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High-Tech Industrial Activity In Greater Cleveland 1992-2000

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Briefing Paper

**HIGH-TECH INDUSTRIAL ACTIVITY
IN GREATER CLEVELAND
1992 – 2000**

Prepared for:
**Economic Development Administration
U.S. Department of Commerce**

By:
**Robert Sadowski
Center for Economic Development
Maxine Goodman Levin College of Urban Affairs
Cleveland State University**

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EXECUTIVE SUMMARY

Objective

This briefing paper provides an analysis of high-tech activity in the Cleveland Primary Metropolitan Statistical Area (PMSA) from 1992 to 2000. It begins by defining the term high-tech industry, using criteria developed by the Bureau of Labor Statistics (BLS). High-tech industries are then analyzed from the viewpoint of employment levels, average earnings, and number of establishments. The City of Cleveland's share of high-tech activity is discussed along with a comparison of the Cleveland PMSA versus the U.S. The paper concludes with a summary analysis of Cleveland's position in the world of high-tech.

The Economic Development Administration, U.S. Department of Commerce, provided funding for this paper.

MAJOR FINDINGS

- Twenty-three of 31 industries that are designated high-tech by the Bureau of Labor Statistics have a presence in the Cleveland PMSA. These industries employed almost 100,000 people in 2000 and paid annual wages of just over \$5 billion.
- High-tech growth in the Cleveland PMSA is much smaller than in the rest of the country. From 1992 to 2000, employment grew 29 percent nationally versus five percent in the region. Per capita earnings in the PMSA increased at an annual rate of 1.3 percent compared to a national rate of 3.6 percent. The number of high-tech establishments grew by 74 percent in the U.S. compared to regional growth of 48 percent.

High-Tech Industries In Cleveland

- Across the Cleveland PMSA, seven high-tech industries stand out in terms of employment, earnings, and establishment growth. They include Computer and Data Processing (SIC 737), Management and Public Relations (SIC 874), Measuring and Controlling Devices (SIC 382), Communications Equipment (SIC 366), Research and Development (SIC 873), Special Industrial Machinery (SIC 355), and Construction Machinery (SIC 353).
- In the City of Cleveland, Computer and Data Processing (SIC 737), Engineering and Architecture (SIC 871), and Management and Public Relations (SIC 874) recorded significant baseline employment and growth. In 2000, these industries contributed 35 percent of the total high-tech employment in the city and 39 percent of net growth over the eight-year reporting period. They also form part of the business support services segment, which is seen by many outsiders as Cleveland's high-tech advantage.
- In 2000, high-tech industry per-capita earnings in the City of Cleveland stood at \$53,500. Industries with the largest earnings growth are Research and Development (SIC 873) and Management and Public Relations (SIC 874). From 1992 to 2000, earnings in SIC 873 grew by \$27,000, or 80 percent. SIC 874 saw growth of 49 percent, or \$26,000.
- The City of Cleveland's share of high-tech employment, as a percentage of the six-county PMSA region, stood at 22 percent in 2000. This is slightly above the city's share of the population. The city's share of high-tech establishments in 2000 was 17 percent, a decrease of three percent over the eight-year reporting period.
- Motor Vehicles and Equipment (SIC 371) is by far the largest high-tech employer in the metropolitan area (excluding the City of Cleveland). With over 16,000 employees, this industry accounts for approximately 21 percent of total aggregated high-tech employment. However, its growth over the eight-year briefing period was

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only two percent. Multiple regional plants operated by the big three automakers account for much of the employment.

- In the metropolitan area (excluding the City of Cleveland), Computer and Data Processing (SIC 737) is the most prominent of all high-tech industries in terms of base-line employment and growth. SIC 737 employed almost 10,000 people in 2000. This represents a 50 percent increase, or 3,300 jobs, over eight years. The industry includes software development companies and system integrators.
- In 2000, average per-capita earnings in the metropolitan area (excluding the City of Cleveland) stood at \$51,300. Industries showing the largest earnings growth in the metropolitan area are Communications Equipment (SIC 366) and Computer and Data Processing (SIC 737). From 1992 to 2000, earnings in SIC 366 grew by \$25,000, or 78 percent. SIC 737 saw growth of 31 percent, or \$14,000.
- Due to reporting issues, Research and Development (SIC 873) and Computer and Data Processing (SIC 737) are underrepresented in the statistics. NASA's 2,000 employees are not included under SIC 873, nor are the R&D facilities of some major corporations. Forty-five thousand IT professionals are not reported under SIC 737 because they work for companies that do not consider IT to be their main product or service.

INTRODUCTION

The existence of high-tech industries in Greater Cleveland is an intensely debated subject. Most local media reports tend to treat this issue somewhat negatively. While reference is often made to high-tech activity in bio-med and information technology (IT), the conventional wisdom is that the region lags behind many other U.S. metropolitan areas in the number of companies, employment levels, and product innovation.

This briefing paper provides an analysis of high-tech activity in the Cleveland Primary Metropolitan Statistical Area (PMSA). It begins by defining the term high-tech industry, using criteria developed by the Bureau of Labor Statistics (BLS). This is followed by a discussion of the data used in the analysis. Next, high-tech industries are analyzed from the viewpoint of employment levels, average earnings, and number of establishments. Within this section, the City of Cleveland's share of high-tech activity is discussed along with a comparison of the Cleveland PMSA versus the U.S. The paper concludes with a summary analysis of Cleveland's position in the world of high-tech.

The Economic Development Administration, U.S. Department of Commerce, provided funding for this paper.

DEFINING HIGH-TECH INDUSTRIES

It should not be a surprise that multiple definitions exist for the term ‘high-tech industry.’ Almost every major metropolitan region in the United States wants to market itself as high-tech for purposes of attracting businesses and status. Hence, definitions are formed to fit the type of industries that exist in a specific geographic area.

Two definitions that are gaining broad-based acceptance on a national level are those developed by the Bureau of Labor Statistics (BLS)¹ and the American Electronics Association (AEA). This briefing paper uses the BLS definition, which defines high-tech industries based on the proportion of their scientific, technical, and engineering personnel and on the proportion of the aforementioned personnel engaged specifically in research and development. Technology-oriented personnel include engineers, life and physical scientists, mathematical specialists, engineering and science technicians, computer specialists, and engineering, scientific, and computer managers. Personnel in these occupations require in-depth knowledge of the theories and principles of science, engineering, and mathematics, which is generally acquired through specialized post-high school education in some field of technology ranging from an associate’s degree to a doctorate. Firms that engage significant numbers of these personnel typically design, develop, and introduce new products and innovative manufacturing processes, or both, through the systematic application of scientific and technical knowledge.

BLS concludes that industries are high-tech if employment in both research and development and in all technology-oriented occupations account for a proportion of employment that is at least twice the average for all industries in the Occupational Employment Statistics Survey. High-tech industries must employ at least six research and development workers per thousand workers and 76 technology-oriented workers per thousand workers. A subset of 10 high-tech industries, those with ratios at least five times the average, is referred to as high-tech intensive industries. These industries have at least 15 research and development workers per thousand workers and 190 technology-oriented workers per thousand workers. Table 1 lists BLS-defined high-tech intensive and high-tech industries by three digit SICs.

¹ Hecker, Daniel. “High Technology Employment: A Broader View,” *Monthly Labor Review*. June 1999, pp. 18 – 28.

The common denominator among all industries listed in Table 1 is that they actively engage in developing new products and production processes through the application of scientific and technical knowledge. This denominator applies whether the industry is mature (paint and allied products) or a relative newcomer (computer and data processing) to the marketplace.

Table 1. BLS Defined High-Tech Industries

| SIC | Description |
|---------------------------------------|--------------------------------------|
| High-Tech Intensive Industries | |
| 281 | Industrial Inorganic Chemicals |
| 283 | Drugs |
| 286 | Industrial Organic Chemicals |
| 357 | Computer & Office Equipment |
| 366 | Communications Equipment |
| 367 | Electronic Components & Accessories |
| 372 | Aircraft & Parts |
| 376 | Guided Missiles & Space Vehicles |
| 381 | Search & Navigation Equipment |
| 382 | Measuring & Controlling Devices |
| 737 | Computer & Data Processing Services |
| 873 | Research & Development Services |
| High-Tech Industries | |
| 282 | Plastic Materials & Synthetics |
| 284 | Soaps, Cleaners & Toilet Goods |
| 285 | Paint & Allied Products |
| 287 | Agricultural Chemicals |
| 289 | Miscellaneous Chemical Products |
| 291 | Petroleum Refining |
| 348 | Ordnance & Accessories |
| 351 | Engines & Turbines |
| 353 | Construction & Related Machinery |
| 355 | Special Industrial Machinery |
| 356 | General Industrial Machinery |
| 361 | Electrical Distribution Equipment |
| 362 | Electrical Industrial Apparatus |
| 365 | Household Audio & Video Equipment |
| 371 | Motor Vehicles & Equipment |
| 384 | Medical Equipment & Instruments |
| 386 | Photographic Equipment & Supplies |
| 871 | Engineering & Architectural Services |
| 874 | Management & Public Relations |

DATA AND METHODOLOGY

This briefing paper examines employment levels, average earnings, and number of establishments for each applicable high-tech industry. It focuses on the time period from the second quarter of 1992 to the second quarter of 2000. All 1992 earnings have been inflated to 2000 levels. Statistical information presented is derived from ES202 estimates. Background information on specific companies is taken from *Crain's Cleveland Business* archives.

