Michigan: The High-Technology Automotive State

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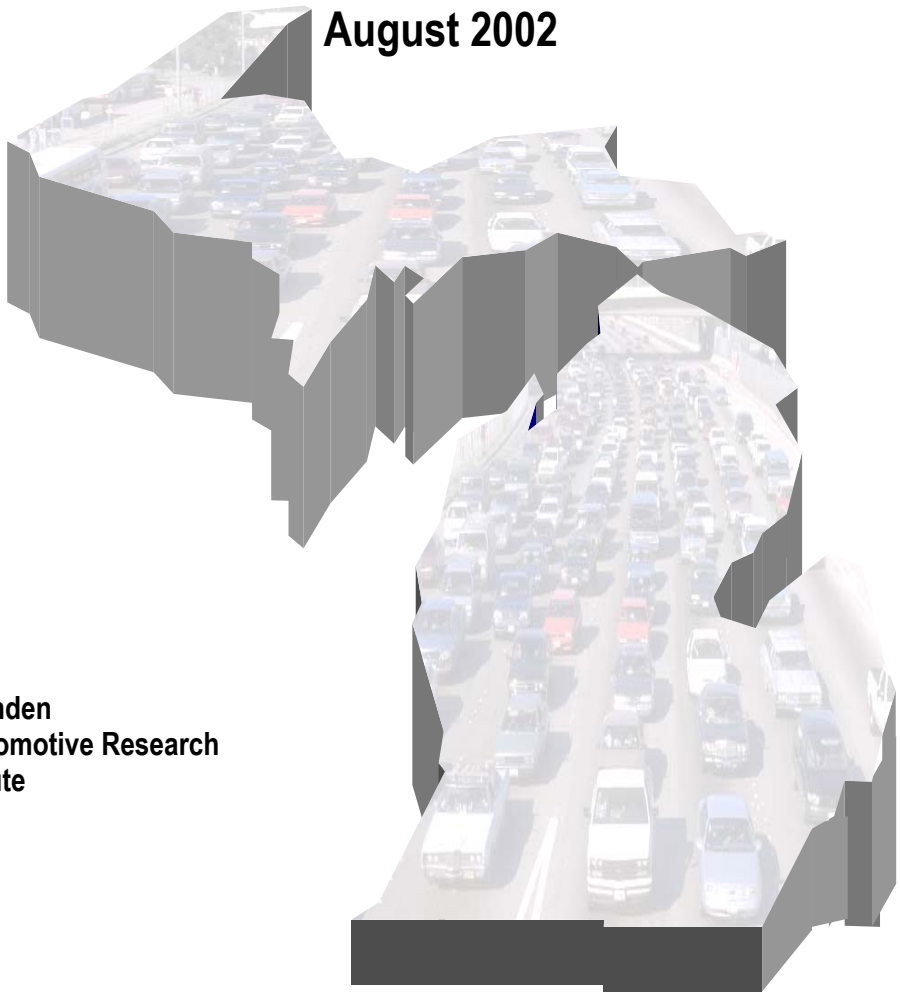

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EXECUTIVE SUMMARY

Our research has reviewed several methods and reports that rank states in terms of high-tech activity. We have conducted our own review of Michigan's relative position in this area and have measured the contribution of Michigan's auto industry to the state's high-technology sector. Because there is no agreed-upon "official" definition of high tech, we chose technology indicators that are fundamental and widely used. Research and development spending, patent grants, scientific and engineering employment are all generally accepted measures of technological activity. The basic conclusion in all the technology tables presented is the same: Michigan is one of the leading high-tech states. Regardless of the indicator used, Michigan is listed consistently among the top states in the technology rankings. Our findings include the following conclusions.

1) Michigan ranks second among the fifty states in total private spending on research and development activity in 1999.
2) Michigan ranked sixth among the fifty states in total patents received during the 1997 - 2001 time period.
3) Michigan ranks fourth among the fifty states in 2001 in terms of total employment in high-tech industries as defined by the US Department of Labor's Bureau of Labor Statistics (BLS).
4) Michigan ranks sixth among the fifty states in 2001 in terms of employment in high-tech occupations. If the focus is on the private sector, Michigan's high tech occupations rank rises to fifth.
5) Michigan ranks eleventh in high-tech employment when automotive high tech employment across all states is added to the American Electronic Association's (AeA) high-tech industry jobs total. The state's overall rank improves to tenth when automotive related, high-tech engineering services employment is also added to Michigan's high-tech employment count.

MICHIGAN: THE HIGH-TECHNOLOGY AUTOMOTIVE STATE
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INTRODUCTION

There is no fixed "official" definition for the concept of high tech. At different times various organizations and individuals have issued such labels as the "new category," "information age," "Internet economy," "dot.com economy," "web economy," "silicon states," or cyber-states," and so on. Different categorizations of firms, industries, states, and regions in the United States as high technology or not have been published. Despite the recent decline in the electronics and telecommunications segments of high tech, the mystique of the high tech idea is undiminished. Public officials and economic development authorities continue to show great concern about the ranking of their state or community in terms of advanced economic activity. Presumably this concern is fueled by a growing belief that the economy is fundamentally changing in many important structural parameters. It also reflects a widely held belief that all industries, including the "newest," agglomerate their activities in geographic regions. Since the fastest-growing new industries are presumably still deciding where to locate their operations, it is thought critical to advertise the business suitability of a region and put in the best possible light the region's potential in terms of employees costs, markets, and infrastructure.

This report updates our 2000 study of the contribution of Michigan's automotive industry to the high-technology sector of the state's overall economy. Of course, the largest U.S. automotive firms have concentrated much of their employment, the bulk of their engineering, and their headquarters in Michigan for a full century. However, automotive production no longer dominates the Michigan economy to the extent it once did. Yet, many outside observers paint a picture of Michigan as an automotive manufacturing state and not much more. This erroneous perception is especially troublesome when the state is ranked on the basis of its high-technology activity and infrastructure. Several definitions of the new economy exclude the auto industry as a high-technology sector. The reasons for excluding the industry usually focus on its maturity, its heavy manufacturing orientation, or even the fact that it is a manufacturing industry.

We once again take issue with the characterization of the automotive industry as "low-tech." The industry's major product, the modern motor vehicle, is one of the most important host products for delivering advanced technologies directly to the consumer in the world today. The industry leads all others in spending on research

& development and the rate of product and manufacturing innovation. Michigan more than fully shares in the high-technology activities of the United States and world auto industry. In fact, Michigan's auto industry is different than the overall U.S. industry because the greatest share of automotive technology is located in this one state. A careful measurement of this special role of the auto industry in Michigan allows this study to assess the state as a high-technology region.

This report begins with a review of two definitions of high tech employment by industry: the definition offered by the American Electronics Association (AeA) and that provided by the U.S. Bureau of Labor Statistics (BLS). Because the AeA is the largest electronic industry trade association in the United States, because they use public data sources and because their reports are published regularly, their rankings receive some amount of public attention. The BLS definition is noteworthy because it is from a Federal statistical agency. The report then looks at some measures of technology activity by industry and state published by various national statistical agencies. Employment in high tech occupations is offered as a more meaningful and less problematic measure of high tech employment than industry. Finally, some suggestions are provided on supplementing the AeA numbers to include automotive high tech employment. The purpose of this investigation is to provide a more accurate understanding and appreciation of Michigan as the high-technology automotive state.

I. RANKING STATES BY HIGH-TECHNOLOGY ACTIVITY

The AeA is a Washington, D.C. and California headquartered association that publishes a series of annual reports on high-technology economic activity in states, various metro areas, and at the national and international levels. The AeA annual publication of greatest relevance to this report is Cyberstates, a ranking and description of high-technology activity, as defined by AeA, for the 50 United States.[1] The heart of the Cyberstates methodology is its selection of 45 U.S. industries, which the AeA asserts constitute the high-technology sector of the U.S. economy. The 45 industries (see appendix) are selected from hundreds of "4-digit" industries classified according to the Standard Industrial Classification (SIC) coding system used by U.S. government statistical agencies (see appendix). Cyberstates ranks states according to their total employment in these 45 defined industries. Employment data are gathered from the BLS publication, Covered Employment and Wages, Annual Averages.

The AeA divides their list of 45 industries into three large sectors: high-tech manufacturing, communication

services, and software and computer-related services. The high-tech manufacturing list of industries includes computer and office equipment, consumer electronics, semiconductors, electronic components and accessories, and defense electronics. The communications sector includes such industries as telephone communications, cable and pay television, and radiotelephone communication. Finally, the AeA software sector includes such industry groups as software services, data processing and rental; maintenance and other computer related services.[2]

The 45-industry definition list for high-technology activity in the United States is compiled by the AeA from the SIC codes reported by the members of the association. Cyberstates may represent a category of ranking methodology that can be labeled as "industry self-defined." The AeA methodology is open to at least three areas of criticism:

1. Narrowness of Industry Focus. The AeA list of 45 high-technology industries clearly excludes some of the most advanced scientific and engineering-intensive industries in the United States. These industries include those performing biotechnology and health research, advanced industrial equipment, engineering and architectural services, research and testing services, and all government and academic (university) science, health, and engineering research activity. Incredibly, the AeA researchers admit this deficiency; yet still claim their definition is "solid" and "conservative." The AeA maintains that there is "no consensus on the definition of the high-tech industry," and that there is "no clear consensus on the definition of the bio-technology industry." [3]

The comments above can be generalized into a more fundamental, and perhaps more damaging criticism, of the AeA concept, which is that it does not really offer a definition of the high tech universe. It only offers a definition of the electronics, software and telecommunications segments of high tech. These are very important segments but it is a large conceptual leap to assert that the industries comprising the electronics, software and telecommunications sectors also represent high tech in its entirety. The distribution of research and development expenditures by industry illustrates this point. (R+D expenditures are generally considered one of the key indicators of technology effort). The AeA industries account for about one-third of total private industry R+D. This is a large proportion, to be sure, but this figure also means that the AeA definition is not addressing two-thirds of the technological activity in the U.S. economy.

