

Technology Policy Consultant Study

Prepared for:

**Industrial Development Authority
James City County, Virginia**

Submitted:

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Section 1

Executive Summary With Recommendations

Executive Summary

Moran, Stahl & Boyer was retained by James City County's Industrial Development Authority to assess and comment on the viability of attracting technology-based companies to the County leveraged by research activity within the Hampton Roads area. Four objectives of the study are:

1. Review the types of technology-related R&D that are currently being performed at local universities and government labs
2. Determine the types of local R&D efforts that have the highest commercialization potential and may result in attracting or establishing technology-related employers within James City County
3. Identify industry clusters that are most closely related to the local R&D efforts
4. Define the elements of an economic development technology policy that would enhance the County's position in attracting prospective technology-related companies to County office and industrial parks

Highlights From the Study

- The area has a significant level of technology-related research activity based on the combined efforts of NASA-Langley, Jefferson Lab and the three major research universities (The College of William & Mary, Old Dominion University, and Eastern VA Medical School).
- A majority of local research is focused on physical and earth sciences (including marine and atmospheric) and engineering sciences (particularly in materials). There is a limited amount of life science research and it is primarily conducted at Eastern VA Medical School. The areas of research emphasis are in contrast to other major research communities along the East Coast that are focusing primarily on life sciences. This creates a possible niche in technology for the area.
- Research efforts of the local universities and their combined efforts at the Applied Research Center are relatively new and in the formative stage. Time will be a factor in the maturing of the process from research to commercialization and its ultimate success.
- Key success factors in the commercialization of research include the following:
 - The research efforts have some level of focus with a mission and specific technology targets
 - A significant portion of the research is from private sources interested in commercialization
 - A designated group is manages the technology transfer and incubator/technology park
 - The venture is backed by the State, local government, local university and private sector
 - The technology park is relatively close to the research activity with other parks available to handle growth
 - Flexible facilities are available that cover the complete business life cycle
 - The industrial/office park is designated as an Enterprise or Technology Zone to offer incentives
- There are two strategies for bringing technology-related companies to James City County:
 1. Recruit external companies to locate in the County and leverage the local research resources
 2. Support the development of new/emerging companies through a business incubator and flexible facilities approach

Executive Summary (cont'd)

- Three target areas of technology that have significant commercialization potential have been identified along with their related industry clusters:

1. Computation, Analysis and Simulation Software and Systems Development

Clusters: biotechnology/life science computations, sensor/instrument data processing, and remote learning software

2. High Performance Material Components Manufacturing

Clusters: automotive/aircraft components, sports equipment, power tools, and prosthetics

3. Sensors and Instrumentation Manufacturing

Clusters: medical monitoring/detection, security monitoring/detection, industrial process control, environmental monitoring, and traffic management

- In order to fully realize its technology-based potential, the area has some inherent challenges to overcome:

Hampton Roads is not well known for its technology-related activities and reforming external perceptions can and will be a significant challenge (but the evidence is there to achieve it).

The success of the area in attracting technology companies or developing new companies requires a substantial amount of collaboration between universities, government, private sectors, etc. and this area does not have a strong track record of stimulating collaboration – although there are several emerging success stories.

- A Technology Policy recommendation was developed with five key elements:
 1. Define Target Areas of Opportunity (that have broad commercial application)
 2. Promote and Facilitate Technology-Related Economic Development Activities
 3. Enhance Local Human Capital
 4. Provide Flexible Facilities and Infrastructure
 5. Offer Access to Financial Resources (including incentives)

Details of the policy recommendation are presented in Section 8 of the report along with key action items

Final Thoughts

The area does have significant potential for converting locally-developed technology into commercial opportunities that enhance economic development for James City County. The County is positioned well geographically within the peninsula along with its proximity to the College of William and Mary, and the Applied Research Center. The ultimate success of commercialization will depend on how well the local and regional stakeholders come together and embrace the opportunity and stimulate collaboration of efforts and on the ability of James City County to define and communicate their unique advantages. Playing in the technology “game” has its challenges and above all will take significant time, patience and commitment before success is achieved.

Section 2

Introduction

Introduction

2.1 Objectives

Moran, Stahl & Boyer was retained by James City County's Industrial Development Authority to assess and comment on the viability of attracting technology-based companies to the county leveraged by research activity within the Hampton Roads area. The four key objectives of the study are:

1. Review the types of technology-related R&D that are currently being performed at local universities and government labs
2. Determine the types of local R&D efforts that have the highest commercialization potential and may result in attracting or establishing technology-related employers within James City County
3. Identify industry clusters that are most closely related to the local R&D efforts
4. Define the elements of an economic development technology policy that would enhance the county's position in attracting prospective technology-related companies to county office and industrial parks

2.2 Methodology

Moran, Stahl & Boyer applied a four-step process to completing the study:

Step 1: Data Collection

- All reports that have been prepared by the county and its consultants over the past five years that related to some aspect of technology R&D and economic development were reviewed
- Interviews were conducted with contacts from all major local research institutions and labs in the Hampton Roads area (as well as VA Commonwealth University in Richmond) to discuss and understand research activity within the region and its commercialization potential (see page A-1 in the Appendix)
- Interviews were also conducted with key economic development leaders and technology-related associations within the area
- Web sites and printed literature relating to area research institutions were reviewed
- Initial feedback on technology commercialization opportunities was gathered from a presentation to the James City Industrial Development Authority Board of Directors

Step 2: Evaluation of Technology Industry Opportunities

- A listing of local major technology-related research institutions was made along with their key research activities
- Commonalities and collaboration activities were reviewed and identified
- An overview of university research nationally and regionally was incorporated into the evaluation in order to put local research activities in perspective
- Target high potential industries were identified based on the evaluation of key societal needs for which there are technology-based solutions (e.g., healthcare, food production, defense/crime/terrorism, education, environmental cleanup, etc.).

Introduction

2.2 Methodology (continued)

Step 3: Selection and Prioritization of Technology Industry Options

- Specific industries were selected for the County to focus on based on several factors:
 1. There is significant research activity in the area that supported the industry
 2. The industry has a significant economic potential based on societal needs
 3. The resource requirements to support the industry exist in the area
 4. There is a potential financial payback to the community for having the industry in the County
 5. There is currently some industry presence in the area to jump-start additional growth
- A simple economic model was developed to determine the value of revenue streams for both the County and the Commonwealth.

Step 4: Development of Policy Recommendations

- Reviewed Technology Zone and Enterprise Zone incentive packages in the area
- Evaluated policy strategies at the local, state and federal levels
- Determined the critical areas to focus on in the policy to support the success of attracting technology-based companies

Section 3

**Perspective on the
Area Economy**

Perspective on the Area Economy

3.1 Evolution of the Area Economy

For most of its 400 year history, the Virginia peninsula has been an agricultural-based economy with several port cities. The Newport News shipyard began in the late 19th century and gradually expanded the industrial job base.

A major build-up of government and military operations came about at the onset of WWII and continues to be the major underpinning of the area economy.

In the 1950’s when jobs became more plentiful and the concept of leisure was prevalent, the regional tourism industry began to expand around Virginia Beach and Colonial Williamsburg. When I-64 was completed in the 1960’s, it gave regional and national access to the area that enhanced tourism and related retail activity in the area.

In the 1970’s, Anheuser-Busch began making a major investment into the Williamsburg area with the construction of the brewery, an office park, a planned residential community and Busch Gardens. The brewery also attracted several packaging plants.

More recently, economic growth has come from electronics manufacturing in the Hampton area, software contractors serving NASA-Langley, distribution centers and back office/call center operations.

Figure 3.1 – Key Area Economic Drivers/Segments



Area Economic Development Timeline

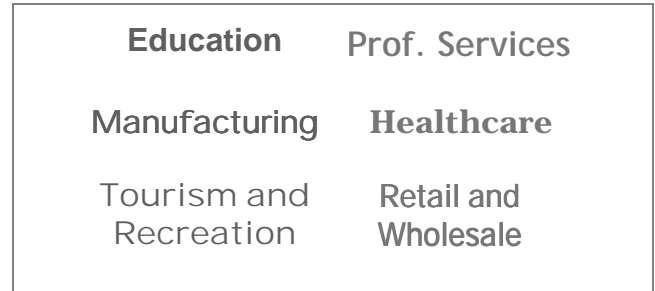
<u>Time Period</u>	<u>Economic Activity</u>
1600's to 1940's	Primarily agricultural area with several port cities
1889	Newport News Shipyard established
1917	Langley Research Center began as first civilian aeronautics lab
1930's	Colonial Williamsburg Foundation begins restoration
1940s	Major build-up of military operations along with service, support and retail industries
1950's	Recreation/tourism industry begins with regional travel to VA Beach and Colonial Williamsburg
1960's	U.S. Government develops the Yorktown and Jamestown National Historic Parks and connects with the Colonial Parkway I-64 construction brings national access to the area
1970's	Anheuser-Busch began beer production in the Williamsburg area along with Busch Gardens and other development projects Packaging manufacturing established to support the brewery Kingsmill planned community begins the trend of major residential developments that attract retired and regional executive families
1980's	Jefferson Lab begins construction in 1987
1990's	Area builds reputation as low cost, modest growth metro area for call centers and some manufacturing Several industrial parks are developed to attract other industrial and distribution employers to the area The Applied Research Center established in 1996 Software and electronics firms are established in the area

Perspective on the Area Economy

3.2 The Williamsburg/James City County Economy

The economy for the Williamsburg/James City County area is a combination of a college town with a large tourism base. It also has a significant professional services presence, the hospital, and a manufacturing cluster primarily related to the brewery. The emerging growth of the relatively wealthy retirement and executive community brings a demand for specific types of services and retail.

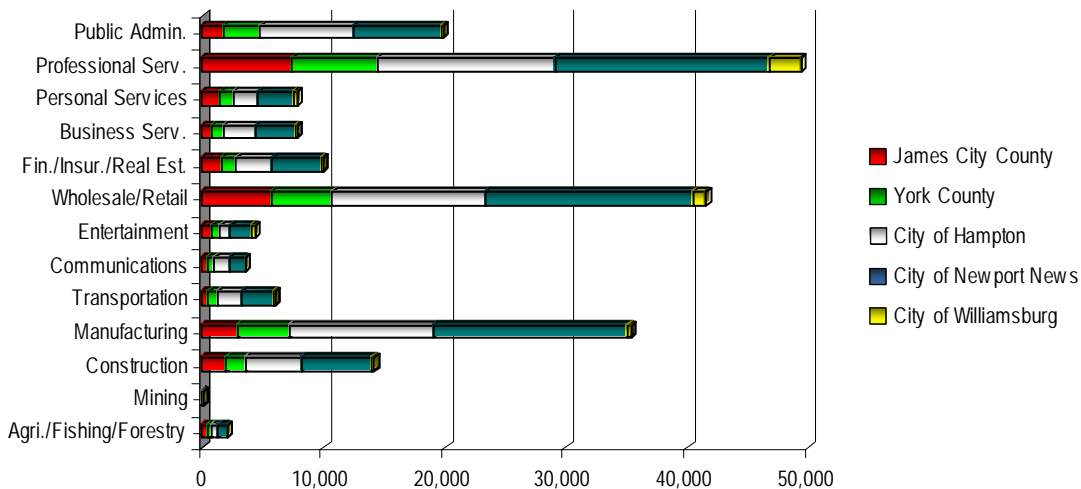
Figure 3.2 – Williamsburg/James City County Economy



3.3 General Observations on Area Economy

- The U.S. Government operations have brought relative stability to the area over the past 60 years from both military and civilian employment along with a variety of contract services
- Unemployment rates run lower than the national average for the Norfolk MSA and over the past six months have dropped from 4.4% to 3.8% due to the high military activity. Unemployment in Norfolk is about 6.0% while in James City County it is 2.2 – 2.3%.
- Shipbuilding is still a major economic driver although it has been down-sized over the past 10 years
- Tourism, retail and service jobs are relatively low paying and provide a potential source of underemployment for other industries
- Other than selected government, shipyard, software, academic and manufacturing jobs, there are limited opportunities for college grads with salaries from \$45,000-\$100,000 in the 25-40 year old age bracket

Figure 3.3 – Economic Segments (by Employment) for the Peninsula Area



Source: Claritas (2002 Data)

Perspective on the Area Economy

3.4 Stability of the Local Economy

Segments of a local economy are analogous to the diversification of stocks, bonds and funds in an investment portfolio. Some are low risk and low return while others have a higher risk and higher return. Service and retail jobs are stable as long as other segments are in place, but they also represent relatively low paying jobs.

The government and shipbuilding segments are like “blue chip” stocks as long as there aren’t any major cutbacks or repositioning that can effect both direct and indirect employment in the community.

Colleges and universities provide stable employment but with limited growth potential while tourism is stable but seasonal as long as there is an interest in local attractions.

The expanding retirement community is a fairly stable source as long as the demographics hold and the interest in the area is sustained. This segment has a natural growth curve as the Baby Boomers cycle through but will it hold the attraction for the next generation?

Local industry (brewery, electronics and other goods) is moderately stable but can be impacted by company ownership changes, escalation of operating costs, shift in markets or regulations, and other factors that drive demand for products and profitability.

Consider the agricultural base, that buoyed the area for over 300 years, is a small fraction of today’s economy.

3.5 Value of a Technology-Based Segment

Technology can be defined as change through innovation in materials, processes, equipment and software. It is a primary byproduct of our knowledge-based economy and it’s what keeps the U.S. competitive in a global economy. Rapid obsolescence is inevitable and sustaining an “edge” is a constant challenge when dealing with technology-based companies – a significant paradigm shift from the traditional companies that make the same product for 50+ years.

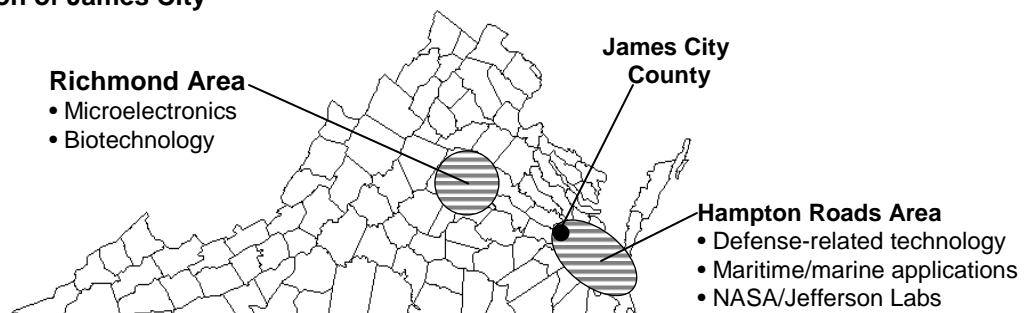
The boom/bust growth of the 90’s and its impact on “high tech” areas has brought some skepticism to the long-term value of technology-related companies to a community. However, the recent compression in stock prices and the economy is more a reflection of over exuberant investing than an inherent industry trait.

Investing in technology-related industries can provide the following value to the local economy:

- Provide a broader range of opportunities for higher paying jobs in James City County
- Maximize community revenues while minimizing consumption of valuable land resources
- Provide a hedge against future changes to existing segments of the local economy
- Bring additional revenue and stature to the College of William & Mary
- Enhance and leverage the experiences and knowledge gained from Colonial Williamsburg through distance learning and other software enhanced education experiences

Figure 3.4 – Strategic Location of James City County

James City County is strategically located between the technology activities of both Richmond and the Hampton Roads areas.



Section 4

Overview on Technology Commercialization

Overview on Technology Commercialization

4.1 Technology Applications

Applied technology is commonly derived from the life sciences and physical sciences research that results in better performing materials, components, equipment, systems or procedures that address particular societal problems and needs. Typical areas where technology is applied are noted in Figure 4.1 below. Some technologies can be applied to more than one application, such as lighter or corrosive-resistant materials used in both industrial and transportation equipment or an instrument that can be used in medical and marine environment applications.

Much of the new technology that has been developed over the past 60 years has come from government, university and private industry research centers. Grants from government agencies and private sources feed billions of dollars into university-based research each year, with some applications maturing to be viable products in the marketplace.

