Advancing the Aberdeen Proving Ground Region’s Technology Hub:

A Feasibility Assessment and Action Plan for a University Research Park Initiative

August 2013
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Executive Summary

Harford County and the broader Aberdeen Proving Ground (APG) Region have taken a significant leap forward as a technology hub over the last decade. The main driver has been the significant build-up of the Aberdeen Proving Ground with the 2005 base realignment and closure (BRAC) process, which has transformed APG into one of the military’s leading and most diverse centers of excellence for science and technology development. The implications of this build up go well beyond the boundaries of Aberdeen Proving Ground. It has resulted in significant growth in private sector technology industries, a robust demand for high-skilled workers in the fields of science, technology, engineering and math (STEM), and the buildup of more than 1 million square feet of Class A office and flex space suited for technology companies in the APG Region over the past decade.

But the broader transformation of the APG Region into a world-class regional technology hub is still a work in progress. Moving forward, leadership in the APG Region recognizes that a high-value, place-based strategy needs to be implemented to address the changing terms of competition in today’s 21st century knowledge economy and provide an impetus for the next generation of technology growth in the region. In the past, a region’s natural resources and proximity to markets were critical factors for business location. But with the rising importance of knowledge workers and innovation, a region’s competitiveness for economic growth depends on its ability to create physical environments that attract and facilitate industry, university and other research driven interactions.

Perhaps one of the best known approaches for place-based strategies to advance technology hubs is the establishment of university research parks. According the National Research Council in its study of research park best practices:

“Research parks are seen increasingly around the world as a means to create dynamic clusters that accelerate economic growth and international competitiveness. They are widely considered to be a proven tool to encourage the formation of innovative high technology companies. They are also seen as an effective means to generate employment and to make existing companies more competitive.”

Given the importance of advancing a place-based strategy to create physical environments that facilitate industry, university and other research driver interactions, the Harford County’s Economic Development Advisory Board (EDAB) has supported the formation of a University Research Park (URP) Board as a separate 501 (c) (3) organization to pursue this mission. In order to provide an expert and independent analysis of the feasibility and recommended development pathway for a University Research Park Initiative in the APG Region, Harford County and the

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Chesapeake Science and Security Corridor Consortium engaged Battelle’s Technology Partnership Practice.

A key objective of this effort was to identify the targets of opportunity that build upon the technology industry base and APG requirements for talent and research collaborations and advance an integrated and comprehensive program of activities to realize these opportunities. In conducting the opportunity assessment, this effort builds upon the earlier work on specific APG needs for university talent and R&D collaborations identified in the report, Accelerating University Talent Development and Research & Development Partnerships at Aberdeen Proving Ground, and augments it with further industry, innovation, talent and workforce and commercial real estate assessments. In the development of program activities, this effort draws on best practice examples as it seeks to translate the opportunities into program development, marketing and outreach, operations and governance options, and funding approaches.

**Findings from Assessment of APG Region’s Technology Industry, Innovational, Workforce and Commercial Real Estate Developments**

An analysis of the APG Region’s technology industries, innovation potential, workforce and talent and commercial real estate point to a set of significant assets to build upon and gaps to address across the development challenges for advancing the APG Region’s technology hub in the years ahead. These assets and gaps are summarized in Figure ES-1 below.

Of particular concern is that after the immediate technology industry gains from the 2005 BRAC decision, the pace of growth of the technology industry has fallen off in the APG Region. A closer examination of the dynamics of technology industry growth in the APG Region suggests there remain significant opportunities to further engage technology companies with connections to the military organizations found at APG. At the same time, there is a need to promote more home-grown technology industry development through innovation.

At the same time, a 2012 independent study by Battelle on Accelerating University Talent Development and Research & Development Collaborations at Aberdeen Proving Ground, funded by the Department of Defense, identified unmet needs and significant value to APG organizations in having more intensive university resources in the APG Region. A growing presence of university activities in the APG Region can both advance scientific and engineering talent development to support the needs of APG organizations and its contractors as well as deepen the applied research and cutting-edge technology collaborations that align with the varied and extensive research and development activities now found at APG (see text box for more specifics).

Battelle’s overall analysis points to three inter-related challenges confronting the APG Region which must be addressed as part of the University Research Park Initiative. These three development challenges are:

- Growing the regional technology industry base in Aberdeen;
• Advancing workforce development to meet the demands by technology industry and APG organizations; and

• Fostering “live, work, play” development to create a higher value physical environment to align with the commercial Class A office developments taking place in the region.

Figure ES-1: Summary of Assets and Gaps in APG Region’s Technology Development

<table>
<thead>
<tr>
<th>Key Factor</th>
<th>Assets To Build Upon</th>
<th>Gaps to Address</th>
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</thead>
<tbody>
<tr>
<td>Development Challenge: Growing the Technology Industry Base in the APG Region</td>
<td></td>
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<tr>
<td>Technology Industry</td>
<td>Major gains in tech industry for APG Region Increased presence of C4ISR related defense contractors</td>
<td>Tech industry growth stalled in APG Region after 2007</td>
</tr>
<tr>
<td>Innovation</td>
<td>Many inventors living in APG Region Significant base of SBIR and patent activity associated with APG tenant organizations</td>
<td>Few companies in APG Region assigned patents, winning SBIR awards from APG organizations and venture-backed</td>
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Development Challenge: Addressing Workforce Issues

<table>
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<tr>
<th>Key Factor</th>
<th>Assets To Build Upon</th>
<th>Gaps to Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEM Occupational Demand</td>
<td>Strong projected demand for high-skilled workforce across range of skills from scientists to engineers to math and computer sciences to business and financial operations. Key need for integrated, hands-on post-baccalaureate and master’s programs to support APG – C4ISR, Chem/Bio, Business/ Financial</td>
<td>Many of the newer and mid-to-small tech companies finding it hard to fill high-skilled jobs and not connected to top talent being generated</td>
</tr>
<tr>
<td>STEM Occupational Supply</td>
<td>Highly educated/skilled residents in region (42% AA degree or higher) Significant top talent generation of new university graduates just outside of APG Region STEM activities in region growing new pipeline initiatives – Towson-HCC new 2+2 facility; UDel-HCC-Cecil-DTCC Regional Cybersecurity Education Alliance</td>
<td>Many of the high educated/skilled residents commute Hard for universities to aggregate demand and serve needs of APG organizations and contractors</td>
</tr>
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Development Challenge: Fostering a High-value Place Strategy

<table>
<thead>
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<th>Key Factor</th>
<th>Assets To Build Upon</th>
<th>Gaps to Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Real Estate</td>
<td>Established significant Class A Office &amp; Flex Market around APG</td>
<td>Class A Office and Flex Market is scattered across Routes 40 and 22 – lacks sense of place High vacancy rates found in Class A and Flex Limited mixed use development</td>
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</table>

While each development challenge requires focused attention, it is important to recognize how inter-related these development challenges are and the importance of working on each simultaneously in order to successfully advance the APG Region’s technology hub in the years ahead. For instance, while there are specific targets of opportunity for growing the technology industry base in the APG Region, particularly outreach to SBIR companies and expanding the activities of existing defense-related technology firms that have located in the region in recent
years, these business development efforts depend upon tapping the potential pools of STEM-related workforce and having more attractive and competitive mixed-use real estate developments in the region. Similarly, sustaining workforce development will not succeed without ensuring growing demand for STEM-related jobs and having the high-value, mixed use developments that technology professionals seek. And, advancing mixed use development in the region depends upon having strong demand by growing companies seeking space and growing pools of technology professionals. So the best way to conceive of the challenges is as inter-related program activities and not stand alone initiatives as depicted in Figure ES-2.

