THE MARYLAND-NATIONAL CAPITAL PARK AND PLANNING COMMISSION

The Maryland-National Capital Park and Planning Commission is a bi-county agency created by the General Assembly of Maryland in 1927. The Commission's geographic authority covers most of Montgomery and Prince George's counties. The Commission's planning jurisdiction, the Maryland-Washington Regional District, comprises 1,001 square miles; its parks jurisdiction, the Metropolitan District, comprises 919 square miles.

The Commission has three major functions:

(1) The preparation, adoption, and, from time to time, amendment or extension of *The General Plan (On Wedges and Corridors) for the Physical Development of the Maryland-Washington Regional District Within Montgomery and Prince George's Counties.*

(2) The acquisition, development, operation, and maintenance of a public park system.

(3) In Prince George's County only, the operation of the entire County public recreation program.

The Commission operates in each county through a Planning Board appointed by and responsible to the county government. The Planning Boards are responsible for preparation of all local master plans, recommendations on zoning amendments, administration of subdivision regulations, and general administration of parks.

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Abstract

TITLE: The Information Technology and Telecommunications Industry In Montgomery County

AUTHOR: Gary Goodwin, Research Coordinator, Research & Technology Center

SUBJECT: A study of the information technology and telecommunications industries in the region and Montgomery County. The Montgomery County discussion includes an analysis of an inventory of 1,900 Montgomery County IT and Telecom firms. This analysis includes: a study of firm size and activity, where these firms have clustered, the type of space used, and the differences between Montgomery County's firms and those found elsewhere in the region.

DATE: June 2001

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8787 Georgia Avenue
Silver Spring, MD 20910-3760

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Technical Report
June 2001

The Information Technology & Telecommunications Industry in Montgomery County

THE MARYLAND-NATIONAL PARK AND PLANNING COMMISSION

Research and Technology Center
The Montgomery County Department of Park and Planning
8787 Georgia Avenue, Silver Spring, Maryland 20910-3760
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Major Findings

Washington Area Is Major Center of InfoCom Activity

- The InfoCom industry (information technology and telecommunications) has a long history in the Washington region, growing out of federal government spending, innovations, and its role as regulator.

- InfoCom employment increased nearly 5 fold between 1969 to 1999. Some estimates place InfoCom employment equal to or exceeding total local federal government employment. In 1999, InfoCom employment totaled more than 350,000 jobs.

- The Washington area InfoCom employment is forecast to show steady growth 1999 to 2009. By 2009, there will be more than 427,000 InfoCom employees in the area.

Montgomery County InfoCom

- Montgomery County is an important center of InfoCom activity. Montgomery County's InfoCom base grew out of the needs of the federal government. In fiscal year 2000, County firms captured about 15 percent of the federal procurements awarded to Washington area firms. Only two other jurisdictions captured more (Fairfax County firms received nearly 38 percent and the District of Columbia companies 25 percent). Lockheed-Martin (Bethesda) has held the number one position of all U.S. federal contractors for the last seven years.

- The InfoCom economy in the County is not just comprised of federal contractors. A wide variety of firms are: developing software, providing systems integration, designing Websites, and competing in the Internet marketplace.

- As of January 2001, there were an estimated 1,840 Montgomery County firms engaged in InfoCom. These firms employed 59,233 workers, or nearly 12 percent of the total Montgomery County employment base. Most firms are small businesses; 70 percent have 9 or fewer employees. Large firms, however, hold most of the employment. Firms with 100 or more employees account for 69 percent of the total InfoCom employment.

Future of InfoCom in Montgomery County

- Montgomery County will continue to be a major location for InfoCom firms. The County will be able to attract and retain a large share of regional InfoCom firm and employment due to:

- the quality of the County's urban centers such as Bethesda and Silver Spring
- the quality of the County's business parks, especially those in the I-270 corridor
- the high quality of life in Montgomery County
- the synergistic effect of the County's concentration in biotechnology, large base of government contractors (i.e. Lockheed-Martin) and system integration/software expertise.

- Some conditions will limit the number of firms and amount of InfoCom employment that can be attracted and accommodated in Montgomery County.

    - The expansion of MAE-East (a major Internet switching point) to new office areas in Northern Virginia. This will be a powerful attractor of those firms that require/desire to be close to this InfoCom focal point.

    - The outward expansion of office/flex/industrial developments for InfoCom firms in the more distant suburbs. Although InfoCom has been widely dispersed in the region, with firms in downtown Washington, in Montgomery County to the north and Fairfax County to the south and west, developments in the outer suburbs will spread firms even further. Loudoun and Prince William County projects are already creating new InfoCom clusters. With each new cluster comes greater competition among all clusters, spreading a growing but limited supply of InfoCom firms more thinly across the region.

    - The demand for large tracts of land for business park/campus development. Montgomery County's supply of land for large developments (i.e. 80+ acres) is extremely limited. Much of the land that had been allocated for business development in the 1980s and 1990s has now been developed or spoken for.

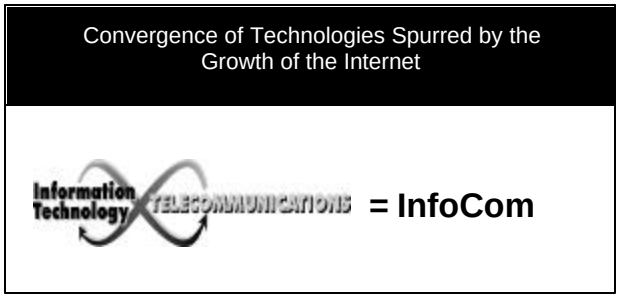
Section 1. Introduction

Montgomery County's economy is rapidly being shaped by high technology industries. Aerospace, biotechnology, information technology, and telecommunications are adding jobs almost twice as fast as the economy as a whole. High tech jobs grew 11.9 percent between the second quarters of 1999 and 2000, while the growth rate for all sectors was 4.8 percent. The local rate clearly out paced the high technology job growth found at either the national level (1.7%) or within the State of Maryland (8.3%).[1]

This report, the second publication on high technology sectors in the Montgomery County economy,[2] concentrates on the information and telecommunications technology industries encompassing six types of activities:[3]

Information Technology	**Telecommunications**
Hardware Manufacturing & Sales	Communications Equipment
Software Manufacturing & Sales	Communications Services
IT Services (consultants, maintenance)	
Internet Driven Enterprises	

Until just a few years ago, information technology and telecommunications were separate industries. Today, the two have merged as mobile phones access the Internet and as televisions and computers become "web TV." Following this trend, this report will refer to the two industries as a single economic sector by using the collective term "InfoCom."



Anticipated Growth of Industry

Over the last two decades the influence of InfoCom has become so widespread that very few households and individuals remain untouched. Personal computers

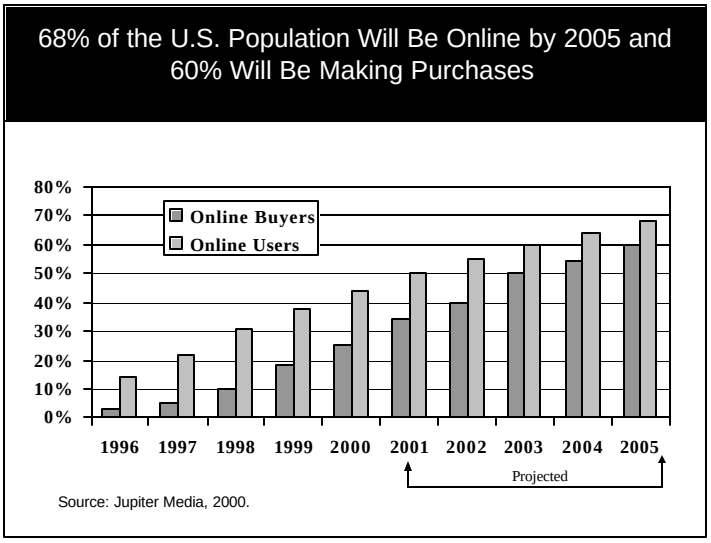
[1] Economic Forces That Shape Montgomery County-Update 2001, Research & Technology Center, Montgomery County Department of Park and Planning, The Maryland-National Park and Planning Commission, pps. 50, 49,64, 57 (in the order data were presented in this report).

[2] The first report is entitled: *The Biotechnology Industry in Montgomery County: Factors Related to the Development of the Industry Including Real Estate Issues*, July 2000, Research & Technology Center, Montgomery County Department of Park and Planning, The Maryland-National Capital Park and Planning Commission.

[3] Based upon a listing of information technology industry categories provided by the U.S. Department of Commerce. A detailed listing of the specific North American Industrial Classification codes studied can be found in the Appendix, Item 1.

now outsell television sets. Mobile phones and personal digital assistants (i.e. Palm Pilots) are replacing pay phones, paper calendars, and pens. Businesses are tying their futures to the Internet and entrepreneurs are creating such a demand for Internet addresses that, as of July 2000, a new dot com address was registered every 3.9 seconds.[4]

Despite explosive growth over the last six or seven years, forecasts show that InfoCom has only just begun to touch our lives. Citing only a few examples on the Internet related portion of InfoCom, the anticipated trend is clear:



- Internet commerce contributed 0.5 percent of the U.S. gross domestic product in 1998; by 2002 it is projected to contribute 4.4 percent.[5]

- Consumers spent $20 billion on the Internet in 1999; 2004 forecasts show a nine-fold increase, growing to $184 billion.[6]

- Businesses trading with other businesses on the Internet in 1999 spent approximately $100 billion; by 2003, U.S. sales are expected to jump 20 times to $2 trillion.[7]

- In 1999, 20,000 people in the U.S. accessed the Internet using mobile devices (mobile phones and personal digital assistants); in five years, forecasts predict that this will grow to 97 million.[8]

InfoCom Growth and Montgomery County

As will be shown in the next section, the Washington region is a major center of InfoCom activity. When the overall InfoCom industry grows, Washington area employment in that

[4] Business 2.0, August 22, 2000, p. 37.
[5] University of Texas and Morgan Stanley Dean Witter Research, cited in "Net Drives Economic Boom," The Standard, June 26, 2000.
[6] Forrester Research, cited in "Chasing Retail's Tail," Business 2.0, January 1, 2000.
[7] Gartner Group, cited in "Behind the Numbers: The Mystery of B-to-B Forecasts Revealed," The Standard, February 21, 2000.
[8] Ovum Research, cited in "Wireless Net: Not Yet," The Standard, May 22, 2000.

sector, demand for office, flex, and industrial space, and business service demand, will also grow with it. Montgomery County will certainly participate in this expansion since it has been historically a prominent location for InfoCom. During the "Space race" the County was home to the satellite industry and today it hosts the headquarters of the largest regional InfoCom employer, Lockheed-Martin.[9] The County's supply of office space, access to Internet infrastructure, number of Metrorail stations, proximity to the Capital Beltway and regional airports, high level of business activity, and high quality of life makes it very attractive to large and small InfoCom concerns.

