that initiated the changes and funded the subsequent projects. In order for the Great Lakes Region to work on a new level as a partner with the federal government, changes in the way policy gets created and executed must be made. Five recommendations were made in *Reinventing the Heartland* in order to facilitate high-performance survival in the Great Lakes Region. The recommendations were:

1. Move to customer-driven government
2. Develop performance-based appraisals through benchmarking
3. Establish a leadership network
4. Develop integrated economic development, environmental, and trade strategies for the Great Lakes Region
5. Use regional test beds to develop high-performance environments³⁹

The USIP could serve many of the recommendations by conducting forums to address each of these points. The leadership network will be of key importance, because if the states in the Great Lakes Region cannot communicate with themselves, all of the other goals to creating a high-performance are will be unattainable. USIP has the ability to oversee such a network, possibly working with the CGLG or creating a new regional partnership just to focus on high-performance manufacturing and advanced vehicle technology.

4.2 USIP

With the inception of USIP, a lot of the policy work has already been done for state-federal collaboration on advanced vehicle technology initiatives such as PNGV. One policy issue that still needs to be worked out is funding for the various projects that will be needed particularly in those states that are dependent on the automotive industry.

³⁸*Reinventing the Heartland*, 75.

³⁹*Ibid.*, 78 - 82.

John Ahlen, former ASME Fellow in the White House Office of Science and Technology Policy (OSTP), provided an overview of these funding issues in his report: *A Washington, D.C. Perspective on Economic Development*. He called for the establishment of a R&D Infrastructure Fund in Arkansas. Although not all of the goals would also pertain to the Midwest, a few could be used to help with the future changes in the automotive industry:

1. State-matched funding for large-scale R&D projects

With state-matched funding, a long-term R&D infrastructure will be built that will lead to a more stable state economy.

2. Support pre-commercialization centers in order to move results to marketplace

Pre-commercialization centers can be created for universities and small businesses under the same goals of ACE-Net: joining capital with entrepreneurship in order to create a resulting product.

3. Technology transfer

Technology transfer during a project and before its completion is important.⁴⁰ Revenue from marketing a valuable new technology, even though it is only a step towards the finished product, can give much-needed financial support so the project can be completed.

4. Pursue community-based economic development

This would be a way to break down the state into separate communities - to create rural and urban funding programs depending on the need and number of small to medium-size manufacturers in an area.

The R&D Infrastructure Fund also laid out the framework for working on policy issues. Funding for state R&D is important, but the checks and balances laid out here will help insure that funding will continue for as long as it is needed.

1. R&D scale and balance

Where is the money going to? Are the companies mostly small, medium, or large, and does the funding reflect the need for those companies?

2. Conduct R&D policy planning

What technologies need the most R&D funding in order to prosper? In Arkansas, there were advanced materials, agriculture and biology, biotechnology, environment, manufacturing, and transportation and logistics. For Michigan and Indiana, a similar list needs to be created.

3. Establish a Washington, D.C. presence

⁴⁰Talk by Marc G. Stanley, Associate Director for Policy and Operations, NIST. "Public-Private Partnerships, is this a Proper Role for Government?", 29 July 1998.

“If you don’t promote your own interests, you can bet that no one else will.”⁴¹

Like Arkansas, if Michigan and Indiana want to receive funding from the federal government for their industry projects, they have strong representation in Washington, D.C. A presence could be created by locating an extended campus or office from one of the technological universities, or even working more closely with NGOs like ASME.

4. Better use of the Federal Grant Clearinghouse

Which universities are taking advantage of federal funding and to what extent? Are industries working with universities on R&D with labor and/or additional funding?

The R&D Infrastructure Fund was created with Arkansas in mind, but with very few changes, it could be adapted and used as a beneficial tool for the states of the Great Lakes Region. Without strong R&D funding, neither Michigan and Indiana will be able to help those small to medium-size manufacturers who need to adapt due to changes in advanced vehicle technology.

4.3 Current R&D Policy

4.3.1 Innovation, Social Capital, and the New Economy⁴²

In July 1998, the Progressive Policy Institute (PPI) released a policy briefing on how federal policies could better support networks, partnerships, and collaborations. Small and medium-size firms are becoming more involved with innovation. Their budgets do not allow for large internal R&D projects. Therefore, partnerships need to be made with larger firms such as universities and federal labs who can support some of the economic risk. PPI believes that Congress should create ways for states to get more involved in innovation partnerships. PPI would like to see a State Technology Innovation Challenge Grants Initiative established which would be a joint investment by the state and federal governments. States can have more direct and efficient contact with small to medium-size firms or smaller universities than the federal government. With the appropriate funding from the federal government and industry, regional innovation can be properly developed and will prosper.

Currently, corporations fund 65% of all U.S. R&D, and where there is strong R&D, there is often strong economic growth.⁴³ PPI’s report stated that the new

⁴¹Lieberman, Joseph (D-CT), The McGraw-Hill Companies’ Federal Technology Report, 2 July 1998, 3.

⁴²Fountain, Jane E. and Atkinson, Robert D. *Innovation, Social Capital, and the New Economy: New Federal Policies to Support Collaborative Research*, 17 July 1998.

⁴³Talk by Paul N. Doremus, NIST. “Public Policy for Private R&D: The Research & Experimentation Tax Credit”, 29 July 1998.

Federal Research Investment Act (S. 2217) that is currently in the Senate could be used to help fund an Industry Research Alliance Challenge Grant Fund that would match funds with industries that invest in R&D at universities and federal labs. Where there is increased R&D funding, there is more innovation and science, technology, engineering, and the economy will benefit from it.