Table 4.1 - Typical Areas of Applied Technology

Communications	Healthcare	Energy
<ul style="list-style-type: none"> • Photonics/optical networks • Electronics 	<ul style="list-style-type: none"> • Prevention of disease • Detection of problems/disease • Treatment of disease • Eldercare support 	<ul style="list-style-type: none"> • Fuel Cells • Battery technology • Nuclear • Portable power sources
Defense/Crime/Terrorism	Environment	Food Production
<ul style="list-style-type: none"> • Guidance/navigation systems • Detection of enemy/criminal/terrorist • Weapons systems • Security systems 	<ul style="list-style-type: none"> • Protection of water, air and land resources and ecosystems • Climate impact • Monitoring and remediation 	<ul style="list-style-type: none"> • Plant/animal hardiness • Production efficiency • Preservation
Education	Transportation	Entertainment
<ul style="list-style-type: none"> • Distance learning • Virtual learning environments 	<ul style="list-style-type: none"> • Aerospace • Surface/underwater • Automotive/Trucks 	<ul style="list-style-type: none"> • Digital media • Special effects
Construction	Manufacturing	
<ul style="list-style-type: none"> • Performance of materials • Efficiency of equipment 	<ul style="list-style-type: none"> • Capability of production equipment • Efficiency of equipment • Types of materials used 	

Overview on Technology Commercialization

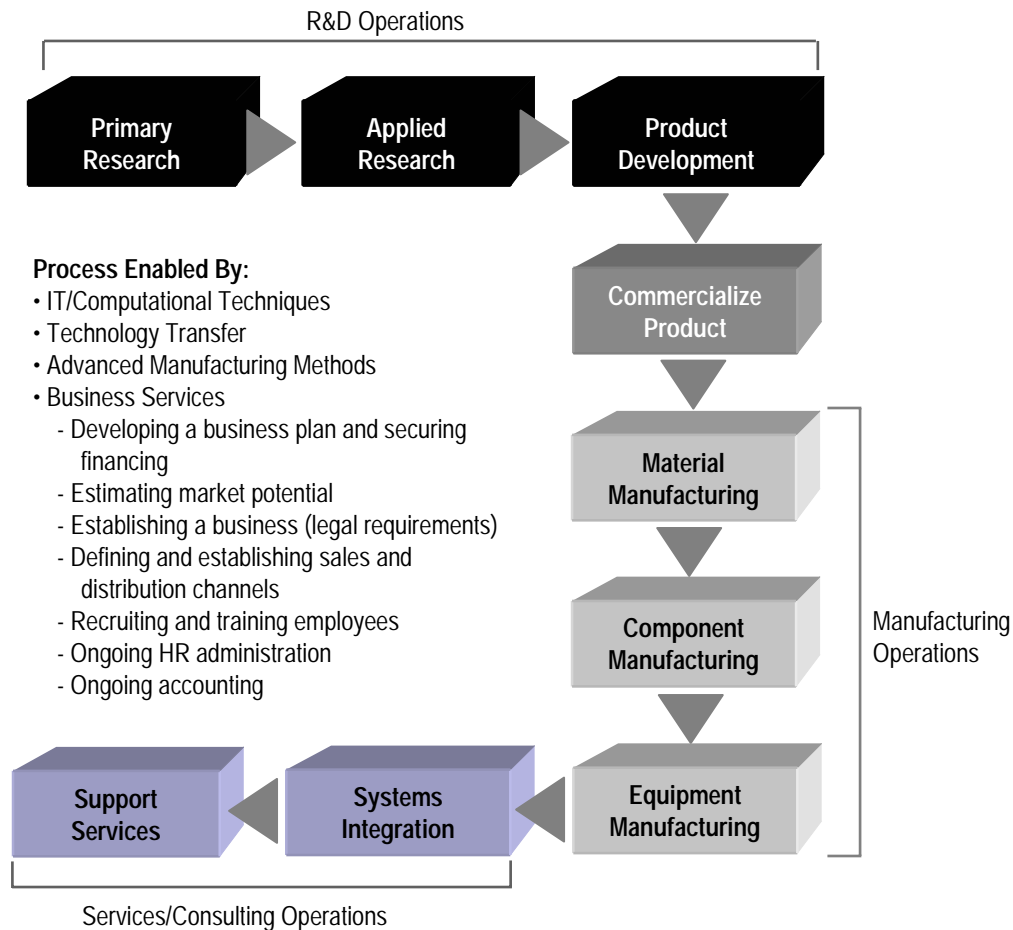
4.2 The Technology Implementation Process

Technology research commonly begins with Primary Research in the life and physical sciences that is then directed to a particular discipline in Applied Research as shown in Figure 4.1 below. Within the Hampton Roads area, primary research is being conducted in the field of physics at Jefferson Lab’s linear accelerator that provides insights into the behavior of electrons and quarks – the building blocks of the atom. Most of the other research is applied toward marine science, materials, use of light, medicine, and related fields. There are also significant efforts in computation and modeling that support and enable research efforts.

When applied scientists perceive that they have a potentially viable discovery there is then collaboration with engineers to engage in Product Development. This is the process of optimizing the performance of a potential product and review the feasibility of economic mass production.

After product development, the Commercialization team gets involved in the licensing of the technology, defining market potential and addressing all the details of getting the product to market, which can be a fairly detailed process.

Figure 4.1 - Overview on the Technology Research, Development and Commercialization Process



Overview on Technology Commercialization

4.3 The Challenges of Technology Commercialization

Converting a research concept at a university or government laboratory into a marketable product has its challenges. At the university, the professor must meet the school's expectations of sustaining high teaching standards while bringing in much needed grants to offset operating costs. It is perceptibly easier to secure an additional grant than it is to work through all the details of licensing and commercialization in hopes that in the future a viable product is achieved.

In addition, professors are encouraged to publish papers on their research, and if not properly written, may disclose too much about an idea and render it useless for licensing purposes.

There are similar work pressures, time constraints and disclosure issues at a government lab that can also limit commercialization potential. Because of the openness and objectivity required by the government, many ideas lose their competitiveness by the time they are available for the marketplace.

As noted in Figure 4.2, the process of simply licensing an idea is an eight-step endeavor that takes months or even longer to complete. The outcome of the process is most effectively approached by those that are both knowledgeable and committed.

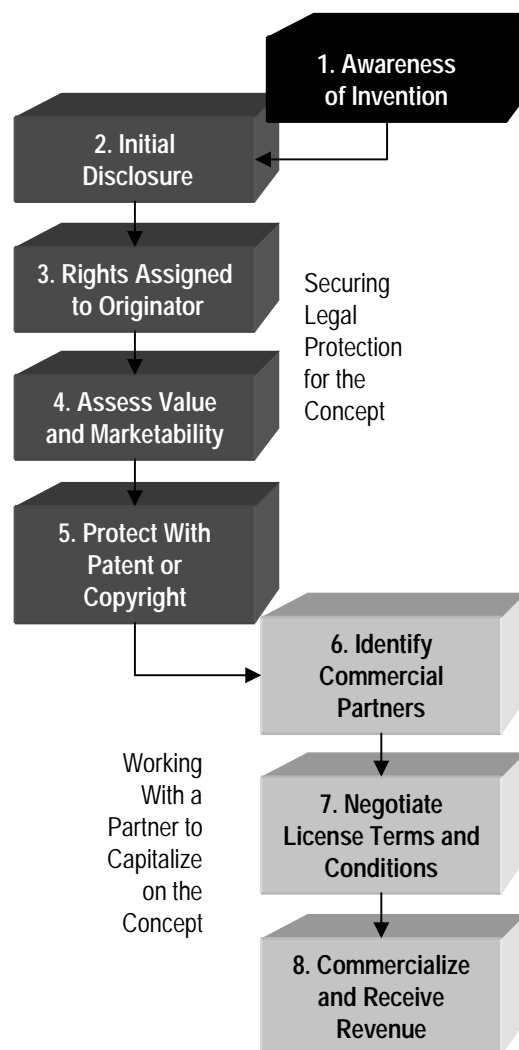
To date, the most successful institution in the region for licensing technology is Eastern Virginia Medical School in Norfolk, which is currently realizing over \$1 million in licensing fee revenue annually and another ~\$30 million in the pipeline. They have a strong team with close ties between the offices of research and technology transfer along with ongoing relationships with partners that sponsor their research.

In summary, deriving commercial value from research is possible but it takes a high level of awareness among the researchers of the overall process and a team of facilitators that minimizes the time and issues that can arise along the way.

4.4 Case Study on Technology Commercialization

A summary of the Virginia Commonwealth University's commercialization program and relationship with the Virginia Biotechnology Park in Richmond is presented in the Appendix on page A-2 along with a list of success factors relating to this joint effort.

Figure 4.2 - Technology Licensing Process



Note:

The process is slightly altered when the commercial partner is engaged or supports the research efforts prior to commercialization

Overview on Technology Commercialization

4.4 Infrastructure for Stimulating Technology-Derived Economic Development

In order to successfully leverage R&D activity within a geographic region into commercial products, there needs to be a formal organizational infrastructure integrating the three levels of effort. As shown in Figure 4.3 below, at the highest level, there is Vision, Oversight and Promotion that looks internally at the R&D activity and is aware of the commercial potential and encourages inter-group synergies while promoting the efforts externally. They don't direct the activity but foster co-operation.

The next layer is the New Technology R&D Activity that consists of all the local college, university, industrial and government R&D institutions. They convert multi-source funding into tangible opportunities. The third layer are the Commercialization Facilitators that screen companies interested in technology commercialization and provide qualified individuals/companies access to Local Resources (labor, facilities, utilities, training, etc.) as well as Business/Product Startup Resources on an as needed basis.

- The success of an area in technology commercialization is dependent on the following factors:
- Local research efforts ultimately have market potential
- There is an effectiveness in the coordination of R&D efforts and support of commercialization
- The area has an external image that attracts leading-edge companies
- The local culture stimulates innovation and change
- A local pool of entrepreneurs exists to undertake new business opportunities
- Local labor, cost structure, facilities, training, etc. are adequate to support new businesses
- Local opportunities and conditions exceed those of competitor locations
- The area can develop a cluster/critical mass of an industry that is sustainable

Figure 4.3 - Typical Infrastructure for Stimulating Technology-Related Economic Development



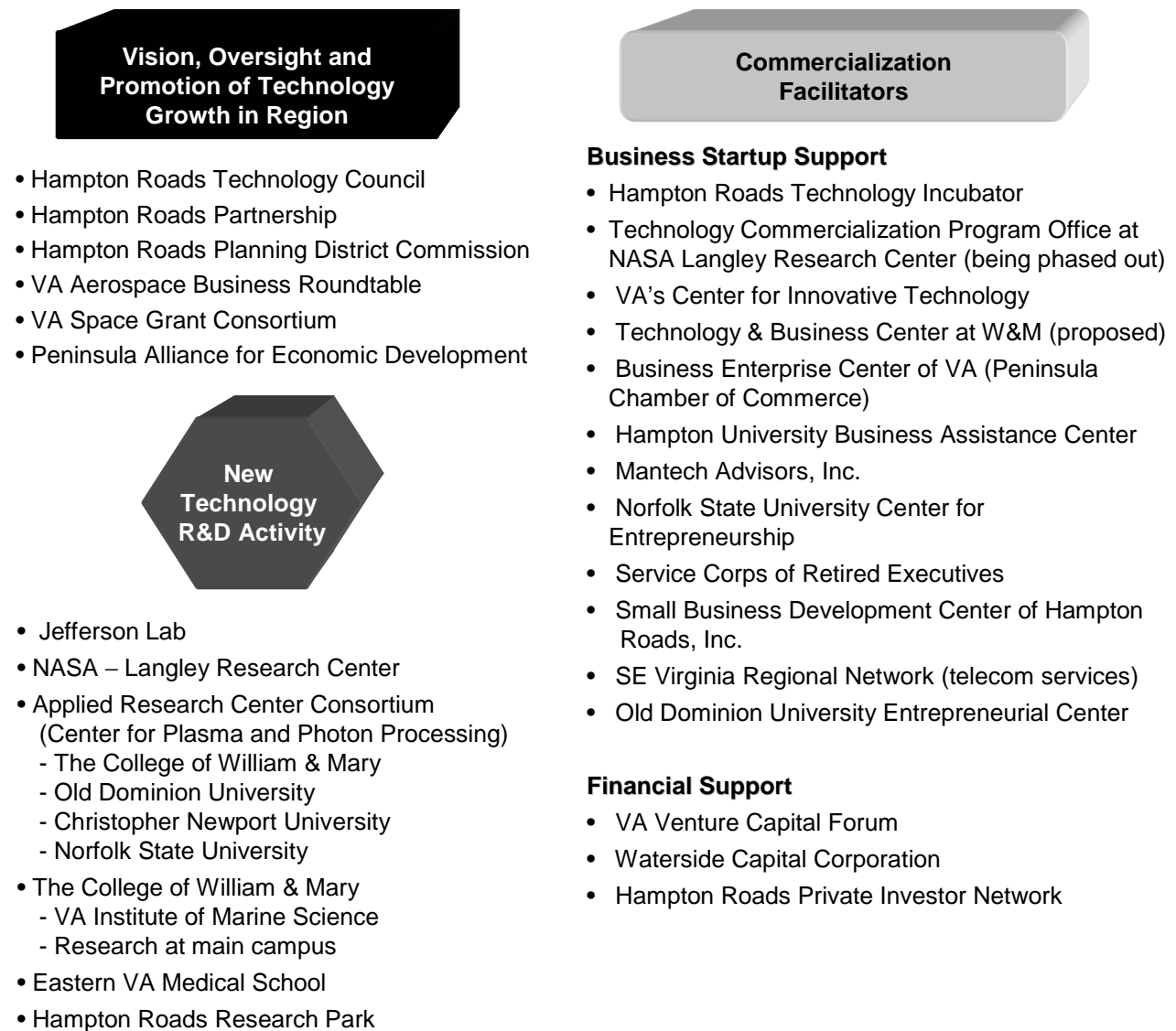
Overview on Technology Commercialization

4.5 Local Organizations That Focus on Technology-Related Efforts and Business Opportunities

Listed below in Figure 4.4 are the local resources available to address the different levels of effort required to support technology-related growth in the area. Comments on the adequacy and effectiveness of the resources, based on the research efforts, are as follows:

- There is no clear organization that incorporates the vision, oversight and promotion of the region . . . it is split among several organizations
- The Hampton Roads Technology Incubator and Eastern Virginia Medical School are among the few organizations that have been successful in technology commercialization for the area
- The Applied Research Center (ARC) is playing a key role in the integration of area university and government research focused on light (laser) and materials technology

Figure 4.4 - Local Infrastructure for Stimulating Technology-Related Economic Development

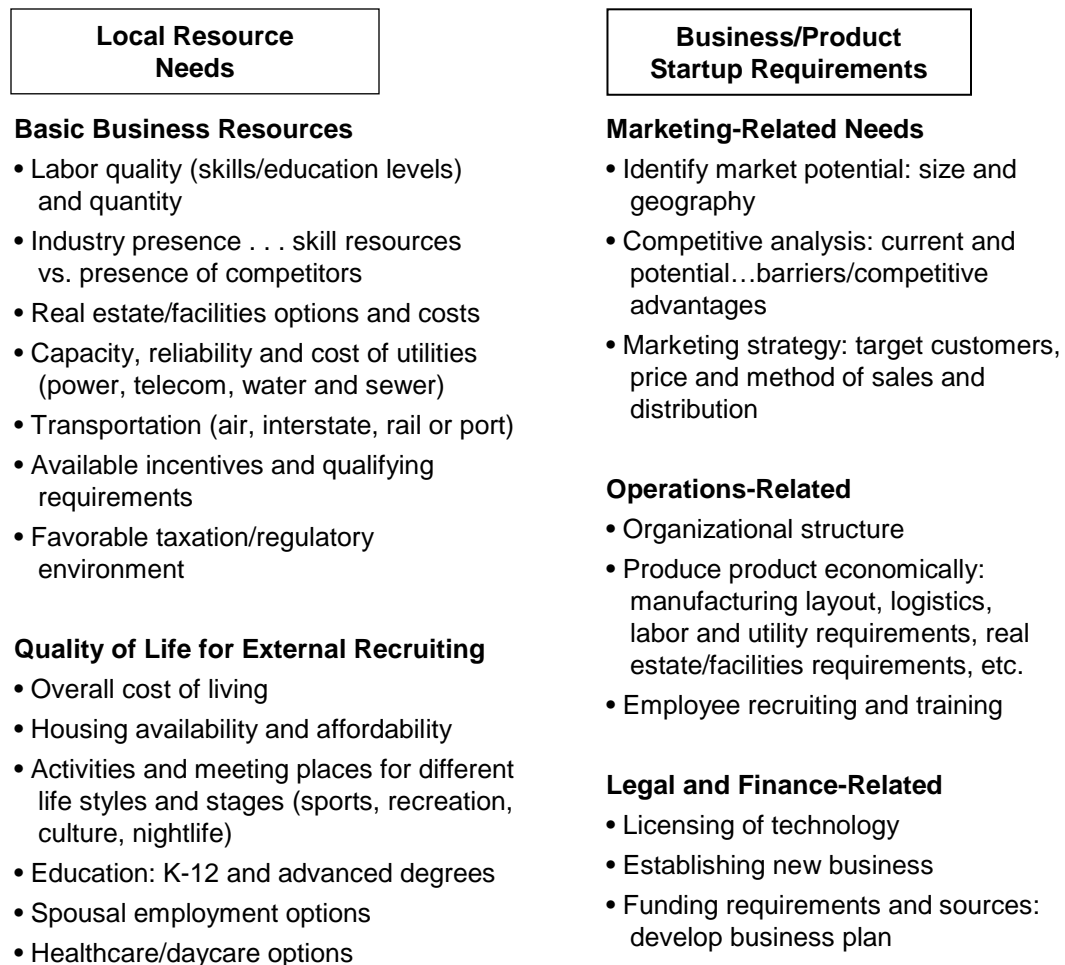


Overview on Technology Commercialization

4.6 Local Resources and Commercialization Requirements for Technology-Related Companies

Listed below in Figure 4.5 are resource and needs and commercialization requirements for establishing a new technology-related product or business. Many of the business/product startup needs for new companies are provided by a business incubator while existing companies rely on in-house resources. The Local Resource Needs are common to any company and differ mainly in scale as the business or product line grows. A more in-depth evaluation of local resources is provided in Section 7 of this report.

Figure 4.5 – Local Resource and Commercialization Requirements for Technology-Related Companies



Section 5

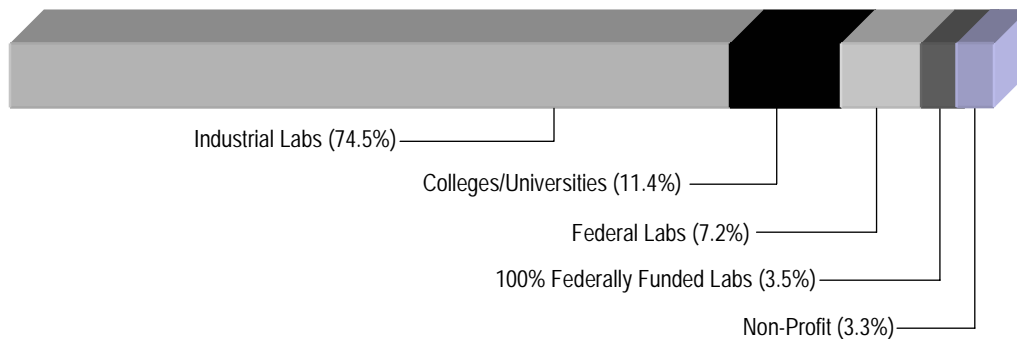
Overview on Technology-Related Research Activity

Overview on Technology-Related Research Activity

5.1 R&D Activity in the United States

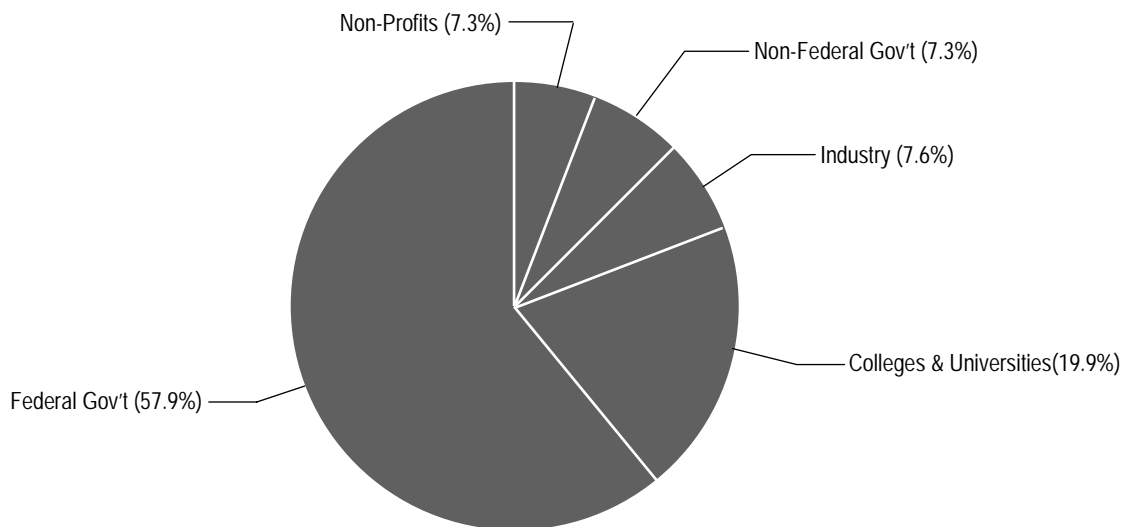
Within the United States, the annual R&D budget exceeds \$250 billion with nearly 75% of the activity performed by private industry. Colleges and universities perform only about 11% of the total R&D effort but over 40% of the nation’s basic research. Industry focuses primarily on development activity with a defined product outcome. The federal government funds nearly 60% of the college and university research due to its perceived long-term strategic value to society and the economy.