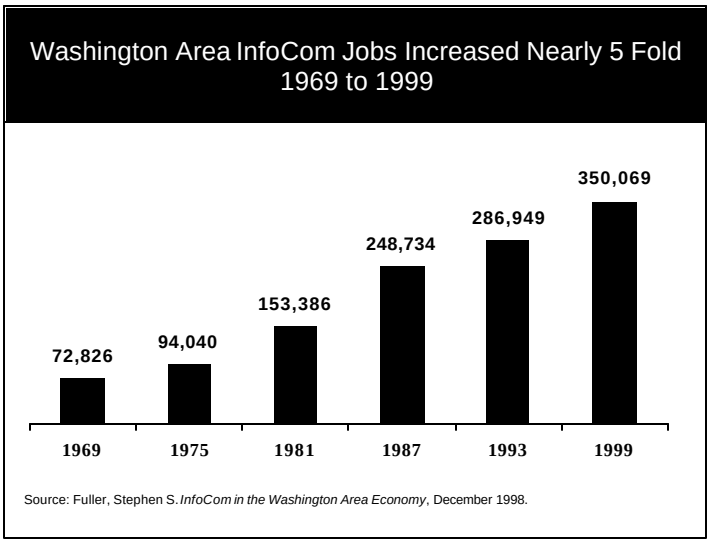
The goal of this report is to provide a general view of the InfoCom industry, its development in this region, its impact on Montgomery County, and its likely future form (in terms of building construction and use). It also answers some fundamental questions of recent interest to governmental and business leaders: How big is the Montgomery County InfoCom sector? What is the County's relationship to the Internet backbone (the main infrastructure)? What is the future for InfoCom in this region? How does Montgomery County differ from Northern Virginia as a place to do InfoCom business? What sort of InfoCom business are here in Montgomery County? Where are these businesses located? Answers to these questions were developed from a literature review, field observations, and interviews with InfoCom industry representatives.

Section 2 considers how InfoCom came to be concentrated in the Washington region and provides a projection of InfoCom employment to 2009. Section 3 narrows the focus to Montgomery County InfoCom showing the number of InfoCom firms as of March 2001, where they have concentrated, the types of real estate space used, firm characteristics, and the future of InfoCom in Montgomery County.

[9] Not all of Lockheed-Martin's employment is Montgomery County but is also found in Northern Virginia, the District of Columbia, and other Washington, D.C. Maryland area counties.

Section 2. Regional InfoCom

A recent report on the InfoCom industry authored by George Mason University professor Dr. Stephen Fuller, highlights InfoCom's rise and wide influence on the Washington metropolitan regional economy. [10] Over the thirty-year period, 1969 to 1999, InfoCom employment grew by 381 percent while total employment grew by 112 percent. In 1969 InfoCom employed an estimated 72,826 workers and accounted for 4.6 percent of the area's total employment base. By 1999, that percentage had jumped to 10.4 percent, bringing InfoCom employment to 350,069.[11]



The industry's growth has been robust between 1969 to 1999. While total employment was showing a compound growth rate of 2.5 percent, InfoCom grew by 5.4 percent.

Multiplier Effect Of InfoCom Growth

Besides its own growth in jobs, the InfoCom industry generates jobs for those not in that field (i.e. office suppliers, employment agencies, office maintenance workers). Dr. Fuller estimates that for every new InfoCom job created more than one additional job is generated elsewhere in the area economy (1.01 jobs for every InfoCom job). By this estimate, an increase of 69,783 InfoCom workers from 1990 to1999 supported the creation of 70,480 additional non-InfoCom jobs.

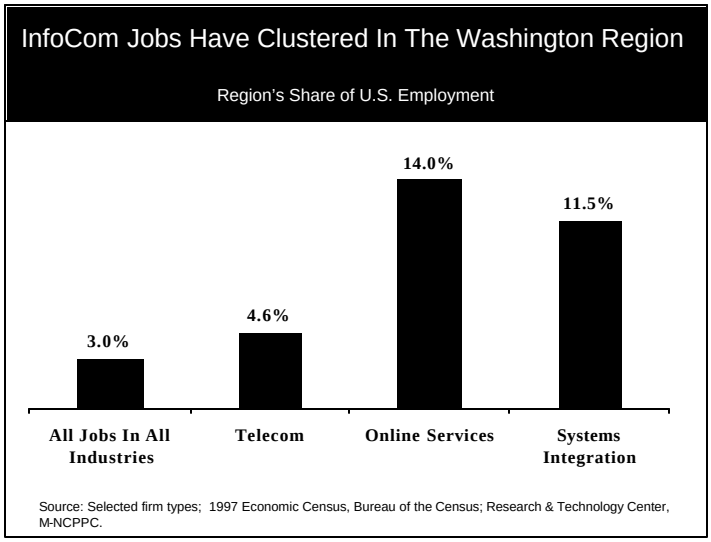
[10] Fuller, Stephen. S. *InfoCom Industry Study* (Herndon, VA: Potomac Knowledgeway, 1998, www.knowledgeway.org) PMSA data were used; this includes the jurisdictions contiguous to the District of Columbia, the nearby suburban jurisdictions (e.g. Prince William, Frederick Counties), and the more distant exurbs (e.g. Stafford County, VA, Berkeley County, WV).

[11] InfoCom employment is actually higher since these employment figures were gathered for InfoCom firms and therefore does not count InfoCom workers within government agencies or private sector establishments where InfoCom is not the primary activity (e.g. the data processing department of a chain of restaurants).

Washington Region Compared To Total U.S. InfoCom Employment

InfoCom employment is concentrated in Washington compared to the U.S. In 1997 (the most recent year these data are available), five percent of all U.S. InfoCom jobs were located in the Washington region compared to about three percent of total U.S. employment.[12]

The region stands out as a center of online information services and computer systems integration. Online services include Internet access providers like Vienna, Virginia based America Online (AOL), Beltsville's Digex, Montgomery County's AppNet (recently purchased by Commerce One), and others. In 1997, the Washington region held 14 percent of the national online services employees.



Systems integration services are employed to match computer hardware and software to tasks sought by a computer system user. The process extends from writing system specifications, to installation, to ongoing maintenance and upgrading. The Washington region has nearly 12 percent of the U.S. workers in this field.

Key Events In Regional InfoCom Growth

How Washington came to capture a large share of the U.S. InfoCom employment can be seen in the 40-year history of this region's involvement in InfoCom.

1960s – Federal Government Needs Drives InfoCom

- First computerization of the Federal government begins.
- In the race to gain worldwide superiority in communications satellite technology Congress creates the Communications Satellite Corp. (Bethesda, Maryland). Located in this region to be close to federal agencies, Comsat establishes national and international satellite efforts and spins-off an additional local concern, Intelsat (Washington, D.C.).

[12] Source: Fuller, Stephen S. *InfoCom In The Washington Area Economy*, Table 1. Baseline InfoCom Employment By Major Industrial Sector; County Business Patterns (1997), Bureau of the Census.

- The Vietnam War and the Cold War fuel government spending on defense projects. Scientists and technicians develop companies to compete to capture federal government contract dollars. For instance, Fairfax County based SAIC was able to grow from a small staff of scientists to its current staffing level of 9,000 employees by winning contracts that involved developing strategies for winning nuclear warfare.

1970s - Systems Integration Matures

- Staff members with experience provided by working with large computers owned by the Department of Defense resign their Pentagon jobs to start American Management Systems, Inc. (Fairfax, VA). AMS grows to 5,000 local employees, providing computer systems integration software to the government and private sector around the world.

- Military use of computing expands as systems decrease in size and costs. For instance, the National Security Agency becomes a major Anne Arundel employer and the Naval Research Laboratory at Bolling Air Force Base expand into artificial intelligence, sonar, radar, and computing.

- The owner of Microwave Communications Inc. moves from Chicago to the District of Columbia so his lawyers can be closer to federal regulators (1972). The company, later renamed MCI, waged a legal and marketing battle that helped to dismantle the Bell Telephone monopoly over long distance phone networks.

1980s – Federal Downsizing & The Internet Is Born

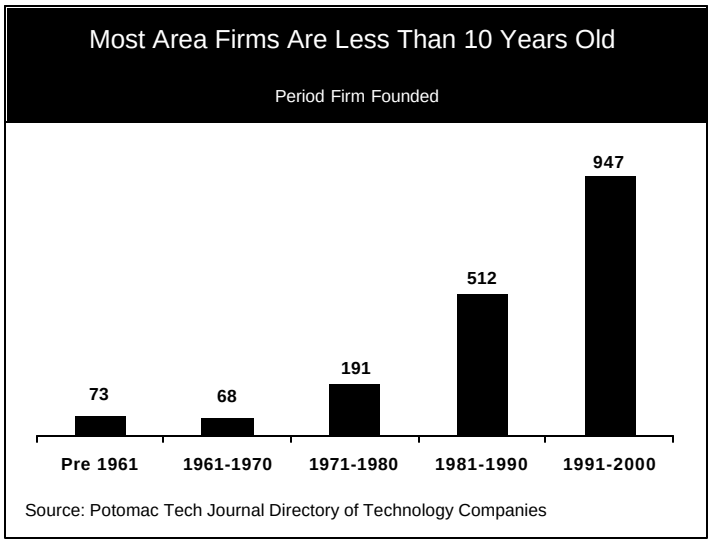
- A massive contract (FTS 2000) to overhaul the federal government telephone system draws major carriers and suppliers into the region.