2. Product Technology Content. The AeA list of 45 high-technology industries includes some that now

produce products with low technology or science content. In particular, a number of the AeA industries are now largely composed of companies producing commodity products with low rates of product innovation. These would include many areas of consumer electronics or even many types of semiconductors and other electronic components.

3. Ranking by Total Industry Employment. Cyberstates provides useful information on payroll and export activity. The AeA also provides information on R&D activity and educational performance by state in other publications. However, the essential core ranking of states is based on total employment in the 45 selected high-tech industries. Yet a more serious flaw in the use of total employment as an indicator of high-technology activity is that it categorizes all jobs within an industry as "high tech" including custodians or low-wage clerical and production labor positions. Employment in many occupations, of course, can be generated by high technology but is not intrinsically high tech. For example, California could outrank Massachusetts in Cyberstates if the former state contained higher total employment in high-tech industries but fewer scientists, engineers, or other research workers than the latter state. In fact, Mexico or China would outrank many American states because of their large number of electronic manufacturing plants. Also, the communications services group of industries is not generally identified by the BLS as a high-tech industry because of their relatively low employment of technology-oriented workers, a criterion we shall emphasize later in this study.

The 2002 publication of Cyberstates ranks Michigan as seventeenth among the fifty states as a high-technology state on the basis of 110,050 jobs in the 45 defined high-technology industries in 2001. The motor-vehicle and motor-vehicle-equipment industry is not recognized by the AeA as a high-tech industry.[4]

THE BLS APPROACH

The BLS has long shown an interest in the definition and measurement of high-technology industry employment. BLS researchers have tracked definitions of high-technology industries, occupations and products since at least 1983.[5] A favorite definition of high technology for the BLS was published in 1982 by the Congressional Office of Technology Assessment. It described high-technology firms as those "that are engaged in the design, development, and introduction of new products and innovative manufacturing processes, or both, through the systematic application of scientific and technical knowledge."[6]

Other definitions noted by BLS researchers included the use of research and development expenditures as a percent of industry value added or the identification of products by the U.S. Bureau of the Census that embody

new or leading-edge technologies falling in ten advanced technology areas.[7]

The BLS has modified its own definition of high technology several times. In 1983, the BLS used a combination of measures that included expenditures for R&D, the use of technology-oriented workers, and the last two measures combined. In 1991, the BLS used a definition of high technology based on the proportion of workers in an industry who spend the majority of their time in R&D, as determined by their employer. The 1991 study categorized an industry as high technology, "Level 1," the proportion of R&D employment was at least 50 percent higher than the average for all industries surveyed. Thirty industry groups fell into this category. Level-two industry groups were those that fell in the average-to-50-percent- above-average range. The motor-vehicle-industry group (SIC 371) easily qualified as a high-technology industry with 8.5 percent of its employees engaged primarily in R&D activity. The 1991 study also contained a rare ranking of states based on the share of total employment located in high-technology industries (somewhat different from the AeA method). Michigan ranked number two among the fifty states. Only Delaware exceeded Michigan in high-technology industry employment as a share of total employment (16.7 percent) according to the BLS in 1991.[8]

The BLS published another analysis of high-technology employment by industry in 1999.[9] The new approach is based on the employment of scientific and technical personnel and research intensity. The BLS researchers identify specific high-technology occupations: "engineers; life and physical scientists; mathematical specialists; engineering and science technicians; computer specialists; and engineering, scientific and computer managers."[10] Individuals employed in these occupations are collectively referred to as technology-oriented workers. The BLS used survey data from the BLS's Occupational Employment Survey (OES) for 1993-1995 to total the two types of occupational employment for their study. In the 1999 BLS analysis, "industries are considered high tech if employment in both research and development and in all technology-oriented occupations accounted for a proportion of employment that was at least twice the average for all industries in the Occupational Employment Survey."[11]

The BLS analysis is applied to industries at the three-digit SIC level of detail because needed data is not available at the more disaggregated four-digit level. Twenty-nine 3-digit industry groups, 25 in manufacturing and 4 in the service sector, are identified by the BLS as high-technology industries. These industries all have at least 6 R&D workers and 76 technology-oriented workers per thousand employees (see appendix). The motor-vehicle industry qualified again for the BLS list of high-technology industries. A subset of ten industry groups,

those with ratios at least five times the average, are characterized by BLS as high-technology-intensive industries. These industry groups have at least 15 research and development workers per 1,000 workers and 190 technology-oriented workers per 1,000 workers.[12]

In terms of total employment, the motor-vehicle industry was the second largest BLS high-technology industry. Only the service industry group, computer and data processing services, had higher total employment. Significantly, the engineering and architectural services industry was one of the four high-technology service industries identified in the study. As will be shown, this industry is heavily involved with the auto industry in Michigan.

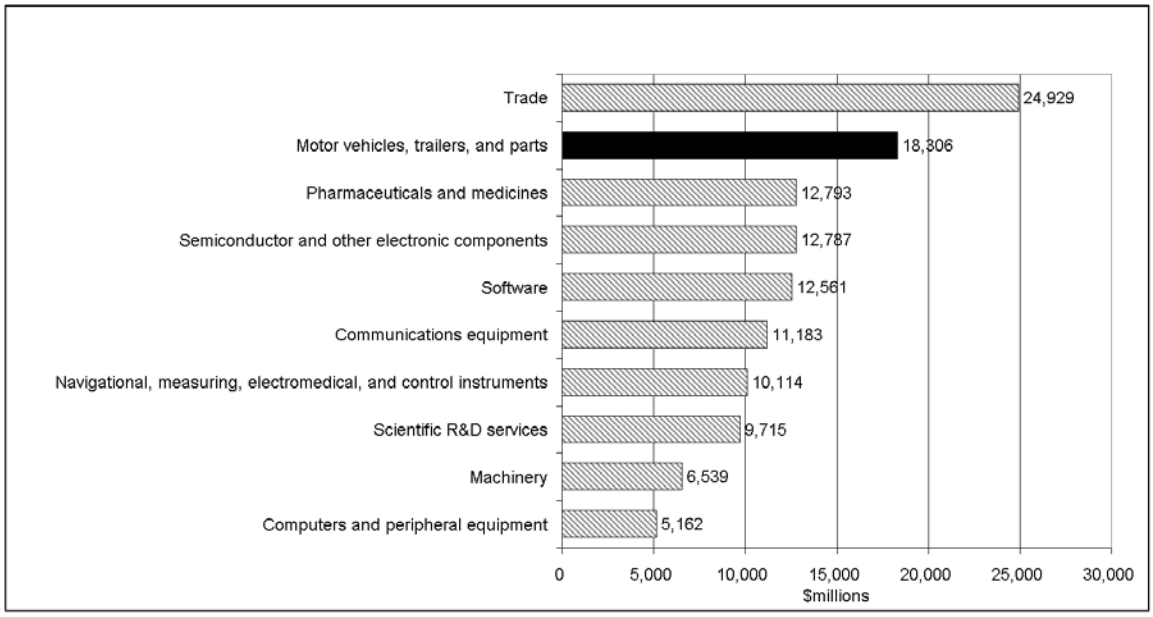
II. A Reranking of U.S. States in Terms of High-Technology

Our state ranking analysis recognizes the auto industry's presence in the Michigan economy. The BLS has consistently listed the auto industry as a high-tech industry and, furthermore, most of the industry's high-tech functions are located in Michigan. What makes Michigan exceptional among the states where the auto industry operates is that Michigan is the headquarters for the three largest auto companies' in the United States. As a result, most of these companies high-tech research, design, engineering, computer facilities, and staff are located in Michigan. In addition, because of the growing interdependence between the auto manufacturers and their supplier firms many suppliers have located their technology-intensive operations in Michigan. In other words, Michigan's automotive industry is far more technology intensive than the U.S. automotive industry in general.

The National Science Foundation (NSF) annually surveys R+D spending. Among the results of these surveys are data on private research and development expenditures by industry. Figure 1 shows the most recent industry ranking based on the survey data collected by NSF for 2000.