Figure ES-2: Inter-related Challenges for Growing the APG Region’s Technology Hub

These inter-related challenges are also shaped by the ongoing needs of the military organizations at APG. Of immediate importance is the need for continuing education and training involving integrated post-baccalaureate and master’s programs, but APG needs to move forward the planned educational partnership with the University Center at HEAT and the Northeast Maryland Higher Education Advisory Board (NMHEAB) to better coordinate APG needs and improve the engagement with universities in meeting these needs. In light of the demand for hands-on instruction and close linkages with applied research and development, there is a clear need for university activities in close proximity to APG—but this will only take place if APG’s needs can be aggregated so that university programs can be sustained. In the future, as pace of retirements pick up, the challenge of recruiting a top flight STEM workforce at APG will likely become an issue. Having in place the types of workforce mechanisms to tap potential pools of graduates at nearby universities as well as residents working in STEM related fields who commute to jobs outside of the region will be critical, along with having the attractive mixed-use developments that technology professionals seek in communities in which they choose to live.
Recommended Program, Governance and Funding Approaches

The three development challenges identified for the APG Region—growing the regional industry base, addressing workforce development and fostering “live, work, play” development—stand as strategic priorities, which if effectively addressed will enable the region to reignite the growth of its technology hub.

To advance these strategic priorities, a focused set of program activities were identified tailored to the specific assets and gaps in technology development found in the APG Region and finalized in consultation with the Project Advisory Committee. These program activities include:

- Targeting outreach marketing to companies doing business with APG organizations, including SBIR companies and those involved in C4ISR and Chem/Bio initiatives.
- Establishing commercialization services to promote homegrown technology development among the base of inventors residing in the APG Region.
- Supporting the proposed educational partnership with APG to aggregate and serve as a clearinghouse and program development facilitator.
- Advancing specialized institutes in high priority skills development and R&D areas requiring university collaborations, such as cybersecurity and chem/bio defense.
- Developing a talent connector to graduates of nearby universities and high-skilled residents for meeting the demands for STEM-related workforce.
- Advancing transit-oriented mixed use development hubs for growing the APG Region’s Technology District.

Together, these six program activities can serve as the basis for a comprehensive University Research Park Initiative for the APG Region recognizing that the APG Region is evolving more along the lines of a technology district with technology hubs rather than a traditional contiguous research park. Part of this reflects the way APG is organized with two posts separated by six miles, and part of this reflects the pattern of scattered development that has taken place in the region, particularly across the US Route 40 and 22 corridors.

The development of these recommended program activities have been guided by several key principles, namely:

- Program activities should seek to leverage broader partnerships across military, state, university, industry and county resources;
- Best practices should inform the design of program activities in a way tailored to meet the circumstances found in the APG Region;
• In turn, the design of these program activities should inform key decisions related to governance and funding approaches, so that form follows function;

• Seek to engage private sector and APG organizational participation and leadership in steering the program activities, while ensuring dedicated resources are identified to implement and work collaboratively with private sector and APG organizations.

Table ES-1 summarizes the program development activities across their governance, operations, funding approaches and best practices examples.

**Table ES-1: Program Development Activity Summary**

<table>
<thead>
<tr>
<th>Program Activities</th>
<th>Governance</th>
<th>Operations</th>
<th>Funding Approaches</th>
<th>Best Practice Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Targeted outreach marketing to companies doing business with APG (i.e., SBIR cos, C4ISR cos, NBC Industry Group)</td>
<td>Economic Development Advisory Board</td>
<td>Primary economic development function</td>
<td>Existing economic development funding</td>
<td>Dayton Development Corporation</td>
</tr>
<tr>
<td>Commercialization services to APG Regional Inventors</td>
<td>URP Board to oversee &amp; advise on activities, funding</td>
<td>Economic development function for staffing to do outreach, generate network, solicit proposals, create mentoring</td>
<td>Need an ongoing source of public funding Seek support from angel investors/serial entrepreneurs</td>
<td>Oklahoma’s Innovation to Enterprise (I2E) – OKC and Tulsa primarily Innovate Arkansas</td>
</tr>
<tr>
<td>Educational Partnership Clearinghouse</td>
<td>APG Organizations with participation of University Center @HEAT / NMHEAB</td>
<td>University Center at HEAT</td>
<td>APG and local with specific project support from State</td>
<td>Suburban MD Technology Council</td>
</tr>
<tr>
<td>Advancing Specialized Institutes for Cybersecurity and Chem/Bio University Collaborations</td>
<td>URP Board in conjunction with APG Organizations</td>
<td>Identify university lead with guidance of APG Possibly house as part of CERDEC technical support lead</td>
<td>APG, with specific project support from State and local government sources and industry</td>
<td>Air Force Institute of Technology</td>
</tr>
<tr>
<td>Talent Connector for Students and Residents</td>
<td>University Center @HEAT / NMHEAB</td>
<td>Economic development function given need for close working relationship with companies Possibly tap university relationships of STEM Pipeline and Clearinghouse</td>
<td>Local with leveraging industry support</td>
<td>Students – Ohio Third Frontier, Massachusetts Life Sciences Center Existing Workforce: Pittsburgh Digital Greenhouse, Iowa, Oklahoma</td>
</tr>
</tbody>
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ES-6
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Advancing transit-oriented mixed use development hubs for growing the APG Region’s Technology District.</td>
<td>Each of the planned TOD developments at Aberdeen and Perryville are being advanced by their local governments in broader partnerships with county, state and private sector. In the future, county and local government units and owners within the APG Technology District should be engaged and consider forming a public-private partnership collaboration.</td>
<td>Each unit of government and private developer would continue to be responsible for their own activities. Over time, as coordinated activities and shared services grow a more centralized set of operations might be advanced.</td>
<td>Each of the planned TOD efforts would involve its own mix of federal, state, local and private investment.</td>
<td>Dayton, Ohio Huntsville, Alabama</td>
</tr>
</tbody>
</table>

As a comprehensive initiative these six program activities reflect a breadth of activities that encompass what defines overall economic development for the Aberdeen Region. This is not surprising given how inter-related the development challenges are in the region. The recommended program activities span physical development, business development, innovation and commercialization, and education and workforce development.

To gain the support needed to make this initiative successful it requires the broad support of the Aberdeen Region as a top economic priority. For Harford County, this means that the University Research Park Initiative must be a priority for the county’s Economic Development Advisory Board and overseen by it.

By working together, the opportunity for the APG Region to grow its technology base is substantial. But it will take a comprehensive effort to build upon the gains made over the last decade. If successful it is expected that what will emerge is a public-private partnership that will advance an Aberdeen Region Technology District. This Technology District will be centered around APG with key developments happening along corridors in the region, particularly the Route 40 corridor from Edgewood through Aberdeen, Havre de Grace and across the Susquehanna River to Perryville and the Route 22 corridor from Aberdeen to the I-95 interchange.
Introduction

Harford County and the broader Aberdeen Proving Ground (APG) Region have taken a significant leap forward as a technology hub over the last decade. The main driver has been the significant build-up of the Aberdeen Proving Ground with the 2005 base realignment and closure (BRAC) process, which has transformed APG into one of the military’s leading and most diverse centers of excellence for science and technology development. APG now stands as a $20 billion annual military research and development, testing & evaluation and acquisition enterprise involving 11 major commands and directly employing 13,000 military and civilian defense workers.