ES202 data are based on quarterly unemployment compensation reports collected by each state under federal mandate. Nearly all employers with paid employees are required to file unemployment reports to their respective states. The data includes quarterly information on each company's name, address, zip code, county, industrial classification, employment, and earnings. Estimates for employment levels, average earnings, and number of establishments by zip code are developed from this data. One advantage of ES202 data is that it supplies records for each establishment operated by a company. This provides a clearer picture of a company's presence in a geographic area.

Confidentiality restrictions limit data presentation. If an industry has less than three companies within the geographic area of interest, or a single company employs 80 percent or more of personnel within an industry in the geographic area of interest, then the data must be suppressed to protect a company's identity. 'N/a' designates suppressed entries in the report tables.

In this briefing, industries are aggregated into the BLS-defined groups: high-tech intensive and high-tech. To be included in a group, a regional industry employment of greater than 350 persons or an establishment level of five or greater is required. Twenty-three of 31 BLS-identified industries fall within these constraints. The eight industries² that did not meet the constraints had an estimated combined employment of 1,431 persons and operated 18 establishments across the entire PMSA during the second quarter of 2000. Since these eight industries have an insignificant presence, they are excluded from the analysis.

²Petroleum Refining (SIC 291); Guided Missiles & Space Vehicles (SIC 376); Search & Navigation Equipment (SIC 381); Agricultural Chemicals (SIC 287); Ordnance & Accessories (SIC 348); Engines & Turbines (SIC 351); Audio & Video Equipment (SIC 365); Photographic Equipment (SIC 386)

In this briefing paper, high-tech activity within the City of Cleveland is segregated from the remainder of the Cleveland PMSA and analyzed separately. Structuring the analysis in this way provides insight into the economic health of the central city, and demonstrates if Cleveland is keeping pace with the metro area in high-tech growth. Tables providing data related to companies located within the City of Cleveland have the designation ‘City of Cleveland’ in their title. Tables showing data related to companies located in the remainder of the Cleveland PMSA have the designation ‘Cleveland Metro Area’ in their title. The latter area includes Ashtabula, Geauga, Lake, Lorain, Medina, and Cuyahoga (excluding the City of Cleveland) counties.

Part of the analysis relates to Cleveland’s share of high-tech industrial activity. Cleveland’s share is defined as the percentage of high-tech employment that is located in the City of Cleveland, or the percentage of high-tech establishments that are located in the City of Cleveland. Arithmetically, Cleveland’s share equals:

$$\left[\frac{\text{City of Cleveland}}{\text{City of Cleveland} + \text{Cleveland Metro Area}} \right] * 100.$$

The final section of the analysis compares high-tech activity in the Cleveland PMSA versus the U.S. Here, data from the Cleveland Metro Area and the City of Cleveland are combined to provide values that represent the entire Cleveland PMSA.

NASA facilities fall under Space Research and Technology (SIC 9661), which is excluded from the BLS list. This exclusion skews the briefing’s analysis because over 1,700 scientists and engineers employed by the NASA Glenn Research Center are not included. However, an additional 1,300 employees who work for firms contracted by NASA are included under Engineering and Architectural Services (SIC 871) and Research and Development (SIC 873).

ANALYSIS

Cleveland Metro Area: Employment

Across the Cleveland Metro Area, aggregated high-tech employment saw limited growth during the 1992 to 2000 time period. As seen in Table 2, a net gain of approximately 2,800 jobs or just under four percent was recorded. High-tech intensive industries realized an employment loss of 418 jobs, a sharp contrast to the high-tech group where an employment gain of 3,178 workers was seen.

Computer and Data Processing (SIC 737) is the most prominent of all high-tech intensive industries, employing almost 10,000 people. This accounts for one-third of total employment in 2000. It experienced 50 percent growth, posting a gain of almost 3,300 jobs. This industry includes software development companies and system integrators. Several hundred of these firms operate in the Cleveland metro area, including the well-known Hyland Software, Everstream, and Ideastar. Everstream has developed a product to help local newspapers, including the *Jerusalem Post*, establish branded radio stations on their Internet portals. Like their traditional broadcast cousins, the newspapers' online radio stations generate revenues by selling airtime to local and national advertisers.

Measuring and Controlling Devices (SIC 382) is another high-tech intensive industry with a significant metro area presence. In 2000, the industry employed over 5,500 people, down about three percent over the eight-year period. This industry employs thousands of degreed engineers. Three familiar names are ABB, Keithley Instruments, and Rockwell Automation. Each of these companies is a major global player and has facilities in the eastern suburbs of Cleveland. Solon-based Keithley makes precision measurement systems for customers in the electronics industry and other high-tech fields. Their core business is providing equipment for testing semiconductor chips. They also work with wireless phone companies, including Motorola, to develop instruments for testing cellular phones.

High-Tech Industries In Cleveland

Aircraft and Parts (SIC 372) is one of only two high-tech intensive industries to post a significant decline. Here, approximately 2,400 jobs, or 46 percent, were lost. This decline is due in part to downsizing production operations by three major Cleveland-based companies.

Motor Vehicles and Equipment (SIC 371) is by far the largest high-tech industry employer in the metro area. With over 16,000 employees, this industry accounts for approximately 35 percent of total employment. However, its growth over the eight-year study period was only two percent. Multiple regional plants operated by the big three automakers account for most of the employment.

The high-tech industry experiencing the most significant growth is Management and Public Relations (SIC 874). This industry recorded a gain of almost 1,500 workers, or 39 percent. Unlike competitors located in downtown Cleveland, such as McKinsey & Company, most firms in the metro area are small, with 87 percent having 10 or less employees. Almost 30 percent of these companies are located in Cuyahoga County (excluding the City of Cleveland). The remaining companies are evenly distributed across the other five metro counties.

Electrical Industrial Apparatus (SIC 362) posted the largest employment decline among high-tech industries. Over 1,300 jobs, or 42 percent, were lost. Many of these jobs were associated with a long-time Cleveland company that was downsized after being purchased by an out-of-town firm in the mid-1990s.

**Table 2. High-Tech Industry Employment, Cleveland Metro Area
(Excluding City of Cleveland)**

| SIC | Description | 2Q92 | 2Q00 | Change | % Change |
|---------------------------------------|-----------------------------------|---------------|---------------|--------------|--------------|
| High-Tech Intensive Industries | | | | | |
| 281 | Industrial Inorganic Chemicals | 1,991 | 1,468 | -523 | -26.3% |
| 283 | Drugs | 561 | 717 | 156 | 27.9% |
| 286 | Industrial Organic Chemicals | 2,605 | 2,012 | -593 | -22.7% |
| 357 | Computer & Office Equipment | 1,509 | 489 | -1,020 | -67.6% |
| 366 | Communications Equipment | 1,646 | 1,918 | 272 | 16.5% |
| 367 | Electronic Components | 1,349 | 2,298 | 949 | 70.4% |
| 372 | Aircraft & Parts | 5,246 | 2,843 | -2,403 | -45.8% |
| 382 | Measuring & Controlling Devices | 5,692 | 5,528 | -164 | -2.9% |
| 737 | Computer & Data Processing Serv. | 6,566 | 9,852 | 3,286 | 50.0% |
| 873 | Research & Development | 2,667 | 2,288 | -379 | -14.2% |
| Total | | 29,832 | 29,414 | -418 | -1.4% |
| High-Tech Industries | | | | | |
| 282 | Plastic Materials & Synthetics | 2,737 | 2,414 | -323 | -11.8% |
| 284 | Soaps & Cleaners | 1,241 | 1,651 | 410 | 33.0% |
| 285 | Paint Products | 1,227 | 1,210 | -17 | -1.4% |
| 289 | Miscellaneous Chemicals | 2,469 | 3,012 | 543 | 22.0% |
| 353 | Construction Machinery | 1,514 | 2,179 | 665 | 43.9% |
| 355 | Special Industrial Machinery | 1,643 | 2,023 | 380 | 23.2% |
| 356 | General Industrial Machinery | 2,472 | 2,274 | -198 | -8.0% |
| 361 | Electrical Distribution Equipment | 172 | 239 | 67 | 38.7% |
| 362 | Electrical Industrial Apparatus | 3,101 | 1,785 | -1,316 | -42.4% |
| 371 | Motor Vehicles & Equipment | 16,185 | 16,514 | 329 | 2.0% |
| 384 | Medical Equipment & Instruments | 2,927 | 3,390 | 463 | 15.8% |
| 871 | Engineering & Architecture | 4,895 | 5,585 | 690 | 14.1% |
| 874 | Management & Public Relations | 3,788 | 5,274 | 1,486 | 39.2% |
| Total | | 44,371 | 47,549 | 3,178 | 7.2% |
| Aggregated Total | | 74,203 | 76,962 | 2,759 | 3.7% |