Figure 5.1 – Total U.S. R&D Budget of \$267.4 Billion for Year 2000



Source: National Science Foundation

Figure 5.2 – Sources of College/University Research of \$30.1 Billion for Year 2000



Source: National Science Foundation

Overview on Technology-Related Research Activity

5.1 R&D Activity in the United States (cont'd)

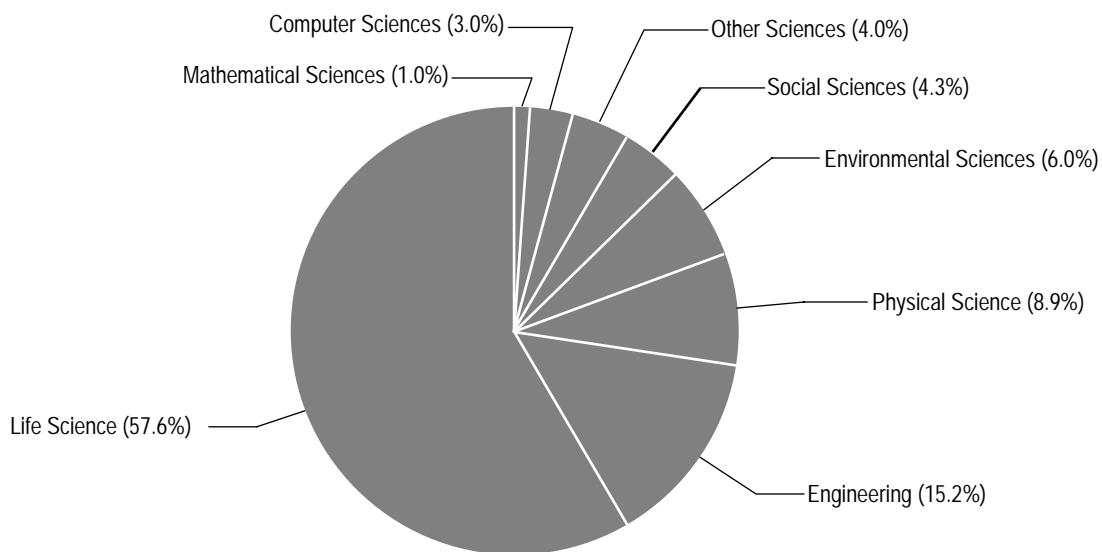
The major research areas performed at colleges and universities are life sciences, engineering and physical sciences. The life sciences continue to be strong due to the strong national focus on medical and biotechnology.

Massachusetts Institute of Technology (MIT) reported in 1999 that the commercialization of University-based research has generated approximately 246,000 jobs and over \$29 billion in economic activity. In addition, American universities receive in excess of \$450 million in royalties from technology-related licenses.

The U.S. research activity is critical to the growth and competitiveness of the country and has been a major source of new business activity over the last decade. There are several criteria to consider when evaluating the strength of a university research program:

- Maturity of program . . . years in place...systems in place for coordinating research efforts and the commercialization of the effort
- The type of research activity . . . multi-faceted or focused around one or two areas
- Sources of funding . . . public, private or non-profit sectors
- Number of licenses issued . . . to large established companies or to startups
- Market interest and value of licenses as derived from royalties

Figure 5.3 – Percent of College and University Research Applied to Specific Math/Science Areas



Source: National Science Foundation

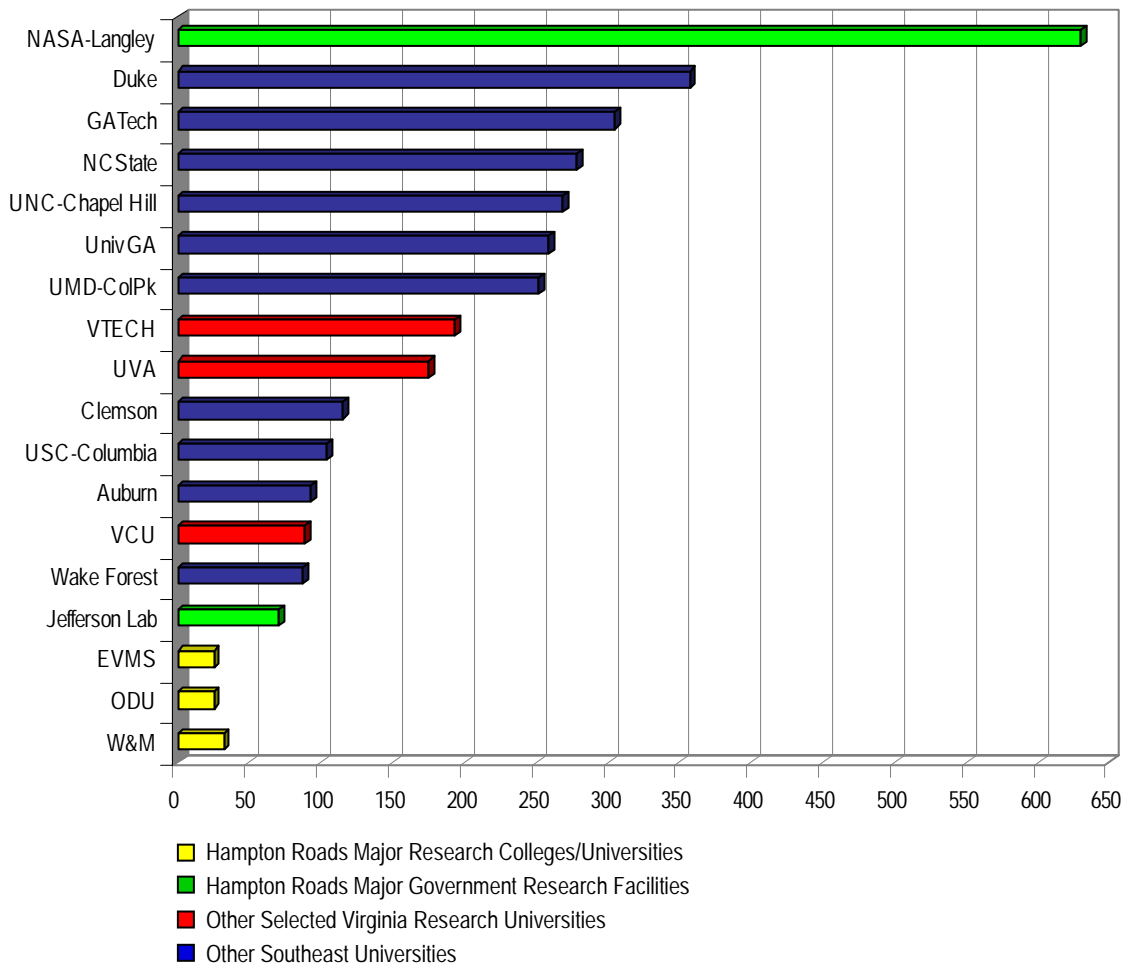
Overview on Technology-Related Research Activity

5.2 Perspective on R&D Activity Within the Southeast Region

Within the Southeast, Duke University has the largest research budget at over \$350 million and is ranked 20th nationally. Johns Hopkins University is ranked number one with over \$900 million in their research budget. In comparison, the three major research colleges and universities in the Hampton Roads area (the College of William and Mary (W&M), Old Dominion University (ODU) and the Eastern Virginia Medical School (EVMS) with a total budget of about \$80 million in 2000.

However, placing research funding in perspective, Jefferson Lab and NASA-Langley “anchor” the research activity in the Hampton Roads area with a combined budget of over \$700 million. NASA-Langley’s budget includes over \$180 million in local spending and research support with over \$7 million going to local universities. They also award over \$225 million to contractors and universities around the country.

Figure 5.4 - Research Budgets at Selected Southeast Institutions for Year 2000 (\$ Million)



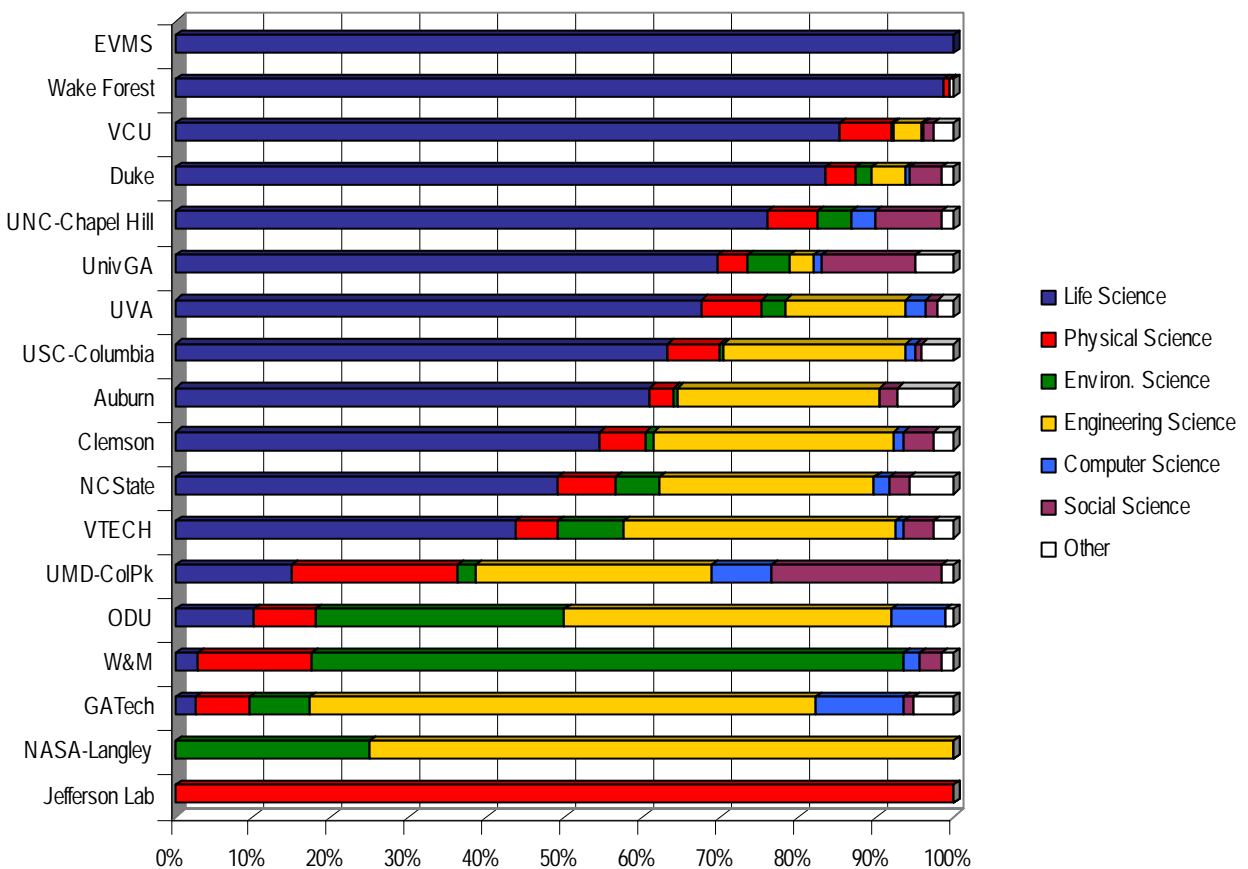
Source: National Science Foundation and Langley/Jefferson Lab Reports

Overview on Technology-Related Research Activity

5.2 Perspective on R&D Activity Within the Southeast Region (cont'd)

Research spending by academic discipline for selected Southeast institutions is presented below in Figure 5.5. Note that for many of the colleges and universities, their major spending budgets are focused on Life Sciences – at levels even higher than the national average of about 58%. Also note that for the institutions in the Hampton Roads area, other than EVMS, research activities are focused primarily on other sciences and engineering. This provides a geographic niche for the area focused around the activities of Jefferson Lab (primarily physics) and NASA-Langley (primarily space science, aerospace, earth science and materials).

Figure 5.5 - Research Spending by Academic Discipline for Selected Southeast Institutions



Source: National Science Foundation and NASA – Langley/Jefferson Lab Reports

Overview on Technology-Related Research Activity

5.3 Current Research Activity Within the Hampton Roads Area

In addition to the government research activity within the Hampton Roads area, there is currently over \$100 million in funded college and university research, with the major activity taking place at ODU (\$32+ million), W&M (\$31+ million), and EVMS (\$28 million).

From the perspective of university research, the local schools are relatively new to the effort, having research budgets that exceeds \$20 million only within the last five years. Output of licensing and commercialization is in its formative stages at W&M and ODU with EVMS further along. Major research activities at area universities and federal labs are summarized below and presented in greater detail in the Appendix. Key strengths and unique attributes of the area that drive research activities include:

- Basic physics research related to atomic structure at the Jefferson Lab linear accelerator
- Aviation safety and space access and exploration at NASA that focuses on materials, systems and instrumentation
- Medical research at EVMA
- Proximity to both estuarine and ocean environments
- Military and commercial maritime activity

Table 5.1 – Major Research Topics at Area Universities and Federal Labs

Area of Research	Jefferson Lab	NASA Langley	ARC Consortium ¹	College of W&M	Old Dom. University	East. VA Medical Coll.
Aeronautics		■				
Space Technology		■				
Materials & Structures	■	■	■	■	■	
Marine, Earth and Environmental Science		■		■	■	
Biotechnology				■	■	■
Computer Computation, Modeling & Simulation	■	■	■	■	■	
Physics (Lasers, Plasma, Photonics, Fiber Optics)	■		■	■	■	
Medical						■
Sensors/Instrumentation ²	■	■	■	■	■	■

Note:

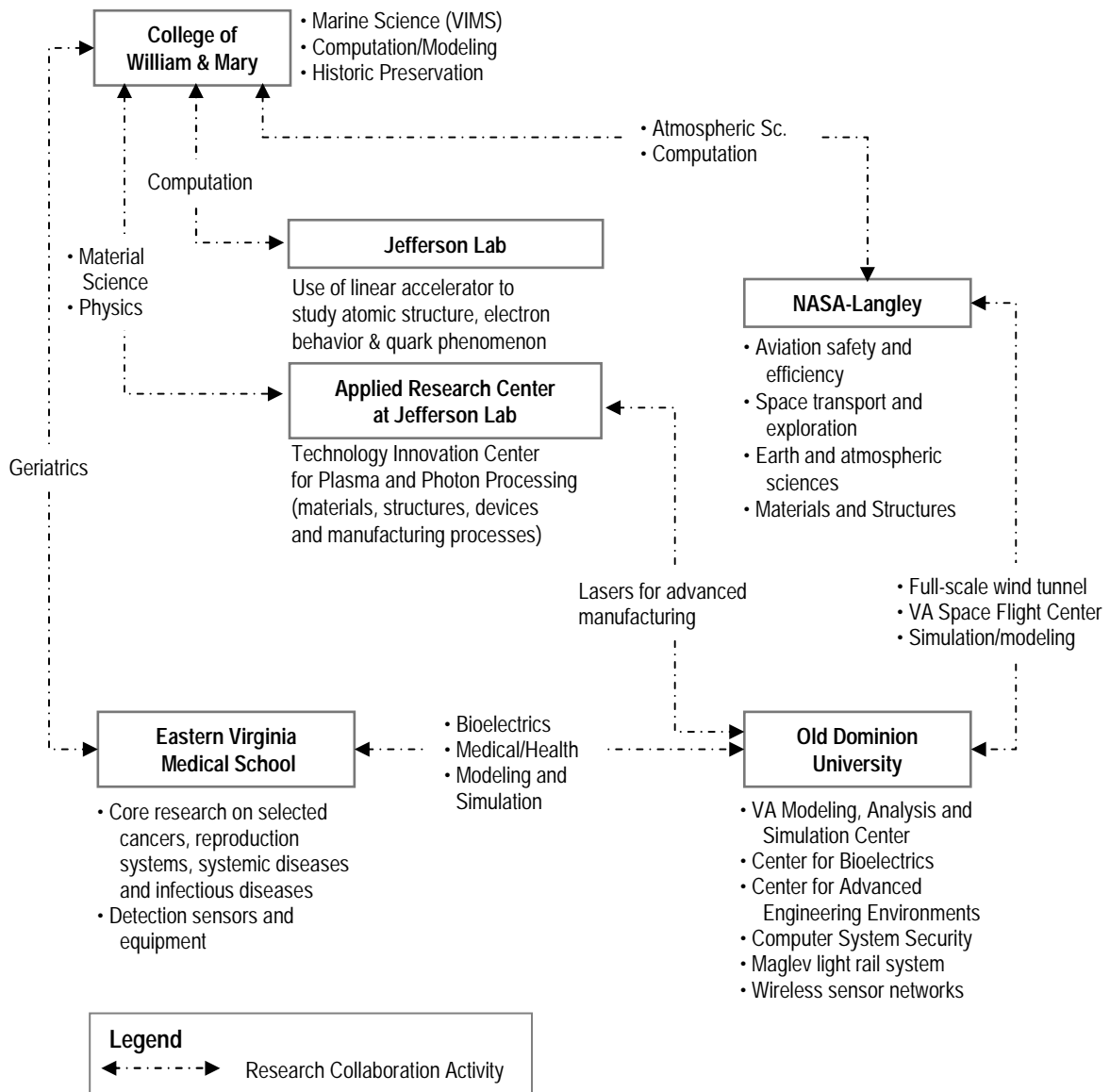
1. The Applied Research Center (ARC) is a research consortium that includes: the College of William and Mary, Old Dominion University, Norfolk State University and Christopher Newport University
2. Sensors and instrumentation research is derived from activities in marine and earth sciences, physics, medical research as well as in aeronautics and space technology

Overview on Technology-Related Research Activity

5.3 Research Activity Within the Hampton Roads Area (cont'd)

Due to the relatively close proximity of the research institutions in the area and limited scope of each institution’s program there is both a need and opportunity for collaboration. Traditionally, local schools have collaborated at times with VA Tech and UVA on specific projects while NASA-Langley and Jefferson Lab collaborate with academic and government institutions around the country. More recently, local collaborative activity has begun to take place through the Applied Research Center (ARC) at Jefferson Lab and directly between organizations as noted below.

