

Appendixes

Descriptions of Local High-Technology Initiatives

The following pages present concise descriptions of 18 major high-technology initiatives undertaken by 22 county, municipal, and other communities. These initiatives, which are analyzed in chapter 4, are described in terms of the institutions or organizations, the technology-related resources or bases they build on, the history and design of the initiatives, their effectiveness and transferability, and the nature and degree of State and Federal Government participation. This material was collected for OTA in early 1983 as part of the contractor report, *Local High-Technology Initiatives Study*, by the Pantus Co., Charles Ford Harding, principal investigator, April 1983.

Huntsville, Ala.

High-Technology Related Bases in the Local Economy

Activity declined at the Redstone Arsenal after World War II, and in the late 1940's the 38,000-acre installation was up for sale. In 1950, however, the Army (wishing to centralize its missile activities and make use of its investment at Redstone) moved Wernher von Braun and his team of 109 technicians from Fort Bliss, Tex., to the Arsenal. Between 1950 and 1960 there was a buildup of Government operations and missile activity at the arsenal. About 14,000 military and civilian personnel worked at the facility during these years.

After Sputnik was launched, President Eisenhower established the NASA Marshall Space Flight Center on a 1,500-acre island in the center of Redstone Arsenal in 1960. NASA, unlike the Army, encouraged contractors to locate in the area, and many—including Northrop, Lockheed, Boeing, GE, and IBM—came to Huntsville. The population of Huntsville grew from 16,000 in 1950 to 72,000 in 1960, 126,000 in 1963, and 139,000 in 1970. During this period of tumultuous growth, the city reacted with grace under pressure. The private sector built tract housing, and, at one point, the city government was adding a classroom a day to local schools.

Von Braun left Huntsville in 1970, and the peak expenditure days of NASA were over. While many research and development (R&D) people were transferred, however, others stayed on to form their own companies. The city concentrated its efforts in the 1970's on creating a more diversified, though still high-technology-oriented, industrial base to make use of the skilled work force developed by the arsenal. Today Redstone has 10,000 civilian personnel and Marshall 3,500, but by the end

of 1983, commercial high-technology firms employed more than 23,000 in Madison County and may employ more than 35,000 by 1987.

Besides the University of Alabama in Huntsville, the area has John C. Calhoun Community College and J. F. Drake State Technical College. There is also one city and one County technical high school.

Initiative #1—Establishment of University of Alabama in Huntsville (UAH)

Background.—The establishment of UAH was the result of the cooperative efforts of the Huntsville City Council, the Madison County Commission, and the University of Alabama in Tuscaloosa. In the early 1950's, evening classes were offered in rooms of the Huntsville school system. Responding to the increasing need for graduate engineering and continuing education programs, the city and county donated land to the university and worked out a financing plan. The first building was opened around 1960. A research institute for pure and applied research also was developed. Today, UAH has not only a full undergraduate curriculum but also a new Center for High Technology Management and Economic Research.

Cost and Effectiveness.—Through a combination of community fund raising drives and the issuing of bonds, the city was able to proffer to the university initial financing of \$250,000, and \$900,000 at a later date.

Transferability.—No contact was made with other cities that had developed or attracted universities.

Federal and State Involvement.—The bond issue for the research institute had to be approved by the State.

Initiative #2—Research Park District/ Cummings Research Park

Background. -In March 1963, the City zoned 3,700 acres as a research park district. (This zone is second in size only to Research Triangle Park). The ordinance provided for a campus-like setting conducive to R&D activities and high-technology manufacturing. UAH is located on 380 acres in this district. Cummings Research Park consists of 1,000 developed acres and is contiguous to UAH, which performs contract research for firms in the park. There are 37 companies in the park, including IBM, Teledyne, Boeing, and GE, with a total of 11,000 employees. These firms are 75 percent nondependent on defense. Almost all, however, are strictly related to the electronics industry in one fashion or another. The city recently purchased 750 acres to expand the park and will offer sites at reasonable prices. Incubator space is being considered.

Cost and Effectiveness. —The city paid for the 750 acres out of general funds and will also issue bonds.

Transferability. -The city was aware of Research Triangle Park.

Federal and State Involvement.—Possible use of U.S. Economic Development Administration (EDA) funds for site improvement.

Initiative #3—Huntsville-Madison County Jetplex Foreign-Trade Zone/Industrial Park

Background.—In February 1983, 1,300 acres at the airport became a Foreign Trade Zone (FTZ) after 3 years of community wide effort to obtain this designation. The airport authority is the sponsor and manager. Companies may also apply for subzone status, which would give them

the advantages of the FTZ without having to move to the airport.

Cost and Effectiveness. -Not applicable.

Transferability. -FTZs (duty-free areas) are considered attractive to electronics companies, especially those that use high value foreign components in their manufacturing processes. Lower duty is paid in an FTZ, and if finished products are shipped outside of the United States, no duty is paid at all.

Federal and State Involvement.—U.S. Department of Commerce's approval of FTZ status.

Initiative #4—Von Braun Civic Center

Background. -In 1975 Huntsville built the Von Braun Civic Center. It contains a 9,000-seat arena, an exhibit hall, a playhouse, a concert hall, and an art museum. The city was attempting to develop the amenities that it lacked and that were important to the research and engineering population brought to the area by high-technology operations. Such amenities were felt to be important to the long-term growth of the city's high-technology base. The Huntsville Symphony Orchestra, Broadway shows, ballets, and professional touring companies appear regularly in the Civic Center.

Local Organizations Working on High-Technology Initiatives

Huntsville Chamber of Commerce

Telephone: (205) 533-4141

Contact: Mr. Bruce Smalley

Huntsville Planning Department

Telephone: (205) 532-7353

Contact: Mr. Dallas Fanning

Phoenix, Ariz.

High-Technology Related Bases in the Local Economy

High-technology employers in the Phoenix area include Motorola, Honeywell, Digital Equipment, Sperry Flight Systems, Goodyear Aerospace, and GTE Automatic Electric. Hughes Aircraft recently began construction of a major aerospace facility in the Phoenix area. Arizona State University provides a broad variety of technical degree programs and has conducted contract research for local industry.

Initiative #1—Excellence in Engineering for the 1980's

Background. -In late 1979, officials at Arizona State University (ASU) and the Phoenix Metropolitan Chamber of Commerce began to work together with Phoenix industry to improve engineering education at ASU. The steering group for this effort was the Advisory Council for Engineering (ACE), representing over 40 Phoenix-area companies. ACE developed a 5-year plan known as "Excellence in Engineering for the 1980's," which pro-

vial recommendations concerning engineering education and facilities at ASU. ACE also acted as an advocacy group, meeting with the Governor and key State legislators to obtain funding for needed improvements at ASU. The 5-year program emphasizes six areas of learning that are of interest to Phoenix industry: computers, computer-aided processes, solid state electronics, thermo sciences, transportation, and energy.

Cost and Effectiveness.—A number of the goals in the 5-year plan already have been achieved, notably the creation of 60 new faculty positions at ASU and the construction of a 5-story, 120,000-square-foot (ft²) research facility on the ASU campus known as the Center of Excellence. The Center of Excellence is to be completed in October 1983 and will house joint university/private industry research efforts. The total budget for the 5-year plan is \$32 million.

Transferability.—Many communities and universities are aware of what has been accomplished at ASU.

Federal and State Involvement.—The State is the major source of funds for this initiative. However, it is expected that local private industry in the Phoenix area will contribute approximately \$20 million to equip the new research center.

Initiative #2—Zoning and Planning

Background.—The Phoenix Metropolitan Chamber of Commerce is very aware that high-technology companies typically want to locate new manufacturing facilities in attractive surroundings. In order to ensure a good supply of esthetically pleasing industrial sites, the Chamber has established a committee to review Phoenix's current zoning ordinances. The committee hopes to persuade City officials to expand the number of industrial zoning districts to include a high-quality research park district with more restrictive design standards.

Cost and Effectiveness.—Staff time is the only cost associated with this effort. It is too early to judge the committee's effectiveness since it was just recently formed.

Transferability.—None.

Federal and State Involvement.—None.

Initiative #3—U.S. Small Business Administration Loan Program

Background.—The city of Phoenix makes loans to small business under the section 503 program of the U.S. Small Business Administration (SBA). The city conducts credit analyses, and packages and makes loans to businesses with a net worth of about \$6 million for fixed-asset purchases. About 20 percent of these loans are made to suppliers to area high-technology companies. The city sells debentures to finance the program, as well as using Community Development Block Grants (CDBG) funds.

Cost and Effectiveness.—The total budget for the overhead of the operation is \$250,000 per year. None of the loans made have been lost.

Transferability.—Tucson and several other cities have similar programs.

Federal and State Involvement.—The Federal government has been involved through the SBA. CDBG and Urban Development Action Grant (UDAG) funds have also been used to finance portions of several deals.

Local Organizations Working on High-Technology Initiatives

Office of Community Services

Telephone: (602) 262-6004

Contact: Mr. Brian H. Aby

Phoenix Metropolitan Chamber of Commerce

Telephone: (602) 254-5521

Contact: Mr. Walter Cadow

San Diego, Calif.

High-Technology Related Bases in the Local Economy

A number of high-technology companies have operations in the San Diego area, including Hughes Aircraft, General Dynamics, Cubic, General Atomic, NCR, Teledyne, Burroughs, and others. The University of California-San Diego is a major research institution and is one of several campuses in the system designed to be strong in technological fields. There are also several other

universities in the area offering programs in engineering and science.