Cleveland Metro Area: Average Earnings

Per capita average earnings across all BLS-designated industries increased, in real terms, by just over nine percent during the study period, as seen in Table 3. This yields an average annual increase of 1.1 percent, or \$534 per year. High-tech intensive industries saw real increases of just under 19 percent, or about \$8,300 on average. By contrast, high-tech industries posted an eight-year aggregated increase of only 3.4 percent, or \$1,646.

Among high-tech intensive industries, Communications Equipment (SIC 366) led the way with earnings increases of over \$25,000, or 78 percent. Rapidly growing Marconi Communications, formerly Reltec Corporation, is a major global player within SIC 366. The company produces DC power systems, rectifiers, and power converters used in voice and data networks. Marconi attributes its growth to the blitz of telecommunications companies that are expanding and upgrading their systems for video, audio, and data transfer. Telecommunication companies use power conversion units made by Marconi to operate their systems.

Two other high-tech intensive industries posting large earnings increases are Computer and Data Processing (SIC 737) and Measuring and Controlling Devices (SIC 382). The former saw an increase of almost \$14,000, or over 31 percent. Measuring and Controlling Devices recorded an earnings increase of just over \$11,000, or 26 percent. Earnings estimates show that the increases are evenly distributed across all companies within their respective industries.

General Industrial Machinery (SIC 356) recorded the highest earnings increase among the high-tech group at just over \$10,000, or 30 percent. This industry is comprised of over 70 companies in the metro area, almost all of whom employ less than 50 people. Here also, earnings increases are evenly distributed across all companies.

Other high-tech industries posting large increases in average earnings are Soaps and Cleaners (SIC 284) and Medical Equipment and Instruments (SIC 384). Nationally known companies Matrix Essentials and Colgate Palmolive are among several contributors to the 25 percent earnings increase seen in SIC 284. Medical Equipment and Instruments saw earnings increase

by over 19 percent. Mentor-based Steris Corporation, known for their sterilization and decontamination systems, and Invacare, a producer of non-acute healthcare products, play leading roles in SIC 384.

Table 3. High-Tech Industry Average Earnings, Cleveland Metro Area (Excluding City of Cleveland)

| SIC | Description | 2Q92 | 2Q00 | Change | % Change |
|---------------------------------------|-----------------------------------|-----------------|-----------------|----------------|--------------|
| High-Tech Intensive Industries | | | | | |
| 281 | Industrial Inorganic Chemicals | \$50,202 | \$57,608 | \$7,406 | 14.8% |
| 283 | Drugs | \$33,434 | \$37,842 | \$4,408 | 13.2% |
| 286 | Industrial Organic Chemicals | \$57,185 | \$58,867 | \$1,681 | 2.9% |
| 357 | Computer & Office Equipment | \$33,623 | \$42,533 | \$8,910 | 26.5% |
| 366 | Communications Equipment | \$32,592 | \$58,048 | \$25,456 | 78.1% |
| 367 | Electronic Components | \$28,015 | \$31,002 | \$2,988 | 10.7% |
| 372 | Aircraft & Parts | \$50,985 | \$47,895 | -\$3,091 | -6.1% |
| 382 | Measuring & Controlling Devices | \$42,822 | \$54,057 | \$11,235 | 26.2% |
| 737 | Computer & Data Processing Serv. | \$44,445 | \$58,404 | \$13,959 | 31.4% |
| 873 | Research & Development | \$37,089 | \$40,407 | \$3,318 | 8.9% |
| Total | | \$43,973 | \$52,234 | \$8,261 | 18.8% |
| High-Tech Industries | | | | | |
| 282 | Plastic Materials & Synthetics | \$55,241 | \$58,782 | \$3,540 | 6.4% |
| 284 | Soaps & Cleaners | \$33,378 | \$41,766 | \$8,388 | 25.1% |
| 285 | Paint Products | \$42,414 | \$46,598 | \$4,185 | 9.9% |
| 289 | Miscellaneous Chemicals | \$45,218 | \$44,774 | -\$444 | -1.0% |
| 353 | Construction Machinery | \$41,194 | \$42,587 | \$1,393 | 3.4% |
| 355 | Special Industrial Machinery | \$38,343 | \$43,010 | \$4,666 | 12.2% |
| 356 | General Industrial Machinery | \$33,462 | \$43,507 | \$10,045 | 30.0% |
| 361 | Electrical Distribution Equipment | \$31,464 | \$32,405 | \$941 | 3.0% |
| 362 | Electrical Industrial Apparatus | \$47,680 | \$51,445 | \$3,765 | 7.9% |
| 371 | Motor Vehicles & Equipment | \$59,920 | \$58,045 | -\$1,875 | -3.1% |
| 384 | Medical Equipment & Instruments | \$38,706 | \$46,154 | \$7,448 | 19.2% |
| 871 | Engineering & Architecture | \$43,346 | \$47,073 | \$3,727 | 8.6% |
| 874 | Management & Public Relations | \$43,031 | \$47,730 | \$4,699 | 10.9% |
| Total | | \$49,039 | \$50,685 | \$1,646 | 3.4% |
| Aggregated Total | | \$47,003 | \$51,277 | \$4,274 | 9.1% |

CLEVELAND METRO AREA: ESTABLISHMENTS

Table 4 shows aggregated high-tech establishment growth at just under 54 percent, or 1,059 units, during the 1992 to 2000 time period. This is primarily due to significant growth in just three industries: SICs 737, 871 and 874. They contributed 90 percent of establishment growth. Removing these industries from the analysis results in aggregated growth of 15 percent, or 101 units. High-tech intensive industries recorded establishment growth of about 73 percent, or 511 units. Removing SIC 737 from the analysis reduces growth to 46 units, or 15.6 percent. Likewise, high-tech industries will record an establishment increase of 14.5 percent instead of 43.3 percent if SIC 871 and SIC 874 are taken out of the analysis.

Within the high-tech intensive group, Computer and Data Processing (SIC 737) saw the largest establishment growth at 464 units, or 115 percent. Most establishments are very small operations, with 58 percent having only one or two employees. Approximately 70 percent are located in Cuyahoga County, and 38 percent perform work that is related to software development. One nationally known company is Hyland Software, which specializes in document management systems. The company increased their sales by over 2,600 percent during the past five years. It was named to the 1999 *Inc. 500* list of the fastest growing private companies in the U.S. Hyland was also named to the 1999 *Deloitte & Touche Technology Fast 500* list of the fastest growing technology companies in the U.S.

Also within the high-tech intensive group, Measuring and Controlling Devices (SIC 382) and Research and Development (SIC 873) both recorded establishment growth of just over 30 percent. Many R&D establishments are relatively small facilities, with 66 percent employing 10 or less people. Over 70 percent are located in Cuyahoga County. Types of commercial research conducted are evenly distributed among physical, non-physical, and testing services. The size of establishments related to Measuring and Controlling Devices varies widely, with over 40 percent having 25 or more employees. Cuyahoga County is home to over 60 percent of the establishments, and 34 percent perform work that is related to process control instrumentation.

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Engineering and Architecture (SIC 871) and Management and Public Relations (SIC 874) contributed significantly to establishment growth in the high-tech group. The latter grew by almost 76 percent, or 366 units. Seventy percent of the establishments are located in Cuyahoga County, and 75 percent employ three or less people. Two-thirds of SIC 874- related establishments are engaged in management consulting services.