- The Reagan administration's emphasis upon downsizing government accelerates spending at and creation of consulting firms assuming some of the projects previously conducted by government employees.

- Washington, D.C. based National Science Foundation receives funding from the federal government to become the chief administrator of the Internet (1985 to 1995). NSF is selected because of its close relationship to the scientific and education communities.

- A major East Coast Internet network operation center is developed in College Park, Maryland and maintained by SURANet. SURANet, sponsored by the Southeastern Universities Research Association (SURA), also acts as an exchange point where federal government Internet connections can merge and share signals. Dubbed FIX-East (Federal Internet Exchange), this operation center will act as the model for commercially run exchange points will lead to the establishment of a major operations center in the Washington area.

- UUNet, Inc. is founded (1987) by a former employee of the Arlington, Virginia based Department of Defense supported Center for Seismic Studies. UUNet becomes the first provider of Internet access to commercial clients. UUNet ties its international network into the Washington area network access point selling its services to regional and local Internet access providers.



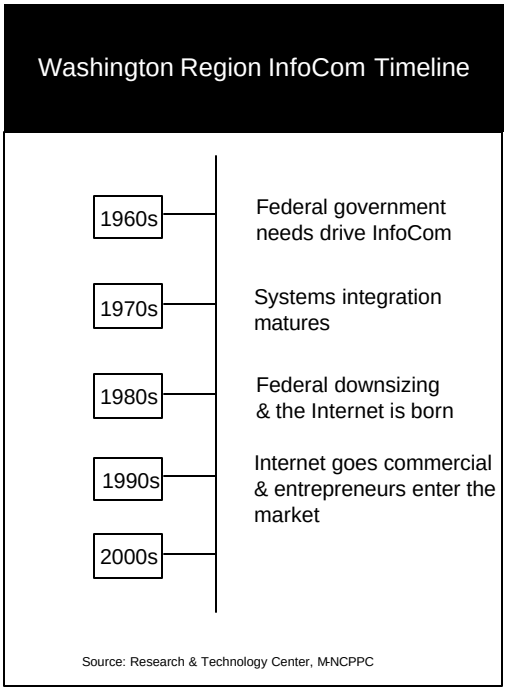
- In 1989, the owner of Performance Systems International moves his company from New York to Reston, Virginia to be near the pool of technological workers and federal regulators. PSINet develops a network similar to UUNet and both firms become two of the largest Internet access providers in the world.

- MCI leases (1982) right-of-way to install single-mode fiber from Washington to New York; this establishes single-mode fiber as the industry standard for world-wide fiber networking.

- Control Video Corporation (Vienna, VA) is launched (1982). The founder of CVC had moved to the Washington area in the 1960s to attend Georgetown University. Although CVC would eventually cease operations, much of the original business model and staff go to start America Online.

- Orbital Sciences (Dulles, Virginia and, as of 1994, Montgomery County) incorporates (1982) to concentrate on building and launching low-earth orbit

satellites for communication and navigation. Eventually other companies will also either start in or move to the Washington area to be near the government agencies authorizing commercial space launches and licensing of radio frequencies. As of July 2000, more than 50 companies are engaged in satellite activities in the Washington region.[13]



- Three new cable networks are founded. Former staff member of the Washington, D.C. based National Cable Television Association launches Black Entertainment Television. Former analyst in the White House Office of Telecommunications founds C-SPAN and former director of corporate relations for the University of Maryland and consultant to universities, starts Discovery Communications (1985).

- Employees start to leave MCI to form their own companies (i.e. LCI, Nextel, Telegent, Primus Telecommunications Group, American Mobile Telephone).

1990s – The Internet Goes Commercial & Entrepreneurs Start Business

- Network Solutions, Inc. (Herndon, Virginia) is authorized to be the only private sector registrar of Internet domain names (i.e. washingtonpost.com, bingo.com).

- America On Line (Vienna, VA) captures the largest share of the residential Internet access market of any company in the world. Merges with Time-Warner.

- In 1993, the National Science Foundation issues a solicitation for bids for development of special Internet connection points (explained in greater detail later in this chapter). NSF decides that there should be four; locations in San Jose, New York City area, Chicago, and the Washington, D.C. area (1919 Gallows Road, Vienna, Virginia) are selected. A few years later the College Park network access point (FIX-East) is shut down.

[13] Phone interview with business data supplier InfoUSA. Includes SICs 4841-03 and 3663-05.

- Internet related companies are attracted to the Washington region because of the region's diverse cluster of InfoCom firms.

- Area Internet entrepreneurs pass on their success by forming venture capital funds for new Internet enterprises. Established

- Venture capital firms open branch offices while new venture capital companies are created.

- Local genetic research sparks growth of bioinformatics firms that utilize powerful computers to decipher attributes and relationships of DNA.

- The commercialization of satellite launches and satellite network operations moves from business uses to consumer interests. In addition to satellite based pager and mobile phone service, two area firms develop satellite radio providing dozens of channels of music and news.

- Orbital Sciences brings space launches to the Mid-Atlantic region when it begins to use Wallops Island, a U.S. government launch site located on Virginia's Eastern Shore.

2000s

- A *Washington Post* article observes that the Washington, D.C. region is becoming "a mecca" for fiber optics firms as older firms expand or are purchased by large telecommunications companies and new firms are started by ex-employees.[14]

- The Washington area is ranked fourth in terms of new Internet domain name creations. Los Angeles/Long Beach is the number one metropolitan area followed by New York, and Dallas, Texas.[15]

- The fortunes and wild growth of Internet commerce companies stall as InfoCom stocks take a plunge in April 2000. The summer of 2000 is marked by a sharp pull back in venture capital investment in dot coms and the first closures of dot com firms are seen. By fall, a large tide of firm deaths are being reported. In 2001, Internet advertising revenues fall sharply as a decline in advertising occurs across all media (i.e. newspapers, broadcast media, and magazines). This drives more InfoCom firms out of business and fiber networks and data centers operate well below capacity.

[14] Noguchi, Yuki. "Internet? Poo. It's Fiber Optics That's On Fire," *Washington Post*, August 21, 2000, F16.
[15] Network Solutions.com MSA rankings, June 2000.

- By early 2001 it becomes apparent that the companies that are fairing the best in this shake-out are the "brick and mortar" operations, those companies with stores in addition to Web sites. Brick and mortars, such as Sears, Eddie Bauer, and Barnes and Noble combine traditional marketing tactics and their store presence with Web marketing to capture sales.[16]

Summary of Factors Leading To InfoCom Concentration

Before turning from the history of regional InfoCom development to other issues, it is important to look to that history for the factors that have attracted firms to the Washington area.

Federal Government Spending

The Washington, D.C. area is a very important location for firms receiving federal government funding. According to According to the *Washington Post*, nearly half of the $20 billion that the federal government spends each year on InfoCom nationwide goes to Washington area firms (1998). Whether or not these firms need to be located in Washington is something that can't be determined, but the success of local firms in capturing $10 billion is strong incentive not to leave the area and it is a strong incentive for those thinking about moving here to open local offices.

Federal Government As Regulator

The migration of technology spawned by the U.S. military and government to commercial applications has required considerable public and private effort. The process of lobbying, responding to proposed legislation, and then reacting to regulatory review makes a Washington area location very desirable for high technology companies.

Desire To Be Near Similar Businesses

Driving the expanding concentration of Washington area InfoCom firms is a tendency of firms within an industry to locate near other firms doing the same sort of business. The thought is, if a location has worked for one or two companies it must be a suitable location for other companies in that industry. Resources, such as workers, suppliers, distribution channels, and financial institutions, build up around this original cluster of businesses and this in turn attracts still more firms and more resource providers. "Following the herd" was how this phenomenon was repeatedly described by people interviewed for this report.

Concentration is especially important when recruiting personnel. InfoCom companies have specialized needs and they tend to require large numbers of employees to expand their firms. Locating near an existing pool of workers that one might be able to "pirate" from other firms is very important and guides the

[16] Walker, Leslie. "Plugged In For Maximum Efficiency: Undaunted by Dot-Com Flameout, Companies Move To Streamline Operations by Harnessing the Web," *Washington Post*, June 20, 2001, p.G01

decision making process of where a firm will locate. This trend was recently illustrated in a survey conducted by The Silicon Valley Network, a nonprofit economic development group in California. The organization surveyed nearly 150 technology CEOs and found that 75 percent said that access to a skilled labor pool was the prime reason why they chose a particular location.[17]

Concentration is also important to companies that have developed a portion of their business to sell to other firms within the cluster. Other businesses rely upon firms within the cluster to be their suppliers, providing goods and services "just in time" rather than seeking them from other locations around the region, U.S. or even the world.

Loyalty To Home/Work Location

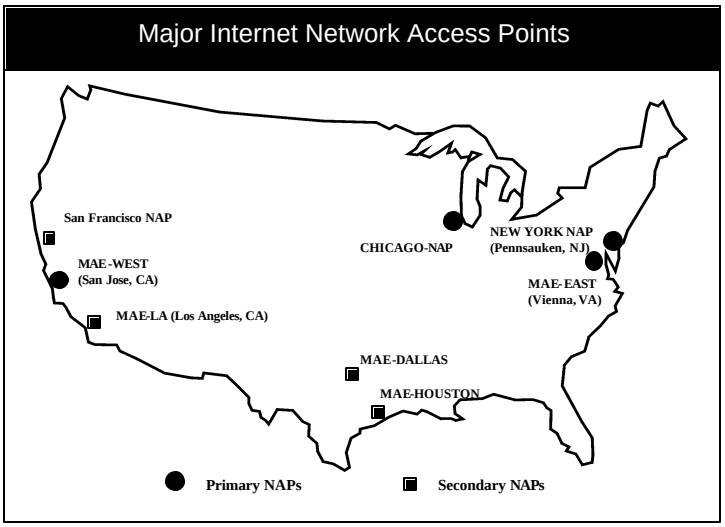
Also seen in the above history is the tendency of people starting new InfoCom businesses to locate their businesses near their current residence or last place of employment (i.e. AOL, UUNet, AMS). Most entrepreneurs don't uproot themselves from their current environment while starting a new enterprise. This reluctance even inhibits movement even within a relatively small region such as the Washington, D.C. area. Montgomery County firms/personnel tend to stay in Montgomery County and Northern Virginia firms stay in Virginia. Essentially, once a concentration of businesses exists it tends to hold employees to that location and a closed cycle is created; few, mass intra-regional migrations of personnel or firms occur.