Initiative #1—Attraction of the University of California

Background.—In the 1960's, when the University of California was developing new campuses around the State, the city of San Diego donated land to the university as an inducement to the State to locate a major

branch in the city. The University of California-San Diego was designed as a science-intensive institution from its inception. The city also developed roads, sewers, and water systems in the area.

Cost and Effectiveness.—Since the city already owned the land from a Spanish land grant, the only cost associated with the donation was the opportunity cost of the property. The cost of local utility and road improvements were also borne by the city.

Transferability.—The quantities of land that the city owned are somewhat unique. For this reason, transferability is limited.

Federal and State Involvement.—The State was responsible for the construction and staffing of the university.

Initiative #2—Research Parks

Background.—At the time the university was built, the city planned the surrounding land that it owned for compatible uses. One of these uses was research parks for companies that wanted locations near the university. The city prepared the appropriate zoning laws, developed several parks, and managed and sold the land through its property department.

Cost and Effectiveness.—The cost was only for site development. The first development, Torrey Pines Science Park, is now almost fully developed and houses such organizations as the Salk Institute, General Atomic, Aerojet General, and others. The newer Campus Point Research Park is now about two-thirds occupied by research operations of local, national, and international companies.

Transferability.—The city is aware of research parks in other cities.

Federal and State Involvement.—None.

Initiative #3—Land Development and Sale

Background.—The city has developed additional property from its land-grant holdings for sale to private industry. Though some cost discount was offered to the

purchasers in some cases, the principal advantage was the availability of fully developed sites in attractive areas.

Cost and Effectiveness.—The opportunity cost of any discounts given were the only identifiable costs of the initiative. Such companies as Cubic and General Dynamics have acquired these properties.

Transferability.—The large quantities of land owned by the city are unique.

Federal and State Involvement.—None.

Initiative #4—Marketing Program

Background.—At various times over the past 20 years, the city, council of governments, chamber of commerce, and the Economic Development Corp. have conducted studies to determine the types of industries that would find a San Diego location attractive and developed marketing programs to attract them. The most recent of these studies, known as “Operation Bootstrap,” was completed in the late 1970’s. Generally, these programs have focused on such high-technology industries as electronics, aerospace, and biomedical products.

Cost and Effectiveness.—Staff time and organizational budgets are the principal costs. Numerous companies locating in the area have worked with these development organizations, including NCR, Sony, and others.

Transferability.—The staff of the Economic Development Corp. is well aware of the marketing programs run by other cities with which it competes.

Federal and State Involvement.—None.

Local Organizations Working on High-Technology Initiatives

Department of Planning, City of San Diego
Telephone: (619) 236-6450

Contacts: Mr. Michael Stepner, Assistant Planning Director and Mr. Tim O’Connell

San Diego Economic Development Corp.
Telephone: (714) 234-8484

Contact: Ms. Jane Signiogo-Cox

Colorado Springs, Colo.

High-Technology Related Bases in the Local Economy

The military presence in Colorado Springs is considerable. Besides the U.S. Air Force Academy, North American Air Defense (NORAD) headquarters, Peterson Air Force Base, and Fort Carson, the Air Force’s new Space Command located there last year. The Con-

solidated Space Operations Center (CSOC), for which Congress has allocated \$67 million, is expected to be fully operational by 1987.

Eighty percent of the manufacturing base in the city is composed of electronics firms, and Colorado Springs has established ties with venture capital firms in the San Francisco Bay Area. Ford Aerospace plans to add a \$100-million complex to its current facility because of CSOC

and NORAD. An advisory council made up of local electronics executives helps the Engineering School at the University of Colorado at Colorado Springs (UCCS) to develop its curriculum. NCR Microelectronics has donated an integrated circuits laboratory to the university.

Initiative #1—Targeted Marketing Efforts

Background.—The chamber of commerce's economic development department was established in 1970, when it prepared a study that identified high-value, low-bulk products as being most appropriate for manufacture in Colorado Springs. Many high-technology products have these characteristics.

Cost and Effectiveness.—The high percentage of electronics firms in the city is indication of the effectiveness of this initiative.

Transferability.—The chamber was aware of other cities' marketing efforts.

Federal and State Involvement.—None.

Initiative #2—University of Colorado at Colorado Springs

Background.—In 1965 a campus for UCCS did not exist. Over the last 10 to 15 years, the chamber and existing industry have lobbied for university development. Since 1976, there has been an even more determined push with incremental goals. The UCCS Task Force, made up of local business leaders who volunteer their time, came into being 2½ years ago.

Cost and Effectiveness.—It is expected the UCCS will be designated a research university in early May, with doctoral programs in electrical engineering and computer science. UCCS also hopes to receive funding for a new engineering building.

Transferability.—No other cities which attracted universities were studied.

Federal and State Involvement.—The State awards the designation of research university. State funds also are involved.

Initiative #3—institute for Business and Industrial Technology (IBIT)

Background.—The idea for this skills center, which has been in operation for a year, emerged when the com-

munity perceived the need for an educational facility that could change rapidly with high-technology employers' needs. It trains qualified students to fill entry-level technical positions, and there are currently 150 students in the standard electronics curriculum, which provides the equivalent of a 2-year associate science degree in only 11 months. The title to a condemned school building was given to the city. The city then applied for Federal grants for rehabilitation purposes. IBIT is staffed by employees of the city's Industrial Training Department, and the city also provides services in kind for the Institute. There is no rent, and the city provides the funds for day-to-day operations.

Cost and Effectiveness.—The Institute was funded by Comprehensive Education and Training Act (CETA) funds until October 1983, when the Job Training Partnership Act took over. Federal funds are used for instructors, textbooks, training supplies, and equipment. Some equipment has been donated by local industry as well. When Texas Instruments needed optical fabricators, IBIT was able to set up a program quickly. Equipment was purchased and instructors were hired from Texas Instruments' headquarters in Dallas.

Transferability.—Skills centers in other cities were visited, but the local tax base in those cities would not have provided for the extremely up-to-date facilities in Colorado Springs.

Federal and State Involvement.—Heavy Federal involvement—the city said it could not have created this facility without Federal funds.

Local Organizations Working on High-Technology Initiatives

Economic Development Department
Colorado Springs Chamber of Commerce
Telephone: (303) 471-8183

Contact: Mr. Frank O'Donnell

Industrial Training Department
City of Colorado Springs
Telephone: (303) 578-6870

Contact: Mr. Michael St. Clair

Brevard County, Fla.

High-Technology Related Bases in the Local Economy

Cape Canaveral, first developed by NASA in 1957, profoundly affected the subsequent development of Brevard County. Firms that originally came to the area to be close to the Cape (encouraged by NASA, as had been the case in Huntsville) now have worldwide markets. Members of the high-technology community in Brevard County include Dictaphone, Collins Avionics, and Documentation. In 1978, Harris Corp. moved its headquarters to Melbourne to be closer to its high-technology facilities located there. However, there are no local seed or venture capital funds.

Years ago, Kennedy Space Center offered an interactive audiovisual program called the Graduate Engineering Education System (GENESYS) with worksite classrooms from which students can tune into courses anywhere in the State. GENESYS has recently been reinstated with State and private funds, and Harris Corp. currently uses it. To encourage more sophisticated training and continuing education for those in high-technology fields, the University of Central Florida (UCF) has opened the Lifelong Learning Center on the Brevard Community College campus. Students attend Brevard Community College for 2 years and then, if they wish, complete their junior and senior years at UCF's Brevard campus. Five master's programs will be offered.

Initiative #1 —Melbourne Airport Authority "Incubator Facilities"

Background.—The naval air station installation in Melbourne was deeded to the city in 1947, and in 1951 Federal legislation permitted the facilities to be used for purposes other than those considered airport-related. The Melbourne Airport Authority saw this as a means of increasing revenue. For over 20 years, the barracks were rented at reasonable rates to fledgling businesses, a number of which were high-technology oriented. Radiation, Inc., a company later merged with Harris Corp., got its start in the barracks, as did Opto-Mechanik. Although most of the original buildings have been demolished, several firms still claim the airport as home, including Hetra Computer & Communications and Campbell Optics. Florida Institute of Technology (FIT), currently celebrating its 25th anniversary, also was born at the airport, and today several high-technology executives are on FIT's board of trustees.

Cost and Effectiveness.—The low cost space has helped a number of local firms with innovative products get started, and the airport authority recovers its costs through rental income.

Initiative #2—Labor Needs Survey/Educational Task Force

Background.—In 1982, the Brevard Economic Development Council, Brevard Community College, and other groups conducted a "Labor Needs Survey." Firms in Brevard County were asked to project their labor requirements through 1986. An outgrowth of the survey is the new educational Task Force, whose purpose is to encourage dialogue between industry (especially the high-technology segment) and education. The Melbourne Area Committee of 100 (an economic development unit associated with the chamber of commerce) spearheaded this effort, and the volunteer task force members represent FIT and other educational institutions (Brevard Community College, UCF, and the branch of Rollins College at Patrick Air Force Base), the Brevard Economic Development Council, and industry leaders.

Cost and Effectiveness.—The Labor Needs Survey was well received—there was an 80-percent response rate, with large high-technology firms accounting for much of this—and the results of the survey served as a catalyst for further improvements of technical training and development.

Transferability.—Familiar with the output of educational task forces in other parts of Florida.

Federal and State Involvement.—None.