Figure 5.6 – Examples of Collaboration Between Major Research Universities and Federal Labs in the Hampton Roads Area



Summary of Area Technology-Related Research

5.4 Research Activity With Highest Potential Value for James City County

Based on the scope and magnitude of local research activity and the potential for commercialization, the following three research areas were selected:

Table 5.2 – Summary of Local Research Areas With Potential Commercial Applications

Research Area	Area Research Activity	Commercial Applications*
High Performance Material Development and Optimization	<ul style="list-style-type: none"> • Polymer and composite materials development for high-temperature, high-strength, resistance to corrosion or oxidation, or increased conductive or semi-conductive properties (W&M) • Development of new materials that are light and durable for aerospace and space applications (NASA – Langley) • Testing of materials and large scale structures under stress of applied loads, temperature extremes, corrosive environments and other high-stress conditions (NASA – Langley) • Characterization and non-destructive testing of materials, tissues, cells, etc. using a variety of analytical techniques (W&M) • Nanotechnology: development of carbon nanotubes (W&M/ARC) • Operation of several large-scale wind tunnels for aerodynamic analysis (NASA – Langley and ODU) • Use of lasers for cutting and modifying materials in advanced manufacturing applications (ODU) 	<ul style="list-style-type: none"> • Advanced aircraft parts mfg. NAICS Code: 3364 • High performance vehicle parts and components (e.g., hydrogen car, high efficiency vehicles, etc.) NAICS Code: 3363 • High performance parts for hand and machine power tools NAICS Codes: 333991 and 3332 • High performance sports equipment NAICS Code: 33992 • Household appliances NAICS Code: 3352 • Medical equipment NAICS Code: 3391

* North American Industry Classification Codes (NAICS) are provided for each industry category

Summary of Area Technology-Related Research

5.4 Research Activity With Highest Potential Value for James City County (cont'd)

Table 5.2 (cont'd) – Summary of Local Research Areas With Potential Commercial Applications

Research Area	Area Research Activity	Commercial Applications*
Sensors and Instrumentation	<ul style="list-style-type: none"> • Marine detection devices using ultrasound (W&M – VIMS) • Sensors for atmospheric monitoring (NASA – Langley) • Sensors and instrumentation for medical applications (EVMS) • Development of remote sensor networks (ODU) • Physical and chemical sensors (Jefferson Lab) • Development of software to process sensor data (W&M) 	<ul style="list-style-type: none"> • Manufacturing of sensors, sourcing off-the-shelf components and final assembly of instrumentation NAICS Code: 3345 • Note: the software required to process the sensor data could also be developed locally
Research Area	Area Research Activity	Commercial Applications*
Computation, Analysis and Simulation Software and Systems Development	<ul style="list-style-type: none"> • Bioinformatics and Proteomics computations (W&M and EVMS) • Structural analysis modeling (NASA – Langley) • Military applications . . . simulated battle lab and transportation networks (ODU) • Develop system of systems for complex data integration (ODU) • Medical emergency modeling and simulation (EVMS and ODU) • System for digital library research (ODU) • Software to support distance learning and education-focused simulation and visualization (ODU) • Application of computation methods to physics, chemistry and atmospheric/marine environments in order to process sensor data and create visualizations (W&M) 	<ul style="list-style-type: none"> • Computations to support biotech and medical research (Bioinformatics and Proteomics) • Wide application of simulation and virtual imaging for military training, education and entertainment applications • Software to support sensor and instrument manufacturing • Homeland security and medical emergency response systems NAICS Code for all applications: 541512

* North American Industry Classification Codes (NAICS) are provided for each industry category

Section 6

Evaluation of Technology
Commercialization
Opportunities

Evaluation of Technology Commercialization Opportunities

6.1 Opportunity Evaluation

Each of the three research areas listed in Table 5.2 are compared to determine their economic potential and priority for James City County.

Table 6.1 – Comparison of Top Three Research Areas With Potential Commercial Applications

Evaluation Criteria	High Performance Material Components
Key Application Areas	<ul style="list-style-type: none"> • High performance (high temperature, lightness, strength) components for automotive and aircraft (possibly the new hydrogen-fueled vehicle or race vehicles) • High performance sports equipment (skis and snow boards, bicycle frames, golf equipment, boating equipment, fishing gear, etc.) • Housings for hand power tools and larger machine tools • Artificial limbs, joints and other biotech components
Amount of Competition (Geographic Locations)	<ul style="list-style-type: none"> • Moderate to High (Midwest and West Coast)
Barriers/Advantages to Competitive Locations	<ul style="list-style-type: none"> • Proximity to NASA/Jefferson Lab research activity • Competitive operating cost • Strategic location to serve East Coast markets
Local industry Presence (See Table 7.2 for details)	<p>Moderate presence of component/equipment manufacturing presence in Hampton Roads area, including (No. employees noted):</p> <ul style="list-style-type: none"> • Ford truck assembly plant in Norfolk (2,200) • Siemens VDO Automotive electronic components (800) • Stihl chainsaws in Virginia Beach (1,300) • Federal-Mogul automotive lighting components (300) • Ocean Marine Yacht Center boat building (315) • Valeo Clutches and Transmissions manufacturing (175)
Key Resource Needs (See Section 7 for details)	<ul style="list-style-type: none"> • Competitive operating costs (labor, real estate, taxes, energy) • Labor skills for equipment operation and testing/quality • Training resources (initial and on-going) • Logistic positioning relative to target markets (both U.S. and international) • Manufacturing space
Revenue Potential Based on Tax Receipts (See Section 6.2 for details)	<ul style="list-style-type: none"> • Highest potential
Short vs. Long Term Opportunity	<ul style="list-style-type: none"> • Longer term

Evaluation of Technology Commercialization Opportunities

6.1 Opportunity Evaluation (cont'd)**Table 6.1 (cont'd) – Comparison of Top Three Research Areas With Commercial Applications**

Evaluation Criteria	Sensors and Instrumentation
Key Application Areas	<ul style="list-style-type: none"> • Medical monitoring and detection • Homeland security (detection, screening, etc) • Industrial process control • Environmental monitoring • Traffic management
Amount of Competition (Geographic Locations)	Moderate (Midwest, NY and New England)
Barriers/Advantages to Competitive Locations	<ul style="list-style-type: none"> • Proximity to NASA/Jefferson Lab research activity • Competitive operating cost
Local industry Presence (See Table 7.2 for details)	<p>Significant presence of computer, electronic and medical equipment manufacturers in the area, including (No. employees noted):</p> <ul style="list-style-type: none"> • Canon Virginia copy machines (1,600) • Siemens VDO Automotive electronic components (800) • M&G Electronics cable assemblies/harnesses (500) • Lucas – TRW Aeronautical Systems (450) • Milcom Systems Corp. telecom systems (350) • BAE Systems No. America communications systems (170) • Cybernetics computer equipment (150) • Pressure Systems measurement instruments (150) • Texcom telecommunications equipment (130) • End-to-End Technical Services test equipment (100)
Key Resource Needs (See Section 7 for details)	<ul style="list-style-type: none"> • Competitive operating costs (labor, real estate, taxes, energy) • Labor skills for equipment operation, assembly and testing/quality • Training resources (initial and on-going) • Manufacturing space
Revenue Potential Based on Tax Receipts (See Section 6.2 for details)	Moderate potential
Short vs. Long Term Opportunity	Moderate Term

Evaluation of Technology Commercialization Opportunities

6.1 Opportunity Evaluation (cont'd)**Table 6.1 (cont'd) – Comparison of Top Three Research Areas With Commercial Applications**

Evaluation Criteria	Computation and Software
Key Application Areas	<ul style="list-style-type: none"> • Bioinformatics and Proteomics computation software • Data processing and display software for sensors and instruments • Visual imaging for education (remote learning), training and entertainment. For example: (1) using Colonial Williamsburg as a platform, develop remote learning/interactive packages on Colonial America and antiquity restoration techniques; (2) develop remote learning platform for military (in conjunction with ODU) and for an MBA program with local universities
Amount of Competition (Geographic Locations)	High (West Coast, Austin, Chicago, Boston and Washington, DC)
Barriers/Advantages to Competitive Locations	<ul style="list-style-type: none"> • Unique quality of life (small college town near fresh/salt water and near larger metro area) that is attractive to certain individuals
Local industry Presence (See Table 7.2 for details)	<p>Significant NASA/military/marine software contractors and other software developers, including (No. employees noted):</p> <ul style="list-style-type: none"> • USJFCOM/JWFC Joint Training modeling/simulation (600) • Space and Naval Warfare Systems Center Afloat Software (455) • Allied Technology IT support services (350) • ABSolute Integrated Solutions healthcare software (325) • Symantec software development (300 employees) • Computer Services Corp. computer systems design (200) • Keane IT services (200) • Prosoft technical computer services (170) • UNISYS Corp. software development (170) • Wyle Labs control systems/software (130) • ISS Business Solutions IT services (130) • Compass Technology Management computer systems (115) • Lockheed-Martin computer systems for logistics (115) • S³ computer programming (110) • INCOGEN bioinformatics and other software providers (25)
Key Resource Needs (See Section 7 for details)	<ul style="list-style-type: none"> • Office facility • Quality of life • Local IT grads • Industry cluster
Revenue Potential Based on Tax Receipts (See Section 6.2 for details)	Lowest potential
Short vs. Long Term Opportunity	Shorter term

Evaluation of Technology Commercialization Opportunities

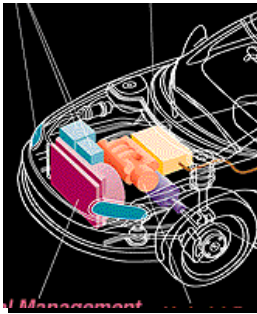
6.2 Economic Comparison of High-Potential

For the three high-potential research-derived commercial opportunities identified in Section 5 of this report, an economic impact analysis was performed. The objective was to determine the relative value of a business of equal size to James City County in terms of revenues generated. This information is important input into the overall policy development for attracting these types of business to the area. The scenarios developed were kept as simple and straight forward as possible so as to focus on relative value and not irrelevant detail. The three business opportunity scenarios used in the comparison are defined below in Table 6.1.



Scenario 1: Technology-Related Software Development

This scenario includes a broad range of firms engaged in computer-based computations for biotechnology (Bioinformatics and Proteomics), software for supporting data acquisition from sensors and converting to visualization, or virtual imaging for distance learning and other applications. The company would have 50 employees, the majority being software developers and code writers. There is an existing base (>5,000) of software-related employees in the Hampton Roads area (primarily government contractor staff) and also a student base of code writers at Christopher Newport University and computer science majors at William and Mary, Old Dominion University, Hampton University and Norfolk State University.



Scenario 2: High Performance Material Component Manufacturer

Based on the material development activity at NASA-Langley and the local universities, a company could leverage the local capabilities to both develop and test new products that are produced at a plant site in James City County. Depending on the type of components produced, there may be machine tools, molding machines and other specialized production equipment. The company of 50 employees would primarily have machine tool operators along with some hourly, clerical and professional staff. There would most likely be an interest in work force training and the labor could be recruited primarily from the existing local labor pool along with recent graduates from two-year colleges and ex-military personnel.



Scenario 3: Sensor and Instrumentation Manufacturing

Leveraging the diverse local expertise in sensor/instrumentation development and applications, a company could be located in James City County to produce different types of sensors along with sourcing monitors or other output devices. Products would include some molding and/or machining but primarily assembly and testing. Local labor sources could be tapped along with recent high school and two-year school grads.

Evaluation of Technology Commercialization Opportunities

6.2 Evaluation of Potential Revenues

A summary of the revenue sources is as follows:

Local Revenue Sources	Rate	Basis
Real Property Tax	\$0.87/\$100	100%
Personal Property Tax - Machinery & Tools - Furniture/Fixtures/Equip	\$4/\$100	25% of capitalized cost
Sales & Use Tax	1.0%	100%
Business & Occupational License	\$0.36/\$100	Gross receipts from non-manufacturers
State Revenue		
Corporate Income Tax	6.0%	Taxable income
Sales & Use Tax	3.5%	100%

Summary Comparison of the Three Scenarios (detailed cash flows are in the Appendix on page A-9)

Description	Scenario 1	Scenario 2	Scenario 3
	Software Development Company	High-Tech Comp Manufacturer	Sensor/Instrument Manufacturer
Number of Employees	50	50	50
Weighted Average Salary	\$51,200	\$35,580	\$33,900
10-Year Direct and Indirect Local Taxes	\$876,965	\$1,888,374	\$1,384,083
10-Year Direct and Indirect State Taxes	\$3,727,451	\$3,933,804	\$3,341,815

Section 7

Evaluation of Resources to Support Technology Businesses

Evaluation of Resources to Support Technology Businesses

7.1 Overview on Resources

In addition to research activity, an area must also have the essential resources to support technology-related businesses, that include:

- Operating cost comparisons
- Access to an adequate supply of qualified labor within a designated commute area
- Training and education resources
- Air access to strategic locations
- Adequacy and availability of office and industrial parks
- Quality of life to attract and retain top talent

7.2 Operating Cost Comparison

A comparison of labor, energy and office rent index costs are presented in Table 7.1 below and demonstrate that the Norfolk MSA compares favorably to other technology areas.

Table 7.1 – Comparison of Operating Costs for Selected Technology Metro Areas

Criteria	Norfolk	Raleigh	Atlanta	Austin	Boston	Denver	San Diego
Labor Cost Index A ¹	84	105	100	99	110	111	103
Labor Cost Index B ²	97	104	99	97	109	95	101
Energy Cost Index	81.2	94.6	93.3	85.2	165.2	81.9	140.6
Office Rent Index	72.9	89.7	100.7	98.7	131.4	82.9	98.6

Sources: US Bureau of Labor Statistics and MS&B Indexes

Notes:

1. Index A based on computer programmer, systems analyst and secretary
2. Index B based on supervisor, electronic equip. assembler and molding machine operator
3. U.S. Average = 100

7.3 Access to Qualified Labor

A number of factors are considered when evaluating the adequacy of the local labor market:

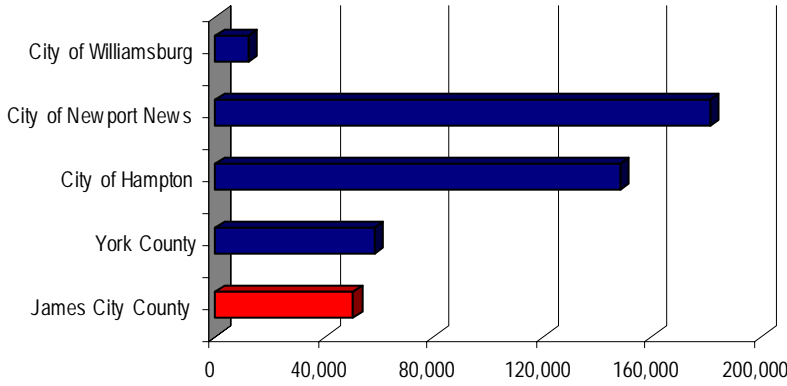
- Population size and growth dynamics
- Education levels of population
- The draw of labor within a culturally acceptable commute zone (ranges from 15 to 60 minutes depending on what the population is willing to accept)
- The presence of particular industries that have the skills required for supporting a new operation

Evaluation of Resources to Support Technology Businesses

7.3 Access to Qualified Labor (cont'd)

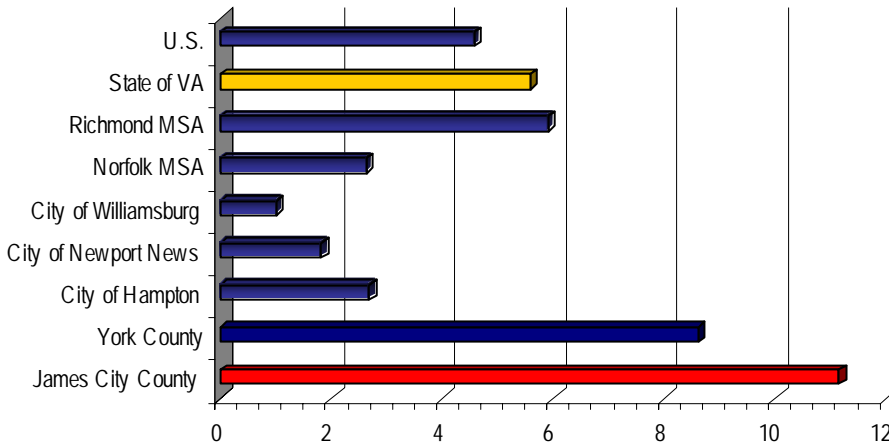
The most populated areas on the peninsula are to the south of James City County in the Cities of Hampton and Newport News; however, the highest projected growth rates are in the less populated counties adjacent to James City County.