Engineering and Architecture grew by 128 units, or 31.5 percent. Within the industry, 75 percent of establishments are engaged in engineering services, 18 percent in architectural services, and seven percent in surveying-related work. Almost all establishments are small, with 81 percent employing 10 or fewer employees. Sixty-five percent are located in Cuyahoga County. R.E. Warner, a Westlake, Ohio-based consulting engineering firm, typifies the engineering expertise available in Greater Cleveland. The company boasts 130 employees, an increase of more than 60 percent since 1995. Warner's activities include construction management and manufacturing facility analysis. Its focus on multi-disciplined consulting has attracted clients such as Honda, Ford, Corning, and the Richard E. Jacobs Group.

Table 4. High-Tech Industry Establishments, Cleveland Metro Area (Excluding City of Cleveland)

| SIC | Description | 2Q92 | 2Q00 | Change | % Change |
|---------------------------------------|-----------------------------------|--------------|--------------|--------------|--------------|
| High-Tech Intensive Industries | | | | | |
| 281 | Industrial Inorganic Chemicals | 25 | 22 | -3 | -12.4% |
| 283 | Drugs | 8 | 5 | -3 | -39.4% |
| 286 | Industrial Organic Chemicals | 10 | 9 | -1 | -5.0% |
| 357 | Computer & Office Equipment | 14 | 12 | -2 | -13.2% |
| 366 | Communications Equipment | 8 | 12 | 4 | 53.1% |
| 367 | Electronic Components | 42 | 46 | 5 | 11.4% |
| 372 | Aircraft & Parts | 31 | 27 | -3 | -11.0% |
| 382 | Measuring & Controlling Devices | 53 | 70 | 17 | 31.8% |
| 737 | Computer & Data Processing Serv. | 404 | 868 | 464 | 114.9% |
| 873 | Research & Development | 107 | 140 | 33 | 30.6% |
| | Total | 701 | 1,212 | 511 | 72.8% |
| High-Tech Industries | | | | | |
| 282 | Plastic Materials & Synthetics | 13 | 18 | 5 | 41.8% |
| 284 | Soaps & Cleaners | 13 | 15 | 2 | 18.3% |
| 285 | Paint Products | 14 | 15 | 1 | 9.4% |
| 289 | Miscellaneous Chemicals | 51 | 47 | -4 | -8.7% |
| 353 | Construction Machinery | 31 | 44 | 13 | 40.4% |
| 355 | Special Industrial Machinery | 39 | 55 | 16 | 40.1% |
| 356 | General Industrial Machinery | 60 | 68 | 8 | 13.6% |
| 361 | Electrical Distribution Equipment | 12 | 13 | 1 | 8.5% |
| 362 | Electrical Industrial Apparatus | 38 | 45 | 7 | 17.3% |
| 371 | Motor Vehicles & Equipment | 60 | 62 | 2 | 3.8% |
| 384 | Medical Equipment & Instruments | 47 | 51 | 4 | 8.4% |
| 871 | Engineering & Architecture | 407 | 536 | 128 | 31.5% |
| 874 | Management & Public Relations | 482 | 848 | 366 | 75.9% |
| | Total | 1,267 | 1,816 | 549 | 43.3% |
| | Aggregated Total | 1,968 | 3,028 | 1,059 | 53.8% |

CITY OF CLEVELAND: EMPLOYMENT

Aggregated high-tech employment in the City of Cleveland grew by about 1,900 workers, or just under 10 percent, during the 1992 to 2000 time period (see Table 5). This means that the city recorded a net gain, on average, of 237 jobs per year. The high-tech intensive group showed an increase of only 80 employees, or 1.6 percent, whereas the high-tech group recorded growth of just under 12 percent, or 1,815 employees.

Of the 23 BLS-designated industries, three stand out in terms of both baseline employment and growth: Computer and Data Processing (SIC 737), Engineering and Architecture (SIC 871), and Management and Public Relations (SIC 874). These industries form part of the business support services segment, which is seen by many outsiders as Cleveland's high-tech advantage. They comprised 35 percent of aggregated employment in 2000 and contributed 39 percent of net growth over the eight-year briefing period.

Within the high-tech intensive group, Computer and Data Processing posted the largest employment growth by adding 959 employees, a 99 percent gain. Functionally, software development and systems integration saw the largest growth, followed by information retrieval services. Downtown Cleveland experienced the largest employment gain. One such employer is Flashline.com. Launched in 1998, the company created a virtual marketplace for vendors and consumers of software components. Through its website, Flashline provides a medium where software developers can buy and sell pre-built software components. Their efforts to create a worldwide software component marketplace has won praise from trade publications such as *Internet World* and *PC Week*.

Two other high-tech intensive industries recorded significant employment growth, Inorganic Chemicals (SIC 281) and Research and Development (SIC 873). The former posted growth of more than 83 percent, or 314 employees. Leading the way were Colormatrix Corp and NPA Coatings. Research and Development grew by almost 110 percent, or 304 employees. In this industry, growth is attributable mainly to the opening of new companies, such as biomed-related Athersys and Copernicus Therapeutics. Athersys leapt into the limelight of the gene therapy race

High-Tech Industries In Cleveland

in 1997 when its scientists became the first to create an artificial chromosome. Its newest development is RAGE technology (random activation of gene expression). This technology is used to activate genes, which enables scientists to turn on and off the expression of genes and control the transmission of hereditary characteristics and diseases. Using RAGE, Athersys can activate a gene without cloning it and can “tag” genes to identify them. By applying the technology, the company has discovered 10,000 genes and holds 18 related patent applications.

Management and Public Relations (SIC 874) showed the largest employment increase within the high-tech group at 873 employees, or almost 36 percent. Downtown Cleveland experienced most of the increase. The west side of the city showed a slight gain, whereas the east side recorded an employment decrease of almost 40 percent. Management consulting-related jobs posted significant employment increases whereas public relations and facilities support showed only minor gains.

Other high-tech industries showing significant increases include Special Industrial Machinery (SIC 355) and Medical Equipment and Instruments (SIC 384). Employment in SIC 355 grew by almost 300 people, or 112 percent. Newcomers to the market account for most of the increase. Medical Equipment and Instruments recorded growth of 166 percent, or 318 employees.

Norman Noble Inc, known for their computer-controlled laser machining, contributed to this increase. In the mid-1990s, the company began making coronary artery implants for Johnson & Johnson and other medical product suppliers. These tiny stainless steel implants, or stents, are placed into previously blocked arteries during angioplasty surgery to keep the arteries open. Norman Noble’s laser technology enables them to produce other highly robust medical devices, such as those used as drug delivery devices and DNA testing probes.

TABLE 5. HIGH-TECH INDUSTRY EMPLOYMENT, CITY OF CLEVELAND

| SIC | Description | 2Q92 | 2Q00 | Change | % Change |
|---------------------------------------|-----------------------------------|---------------|---------------|---------------|-----------------|
| High-Tech Intensive Industries | | | | | |
| 281 | Industrial Inorganic Chemicals | 378 | 692 | 314 | 83.2% |
| 283 | Drugs | N/a | N/a | N/a | N/a |
| 286 | Industrial Organic Chemicals | 512 | N/a | N/a | N/a |
| 357 | Computer & Office Equipment | N/a | N/a | N/a | N/a |
| 366 | Communications Equipment | 27 | N/a | N/a | N/a |
| 367 | Electronic Components | 436 | 190 | -246 | -56.3% |
| 372 | Aircraft & Parts | 1,523 | 681 | -842 | -55.3% |
| 382 | Measuring & Controlling Devices | 876 | 804 | -72 | -8.3% |
| 737 | Computer & Data Processing Serv. | 968 | 1,927 | 959 | 99.0% |
| 873 | Research & Development | 278 | 582 | 304 | 109.4% |
| | Total | 5,022 | 5,102 | 80 | 1.6% |
| High-Tech Industries | | | | | |
| 282 | Plastic Materials & Synthetics | N/a | 246 | N/a | N/a |
| 284 | Soaps & Cleaners | 1,180 | 1,384 | 204 | 17.3% |
| 285 | Paint Products | 3,128 | 3,058 | -70 | -2.2% |
| 289 | Miscellaneous Chemicals | 1,486 | 1,483 | -3 | -0.2% |
| 353 | Construction Machinery | 356 | 355 | -1 | -0.4% |
| 355 | Special Industrial Machinery | 262 | 557 | 295 | 112.6% |
| 356 | General Industrial Machinery | 1,133 | 771 | -362 | -31.9% |
| 361 | Electrical Distribution Equipment | N/a | N/a | N/a | N/a |
| 362 | Electrical Industrial Apparatus | 1,269 | 1,088 | -181 | -14.3% |
| 371 | Motor Vehicles & Equipment | 1,331 | 1,652 | 321 | 24.1% |
| 384 | Medical Equipment & Instruments | 191 | 509 | 318 | 166.5% |
| 871 | Engineering & Architecture | 2,166 | 2,500 | 334 | 15.4% |
| 874 | Management & Public Relations | 2,452 | 3,325 | 873 | 35.6% |
| | Total | 15,320 | 17,135 | 1,815 | 11.8% |
| | Aggregated Total | 20,342 | 22,237 | 1,895 | 9.3% |

CITY OF CLEVELAND: AVERAGE EARNINGS

Aggregated average earnings in the City of Cleveland increased by about \$6,900, or just under 15 percent, during the briefing period (see Table 6). High-tech intensive industries saw earnings grow by less than six percent, or 0.7 percent annually in real terms. This translates into a yearly average earnings increase of \$340 per employee. Persons in high-tech industries fared better with an annual earnings increase of \$1,017 on average, or 17.5 percent over the eight-year period.