The implications of this build-up go well beyond the boundaries of Aberdeen Proving Ground. It has resulted in significant growth in private sector technology industries, a robust demand for high-skilled workers in the fields of science, technology, engineering and math (STEM), and the build-up of more than 1 million square feet of Class A office and flex space suited for technology companies in the APG Region over the past decade.

But the broader transformation of the APG Region into a world-class regional technology hub is still a work in progress. After the immediate technology industry gains from the 2005 BRAC decision, the pace of growth of the technology industry has fallen off in the APG Region. At the same time, a 2012 independent study by Battelle on Accelerating University Talent Development and Research & Development Collaborations at Aberdeen Proving Ground, funded by the Department of Defense, identified unmet needs and significant value to APG organizations in having more intensive university resources in the APG Region. A growing presence of university activities in the APG Region can both advance scientific and engineering talent development to support the needs of APG organizations and its contractors as well as deepen the applied research and cutting-edge technology collaborations that align with the varied and extensive research and development activities now found at APG (see text box for more specifics).
**Value Proposition of Growing the Presence of University Talent and R&D Resources in the APG Region**

A 2012 independent study by Battelle on *Accelerating University Talent Development and Research & Development Collaborations at Aberdeen Proving Ground*, funded by the Department of Defense, identified the value closer proximity of university activities would bring to fulfilling the mission of Aberdeen Proving Ground.

From a talent perspective, closer proximity of university collaborators can advance much needed master’s level education programs that couple teaching basic methods with more hands-on learning and applications development to create more “journeyman” scientists and engineers. At the same time, closer proximity of university collaborators would offer the opportunity to establish relationships and improve the ability to recruit doctoral students and post-graduate fellows working on APG-related research projects for basic research at APG.

In research, close proximity of university shared use facilities supported by APG organizations would enable a more interactive environment between APG researchers and university researchers to address both complex multi-disciplinary research challenges and to speed the pace of research advances, raising the broader level of science and creativity for APG’s own research and development efforts. Five specific opportunities for collaboration were identified in critical areas of emerging technology development at APG that call for university-related talent and research collaborations that would benefit from proximity to APG, including:

- **System of systems network development that lends itself to the promise of C4ISR full life cycle development**, with possible activities including: 1) Broader applied education and training of engineers with tailored courses, instructional labs, and master’s research projects; and 2) Create a dedicated collaboration space in which best practices with academia and industry on system of systems networks can be shared and new innovation explored.

- **Cybersecurity talent connections and applied research collaborations**, with possible activities including: 1) Build stronger connections to the talent pipeline being generated through Information Assurance programs found across the region; 2) Augmenting the curriculum to address broader cybersecurity topics that APG addresses; 3) Having Professors of Practice drawn from the ranks of APG to work with students on applied research problems; and 4) Creating more intensive cyber engineering and immersive programs to engage top students.

- **Systems biology tying together ongoing efforts in genomics and proteomics**, with possible activities including: 1) Focus on creating collaboration space for wide range of university researchers and doctoral students/post-docs to work in proximity with APG researchers, including possibly joint projects; and 2) Augment existing lab facilities with enhanced modeling and informatics.

- **High performance computing for modeling**, with possible activities including: 1) Create a dedicated collaboration and user support center for computational sciences analysis, visualization and modeling—example of Pittsburgh Supercomputing Center, but for multi-university presence; and 2) Tap the broad expertise in high performance computing for modeling and applications development found at universities in a more efficient and timely manner.

- **Incubating material sciences solutions**, with possible activities including: 1) Create a Materials Applications Center with flexible lab space and access to existing material sciences facilities at APG; and 2) Consider ways to invite collaborators to Materials Applications Center through open solicitation of best ideas to conduct proof of concept and other development activities.
Moving forward, leadership in the APG Region recognizes that a high-value, place-based strategy needs to be implemented to address the changing terms of competition in today’s 21st century knowledge economy and provide an impetus for the next generation of technology growth in the region. In the past, a region’s natural resources and proximity to markets were critical factors for business location. But with the rising importance of knowledge workers and innovation, a region’s competitiveness for economic growth depends on its ability to create physical environments that attract and facilitate industry, university and other research-driven interactions.

In an interesting paradox, the more globally integrated the U.S. economy becomes, the more *local* research and development (R&D) know-how, entrepreneurial culture, and workforce skills matter for economic success. A 2009 *Harvard Business Review* article by Harvard Professors Gary Pisano and Willy Shih on “Restoring American Competitiveness” refers to this phenomenon as creating geographically-based “industrial commons.” As they explain, “Once an industrial commons has taken root in a region, a powerful virtuous cycle feeds its growth. Experts flock there because that’s where the jobs and knowledge networks are. Firms do the same to tap the talent pool, stay abreast of advances, and be near suppliers and potential partners.”

Perhaps one of the best known approaches for place-based strategies to advance technology hubs is the establishment of university research parks. According the National Research Council in its study of research park best practices:

“Research parks are seen increasingly around the world as a means to create dynamic clusters that accelerate economic growth and international competitiveness. They are widely considered to be a proven tool to encourage the formation of innovative high technology companies. They are also seen as an effective means to generate employment and to make existing companies more competitive.”

These research park developments are having significant economic spill-over impacts for their regions. Perhaps best known is Research Triangle Park, the signature development for the Raleigh-Durham region, which now encompasses 7,000 acres (up from 4,400 at its outset in 1959), more than 22.5 million square feet and more than 38,000 full-time equivalent employees along with an estimated 10,000 contract workers. Another example is Shady Grove Research Park in Montgomery County, MD that became the epicenter for that region’s growing biotechnology cluster that now spreads up and down the I-270 corridor. And another is Sandia Science & Technology Park, located in the high desert Manzano Mountain foothills of Albuquerque, New Mexico adjacent to one of our nation’s leading national labs. Started in 1998, it now has 1.1 million square feet built out across 24 buildings that are home to 33 companies and organizations employing nearly 2,500 workers. Of particular note is that these three research parks are not adjacent to a specific university, yet have leveraged the presence of non-university research organizations and created their own demand for university-related talent and R&D collaborations.

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2 Pisano and Shih, op cit.
Given the importance of advancing a place-based strategy to create physical environments that facilitate industry, university and other research driver interactions, the Harford County’s Economic Development Advisory Board has supported the formation of a University Research Park Board as a separate 501 (c) (3) organization to pursue this mission. The focus of the University Research Park is to advance a multidisciplinary academic, science and research environment in Northeastern Maryland that strengthens national defense priorities and creates technology-led economic growth through advanced degree opportunities, technology transfer collaborations, critical skill-oriented workforce development and technology business incubation.

**Project Goals and Approach**

In order to provide an expert and independent analysis of the feasibility and recommended development pathway for a University Research Park Initiative in the APG Region, Harford County and the Chesapeake Science and Security Corridor Consortium engaged Battelle’s Technology Partnership Practice. Battelle is the world’s largest independent nonprofit research and development organization, with revenues in excess of $6 billion. The Technology Partnership Practice at Battelle is a leading technology-based economic development consulting group, which taps the organization’s broad technology knowledge base. The Battelle Technology Partnership Practice brings a strong understanding of the dynamics and requirements for growing technology industries and developing research parks that leverage university activities, including work in Atlanta, Pittsburgh, Baltimore, Los Angeles and Memphis.