Local Organizations Working on High-Technology Initiatives

Brevard Economic Development Council
Telephone: (305) 453-9519

Contacts: Mr. John McCauley, Executive Director, and
Mr. Bruce Ingram (located at Melbourne Chamber)

City of Melbourne
Telephone: (305) 727-2900

Contact: Mr. Edward Washburn, on retainer with the
city as city planner

Melbourne Airport Authority
Telephone: (305) 723-6227

Contact: Mr. Edward Foster, Director

Orlando, Fla.

High-Technology Related Bases in the Local Economy

The University of Central Florida (UCF) will soon have an endowed chair in Computer Science, the fourth such chair in the United States (Yale, Harvard, and MIT have the other three). About 90 percent of the graduates of UCF remain in the area, which is home to half of all the engineers in Florida.

The world headquarters of GE Robotics is in Orlando. Martin Marietta, which already has an older facility in the area, plans to open a new plant in Orlando devoted to research and manufacturing of laser optics and micro-circuits. Westinghouse opened the world headquarters of its Steam Turbine Generator Division in Orlando in 1983.

Though there is a shortage of venture and seed capital, the community does not view this as a serious problem.

Initiative #1—Central Florida Research Park

Background.—In 1978-79, the State passed legislation enabling counties, in conjunction with universities, to form research park authorities. Orange County and UCF petitioned the Florida Research and Development Commission, the petition was approved, and the Orange County Research & Development Authority was formed. This five-person volunteer body, which oversees the park, is chaired by the provost of UCF, and its executive director is on a leave of absence from UCF.

The park is to the south of the university and is also close to the new Westinghouse and Martin Marietta facilities. It consists of 1,440 acres, 250 of which are completely developed. It is not solely high-technology oriented: any company, small or large, with research needs and/or capabilities in various disciplines is a candidate. The key to the park is the university/industry link, but the cooperation of the county has been important in its development. For example, it has permitted

the park to contract with the university to use UCF's excess sewage treatment capability. At some future date, when county treatment facilities are improved, the park will use those facilities.

Cost and Effectiveness.—The park is a privately financed venture. Some of these funds are borrowed and will be paid back by the park. The acreage will be sold or leased except for one parcel of land owned by the university, which will be leased on a long-term basis.

Ground soon will be broken for two incubator buildings, and a third one is scheduled. These facilities are being planned and financed by a group of Boston developers.

The American Electroplates' Society will establish its new world headquarters in the park. The authority has also granted 40 acres to the Naval Training and Equipment Center (NTEC)—an R&D facility for training devices—and the Navy plans to invest \$25 million in a facility of up to 300,000 ft². The project will be funded in October 1984.

Transferability.—Research Triangle Park was studied, as were parks at MIT, Stanford, and Princeton.

Federal and State Involvement.—The Federal Government is involved only as an occupant of the park. The State passed the enabling legislation and is involved through the university.

Local Organizations Working on High-Technology Initiatives

Industrial Development Commission of Mid-Florida, Inc.
Telephone: (305) 422-7159

Contact: Mr. Roy L. Harris, Executive Vice President

Central Florida Research Park

University of Central Florida

Telephone: (305) 275-2275

Contacts: Dr. Ralph Gunter, Executive Director, and Mr. Ben E. Whisenant, Director of Marketing

Chicago, Ill.

High-Technology Related Bases in the Local Economy

The Chicago area is the home of several major universities (University of Chicago, Northwestern University, Illinois Institute of Technology, University of Illinois at

Chicago, and others), well-known medical centers (Rush Presbyterian—St. Lukes Medical Center among them), two major Federal research installations (Fermi and Argonne National Labs), and the headquarters of numerous technology-based companies in pharmaceuticals (Baxter-Trevenol, G. D. Searle, Abbott Laboratories and

American Hospital Supply), communications and electronics (Motorola, GTE Automatic Electric, Zenith, Gould), and chemicals and petrochemicals.

Initiative #1 —Mayor's Task Force on High-Technology Development

Background.—The task force was established in August 1981 by Mayor Jane Byrne to “advise the City how it could attract and develop high-technology growth industries in the Chicago area [and] develop strong links among the city administration, the region’s universities, industries, and research and development centers.” Dr. Walter E. Massey, director of Argonne National Laboratory, was chairman of the task force with membership from government, industry, and academia. In May 1982 he also was named to the city’s Economic Development Commission.

The final report of the task force, submitted in October 1982, presented 10 detailed recommendations, including the development of a seed capital corporation; improvements in precollege math and science programs; increased cooperation between universities and industries; and the importance of a welcoming attitude on the part of the city. It also targeted four growth fields especially suitable for the area. Since then a plan for the implementation of these recommendations has been developed at the request of the Mayor and the Governor.

Cost and Effectiveness.—The time and effort of members of the task force were volunteered. Word processing facilities at Argonne were used (pro bono) so that all the city paid for was the printing of the report. The task force has resulted in increased public awareness and media attention to high technology, and it has encouraged new linkages between various sectors of the city’s economy.

Transferability.—The idea for the task force was proposed by an alderman at a City Council meeting.

Federal and State Involvement.—The chairman of the task force was a Federal employee. Also, certain members of the Task Force worked closely with members of Governor Thompson’s High Technology Task Force, since the city and State were working toward the same ends.

Initiative #2—High-Technology Development Unit, Chicago Department of Economic Development

Background.—This city unit was formed in October 1981 as a staff initiative for the task force. It serves as a clearinghouse for all sorts of high-technology news and happenings in the city and as a catalyst for other high-technology programs. It publishes a bimonthly newsletter, the “Chicago Tech Connection,” focusing on pertinent topics, interviewing area entrepreneurs, and listing

available Chicago resources. It is sent to members of the Chicago High Tech Association, which has recently been formed under the auspices of the department of economic development. The association also will host bimonthly luncheons.

Cost and Effectiveness.—The unit is funded by the city budget, and the allotted funds cover staff salaries. Various expenses of the unit come under the aegis of other city departments. Since the publication of the first newsletter in January 1983, the unit has been receiving phone calls continually, asking to see a sample copy of the newsletter and requesting information about the association. The association already has over 100 members.

Transferability.—The city is not aware of another city having a unit similar to this one.

Federal and State Involvement.—None.

Initiative #3— Biomedical Research Park

Background.—The University of Illinois, the city, and the State are cooperating in a joint venture to acquire 46 acres of land (mostly vacant) adjacent to the University’s near west side campus and its newly opened genetics research center. The site is planned as a high-technology research park, including a building formerly owned by the Chicago Medical School, which will be developed as an incubator facility. The university’s architectural school will do the landscaping of the Park.

Cost and Effectiveness.—About 85 percent of the land area of the park is in the custody of the city and the Chicago Medical District Commission (CMDC). The City will turn over its share to CMDC, which has the power of eminent domain over areas close to the University of Illinois at Chicago. It is expected that the State legislature will turn the title to the Chicago Medical School building over to the university for use by entrepreneurial firms. In a sense, the CMDC will be the manager of the park. The city plans to apply for \$11 million in U.S. Department of Housing and Urban Development (HUD) and EDA funds to be used for site planning and infrastructure development.

Applied Molecular Genetics, Inc. (AMGen), a California-based biotechnology firm, plans to break ground soon for a pilot plant. AMGen chose Chicago because of its central location and proximity to scientific and medical centers and also because of city and State support. Both the city and State have worked closely with AMGen to secure a \$2-million UDAG and an \$8-million Industrial Revenue bond (IRB) (guaranteed by Continental Bank). The city has received no other inquiries about the proposed incubator space, where firms would have to make lease-hold improvements but would have ready access to all the normal funding mechanisms and training programs of the city and State.

Transferability. -The city studied and/or visited research parks in Philadelphia, at the University of Utah, and the Incubator Space Project at Rensselaer Polytechnic Institute in Troy, N.Y. The Task Force Report suggests Control Data Corp.'s Business and Technology Centers as models for incubator facilities. The high technology unit has received a number of phone calls from neighboring States regarding the new research park.

Federal and State Involvement.—Federal funds have been and will be employed as stated above. CMDC is a State-level entity, with members appointed by the Governor.

Local Organization Working on High-Technology Initiatives

High Tech Development Unit,
Chicago Department of Economic Development
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Contact: Ms. Linda Darragh, CityPlanner

Montgomery County, Md.

High-Technology Related Bases in the Local Economy

Montgomery County, Md., has a high concentration of medical science installations, including the National Institutes of Health (NIH), the Food and Drug Administration, the National Library of Medicine, and the Naval Medical Center. NIH alone employs 13,000, and it has awarded 21 percent of its total R&D contract budget to Montgomery County firms. Access to major educational institutions is easy—for example, Johns Hopkins, Georgetown University, and the University of Maryland, which provides an applied molecular biology program.

The Department of Economic Development has been courting high-technology actively since 1978. Its goal is to encourage existing high-technology firms (40 percent of firms in the County) and to attract new companies. The majority of new high-technology jobs have come from the expansion of firms already in the county.

Initiative #1 —Shady Grove Medical Park

Background.-Shady Grove Medical Park is a 230-acre medically oriented science park. The inner core, 40 acres, is devoted to a hospital, an ambulatory care facility, and a psychiatric institute—all private institutions that are currently in operation. The outer area is intended for medically oriented companies engaged in R&D or manufacturing. The University of Maryland may establish a health research facility in the park.

Cost and Effectiveness.-The county owned this land, and county funds were used for its development. The land will be leased below market rate to companies who build in the Park. These companies will have access to IRBs, as well as loan guarantees from the Maryland In-

dustrial Development Financing Authority. The county currently is negotiating with four companies that may locate in the Park.