Figure 1

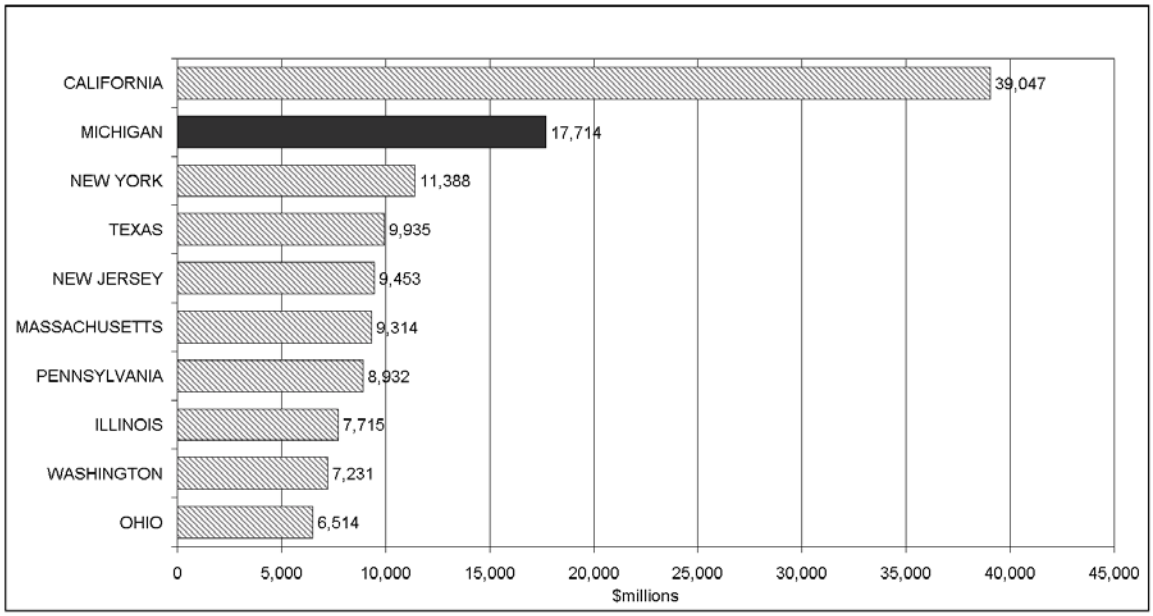
R&D Spending by Industry – 2000
Motor Vehicle is 2nd of 39 Major U.S. Industries



Source: National Science Foundation, Research and Development in Industry: 2000, Table E-2.

The motor-vehicle and motor-vehicle and equipment industry ranked second on the list with $18.3 billion in R&D spending.[13] The motor-vehicle industry's high level of R&D spending naturally influences Michigan's position in a similar ranking of states. Figure 2, shows that Michigan ranked second among the fifty states in total private spending on R&D at $17.7 billion in 1999.[14]

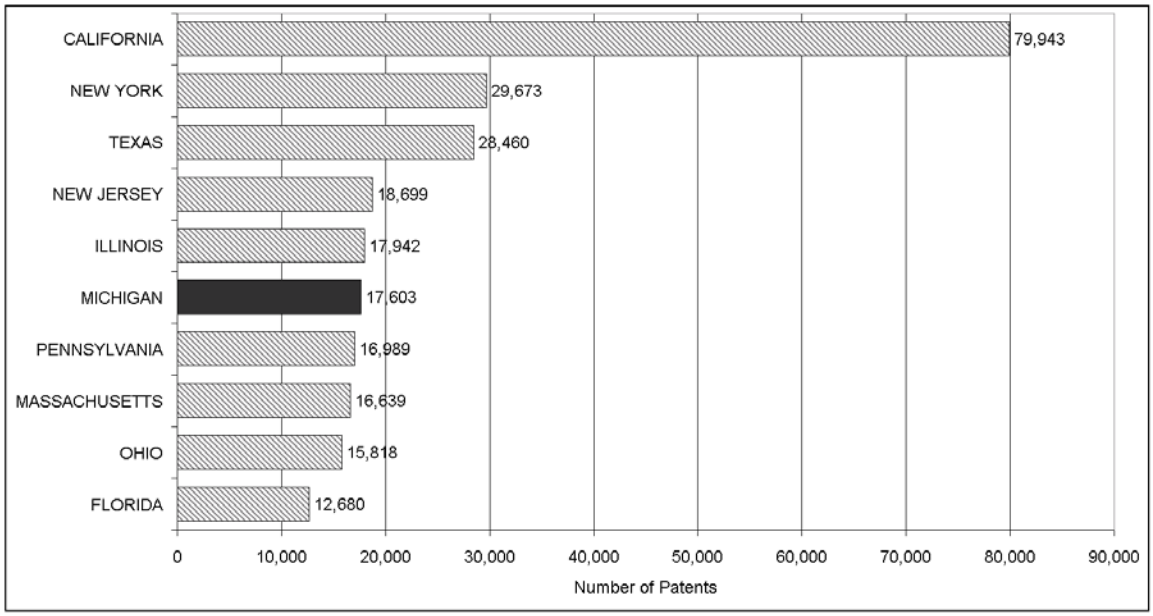
Figure 2
States Ranked by Industrial Research & Development – 1999
Michigan Ranked 2nd of the 50 States



Source: National Science Foundation, Division of Science Resources Statistics, Research and Development in Industry: 1999, Table 1-32.

A similar analysis of U.S. Patent Office information on patents received by state found that Michigan ranked in sixth position with 17,603 patents received during the five-year period 1997-2001. The rankings based on this measure are shown in figure 3.[15]

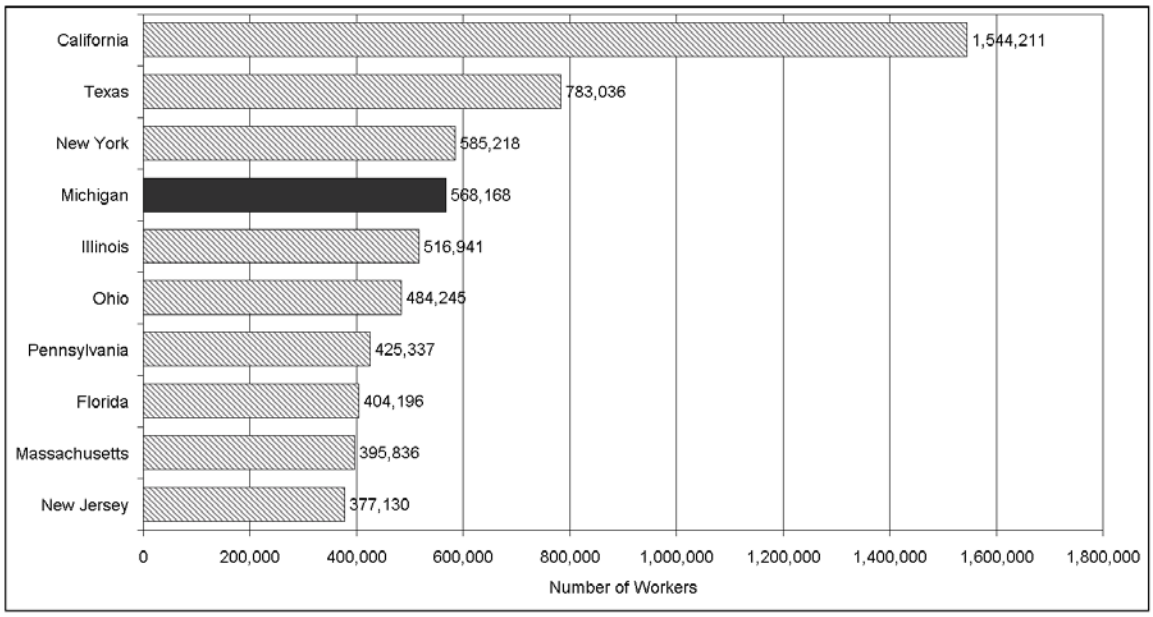
Figure 3
States Ranked by Patent Issued 5-Year Period: 1997 – 2001
Michigan Ranked 6th of the 50 States



Source: U.S. Patent and Trademark Office, PATENT COUNTS BY CONTRY/STATE AND YEAR: UTILITY PATENTS, JANUARY 1, 1963 – DECEMBER 31, 2001

As discussed above, the BLS has identified twenty-nine industry groups in the United States as high-technology industries. Industries were defined as "high tech" if the percentage of their work force in both research and development and technology-oriented jobs was twice the all industry average. The Bureau's list of high-tech industries is shown in the appendix. It should be noted that motor vehicles is one of the industries listed. When the states are ranked by the total number of jobs in high tech industries, using the BLS list, Michigan would rank fourth. Based on the BLS definition Michigan had 568 thousand jobs in high tech industries in 2000. These data are shown in figure 4. (It is interesting to note that if we had added motor vehicle industry employment to the AeA list of high-technology total employment, Michigan's rank climbs from seventeenth to third among the fifty states.) The source of the data for The BLS-concept high tech ranking is the Bureau of Labor Statistics' Covered Employment and Wages database.[16]

Figure 4
Employment in BLS Total High-Tech Industries Ranked by State – 2001
Michigan Ranked 4th of the 50 States