**A key objective of this effort was to identify the targets of opportunity that build upon the technology industry base and APG requirements for talent and research collaborations and advance an integrated and comprehensive program of activities to realize these opportunities.**

In conducting the opportunity assessment, this effort builds upon the earlier work on specific APG needs for university talent and R&D collaborations identified in the report, *Accelerating University Talent Development and Research & Development Partnerships at Aberdeen Proving Ground*, and augments it with further industry, talent and workforce and commercial real estate assessments. In the development of program activities, this effort draws on best practice examples as it seeks to translate the opportunities into program development, marketing and outreach, operations and governance options, and funding approaches.

The specific methodology undertaken by Battelle was organized in two phases:

**The Phase One effort** was focused on assessing the opportunities for advancing technology industry development and university-related talent and R&D collaborations. This involved:

- Further discussions with APG organizations on specific talent and R&D collaborations in focused areas of activity.
- An analysis of technology industry developments and discussions with industry in the region and connected to APG on specific opportunities for advancing increased presence of technology innovation and industry growth.
• A close examination of commercial real estate developments and position of the region for creating the physical environments needed to that facilitate industry, university and other research driver interactions.

**The Phase II effort** was focused on developing specific recommendations for programmatic design and implementation plan for services, the branding/marketing plan and program, and the governance and management approach for the activities.

**Figure 1: Project Methodology**

**Phase I: Assessment of Demand Drivers**
- APG-related opportunity areas
- Technology industry development
- Real estate analysis

**Phase II: Development Planning**
- Program & Funding Approaches
- Best Practices for Design of Program Activities
- Organizational & Management Structures

Guiding the project was an advisory committee brought together by Harford County Office of Economic Development and CSSC. The advisory committee provided relevant past reports and studies that served as a basis of initial information, identified key stakeholders to interview, reviewed findings and provided additional input and feedback. (See Appendix A for a listing of the Advisory Committee members).
A Technology Hub in Development: APG Region’s Technology Industry, STEM Workforce and Commercial Real Estate Market Trends and Position

University research parks offer physical environments and value added services that can generate, attract and retain technology companies and talent in alignment with nearby research and development drivers. According to the Association of University Research Parks, university research parks differ from other types of technology-oriented industry parks in that they are generally developed by, or in collaboration with, a leading research institution and place an emphasis on innovation and connecting talent to technology industries. Most university research parks are affiliated with one or more universities; however, research parks have also been affiliated with, and located close to, national civilian and defense laboratories or other sources of technology and innovation. The term “university research park” encompasses all of these situations.

So while the focus on collaboration with a local research and development organization is a cornerstone of a university research park, it is essential to take stock of a community’s technology industry and workforce development as well as commercial real estate development in assessing the potential of a university research park initiative.

The key findings of this assessment point to many positive developments in the maturation (or growth) of the APG’s technology hub:

- The technology-based industry in the APG Region grew significantly over the past decade and has become a major economic driver for the region;
- Along with this technology-based industry growth, there is now a strong demand for STEM (science, technology, engineering and math) workforce in the region;
- Also with this technology-based industry growth has been the development of a commercial Class A office market in the APG Region and continued growth in flex buildings suited for R&D labs.

But the assessment also points to recent challenges in advancing growth:

- Since 2007, the technology-based industry realized a significant decline from its peak levels during the severe recession and has not picked up in growth in recent years;
- Commercial real estate for both Class A Office and Flex Buildings are plagued by high vacancy rates.
This build-up in the base of technology industry and commercial real estate offers a foundation for the APG Region’s technology hub, but its continued growth in the years ahead is a major challenge for the region.

**Technology-based Industry in the APG Region Grew Significantly Over the Past Decade**

The base of technology-based industries in the APG Region significantly grew with the 2005 BRAC decision that increased the military missions and organizations found at the Aberdeen Proving Ground (APG). The 2005 BRAC built upon APG’s longstanding missions in the research, development and testing of land combat systems and chemical and biological defense, by:

- Adding communications, electronics and computer security research and development with the relocation of the Army’s C4ISR (command, control, communication, computers, intelligence, surveillance & reconnaissance) center of excellence.
- Enhancing chemical and biological research and development with the relocation of the Army’s activities involved in Medical Research Institute of Chemical Defense (MRICD), the Joint Program Executive Office for Chemical and Biological Defense, Non-Medical Chemical and Biological Defense Development & Acquisition and the Defense Threat Reduction Agency.
- Expanding the existing base of testing and evaluation with the relocation of the Army Test and Evaluation Command (ATEC) headquarters.
- Adding a lead research institute for training, leader development, soldier research and development involved with behavioral and social science research involving survey research on soldier and leader attitudes and occupational analysis.
- Adding Army Research Laboratory’s Vehicle Technology Directorate focused on pursuing mobility-related science and technologies leading to advanced capabilities and improved reliability for Army air and ground vehicles involving platform, propulsion, intelligent systems and logistics technologies.

This major expansion of the military’s presence at Aberdeen Proving Ground has also translated into sizable growth in private sector, technology-based industries. Technology industries are defined by the U.S. Bureau of Labor Statistics as those industries having double the proportion of workers found in scientific, engineering and technician occupations than found for all industries.4

For the APG Region—encompassing Harford and Cecil Counties—technology industry employment per NAICS-based data, stood at 6,768 jobs in 2001 and for the most recent available year of 2011, reached 8,587 jobs—a substantial gain of 26.9 percent over the ten years.

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To put this technology-based industry growth in perspective as a regional industry driver, total private sector industry grew by nearly 11,000 jobs in the APG Region from 2001 to 2011, a healthy gain of 15 percent growth—which still is off the pace of the growth in technology-based industry in the region. Nearly one out of every five net new jobs created in the APG Region was the direct result of technology-based industry growth. Considering the economic multiplier effects of the direct job gains from technology-based industry growth in the APG Region, which generate new income for the region and drive retail and other local services—it is estimated that the total impact of the technology-based industry growth in the APG Region might reach over three out of every five net new jobs in the region.

This pace of technology-based industry growth in the APG Region even exceeded that of the larger Baltimore metropolitan area, which includes technology-based industry growth from both the expansion of Aberdeen Proving Ground and Fort Meade due to the 2005 BRAC decisions. In the Baltimore metropolitan region, total technology-based industry grew by 11.6 percent from 2001 to 2011—so less than half the rate of growth realized by the APG Region in technology-based industry growth.

Part of the significant upside in the APG Region technology-based industry growth was the fact that it did not benefit from the earlier wave of technology industry growth, particularly from the dot.com boom of the late 1990s that peaked in 2001. However, the severity of the dot.com bust followed by the severe 2007 recession meant that national technology-based industry declined by 5.9 percent from 2001 to 2011.

Figure 2: Comparison of Technology-based Industry Job Growth: APG Region, Baltimore Metro and Nation

![Comparison of Technology-based Industry Job Growth](image)

A better way to see the significant growth in technology-based industries is to consider the significant growth of specific technology-based industries in the APG Region compared to the nation. Several technology industries well outpaced national growth from 2001 to 2011, including:

- Engineering services, which increased by 1,050 jobs or 161 percent (so more than doubled in size) in the APG Region from 2001 to 2011, compared to growth of 9.4 percent nationally.

- Space vehicle propulsion, which increased by 717 jobs or 176 percent in the APG Region from 2001 to 2011, compared to a decline of 6.7 percent nationally.

- Analytical laboratory instrument manufacturing, which in 2011 stood at 348, while in 2001 it had no employment in the APG Region. Nationally, this industry declined by 10.6 percent from 2001 to 2011.

- Custom computer programming services, which increased by 333 jobs or 275 percent in the APG Region from 2001 to 2011, compared to an increase of 19.5 percent nationally.