InfoCom Infrastructure

The Internet is what it is because it is a networking of millions of computers, linked by a central system of connections called by the industry, the Internet "backbone." The main backbone, originally established through government funding but expanded and now operated commercially, is comprised of fiber optic and telephone lines that crisscross the United States. Several hundred firms have entered the market to tie customers (business and residential) to the backbone via physical infrastructure and thousands of firms have sprung up to sell access to this network.

An integral part of the InfoCom infrastructure are Network Access Points (NAPs). NAPs are switching centers that move Internet from one access provider to another. Without this set-up, a person could not send e-mail messages to anyone not on their same system. For instance, an AOL customer could not communicate with a Sprint customer, they could only mail other AOL subscribers.

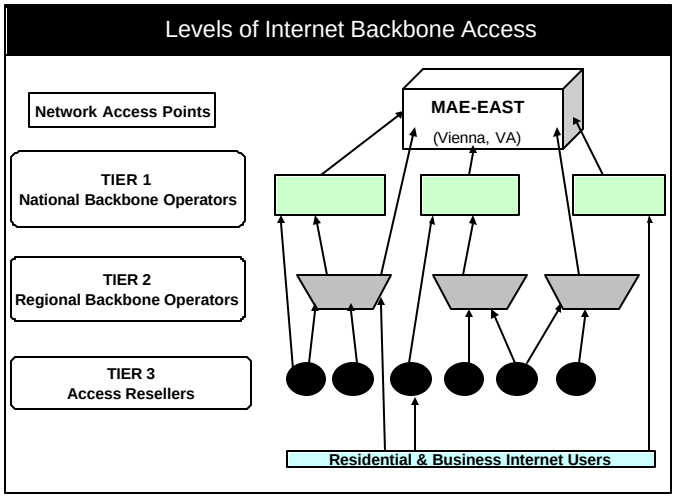
[17] *Urban Land*, May 2000, p.18.



The primary NAPs are located in just four locations: in Chicago, outside New York City in New Jersey, in San Jose, and in suburban Washington, D.C. (Vienna, Virginia). Secondary sites have been added in Dallas, San Francisco, Los Angeles, and Houston. The Washington area NAP, called MAE-EAST for Metropolitan Area Exchange, has more than a 100 Internet access providers attached to it. In recent years major companies such as MCI/World Com have developed additional access points but the primary NAPs remain very important.

Although Internet access is rapidly moving to ubiquity, access comes in varying levels of speed, quality, and privacy and these differences are important considerations to companies doing business on the Internet. Arrayed in a hierarchy, Internet access breaks out in four major levels.

The first level is at Network Access Points. Some companies prefer to be close to a NAP because it offers the fastest route from one Internet access provider to another. Although the speed being considered is in milliseconds, the industry realizes that even small loses of speed can lead to larger problems further down the network.



The Northern Virginia NAP has been so successful, the operators of the facility recently announced that they are building similar operation centers in three locations: Ashburn, Reston, and Tysons Corner. A high-speed network will interlink these three locations with the original center on Gallows Road. It can be expected, that with this expansion, will be an expansion of firms locating in Virginia near this NAP network.

Some firms, however, have been able to tie into regional high-speed networks that carry them directly to the NAP. The best example of this in the Washington area is Digex of Beltsville, Maryland. This company "hosts" very high profile web sites (i.e. Martha Stewart, J.Crew, J.P. Morgan) by storing, securing, and maintaining all the equipment necessary to run the sites. Although Digex sits 18 miles from MAE-East, it can still achieve direct access to MAE-East through a special Internet network that rings the Washington area.

Tier 1 is provided by 48 large Internet access providers such as MCIWorldCom, Sprint, and Qwest. Each of these firms has spent billions of dollars to lay fiber optic lines throughout the world and are called "backbone" operators by the InfoCom industry. Companies find it desirable to be close to these fiber lines because they provide high quality, long-distance, and high-speed access to millions of customers on the network and on the larger Internet. Several of them also offer the advantage of having their own network access points that augment the larger NAPs.

A local example of companies clustering around Tier 1 operators appears to be developing near the intersection of Florida and New York Avenues in the District of Columbia. First Qwest and then MCI/WorldCom announced in 1998 and 1999, respectively, that they were opening data centers in this location. Each was attracted there by the availability of industrial space, proximity to downtown Washington and to access to their own fiber optic lines that run along the Amtrack/Metrorail/CSX line about a block away. Owners of nearby buildings are rapidly renovating space in anticipation that access to Tier 1 companies will draw a large number of network dependent firms.

Tier 2 operators act in much the same way as the national providers, but they are limited to backbone operations within a region. While the companies provide high speed access through fiber or telephone lines, their regional or local reach does not provide the technological advantages found at the Tier 1 level where sheer reach in number of customers or speed across networks is a powerful advantage.

Tier 3 firms resell usage of national and regional backbone providers. Companies can range in size from one or two employees to thousands of employees (such as AOL). Each year the number of resellers seems to grow with the current total more than 7,000 companies.

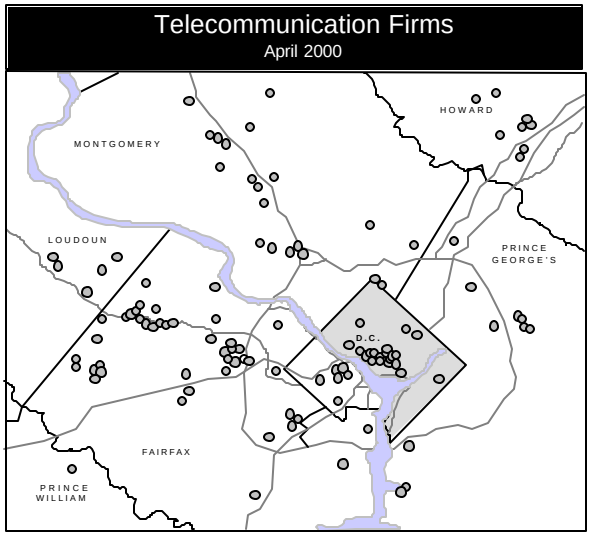
Because of MAE-East, that Washington is the nation's capital, and because there is a large customer base here, all of the major transcontinental Internet lines run through this region. This has made the Washington area a very attractive place to do InfoCom business. The Washington Internet trade journal *The Industry Standard* lists the Washington, D.C. area as the fifth most popular area to start an

Internet business. [18] The top position was held by New York City. San Francisco came in second, Los Angeles third, and the Silicon Valley, fourth.

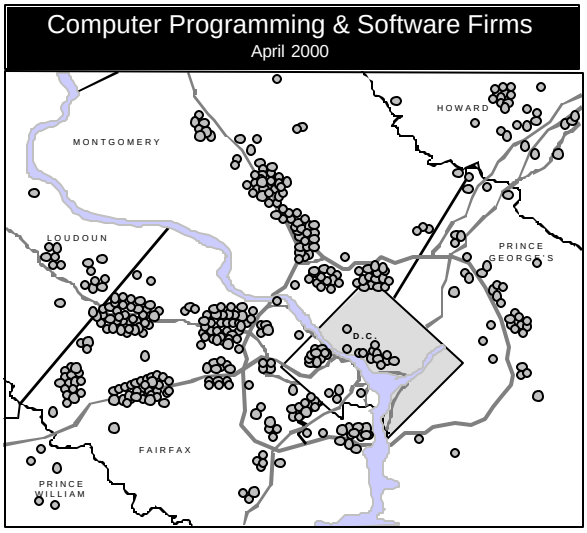
Location of Regional InfoCom Clusters

The *Washington Post* recently mapped two major types of InfoCom firms, telecommunications and computer programming/software companies.[19] Concentrations of telecommunications firms are found in Montgomery County, Washington, D.C. and Fairfax County, Virginia. Montgomery County's share follows I-270 from North Bethesda to Clarksburg. The concentration in the District of Columbia is located in the central business district, roughly between Wisconsin Avenue in the west to the North Capitol Street area in the east. Fairfax County concentrations are seen in two areas, Tysons Corner and along the Dulles Access Toll Road.

Computer programming and software firms are concentrated in Montgomery County along I-270, but also in the Bethesda and Silver Spring business districts. Again, Fairfax County's clusters are seen at Tyson's Corner and along the Dulles corridor, but also along I-66. Arlington and the City of Alexandria have their share of firms as well.



Source: Washington Post, April 5, 2000, G13.

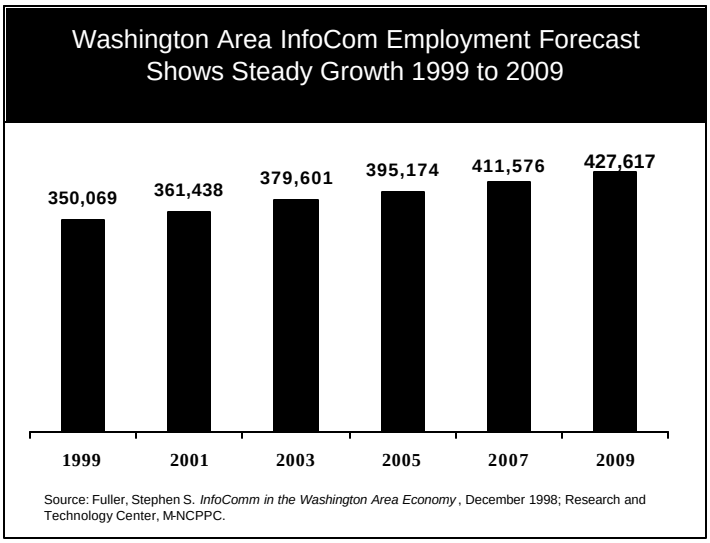


Source: Washington Post, April 5, 2000, G13.