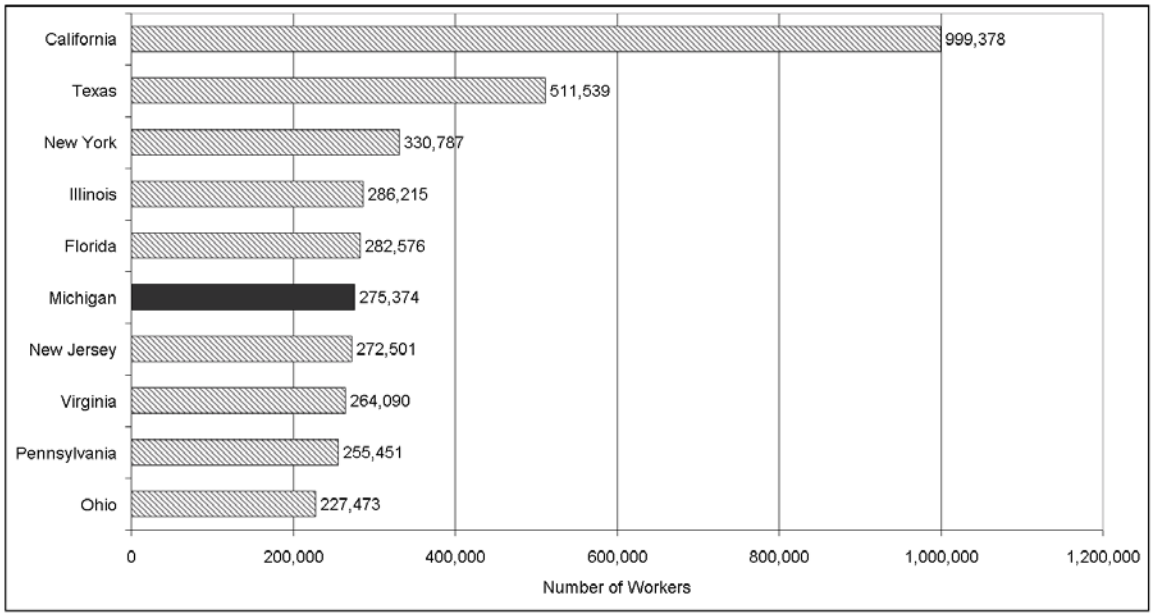
Source: U.S. Bureau of Labor Statistics, Covered Employment and Wages 2000; U.S. Census Bureau, County Business Patterns 1997

Ranking the states on the basis of high tech occupations rather than industry is an attractive option because the industry approach has a number of significant problems attached to it. The industry tabulations include all workers in an industry, not just those in technology-based jobs. An industry may be high tech nationally but not locally; high tech R+D activity may take place in one state and "low tech" low value added activity in another. The industry definitions are inherently contentious and difficult to standardize. One statistician or organization may believe that *industry a* belongs on the list; another will think that *industry b* should be represented but not *a.* The occupational approach largely avoids these problems. High tech occupations specifically address high tech workers. The content of high tech occupations will be more homogeneous across regions than industries. The types of occupations that are high tech intuitive and not very contentious.

In other words a simple count of the number of workers in each state in technology-oriented occupations may offer a more meaningful ranking than the industry numbers. The occupations counted as high-tech are: natural scientists, engineers, engineering and science technicians and computer professionals (see appendix). These occupations are essentially the same as those referenced in the Bureau of Labor Statistics high tech industry analysis and the AeA Cybereducation list.[17] Employment by state in the high tech occupations is shown in figure 5. (The source of the data is a special tabulation from the U.S. Census Bureau's Current Population

Survey.) Michigan ranks sixth in total high-tech occupational employment.

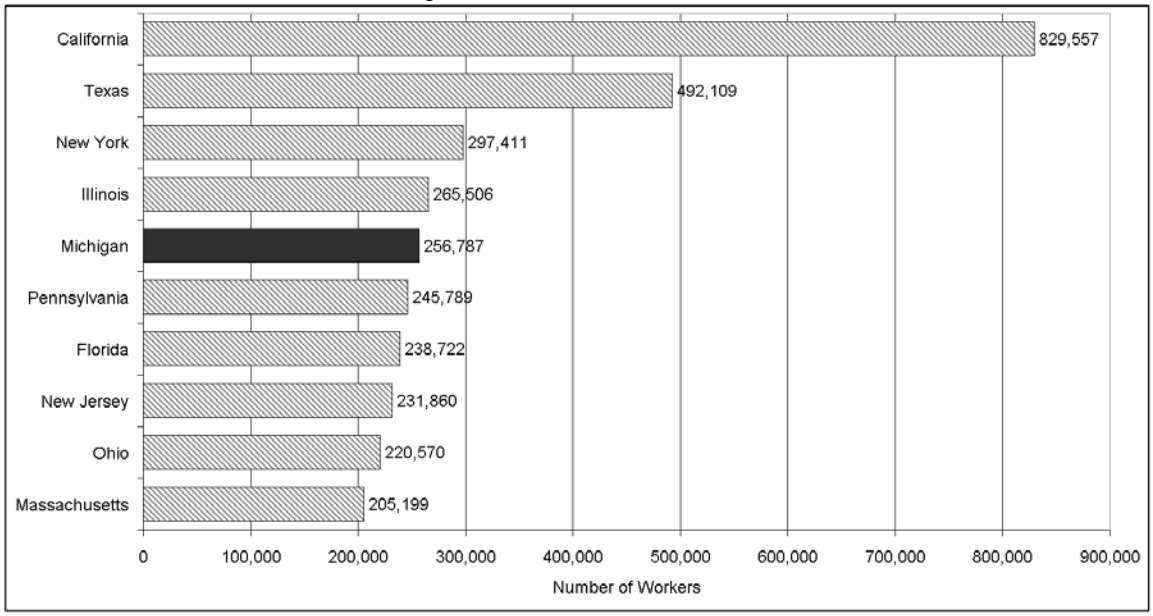
Figure 5
State Ranking of Total High-Tech Occupational Employment – 2001
Michigan Ranked 6th of the 50 States



Note:: High-Tech occupations are defined as Engineers, Math. & Computer Scientists, Engineering Technicians, Science Technicians and Computer Programmers. Source: Special tabulation from the U.S. Bureau of the Census' Current Population Survey.

The number of workers in the high tech occupations in Michigan totaled 275 thousand in 2001. The high tech occupational employment totals can also be calculated for the private sector (plus universities). This ranking is presented in figure 6. Based on private sector plus university employment, Michigan's occupation high tech ranking moves up to number five.[18]

Figure 6
State Ranking of High-Tech Occupational Employment (Private Sector + University):
1999 – 2001 avg.
Michigan Ranked 5th of the 50 States



Source: Special tabulation from the U.S. Bureau of the Census' Current Population Survey.
Note: High-Tech occupations are defined as Engineers, Math. & Computer Scientists, Engineering Technicians, Science Technicians and Computer Programmers. Source: Special tabulation from the U.S. Bureau of the Census' Current Population Survey.

Reconciling the AeA ranking based on industry and the occupational approach to counting high tech is a challenge. The AeA ranks states according to the total number of workers in its list of high-tech industries, regardless of whether these workers hold technology-oriented jobs or not. On the other hand, the occupational ranking is specifically concerned with technology-oriented employment and counts all technological workers, not just those in the AeA industry list. One approach would be to recognize automotive technological employment as high-tech employment and to combine this figure with the high-tech industry numbers reported by AeA.

It seems reasonable to add auto industry high tech jobs to the AeA totals. The Office for the Study of Automotive Transportation, (now CAR) conducted a special survey (fall of 1999) of the three largest motor-vehicle-manufacturing firms in the United States (General Motors, Ford, and DaimlerChrysler) to directly tabulate their high-tech employment. The three automotive firms were asked to provide their year-end, 1998, U.S. and Michigan employment in the BLS (and AeA) list of technology-oriented occupations. As shown in table 3, technology-oriented U.S. employment for the three firms totaled 47,548 in 1998. The Big Three employed 37,489 of these employees in Michigan. In other words, almost 79 percent of Big Three, U.S.,

technology-oriented employees were working in the State of Michigan in 1998. Furthermore, our results show that about 16 percent of the three companies' employment in Michigan falls into the high-tech category compared with only 4 percent of their employment in the other 49 states (see table 4). The BLS definition of a high-technology intensive industry calls for the employment of at least 190 technology-oriented workers out of every 1,000 workers. The Big Three in Michigan employ 160 technology-oriented workers out of every 1,000 employees, a level that almost qualifies the industry for the BLS category of a high-technology-intensive industry.

Table 1
Big Three Auto
Technology Employment Questionnaire Results

Total 1998	U.S.	Michigan	Michigan %
Auto Employment	492,887	235,807	47.8%
High-Tech Auto Employment	47,548	37,489	78.8%

Source: Special Company tabulation – 1999, OSAT/UMTRI/University of Michigan.