Transferability.-A number of counties in Maryland are interested in Shady Grove, and they hope to develop a similar type of area. Local officials recently traveled to New Jersey to inspect Scanticon Princeton, a conference center and hotel located in the Forrestal Center. This type of facility is being considered for Shady Grove.

Federal and State Involvement.-No Federal involvement. The State is involved only in the sense that the normal State financing mechanism is available to those building in the Park.

Initiative #2—Upgrading Skills Training Program/Corporation for Technical Training

Background.-The Upgrading Skills Training Program is run by the Department of Economic Development with CETA/JTPA funds. It involves all types of firms, high-technology included. It identifies firms that need to upgrade their employees' skills and then works with the company to design a curriculum and select employees for the program. Half of the time is spent in a classroom and half on the job. Once the employee has been upgraded, the county will refer a eligible client to fill the vacated position.

The Corporation for Technical Training (CTT) is a quasi-public corporation whose board of directors, appointed by the county executive, includes many executives of high-technology firms. CTT's mission is to design and implement training programs that would expand the high-technology labor force. CTT will contract with various educational institutions in the area to provide the actual training. These programs were supplemented in

December 1983 by the creation of the Technical Occupations Employment Group (TOEG), a private nonprofit labor exchange program. Using computers, TOEG tests applicants for general and math skills and refers them to high-technology firms that are seeking new employees.

Cost and Effectiveness. -Instructors are paid by the county. The budget for the CETA/JTPA program depends on the needs of the companies. This program has been operational for a year and appears successful. The budget for the first year of the CTT is \$230,000, and that of TOEG is \$410,000.

Transferability. -In terms of the CTT, the County did not study other areas.

Federal and State Involvement. -JTPA funds the "Upgrading Skills Training Program," and funds for the CTT come from the JTPA, the State, the county and, eventually, from the private sector. TOEG's budget comes from matching county and State funds.

Additional Comments

It is debatable whether Montgomery County's communication/marketing efforts should be classed as a high-technology initiative since they are similar to many communities' normal marketing approach. However, they are definitely geared toward high-technology and should be mentioned because of their innovative features.

Of the county's total economic development budget of \$650,000, some \$140,000 is allotted for marketing. One month of advertising in other areas is followed by a direct mail campaign, with respondents receiving a booklet on "High Tech Business Opportunities in Montgomery County, Maryland." The Department also visits existing firms frequently and conducts a tour of the county every 2 years for high-technology executives (the executives pay their travel expenses).

An annual Consensus Conference held in May allows corporate executives in the county to air their problems; two of the major issues at last year's Conference were training and the lack of venture capital. The county has been working with local and regional banks since then to try to arrange some help. There is also a plan to create a science advisor board to provide a forum for informal communication between the County and the scientific community.

Local Organization Working on High-Technology Initiatives

Montgomery County Department of
Economic Development
Telephone: (301) 251-2345
Contact: Mr. Duc Duong, Assistant Director of
Economic Development

Lowell, Mass.

High-Technology Related Bases in the Local Economy

Lowell's proximity to Boston's Route 128 and the academic institutions in the Boston area is a key factor in its high-technology strategy. Another resource is the University of Lowell, formed in the 1970's through the merger of the Lowell Technological Institute and the Lowell State Teacher's College.

Initiative #1 —Wang World Headquarters Decision

Background. -In the mid-1970's, the most serious issue facing the city of Lowell was the fact that two-thirds of its industrial property was vacant. Several things occurred as a result of this problem. A new city manager was hired, one from outside the area with no political ties. The city's Department of Planning and Development was formed and now has a staff which is the second larg-

est in the State. With the support of this department, the city manager recruited Wang. The company opened a small manufacturing facility in Lowell because of the low cost of the land. In 1978, when Wang was deciding on its world headquarters location, Lowell responded and eventually convinced the company to locate there.

Cost and Effectiveness. -Wang chose Lowell for two reasons. The city obtained a \$5-million UDAG, which was loaned to Wang at 4-percent interest. Wang was also impressed with the city's Department of Planning and Development, whose staff of 32 reduced red tape for the company and convinced it that development would be attractive and orderly. Since Wang opened in the area, many support industries have also sprung up with 30 to 100 employees each. There is currently no vacant industrial land, and the city is considering rezoning. In May, Wang will begin construction of a \$10 million research training center in downtown Lowell, in addition to its two 12-story office buildings and 250,000-ft² manufacturing facility.

Transferability.- Lowell was aware of the tremendous potential and activity in the nearby Boston area and deliberately set out to tap it.

Federal and State Involvement.—The Federal Government was the source of the \$5-million UDAG. There was no State involvement.

Local Organization Working on High-Technology Initiatives

Department of Planning and Development
Telephone: (617) 454-8821
Contact: Mr. James Cook

Minneapolis-St. Paul, Minn.

High-Technology Related Bases in the Local Economy

The Twin Cities are the home of such major computer manufacturers as Honeywell, Control Data, and Cray Research. Other technology-based companies headquartered in the area include 3M and Medtronic. These larger firms have spun off many smaller ones that are still located in the area, most recently ETA, a supercomputer firm. Roughly 34 percent of the area's manufacturing employment is high-technology oriented. Several venture capital companies operate in the area, and the University of Minnesota and local private colleges offer many technical programs. The area is noted for its activist business leaders and a history of successful public/private partnership.

Initiative #1—Blue Ribbon Task Force on Research and Technology

Background.—This task force, appointed by Minneapolis Mayor Donald Fraser, was composed of business executives, venture capitalists, bankers, and others. Its mandate was to design a program to increase the high-technology component of the city's economy. Among the recommendations in its report, published in August 1983, was the creation of a high-technology park with additional incubator facilities and low-cost office space for small firms.

As a result of the task force recommendations, Minneapolis has just completed the development plan for Technology Corridor, a 60-acre riverfront site between the downtown area and the University of Minnesota. The area contains many underutilized buildings that, once renovated, would be appropriate for startups and small growing firms. The Minneapolis Business and Technology Center (BTC, see below) and another private incubator facility are already located in the Corridor, and the city hopes that their "graduates" will remain in the area once their need for special support services is past. In addition, the site is coterminous with a State enterprise zone, which will provide tax and other incentives for existing companies to locate in the Corridor. The city

hopes to attract research installations from some of the major high-technology corporations in the region.

Cost and Effectiveness.—The task force was composed largely of volunteers, so its cost was modest. Costs for land acquisition and building renovation have not yet been determined but may be considerable. The city has entered into a cooperative, cost-sharing arrangement with the University of Minnesota and also hopes to obtain additional seed money from the State. The project will generate income in the form of rents and tax revenues, but it is too soon to project the eventual return on investment.

Transferability.—Similar task forces have been created elsewhere, and Technology Corridor is similar to initiatives undertaken in Philadelphia to leverage the resources created by the University City Science Center and BTC (see below). These advantages exist in only a few other communities.

Federal and State Involvement.—No Federal involvement. The project will take advantage of State enterprise zone legislation and may obtain State funds for site acquisition and preparation.

Initiative #2—Energy Park

Background.—Concerned with the loss of population and employment in the central city, public and private officials in St. Paul saw an opportunity for job creation and economic development in the growing importance of energy-related technologies and the strong high-technology resources of the Twin Cities region. One result was Energy Park, a joint undertaking of the City of St. Paul and the State-chartered Port Authority of St. Paul, on which work was begun in 1981. It consists of 218 acres of mixed-use development that includes 950 units of housing, as well as retail, office, and manufacturing space. The buildings include both new and rehabilitated structures, including some 100-year-old railroad repair shops. All of the buildings are designed or retrofitted to be highly energy-efficient, and they are heated and cooled by a central plant whose heat pumps are connected to an aquifer 500 ft beneath the site.

Related development efforts in St. Paul include the Homegrown Economy Program, which provides financial and technical assistance and incubator space to new and existing small businesses that will create quality jobs and diversify the local economy; and the recently announced World Trade Center in downtown St. Paul, in which 10 percent of the building has been reserved as incubator space for small businesses and spinoffs that will generate exports. These efforts emphasize modernization and advanced technology applications, as well as new high-technology products.

Cost and Effectiveness.—Public costs of Energy Park total almost \$50 million, including two UDAGs totaling \$15.5 million and an EDA public works grant of \$2.3 million, plus \$31 million in IDBs issued by the city and loaned to the Port Authority, which administers the Park. The Port Authority has issued additional IDBs, most of which have been bought by private investors and local financial institutions. Private investment in the park will eventually exceed \$100 million.

The park includes a 240,000-ft² incubator facility, Control Data's Energy Technology Center, which houses some 20 new companies. One of these is ETA, a firm recently spun off by Control Data to develop supercomputers, which plans to begin construction of its own 200,000-ft² building in the park in late 1984. Other technology-related tenants of Energy park include GNB Batteries Inc., a manufacturer of advanced automobile batteries, as well as a number of small computer- and energy-related manufacturing and service companies. The Port Authority hopes that other firms spawned by the Energy Technology Center and the St. Paul BTC (see below) will eventually lease or build in the park, and projects the creation or retention of 6,500 jobs over 5 years.

Transferability.—No other cities' initiatives were studied, but the Port Authority has received inquiries and visitors from a large number of economic development agencies, utility companies, and foreign countries.

Federal and State Involvement.—Federal involvement included an EDA grant and UDAG funds for site acquisition and rehabilitation, as well as tax exemptions for IDBs issued by both the city and the Port Authority. St. Paul's other initiatives have made use of CDBG, UDAG, and SBA loan programs. State funds will be involved in the World Trade Center.