The fact that these leading drivers of job growth among technology-based industries more than doubled in size over the 2001 to 2011 period or emerged from no prior employment in the region points to the strong growth generated by the enhanced military missions found at APG. One possible exception is that the growth in space vehicle propulsion, which is led in the region by ATK Defense Aerospace Group’s activities in Cecil County—one of the world’s top producers of solid rocket propulsion systems and a leading supplier of military and commercial aircraft structures—and so not related to the activities at APG.

**Strong Demand for STEM Workforce Reflects Growth of APG Region’s Technology Hub**

By definition, technology-based industries and military research and development activities require a significantly higher level of well-educated, high-skilled STEM workforce. These STEM fields are found across a wide range of higher education degrees involving physical and life sciences, engineering and engineering technicians, math and computer sciences as well as business and financial operations (finance, accounting, logistics, etc.).

For the APG Region, there is a significant level of demand for STEM workers documented by recent studies and occupational workforce demand projections for the region. This demand for occupations includes both new jobs created as well as the need for replacement workers due to retirement and those that leave specific occupations—or what is commonly referred to as “job openings.”

A 2009 study by Beacon Associates focused on the job openings in military civilian occupations associated with APG organizations across specific degree fields of sciences, engineering, math and computer sciences, and financial and business operations, based on likely retirements over the next decade. This study forecasted average annual job openings in STEM fields of roughly 350
positions over the 2010 to 2019 time frame across all levels of higher education degrees in these specific degree fields. As presented in Table 1, the highest demand is at the bachelor’s and master’s level of degree completion, with smaller annual openings for associate and doctorate degrees.

**Table 1: 2009 Beacon Study Projections of Job Openings by Type of Degree for APG Organizations**

<table>
<thead>
<tr>
<th>Type of Degree</th>
<th>Total Job Openings at APG from 2010 to 2019</th>
<th>Range in Annual Job Openings from 2010 to 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associate Degree</td>
<td>432</td>
<td>35–58 per year</td>
</tr>
<tr>
<td>Bachelor’s Degree</td>
<td>1,618</td>
<td>127–200 per year</td>
</tr>
<tr>
<td>Master’s Degree</td>
<td>1,340</td>
<td>99–217 per year</td>
</tr>
<tr>
<td>Doctoral Degree</td>
<td>163</td>
<td>16–18 per year</td>
</tr>
</tbody>
</table>


The Beacon Study also considers the types of degrees at different levels of higher education that will be required to fill anticipated job vacancies over the 2010 to 2019 period. From this analysis, the importance of financial & business operations, followed by engineering and then computer sciences and math occupations can be seen.

**Table 2: Demand for Degrees at APG Organizations, 2010–2019**

<table>
<thead>
<tr>
<th>Sciences Fields:</th>
<th>Associates Degree</th>
<th>Bachelor Degree</th>
<th>Masters Degree</th>
<th>Doctoral Degree</th>
<th>Total All Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>24</td>
<td>0</td>
<td>2</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Chemistry</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biodefense</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering Fields:</td>
<td>0</td>
<td>477</td>
<td>506</td>
<td>119</td>
<td>1102</td>
</tr>
<tr>
<td>Engineering</td>
<td>477</td>
<td>405</td>
<td>119</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reliability Engineering</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations Research</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systems Engineering</td>
<td>82</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer Science &amp; Math Fields</td>
<td>301</td>
<td>37</td>
<td>64</td>
<td>12</td>
<td>414</td>
</tr>
<tr>
<td>Office Automation</td>
<td>121</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer Technician</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Technology</td>
<td>90</td>
<td>12</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer Sciences</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statistics</td>
<td>n/a</td>
<td>25</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Applied &amp; Computational Math</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

10
<table>
<thead>
<tr>
<th>Business Fields</th>
<th>Associates Degree</th>
<th>Bachelor Degree</th>
<th>Masters Degree</th>
<th>Doctoral Degree</th>
<th>Total All Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Administration</td>
<td>41</td>
<td>1469</td>
<td>308</td>
<td>39</td>
<td>1587</td>
</tr>
<tr>
<td>Financial Management</td>
<td>n/a</td>
<td>24</td>
<td>11</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Financial Management</td>
<td>n/a</td>
<td>15</td>
<td>19</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Logistics</td>
<td>410</td>
<td>119</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Chain Mgmt</td>
<td>n/a</td>
<td>358</td>
<td>48</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Engineering</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graphic Design</td>
<td>n/a</td>
<td>17</td>
<td></td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Logistics</td>
<td>n/a</td>
<td>410</td>
<td></td>
<td>n/a</td>
<td></td>
</tr>
</tbody>
</table>


More broadly across both industry and military civilian requirements, the State of Maryland’s Office of Workforce Information and Performance prepares ten year occupational forecasts detailing annual job openings at the regional level. The most recent ten year time period available is for 2008-2018. On average, there is expected to be 544 job openings in STEM occupational fields for the APG Region (called the Susquehanna Region by the Maryland Labor Market Information Office, and covers Harford and Cecil Counties). These are broken out as follows by major occupations:

- Physical and Life Scientists – 54 average job openings per year from 2008–2018
- Engineers – 115 average job openings per year from 2008–2018
- Technicians – 37 average job openings per year
- Computer & Math – 101 average job openings per year
- Business and Financial – 237 average job openings per year

While most of these job openings reflect the need for replacement workers, there is also expected to be a significant increase in total STEM jobs in the APG Region. The State of Maryland forecasts that for the APG Region the total number of STEM jobs across all employers (industry, state & local government and federal government) will rise from 15,115 in 2008 to 17,160 jobs, an increase of 2,065 or 13.7 percent from 2008 to 2018.

These two separate reports on STEM-related occupational demand suggest that high quality career opportunities will be found in the APG Region, and there will be a need for a range of STEM related skills in the region.

*With Technology Industry Growth, the Commercial Class A Office Market Has Developed in the APG Region*

Not surprisingly, the growth of technology-based industries in the APG Region has spurred commercial real estate development in the region. In particular, since the 2005 BRAC decision, a market for Class A office space has developed in the APG Region. Class A office space stands out...
for technology-based companies because it represents high-quality buildings for professional and technical workers with state-of-the-art systems involving Internet access, power and cooling systems, along with a high-touch finish and good accessibility. Back in 2005, according to CoStar’s real estate database for the APG Region, there was one Class A office building in the APG Region with 161,000 of rentable square feet. By 2012, there were 17 Class A office buildings with 1.425 million of rentable square feet.

Along with the strong growth in Class A office space, the APG Region has also recorded a significant growth in flex space, rising from 2.676 million square feet in 2005 to 3.033 million square feet in 2011. Flex commercial real estate is often used for research and development labs because it combines office space with light industrial uses and is easily adaptable for conversion to dry or wet labs, as well as offering loading docks for ease of receiving or shipping equipment or products.

Table 3 presents the timeline of how space has been added over the years in the APG Region. It shows that while flex space has remained relatively flat in recent years, much of the Class A office space has come on line since 2009. Indeed, over 1 million square feet of Class A office space—or approximately 70 percent of the Class A office space in the APG Region has been completed since 2009.