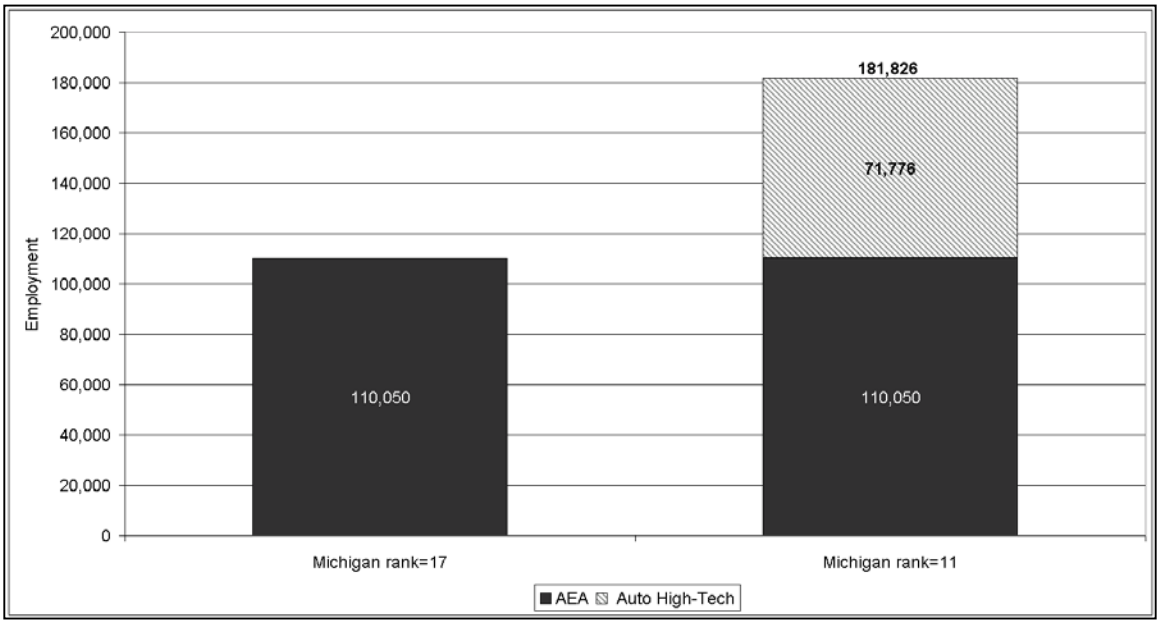
Table 2
1998 High-Tech Employment
as Percentage of Total Big Three Auto Employment

Other States	Michigan
3.9%	15.9%

Source: Special Company tabulation – 1999, OSAT/UMTRI/University of Michigan.

This approach is depicted in figure 7. The AeA reported 110,050 high-tech jobs in Michigan in 2001.

Figure 7
2001 High-Tech Employment Comparison:
AeA & AeA + Auto High-Tech Employment



Sources: (1) The AeA data are from the AeA's Cyberstates 2002 publication. (2) The High-Tech auto (sic 371) employment numbers are from a special tabulation of the U.S. Bureau of Census' Current Population Survey: 1997-2001. High-Tech occupations are defined as Engineers, Math. & Computer Scientists, Engineering Technicians, Science Technicians and Computer Programmers.

This was the sum of Michigan employment in the AeA-defined list of 45 high-technology industries. We add to this AeA total the employment of scientists, engineers, engineering and science technicians, and computer professionals working in the auto industry. According to a special tabulation from the U.S. Census Bureau's Current Population Survey, the number of such automotive workers employed in Michigan averaged about 71,800 during the 1997 - 2001 time period. Inclusion of these technology-related automotive workers raises Michigan's high-technology employment total to 181,800. The same procedure was followed in the other states to account for the approximately 57,000 technology-oriented jobs in the auto industry located outside Michigan. The state-by-state results are shown in table 1. Once the auto sector technology-related workers are added to AeA state totals, Michigan's ranking improves from seventeenth to eleventh.

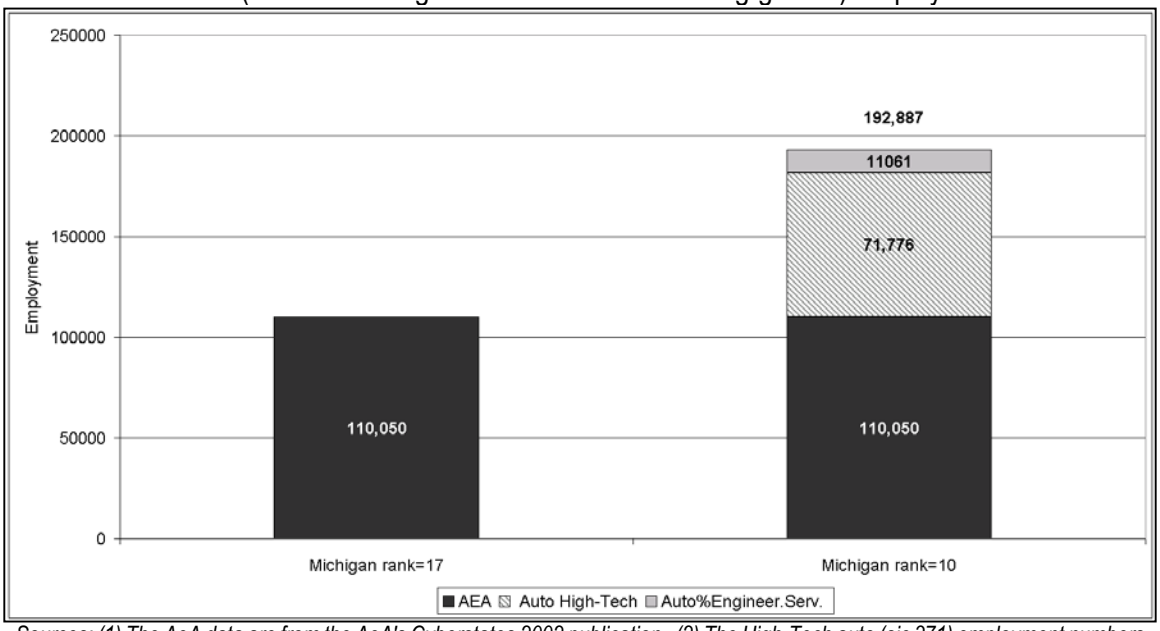
Michigan's automotive-related high-tech employment is not confined to the manufacturing sector. The BLS study identified engineering and architectural services as one of four high-technology service industries in the U.S. economy. In the late 1990s the Office for the Study of Automotive Transportation (now CAR) surveyed the larger Michigan companies (10+ employees) in the engineering segment of this industry and found that a large majority were primarily auto-related.

Occupation by industry surveys indicate that about one third of the jobs in engineering services are in the high tech occupations. Combining the CAR survey results and the industry's high tech occupation proportion yields a figure of about 23 percent of engineering services as high tech and auto related. For 2001, industry data is, at this time, only available for the somewhat broader engineering and architectural services industry. The engineering services high tech auto- related ratio was adjusted to accommodate this industry difference and this employment segment was extrapolated to 2001. There were 54,000 workers employed in architectural and engineering services in the state in 2001. The final result of these calculations is a figure of 11,061. This is the number of high tech workers employed in the automotive-related segment of Michigan engineering services in 2001.[19]

This percentage can be used to help determine the number of engineering-services workers in Michigan who are both high-tech and auto-related. The first step in the calculation is to apply the high-tech (BLS and AeA occupations) share of employment in the latest available Occupational Employment Statistics (OES) survey to the Michigan engineering-services employment total. Second, we apply the estimated automotive share of engineering-services employment (68 percent as noted above) to our first calculation. Third, these figures are adjusted to the engineering and architectural services total for 2001.The final output of these calculations is a figure of 11,061. This is the number of high tech workers employed in the automotive-related segment of Michigan engineering services.

Michigan's high tech employment total can now be further adjusted to reflect the automotive activity in Michigan's engineering-services industry. The logic is that large segments of engineering services in Michigan are virtually an extension of the auto companies' R&D and product-development efforts. Many of the auto companies' high-tech design-and-engineering operations are contracted to firms in the engineering services industry. The engineering services adjustment is highlighted in figure 8. This chart sums AeA measured jobs plus auto industry high tech employment plus the auto related portion of high tech jobs (11,061) in Michigan's engineering services industry.

Figure 8
2001 High-Tech Employment Comparison:
AeA & (AeA + Auto High-Tech + Auto % Mich. Engrg. Svc.) Employment



Sources: (1) The AeA data are from the AeA's Cyberstates 2002 publication. (2) The High-Tech auto (sic 371) employment numbers are from a special tabulation of the U.S. Bureau of Census' Current Population Survey: 1997-2001. High-Tech occupations are defined as Engineers, Math. & Computer Scientists, Engineering Tech., Science Tech. and Computer Programmers. (3) Engineering Service (sic 8711) high-tech occupations are defined similarly to auto high-tech. The employment figure is computed by: (a) Applying the high-tech occupation share of industry employment, (b) Adjusting for the industry's auto share and extrapolating the results to 2001. Auto-related high-tech employment in Engineering Services is calculated at 11,061 in 2001.

That is, to give a full accounting of high tech employment in Michigan, the state's AeA technology employment total needs to be supplemented by high tech workers in the motor vehicle industry and high tech workers in engineering services whose work is primarily automotive. The new high-technology employment total is 192,887. Making these adjustments raises Michigan's high tech employment ranking to tenth place from seventeenth in the original AeA calculations.

III. CONCLUSION

High tech continues to be a major preoccupation for public officials and economic developers. All areas and regions want to have a strong position in the "jobs of the future." The purpose of this report is to provide a numerical analysis of Michigan's position in the high tech arena. This report updates a similar study on high tech in Michigan which was conducted in 1999 and published in 2000.

Both studies come to the same basic conclusion. Michigan does have many strengths in the high tech arena. Michigan ranks highly in most measures of high tech: R&D expenditures, patent grants, high tech occupational employment and high tech industry as defined by the U.S. Bureau of Labor Statistics.

The report also examined the industry based ranking produced annually by the American Electronics Association. Their latest report ranks Michigan seventeenth in high-tech jobs—as defined by the AeA. Evaluating the AeA definition and methodology, the conclusion was that its coverage of the high tech world is very incomplete. The AeA industries only account for about one-third of all R&D expenditures. When the AeA numbers are supplemented with auto industry high tech employment and related engineering services, Michigan's ranking moves up substantially.