Figure 7.1 – Population of Local Cities and Counties



Source: U.S. Census, Year 2000

Figure 7.2 – Five-Year Projected Population Growth Rates (%) for Selected Locations



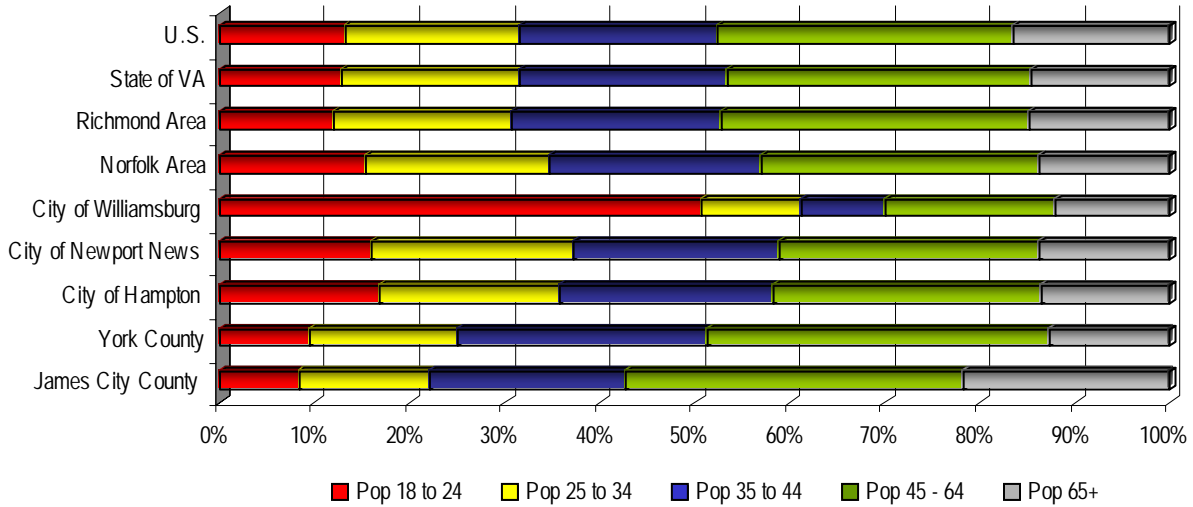
Source: Claritas projections based on U.S. Census data

Evaluation of Resources to Support Technology Businesses

7.3 Access to Qualified Labor (cont'd)

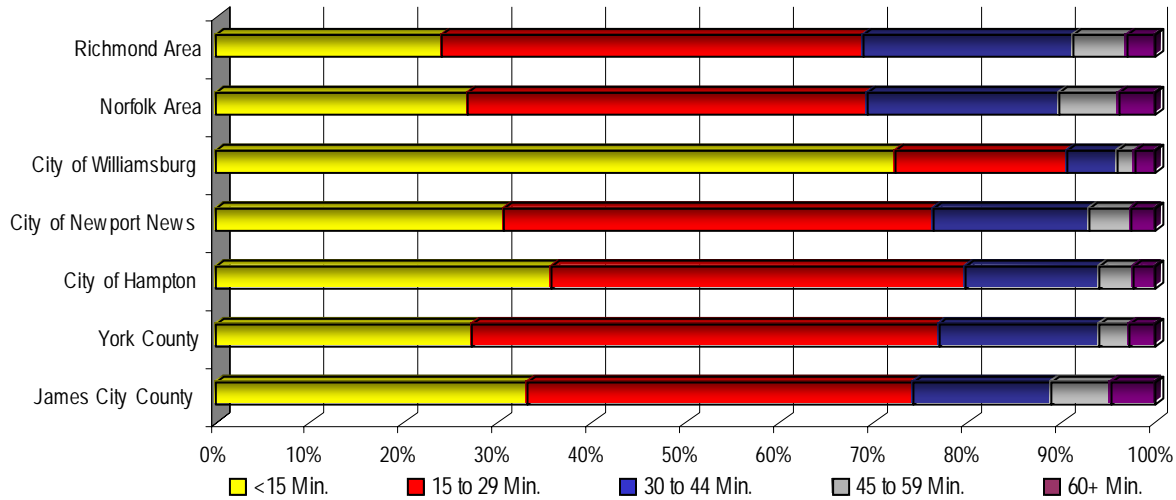
The City of Williamsburg has the highest 18 – 24 year old age range percentage due to the William and Mary students being counted in the census and James City County has the highest 65+ year old are range percentage due to the retirement community expansion over the past ten years.

Figure 7.3 – Population Profile by Age Range for Selected Area Locations



Source: U.S. Census, Year 2000

Figure 7.4 – Commute Times for Residents of Selected Area Locations



Note: 30 minutes is a reasonable acceptable commute time for the area (except for those living/working in the City of Williamsburg)

Source: U.S. Census, Year 2000

Evaluation of Resources to Support Technology Businesses

7.3 Access to Qualified Labor (cont'd)

There is a relatively strong presence of technology-related employment in the Richmond and Norfolk metro areas as noted below:

Table 7.2 – Regional Presence of Technology-Related Industries: Employment Levels and Companies

Industry Classification	Richmond MSA	Norfolk Area MSA
Pharmaceutical & Medicine	C (2)	A (2)
Computer & Electronic Equipment	C (18)	C (41)
Transportation Equipment	B (20)	E (57)
Medical Equipment	C (31)	B (56)
Computer System Design	B (23)	D (349)
Scientific Research & Development	B (31)	C (75)

Key:

Source: Year 2000 U.S. County Business Patterns
(U.S. Census Bureau)

<u>Code</u>	<u>Employment Level</u>
A	10 – 99
B	100 – 999
C	1,000 – 4,999
D	5,000 – 9,999
E	10,000+

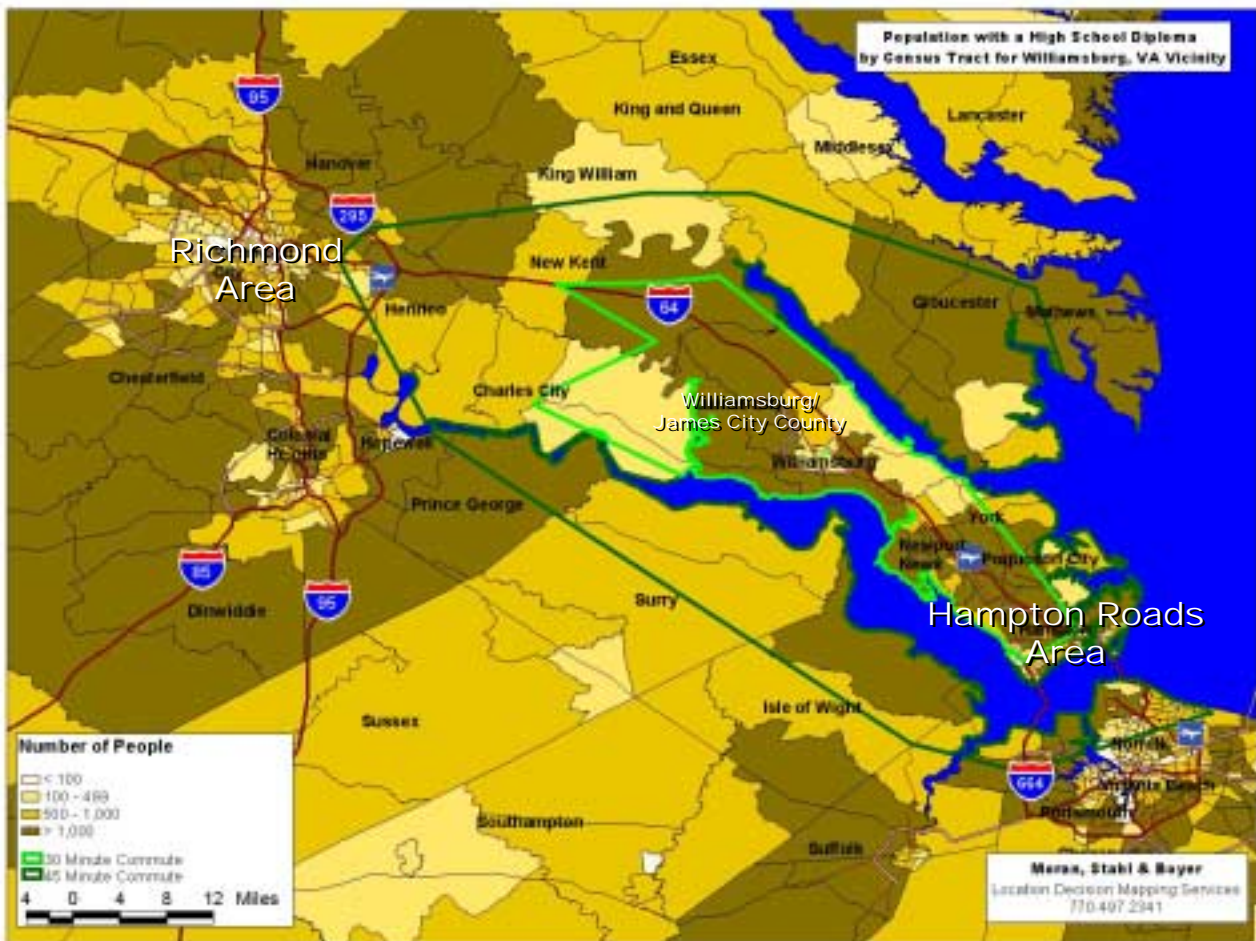
Note: () = the number of companies in each classification

Evaluation of Resources to Support Technology Businesses

7.3 Access to Qualified Labor (cont'd)

To locate the actual location and concentration of different education levels, each has been plotted as shown in Figures 7.5 through 7.7 below.

Figure 7.5 – Location of Population by Census Tract With High School Diploma Only



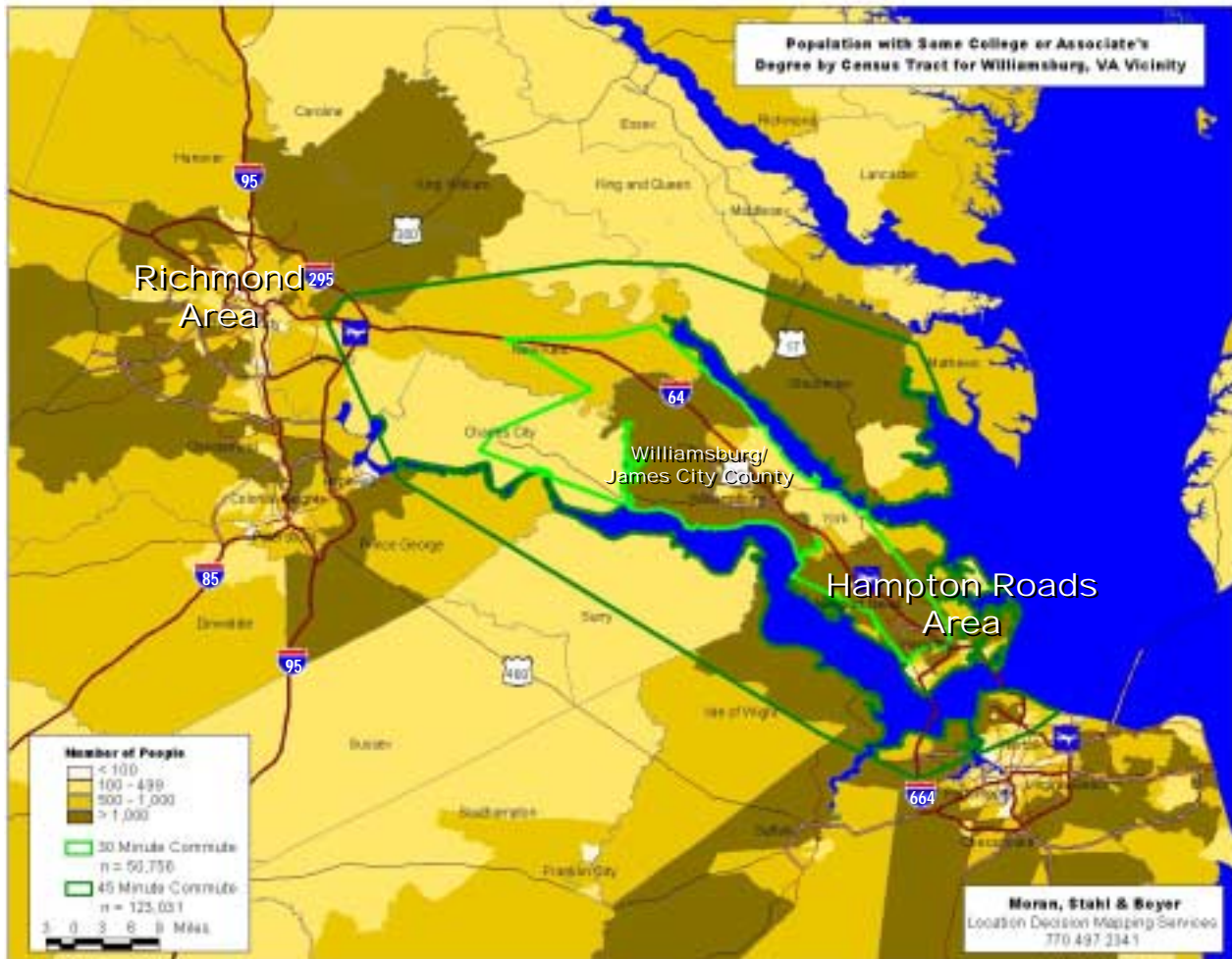
Comment:

There is a significant concentration of High School grads in James City County as well as in Newport News and in the western segment of the Richmond area. Many of these individuals have jobs in the service and retail industries and would require some retraining to work in manufacturing. This level of labor is somewhat intolerant of long commutes if other options are local and they will change jobs for relatively small increments in pay.

Evaluation of Resources to Support Technology Businesses

7.3 Access to Qualified Labor (cont'd)

Figure 7.6 – Location of Population by Census Tract With Two-Year or Some College



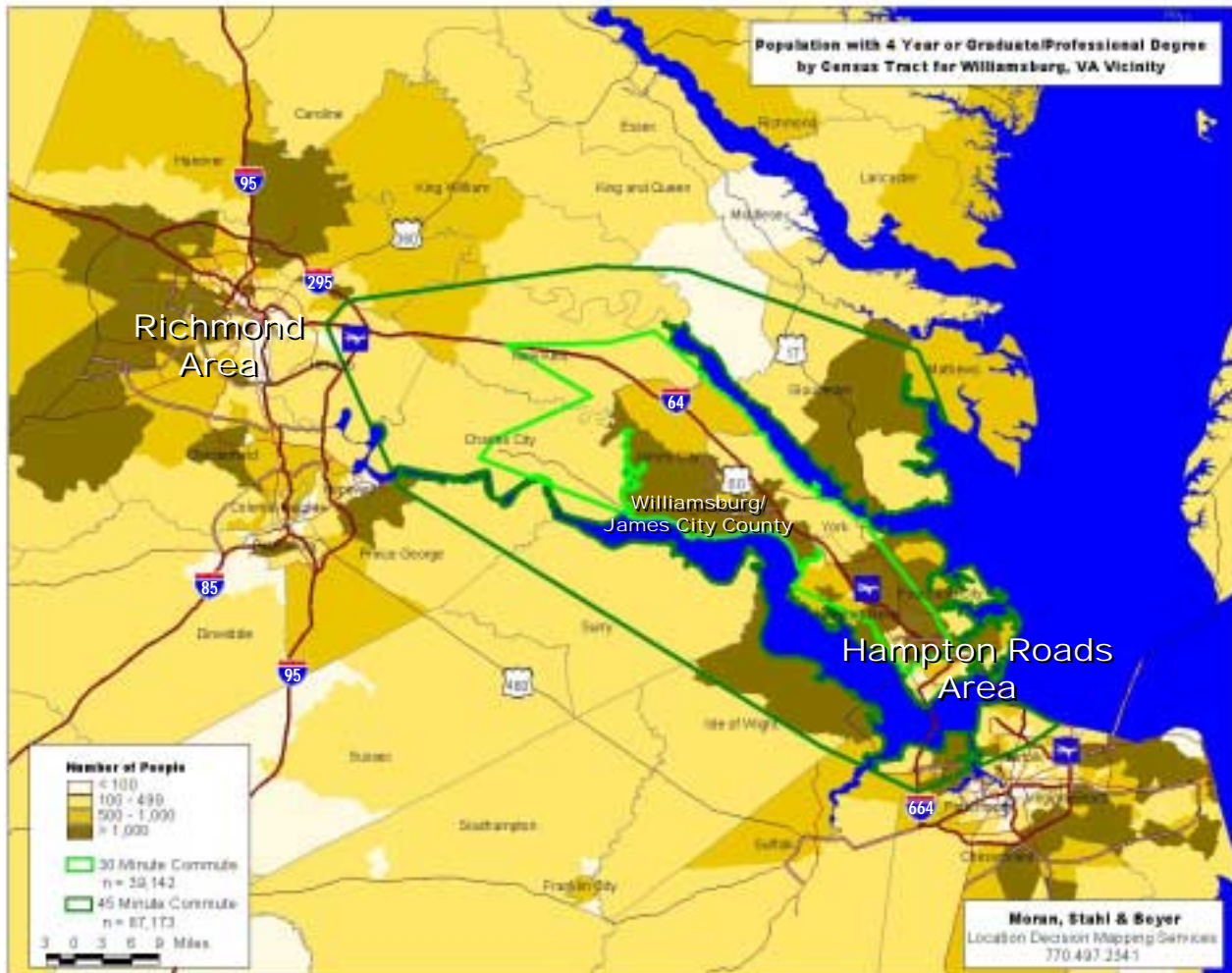
Comment:

There are a substantial number of former military personnel with this education level that are ideal candidates for manufacturing operations with some retraining.