[18] "The State of the Internet Startup," *The Industry Standard*, June 12, 2000, p.187.
[19] Behr, Peter. "The Evolution of Wired Washington," *Washington Post*, April 5, 2000.

Projections of Regional InfoCom Employment & Growth

According to the George Mason University study, continued growth of the InfoCom industry between 1999 to 2009 will generate 77,548 new jobs, a 22 percent increase in this sector's employment. This will in turn support the creation of about 78,000 other private sector jobs in the area economy combining to account for 24 percent of all new private sector jobs generated over this ten-year period.



Although there has been a major downturn in InfoCom since mid-2000, George Mason University professors Dr. Steven Fuller and Dr. Roger Stough are confident that the above estimates will come to pass.[20] As will be discussed at the end of the next section, this region has several factors that will sustain it through this downturn. It also has the capability to exceed the employment growth of other U.S. high technology locations such as Boston and the Silicon Valley.

Conclusion

In 1994, the Washington area was nicknamed "The Netplex" by *Fortune* and in 1995 it was called the "Potomac Knowledgeway" by an economic development group.[21] While neither of these names has been widely adopted like "Silicon Valley," they convey the importance of Washington area in the worldwide InfoCom economy. InfoCom assets in our region are considerable: principal parts of the Internet backbone, a large InfoCom employment base, key regulatory agencies, bioinformatics, AOL and its spin-offs, and venture capital funds. Regional developments over the last 40 years have assured that the Washington region will be a major InfoCom leader in 2001 and for the foreseeable future.

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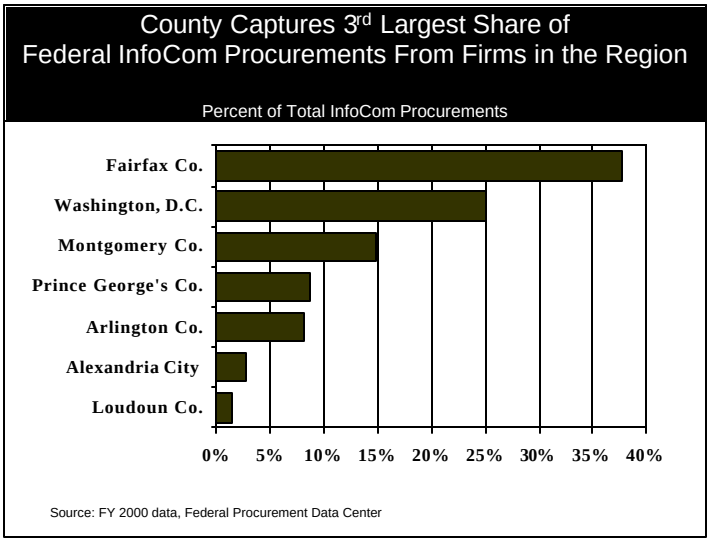
[20] Stough, Roger R. and Rajendra Kulkarni. "A Soft Landing for the Regional Economy?" *Proceedings of the 9th Annual Conference Forecasting the Greater Washington Economy:2001*, http://policy2.gmu.edu/ixconf/new.htm. Note: Although this study report on all high technology sectors, not just InfoCom, the authors do note that almost 90 percent of the technology sector in the Washington area is in the information technology, telecommunications, and management services industries.

[21] Stewart, Thomas A. "The Netplex: It's A New Silicon Valley," *Fortune*, March 7, 1994, pp. 98-104; Potomac Knowledgeway Project, www.knowledgeway.org.

Section 3. Montgomery County InfoCom

Montgomery County's InfoCom base grew out of the needs of the federal government. In 1963, shortly after Congress created the Communications Satellite Corp. (Comsat), that firm was established in Clarksburg. IBM and ACS Government Solutions, Inc. opened offices in the late 1960s to respond to the great demand for computer system hardware and integration services. Also following government contracts was Lockheed-Martin (formerly Martin Marietta) who consolidated its operations in the County in 1976.



This connection to federal contracting continues today. Montgomery County firms captured the third highest percentage of federal procurement contracts (FY2000) awarded to Washington area companies. At nearly 15 percent, Montgomery County was exceeded by Fairfax County (37.7%) and the District of Columbia (25.1%).

A single firm has been successful in garnering a large share of both Washington area and national federal procurements in InfoCom. Montgomery County's Lockheed-Martin (Bethesda) has held the number one position of all U.S. federal contractors for the last seven years.[22] Four other Montgomery County firms also ranked in the top 100. Combined with Lockheed-Martin, these firms captured $2.84 billion in contracts in FY 2000.[23] InfoCom clearly plays a large part in bringing federal procurement dollars to the County. InfoCom purchases account for nearly 45 percent of all federal contracts awarded to Montgomery County firms.[24]

The InfoCom economy in the County is not just comprised of federal contractors. A wide variety of firms are: developing software, providing systems integration, designing websites, and competing in the Internet marketplace. This latter group has been as creative as those entrepreneurs frequently mentioned in the media. A sample of these firms include:

[22] *Washington Technology*, "7th Annual Top 100 Federal Prime Contractors Information Technology Services," www.wtonline.com.
[23] #1. Lockheed-Martin; #22 Federal Data Corp.; #58 Comteq Federal, Inc.; #66 Comsat; #71 Aspen Systems.
[24] Federal Procurement Data Center; Research & Technology Center, M-NCPPC.

- Allsoldout.com - Auction site for concert and sporting event tickets
- Presidentialbank.com – The first Internet bank (opened in 1995)
- Buydomains.com – Registers Web site names and sells them to the highest bidder
- Drugmonitor.com – Notifies patients of clinical trials
- Associationcentral.com – A one-stop location to access associations
- Ecentives.com – Provides e-commerce sites with ecoupons
- USLAW.com – Lawyer locating, legal advice
- AtYourBusiness.com – Helps businesses to manage employee-related paperwork
- Showmethescore.com – Web pages for amateur sports teams
- Bid4assets.com – An auction site for high value distressed properties (the site recently sold the U.S. Presidential yacht the U.S.S. Sequoia).

Firm Statistics

As of January 2001, there were 1,840 firms providing a wide variety of InfoCom services and products in Montgomery County.[25] These firms employed 59,233 workers, or nearly 12 percent of the total number of employees working in the County.[26] Most firms can be classified as small businesses given that 70 percent of them have 9 or fewer employees. This high percentage of small firms is consistent with that found region-wide. The Greater Washington Initiative estimates that 72 percent of the Washington region high technology firms (includes other activities in addition to InfoCom) have 10 or fewer employees.[27]

Table 1. Montgomery County Firm Size Distribution

	Distribution By Firm Size		Employee Distribution By Firm Size	
Firm Size (Employees)	Total Firms	Percent of All Firms	Total Employees	Percent of All Employees
1 - 4	787	46.5	2,345	4.0
5 - 9	393	23.2	2,734	4.6
10 - 19	177	10.5	2,437	4.1
20 - 49	153	9.0	5,185	8.8
50 - 99	81	4.8	5,781	9.8
100 - 249	56	3.3	9,294	15.7
250 - 499	30	1.8	11,831	20.0
500+	16	0.9	19,626	33.1
Total	1,693	100.0	59,233	100.0
Unassignable	147	-	-	-
Grand Total	1,840		59,233	

Source: Data collected from published sources (e.g. *Washington Post, Washington Techway, Potomac Tech Journal*), phone interviews, and InfoUSA.

[25] Data gathered from a variety of sources. Sources used: IT Company Guide; various issues of the Washington Business Journal, Potomac Tech Journal, Washington Post, and Washington Techway; postings on sites such as dbusiness.com, netpreneur news, potomactechwire.com; Information Technology Almanac; Dun & Bradstreet (companiesonline.com); Network Solutions (dotcomdiretory.com); InfoUSA.
[26] Total County At-Place Employees = 513,000, Round 6.1 Forecasts; M-NCPPC.
[27] Radio interview on WWRC-980 AM, July 2000.

Large firms, however, hold most of the employment. Firms with 100 or more employees account for 69 percent of the total InfoCom employment. The largest of these firms include:

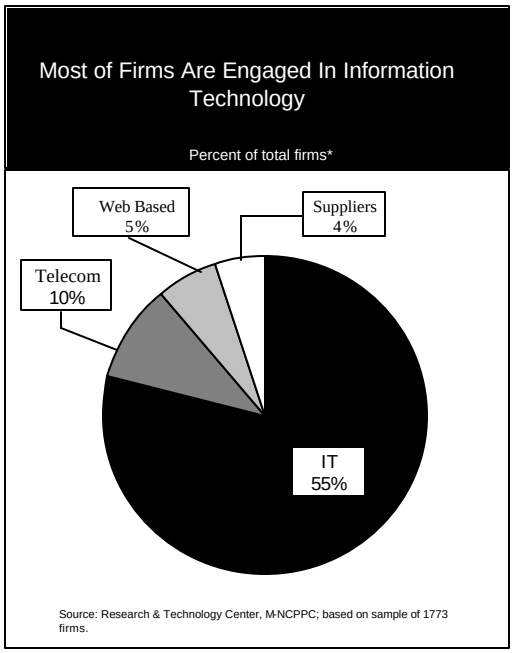
Table 2. Top Seven Firms By Number of Employees

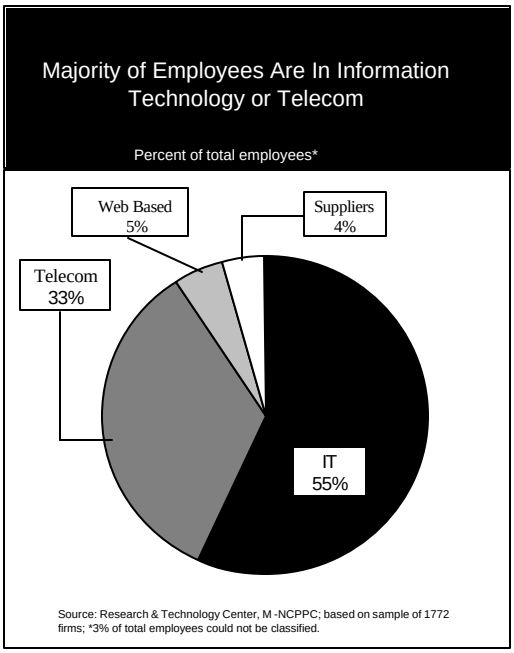
Firm	Number of Employees
Lockheed-Martin	4,000
Hughes Network Systems	3,500
Discovery Communications	2,000
BAE Systems	2,000
Comsat Corp.*	950
TTC	910
GE Information Systems	800

*Acquired by Lockheed-Martin in 2000.