Initiative #3—Business and Technology Centers

Background.—The original Control Data BTC was established in St. Paul in 1979, and the Minneapolis BTC

was established in 1982. These incubator facilities are important components of a "job creation network" that provides small enterprises in the Twin Cities with the services and facilities they need to survive. The BTCs themselves are a profit-making venture of the Control Data Corp., but prospective clients are referred to them by the city governments and local banks. They maintain close ties with other HTD organizations, such as the Minnesota Cooperation Office and the Minnesota Seed Capital Fund, and they provide a necessary foundation for subsequent business development initiatives like StarCo and Project Innovation (see ch. 5).

Cost and Effectiveness.—The St. Paul BTC consists of two existing buildings that were purchased and renovated by Control Data without financial assistance from the city, the first containing 200,000ft² of mixed office and manufacturing space and the second 100,000 k² of manufacturing space. The Minneapolis BTC contains 200,000 ft² of mixed-use space in a building that was also purchased and renovated without public funds. The space is leased to small new enterprises, and Control Data provides the tenants with shared services, including computer time and technical assistance as well as utilities and maintenance, at reasonable rates.

These BTCs have proven to be highly effective in promoting the survival and growth of small entrepreneurial firms. The St. Paul BTC has helped to create 126 new companies representing over 1,000 new jobs. While as many as 80 percent of all new businesses fail in the first 5 years, the survival rate for St. Paul BTC clients is 88 percent over the same period. The Minneapolis BTC is fully occupied after less than 2 years and has already helped to launch 113 new companies. The majority of tenants in both BTCs are service companies.

Transferability.—These efforts have been widely and successfully replicated. BTCs have already been established in 10 other U.S. cities, including Philadelphia (see below), Toledo, and Baltimore. The BTC in Charleston, S. C., has in 2 years helped to launch over 100 new firms, most of them minority owned. Control Data plans to open as many as 13 additional BTCs during 1984. Many universities and communities have established similar incubator facilities, often citing the BTCs as their models (see above and ch. 3).

Local Organizations Working on High-Technology Initiatives

City Planning Department
City of Minneapolis
Telephone: (612) 348-2576
Contact: Mr. Philip Meininger

Port Authority of the City of St. Paul
Telephone: (612) 224-5686
Contact: Mr. Ken Dzugan, Project Director

Division of Business Revitalization
Department of Planning and Economic Development
City of St. Paul
Telephone: (612) 292-1577
Contact: Mr. Alan D. Emory, Deputy Director

Business and Technology Centers
Control Data Corp.
Telephone: (612) 853-8802
Contact: Mr. Wilbur D. French, Vice President

Albuquerque, N. Mex.

High-Technology Related Bases in the Local Economy

Sandia Laboratories, a federally funded research facility, started operations in the early 1950's and currently employs 7,000 people, of whom 3,000 have advanced degrees in physics, chemistry, and electrical engineering. Other high-technology employers in the Albuquerque area are GTE Lenkurt, Sperr, Flight Systems, Intel, Signetics, and Motorola. Albuquerque is the home of the University of New Mexico, which has a total enrollment of 23,000 students and provides technical degrees in a number of fields.

Initiative #1—Venture Capital Conference

Background. -Albuquerque officials were disturbed by the number of companies that have started up locally, and then have had to relocate to get venture capital. One example of such a company is Microsoft, which is now a multimillion dollar operator. To counteract this trend, the Albuquerque Industrial Development Service (AIDS) identified sources of venture capital available locally (only two or three) as well as sources in other parts of the country. Last year, AIDS cosponsored a conference on venture capital funding that was attended by 25 to 35 local entrepreneurs who listened to presentations by a number of persons involved in venture capital financing.

Cost and Effectiveness. -Minimal cost. While no deals were struck at the venture capital conference (this was not its purpose), it did serve to acquaint local business interests with the financing opportunities available. AIDS has no plans to sponsor a similar conference in the future but plans to work on an individual basis with companies seeking this type of financing.

Transferability. -AIDS is aware that other communities have sponsored conferences of this type, but did not specifically seek the advice of other communities.

Federal and State Involvement. -Former U.S. Senator Jack Schmitt gave the keynote address at the venture capital conference.

Initiative #2—incubator Space

Background. -AIDS owns a 40,000-ft² building which it leases at below market rates to encourage development of new or expanding industry. In the past the facility has been used primarily as temporary quarters by such high-technology companies as Motorola and EG&G. A new company planning to manufacture wind-driven energy devices (a Sandia Labs spinoff) began leasing 5,000 ft² in May 1983.

Cost and Effectiveness. -AIDS has owned its building since 1962, so the only ongoing costs are for insurance, property taxes, and utilities. When the building is fully occupied, the organization breaks even on expenses. AIDS is pleased with the building since it provides one more way that it can accommodate the needs of new and expanding industry. Discussions have been held about building more space, but this has met resistance from local real estate developers who do not want additional competition.

Transferability. -AIDS has not investigated incubator buildings in other communities, nor have other communities inquired about its space.

Federal and State Involvement. -None.

Local Organization Working on High-Technology Initiatives

Albuquerque Industrial Development Service
Telephone: (505) 842-0400
Contact: James A. Coven

Binghamton, N.Y.

High-Technology Related Bases in the Local Economy

The Binghamton area contains a number of high-technology companies, including IBM, General Electric-Aircraft Equipment Division, Singer-Link Division, and Universal Instrument. In addition, Savin Co. opened a new facility in the Binghamton area in 1981. The State University of New York (SUNY) at Binghamton began offering a master's degree program in electrical engineering in fall 1983.

Initiative #1 —High Technology Council

Background.—The Broome County Chamber of Commerce formed the High Technology Council in 1980. The council is composed of representatives from local government, private industry, educational institutions, and other organizations. The chamber of commerce serves as staff for the council. The main thrust of this group has been to improve educational opportunities for engineers in the Binghamton area. The council found that development of local graduate engineering training was the area's biggest need in order to retain, expand, and attract high-technology employment. The council commissioned a study by the National Center for Higher Education Management Systems to verify the area's need and worked actively at the State level to obtain approval and funding of the engineering program at SUNY-Binghamton.

Cost and Effectiveness. —SUNY-Binghamton began offering a master's degree in electrical engineering in fall 1983. Local employers are pleased that the program was approved and that the State legislature reacted so quickly to the area's need. By 1987, it is expected that SUNY-Binghamton will award master's degrees in mechanical and industrial engineering, and provide the last 2 years of engineering training at the undergraduate level.

Transferability. —The High Technology Council is aware of efforts by other communities to attract and retain high-technology employment. Specific areas investigated included Long Island, N. Y., and Raleigh, N.C.

Federal and State Involvement.—State funds will provide the bulk of money for the engineering program at

SUNY-Binghamton. Local industry also plans to donate funds and equipment to the engineering program.

Initiative #2—incubator Space

Background.—A 27,000-ft² incubator facility has been in operation in the Binghamton area since the mid-1970's. The building is owned and operated by the Broome County Industrial Development Agency, a unit of county government. The building, formerly a bowling alley, was donated to the county by a local company and has been used to foster growth of emerging high-technology businesses and to serve as temporary quarters for companies locating in the Binghamton area. The county has used two low-interest revolving loan funds to provide financial assistance to building occupants.

Cost and Effectiveness.—Local officials are pleased with the success of the incubator building. Two high-technology-related companies employing a total of over 200 workers have been developed in the facility and now are operating independently. The building currently is occupied by four companies, three of which are high-technology-related.

Transferability. —Binghamton's incubator facility has been publicized in economic development journals and has been investigated by other communities.

Federal and State Involvement. —The county received a grant from EDA to modify the building for industrial use. EDA funds were also used to establish one of the county's low-interest revolving loan funds. Appalachian Regional Commission funds were used to establish the other loan fund.

Local Organizations Working on High-Technology Initiatives

Broome County Chamber of Commerce

Telephone: (607) 772-8860

Contact: Mr. Hal Kammerer

Broome County Industrial Development Authority

Telephone: (607) 772-8212

Contact: Mr. Peter Kay

Cincinnati, Ohio

High-Technology Related Bases in the Local Economy

Cincinnati is the home of Cincinnati Milacron, a leader in the robotics industry, and General Electric has its jet engine operations in the area. The University of Cincinnati offers a variety of technological degrees. The U.S. Environmental Protection Agency (EPA) also has a major research facility in the area.

Initiative #1—Cincinnati Venture Capital Fund

Background.—In October 1982, the city asked for and received a grant of \$150,000 from the Gannett Foundation (the *Cincinnati Enquirer* is a Gannett paper). The city will contribute at least \$50,000 (using CDBG funds) and, combined with the Gannett grant, this will provide the startup for a venture capital pool. A blue ribbon committee hopes to raise an additional \$15 million in private funds. The venture capital fund will be private once in operation.

Cost and Effectiveness.—The cost to the city will be at least \$50,000. It is felt the fund will be most effective on a private basis. It will lend capital wherever deemed appropriate, anywhere in the country, but will encourage recipients to explore the possibility of moving to Cincinnati with potential investments. The board of directors will be made up of knowledgeable people from the private sector. The chamber and the city will have direct input.

Transferability.—*Minnesotans* program was studied, though it was decided that a State fund was too restrictive and could not be as successful as a private one.

Federal and State Involvement.—Use of CDBG funds.