Leading the high-tech intensive group are Research and Development (SIC 873) and Computer and Data Processing (SIC 737). Businesses contributing significantly to the \$27,000 R&D earning gains are found performing work related to biomed/biotech and finance. SIC 737 posted an increase of almost 36 percent, or \$14,360. Businesses with products involving software development and systems integration realized the largest earnings growth. One example is Netgenics, a software company located in downtown Cleveland. They developed a program called Synergy, which is designed to help drug researchers share data. It is tailored specifically for pharmaceutical companies and those researchers engaged in gene-based drug discovery and bioinformatics. The latter makes use of computers to analyze biological data such as DNA sequencing. Synergy organizes and integrates on a single platform DNA sequence information from multiple databases.

Within the high-tech group, three industries posted significant earnings increases. Special Industrial Machinery (SIC 355) saw an annual growth rate of about 4 percent, or \$12,200 for the eight-year period. Increases were spread evenly across all businesses within the industry. Motor Vehicles and Equipment (SIC 371) posted an increase of just over 36 percent or \$16,740. Global players in this industry include Eaton Corporation and Midland Steel Products. Management and Public Relations (SIC 874) recorded the highest earnings growth at 48.7 percent, or just over \$26,000. Within the industry, management consulting services saw earnings rise by just over 100 percent, while public relations services posted an increase of nearly 60 percent. Firms located on the city's east side and downtown recorded increases whereas west side companies saw a decline in earnings.

Medical Equipment and Instruments (SIC 384) is the only high-tech industry in the City of Cleveland to record a significant earnings decline. One possible reason for the 31 percent decrease was the move of DePuy AcroMed to Massachusetts in the late 1990s by parent company Johnson & Johnson.

Table 6. High-Tech Industry Average Earnings, City of Cleveland

| SIC | Description | 2Q92 | 2Q00 | Change | % Change |
|---------------------------------------|-----------------------------------|-----------------|-----------------|----------------|--------------|
| High-Tech Intensive Industries | | | | | |
| 281 | Industrial Inorganic Chemicals | \$47,339 | \$47,766 | \$427 | 0.9% |
| 283 | Drugs | N/a | N/a | N/a | N/a |
| 286 | Industrial Organic Chemicals | \$69,579 | N/a | N/a | N/a |
| 357 | Computer & Office Equipment | N/a | N/a | N/a | N/a |
| 366 | Communications Equipment | \$49,592 | N/a | N/a | N/a |
| 367 | Electronic Components | \$28,365 | \$25,422 | -\$2,943 | -10.4% |
| 372 | Aircraft & Parts | \$60,771 | \$56,344 | -\$4,427 | -7.3% |
| 382 | Measuring & Controlling Devices | \$30,405 | \$33,339 | \$2,934 | 9.7% |
| 737 | Computer & Data Processing Serv. | \$40,216 | \$54,576 | \$14,360 | 35.7% |
| 873 | Research & Development | \$33,960 | \$60,986 | \$27,027 | 79.6% |
| | Total | \$46,942 | \$49,653 | \$2,711 | 5.8% |
| High-Tech Industries | | | | | |
| 282 | Plastic Materials & Synthetics | N/a | \$64,898 | N/a | N/a |
| 284 | Soaps & Cleaners | \$33,161 | \$34,159 | \$998 | 3.0% |
| 285 | Paint Products | \$51,078 | \$52,443 | \$1,365 | 2.7% |
| 289 | Miscellaneous Chemicals | \$48,673 | \$49,868 | \$1,195 | 2.5% |
| 353 | Construction Machinery | \$43,438 | \$40,007 | -\$3,431 | -7.9% |
| 355 | Special Industrial Machinery | \$34,590 | \$46,788 | \$12,198 | 35.3% |
| 356 | General Industrial Machinery | \$40,169 | \$47,166 | \$6,997 | 17.4% |
| 361 | Electrical Distribution Equipment | N/a | N/a | N/a | N/a |
| 362 | Electrical Industrial Apparatus | \$27,627 | \$36,203 | \$8,575 | 31.0% |
| 371 | Motor Vehicles & Equipment | \$46,185 | \$62,925 | \$16,740 | 36.2% |
| 384 | Medical Equipment & Instruments | \$57,774 | \$39,980 | -\$17,794 | -30.8% |
| 871 | Engineering & Architecture | \$50,601 | \$50,674 | \$73 | 0.1% |
| 874 | Management & Public Relations | \$53,613 | \$79,734 | \$26,120 | 48.7% |
| | Total | \$46,574 | \$54,713 | \$8,139 | 17.5% |
| | Aggregated Total | \$46,665 | \$53,552 | \$6,887 | 14.8% |

CITY OF CLEVELAND: ESTABLISHMENTS

Aggregated high-tech establishment growth in the City of Cleveland during the study period is estimated at 137 units, or about 28 percent, as seen in Table 7. These statistics do not reflect growth patterns across all BLS-designated industries due to significant increases in just two industries, Computer and Data Processing (SIC 737) and Management and Public Relations (SIC 874). Removing SIC 737 and SIC 874 from the analysis yields an aggregated net increase of just 19 units, or 6.3 percent.

The high-tech intensive group saw establishment growth of 40.6 percent, or 58 units. If Computer and Data Processing is taken out, the net increase drops to only four units, or just over five percent. Within the high-tech group, establishments grew by 79 units, or 22.4 percent. Removing Management and Public Relations from the analysis changes the net increase to just 15 units, or almost seven percent.

Computer and Data Processing (SIC 737) posted the largest establishment growth within high-tech intensive industries at 54 units, or just under 82 percent. Most establishments are small, with 43 percent employing one or two persons. Only 18 percent have more than 20 employees. Fifty-one percent are located in downtown Cleveland, and 38 percent are involved in software development and systems integration.

The only industry in the high-tech group to experience significant establishment growth is Management and Public Relations (SIC 874). A net increase of 64 establishments, or 50.4 percent was recorded. Sixty-two percent of the establishments employ three or less people, and only seven percent have 50 or more employees. Downtown Cleveland is home to 64 percent of the establishments, including such well-known names as Edward Howard & Company, Dix & Eaton, McKinsey & Company, Accenture, and Booz Allen & Hamilton.

TABLE 7. HIGH-TECH INDUSTRY ESTABLISHMENTS, CITY OF CLEVELAND

| SIC | Description | 2Q92 | 2Q00 | Change | % Change |
|---------------------------------------|-----------------------------------|------------|------------|------------|--------------|
| High-Tech Intensive Industries | | | | | |
| 281 | Industrial Inorganic Chemicals | 9 | 9 | 0 | 0.0% |
| 283 | Drugs | N/a | N/a | N/a | N/a |
| 286 | Industrial Organic Chemicals | 7 | N/a | N/a | N/a |
| 357 | Computer & Office Equipment | N/a | N/a | N/a | N/a |
| 366 | Communications Equipment | 2 | N/a | N/a | N/a |
| 367 | Electronic Components | 8 | 4 | -4 | -50.0% |
| 372 | Aircraft & Parts | 9 | 10 | 1 | 11.1% |
| 382 | Measuring & Controlling Devices | 13 | 15 | 2 | 15.4% |
| 737 | Computer & Data Processing Serv. | 66 | 120 | 54 | 81.8% |
| 873 | Research & Development | 27 | 34 | 7 | 25.9% |
| | Total | 143 | 201 | 58 | 40.6% |
| High-Tech Industries | | | | | |
| 282 | Plastic Materials & Synthetics | N/a | 4 | N/a | N/a |
| 284 | Soaps & Cleaners | 14 | 10 | -4 | -28.6% |
| 285 | Paint Products | 22 | 20 | -2 | -9.1% |
| 289 | Miscellaneous Chemicals | 17 | 15 | -2 | -11.8% |
| 353 | Construction Machinery | 10 | 10 | 0 | 0.0% |
| 355 | Special Industrial Machinery | 12 | 19 | 7 | 58.3% |
| 356 | General Industrial Machinery | 20 | 21 | 1 | 5.0% |
| 361 | Electrical Distribution Equipment | N/a | N/a | N/a | N/a |
| 362 | Electrical Industrial Apparatus | 13 | 13 | 0 | 0.0% |
| 371 | Motor Vehicles & Equipment | 20 | 18 | -2 | -10.0% |
| 384 | Medical Equipment & Instruments | 7 | 9 | 2 | 28.6% |
| 871 | Engineering & Architecture | 82 | 97 | 15 | 18.3% |
| 874 | Management & Public Relations | 127 | 191 | 64 | 50.4% |
| | Total | 352 | 431 | 79 | 22.4% |
| | Aggregated Total | 495 | 632 | 137 | 27.7% |

CLEVELAND'S HIGH-TECH EMPLOYMENT SHARE

The City of Cleveland's share of employment across all BLS-designated industries stood at just over 22 percent in 2000, an increase of about one percent during the eight-year analysis period (see Table 8). These percentages reflect Cleveland's share of the PMSA population. In 1992, the city's population share was just under 23 percent, falling to 21 percent in 2000.