4.3.2 The Federal Research Investment Act

Currently, there is a bi-partisan bill in the Senate entitled the Federal Research Investment Act (S. 2217) that would double R&D spending over the next twelve years. It was introduced in the Senate on June 25 by Senator Bill Frist (R-TN). The Federal Research Investment Act would increase federal research funding by 2.3% over inflation, and it would have the OSTP commission a study by the National Academy of Sciences in order to look into expanding federal R&D funding. It was written partly in response to the fact that for FY-98 the United States spent only 1.9 cents of every federal dollar on civilian R&D, compared to the 6.5 cents in 1965.⁴⁴ The decline in R&D funding in the U.S. must be reversed. The timeframe for this bill seems more feasible compared to doubling funding over eight years that House Speaker Gingrich had sponsored or within the ten year timeframe that S. 1305 had supported.

This bill has been receiving a lot of support in the Senate as it will require Federal agencies to report and justify their spending. There have been 23 co-sponsors on the bill as of July 31: Senators Rockefeller (D-WV), Domenici (R-NW), Lieberman (D-CT), Burns (R-MT), Bingaman (D-NM), Gramm (R-TX), Breaux (D-LA), Cleland (D-GA), D'Amato (R-NY), Moynihan (D-NY), Kerry (D-MA), Moseley-Braun (D-IL), Kerrey (D-NE), Allard (R-CO), Abraham (R-MI), Boxer (D-CA), DeWine (R-OH), Snowe (R-ME), Feinstein (D-CA), Hutchison (R-AR), Durbin (D-IL), Faircloth (R-NC), and Dodd (D-CT). It was introduced by a Republican and has been co-sponsored by thirteen Democrats and ten Republicans so far. The Federal Research Investment Act has also been endorsed by the American Society of Mechanical Engineers (ASME). This bill has a good chance of being passed due to its bi-partisan support. On July 29, the Senate Commerce Committee approved S. 2217 and it now awaits scheduling for a Senate vote.

There are few parts of the Federal Research Investment Act that would be beneficial to the Midwest as it adapts to the changes in the automotive industry. One part is to maintain a strong American research infrastructure (Section 3, Part 2) so that a stable and strong relationship can be created between science, engineering, and technology research and education. The Federal Research Investment Act also outlines the need for partnerships among industry, universities, and federal labs (Section 3, Part 4). Funding partnerships will encourage information and technology transfer that will trickle through all of the parts of the Midwest affected by advanced vehicle technology.

⁴⁴The McGraw-Hill Companies' Federal Technology Report, 2 July 1998.

5 Recommendations

By taking a closer look at two Great Lakes states, the differences between those states and the challenges they face become more clear. Michigan's economy is intertwined with the automotive industry from small to large-size manufacturing plants. Indiana has a stake in automotive manufacturing, but its industry is made up of small-sized manufacturers. Both will be affected by changes in the auto industry due to PNGV and advanced vehicle development, but to what degree is difficult to assess. Michigan has representatives of the Big Three located within its borders, and it has worked extensively on supporting small to medium-size manufacturers. Indiana has begun to have an increase in large-size manufacturers, but it still needs to work on helping its small to medium-size manufacturers adapt to changes in industry. The same type of comparisons will be found when the other states located in the Great Lakes Region are analyzed. All of the states will have to adapt, and in order for change to proceed smoothly, the Great Lakes Region should create a partnership via a network of information resources, technology developments, and educational programs.

USIP could be the overseer that the Great Lakes Region needs in order to facilitate change as advanced vehicle technology becomes a reality. From USIP's increasing experience in dealing with MEP, ACE-Net, and the pilot state-federal forum in Florida, there are many resources to take advantage of. Any change will require the fulfilling of basic steps. First, a detailed look at the Great Lakes Region needs to be completed with projections created in order to see in which direction the economy might turn with changes in the automotive industry. Representatives of PNGV and/or USIP need to approach the governors of the Great Lakes States, possibly throughout CGLG, in order to educate the state governments on the status of PNGV and advanced vehicle technology. From there, the states should take on the responsibility of talking to the federal government, through the DOC and PNGV, about the implications of changes in the auto industry on their states and region. They will be able to get a view of how they must help and develop their manufacturing companies in order to benefit, instead of fail, due to change.

Anything that the states decide to do will require funding. The states should partly contribute to any business innovation projects as it is their responsibility to take care of the industries within their borders. Yet, the federal government and the Big Three should also contribute to helping the Great Lakes Region's small to medium-size manufacturers. If the small to medium-size manufacturers cannot find ways to produce the parts needed for future cars, it will not only hurt the states in which they are based; it will hurt the auto industry as well, because they will have to find other companies that can produce their part. This could lead to the creation of a new infrastructure in order to transport necessary parts that could cost millions or even billions of dollars.

The new Federal Research Investment Act is a step towards encouraging further innovation in the United States. If it is passed, it could be a beneficial tool for the Great Lakes Region. They could use some of the funding to help their small to medium-size manufacturers develop new technology by taking advantage of partnerships created between industries, universities, and federal labs. Also, the Midwest could take full advantage of a strong information, education and research infrastructure. This would help facilitate change by sharing information between states so that errors could avoid being repeated, and new ideas could be fully shared. It would be in the entire nation's best interest for the Federal Research Investment Act to pass, because R&D leads to more innovation and a better economy. Yet, with the passing of S.2217, the Midwest would have a place to turn to in order to find some federal funding in order to react to the changes due to advanced vehicle technology.

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WISE PROGRAM

Washington Internships for Students of Engineering (WISE) is a ten week educational internship program for engineering students entering their senior year of college who are interested in public policy and government. Throughout WISE, the students are introduced to leaders in industry, Congress, and governmental agencies. Each student completes a research paper on a current public policy topic. For further information, contact: Anne Hickox, 400 Commonwealth Drive, Warrendale, PA 15096-0001 (Tel: 412/776-4841)

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