**Table 3: Timeline of Cumulative Inventory of Total Rentable Building Area (RBA) in the APG Region**

<table>
<thead>
<tr>
<th>Year</th>
<th>Class A Office Space, RBA Sq. Feet</th>
<th>Flex Space, RBA Sq. Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>161,000</td>
<td>2,676,199</td>
</tr>
<tr>
<td>2006</td>
<td>201,000</td>
<td>2,706,531</td>
</tr>
<tr>
<td>2007</td>
<td>301,000</td>
<td>2,867,023</td>
</tr>
<tr>
<td>2008</td>
<td>386,000</td>
<td>2,958,523</td>
</tr>
<tr>
<td>2009</td>
<td>419,446</td>
<td>2,982,523</td>
</tr>
<tr>
<td>2010</td>
<td>731,334</td>
<td>3,033,643</td>
</tr>
<tr>
<td>2011</td>
<td>1,134,453</td>
<td>3,033,643</td>
</tr>
<tr>
<td>2012</td>
<td>1,425,153</td>
<td>3,033,643</td>
</tr>
</tbody>
</table>

Note: Data represent total inventory of existing rentable square feet as of the end of each year. Source: Battelle analysis of CoStar Property database for APG Region (Harford and Cecil Counties)

**Since 2007, Technology-based Industry Growth in the APG Region Declined Sharply with the Severe Recession and Has Largely Stalled in Recent Years**

This impressive growth in technology-based industry over the past decade in the APG Region peaked in 2007, then took a sharp decline over the recession and has largely stalled over the recovery years through 2011. While technology-based industry employment at the national level realized only a modest decline over the 2007 to 2011 period of 2.1 percent, this was not the case in the APG Region. In 2011, technology-based industry employment in the APG Region was well
off its peak of 10,446 jobs recorded in 2007, standing at 8,587 jobs in 2011, a decline of 18 percent over the 2007 to 2011 period. The overall Baltimore metro area, meanwhile, tracked much closer to national trends in its technology-based industry base, recording a 2.9 percent decline over the 2007 to 2011 period.

Figure 3 (below) shows the quick rise of technology-based industry employment in the APG Region through 2007 and then its sharp fall relative to both the Baltimore metro and nation over the 2007 to 2011 period.

**Figure 3: Annual Trends in Technology-based Industry Employment from 2001 to 2011—APG Region, Baltimore Metro and Nation**

The sharp decline in technology-based industry employment in the APG Region largely reflected a fall off in two of the region’s largest technology industries—commercial scientific research and development and engineering services. In 2007, commercial scientific research and development industry reached slightly more than 3,200 jobs, but fell back to just under 1,400 jobs in 2011. This is still a very specialized industry for the APG Region, having nearly double the share of private sector employment in the APG Region than found nationally—and so represents an important economic driver for the APG Region. Engineering services, meanwhile, declined more modestly in the APG Region, from a peak employment of just under 2,000 jobs in 2007 to just under 1,700 jobs in 2011. It also represents a highly specialized industry for the APG Region, with 1.5 times the share of private sector employment in the APG Region than found nationally.
As shown in Figure 4, the other large technology-based industries in the APG Region fared better than commercial scientific research and development and engineering services, with many holding on to the gains realized earlier in the decade and a few actually growing over the 2007 to 2011 period.

**Figure 4: Industry Employment Trends in the APG Region for Leading Technology-Based Industries, 2001–2011**

![Graph showing industry employment trends in the APG Region for leading technology-based industries, 2001–2011.](image)


**Result of Technology-based Industry Stalling is High Vacancy Rates in Commercial Real Estate Market for Class A Office and Flex Buildings**

The strong gains in Class A office inventory, unfortunately, has coincided with the sharp decline and stalling of the technology-based industry growth in the APG Region over the 2001 to 2011 period. The result has been low levels of net absorption of Class A office space in recent years, and a high vacancy rate. In 2012, the vacancy rate for Class A office space in the APG Region stood at 41 percent or 584,000 rental square feet, while net absorption was a mere 72,540 square feet. By comparison, the Baltimore metro area had a vacancy rate in Class A office space of 15 percent.

A similar pattern of high vacancy and low net absorption is also found in the market for flex building space, though at a more modest level. The vacancy rate in the APG Region for flex building space stood at 21 percent in 2012 and net absorption was a negative 44,118 rentable
square feet. By comparison, the vacancy level for flex buildings in the overall Baltimore metro area stood at 11 percent—so roughly half the rate for the APG Region.

Table 4: Year End 2012 Conditions for Class A Office and Flex Building Markets: 
APG Region and Baltimore Metro Area

<table>
<thead>
<tr>
<th>Market</th>
<th># Blgs</th>
<th>Total Rentable Space</th>
<th>2012 Net Absorption</th>
<th>Vacancy Rate</th>
<th>Leasing Rates</th>
<th>Vacancy Rate</th>
<th>Leasing Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A Office</td>
<td>17</td>
<td>1.45 MSF</td>
<td>72,540</td>
<td>41%</td>
<td>$31.02*</td>
<td>15%</td>
<td>$24.53</td>
</tr>
<tr>
<td>Flex Buildings</td>
<td>149</td>
<td>3.03 MSF</td>
<td>(-44,118)</td>
<td>21%</td>
<td>$16.84*</td>
<td>11%</td>
<td>$11.26</td>
</tr>
</tbody>
</table>

Source: Battelle analysis of CoStar Property database for APG Region (Harford and Cecil Counties).

This weakness in the commercial real estate market for Class A office and flex space is also a growth opportunity for the APG Region. It means there is available space that can be occupied immediately, which is often critical for attracting industry tenants. If the APG Region had a 15 percent vacancy rate—closer to the overall market conditions found in the Baltimore metro area—it would result in an additional 559,259 rentable square feet occupied and an additional 2,796 jobs gained in the region (assuming 200 rentable square feet per job).

This suggests that the development of physical space is less of a priority for advancing a university research park initiative in the APG Region then identifying and pursuing opportunities for growth in technology-based industry development and university collaborations in the APG Region.
Development Challenges and Approaches for Advancing the APG Region’s Technology Hub

The context of the APG Region’s existing technology hub—across its technology industries, workforce and commercial real estate—suggests a region that over the last decade has significantly expanded and is reaching critical mass. But it is a region that faces key challenges going forward.

To better understand these challenges and to identify the specific development approaches that offer promise in addressing them, Battelle examined more closely the dynamics behind the assessment of the APG Region’s technology industry, STEM workforce and commercial real estate position. This involved focused outreach to industry and universities, both in the region as well as outside of the region with connections to APG, as well as with APG leadership. It also required further discussions with economic development leaders in the APG Region and universities seeking to serve the APG Region.

Battelle’s further outreach and additional analysis point to three inter-related challenges confronting the APG Region which must be addressed as part of the University Research Park Initiative. These three development challenges are:

• Growing the regional technology industry base in Aberdeen

• Advancing workforce development to meet the demands by technology industry and APG organizations

• Fostering “live, work, play” development to create a higher value physical environment to align with the commercial Class A office developments taking place in the region.

Honing in on these specific challenges, it is possible to identify specific development approaches that can help define the program elements and activities for the University Research Park Initiative.

Growing the Regional Technology Industry Base in Aberdeen

The technology-based industry trends examined in the previous section make clear that a focused effort is needed to reignite the APG Region’s technology development. A closer examination of the dynamics of technology industry growth in the APG Region suggests there remain significant opportunities to further engage technology companies with connections to the military organizations found at APG. At the same time, there is a need to promote more home-grown technology industry development through innovation.
Opportunities for Further Engaging Technology Companies with Connections to Aberdeen Proving Ground

The strong growth in the technology industry base in the APG Region through 2007 was driven by the enhanced military missions and activities associated with the APG, particularly associated with the relocation of the Army’s C4ISR (command, control, communication, computers, intelligence, surveillance & reconnaissance) center of excellence to APG. The Harford County Office of Economic Development reports that 97 new defense contractors have relocated to the county since the 2005 BRAC decision, bringing the total number of defense contractors to 137. These defense contractors are among the leading technology firms in the world and their growing presence is transforming the local economy around the Aberdeen Proving Ground.