Evaluation of Resources to Support Technology Businesses

7.3 Access to Qualified Labor (cont'd)

Figure 7.7 – Location of Population by Census Tract With Four-Year College and Above



Comment:

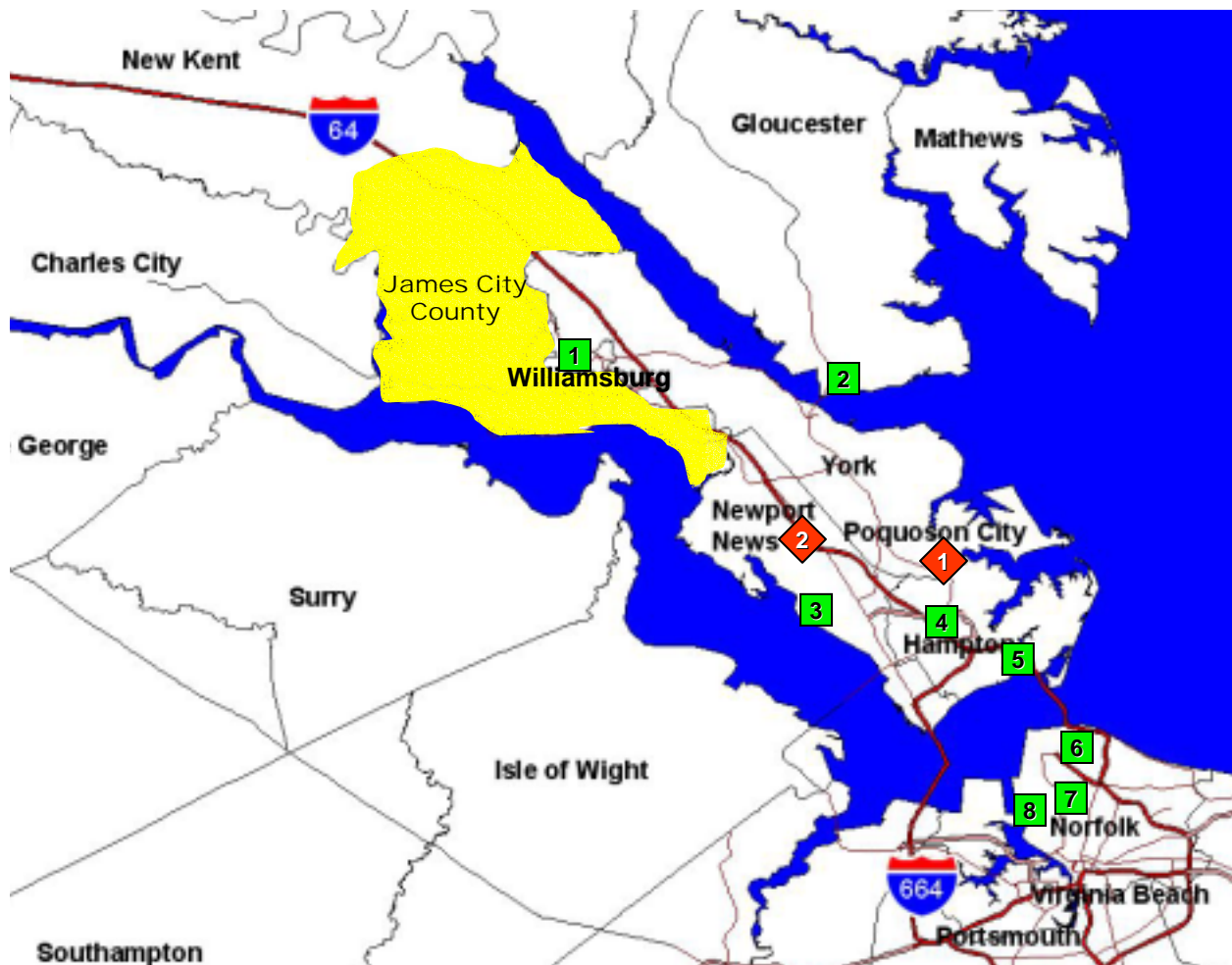
Many of the college-trained individuals in the James City County area are either professionals (doctors, lawyers, engineers), college professors/staff living and working near Williamsburg or are executives commuting to Richmond or are retired. The retired executives may be a valuable resource of talent to support emerging companies. There is also a supply of technical staff further down the peninsula working at Jefferson Lab, NASA or NASA/military contractors. There is minimal opportunity to attract college-level labor from Richmond due to their locations being on the far (west) side of the metro area.

Evaluation of Resources to Support Technology Businesses

7.4 Training and Education Resources

The education resources of the Hampton Roads area are dispersed throughout the peninsula as well as in the Norfolk area.

Figure 7.8 – Major Education and Research Resources in the Hampton Roads Area



- 1 Colleges and Universities**
- 1 College of William & Mary
 - 2 VA Institute of Marine Science
 - 3 Christopher Newport College
 - 4 Thomas Nelson Community College
 - 5 Hampton University
 - 6 Old Dominion University
 - 7 Norfolk State University
 - 8 Eastern VA Medical School

- 1 Government Research Laboratories**
- 1 NASA – Langley
 - 2 Jefferson Labs/Applied Research Center

Evaluation of Resources to Support Technology Businesses

7.4 Training and Education Resources

There is a wide diversity of two and four-year colleges within the Hampton Roads and Richmond areas to draw upon for the recruiting, training and on-going development of required labor resources.

Table 7.3 – Education Resources in the Hampton Roads Area

	College of W&M (7,430)*	Old Dominion (15,300)	Christopher Newport (4,300)	Hampton Univ. (5,400)	Norfolk State (5,500)	Thomas Nelson (2,500)	EVMS (1,000)
Engineering							
Aerospace		■					
Biomedical							
Chemical				■			
Civil		■					
Computer		■	■				
Electrical		■		■		■	
Electronics		■			■		
Environmental		■					
Manufacturing		■					
Materials	■	■					
Mechanical		■				■	
Sciences							
Biology	■	■	■	■	■	■	■
Biochemistry							■
Biotech		■					
Chemistry	■	■		■	■		
Earth/Env. Sc.		■	■				
Marine Sc.	■	■					
Medicine (MD)							■
Physics	■	■	■	■	■	■	
Info. Tech.							
Computation	■						
Comp. Science	■	■	■	■	■	■	
Info. Science			■				

* Full-time student enrollment

Sources: College web sites and printed materials

Evaluation of Resources to Support Technology Businesses

7.4 Training and Education Resources

Table 7.4 – Education Resources in the Richmond Area

	University of Richmond (4,500)	VA Commonwealth University (22,000)	VA State University (4,000)	J. Sargeant Reynolds Community College (2,700)
Engineering				
Aerospace				
Biomedical		■		
Chemical		■		
Civil				■
Computer			■	■
Electrical		■		■
Electronics				
Environmental				
Manufacturing			■	
Materials				
Mechanical		■		
Sciences				
Biology	■	■	■	■
Biochemistry	■	■		
Biotech				
Chemistry	■	■	■	
Earth/Env. Sc.				
Marine Science				
Physics	■	■	■	■
Info. Tech.				
Computation				
Comp. Science	■	■	■	■
Info. Science				■

* Full-time student enrollment

Sources: College web sites and printed materials

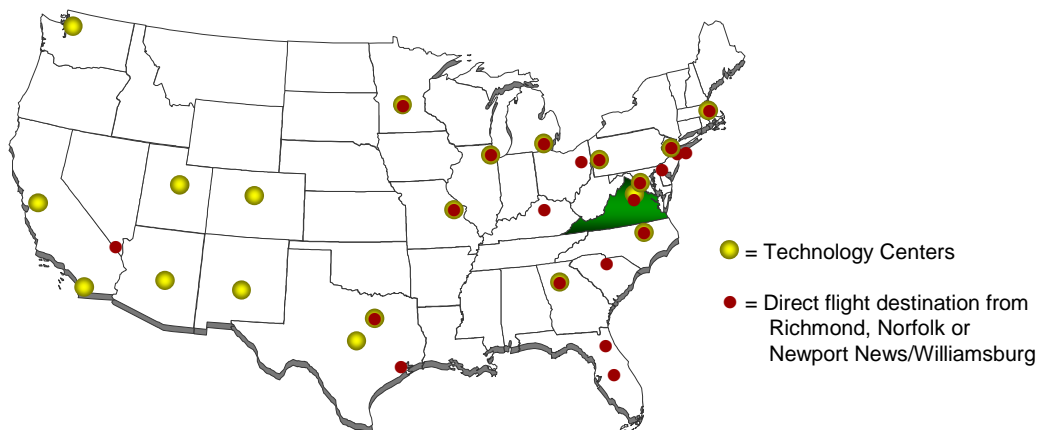
Evaluation of Resources to Support Technology Businesses

7.5 Air Access to Strategic Locations

Table 7.5 – Direct Air Access Destinations for the Three Area Airports

Destination	Richmond Int'l	Newport News - Williamsburg	Norfolk Int'l
Atlanta	■	■	■
Baltimore	■		■
Boston	■		■
Charlotte	■	■	■
Chicago	■		■
Cincinnati	■		■
Cleveland	■		■
Dallas	■		■
Detroit	■		■
Houston (IAH)	■		■
Jacksonville, FL			■
Las Vegas			■
Minneapolis	■		
NYC (LGA)	■	■	■
NYC (JFK)			■
Newark	■		■
Orlando	■		■
Philadelphia	■	■	■
Pittsburgh	■		■
Raleigh			■
St. Louis	■		■
Wash. DC (DCA)		■	■
Wash. DC (IAD)	■		■

Figure 7.9 – Direct Flights to Technology Centers



Evaluation of Resources to Support Technology Businesses

7.6 Presence of Industrial Parks

James City County has significant acreage dedicated to a wide variety of office, light industrial and distribution operations. Each of the parks has good access to I-64 for travel either west to Richmond and I-95 or east to Norfolk.

Figure 7.10 – Location of James City County Industrial and Office Parks



- | No. | Industrial/Office Park |
|-----|------------------------------|
| 1 | Stonehouse Commerce Park |
| 2 | Hankins Industrial Park |
| 3 | New Town (Under development) |
| 4 | Busch Corporate Center |
| 5 | James River Commerce Center |
| 6 | Green Mount |

Evaluation of Resources to Support Technology Businesses

7.7 Quality of Life Comparison

For companies recruiting talent into an area or concerned with retention of recent graduates, the quality of life for an area is an important consideration. In general, the Norfolk Metropolitan Area compares favorably with other technology areas. Its cost of living is relatively low and it has strong education, arts and recreation resources. The healthcare issue can be dealt with by looking at it from a local resource perspective and evaluating the access to specialists and major hospitals for more complex operations and services. James City County can also leverage the resources of Richmond due to its proximity.

Table 7.6 – Comparison of Quality of Life Criteria (Percentile Basis) for Selected Technology Areas

Criteria ¹	Norfolk ²	Raleigh	Atlanta	Austin	Boston	Denver	San Diego
Overall	68	74	70	71	69	74	72
Cost of Living	45	13	39	50	1	22	3
Education	87	100	83	98	100	92	80
Crime	44	40	12	71	47	43	25
Arts	85	86	95	72	99	98	91
Healthcare	24	93	57	65	95	85	69
Recreation	99	73	76	69	77	83	90
Climate	69	71	70	72	59	50	100
Transportation	81	92	98	79	95	99	89

Source: Places Rated Almanac, 2000 Edition

Note:

1. Quality of life criteria are rated on a percentile basis (0 = least favorable and 100 = most favorable) for over 330 North American metro areas. Each criterion is comprised of a number of evaluation factors.
2. Information based on Norfolk metro area

For the younger and unmarried workers, the quality of life has some unique requirements that have been gathered by Moran, Stahl & Boyer from experience with many client situations

- Being in a location that they can be proud of saying they are from: “That’s a cool place”
- Having meeting places . . . bars, coffee shops, restaurants . . . to meet others and network for jobs and relationships
- Wide range of diversity . . . skills, ethnicity, ideas, etc.
- Lots of places for activities . . . sports, outdoor recreation, culture, etc.
- Critical mass of employers to assure job opportunities for career growth and survival
- Access to a university for additional education and the culture it produces locally
- Affordable and unique housing, apartments and condos

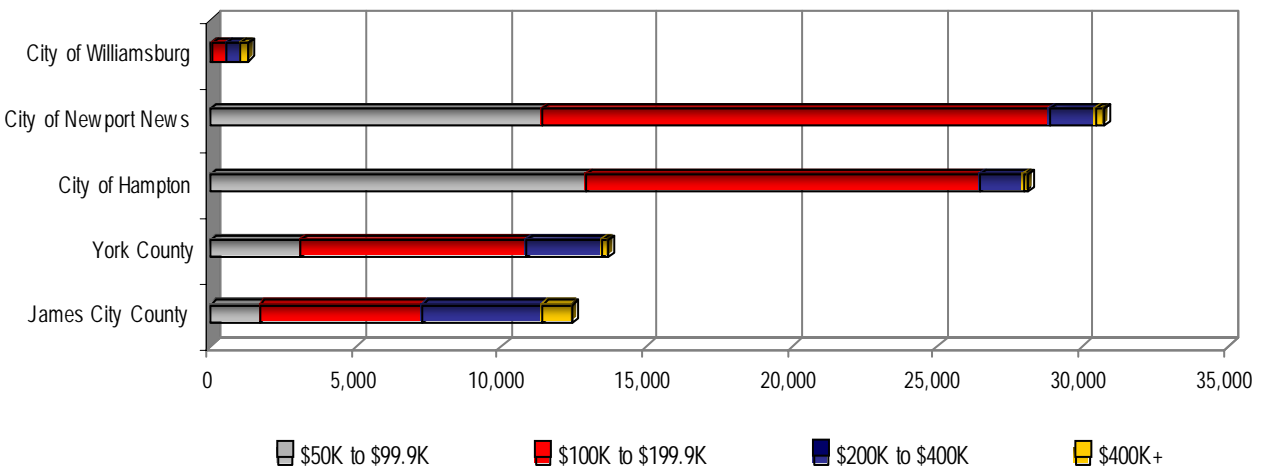
For the married employees with children, the needs focus on the quality of K-12 education and special programs available, community safety and security, youth-oriented recreation, wellness health programs, daycare resources and potential employment for spouses.

Evaluation of Resources to Support Technology Businesses

7.7 Quality of Life Comparison (cont'd)

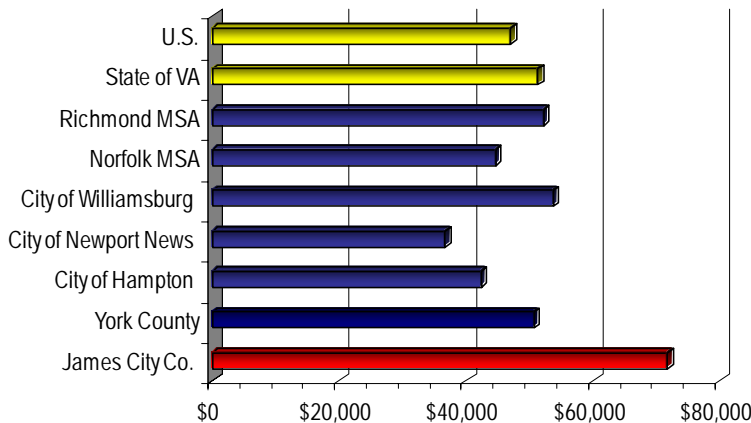
From a quality of life perspective, one of the critical issues always focuses on the cost and availability of housing within a 30-minute commute area. There is a significant amount of housing stock in the area within the different price ranges. James City County is a highly desirable area and there is some new construction underway. The county also has the largest concentration of houses in the \$400,000+ range due to the construction of the Kingsmill, Governors Land and Fords Colony developments within the past 10-20 years. The county also has the largest concentration of families with the median household income above \$100,000.

Table 7.11 – Housing Stock Inventory by Price Range



Source: Claritas derived from U.S. Census Data

Figure 7.12 – Median Household Income



Source: Claritas derived from U.S. Census Data

Section 8

Policy
Recommendations

Policy Recommendations

8.1 General Considerations

Based on a review of the Hampton Roads area relative to technology-related research and economic development, it is evident that the sum of the parts within the area are much stronger than each individual piece. There is a compelling need to build an integrated effort as viewed from the outside while efficiently leveraging the limited resources to achieve growth potential. To this end, the objective of a technology policy is primarily to stimulate business activity within James City County derived from the technology-related research within the area. However, the policy should also support and complement the overall development of a critical mass of technology industry clusters within the Hampton Roads area.

An important consideration in policy development is that the area has some inherently attractive attributes for business that should be emphasized along with a prudent incentive package. The attributes include:

- Cost of labor is below national average – particularly for software programmers and systems analysts
- A unique quality of life package that includes outdoor recreation (with access to both fresh water lakes and rivers as well as the ocean), cultural activities, and small college town atmosphere that should not be undersold but also not over-emphasized
- Strategic location on the East Coast with east/west and north/south interstate access as well as port access to international markets
- Reasonable air access through one local and two regional airports
- Access to significant government and military operations in an area that is considered strategic to the federal government
- Area research strengths are not all focused on life sciences/biotechnology (with the exception of Eastern VA Medical School) but rather on the physical sciences. This differentiates the area from many other major East Coast research areas (e.g., Baltimore, Raleigh/Durham and Boston) that have the majority of their research focused on life sciences. This allows the area to play their own unique strengths rather than having to compete with major East Coast metro areas.

In addition, the area has some inherent challenges to overcome:

- Hampton Roads is not well known for its technology-related activities and reforming external perceptions can and will be a significant challenge (but the evidence is there to achieve it)
- The success of the area in attracting technology companies or developing new companies requires a substantial amount of collaboration between universities, government and the private sector. However, this area does not have a strong track record of stimulating collaboration – although there are some emerging successes

Policy Recommendations

8.2 Policy Elements

An effective technology-related economic development policy for James City County needs to address five key areas:

1. Define Target Areas of Opportunity (that have broad commercial application)
2. Promote and Facilitate Technology-Related Economic Development Activities
3. Enhance Local Human Capital
4. Provide Flexible Facilities and Infrastructure
5. Offer Access to Financial Resources (including incentives)

8.3 Policy Provisions

Provisions for each of the five policy elements are provided below:

1. Define Target Areas of Opportunity

Based on the collective research efforts of government and university institutions within the Hampton Roads area, there are three areas of technology that have broad commercial potential:

- Computation, Analysis and Simulation Software and Systems Development
- High Performance Material Components Manufacturing
- Sensors and Instrumentation Manufacturing

These three areas have very broad commercial potential due to their fundamental nature. There are opportunities for some type of software, materials or sensors in virtually every societal needs category (refer to Figure 4.1) from medical and biotechnology, to alternative energy vehicles, to distance learning. This allows the area to have a stake in many different technology developments .

The target company profile should include both startup/emerging companies as well as established companies. The policy should be tailored to meet the unique needs of both startup/emerging companies as well as established companies locating in the area.

2. Promote and Facilitate Technology-Related Economic Development Activity

James City County does not have the resources required to underwrite the promotion and facilitation required to support a technology-related economic development initiative, but can incorporate into their policy, provisions to support an area-wide effort. In order to be successful, the Hampton Roads area needs to establish a non-profit organization that incorporates all the resources required to incubate new businesses, attract investors, and provide the external promotion of the area with a focus on the three technology targets. This has been the success of most commercialization efforts across the country and is particularly needed in this area with its multiple research institutions.