Initiative #2—Long View Research/Manufacturing Park (tentative name)

Background.—The city bought a former State hospital property (Long View) for \$1.25 million and hopes the State will give additional acreage to form a 150-acre site. There is also a 150-acre golf course adjoining this property, which the city also hopes to buy through a grant arrangement using UDAG, EDA, or CDBG funds. Site improvements for this initiative will cost about \$6.5 million more, and again the city will have to arrange financ-

ing, possibly through a combination of Federal, State, and city funds. Federal and State funds also will be required to complete a highway interchange in the area.

Cost and Effectiveness.—The \$2 million for the first 150 acres will come out of the city's budget.

Transferability.—City officials are aware of research parks in other cities.

Federal and State Involvement.—Definite use of Federal funds. State funds will probably be used also.

Initiative #3—Institute of Advanced Manufacturing Sciences (IAMS)

Background.—IAMS will be located at Long View and was created at the initiative of the city and chamber of commerce. The State will lend the city \$8 million for its construction, and the city will donate its 300 acres to the Institute. IAMS will support itself through contractual research, Federal research grants, and by leasing the land to appropriate tenants, i.e., those who are research-oriented. It will be a combination of a factory/laboratory environment, where new technologies may be developed or new applications discovered for existing ones. The University of Cincinnati is 10 to 20 minutes away, and it is hoped there will be interaction. IAMS also would attract faculty members to the university.

Cost and Effectiveness.—The startup costs of IAMS would be paid from the university (State budget) and private contributions.

Transferability.—No apparent transferability, though initiative is not unlike other specialized research centers.

Federal and State involvement.—Heavy State financial involvement.

Local Organization Working on High-Technology Initiatives

Department of Development, City of Cincinnati
Telephone: (513) 352-3783

Contact: Mr. Ralph D. Grieme, Jr. (industrial development consultant on retainer to the city)

Cincinnati Chamber of Commerce
Telephone: (513) 579-3100

Contact: Mr. Bruce Crutcher

Portland, Oregon

High-Technology Related Bases in the Local Economy

High-technology companies in the Portland area include Tektronix, Electro-Scientific Industries, Intel, Floating Point Systems, Wacker Siltronic, and Hewlett Packard. Technical degree programs are offered at several schools in the area, including Portland State University, the Oregon Graduate Center, and the Oregon Health Sciences University.

Initiative #1—Marketing the Portland Area

Background. -Officials in the three-county Portland area have begun a coordinated effort to market and develop their community to attract new industry. Much of this effort is directed toward attracting high-technology jobs. A steering group for this effort was formed in early 1983 and is called the Metropolitan Chambers Economic Development Council. The steering group has established six task forces composed of representatives from local government, private industry, chambers of commerce, educational institutions, and other organizations. The task forces are addressing such issues as coordinated private/public funding of marketing efforts in the Portland area; labor availability and training; retention of existing industry; development of industrial sites; and State legislation that would encourage Oregon's development.

Cost and Effectiveness.—Portland area officials are pleased with the success of their marketing efforts, as demonstrated by recent plant location activity. Costs for many of the area's marketing activities (advertising, brochure preparation, direct mail campaigns) will be shared by both the public and private sector. Mayor Frank Ivancie has made a special effort to recruit Japanese high-technology companies into the Portland area.

Transferability.-Officials are aware of high-technology marketing efforts in other communities.

Federal and State Involvement.—None.

Initiative #2—Portland State University Expansion

Background.—Portland State University, the area's largest technical-degree-granting institution, is located near Portland's central business district where expansion space is limited. A university benefactor recently donated a high-powered computer to the school, and the university faced the possibility of not having sufficient space to house the new (and much needed) computers. The city of Portland agreed to lease a vacant city-owned building to the university for \$1 per year. The building is being renovated and will contain, in addition to the university's new computer, PSU's engineering school and physics department.

Cost and Effectiveness.-The city's action has been well received by community leaders. The cost to the city for this initiative consists of the revenue lost because the building is not leased at market value. However, the university will have to purchase the building or pay market value in the near future.

State and Federal Involvement.—State funds were used to prepare the city building for occupancy.

Local Organization Working on High-Technology Initiatives

Portland Chamber of Commerce
Telephone: (503) 228-9411
Contact: Ms. Sharon Kafoury

Portland Development Commission
Telephone: (503) 796-5300
Contact: Mr. Carter MacNichol

Philadelphia, Pa.

High-Technology Related Bases in the Local Economy

The Philadelphia metropolitan area is the fourth most populous in the country. As such, it is a major manufacturing, banking, education, insurance, and trade center. High-technology companies operating locally include Smith-Kline Beckman, McNeil Pharmaceutical, Wyeth

Laboratories, Commodore Computer, Sperry Univac, General Electric-Space Division, Franklin Computer, and Kulich & Soffa. Among the many colleges and universities located in the area are the University of Pennsylvania, Drexel University, and Temple University. The Philadelphia area also has one of the highest concentrations of medical schools—six—anywhere in the United States.

Initiative #1—University City Science Center

Background.—According to Philadelphia officials, the Science Center is the country's only urban research center. The center is located in West Philadelphia on 16 acres of land that were cleared and prepared for redevelopment by the city of Philadelphia. The city, in turn, sold the land for development to a consortium of 28 colleges, universities, and professional health institutions. The city and the consortium currently have a redeveloper's agreement whereby the city will sell additional land as it is needed. At the present time, the Science Center has nine buildings containing 1.1 million ft² of space and houses over 60 companies and organizations employing approximately 5,000 workers. Many of the companies are engaged in high-technology activities, and the center has been a breeding ground for over 30 new businesses, some of them also in the high-technology sector. The two most notable examples of high-technology companies that got their start in the Science Center are Centocor and Biological Energy.

Cost and Effectiveness.—It is hard to estimate the cost of this project. Front-end costs for the city of Philadelphia included land acquisition, demolition, and upgrading utility services. Local officials are pleased with the success of the Science Center to date. Long-range plans for the Science Center call for it to contain 5 million ft² of space (representing an investment of \$250 million) and house 20,000 employees.

Transferability.—The Science Center has been visited by representatives of over 50 cities in the United States and abroad.

Federal and State Involvement.—Federal urban renewal funds were used to prepare land for development. The Federal Government is also one of the major tenants in the center, with regional offices employing a total of 2,000 people. Pennsylvania Industrial Development Authority funds were used to help finance construction of buildings. A \$5-million UDAG has been received for construction of a residential conference center.

Initiative #2—Business and Technology Center

Background.—Control Data Corp. has agreed to establish a Business and Technology Center (BTC) in

the city of Philadelphia. Control Data has purchased an existing 300,000 ft² building that will be renovated and leased to other companies. The building is located on a 5-acre site adjacent to a 60-acre abandoned railroad yard, which the city of Philadelphia plans to purchase and redevelop, using the BTC as an anchor. It is hoped that companies that outgrow the BTC will construct facilities in the adjacent parcel. Local community groups and colleges have initiated training programs in connection with the BTC.

Cost and Effectiveness.—It is too early to judge the effectiveness of this initiative. However, city officials hope that this development will offer reasonably priced alternatives for companies once they pass the product development stage. Cost of purchasing and renovating the 300,000 ft² building is \$5.9 million. It is hoped that half of the building will be ready for occupancy by the end of 1983. Costs of purchasing the adjacent 60-acre site and preparing it for development have not been determined.

Transferability.—Control Data Corp. has established similar developments in 11 other cities, including Baltimore, Toledo, and Minneapolis-St. Paul, and plans to open as many as 13 additional BTCs in 1984 (see above and ch. 5).

Federal and State involvement.—A \$1.3-million UDAG grant was obtained to purchase the 300,000-ft² building.

Local Organization Working on High-Technology Initiatives

Department of Commerce, City of Philadelphia

Telephone: (215) 686-7302

Contact: Mr. John Claypool

Parkside Association of Philadelphia

Telephone: (215) 877-1199

Contact: Mrs. Ella Francis, President

Oak Ridge, Term.

High-Technology Related Bases in the Local Economy

The U.S. Department of Energy's (DOE) research and manufacturing facilities employ 17,000 people in the Oak Ridge area. Other high-technology employers are EG&G-ORTEC, Boeing Co., Tenelec, Remote Technology, and Elo Graphics. The University of Tennessee at Knoxville (located 25 miles east of Oak Ridge) offers a wide variety of technical degree programs. In addition, the University of Tennessee operates the Oak Ridge School of Biomedical Sciences.

Initiative #1—Incubator Space

Background.—The city of Oak Ridge owns a 12,000-ft² incubator building which has been operating for 2 years. This is the city's second incubator building; the first contained 7,500 ft² of rentable space, was in operation for 15 years and was recently demolished.

Cost and Effectiveness. —Cost of constructing the new building was \$300,000, and it is currently fully occupied by seven companies, six of which are classified as high-technology firms. The first incubator building led to development of at least two manufacturing companies now employing a total of 110 people, although neither of these companies was in a high-technology field.

Transferability.—The city is aware that other communities have built incubator space but has relied solely on its own experiences.

Federal and State Involvement.—The city received a \$96,000 grant from the Appalachian Regional Commission to help construct the new incubator building.

Initiative #2—Industrial Site Program

Background.—Since 1965, the city of Oak Ridge has developed three industrial parks containing a total of 300 acres. Roughly half of the acreage has been sold to new and expanding industry and roughly 20 percent of this amount (30 acres) has been purchased by high-technology companies.