Source: Research & Technology Center, M-NCPPC.

The majority (79 percent) of County InfoCom firms are engaged in some aspect of information technology such as software development, data processing, computer programming, and computer systems integration. The next largest share (10 percent) includes those firms supplying telecommunications. Web based enterprises account for the third ranking share (6 percent). Five percent of the Montgomery County firms provide supplies to the InfoCom industry (i.e. equipment sales/rental).

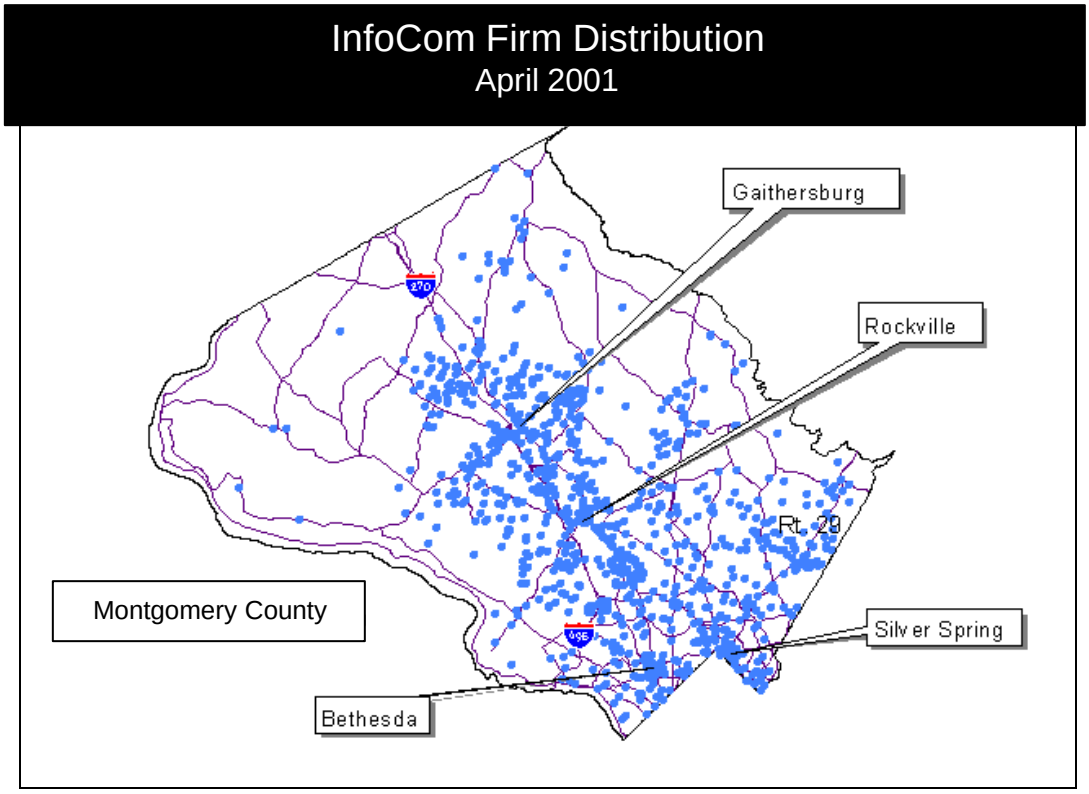




Fifty-five percent of all InfoCom employees are focused on information technology (31,727 workers). Telecommunications workers account for 33 percent of the total (19,036 workers). So far, 5 percent of County InfoCom workers (2,884) work at Web based enterprises (i.e. Presidentialbank.com). Another four percent of the work force (2,307) come from direct suppliers to the industry such as high tech employment agencies and firms that provide electronic parts. (Sixty-eight firms with 1,546 employees could not be specifically classified).

Concentrations of Firms By Location

When the inventory of InfoCom firms is mapped, their locations are widely disbursed. Clusters can be seen in Silver Spring, Rockville, and Bethesda, as well as near I-270. Also seen are a large number of firms located in homes in residential areas of the County.



Sorting the InfoCom inventory by mailing address, concentrations are found in and around Rockville, Bethesda, Gaithersburg, Silver Spring, and Germantown.

Table 3. Concentration of Firms By Location

City	Number Of Firms	Percent of All Firms	Number Of Employees	Percent of All Employees
Rockville	452	24.6	19,216	32.4
Gaithersburg	349	19.0	7,681	13.0
Silver Spring	342	18.6	6,433	10.9
Bethesda	292	15.9	15,950	26.9
Germantown	103	5.6	7,331	12.4
Potomac	57	3.1	238	0.4
Olney	40	2.2	195	0.3
Chevy Chase	32	1.7	275	0.5
Kensington	30	1.6	264	0.4
Takoma Park	24	1.3	87	0.1
Wheaton	15	0.8	249	0.4
Other	104	5.7	1,314	2.2
Total	1,840	100.0	59,233	100.0

Source: Research & Technology Center, M-NCPPC.

Table 4. Locations of Notable Firms

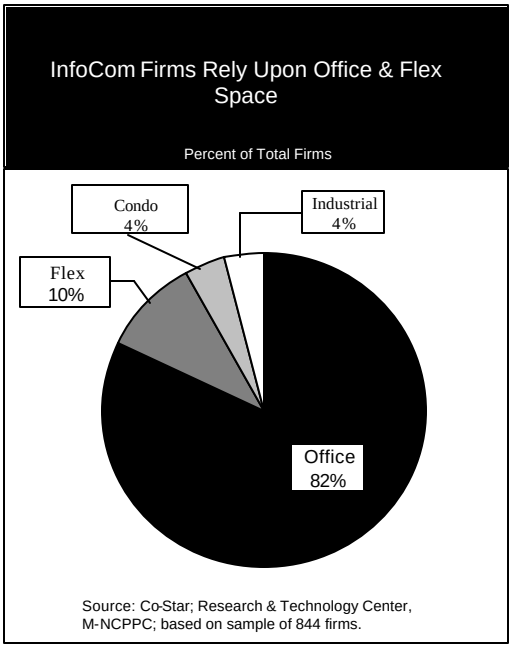
Firm	Location*
Lockheed-Martin	Bethesda
Discovery Communications	Bethesda
BAE Systems	Rockville
Startec Global Communications	Bethesda
TTC	Germantown
GE Information Systems	Gaithersburg
Loral Cyberstar	Rockville
CityNet Telecommunications	Silver Spring

*As determined by zip code

Source: Research & Technology Center; M-NCPPC.

Types of Space Used

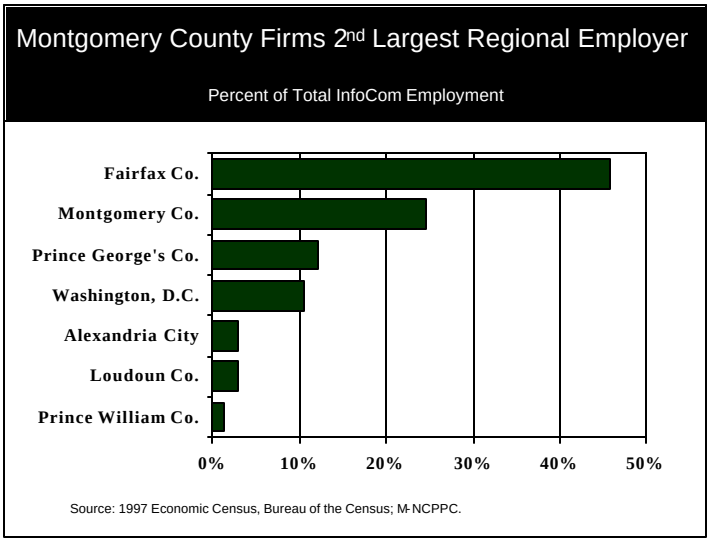
The addresses of InfoCom firms were matched with the Co-Star building database from the Realty Information Group. Matches were found for 844 firms. The majority of firms are located in general office space while others use flex, industrial, and office condo space.



Most firms occupy Class A or Class B space. Use of these classes was almost equally split, 351 firms filled Class A space and 338 firms occupied Class B locations. Class C was occupied by 119 firms.

Comparisons With Other Washington Area InfoCom Centers

Montgomery County is frequently compared with counties in Northern Virginia in terms of number of firms, number of employees, and other economic factors. Data, interviews, and field observations were used to differentiate Montgomery County from the surrounding jurisdictions.

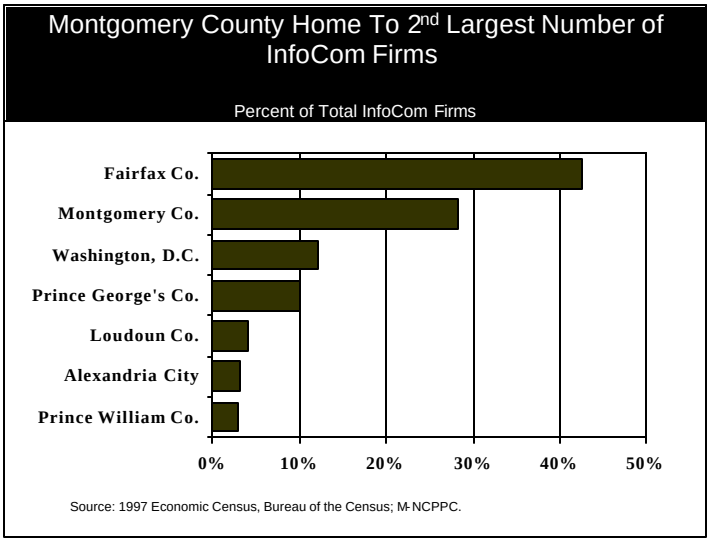


The Employment and Firm Comparison

Montgomery County InfoCom employment has expanded along with the rapid ramp-up in the region. In fact, the County has the second largest share of regional employment following Fairfax County.