The non-profit organization would work closely with representatives of each research organization and their commercialization coordinators and would ultimately provide the clearing house for technology transfer by identifying the entrepreneurs, local business development resources, venture capitalists, and outside companies to assure commercialization takes place.

Policy Recommendations

8.3 Policy Provisions (cont'd)

James City County should promote the expansion of the Hampton Roads Incubator effort with a local presence within the county. This would leverage the expertise of the incubator along with the resources of the College of William and Mary to assure business takes advantage of the facility/business park opportunities within James City County along with its strategic and pivotal location on the peninsula.

3. Enhance Local Human Capital

There are opportunities to improve and better utilize the local human capital at all education and skill levels. Initiatives that should be incorporated into the policy include:

- Expansion of the local presence of Thomas Nelson Community College to enhance workforce development at the post high school level. There will be shifts in skill requirements on an ongoing basis that will require local training and retraining resources.
- Develop a strong relationship between area high schools and employers to better understand the needs and opportunities of the emerging work force to support the technology-related businesses. High school graduates need strong reading and basic math skills to participate in technology-based manufacturing operations. This effort has some very promising potential under the leadership of the Hampton Roads Workforce Development organization.
- Encourage the College of William and Mary to develop an entrepreneurial track within their MBA program. The MBA program would be a major resource for the incubator program and the experience the students would receive would enhance and help differentiate William and Mary's MBA program. Some MBA students are already being used in the incubator program but they would be better equipped if a formal program was initiated. There would also be value in recruiting science and engineering majors into the entrepreneurial program to not only round-out their expertise but also make an effective bridge between technology and the challenges of real-world commercialization. As an example, Virginia Commonwealth University has just been given a grant to provide entrepreneurial education to their research science majors to improve the potential for converting research into commercial opportunities.

4. Provide Flexible Facilities and Infrastructure

There are unique characteristics to the development of leading-edge technology products. There are periods of high growth followed by intense competition which may require quick consolidation and then periods of more steady growth before commoditization sets in. This type of growth requires facilities that are very flexible and adaptive. Both office and manufacturing space needs to evolve and reflect the stage and corresponding needs the company has at any given time. Examples of flexible and cost-effective space are presented in Figures 8.1 and 8.2.

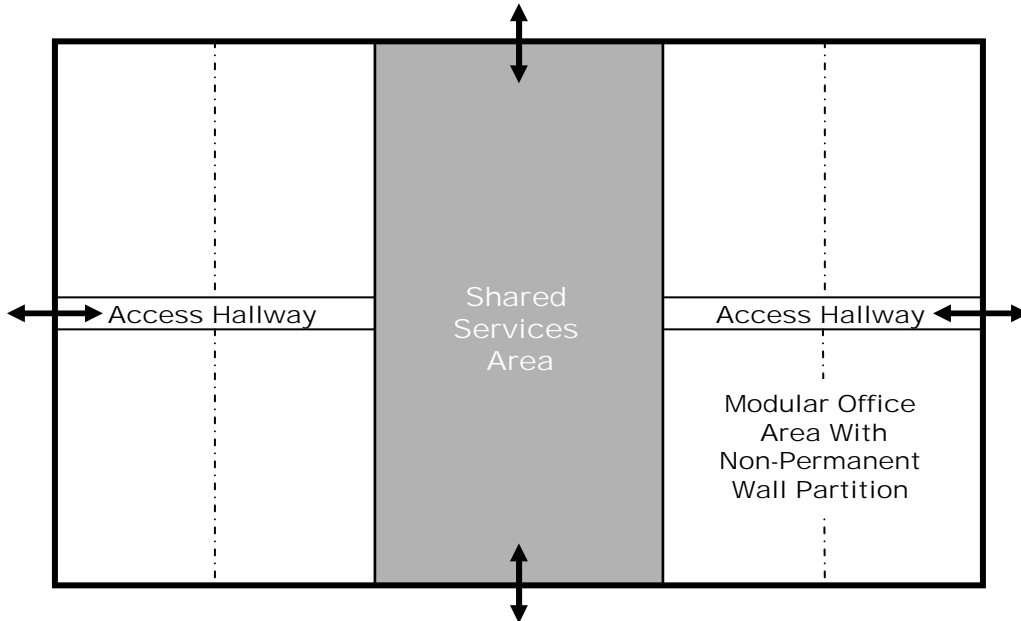
Providing flexible facilities for technology companies can also be a hedge against obsolescence for the community. It allows different companies with individual needs to make better use of available facilities within the community while providing a marketing advantage.

Policy Recommendations

8.3 Policy Provisions (cont'd)

4. Provide Flexible Facilities and Infrastructure (cont'd)

Figure 8.1 - Facility Layout Concept for Flexible Office Space



Shared Services Area Would Include:

- Receptionist
- Meeting rooms and main conference room
- Copy machine and other shared equipment
- Utility room
- Break room/vending /kitchen
- Uninterruptible power supply (UPS)
- Telecommunications/wireless broadband

Modular Office

The modular office area provides flexibility to allow tenants to expand or contract as needed to serve their needs. Individual offices and work stations would have open architecture that is easy to reconfigure to meet the ever-changing needs of tenants.

Office Building Size

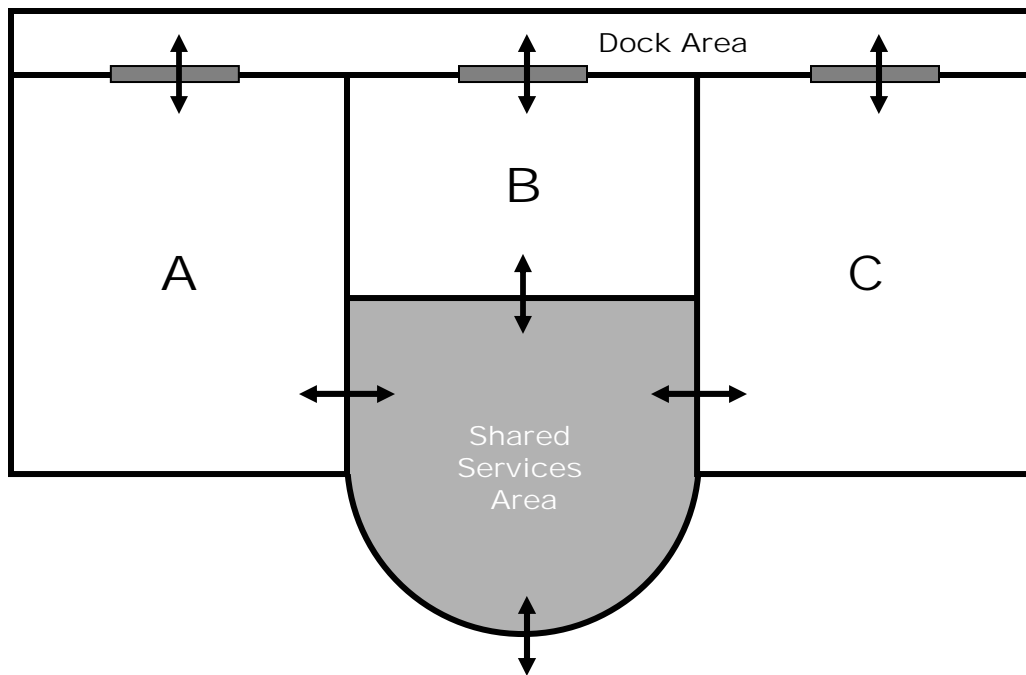
Consider a floor plate size of 24,000 – 30,000 square feet or distribute the shared services space among multiple floors

Policy Recommendations

8.3 Policy Provisions (cont'd)

4. Provide Flexible Facilities and Infrastructure (cont'd)

Figure 8.2 - Facility Layout Concept for Post Incubator Manufacturing (Light Industrial) Space



Shared Services Area Would Include:

- Receptionist
- Meeting rooms and main conference room
- Copy machine and other shared equipment
- Utility room
- Break room/cafeteria
- Locker room for workers

Modular Manufacturing Space (A, B and C)

The modular manufacturing area would be open high bay area with high floor loads and dock access with rollup doors at back

Industrial Building Size

Consider a floor plate size of 30,000 – 50,000 square feet

Policy Recommendations

8.3 Policy Provisions (cont'd)

5. Offer Access to Financial Resources (including incentives)

There are many different approaches, and corresponding risks, to providing financial resources for enabling startup companies and attracting existing companies to the County. Financial resources are critical to new product and company startups as well as serve as a differentiator for communities. A summary of options to consider for inclusion in the policy are as follows:

- **Access to Venture Capital:** through heavy promotion of the area's technology resources and the development of aggressive and credible business plans, more angel and venture capitalists may begin taking up residence in the area
- **Low Interest Loans:** make available state or federal-backed low interest loans for start-up funding needs, particularly those with tangible collateral (equipment, tooling, vehicles, etc.) Loans are available from the Federal government under the Small Business Administration and under the Virginia Department of Business Assistance that cover acquisition of land, buildings and improvements, as well as machinery and equipment. The loans cover a variety of situations, including the government acting as a third party guarantor on a loan from a lending institution. There are specific guidelines on qualification and are usually tied to the number of jobs created by the business.
- **Development of a Technology Zone:** provide tax and other incentives that are offered on a pay-as-you-go basis which limits the risk to the community. The incentives package would be available to any company within the target industries with no set minimum employment level so as not to discourage the start-up companies. Include the following offerings:
 - Job incentives (\$ per job offered)
 - Training and education services through Thomas Nelson Community College
 - Employee search services
 - Child care grant
 - Sliding scale rent in county-owned or leased facilities, beginning at below market rate
 - Tax abatements similar to Hampton Roads Technology Zone Incentives, such as:
 - * Five-year declining reduction in business, professional and occupational license tax (from 80% in year 1 to 20% in year 5)
 - * 100% rebate in building permit fees
 - * Five-year investment grant – decrease in personal property, real estate and machinery and tools taxes (from 80% in year 1 to 20% in year 5)

Policy Recommendations

8.4 Policy Implementation Plan With Key Action Items

In order to assure that a technology-based economic development initiative is successfully launched and implemented, there are a number of task areas that need to be addressed.

1. Gain Local Buy-in to the Initiative

With the strong local focus on tourism, The College of William and Mary, the beverage industry, and the retirement communities, there will be factions of the County that may not initially embrace this effort. In order to present them the “case”, a series of informal meetings should be established to inform and gather feedback similar to the community workshops that were conducted to collect feedback on the Williamsburg Crossroads effort in 1998. The meetings should include a summary of the report and its findings as well as the actions that are proposed to be undertaken to facilitate the initiative.

2. Build Relationships With Key Area Technology Stakeholders

Based on the many interviews engaged in during the fact-finding phase of this project, it became evident that there are a number of regional stakeholders that James City County could benefit from building strong relationships. An advisory group or council should be established to focus on the growth of technology-based industries derived from retention and expansion of existing companies, attraction of additional companies to the area, and the startup of new companies through an incubation process. They would develop an overall vision and strategy for technology industry growth as well as sponsor the establishment of a 501(c)(3) organization to act as the implementer and facilitator of the initiative. The advisory group would consist of:

- Local research colleges/universities
- Training Institutions and Hampton Roads Workforce Development
- ARC, Jefferson Lab and NASA
- Economic development organizations
- Hampton Roads Technology Incubator
- Hampton Roads Technology Council

The Hampton Roads Technology Council could potentially expand its scope and assume the role as the overall advisory coordinator. The rationale for this recommendation is that they currently have a charter to “promote the development, growth and recognition of technology businesses”. They would integrate their efforts with local/regional economic developers as the key area marketers as well as with the Hampton Roads Technology Incubator in their support of new and emerging technology companies.

Policy Recommendations

8.4 Policy Implementation Plan With Key Action Items (cont'd)

3. Promote Technology-Related Economic Development Activities

For recruiting external companies into James City County, develop a message and resource package and market to target industry companies (see details in Tables 5.2 and 6.1) through the Peninsula Alliance for Economic Development.

4. Enhance Local Human Capital

Moving James City County into the technology-based economy will require enhancement and leveraging of the work force and its skills at all levels. There are a number of challenges that need to be faced related to the work force and they include:

- Develop an initiative with The College of William and Mary to have an entrepreneurial program as part of their MBA degree. Host a meeting with the Dean of the Business School, Jim Golden of W&M, Martin Kaszubowski of the Hampton Roads Technology Incubator and possibly a representative from VCU to discuss the details of establishing this offering.
- Continue the discussions with Thomas Nelson Community College in establishing a branch of the college in James City County.
- Build a stronger bond between technology employers and the local high schools for better preparing students to work in this type of environment. Establish a career fair, an internship program, field trips to employers and an industry/teacher job-switch day to build a higher awareness in teachers and students as to the potential career opportunities in the area.

5. Provide Flexible Facilities and Infrastructure

In order to make available affordable, attractive, functional and flexible facilities that match the needs of technology companies through their business life cycles, it is recommended that James City County consider the development of flexible office and industrial space. A facilities task group should be formed to pursue the options of participation in the development of flexible office space in the New Town multi-use project and either renovating or developing flexible manufacturing space within the Stonehouse Commercial Park or equivalent. Concepts for the flexible space have been provided on pages 8.4 and 8.5 of this report.

Policy Recommendations

8.4 Policy Implementation Plan With Key Action Items (cont'd)

6. Develop Incentives That Position the County to be Competitive

Establish a working group to evaluate the incentive options, the related costs, the offerings of competitor communities and the process for establishing a Technology Zone for designated industrial parks that may include:

- Job incentives (\$ per job offered)
- Training and education services through Thomas Nelson Community College
- Employee search services
- Child care grant
- Sliding scale rent in county-owned or leased facilities, beginning at below market rate
- Tax abatements similar to Hampton Roads Technology Zone Incentives
 - Five-year declining reduction in business, professional and occupational license tax (from 80% in year 1 to 20% in year 5)
 - 100% rebate in building permit fees
 - Five-year investment grant – decrease in personal property, real estate and machinery and tools taxes (from 80% in year 1 to 20% in year 5)

Appendix

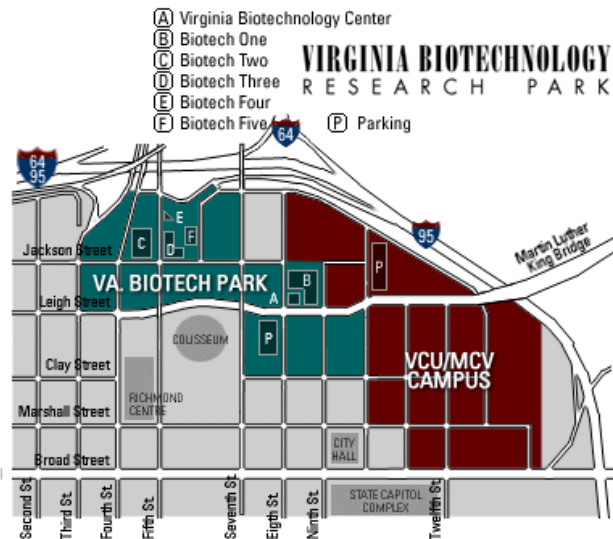
Persons Interviewed During Data Collection Phase of Study

Contact	Affiliation
Jim Golden	College of William & Mary – Economic Development and Corporate Relations
Bernadette Kulas	Applied Research Center
Lee Scruggs	College of William & Mary – Technology & Business Center
Bill Unaitas	College of William & Mary – Technology & Business Center
Maciek Sasinowski	Incogen
Matt Clayton	College of William & Mary
Duncan McIver	Technology Commercialization Center, Inc. (NASA)
H. Frederick Dylla	Jefferson Lab
Robert Williams	Eastern VA Medical School – Office of Technology Transfer
William Wasilenko	Eastern VA Medical School – Office of Research
Robert Ash	Old Dominion University – Office of Research
Richard Franson	Virginia Commonwealth University – Intellectual Property Foundation
Greg Wingfield	Greater Richmond Partnership
Martin Kaszubowski	Hampton Roads Technology Incubator
Lee Beach	Hampton Roads Research Partnership
Terry Riley	Hampton Roads Technology Council
Don Wright	Virginia Institute of Marine Science
Sam Morello	NASA Langley (retired)
Two Students	College of William & Mary – Department of Physics
Matthew James	Peninsula Alliance for Economic Development – Workforce Development
Richard Weigel	Peninsula Alliance for Economic Development
Sanford Wanner	County Administrator, James City County
Skip Campana	James City County Industrial Development Authority
John Berkenkamp	James City County Industrial Development Authority
Keith Taylor	James City County Economic Development
Sandra Barner	James City County Economic Development

Case Study: Virginia Biotechnology Research Park in Richmond

Background

- The biotechnology initiative began in the early 1990's when the Richmond area defined their economic development vision to include adding an engineering school to Virginia Commonwealth University (VCU) and develop an adjacent biotechnology/life sciences research park
- The first step was the formation of a 501(c)(3) corporation to administer the initiative and act as a focal point. Backing for the venture was supported by the Commonwealth of VA, VCU and the City of Richmond
- A 34-acre parcel was acquired (former low-end residential and parking lots) adjacent to the VCU and Medical College of Virginia (MCV) campus
- The park has been designated as an Enterprise Zone to allow companies to take advantage of state and local incentives



VCU/MCV Research

- The VCU/MCV life science, health science and engineering departments and hospitals are ranked as a Research University I by the Carnegie Foundation
- The university receives over \$100 million annually in external support primarily from private sources



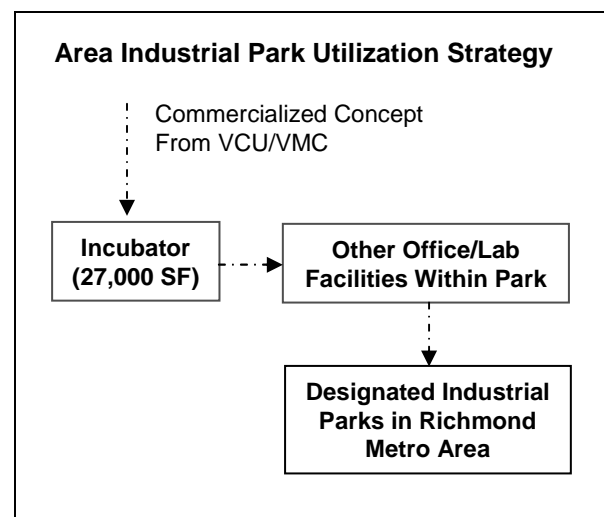
Biotechnology Center (Incubator)