Cost and Effectiveness. —Generally, the city purchases land for development at the prevailing market rate, pays to extend utilities to the site, and then resells the land to industrial users for less than the cost of comparable land in the Oak Ridge area. The city is pleased with its industrial site program and is currently negotiating to

buy an additional 280 acres for industrial development. In the last 3 or 4 years, city officials have seen an increase in the number of high-technology companies interested in low-cost industrial land.

Transferability. —Other communities in east Tennessee have visited Oak Ridge to investigate the city's industrial parks.

Federal and State Involvement.—The city of Oak Ridge has used DOE funds to purchase land for this program. In addition, the city received a \$276,000 grant from the Appalachian Regional Commission to provide utility services at one industrial park.

Initiative #3—Selection of New Contractor-Operator for DOE in Oak Ridge

Background.—DOE recently selected Martin-Marietta Corp. as the new contractor-operator for its Oak Ridge facilities. The Oak Ridge Chamber of Commerce and city officials had desired that the company selected by DOE address the community's private employment needs by encouraging development of spinoff companies and assisting in attracting support industries to the area. DOE therefore agreed to add a clause in its request for proposal that emphasized the need for the new contractor-operator to be responsive to the community's private employment concerns.

Cost and Effectiveness.—Staff time is the only cost associated with this initiative. It is too soon to gauge its effectiveness since the new contractor-operator has only recently been selected.

Transferability.—Oak Ridge officials report that this approach was also used by a community in the State of Washington.

Federal and State Involvement.—DOE cooperation is required.

Local Organizations Working on High-Technology Initiatives

City of Oak Ridge
Telephone: (615) 483-5671
Contact: Mr. Ric Sonnenburg

Oak Ridge Chamber of Commerce
Telephone: (615) 483-1321
Contact: Ms. Louise Dunlap

Austin, Tex.

High-Technology Related Bases in the Local Economy

The University of Texas is a major institution of higher learning and one of the wealthiest, with a permanent endowment fund of approximately \$2 billion. There are about 25 science and engineering laboratories at the university's 475-acre Balcones Research Center. Plans call for a new facility to house the Center for Electromechanics and the Center for Energy Studies.

In the late 1950's, four graduates of the University of Texas School of Engineering founded Tracer, Inc., which now employs about 1,500 at its Austin headquarters. Between 1965 and 1980, Austin's manufacturing employment increased by 25,(X)0 jobs. IBM, which arrived in 1967, focuses its worldwide development of office systems in Austin. IBM has been joined by Texas Instruments, Motorola, Data General, Advanced Micro Devices, Rolm, Tandem Computers, and others. This high-technology base is one of the reasons Austin was recently selected over 50 other communities as the site of the Microelectronics and Computer Technology Corp.

Initiative #1—Targeted Marketing Effort

Background.—In the early 1960's, local leaders of Austin were aware that the job base of the city had to be expanded. Austin was not as well situated geographically for heavy industry as some Texas cities, and there was concern for the environmental problems those industries might bring. A University of Texas Bureau of Business Research study recommended that the city should recruit high-technology industries.

Cost and Effectiveness. —Since the mid-1960's, the Economic Development Department has actively solicited

these "clean" industries. Their efforts have met with great success. This year's economic development budget is approximately \$170,000. Between 70 and 80 percent of this budget is geared toward attracting high-technology firms and the remainder toward nonpolluting low-technology operations that would provide jobs for less skilled workers.

Transferability.—Austin is aware of other cities' marketing efforts.

Federal and State Involvement.—None.

Initiative #2—Austin Community College

Background.—Responding to a need in the city that was emphasized by the chamber, the Austin Independent School District (AISD) established Austin Community College 5 years ago. It is housed in AISD facilities and offers academic courses at the freshman and sophomore levels; occupational and technical education programs such as electronic technology; and adult education courses.

Cost and Effectiveness.—20,000 students are enrolled in Austin Community College. The school is funded by the State and by student tuition.

Transferability.—Other cities have similar facilities.

Federal and State Involvement.—State funds employed.

Local Organization Working on High-Technology Initiatives

Economic Development Department

Austin Chamber of Commerce

Telephone: (512) 478-9383

Contact: Mr. John H. Gray, Manager

San Antonio, Tex.

High-Technology Related Bases in the Local Economy

High-technology establishments in the San Antonio area include branch plants of Datapoint, Advanced Micro Devices, Tandy, Harris-Farion Division, and Control Data. With the exception of Datapoint, these have all opened plants in the area in recent years. San Antonio is also the home of the Southwest Research Institute and the South Texas Medical Center. The University of Texas at San Antonio provides degree programs in a number of technical fields.

Initiative #1—Mayor's High-Technology Action Plan

Background.—*San Antonio's Place in the Technology Economy: A Review of Opportunities and a Blueprint for Action*, a 65-page report (plus 177-page appendix of high-technology readings) written by San Antonio Mayor Henry G. Cisneros, was distributed to the public in late 1982. The report addresses eight broad initiatives that San Antonio can take to expand its base of high-technology employment, including developing research parks, improving technical education, creating venture

capital firms, attracting foreign high-technology investment, and encouraging high-technology development in Texas through State policies. Discussion also focuses on current and emerging research in five high-technology industries: industrial processes equipment, electronics and communications, aerospace and defense, agriculture, and biomedicine.

Cost and Effectiveness.—A 22-page questionnaire was distributed along with the mayor's report, asking readers to assess the importance of each initiative and its chance of succeeding in San Antonio. Survey results were tabulated by the mayor's staff and reported to the public in March 1983. A network of groups has been formed to address each initiative, and implementation of recommendations is now under way.

Transferability.—Requests for the mayor's report have been received from business leaders, educators, and government officials all over the country. Mayor Cisneros was subsequently appointed vice-chairman of the Governor's Task Force on Emerging Jobs and Unemployment.

Federal and State Involvement.—None.

Initiative #2—High-Technology High School

Background.—The mayor's office also began this initiative, with the cooperation of the Alamo Community College District, United San Antonio, and the area's independent school districts. The school opened in fall 1983 with 100 students and will develop strengths in math, science, and technology.

Cost and Effectiveness.—It is anticipated that startup costs will be \$150,000. Operating the school will cost approximately \$300,000 per year. Plans are now being developed for second "magnet" high school focusing on medical technologies and jobs.

Transferability.—Similar schools in Houston, Dallas, and California were investigated.

Federal and State involvement.—State funds will be used for startup and the first 3 years of operation, after which the school most likely will be locally funded.

Initiative #3—Vista Verde South

Background.—Vista Verde South is a 14 S-acre urban redevelopment area located in San Antonio's inner city. The project was initiated by the city of San Antonio and entailed land acquisition, relocation of area businesses and residents, demolition of existing structures, upgrading public utility services, and redevelopment of the project area. Control Data Corp.'s 60,000-ft² building, which presently employs 300 people making electronic components, is the anchor for the project. The company is currently completing construction of an additional 200,000 ft² building that eventually could employ

1,000 workers, and Control Data also plans to open a Business and Technology Center in Vista Verde South that would serve as an incubator facility for new local businesses (see above and ch. 5). Several other small manufacturers (at least one of which is high-technology related) are located in the development area.

Cost and Effectiveness.—Project costs are approximately \$98 million. San Antonio officials are pleased with the benefits the redevelopment has created.

Transferability.—Control Data has been involved in similar redevelopment projects in several cities, including Minneapolis-St. Paul and Philadelphia (see above).

Federal and State Involvement.—The project was funded by an \$18.8-million UDAG, plus \$4 million in CDBG funds. Highway funds have been made available to improve access to a nearby Interstate highway.

Initiative #4—Engineering Programs at University of Texas-San Antonio

Background.—Community leaders decided to press for the creation of an engineering school at the University of Texas at San Antonio after a major high-technology company dropped the city from consideration for a large plant because of the absence of engineering courses. The initiative was spearheaded by United San Antonio, a local civic organization with strong representation from local government as well as industry and community groups. Studies of need were conducted among local industry, reports were prepared, funds raised, and a lobbying effort was conducted.

Cost and Effectiveness.—The community raised over \$6 million for faculty salaries, equipment, and other needs of the school. Only 250 students were expected the first year, but enrollment is already up to 500. The San Antonio Economic Development Foundation has found that the community is much easier to market to high-technology prospects now that the program is in place. It is considered so successful that the community is now planning an initiative to develop graduate programs in engineering.

Transferability.—The Oregon Graduate Center in Beaverton may be used as a model for developing graduate programs.

Federal and State Involvement.—The University's Board of Regents and Coordinating Board had to approve the establishment of the program, and State funds were used.

Initiative #5—Marketing to High-Technology Industry

Background.—The San Antonio Economic Development Foundation (EDF) was created by the chamber of commerce in 1974 to help attract industry to the city.

EDF works closely with the city's Department of Economic and Employment Development (DEED), and many of their cooperative marketing efforts have been directed at branch plants of expanding high-technology industries. For example, one of EDF's newsletters was directed toward the electronics industry, and Mayor Cisneros has accompanied EDF representatives on sales trips. Other techniques have included direct mail, telephone, and advertising campaigns in national newspapers and magazines.

Cost and Effectiveness.—EDF's annual budget of about \$700,000 is raised from dues of member firms, but the city makes contributions for specific programs. A number of high-technology firms have located in the area after working with the foundation.

Transferability.—No similar cooperative marketing initiatives were studied, but EDF and DEED have received inquiries about their high-technology development programs.

Federal and State Involvement.—Some of DEED's activities have been supported by EDA planning grants and

CETA funds, but there is no Federal or State involvement in the EDF/DEED marketing efforts.