The high-tech intensive employment share held steady at about 14.5 percent between 1992 and 2000. The high-tech group fared better, with a share of approximately 26 percent. The dominance of Motor Vehicles and Equipment (SIC 371) in suburban locations skews the 26 percent statistic. If SIC 371 is removed from the analysis, then the city's share within the high-tech group rises to just over 33 percent in both 1992 and 2000 and the aggregated employment share increases to 25.4 percent in the second quarter of 2000.

Paint Products (SIC 285) holds the highest share at almost 72 percent. This is due in part to the downtown corporate headquarters for Sherwin-Williams and ICI Paints and a large PPG Industries production facility located on the city's west side. Within business support services, Engineering and Architecture (SIC 871) and Management and Public Relations (SIC 874) hold significant employment shares. This is attributable to large, national firms locating their regional offices in downtown Cleveland.

High-Tech Industries In Cleveland

TABLE 8. EMPLOYMENT SHARE, CITY OF CLEVELAND

| SIC | Description | 2Q92 | 2Q00 |
|---------------------------------------|-----------------------------------|--------------|--------------|
| High-Tech Intensive Industries | | | |
| 281 | Industrial Inorganic Chemicals | 16.0% | 32.0% |
| 283 | Drugs | 2.3% | 5.4% |
| 286 | Industrial Organic Chemicals | 16.4% | 6.3% |
| 357 | Computer & Office Equipment | 0.7% | 1.6% |
| 366 | Communications Equipment | 1.6% | 2.0% |
| 367 | Electronic Components | 24.4% | 7.6% |
| 372 | Aircraft & Parts | 22.5% | 19.3% |
| 382 | Measuring & Controlling Devices | 13.3% | 12.7% |
| 737 | Computer & Data Processing Serv. | 12.8% | 16.4% |
| 873 | Research & Development | 9.4% | 20.3% |
| Total | | 14.4% | 14.8% |
| High-Tech Industries | | | |
| 282 | Plastic Materials & Synthetics | 6.5% | 9.2% |
| 284 | Soaps & Cleaners | 48.7% | 45.6% |
| 285 | Paint Products | 71.8% | 71.7% |
| 289 | Miscellaneous Chemicals | 37.6% | 33.0% |
| 353 | Construction Machinery | 19.0% | 14.0% |
| 355 | Special Industrial Machinery | 13.8% | 21.6% |
| 356 | General Industrial Machinery | 31.4% | 25.3% |
| 361 | Electrical Distribution Equipment | 50.4% | 46.3% |
| 362 | Electrical Industrial Apparatus | 29.0% | 37.9% |
| 371 | Motor Vehicles & Equipment | 7.6% | 9.1% |
| 384 | Medical Equipment & Instruments | 6.1% | 13.1% |
| 871 | Engineering & Architecture | 30.7% | 30.9% |
| 874 | Management & Public Relations | 39.3% | 38.7% |
| Total | | 25.7% | 26.5% |
| Aggregated Total | | 21.5% | 22.4% |

CLEVELAND'S HIGH-TECH ESTABLISHMENT SHARE

The city's aggregated high-tech share of establishments stood at just over 17 percent in 2000. This represents a decrease of almost three percent from 1992 as seen in Table 9. Establishment share is somewhat below that of the population. High-tech intensive industries saw their share decrease by almost three percentage points to just over 14 in 2000. The high-tech group posted a similar decrease, falling to 19.2 percent in 2000.

Due to establishment concentration of three industries in suburban locations, the city's percentage share is somewhat skewed on the low side. Computer and Data Processing (SIC 737), Engineering and Architecture (SIC 871), and Management and Public Relations (SIC 874) hold an aggregated establishment level of 2,252 units or almost 75 percent across all BLS-designated industries. Removing these industries from the analysis increases aggregated establishment share in the city to over 22 percent in 2000. High-tech intensive industries see an increase to just over 19 percent, and the high-tech group posts a share of almost 25 percent. These modified shares are all greater than the city's percentage share of the population.

The aggregated share for SICs 737, 871, and 874 in the City of Cleveland is just over 15 percent. Most of these establishments are relatively small, many with as few as two or three employees. In some cases, the business owner would like to locate in downtown Cleveland, however, operating costs such as parking and lease payments are prohibitive. In addition, building owners are reluctant to rent space to many of these companies, fearing they may not exist at the end of the lease term. The fear factor regarding downtown also comes into play. Software development employees are known to work odd hours and may fear walking to their parking garage late at night. In other cases, the small business owner may only have a few clients and wants his or her establishment located within close proximity.

High-Tech Industries In Cleveland

TABLE 9. ESTABLISHMENT SHARE, CITY OF CLEVELAND

| SIC | Description | 2Q92 | 2Q00 |
|---------------------------------------|-----------------------------------|--------------|--------------|
| High-Tech Intensive Industries | | | |
| 281 | Industrial Inorganic Chemicals | 26.6% | 29.3% |
| 283 | Drugs | 10.7% | 28.4% |
| 286 | Industrial Organic Chemicals | 41.3% | 34.6% |
| 357 | Computer & Office Equipment | 6.7% | 7.6% |
| 366 | Communications Equipment | 20.1% | 7.6% |
| 367 | Electronic Components | 16.1% | 7.9% |
| 372 | Aircraft & Parts | 22.6% | 26.8% |
| 382 | Measuring & Controlling Devices | 19.7% | 17.7% |
| 737 | Computer & Data Processing Serv. | 14.0% | 12.1% |
| 873 | Research & Development | 20.2% | 19.6% |
| Total | | 16.9% | 14.2% |
| High-Tech Industries | | | |
| 282 | Plastic Materials & Synthetics | 31.7% | 17.9% |
| 284 | Soaps & Cleaners | 52.2% | 39.7% |
| 285 | Paint Products | 61.3% | 56.8% |
| 289 | Miscellaneous Chemicals | 25.0% | 24.4% |
| 353 | Construction Machinery | 24.3% | 18.6% |
| 355 | Special Industrial Machinery | 23.5% | 25.8% |
| 356 | General Industrial Machinery | 25.1% | 23.6% |
| 361 | Electrical Distribution Equipment | 14.1% | 23.2% |
| 362 | Electrical Industrial Apparatus | 25.5% | 22.6% |
| 371 | Motor Vehicles & Equipment | 24.9% | 22.4% |
| 384 | Medical Equipment & Instruments | 13.0% | 15.1% |
| 871 | Engineering & Architecture | 16.8% | 15.3% |
| 874 | Management & Public Relations | 20.9% | 18.4% |
| Total | | 21.7% | 19.2% |
| Aggregated Total | | 20.1% | 17.3% |

EMPLOYMENT GROWTH: CLEVELAND PMSA VERSUS THE NATION

This section, along with the next two, analyzes the Cleveland PMSA in its entirety, including the City of Cleveland. As a result, statistical information presented is different from that shown in previous tables.

Nationally, employment increased by 29 percent across all BLS-designated industries between 1992 and 2000. By comparison, the Cleveland PMSA recorded an increase of just under five percent as seen in Table 10.

Within the high-tech intensive group, a nationwide increase of about 33 percent was posted, whereas in the Cleveland PMSA, employment decreased by one percent. Computer and Data Processing (SIC 737) is responsible for much of the national growth. In the U.S., SIC 737 grew by over 150 percent compared to 56 percent locally. If SIC 737 is removed from the analysis, the national employment increase is only 1.5 percent and the local area realizes an employment decrease of almost 17 percent. The Cleveland PMSA does very well in Drugs (SIC 283) and Electronic Components (SIC 367), where increases of 32 percent and 39 percent, respectively, are posted. Both increases are over 10 percentage points greater than those seen nationally.