Current Status

- There are currently over 40 biotech/bioscience-related companies (800 employees) in the park. The companies are primarily smaller firms (with a number of local startups) that are taking advantage of the research capabilities at VCU and MCV.
- The Biotechnology Center incubator consists of 27,000 SF of lab and office space along with a full array of fee-based business support services
- Other buildings have been built on the campus in phases for companies as they expand
- Other area office parks have been targeted for future expansion as the companies out-grow the Biotech Park
- Community interest in biotech continues to grow

Long-Term Plan

- The master plan for the Biotech Park is to provide 1.5 million SF of office, research lab and support space for 3,000 technical staff members



Case Study: Virginia Biotechnology Research Park in Richmond

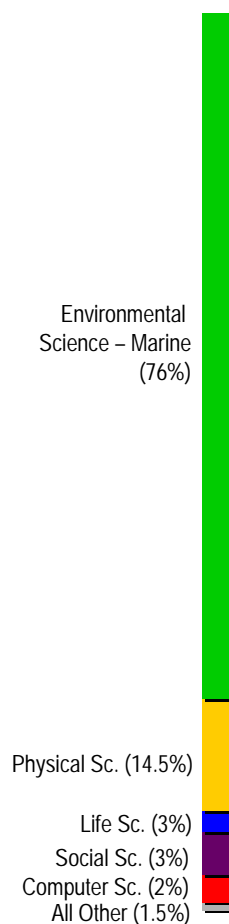
Key Success Factors for a Research Park Initiative

- The initiative started with a well-defined mission and specific technology target
- A 501(c)(3) corporation was established to coordinate the initiative, manage the facility and offer the business support services
- The venture is backed by the Commonwealth of VA, the City of Richmond, VA Commonwealth University and some private sector sponsors
- The technology park is adjacent to university research activity and there are office/industrial park options as a company grows
- Facilities are available that cover the complete business life cycle . . . from incubator space to more expanded office and lab space to full-scale production
- The technology park was designated as an Enterprise Zone to be able to provide an incentive package
- A significant portion of the research is from private sources that have a potential interest in commercialization – in contrast to public funding that focuses primarily on grant activity

Profile of Major Research Facilities (Hampton Roads Area)



Research Program Funding:



Source: National Science Foundation

College of William and Mary

Total Student Enrollment: 5,530 undergraduate and 1,900 graduate level

Graduates by Program (2000 – 2001):

Program	Bachelors	Masters	Doctorate
Engineering	-	-	-
Physics	21	12	7
Biology	118	16	-
Chemistry/BioChemistry	35	5	-
Applied Science	-	4	4
Computer Science	55	19	3
Ocean/Earth/Atmos./Marine	-	18	11
Business Administration	219	199	-

Research Budget: ~\$31 Million

Key Research Activities:

• Materials Applications

- Development of polymers and composites for high temperature, high strength and resistance to corrosion or oxidation, or increased conductive or semi-conductive properties
- Characterization and non-destructive testing of materials, tissues, cells, etc. using a variety of analytical techniques
- Lead role in Center for Piezoelectric Materials (at the Jefferson Lab ARC) that has applications in naval sonar and medical ultrasound devices
- Nanotechnology (carbon nanotubes)

• Marine Science

- Study of estuarine and deep sea ecosystems
- Environmental and aquatic animal health through the identification of toxicological and pathobiological agents
- Study of physical oceanography and the flow of nutrients and harmful agents
- Integration of acoustic sensors, data computation and visualization for marine monitoring and diagnostics
- Biotechnology and genetics

• Computation and Modeling

- Mathematical modeling and other tools to reflect Jefferson Lab operations
- Computational methods to image and sensor data from atmospheric monitoring

• Life Sciences

- Bioinformatics and Proteomics (computation application)
- Systems biology
- Evaluation of genetic-based conditions
- Medical imaging and other detection equipment
- Minimally invasive surgical and diagnostic applications
- Use of directed energetic and laser processing on materials for medical applications

Profile of Major Research Facilities (Hampton Roads Area)



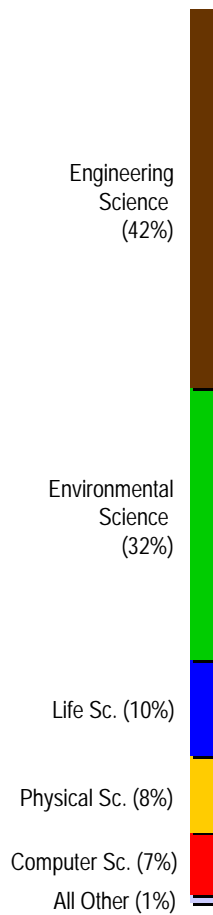
Old Dominion University

Total Student Enrollment: 8,750 undergraduate and 6,530 graduate level

Graduates by Program (2001 – 2002):

Program	Bachelors	Masters	Doctorate
Engineering	232	119	9
Physics	6	0	4
Biology	101	15	9
Chemistry/Biochemistry	12	4	0
Computer Science	49	20	2
Ocean/Earth/Atmos/Marine	16	6	5
Business Administration	217	144	7
Information Systems	123	-	-

Research Program Funding:



Research Budget: ~\$32 Million

Key Research Activities:

• **Engineering**

- Center for Advanced Engineering Environments (aerospace applications)
- Center for Bioelectrics
- Center for Advanced Ship Repair and Maintenance
- System of Systems Engineering (integrating complex/multi-source data points)
- VA Modeling, Analysis and Simulation Center
- Medical modeling and simulations
- Wireless sensor networks
- Maglev light rail transportation vehicles

• **Environmental Science**

- Oceanographic research with focus on physics of coastal ocean and biogeochemistry
- Study of Antarctic
- Modeling of ocean turbulence

• **Life Science**

- Bioinformatics
- Development of cancer-fighting pharmaceuticals

• **Physical Science (work in cooperation with Jefferson Lab)**

- Theoretical and nuclear particle physics
- Experimental nuclear physics
- Condensed matter, material and surface science
- Atomic and plasma physics

• **Computer Science**

- Computer systems security
- Interactive remote education
- Digital library project
- Numerical laboratory for computations in aeronautics and acoustics

Source: National Science Foundation

Profile of Major Research Facilities (Hampton Roads Area)



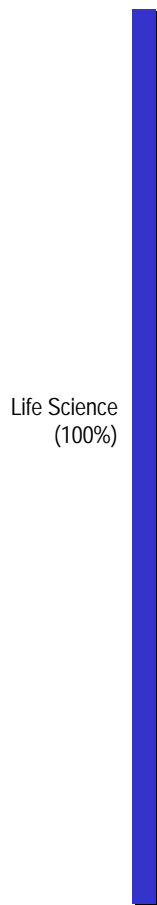
Eastern Virginia Medical School

Total Student Enrollment: 1,000

Graduates by Program (2001 – 2002):

Program	Masters	Doctorate
Health Sciences	89	-
Medical	-	99

Research Program Funding:



Research Budget: ~\$28 Million

Key Research Activities:

- **Cancer**
 - Prostate
 - Breast
 - Leukemia
 - Head
 - Neck
 - Lung
- **Reproduction**
 - Cardiovascular/renal
 - Urology
 - Neurosciences
- **Systemic Diseases**
 - Diabetes
 - Ocular pharmacology
 - Sleep disorders
 - Geriatrics
- **Infectious Diseases**
 - Pediatrics
 - Bioelectronics
 - Modeling and simulation
- **Detection devices/sensors**
 - Medical applications
 - Public health/security applications

Source: National Science Foundation

Profile of Major Research Facilities (Hampton Roads Area)



Research Program Funding:

Engineering
Science
(75%)

Environmental
Science (25%)

NASA – Langley

Local Employment: ~2,200 (1,200 scientists and engineers)

Research Budget: ~\$650+ Million (with national distribution)

Key Research Activities:

- **Material Science and Structures**

- Large-scale material/structure testing in multi-stresses and environments
- Structural analysis and modeling
- Material design and optimization for alloys, polymers, ceramics and adhesives

- **Earth Science**

- Monitoring and analysis of global atmospheric changes
- Evaluating impact of man on the atmosphere
- Development of sensors and detectors to monitor different layers and aspects of the atmosphere

- **Aeronautics (Aviation Safety and Efficiency)**

- Explore technologies that make aircraft cheaper to manufacture, more energy efficient, quieter and environmentally friendly
- Developing a cockpit display with synthetic vision and ground location benchmarks that will greatly enhance weather, limited visibility and human error issues
- Engaged in the development of next-generation passenger aircraft that is essentially a large wing integrated with the fuselage

- **Space Access and Exploration**

- Development of a variety of materials and technologies for spacecraft and satellites
- Wind tunnel testing of spacecraft
- Developing alternatives to make space travel cheaper and safer
- Simulated certain aspects of space travel through wind tunnel experiments and computer simulations

Source: NASA – Langley
Web Site and Literature

Profile of Major Research Facilities (Hampton Roads Area)



Research Program Funding:

Physical
Science
(100%)



Jefferson Lab and Applied Research Center

Local Employment: ~600 staff (about 1,500 scientists around conduct experiments at the lab)

Research Budget: ~\$73 Million

Key Research Activities:

- **Continuous Beam Electron Accelerator Facility:** Utilized for basic research on atomic structure, electron behavior and quark phenomenon
- **Free-Electron Laser**
 - Basic research on lasers
 - Application to manufacturing processes
- **Derivative Technologies**
 - Cryogenics
 - Magnet technology
 - Radio frequency power systems
 - Particle detector and data acquisition
 - Real-time control system software
- **Applied Research Center at Jefferson Lab**
 - The Technology Innovation Center for Plasma and Photon Process applies light and plasma-derived technology to:
 - > Manufacturing of computer and communications equipment
 - > Physical and chemical sensors
 - > Biomedical instruments and applications
 - > Semiconductor applications
 - > Thin films
 - > Photovoltaics
 - > Electronic components
 - > Optical instruments

Source: Jefferson Lab
Web Site and Literature

Evaluation of Technology Commercialization Opportunities

6.1 Background Information (cont'd)

Description	Scenario 1	Scenario 2	Scenario 3
Employee Profile	Software Company	High-Tech Component Mfr.	Sensor/Instrument Mfr.
Total Number of Employees	50	50	50
Sr Management	3	3	3
Average Salary	\$100,000	\$90,000	\$90,000
Manager/Supervisor	6	6	6
Average Salary	\$60,000	\$45,000	\$45,000
Professionals	35	4	4
Average Salary	\$50,000	50,000	50,000
Admin Support	6	5	5
Average Salary	\$25,000	\$25,000	\$25,000
Technicians	0	20	12
Average Salary	0	\$32,500	\$32,500
Hourly	0	12	20
Average Wage	0	\$22,000	\$22,000
Weighted Average Salary	\$51,200	\$35,580	\$33,900
Facility-Related Costs			
Facility Space Req'd	12,500	50,000	50,000
Cost/Sq. Ft.	\$110	\$60	\$60
Acres	0.75	2.0	2.0
Cost/Acre	\$100,000	\$100,000	\$100,000
Building and Land	\$1,450,000	\$3,200,000	\$3,200,000
Furn/Fixtures/Equip/Mach/Tools			
Furniture, Fixtures & Equip. (FF&E) ¹	\$625,000	\$105,000	\$105,000
Machinery & Tools (M&T)	\$0	\$15,000,000	\$10,000,000
Gross Receipts/Purchases			
Assumed Gross Receipts	\$15,000,000	-	-
Income Allocated to VA	\$250,000	\$250,000	\$250,000
Taxable Purchases within the State			
Year 1 ²	\$812,500	\$1,284,650	\$1,284,650
Years 2-10	\$500,000	\$500,000	\$500,000
Taxable Purchases within the County			
Year 1 (33% of State Purchases)	\$268,125	\$423,935	\$423,935
Years 2-10 (33% of State Purchases)	\$165,000	\$165,000	\$165,000
Payroll Taxes			
Estimated State Payroll Tax	5.23%	4.96%	4.92%
Indirect Purchases			
Retail Purchases (Using 1.2 Multiplier)			
Estimated Indirect Retail Purchases	\$3,072,000	\$2,134,800	\$2,034,000
Estimated State Purchases	\$2,918,400	\$2,028,060	\$1,932,300
Estimated County Purchases	\$1,167,360	\$811,224	\$772,920
Employees Relocated to the Area	5	3	3

Notes:

1. Assumed \$7,500 of FFE for non-production workers at mfg. operations and \$12,500/software company employee
2. Year 1 includes 25% of construction cost plus 33% of FFE

Evaluation of Technology Commercialization Opportunities

Scenario No. 1: Software Development Company with 50 Employees

Direct Revenues	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Payroll	2,560,000	2,624,000	2,689,600	2,756,840	2,825,761	2,896,405	2,968,815	3,043,036	3,119,111	3,197,089	28,680,657
Local Taxes											
Real Property Tax	12,615	12,615	12,615	12,615	12,615	12,615	12,615	12,615	12,615	12,615	126,150
Personal Property Tax											
>Machinery and Tools	0	0	0	0	0	0	0	0	0	0	0
>Furn./Fixtures/Equip.	6,250	6,250	6,250	6,250	6,250	6,250	6,250	6,250	6,250	6,250	62,500
Bus./Occup. Lic. Tax	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	540,000
Sales Tax	<u>2,681</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>17,531</u>
Total	75,546	74,515	74,515	74,515	74,515	74,515	74,515	74,515	74,515	74,515	746,181
State Taxes											
Payroll Tax	133,975	137,324	140,758	144,276	147,883	151,580	155,370	159,254	163,236	167,316	1,500,974
Sales Tax	28,438	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	185,938
Corporate Income Tax	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	150,000
Total	252,959	244,339	247,773	251,291	254,898	258,595	262,385	266,269	270,251	274,331	2,583,092
Indirect Revenues											
Local Taxes											
Sales Tax	11,674	11,965	12,265	12,571	12,885	13,208	13,538	13,876	14,223	14,579	130,784
State Taxes											
Sales Tax	102,144	104,698	107,315	109,998	112,748	115,567	118,456	121,417	124,453	127,564	1,144,358
Total Revenues											
Local Taxes	87,220	86,480	86,780	87,086	87,400	87,723	88,053	88,391	88,738	89,094	876,965
State Taxes	355,103	349,037	355,088	361,289	367,646	374,162	380,841	387,686	394,703	401,895	3,727,451

Evaluation of Technology Commercialization Opportunities

Scenario No. 2: High-Tech Material Component Manufacturer with 50 Employees

Direct Revenues	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Payroll	1,779,000	1,823,475	1,869,062	1,915,788	1,963,683	2,012,775	2,063,095	2,114,672	2,167,539	2,221,727	19,930,816
Local Taxes											
Real Property Tax	27,840	27,840	27,840	27,840	27,840	27,840	27,840	27,840	27,840	27,840	278,400
Personal Property Tax											
>Machinery and Tools	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	1,500,000
>Furn./Fixtures/Equip.	0	0	0	0	0	0	0	0	0	0	0
Bus./Occup. Lic. Tax	0	0	0	0	0	0	0	0	0	0	0
Sales Tax	<u>4,239</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>19,089</u>
Total	182,079	179,490	179,490	179,490	179,490	179,490	179,490	179,490	179,490	179,490	1,797,489
State Taxes											
Payroll Tax	88,242	90,448	92,710	95,027	97,403	99,838	102,334	104,892	107,515	110,203	988,612
Sales Tax	44,963	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	202,463
Corporate Income Tax	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	150,000
Total	330,284	302,438	304,700	307,017	309,393	311,828	314,324	316,882	319,505	322,193	3,138,564
Indirect Revenues											
Local Taxes											
Local Sales Tax	8,112	8,315	8,523	8,736	8,954	9,178	9,408	9,643	9,884	10,131	90,885
State Taxes											
State Sales Tax	70,982	72,757	74,576	76,440	78,351	80,310	82,317	84,375	86,485	88,647	795,240
Total Revenues											
Local Taxes	190,192	187,805	188,013	188,226	188,444	188,668	188,898	189,133	189,374	189,621	1,888,374
State Taxes	401,267	375,195	379,275	383,457	387,744	392,138	396,642	401,258	405,989	410,839	3,933,804

Evaluation of Technology Commercialization Opportunities

Scenario No.3: Sensor and Instrument Manufacturer with 50 Employees

Direct Revenues	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Payroll	1,695,000	1,737,375	1,780,809	1,825,330	1,870,963	1,917,737	1,965,680	2,014,822	2,065,193	2,116,823	18,989,732
Local Taxes											
Real Property Tax	27,840	27,840	27,840	27,840	27,840	27,840	27,840	27,840	27,840	27,840	278,400
Personal Property Tax											
>Machinery and Tools	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	1,000,000
>Furn./Fixtures/Equip.	0	0	0	0	0	0	0	0	0	0	0
Bus./Occup. Lic. Tax	0	0	0	0	0	0	0	0	0	0	0
Sales Tax	<u>4,239</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>1,650</u>	<u>19,089</u>
Total	132,079	129,490	129,490	129,490	129,490	129,490	129,490	129,490	129,490	129,490	1,297,489
State Taxes											
Payroll Tax	83,383	85,468	87,604	89,794	92,039	94,340	96,699	99,116	101,594	104,134	934,172
Sales Tax	44,963	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	202,463
Corporate Income Tax	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	150,000
Total	275,425	247,458	249,594	251,784	254,029	256,330	258,689	261,106	263,584	266,124	2,584,124
Indirect Revenues											
Local Taxes											
Sales Tax	7,729	7,922	8,120	8,324	8,532	8,745	8,964	9,188	9,417	9,653	86,593
State Taxes											
Sales Tax	67,631	69,321	71,054	72,831	74,651	76,518	78,431	80,391	82,401	84,461	757,690
Total Revenues											
Local Taxes	139,809	137,412	137,610	137,814	138,022	138,235	138,454	138,678	138,907	139,143	1,384,083
State Taxes	343,056	316,779	320,649	324,615	328,681	332,848	337,119	341,498	345,985	350,585	3,341,815