Montgomery County's has wide variety of firms engaged in InfoCom represent every type of major InfoCom business activity from manufacturing (a small amount) to Web design. As is the case with InfoCom employment, the County is second in the region in terms of total number of InfoCom firms. The real difference between Montgomery

County and other regional jurisdictions such as Northern Virginia, is the size and visibility of certain firms. For instance, while Montgomery County has IT consulting firms, it does not have as many firms the size of Booz, Allen, and Hamilton, Price Waterhouse Coopers, Accenture, AMS, or SAIC. Montgomery County has some large firms doing comparable work, but few the magnitude of those just mentioned. Using one other example, Montgomery County has its Internet Service providers, but none reach the size of AOL or MCI/WorldCom.



Data Centers

With the surge in Internet development has come the creation of a new real estate product. Known by a variety of names, "server farms," "cyber hotels," "carrier hotels," or "data centers," these buildings house the equipment that provide the infrastructure of the Internet. Telecommunications firms as well as Internet service providers, Web-hosting companies; Web based application service providers, and other companies house dozens, hundreds, or thousands of switches and switching equipment needed to move traffic along the Internet.[28]

In 1999, local developers stepped in to fill existing and forecasted demand for data center space. Some of the first space to go up is located a few miles from Montgomery County, in the District of Columbia near the intersection of Florida and New York Avenues. Vacant buildings previously used by the printing industry were especially attractive because of their sturdy construction and their location near a fiber network trunk line running parallel to the Metrorail Red Line tracks. This was followed by the construction or purchase of land for development for nearly a million square feet of data center floor area, with plans to build a total of 13 centers. This boom was temporarily halted when the District government placed a moratorium on new construction of data centers until they could get some development restrictions in place aimed at protecting area neighborhoods from the architectural ramifications of these buildings. The opposition lay with how the buildings are constructed and operated. Most centers are windowless and tend to look like the fortresses they are. These centers are constructed to protect the equipment inside from common criminal activity such as burglary and against

[28] Carberry, James. "Second Generation," *Urban Land*, January 2001, p.68.

unusual occurrences such as terrorist attack or acts of nature such as earthquakes, floods, and windstorms.

While these centers were being opened or planned, three dozen centers have also been completed or are planned to be part of the sprawling advance of InfoCom development in Northern Virginia. These projects total an estimated 2.5 to 3 million square feet.[29]

Montgomery County does not have any commercial data centers (some companies and institutions do have proprietary centers). This is largely due to a preference held by most of the data center developers to be near high profile companies that have largely located in Northern Virginia, and where affordable, in urban cores where there is a very high concentration of firms requiring Internet access and services. This latter preference is why the New York Avenue projects went forward. Similar projects have developed in downtown Los Angeles, where 18 buildings totaling more than 3 million square feet that were totally vacant have been converted to data centers.[30]

In 1999 and 2000, data centers became sought after because they were seen as very visible indicators of how a community's economy had shifted to the "new economy" how it was very much part of the "dot com" revolution. The more data centers a community had, the more successful it would soon be. Data centers also have been attractive to some jurisdictions when data centers were slated for urban centers such as downtowns. Typically, these centers place little strain on the existing infrastructure (e.g. traffic and parking) because centers have few employees. Montgomery County did not attract any of the commercial centers in this period. No major obstacles against data center development in the County are evident. The same fiber lines feeding the New York projects run through portions of the County including downtown Silver Spring. Real estate representatives have reported that firms seeking data center space have toured buildings in Montgomery County within the last twelve months.

It could be some time before we know if data centers will be developed here. The deep downturn in Internet investment, sales, and firm creation has largely stopped leasing and further development of data centers. One of the earliest and largest District of Columbia data center projects (800,000 square feet) was cancelled in mid-April while in the planning stage. Other centers in Northern Virginia remain largely or totally vacant.[31] This follows a national trend of overcapacity of data center space. According to the *Wall Street Journal*, data center space in the

[29] Usher, Anne. "Down on the Server Farm," *Washington Techway*, March 26, 2001, p.24.
[30] Ibid, p.71.
[31] Ibid, p.24.

United States is only being utilized at 25 percent of its capacity.[32] Predictions show that center space use will only grow 2 to 5 percent annually over the next four years, down from the previous forecasts used to drive new center construction (25 to 35 percent annual growth rates).

The Internet Infrastructure Comparison

While Northern Virginia is the home of MAE-East and the majority of the region's data centers, Montgomery County shares with it a high level of connectivity. Information gathered in interviews and a literature review for this study failed to identify any current major differences in terms of connectivity.

AOL had spearheaded the installation of many miles of fiber lines in Virginia, now major urban centers and business parks throughout the entire region enjoy access to the Internet via copper-wire solutions (DSL, T-1, and T-3) and fiber optic networks that run at a variety of speeds. Interviews with those familiar with some of the major fiber networks indicate that Montgomery County fiber lines link urban centers such as Bethesda and Silver Spring, and business park areas such as those found in the I-270 corridor.

One difference between Montgomery County and some locations such as the Dulles Corridor is the age of buildings being wired for Internet access. New buildings have the advantage of being designed to accommodate Internet access lines and the storage of associated equipment. Much of the space used by Northern Virginia's InfoCom industry has been new construction along the Dulles Corridor and other emerging areas. Some tenants moving to Montgomery County buildings probably found that the older buildings had to go through a period of rewiring. Owners of older buildings have the special challenge of developing "teleco closet space" for equipment, snaking wires vertically from floor to floor and horizontally into tenant space, often while these spaces are occupied. In some cases, fees are charged service providers wishing to wire a building by landlords who wish to receive a percentage of the charges paid by the tenants. Sometimes these negotiations can slow wiring of a building.

This difference is largely being erased as principal buildings have been rewired and infrastructure companies are providing greater education, incentives, and technical options to building owners for retrofitting many of the remaining older buildings.[33]

[32] Mangalindan, Mylene. "Overcapacity Jitters Hurt Web-Hosting Stocks," *Wall Street Journal*, June 18, 2001, p.B6.

[33] As per presentations at the "Broadband Connectivity Workshop," February 7, 2001, Silver Spring, Maryland, hosted by the Communication Infrastructure Committee and the Montgomery County Chamber of Commerce.

The Future of the InfoCom Industry in the County

The worldwide InfoCom market has suffered a major downturn since mid-2000. A majority of ecommerce firms never got off the ground to show performance expected by venture capitalists, Wall Street, and the general public. Once confidence in key ecommerce businesses collapsed so did many of those firms supplying equipment, services, and other goods to the ecommerce sector. At the same time, the consumer market for computers softened after several years of strong sales. Lastly, wireless and broadband (i.e. fiber) applications did not garner as much consumer and business interest as expected.

This downtrend in ecommerce is leaving its mark on the Washington Region. The most visible impact can be seen in the statistics of the real estate market.[34] The inventory of office space available for subleasing (often times an early indicator of a softening real estate market) has moved up sharply as closing and downsizing firms place office space on the market. This is especially true in the Dulles Corridor where the sublet vacancy rate for Class A office space has jumped from 2.2 percent at the end of 2000 to 6 percent in May 2001. Office construction too, has been affected. Projects, such as data centers for companies like Amazon.com and business parks expansions for MCI/WorldCom, have been put on hold.

The impact has been less visible in terms of InfoCom employment. Some data show layoffs between mid-November 2000 to mid-May 2001 totaled 7,000 employees (about 2 percent of the local 2000 InfoCom workforce).[35] However, a local InfoCom columnist claims that there are more than seven times that number of unfilled InfoCom jobs in the region, and other press reports support this observation that hiring is still going on for certain jobs even in the midst of a downturn.[36]

Several reports released in close succession in the first part of this year point out the important differences between the Washington region and many other high tech locations.[37] It is these differences that will help the Washington region weather the general economic and InfoCom downturns:

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[34] White, Suzanne. "Tech Troubles Trickle Down: Real Estate Market Gets A Loud, Clear Wake-up Call," *Washington Business Journal*, April 6-12, 2001, pps. 1 & 59; Spinner, Jackie. "Now Virginia Is For Subleasing: High-Tech Distress Pulls Rug Out From Under An Office Market Boom," *Washington Post*, April 5, 2001, p. E01; Sunnucks, Mike. "Maryland Suffers Sublet Woes: Vacancy Rate Doubles in Q1 in Bethesda/Chevy Chase," *Washington Business Journal*, April 20, 2001.

[35] Schafer, Sarah. "Welcome Back To The Real World: Jobless Tech Workers Find Balance of Power Has Shifted," *Washington Post*, May 21, 2001, pp E1, E13.

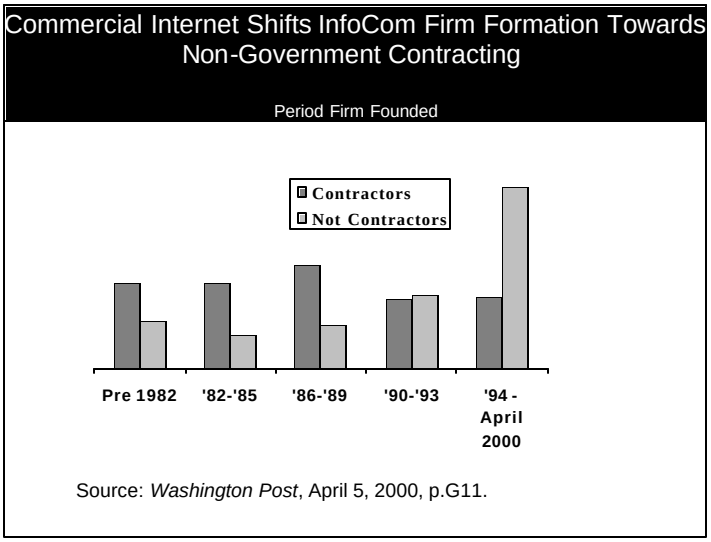
[36] Villella, Paul. "Washington Tech Industry Can Work Through Slump," *Washington Business Journal*, March 23, 2001. See footnote 33.