ENDNOTES

1. Michaela D. Platzer, et al. Cyberstates 2002 American Electronics Association, Washington, D.C., Santa Clara, California, 2002.
2. Ibid., pp. 154 – 159.
3. Ibid., p. 154.
4. Ibid., p. 154
5. Richard W. Riche, Daniel E. Hecker, and John U. Burgan, "High technology today and tomorrow: a small slice of the employment pie," Monthly Labor Review, November 1983.
6. Technology, Innovation, and Regional Economic Development, Washington, U.S. Congress, Office of Technology Assessment, Sept. 9, 1982.
7. Paul Hadlock, Daniel Hecker, and Joseph Gannon, "High technology employment: another view," Monthly Labor Review, Vol. 114, pp. 26 – 30. (July 1991).
8. Ibid., p. 29.
9. Daniel Hecker, "High technology employment: a broader view," Monthly Labor Review, Vol. 122 no. 6. pp. 18 – 28. (June 1999).
10. Ibid., p. 19.
11. Ibid., p. 19.
12. Ibid., pp. 19 – 20.
13. National Science Foundation (NSF) publications are the source of the research and development expenditure data. The data by industry is from the NSF's Research and Development in Industry: 2000, Table E-2. Advance tables from this publication are posted on the NSF web site at: www.nsf.gov/sbe/srs/srs02403/start.htm#tables. The data by state are from Research and Development in Industry: 1999, Table A-32.
14. Ibid.
15. U.S. Patent and Trademark Office, Patent Counts by County/State and Year: Utility Patents, January 1, 1963 – December 31, 2001.
16. U.S. Bureau of Labor Statistics, Covered Employment and Wages 2000; U.S. Census Bureau, County Business Patterns, 1997.
17. Daniel Hecker, "High technology employment: a broader view," Monthly Labor Review, Vol. 122 no. 6. p. 9 (June 1999).
18. The high–tech occupational employment rankings by state are compiled from a special tabulation of the U.S. Bureau of the Census, Current Population Survey. Prof. David Macpherson, Department of Economics, Florida State University, Tallahassee, Florida, prepared this tabulation. This is also the source of the data used in one of the comparison tables, on High-Tech occupational employment in the auto industry by state.
19. Sean P. McAlinden and Brett C. Smith. The Michigan Automotive Policy Survey. UMTRI-99-1. Ann Arbor, MI: University of Michigan Transportation Research Institute, Office for the Study of Automotive Transportation, 1999.

APPENDIX

A. AeA High-Tech Definition by Standard Industrial Classification Codes

High-tech manufacturing	Communication services
Computers and office equipment	4812 Radiotelephone communications
3571 Electronic computers	4813 Telephone communications
3572 Computer storage devices	4822 Telegraph and other message communications
3575 Computer terminals	4841 Cable and other pay television services
3577 Computer peripherals	4899 Other communications services
3578 Calculating and accounting machines	
3579 Office machines	
Consumer electronics	
3651 Household audio and video equipment	
3652 Phonographic records and prerecorded tapes and disks	Software and computer related-services
Communications equipment	*Software services*
3661 Telephone and telegraph apparatus	7371 Computer programming services
3663 Radio and TV broadcast and communications equipment	7372 Prepackaged software
3669 Other communications equipment	7373 Computer integrated systems design
Electronic components and accessories	*Data processing and information services*
3671 Electronic tubes	7374 Computer processing and data preparation
3672 Printed circuit boards	7375 Information retrieval services
3675 Electronic capacitors	7376 Computer facilities management services
3676 Electronic resistors	
3677 Electronic coils, transformers and Inductors	*Rental, maintenance and other computer-related services*
3678 Electronic connectors	7377 Computer rental and leasing
3679 Other electronic components	7378 Computer maintenance and repair
	7379 Other computer-related services
Semiconductors	
3674 Semiconductors and related devices	
Industrial electronics	
3821 Laboratory apparatus	
3822 Environmental controls	
3823 Process control instruments	
3824 Fluid meters and counting devices	
3825 Instruments to measure electricity	
3826 Laboratory analytical instruments	
3829 Other measuring and controlling devices	
Photonics	
3827 Optical instruments and lenses	
3861 Photographic equipment and lenses	
Defense electronics	
3812 Search and navigation systems, instruments and equipment	
Electromedical equipment	
3844 X-ray apparatus and tubes and related irradiation apparatus	
3845 Electromedical and electrotherapeutic apparatus	

Source: AeA, Cyberstates 3.0, 2002

B. Ranking by Industry of Company Funds for Industrial Research & Development

(Excludes Federal)

Industry	NAICS codes	Funds ($millions)	Rank
Trade	42, 44, 45	24,929	1
Motor vehicles, trailers, and parts	3361-63	18,306	2
Pharmaceuticals and medicines	3254	12,793	3
Semiconductor and other electronic components	3344	12,787	4
Software	5112	12,561	5
Communications equipment	3342	11,183	6
Navigational, measuring, electromedical, and control instruments	3345	10,114	7
Scientific R&D services	5417	9,715	8
Machinery	333	6,539	9
Computers and peripheral equipment	3341	5,162	10
Computer systems design and related services	5415	4,943	11
Finance, insurance, and real estate	52, 53	4,024	12
Aerospace products and parts	3364	3,895	13
Small nonmanufacturing companies [3]	Fewer than 15 employees	3,783	14
Medical equipment and supplies	3391	3,741	15
Electrical equipment, appliances, and components	335	3,390	16
Other chemicals	325 (minus 3251-52, 3254)	3,084	17
Resin, synthetic rubber, fibers, and filament	3252	2,842	18
Paper, printing and support activities	322, 323	2,700	19
Small manufacturing companies [3]	Fewer than 50 employees	2,549	20
Other information	51 (minus 511, 513)	2,339	21
Architectural, engineering, and related services	5413	2,232	22
Basic chemicals	3251	2,050	23
Plastics and rubber products	326	1,675	24
Fabricated metal products	332	1,631	25
Petroleum and coal products	324	1,172	26
Food	311	1,145	27
Other professional, scientific, and technical services	54 (minus 5413, 5415, 5417)	1,059	28
Broadcasting and telecommunications	513	1,025	29
Nonmetallic mineral products	327	845	30
Mining, extraction, and support activities	21	822	31
Other transportation equipment	336 (minus 3361-64)	716	32
Other nonmanufacturing [2]	56, 61, 624, 71, 72, 81	713	33
Primary metals	331	598	34
Health care services	621-23	477	35
Other miscellaneous manufacturing	339 (minus 3391)	453	36
Beverage and tobacco products	312	417	37
Newspaper, periodical, book, and database	5111	365	38
Other computer and electronic products	334 (minus 3341-42, 3344-45)	307	39
Furniture and related products	337	284	40
Transportation and warehousing	48, 49	277	41
Textiles, apparel, and leather	313-16	266	42
Construction	23	222	43
Utilities	22	136	44
Wood products	321	105	45
Management of companies and enterprises	55	49	46
Other manufacturing [2]	31-33 (minus 311-6, 321-7, 331-7, 339)	--	
All industries [1]	21-23, 31-33, 42, 44-81	180,421	

Source: National Science Foundation/SRS, Research and Development in Industry: 2000, Table E-2

C. Ranking of States by Funding for Industrial Research – 1999 (millions $)

Area	Total	Rank
CALIFORNIA	39,047	1
MICHIGAN	***17,714***	***2***
NEW YORK	11,388	3
TEXAS	9,935	4
NEW JERSEY	9,453	5
MASSACHUSETTS	9,314	6
PENNSYLVANIA	8,932	7
ILLINOIS	7,715	8
WASHINGTON	7,231	9
OHIO	6,514	10
ARIZONA	4,434	11
CONNECTICUT	3,984	12
NORTH CAROLINA	3,953	13
MINNESOTA	3,379	14
COLORADO	3,136	15
FLORIDA	2,697	16
VIRGINIA	2,488	17
INDIANA	2,246	18
WISCONSIN	1,949	19
GEORGIA	1,827	20
TENNESSEE	1,768	21
MARYLAND	1,700	22
OREGON	1,540	23
MISSOURI	1,387	24
NEW MEXICO	1,342	25
KANSAS	1,284	26
RHODE ISLAND	1,264	27
DELAWARE	1,261	28
IDAHO	1,210	29
UTAH	1,123	30
NEW HAMPSHIRE	1,099	31
KENTUCKY	684	32
SOUTH CAROLINA	665	33
IOWA	559	34
ALABAMA	556	35
OKLAHOMA	365	36
NEVADA	337	37
VERMONT	318	38
ARKANSAS	216	39
WEST VIRGINIA	216	40
LOUISIANA	187	41
NEBRASKA	178	42
DISTRICT OF COLUMBIA	171	43
MAINE	140	44
MISSISSIPPI	114	45
NORTH DAKOTA	75	46
MONTANA	33	47
HAWAII	27	48
SOUTH DAKOTA	13	49
ALASKA	(D)	-------
WYOMING	(D)	-------
UNDISTRIBUTED FUNDS	5,649	
U.S. TOTAL	182,823	