Local Organizations Working on High-Technology Initiatives

Department of Economic and Employment Development
City of San Antonio

Telephone: (512) 299-8080

Contact: Dr. Kenneth Daly, Acting Director

Mayor's Office, City of San Antonio

Telephone: (512) 299-7063

Contact: Ms. Frances Rios

San Antonio Economic Development Foundation

Telephone: (512) 226-1394

Contact: Mr. Terry J. Britton

United San Antonio

Telephone: (512) 277-0207

Contact: Ms. Lila Cockrell

Salt Lake City, Utah

High-Technology Related Bases in the Local Economy

Some 15 to 30 percent of the manufacturing sector in the area is high-technology oriented. Sperry-Univac is the major employer. A number of Eastern venture capital firms have investments in Salt Lake City. The University of Utah is well known in a number of areas—engineering, physical sciences, law, and medicine, to name a few. The university's research park is about 12 years old, and several firms that have spun off from the university are located there. Some of these are involved in biomedical and gene research, and the city is also known for its bionic organ development. The Utah Innovation Center, also located in the park, began with a National Science Foundation grant and is now a private venture.

Initiative #1 —Communications and Networking: the "Key Person Network"

Background.—Within the last year or so, the State, the chamber of commerce, the city, the county, and other municipalities in the area have pooled and shared their resources in a determined effort to attract new high-

technology industry. The resulting "Key Persons Network" is essentially a joint targeted marketing program. A select group of people will be available to entertain or travel to other parts of the country. They will meet with those individuals or companies with a vested interest in Utah, such as suppliers and university alumni.

Cost and Effectiveness.—This high-technology development effort will be funded primarily by the county commission, under the direction of the chamber of commerce. Aside from the salary of a new staff person, about \$25,000 to \$50,000 will be allocated for the operation of the network.

Transferability.—Aware of other cities' marketing efforts.

Federal and State Involvement.—The State is involved but does not provide funding.

Local Organization Working on High-Technology Initiatives

Salt Lake City Chamber of Commerce

Telephone: (801) 364-3631

Contact: Mr. Brad Bertock

Burlington, Vt.

High-Technology Related Bases in the Local Economy

Burlington is the medical, cultural, and educational center of the State. The University of Vermont has a well-developed medical center, which accounts for the interest of biotechnology firms. Champlain College sponsors a nationally known computer camp for children up to 16 years of age.

IBM has been in the Burlington area since 1957. GE has a facility there, as does Digital Equipment with 180 acres. Historically, Vermont has not attracted "smoke-stack" industries. Canadian firms (some of them high-technology) also have shown an increasing interest in Burlington; because of its proximity to the border, Burlington is viewed as a base from which to enter U.S. markets. A research park is under consideration, and the venture capital process is being explored.

Initiative #1—Foreign Trade Zone (FTZ)

Background.—The Greater Burlington Industrial Corp. (GBIC) applied for FTZ status, considering it a sig-

nificant economic development tool due to the city's proximity to Canada. An area at the airport was designated an FTZ in 1980.

Cost and Effectiveness.—The FTZ was a major factor in Mitel's decision to establish a manufacturing facility in Burlington. The company is now expanding its building at the airport and is constructing a second facility outside the FTZ.

Transferability.—Awareness of FTZ in other cities.

Federal and State Involvement.—U.S. Customs approval of FTZ status.

Local Organization Working on High-Technology Initiatives

Greater Burlington Industrial Corp.

Telephone: (802) 862-5726

Contact: Ms. Judy Miller

Seattle, Wash.

High-Technology Related Bases in the Local Economy

Seattle is the home of Boeing, which employs approximately 80,000 Seattle-area residents in research, engineering, and manufacturing activities. Other high-technology companies in the Seattle area include Hewlett-Packard, Fairchild Semiconductor, John Fluke Manufacturing, Honeywell-Marine Electronics, Digital Equipment Corp., Physio-Controls, and ELDEC. The University of Washington is the largest source of technical degree recipients in the Seattle area, and its research labs have spun off several biomedical firms.

Initiative #1—Engineering Education Task Force

Background.—The Engineering Education Task Force was formed by the Economic Development Council (EDC) to upgrade the quality and quantity of engineering education in the Seattle area and the rest of the State. The task force was composed primarily of representatives from private industry, and was created in response to

private industry's concern about current and projected shortages of engineering skills. Also included were representatives from the University of Washington, Seattle University, Washington State, and the State Council for Post-Secondary Education. EDC provided staff support for the task force. The task force's recommendations, published in 1982, included the following: increasing the number of baccalaureate and Ph. D. degrees awarded in engineering; offering new continuing education opportunities for degreed engineers; forming a Washington State High Technology Center; offering State tax incentives to private industry investing in engineering education; and increasing opportunities for joint industry/State/university research activities.

Cost and Effectiveness.—In response to the EDC's study, the University of Washington initiated a bill in the Washington State Legislature to create a high technology research center and fund it at \$17 million.

Transferability.—The task force investigated high-technology research centers at Arizona State University, Stanford, Research Triangle Park, MIT, and other locations. The president of MIT spoke to the task force members.

Federal and State Involvement.—State interests were represented on the task force by the Council on Higher Education. There was no Federal participation.

Initiative #2—industry Attraction Program

Background.—EDC also has made a concerted effort to attract new industry into the Seattle area, and virtually all of its efforts are directed toward high-technology companies. Prospects are identified by seeking leads from Seattle area companies and by inhouse research. Prospects are contacted through telephone calls and personal visits. No funds are spent on media advertising. EDC also works to overcome any obstacles that might prevent a company from locating in the area. This includes working to obtain necessary zoning and environmental approvals for new industry as well as seeking State and Federal funds for site improvements (roads, water and sewer line extensions).

Cost and Effectiveness.—EDC has a budget of \$585,000 for business development. A number of new companies recently have located in the Seattle area, including branches of Hewlett-Packard and Fairchild Semiconductor.

Transferability.—Similar to targeted marketing strategies in many other cities.

Federal and State Involvement.—Federal and State funds totaling \$6 million were used for site improvements for the Fairchild Semiconductor facility. Assistance from the Washington Department of Commerce and Economic Development is sought on an “as needed” basis to help obtain environmental approvals for new industry.

Local Organization Working on High-Technology Initiatives

Economic Development Council of Puget Sound
Telephone: (206) 622-2868
Contact: Lee Smith, Executive Director

Milwaukee, Wis.

High-Technology Related Bases in the Local Economy

A number of technology-based companies are headquartered in the area, including Allen-Bradley, Johnson Controls, Cerac, and the Astronautics Corp. of America. Both Marquette University and the University of Wisconsin-Milwaukee are located in the area and offer technical degrees. The Milwaukee School of Engineering has an Applied Technology Center which performs contract research. The Metropolitan Milwaukee Association of Commerce (MMAC) works with high-technology development through two organizations, the New Business Ventures Office and the Economic Development Group.

Initiative #1 —Milwaukee Area Robotics Task Force

Background.—The task force is a voluntary cooperative effort coordinated by the association to market the Milwaukee area to robotics designers and manufacturers. Members include representatives of the city, MMAC, Wisconsin Electric Power, Milwaukee Area Technical College, and other companies and institutions. Activities include sending 30 Milwaukee executives to market the community at Robotics 7, an industry trade show.

Cost and Effectiveness.—The task force made a presentation to ASEA, a Swedish manufacturer of robots, which induced that firm to locate its industrial robots

division headquarters in the Milwaukee area. In order to win the division to the area, the task force asked the University of Wisconsin to design a state-of-the-art communication network to link ASEA personnel located in separate States. The promise of the customized software program was a crucial element in the firm’s selection of Milwaukee as the headquarters location. It will be paid for through donations to MMAC and given to ASEA.

Transferability.—Milwaukee is aware Michigan also has a program to attract the robotics industry.

Federal and State Involvement.—There has been no Federal involvement with the task force to date. The State has become involved through the university.

Initiative #2—Hilltop Parish Research Park

Background.—This is a newly developed park on the city’s northwest side. Phase I consists of 30 acres, with another 50 available for later expansion. The city rezoned the area from residential to planned development, allowing only research activities. A conference center may be developed in the park. Though the park is privately owned, the city helped acquire UDAG funds to prepare the site.

Cost and Effectiveness.—The UDAG funds totaled \$200,000. The owner of the site, Marquette Electronics, currently is constructing its research facility there and so far is the only user.

Transferability.—The city and Marquette Electronics were aware of other research parks. Those in California were cited specifically.

Federal and State Involvement.—The Federal Government was involved through the UDAG program. There has been no State involvement.

Initiative #3—Research Lab Retention

Background.—When Pabst was acquired by another brewer, the company no longer had a need for its subsidiary, PL Biochemical, which sells fine research chemicals for genetic engineering. In order to avoid the loss of this high-technology resource, the city issued industrial revenue bonds to Pharmacia, the operation's new owner, to finance rehabilitation of the building. The city will also apply for UDAG funds for expansion, as required.

Cost and Effectiveness.—Industrial revenue bonds totalling \$8 million were sold. The laboratory was retained in the area.

Transferability.—N.A.

Federal and State Involvement.—Indirect Federal involvement through IRB legislation.

Local Organizations Working on High-Technology Initiatives

Division of Economic Development, City of Milwaukee
Telephone: (414) 278-2672

Contact: Mr. James Sherer, Manager of Redevelopment

Metropolitan Milwaukee Association of Commerce

Telephone: (414) 273-3000

Contact: Ms. Mary E. Frymark, Economic Development Representative