[37] Stough, Roger R. and Rajendra Kulkarni, *A Soft Landing for the Regional Economy*?, The School of Public Policy, George Mason University, January 2001; Fuller, Stephen. *The Economic Look For The Washington Region*, George Mason University, January 2001;

Difference 1. Our region has a small InfoCom manufacturing base
Personal computer and ecommerce equipment manufacturing have been declining over the past year and along with this has come corporate layoffs and downsizings. These effects have largely been unseen in the Washington region because here, only 14 percent of technology jobs are in manufacturing. Silicon Valley has 58 percent of its workforce engaged in InfoCom manufacturing.[38]

Difference 2. Our region captures a large share of federal procurement
In 1999, Washington region firms captured nearly six times more federal procurement than did Silicon Valley companies. Although the Washington region InfoCom sector has made major strides into commercial markets, federal expenditures still drive many companies. The Potomac Tech Journal found that 49 percent of 1,600 InfoCom firms in its database received government contracts in 2000.[39] These companies can have considerable shielding from the vicissitudes of the purely commercial markets since federal spending cycles usually work independently of those markets.

It should be noted, as InfoCom expands further into commercial markets, the percentage of total regional firms involved with government contracting will decrease. The Washington Post provided a glimpse of this trend with data gathered before the sharp downturn in InfoCom starting in mid-2000.[40] As can be seen in this chart, the number of federal contracting InfoCom firms exceeded those that had no connections to the government before the commercialization of the Internet in the mid-1990s. In recent years, as the Internet became a commonly available in the workplace and the home, the number of firms not associated with government contracts surged. The current downturn has undoubtedly lessened the disparity between contractors and non-government contractors.



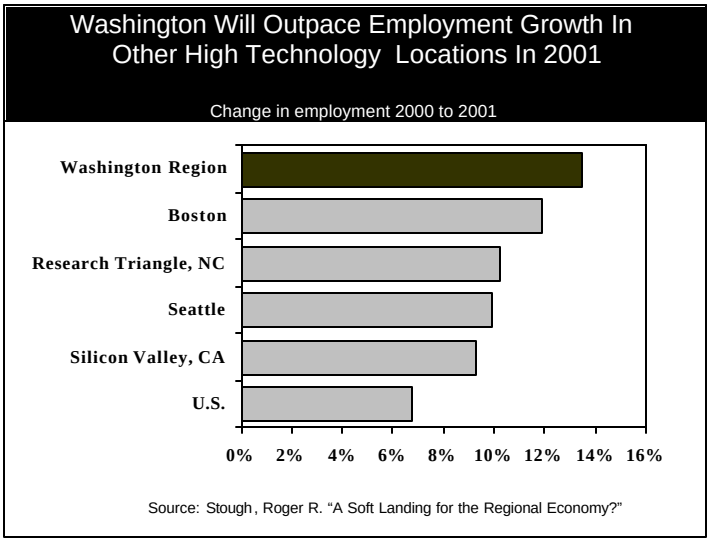
It can be expected that this is but a temporary adjustment. Over time, as the Internet makes new and deeper impacts on our business and personal lives, the

[38] Stephen Fuller findings as cited in: Irwin, Neil. "Upbeat on Area's Tech Sector," *Washington Post*, February 6, 2001, p. E05.
[39] "Government Contracts and Technology Firms," *Potomac Tech Journal*, November 27, 2000, p.12.
[40] Behr, Peter. "The Evolution of Wired Washington: Explosion of Internet Firms Weans Area From U.S. Government," *Washington Post*, p. G11.

growth of firms with products and services aimed not at government users but at the commercial market, will exceed the creation of firms servicing government needs.

Although it is hard to fully substantiate, it is likely that Montgomery County escaped many of the effects of this InfoCom downturn because a smaller percentage of the county's total inventory of InfoCom firms were focused exclusively on providing Web services and products. The *Potomac Tech Journal* reports that in October 2000, nearly 11 percent of 1,300 regional InfoCom firms said that they provide services that are primarily focused on Web related InfoCom activities (i.e. Web site design, software for Web sites).[41] At the same time, MNCPPC estimates show that 6 percent of Montgomery County firms describe themselves as Web companies.

George Mason University expects the Washington region to outperform many U.S. high technology locations. Since the majority of high technology in this region is InfoCom, this projection for 2001 shows not only the resilience in the Washington InfoCom economy but also higher growth potential than found in Boston, the Silicon Valley, and the U.S. high tech economy generally.



As the market for InfoCom services and products goes through periods of expansion and contraction in the coming years, Montgomery County will continue to be a major location for firms in this sector. In summary, Montgomery County will be able to attract and retain a large share of regional InfoCom firm and employment due to:

1. the quality of the County's urban centers such as Bethesda and Silver Spring
2. the quality of the County's business parks, especially those in the I-270 corridor
3. the high quality of life in Montgomery County
4. the synergistic effect of the County's concentration in biotechnology, large base of government contractors (i.e. Lockheed-Martin) and system integration/software expertise.

[41] *Potomac Tech Journal*, October 2, 2000, p. 16.

Some conditions will limit the number of firms and amount of InfoCom employment that can be attracted and accommodated in Montgomery County.

1. The expansion of MAE-East in Northern Virigina.
   This will be a powerful attractor of those firms that require/desire to be close to this InfoCom focal point.

2. The outward expansion of office/flex/industrial developments for InfoCom firms in the more distant suburbs. Although InfoCom has been widely dispersed in the region, with firms in downtown Washington, in Montgomery County to the north and Fairfax County to the south and west, developments in the outer suburbs will spread firms even further. Loudoun and Prince William County projects are already creating new InfoCom clusters. With each new cluster comes greater competition among all clusters, spreading a growing but limited supply of InfoCom firms more thinly across the region.

3. The demand for large tracts of land for business park/campus development. Montgomery County's supply of land for large developments (i.e. 80+ acres) is extremely limited. Much of the land that had been allocated for business development in the 1980s and 1990s has now been developed or spoken for. A recent example of an employer with local ties that chose to go to Northern Virginia to develop a business campus is the Howard Hughes Medical Institute.[42] Long associated with Montgomery County by way of having its headquarters in Chevy Chase, the Institute could not have easily found the 281 acres it wanted in this County.

[42] Howard Hughes Medical Institute, "HHMI Unveils Long-Range, $500 Million Plan for Collaborative Research Campus, Press Release, February 1, 2001 (http://www.hhmi.org/news/020101.html) on Web site, May 22, 2001.

Appendix

Item 1. InfoCom By North American Industrial Classification System Codes
Item 2. List of Cited Sources
Item 3. List of Persons Interviewed
Item 4. Accessing the MNCPPC Database of Montgomery County InfoCom Firms

Item 1.
InfoCom By North American Industrial Classification System Codes

Hardware Industries	SIC	NAICS
Computers and equipment	3571, 2, 5, 7	334111, 2, 3, 9
Wholesale trade of computers & equipment	5045 pt.	42143 pt.
Retail trade of computers & equipment	5734 pt.	44312 pt.
Calculating and office machines, nec	3578, 9	334119, 333313, 339942, 334518
Magnetic and optical recording media	3695	334613
Electron tubes	3671	334411
Printed circuit boards	3672	334412
Semiconductors	3674	334413
Passive electronic components	3675-9	334414, 334415, 34416, 334417, 334418, 336322, 334419
Industrial instruments for measurement	3823	334513
Industrial for measuring electricity	3825	334416, 334515
Laboratory analytical instruments	3826	334516
Software/Services Industries		
Computer Programming Services	7371	541513
Prepackaged software	7372	51121, 334611
Wholesale trade of software	5045 pt.	42143 pt.
Retail trade of software	5734 pt.	44312 pt.
Computer integrated systems design	7373	541512
Computer processing, data preparation	7374	51421
Information retrieval services	7375	514191
Computer services management	7376	541513
Computer rental and leasing	7377	53242
Computer maintenance and repair	7378	44312, 811212
Computer related services, nec.	7379	541512, 541519
Communications Equipment Industries		
Household audio and video equipment	3651	33431
Telephone and telegraph equipment	3661	33421, 334416, 334418
Radio and TV and communications equipment	3663	33422
Communications Services Industries		
Telephone and telegraph communications	481, 22, 99	513321, 513322, 51333, 51331. 513322, 51334, 51339
Radio broadcasting	4832	513111, 513112
Television broadcasting	4833	51312
Cable and other pay TV services	4841	51321, 51322

Source: Based on U.S. Department of Commerce, The Emerging Digital Economy , Appendix 1, p. 19.; Research & Technology Center, M-NCPPC.

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Item 4.
Interviews Conducted

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Mary MacPherson, Executive Director, Morino Institute
Cris Epstein Heerford, DataCentersNow
Willian Drury, Lockheed-Martin
Debbie Alston, Pimmit Run Research, Inc.
Brendan Owen, CB Richard Ellis
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Morgan Sullivan, Spaulding & Slye
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Ed Zaptin, Washington Real Estate Investment Trust
Amy Finan, Montgomery County Department of Economic Development
Basil Allison, Systems Planning, Pepco
Mark Seward, MCI/Worldcom/UUnet
Andrew Afflerbach, Columbia Telecommunications Corp.
David Lillibridge, Mid-Atlantic Technology Associates LLC
Ferdinand Tolentino, MCI/WorldCom, Vienna, Virginia
Anne Rosenau, Cushman & Wakefield

Item 5.
Accessing the MNCPPC Database of Montgomery County InfoCom Firms

The MNCPPC inventory of Montgomery County InfoCom firms compiled for this study can be found online at www.mc-mncppc.org/factmap/databook/resanlys/randa.htm in Excel format.

This inventory may be updated periodically so it may vary from the data cited in this report. It should also be noted that MNCPPC is offering this inventory for general information only. There may be firms listed in the inventory that are no longer in business and the inventory may be lacking other names of firms that have begun operations. Also, the inventory may have data that may no longer be accurate, such as employee counts and addresses.

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