(D) = Data withheld to avoid disclosing operations of individual companies. Source: National Science Foundation, Division of Science Resources Statistics, Research and Development in Industry: 1999, Table A-32

D. Ranking of States by Utility Patents Issued 5-Year Period: 1997 – 2001

State	Total 1997-2001	Rank
CALIFORNIA	79,943	1
NEW YORK	29,673	2
TEXAS	28,460	3
NEW JERSEY	18,699	4
ILLINOIS	17,942	5
MICHIGAN	***17,603***	***6***
PENNSYLVANIA	16,989	7
MASSACHUSETTS	16,639	8
OHIO	15,818	9
FLORIDA	12,680	10
MINNESOTA	12,304	11
WASHINGTON	8,740	12
CONNECTICUT	8,674	13
COLORADO	8,559	14
NORTH CAROLINA	8,402	15
WISCONSIN	8,063	16
ARIZONA	7,195	17
MARYLAND	6,962	18
INDIANA	6,813	19
GEORGIA	6,259	20
IDAHO	5,910	21
OREGON	5,526	22
VIRGINIA	5,170	23
MISSOURI	4,225	24
TENNESSEE	3,876	25
UTAH	3,379	26
IOWA	3,128	27
NEW HAMPSHIRE	2,944	28
SOUTH CAROLINA	2,656	29
OKLAHOMA	2,518	30
LOUISIANA	2,383	31
KENTUCKY	2,032	32
DELAWARE	1,945	33
ALABAMA	1,789	34
VERMONT	1,770	35
KANSAS	1,745	36
NEW MEXICO	1,642	37
RHODE ISLAND	1,397	38
NEVADA	1,377	39
NEBRASKA	1,004	40
MISSISSIPPI	867	41
ARKANSAS	853	42
WEST VIRGINIA	777	43
MAINE	608	44
MONTANA	603	45
HAWAII	416	46
NORTH DAKOTA	356	47
SOUTH DAKOTA	324	48
DISTRICT OF COLUMBIA	310	49
ALASKA	257	50
WYOMING	254	51
UNITED STATES TOTAL	398,584	

Source: U.S. Patent and Trademark Office, Patent Counts by County/State and Year: Utility Patents, January 1, 1963 — December 31, 2001.

E. Industry High-Tech Definitions U.S. Bureau of Labor Statistics (BLS) High – Tech Industry List

Industry SIC	Title
28	Chemicals
291	Petroleum Refining
348	Ordnance & Accessories
351	Engines & Turbines
353	Construction Related Machinery
355	Special Industrial Machinery
356	General Industrial Machinery
357	Computer & Office Equipment
361	Electric Distribution Equipment
362	Electrical Industrial Apparatus
365	Household Audio & Video Equipment
366	Communications Equipment
367	Electronic Components & Accessories
371	Motor Vehicles & Equipment
372	Aircraft & Parts
376	Guided Missiles, Space Vehicles & Parts
381	Search & Navigation Equipment
382	Measuring & Controlling Devices
384	Medical Equipment, Instruments & Supplies
386	Photographic Equipment & Supplies
737	Computer & Data Processing Services
871	Engineering & Architectural Services
873	Research, Development & Testing Services
874	Management & Public Relations Services
American Electronics Association (AEA) High-Tech Industry List	
Industry SIC	**Title**
357	Computer & Office Equipment
365	Household Audio & Video Equipment
366	Communications Equipment
367	Electronic Components & Accessories
381	Search & Navigation Equipment
382	Measuring & Controlling Devices
3844	X-Ray Apparatus & Tubes
3845	Electromedical Equipment
386	Photographic Equipment & Supplies
481	Telephone Communications
482	Telegraph & Other Communications
484	Cable & Other Pay TV Services
489	Communications Services, NEC
737	Computer & Data Processing Services

Note:: High-Tech Industries are those defined in U.S. Bureau of Labor Statistics, Monthly Labor Review, June 1999. Source: U.S. Bureau of Labor Statistics, Covered Employment and Wages 2000; U.S. Census Bureau, County Business Patterns,1997.

F. BLS High-Tech Industry Groups

281,6	Industrial chemicals
282	Plastics materials and synthetics
283	Drugs
284	Soaps, cleaners, and toilet goods
285	Paint and allied products
287	Agricultural chemicals
289	Miscellaneous chemical products
291	Petroleum refining
348	Ordnance and accessories
351	Engines and turbines
353	Construction and related machinery
355	Special industrial machinery
356	General industrial machinery
357	Computer and office equipment
361	Electric distribution equipment
362	Electrical industrial apparatus
365	Household audio and video equipment
366	Communications equipment
367	Electronic components and accessories
371	Motor vehicles and equipment
372,6	Aerospace
381	Search and navigation equipment
382	Measuring and controlling devices
384	Medical equipment, instruments, and supplies
386	Photographic equipment and supplies
737	Computer and data processing services
871	Engineering and architectural services
873	Research, development, and testing services
874	Management and public relations services

Source: Hecker, Daniel, "High-technology employment: A broader view," Monthly Labor Review, June 1999, p.20

G. Employment in High-Tech Industries Ranked by State - 2001 U.S. Bureau of Labor Statistics Total High-Tech Industry Set

States	Employed 2000	Rank
California	1,544,211	1
Texas	783,036	2
New York	585,218	3
Michigan	***568,168***	***4***
Illinois	516,941	5
Ohio	484,245	6
Pennsylvania	425,337	7
Florida	404,196	8
Massachusetts	395,836	9
New Jersey	377,130	10
Virginia	348,553	11
North Carolina	302,500	12
Washington	289,582	13
Indiana	276,595	14
Georgia	253,558	15
Minnesota	218,748	16
Colorado	216,765	17
Maryland	215,930	18
Wisconsin	203,149	19
Missouri	197,630	20
Tennessee	192,625	21
Arizona	186,244	22
Connecticut	180,488	23
Kentucky	132,161	24
South Carolina	127,279	25
Oregon	125,943	26
Kansas	121,853	27
Alabama	119,333	28
Utah	101,147	29
Louisiana	95,607	30
Oklahoma	94,193	31
Iowa	88,545	32
New Hampshire	67,913	33
Arkansas	60,657	34
Nebraska	57,488	35
District of Columbia	56,843	36
New Mexico	52,267	37
Mississippi	48,250	38
Idaho	46,775	39
Delaware	45,194	40
West Virginia	34,421	41
Nevada	32,323	42
Maine	27,612	43
Rhode Island	25,849	44
Vermont	23,066	45
South Dakota	22,251	46
Montana	15,916	47
North Dakota	15,027	48
Hawaii	13,013	49
Alaska	8,502	50
Wyoming	7,826	51
U.S.	10,804,208	

Note:: High-Tech Industries are those defined in U.S. Bureau of Labor Statistics, Monthly Labor Review, June 1999. Source: U.S. Bureau of Labor Statistics, Covered Employment and Wages 2000; U.S. Census Bureau, County Business Patterns,1997.

H. Occupational High-Tech Definitions

Current Population Survey Code	Title
044-059	Engineers
213-218	Engineering and Related Technologists and Technicians
064-068	Mathematical and Computer Scientists
069-083	Natural Scientists
223-225	Science Technicians
229	Computer Programmers

Source: Hecker, Daniel, "High-technology employment: A broader view," Monthly Labor Review, June 1999, p.20

I. State Ranking of Total High-Tech Occupational Employment – 2001

State	High-Tech Employment	Rank
California	999,378	1
Texas	511,539	2
New York	330,787	3
Illinois	286,215	4
Florida	282,576	5
Michigan	***275,374***	***6***
New Jersey	272,501	7
Virginia	264,090	8
Pennsylvania	255,451	9
Ohio	227,473	10
Maryland	215,812	11
Massachusetts	212,338	12
Georgia	204,837	13
Washington	185,282	14
North Carolina	166,811	15
Colorado	166,760	16
Minnesota	148,807	17
Missouri	129,660	18
Wisconsin	119,423	19
Arizona	114,656	20
Indiana	102,428	21
Oregon	101,959	22
Tennessee	92,520	23
Connecticut	91,509	24
Alabama	84,694	25
Louisiana	76,317	26
South Carolina	67,532	27
Kentucky	63,639	28
Iowa	63,385	29
Oklahoma	58,869	30
Kansas	58,329	31
Utah	57,012	32
New Hampshire	46,674	33
New Mexico	37,035	34
Mississippi	33,249	35
Nebraska	32,874	36
Nevada	29,323	37
Idaho	28,962	38
Arkansas	27,764	39
West Virginia	26,609	40
Maine	24,754	41
Delaware	23,049	42
Rhode Island	20,149	43
District of Columbia	17,525	44
Hawaii	17,458	45
Montana	15,175	46
Vermont	14,057	47
Alaska	13,832	48
South Dakota	10,862	49
North Dakota	8,840	50
Wyoming	8,546	51
U.S. TOTAL	6,724,703	

Note:: High-Tech occupations are defined as Engineers, Math. & Computer Scientists, Engineering Technicians, Science Technicians and Computer Programmers. Source: Special tabulation from the U.S. Bureau of the Census' Current Population Survey.