Across the high-tech group, the national employment increase stood at just over 25 percent compared with a regional increase of over eight percent. However, if Soaps and Cleaners (SIC 284), Special Industrial Machinery (SIC 355), and Electrical Distribution Equipment (SIC 361) are segregated into a subgroup, the Cleveland PMSA saw far more growth than was seen nationally. In each of these industries, local growth was over 20 percentage points greater than that recorded nationwide. By contrast, Management and Public Relations (SIC 874) saw far more national than local growth (66 percent versus 38 percent). In addition, Motor Vehicles and Equipment (SIC 371) saw employment growth of greater than 25 percent nationally compared to just under four percent in the Cleveland area.

High-Tech Industries In Cleveland

TABLE 10. EMPLOYMENT GROWTH : CLEVELAND PMSA VS. THE NATION

| SIC | Description | Cleveland | Nation |
|---------------------------------------|-----------------------------------|------------------|---------------|
| High-Tech Intensive Industries | | | |
| 281 | Industrial Inorganic Chemicals | -8.8% | -28.8% |
| 283 | Drugs | 32.1% | 21.9% |
| 286 | Industrial Organic Chemicals | -31.1% | -22.0% |
| 357 | Computer & Office Equipment | -67.3% | -9.5% |
| 366 | Communications Equipment | 17.0% | 12.8% |
| 367 | Electronic Components | 39.4% | 26.7% |
| 372 | Aircraft & Parts | -47.9% | -25.7% |
| 382 | Measuring & Controlling Devices | -3.6% | 1.0% |
| 737 | Computer & Data Processing Serv. | 56.3% | 152.5% |
| 873 | Research & Development | -2.5% | 15.6% |
| Total | | -1.0% | 32.7% |
| High-Tech Industries | | | |
| 282 | Plastic Materials & Synthetics | -9.2% | -12.0% |
| 284 | Soaps & Cleaners | 25.4% | 4.4% |
| 285 | Paint Products | -2.0% | -9.5% |
| 289 | Miscellaneous Chemicals | 13.7% | -5.3% |
| 353 | Construction Machinery | 35.5% | 16.8% |
| 355 | Special Industrial Machinery | 35.4% | 14.4% |
| 356 | General Industrial Machinery | -15.5% | 5.8% |
| 361 | Electrical Distribution Equipment | 28.2% | 2.1% |
| 362 | Electrical Industrial Apparatus | -34.3% | -5.4% |
| 371 | Motor Vehicles & Equipment | 3.7% | 25.3% |
| 384 | Medical Equipment & Instruments | 25.0% | 7.5% |
| 871 | Engineering & Architecture | 14.5% | 34.1% |
| 874 | Management & Public Relations | 37.8% | 66.3% |
| Total | | 8.4% | 25.2% |
| Aggregated Total | | 4.9% | 29.0% |

Average Earnings: Cleveland PMSA Versus The Nation

The nation consistently surpasses the Cleveland PMSA in average earnings as seen in Table 11. Aggregating high-tech intensive and high-tech industries shows earnings grew by almost 29 percent nationally versus just over 10 percent locally. In the second quarter of 2000, per capita earnings are just over \$61,000 nationwide compared to about \$52,000 in the Cleveland PMSA. Only five of 23 BLS-designated industries recorded stronger income growth locally than nationally. Six of 23 industries showed higher per-capita earnings in the Cleveland PMSA than across the U.S., and none of these are considered high-tech intensive industries.

Within the high-tech intensive group, per-capita earnings were almost 35 percent higher nationwide than locally, \$69,814 versus \$51,852. The only advantage for the Cleveland PMSA is earnings growth in Communications Equipment (SIC 366). Here, income grew by almost 75 percent compared to just under 45 percent nationally. However, even in this industry, the local region is still lagging the nation in actual income by almost 20 percent, \$68,626 versus \$57,424. In three industries, national earnings are over twice as high as those paid locally (Drugs (SIC 283), Computer and Office Equipment (SIC 357), and Electronic Components (SIC 367)).

Income comparisons in the high-tech group are somewhat more favorable. In fact, aggregated per-capita earnings are almost identical for the Cleveland PMSA and the nation. However, differences in earnings growth are more substantial, 13.3 percent nationally compared to almost seven percent locally. The Cleveland PMSA boasts higher per-capita earnings in six of 13 high-tech industries. Although none are significantly greater, Paint Products (SIC 285) did record income that is 14 percent higher, \$50,787 versus \$44,459. Soaps and Cleaners (SIC 284) and Special Industrial Machinery (SIC 355) are the only industries that posted significantly higher national earnings. In both cases, employees across the U.S. are paid about 30 percent more than those in the Cleveland PMSA.

High-Tech Industries In Cleveland

It should be noted that the analysis does not take into account cost of living differences between the Cleveland PMSA and the nation. However, published CPIs show price increases in the Cleveland area are on par with the nation, 22.4 percent versus 22.7 percent respectively.

Even though high-tech earnings in Cleveland are below national levels, local high-tech industries pay more than other regional industries. According to 2000 BLS statistics, the average annual pay for all industries in the metropolitan area is \$34,700, and the average annual pay for all durable and non-durable goods manufacturing is \$45,800.

Total wages paid by all high-tech industries across the Cleveland PMSA in 1992 were \$4.4 billion, rising to \$5.1 billion in 2000. This represents an increase of just under 16 percent. In 2000, total wages paid by all private and public sector entities in the Cleveland PMSA amounted to \$39.8 billion. This means that high-tech industry payroll accounts for 12.9 percent of all wages paid in the Cleveland PMSA.

TABLE 11. PER CAPITA EARNINGS: CLEVELAND PMSA VS. THE NATION

| SIC | Description | Cleveland 2Q00 | Cleveland % Chg From 92 | Nation 2Q00 | Nation % Chg From 92 |
|---------------------------------------|-----------------------------------|-------------------|----------------------------|-----------------|-------------------------|
| High Tech Intensive Industries | | | | | |
| 281 | Industrial Inorganic Chemicals | \$54,454 | 9.5% | \$59,644 | 12.4% |
| 283 | Drugs | \$37,903 | 11.4% | \$79,730 | 47.4% |
| 286 | Industrial Organic Chemicals | \$58,264 | -1.6% | \$64,932 | 10.1% |
| 357 | Computer & Office Equipment | \$42,143 | 25.8% | \$94,730 | 63.9% |
| 366 | Communications Equipment | \$57,424 | 74.7% | \$68,626 | 44.8% |
| 367 | Electronic Components | \$30,576 | 8.8% | \$64,962 | 57.4% |
| 372 | Aircraft & Parts | \$49,528 | -6.9% | \$55,797 | 10.1% |
| 382 | Measuring & Controlling Devices | \$51,428 | 24.9% | \$58,372 | 34.6% |
| 737 | Computer & Data Processing Serv. | \$57,778 | 31.6% | \$76,098 | 49.6% |
| 873 | Research & Development | \$44,581 | 21.2% | \$54,752 | 20.1% |
| | Total | \$51,852 | 16.8% | \$69,814 | 41.5% |
| High Tech Industries | | | | | |
| 282 | Plastic Materials & Synthetics | \$59,348 | 2.9% | \$56,401 | 9.5% |
| 284 | Soaps & Cleaners | \$38,297 | 15.1% | \$50,450 | 7.8% |
| 285 | Paint Products | \$50,787 | 4.4% | \$44,459 | 6.7% |
| 289 | Miscellaneous Chemicals | \$46,454 | -0.1% | \$52,435 | 13.5% |
| 353 | Construction Machinery | \$42,226 | 1.5% | \$43,936 | 8.6% |
| 355 | Special Industrial Machinery | \$43,825 | 15.9% | \$56,411 | 33.2% |
| 356 | General Industrial Machinery | \$44,434 | 24.9% | \$42,384 | 6.7% |
| 361 | Electrical Distribution Equipment | \$34,839 | 6.1% | \$42,963 | 17.2% |
| 362 | Electrical Industrial Apparatus | \$45,672 | 9.1% | \$41,426 | 13.9% |
| 371 | Motor Vehicles & Equipment | \$58,489 | -0.7% | \$53,083 | 8.3% |
| 384 | Medical Equipment & Instruments | \$45,348 | 13.7% | \$48,469 | 18.7% |
| 871 | Engineering & Architecture | \$48,187 | 5.7% | \$52,808 | 10.0% |
| 874 | Management & Public Relations | \$60,106 | 27.4% | \$55,578 | 17.9% |
| | Total | \$51,752 | 6.9% | \$51,782 | 13.3% |
| | Aggregated Total | \$51,787 | 10.3% | \$61,289 | 28.9% |

ESTABLISHMENT GROWTH: CLEVELAND PMSA VERSUS THE NATION

Nationwide, the number of establishments within the 23 industries under analysis grew by almost 74 percent, as seen in Table 12. In the Cleveland PMSA, aggregated growth was 48.5 percent.