But that growth in defense contractors has significantly slowed down in the APG Region despite the fact that federal procurement associated with APG activities rose from $3.5 billion in FY 2005 to $15.5 billion in FY 2012.5

One group of technology companies linked to military missions found at APG that has limited presence in the region is emerging, small technology businesses receiving Federal Small Business Innovation Research (SBIR) awards. The SBIR program encourages small businesses to undertake technology commercialization by requiring Federal agencies with extramural research and development (R&D) budgets that exceed $100 million to allocate 2.5 percent of their R&D budget to the SBIR program. Each Federal agency involved in the SBIR program then issues request for proposals on topics reflecting their technology needs and interests and competitively awards SBIR grants based on the technical merits and commercialization potential in a phased approach. The Army operates an autonomous SBIR program, within the framework of the DoD SBIR program, which seeks to support Army-specific goals associated with its research and development organizations.

Battelle identified 399 SBIR awards issued by key organizations found at the Aberdeen Proving Ground, including the Army Research Laboratory’s Weapons & Materials Research Directorate (ARL-WMRD), Communications-Electronics Research, Development, and Engineering Center (CERDEC), Edgewood Chemical Biological Center (ECBC) and Army Testing and Evaluation Center (ATEC) over the period 2010 to 2012. No companies located in the APG Region received any of the Army SBIR awards identified and only 18 companies were located in Maryland. There were only four companies located in the APG Region that received SBIR awards over the 2010 to 2012 period from any federal agency and none from the Army. So this base of out-of-state SBIR recipients represents a significant base of emerging technology companies with connections to APG that could potentially benefit from being located in the APG Region.

To learn more, Battelle was able to get feedback from 35 SBIR awardees from ARL-WMRD, CERDEC, ECBC and ATEC located outside of Maryland on their interest in the APG Region and their requirements for locating activities in the APG Region. Eleven of the 35 SBIR companies did express an interest in having closer proximity to APG. These 11 companies come from across the

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5 Advanced Public Briefing to Industry, (APBI), APG Dec 12’ FY05 was what was used with State Economic impact studies.
U.S., including Massachusetts, California, Texas, Maine, New York, New Jersey and Oregon. The leading reason for the interest of these eleven companies was to enhance APG client relationships. Five of the 11 companies also expressed an interest in accessing specific testing and prototyping lab facilities at APG.

To attract these SBIR companies linked to APG, the key issue that emerged from Battelle’s interviews addressing the particular space needs of these companies. This includes offering flexible leasing terms for short term stays at affordable leasing rates and with some availability of classified space. A number of the companies also raised concerns about accessing qualified workers, but this is more of a longer term need as they would grow in the region.

So, there is clearly an opportunity to target emerging, small technology businesses involved in SBIR activities associated with military organizations at APG.

More broadly, though, it appears that the APG Region can more broadly increase the presence of defense contractors associated with military missions at APG. In the case of the relocation of the Army’s C4ISR (command, control, communication, computers, intelligence, surveillance & reconnaissance) center of excellence from Fort Monmouth, the issue is not about getting defense contractors to locate in the region, but more about growing the base of work they do in the region.

With the relocation of the Army’s C4ISR center of excellence to APG, many of the defense contractors have split their work between the APG Region and the Fort Monmouth Region. An analysis of Hoover’s database of company establishments reveals many examples of firms with significant operations in both regions include Booz Allen Hamilton, CSC, DSCI/D&S Consultants, Engineering Solutions and Products, General Dynamics, Lockheed Martin, Millennium Services, Northrop Grumman and SAIC/Leidos. While it is difficult to see how defense contractors allocate the work they do on specific defense contracts between the Aberdeen and Monmouth Regions, it is possible to track overall employment levels of technology industries involved in defense-related work across these two regions. Back in 2001, the Monmouth Region employed 17,957 workers in defense related industries. By 2011, this employment base of defense-related technology industry in the Monmouth Region was smaller, but still quite sizable at 14,870—which stands more than two times the 5,795 workers employed in these same defense-related technology industries in the APG Region in 2011. Battelle’s discussions with major defense contractors found in both regions suggests that much of the client-facing work is undertaken directly in the APG Region, but more intensive technology activities are still conducted in locations outside of the APG Region.

So, there remains a significant opportunity to expand operations of existing defense-related technology companies in the APG Region, especially connected to the Army’s C4ISR activities.

In the case of the relocation of additional Army activities in chemical and biological research and development at APG, particularly with the relocation of the Army’s activities involved in Medical Research Institute of Chemical Defense (USAMRICD) and the Joint Program Executive Office for

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6 Defense-related technology industries include engineering services, commercial scientific R&D services, space vehicle propulsion, computer system design, customized programming services, testing laboratories and analytical lab instrument manufacturing.
Chemical and Biological Defense JPEO-CBD), there has not been a strong growth of defense contractor activities in the APG Region. Part of this is due to the fact that these activities moved to APG from Northern Virginia, closer in proximity to APG. Given the potential disruption to business operations and the closer proximity, defense contractors associated with the chem/bio activities that have relocated, have decided not to make the move to the APG Region. Attracting these chem/bio defense contractors will require addressing workforce issues and creating a high-quality working environment as explored further below.

**Another factor relating to the fall off in technology industry growth since 2007 in the APG Region is the lack of home-grown technology companies.** While there are notable home-grown technology company successes in the APG Region, such as Safenet, Survive Engineering, and CCL Biomedical, the overwhelming evidence is a lack of home-grown technology venture development. Since 2003, there have been only four venture capital backed companies located in the APG Region. And, the paucity of emerging, small businesses receiving SBIR awards in the APG Region has already been noted.

Interestingly, this lack of home-grown technology companies does not reflect the lack of residents in the APG Region involved in creating intellectual property. Battelle examined patent applications and awards over the 2001 to 2012 period to identify inventors located in the APG Region. Altogether there were 1,328 patent applications and awards to inventors living in the APG Region. But few of these patent applications and awards were assigned to businesses in the APG Region. Instead the largest holders of these patents from inventors living in the APG Region were Black & Decker, DuPont, and Gore.

This strong base of local inventors residing in the APG Region should be viewed as an economic development asset. Particularly of note are the substantial number of patents not assigned to existing companies. This includes 214 patent applications and awards assigned to individuals living in the APG Region rather than specific companies and another 44 assigned to nearby universities, including Johns Hopkins University, University of Maryland Baltimore County and the University of Delaware. In addition, there were another 91 patent applications and awards of APG Region residents associated with the Army. These patents assigned to individuals, universities and the Army as opposed to an existing company require further technology commercialization activities that could result in the formation of new company start-ups. With the inventors living in the APG Region, this offers an opportunity for home-grown technology industry development since it is demonstrated that most start-ups are located near to where their founders reside.

To summarize, the more in-depth examination of dynamics around technology industry development point to a number of specific actions for growing the regional technology industry base stand out:

- Targeting Federal Small Business Innovation Research (SBIR) grant recipients funded by APG organizations;
- Increasing the presence of defense contractors working on C4ISR and Chem/Bio activities for the Army; and
• Advancing technology commercialization by building upon the base of inventors living in the APG Region.

These suggested actions will be further developed in the next section of the report.

*Advancing workforce development to meet the demands by technology industry and APG organizations*

The significant level of demand for STEM workers documented by recent studies and occupational workforce demand projections for the APG Region reflects the rising level of technology activities for the military organizations housed at APG as well as the broader industry base, much of which is found among defense-related contractors expanding and locating in the region.