J. State Ranking of High-Tech Occupational Employment: Private Sector + University 1999 – 2001 Average

State	High-Tech Employment	Rank
California	829,557	1
Texas	492,109	2
New York	297,411	3
Illinois	265,506	4
Michigan	***256,787***	***5***
Pennsylvania	245,789	6
Florida	238,722	7
New Jersey	231,860	8
Ohio	220,570	9
Massachusetts	205,199	10
Virginia	186,269	11
Georgia	169,812	12
Washington	158,113	13
Colorado	149,423	14
Minnesota	144,753	15
Maryland	144,138	16
North Carolina	141,883	17
Wisconsin	109,140	18
Missouri	108,113	19
Indiana	100,943	20
Connecticut	96,062	21
Arizona	96,019	22
Tennessee	77,119	23
Oregon	75,039	24
Alabama	70,937	25
Louisiana	63,817	26
Kentucky	61,809	27
South Carolina	61,319	28
Kansas	56,231	29
Iowa	54,904	30
Oklahoma	47,710	31
Utah	47,539	32
New Hampshire	39,529	33
Arkansas	29,852	34
Nebraska	28,604	35
Mississippi	27,029	36
New Mexico	26,630	37
Idaho	25,379	38
Rhode Island	21,973	39
Nevada	20,785	40
Maine	20,688	41
Delaware	20,142	42
West Virginia	17,759	43
Vermont	13,730	44
Hawaii	12,746	45
District of Columbia	10,339	46
Montana	9,258	47
South Dakota	8,756	48
Alaska	8,324	49
North Dakota	7,001	50
Wyoming	5,573	51
U.S. TOTAL	5,858,706	

Note: High-Tech occupations are defined as Engineers, Math. & Computer Scientists, Engineering Technicians, Science Technicians and Computer Programmers. Source: Special tabulation from the U.S. Bureau of the Census' Current Population Survey.

K. 2001 High-Tech State Rankings Comparison AeA, AeA and Auto High-Tech Employment Rankings

AEA High-Tech Employment - 2001			AEA *plus* Auto High-Tech Employment*		
State	Number	Ranking	State	Number	Ranking
U.S. TOTAL	5,607,091		U.S. TOTAL	5,736,172	
California	997,951	1	California	1,002,902	1
Texas	459,638	2	Texas	462,190	2
New York	364,887	3	New York	367,783	3
Massachusetts	252,421	4	Massachusetts	252,878	4
Florida	238,747	5	Florida	239,382	5
Virginia	228,882	6	Virginia	229,611	6
Illinois	226,348	7	Illinois	228,628	7
New Jersey	197,749	8	New Jersey	198,265	8
Pennsylvania	193,985	9	Pennsylvania	196,174	9
Colorado	183,559	10	Colorado	183,657	10
Georgia	174,216	11	***Michigan***	***181,826***	***11***
Ohio	151,283	12	Georgia	174,729	12
North Carolina	141,477	13	Ohio	161,141	13
Minnesota	136,437	14	North Carolina	143,784	14
Washington	135,763	15	Minnesota	137,018	15
Maryland	119,089	16	Washington	136,278	16
Michigan	***110,050***	***17***	Maryland	119,704	17
Arizona	108,420	18	Arizona	109,027	18
Missouri	90,096	19	Missouri	91,820	19
Oregon	89,443	20	Oregon	89,794	20
Connecticut	80,668	21	Connecticut	81,028	21
Wisconsin	67,760	22	Indiana	73,551	22
Indiana	66,066	23	Wisconsin	69,675	23
Tennessee	56,226	24	Tennessee	58,165	24
Alabama	53,530	25	Alabama	55,636	25
Kansas	52,557	26	Kansas	53,314	26
Utah	51,078	27	Utah	51,535	27
New Hampshire	46,106	28	New Hampshire	46,162	28
Oklahoma	39,723	29	South Carolina	41,965	29
South Carolina	39,528	30	Kentucky	41,741	30
Kentucky	39,398	31	Oklahoma	40,626	31
Nebraska	35,470	32	Iowa	35,672	32
Iowa	34,892	33	Nebraska	35,551	33
Louisiana	28,738	34	Louisiana	28,738	34
Idaho	28,544	35	Idaho	28,544	35
New Mexico	26,786	36	New Mexico	26,786	36
Arkansas	22,867	37	Arkansas	22,867	37
Nevada	19,188	38	Nevada	19,188	38
District of Columbia	17,889	39	District of Columbia	17,889	39
Mississippi	16,802	40	Mississippi	16,941	40
Vermont	16,036	41	Vermont	16,070	41
Rhode Island	14,934	42	Maine	15,310	42
Maine	14,773	43	Rhode Island	15,049	43
South Dakota	12,299	44	South Dakota	12,516	44
West Virginia	10,653	45	West Virginia	10,711	45
Delaware	9,388	46	Delaware	9,584	46
Hawaii	8,629	47	Hawaii	8,629	47
North Dakota	7,685	48	North Dakota	7,705	48
Montana	7,372	49	Montana	7,372	49
Alaska	5,607	50	Alaska	5,607	50
Wyoming	2,422	51	Wyoming	2,422	51

Sources: (1) The AeA data are from the AeA's Cyberstates 2002 publication. (2) The High-Tech auto (sic 371) employment numbers are from a special tabulation of the U.S. Bureau of Census' Current Population Survey: 1997-2001. High-Tech occupations are defined as Engineers, Math. & Computer Scientists, Engineering Technicians, Science Technicians and Computer Programmers.

L. High-Tech Eemployment Rankings Comparison-2 AeA & (AeA+ Auto High-Tech + Auto Share Mich. Engineering Services)

AEA High-Tech Employment - 2001				AEA *plus* Auto High-Tech Emp.* *plus* Auto Share of Mich. Engineering Services High-Tech Employment**		
State	Number	Ranking		State	Number	Ranking
U.S. TOTAL	5,607,091			U.S. TOTAL	5,736,172	
California	997,951	1		California	1,002,902	1
Texas	459,638	2		Texas	462,190	2
New York	364,887	3		New York	367,783	3
Massachusetts	252,421	4		Massachusetts	252,878	4
Florida	238,747	5		Florida	239,382	5
Virginia	228,882	6		Virginia	229,611	6
Illinois	226,348	7		Illinois	228,628	7
New Jersey	197,749	8		New Jersey	198,265	8
Pennsylvania	193,985	9		Pennsylvania	196,174	9
Colorado	183,559	10		***Michigan***	***192,887***	***10***
Georgia	174,216	11		Colorado	183,657	11
Ohio	151,283	12		Georgia	174,729	12
North Carolina	141,477	13		Ohio	161,141	13
Minnesota	136,437	14		North Carolina	143,784	14
Washington	135,763	15		Minnesota	137,018	15
Maryland	119,089	16		Washington	136,278	16
Michigan	***110,050***	***17***		Maryland	119,704	17
Arizona	108,420	18		Arizona	109,027	18
Missouri	90,096	19		Missouri	91,820	19
Oregon	89,443	20		Oregon	89,794	20
Connecticut	80,668	21		Connecticut	81,028	21
Wisconsin	67,760	22		Indiana	73,551	22
Indiana	66,066	23		Wisconsin	69,675	23
Tennessee	56,226	24		Tennessee	58,165	24
Alabama	53,530	25		Alabama	55,636	25
Kansas	52,557	26		Kansas	53,314	26
Utah	51,078	27		Utah	51,535	27
New Hampshire	46,106	28		New Hampshire	46,162	28
Oklahoma	39,723	29		South Carolina	41,965	29
South Carolina	39,528	30		Kentucky	41,741	30
Kentucky	39,398	31		Oklahoma	40,626	31
Nebraska	35,470	32		Iowa	35,672	32
Iowa	34,892	33		Nebraska	35,551	33
Louisiana	28,738	34		Louisiana	28,738	34
Idaho	28,544	35		Idaho	28,544	35
New Mexico	26,786	36		New Mexico	26,786	36
Arkansas	22,867	37		Arkansas	22,867	37
Nevada	19,188	38		Nevada	19,188	38
District of Columbia	17,889	39		District of Columbia	17,889	39
Mississippi	16,802	40		Mississippi	16,941	40
Vermont	16,036	41		Vermont	16,070	41
Rhode Island	14,934	42		Maine	15,310	42
Maine	14,773	43		Rhode Island	15,049	43
South Dakota	12,299	44		South Dakota	12,516	44
West Virginia	10,653	45		West Virginia	10,711	45
Delaware	9,388	46		Delaware	9,584	46
Hawaii	8,629	47		Hawaii	8,629	47
North Dakota	7,685	48		North Dakota	7,705	48
Montana	7,372	49		Montana	7,372	49
Alaska	5,607	50		Alaska	5,607	50
Wyoming	2,422	51		Wyoming	2,422	51

Sources: (1) The AeA data are from the AeA's Cyberstates 2002 publication. (2) The High-Tech auto (sic 371) employment numbers are from a special tabulation of the U.S. Bureau of Census' Current Population Survey: 1997-2001. High-Tech occupations are defined as Engineers, Math. & Computer Scientists, Engineering Tech., Science Tech. and Computer Programmers. (3) Engineering Service (sic 8711) high-tech occupations are defined similarly to auto high-tech. The employment figure is computed by: (a) Applying the high-tech occupation share of industry employment, (b) Adjusting for the industry's auto share and extrapolating the results to 2001. Auto-related high-tech employment in Engineering Services is calculated at 11,061 in 2001.