Within the high-tech intensive group, the local area experienced establishment growth of just over 67 percent compared to almost 119 percent nationwide. As seen previously, Computer and Data Processing (SIC 737) is responsible for a substantial amount of the increase. SIC 737 experienced an upsurge in establishments of almost 200 percent nationally compared to 110 percent locally. Removing SIC 737 from the analysis decreases growth to 23 percent nationwide and 13 percent in the local area. Measuring and Controlling Devices (SIC 382) is the only industry within the group to experience higher growth locally than nationally, 29 percent versus 21 percent. By contrast, the Drug industry (SIC 283) saw establishments decrease by over 22 percent in the Cleveland PMSA while growing nationally by almost 48 percent.

A somewhat more favorable comparison is seen in establishment growth for the high-tech industry group. Here the nation recorded an increase of 48.5 percent compared to a local increase of almost 39 percent. The machinery subgroup (SIC 353, SIC 355, and SIC 356) saw establishments grow by over 26 percent in the Cleveland PMSA compared to 11.5 percent nationally. Plastic Materials and Synthetics (SIC 282) is the only industry where there was significantly more growth nationwide than locally, 40.4 percent versus 15.8 percent.

High-Tech Industries In Cleveland

TABLE 12. ESTABLISHMENT GROWTH : CLEVELAND PMSA VS. THE NATION

| SIC | Description | Cleveland | Nation |
|---------------------------------------|-----------------------------------|--------------|---------------|
| High Tech Intensive Industries | | | |
| 281 | Industrial Inorganic Chemicals | -8.8% | 11.9% |
| 283 | Drugs | -22.2% | 47.9% |
| 286 | Industrial Organic Chemicals | -17.6% | 2.7% |
| 357 | Computer & Office Equipment | -13.3% | 4.3% |
| 366 | Communications Equipment | 30.0% | 31.6% |
| 367 | Electronic Components | 0.0% | 10.0% |
| 372 | Aircraft & Parts | -7.5% | 0.6% |
| 382 | Measuring & Controlling Devices | 28.8% | 20.8% |
| 737 | Computer & Data Processing Serv. | 110.2% | 194.1% |
| 873 | Research & Development | 29.9% | 31.0% |
| Total | | 67.4% | 118.8% |
| High Tech Industries | | | |
| 282 | Plastic Materials & Synthetics | 15.8% | 40.4% |
| 284 | Soaps & Cleaners | -7.4% | 14.1% |
| 285 | Paint Products | -2.8% | -9.7% |
| 289 | Miscellaneous Chemicals | -8.8% | 1.3% |
| 353 | Construction Machinery | 31.7% | 5.9% |
| 355 | Special Industrial Machinery | 45.1% | 19.4% |
| 356 | General Industrial Machinery | 11.3% | 9.3% |
| 361 | Electrical Distribution Equipment | 21.4% | 9.7% |
| 362 | Electrical Industrial Apparatus | 13.7% | 23.1% |
| 371 | Motor Vehicles & Equipment | 0.0% | 14.0% |
| 384 | Medical Equipment & Instruments | 11.1% | 19.1% |
| 871 | Engineering & Architecture | 29.4% | 32.4% |
| 874 | Management & Public Relations | 70.6% | 73.0% |
| Total | | 38.8% | 48.5% |
| Aggregated Total | | 48.5% | 73.8% |

CLEVELAND'S POSITION IN THE WORLD OF HIGH-TECH

As this briefing shows, there is significantly more high-tech activity in the Cleveland PMSA than many media reports indicate. Information technology and biomed could play an important role in the economic growth of the region. However, activity in the metro area is not limited to just these two industries. Twenty-three of 31 BLS-designated high-tech industries have a presence in the Cleveland area. In fact, these industries employed almost 100,000 people in 2000 and paid out annual aggregated wages of just over \$5 billion.

The problem in Greater Cleveland is the limited growth of high-tech industries. When viewed together, industrial employment, per-capita earnings, and establishment growth is much smaller than in the rest of the country. Consider the fact that high-tech employment growth across the nation was 29 percent from 1992 to 2000. In the Cleveland PMSA, it was just under five percent, or 0.6 percent annually. This is especially troublesome when taking into account that the 1990s are considered an economic boom time.

Differences in per-capita earnings and establishment growth are also large. The number of establishments grew nationally by 74 percent compared to regional growth of 48.5 percent. Real earnings in Cleveland grew at an annual rate of 1.3 percent, or just over 10 percent, during the briefing period. This compares to a national growth rate of 3.6 percent, or total growth of almost 29 percent. However, some may view the earnings disparity, especially in high-tech intensive industries, as a plus for the region. Companies looking to locate a new facility may find the local earnings structure very attractive, providing Cleveland with a distinct advantage.

Even with these comparative statistics, the state of high-tech in Cleveland may not be as discouraging as conveyed. Recall the very essence of high-tech: the proportion of technology-oriented personnel including engineers, life and physical scientists, mathematicians, and computer specialists. What is missing here are statistics regarding thousands of high-tech personnel who work in industries that do not fall within BLS criteria. The most glaring example

is the 2,045 employees of the NASA Glenn Research Center. According to a study³ done by The Maxine Goodman Levin College of Urban Affairs, 84 percent of Glenn employees work in high-tech occupations. Salaries in 1998 amounted to \$131.6 million, or a per-capita wage of \$64,350. These numbers are not included in the analysis.

A study⁴ conducted by the Greater Cleveland Growth Association concludes that there are 45,000 IT professionals working in companies that do not consider IT their main product or service. Of that number, 66 percent are software developers, network specialists, or technical support representatives. These statistics are not included in SIC 737 tables. Other reporting issues exist that can distort the real extent of high-tech activity. For example, a large corporation with headquarters in Cleveland may not report its local research and development center as an independent establishment. This results in lower numbers given under SIC 873.

Although several high-tech industries have reduced their presence in the Cleveland PMSA during the 1992 to 2000 time period, seven have experienced significant growth. This paper concludes with a brief summary of these industries.

Computer and Data Processing (SIC 737): This industry is without doubt the fastest growing in the Cleveland area. Per capita earnings increased by almost 32 percent to about \$58,000. Employment grew by 56 percent, approaching 12,000 persons, and establishments more than doubled to 1000. Many of these establishments are located in downtown Cleveland.

Management and Public Relations (SIC 874): Generally known as management consultants, this industry has the highest per capita earnings in the group of seven at over \$60,000, an increase of 27 percent. It boasts over 1,000 establishments with the largest located in the city's central business district. Employment has grown by almost 38 percent to 8,600 people.

³ Z. Austrian. *The NASA Glenn Research Center: An Economic Impact Study*. Maxine Goodman Levin College of Urban Affairs, Cleveland State University. May 4, 2000.

⁴ *Regional Economic Development Strategy Initiative: Northeast Ohio Information Technology Workforce Assessment*. Cypress Research Group and the Greater Cleveland Growth Association. May 2001.

Measuring and Controlling Devices (SIC 382): Even though this industry experienced a slight decrease, it still employs 6,300 workers, many of whom hold advanced engineering degrees. Earnings have increased 25 percent to over \$51,000. The number of establishments stands at 85, an increase of almost 29 percent.

Communications Equipment (SIC 366): Cyberspace has boosted this industry's growth in Greater Cleveland. Although there are only a few major local players, earnings have increased dramatically by almost 75 percent to \$57,400. Employment has reached 2,000, an increase of 17 percent. Establishments grew by 30 percent to fifteen.

Research and Development (SIC 873): The statistics for this industry are low due to reporting issues. However, the number of reported establishments did grow by 30 percent to 174. Average earnings grew by over 21 percent to about \$45,000, and employment showed a slight decrease to just under 3,000.

Special Industrial Machinery (SIC 355): One of the area's traditional employers, this industry experienced employment growth of over 35 percent to 2,600 workers. Establishments saw dramatic growth of 45 percent to 74 units. Earnings increases were limited to just under 16 percent, but the average worker saw wages of about \$44,000.

Construction Machinery (SIC 353): Another traditional employer, this industry also saw significant employment and establishment growth. The number of jobs stood at 2,400, an increase of over 35 percent. Establishments increased by almost 32 percent to 54 units. Earnings remained stable at \$42,200.