There appears to be ample resources to address this demand for STEM-related talent from within the APG Region and within close proximity to the region. While the APG Region does not have a main campus of a university or 4-year school within its borders, it is situated close to many highly-regarded universities. Within a 90-minute drive of Aberdeen Proving Ground, there are 42 universities in Maryland, Delaware, Pennsylvania and New Jersey conducting research activities and offering bachelor and graduate level degrees in computer sciences, engineering, material sciences and life sciences. The level of talent generated each year by universities between 45 and 90 minutes from APG is significant, representing more than four percent of all graduates with a bachelor’s degree and higher across all the technology focus areas identified at APG in the 2012 study on *Accelerating University Talent Development and Research & Development Collaborations at Aberdeen Proving Ground*. Typically in each technology focus area there are more than 1,000 graduates annually, suggesting a strong potential for meeting the STEM workforce demands in the APG Region (see Table 5).

Most promising is the growing presence of activities in the APG Region of these nearby universities connected with advancing the region’s STEM talent pipeline development. One leading effort is being advanced by Towson University in partnership with Harford Community College. This effort will offer a seamless transfer for community college students in the APG Region to pursue a four-year undergraduate degree upon completion of their associate’s degree. A new Towson University building is being constructed on the grounds of Harford Community College to facilitate this partnership. Once the new building is completed, Harford Community College students will be able to enroll in specific degree programs offered by Towson University in the APG Region, including business administration and information technology.

Another notable effort is the Regional Cybersecurity Education Initiative funded by the National Science Foundation involving the University of Delaware in partnership with Harford Community College (HCC) and Delaware Technical and Community College (DTCC). This effort advances a new 2+2 Program to allow community college graduates in cybersecurity from HCC and DTCC to transfer to the University of Delaware to complete a bachelor’s degree in computer and information sciences or computer engineering. It also expands cybersecurity courses and establishes a minor in cybersecurity at the University of Delaware.
Table 5: University Talent Generation within a 45 to 90 Minute Commute of Aberdeen Proving Ground Aligned with Leading Technology Focus Areas Found at APG

<table>
<thead>
<tr>
<th>Technology Focus Areas Identified at APG</th>
<th>Sensors, Electronics and Communications</th>
<th>Information Technology and Software Development</th>
<th>Materials Research</th>
<th>Pathogen Detection and Countermeasures</th>
<th>Testing &amp; Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Degrees, 2010</td>
<td>Universities in Broad Aberdeen Region</td>
<td>1434</td>
<td>2569</td>
<td>790</td>
<td>1387</td>
</tr>
<tr>
<td></td>
<td>Maryland Universities in Broad Aberdeen Region</td>
<td>783</td>
<td>1523</td>
<td>297</td>
<td>662</td>
</tr>
<tr>
<td>Share of U.S. Degrees, 2010</td>
<td>Universities in Broad Aberdeen Region</td>
<td>4.2%</td>
<td>4.3%</td>
<td>13.7%</td>
<td>6.2%</td>
</tr>
<tr>
<td></td>
<td>Maryland Universities in Broad Aberdeen Region</td>
<td>2.3%</td>
<td>2.6%</td>
<td>5.2%</td>
<td>3.0%</td>
</tr>
</tbody>
</table>

Beyond nearby universities and growing STEM-related talent pipeline development initiatives within the APG Region is the presence of a highly educated and skilled resident workforce in the region. Slightly more than four out of ten working age residents of the APG Region have a post-secondary degree, and one in four working age residents in the region work in STEM related fields of computer, engineering and scientific occupations or management, business and financial occupations.

The majority of this highly educated and skilled workforce is already put to work in jobs found in the APG Region. Still, there are significant numbers of these highly educated and skilled workers who commute out of the region for work. The existing number of resident workers in STEM-related occupations who commute would more than address the job demand for STEM-related workers expected over the next ten years. As shown in Table 6, there are 5,838 computer, engineering and scientific workers residing in the APG Region who commute outside of the region for work and 14,828 management, business and financial workers who commute outside of the region for work.
Table 6 College Educated and STEM Occupations for APG Region Residents by Place of Work

<table>
<thead>
<tr>
<th></th>
<th>Work in Region</th>
<th>Work Outside of Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Educated</td>
<td>40,257</td>
<td>34,181</td>
</tr>
<tr>
<td>AA Degree</td>
<td>9,750</td>
<td>6,672</td>
</tr>
<tr>
<td>BS Degree</td>
<td>18,337</td>
<td>19,803</td>
</tr>
<tr>
<td>Grad/Prof Degree</td>
<td>12,170</td>
<td>7,706</td>
</tr>
<tr>
<td>Selected High-skilled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupations</td>
<td>23,327</td>
<td>20,666</td>
</tr>
<tr>
<td>Mgt, Bus, Financial</td>
<td>15,298</td>
<td>14,828</td>
</tr>
<tr>
<td>Computer, Eng &amp; Science</td>
<td>8,029</td>
<td>5,838</td>
</tr>
</tbody>
</table>

Source: Census America Community Survey Public Use Microdata Sample.
Note: Includes Cecil, Harford and Kent Counties

Challenge of Connecting Talent Accessible to the APG Region to Workforce Needs of Technology Companies

The critical question is how to connect and ensure the transferability of skills from both the significant base of new university graduates and resident workers. In discussions with technology companies in the APG Region, this is clearly an issue for those mid-to-small firms who have recently located in the APG Region.

Unlike technology firms that have been located in the APG Region for many years, these new mid-to-small firms lack the extensive connections to local area residents as well as to the universities close by to the APG Region. As an executive at one of the home-grown, mid-sized technology firms in the APG Region explained in correspondence with Battelle: “As a long-time local company in the APG Region, we tap our broad network of in-state and out-of-state university sources and through our local network of students going to school out of the area but wanting to come back here to work—not all of the BRAC-related technology companies moving to the APG Region have these networks established here.” Discussions with one mid-sized defense-related technology firm suggested that unfilled technology positions were costing the firm millions of dollars in contract revenues.

Larger defense-related technology companies due to their broader national resources have been able to find the high-skilled workers, with security clearances, that they need to operate in the region. But again, many are only undertaking client facing activities in the APG Region and not establishing the technical groups doing deeper off-site research and development activities related to their military projects with APG organizations in the region.

This issue of access to skilled workforce has been noted by the NBC Industry Group whose members based in Northern Virginia have not followed the expansion of Chem/Bio activities at
APG. In meetings with APG and Harford County officials, representatives of the NBC Industry Group cited a current inability to hire personnel with the appropriate education, skills and credentials to meet the Chem/Bio mission as an inhibitor for them relocating to the APG Region. For the NBC Industry Group, deeper skills in project management, government contracting, supply chain and other management related skills oriented towards doing business with the military were of particular concern.

So, to grow the technology industry presence in the APG Region more must be done to realize the potential access to new graduates from nearby universities and the ability to tap local residents with STEM-related skills by establishing meaningful mechanisms to connect and to advance transferable skills for defense-related activities.

Today this issue is primarily one that is holding back the growth of the technology industry base in the APG Region. The projected hiring by APG organizations has been slowed down by budget limitations and lower-than-expected retirements from the many DoD workers who are eligible to retire. This situation will change in the future—if only due to a flood of retirements taking place—and then if adequate solutions are not in place to tap potential pools of talent, may become a constraint for military organizations at APG.

Demand for Ongoing Education and Training of the APG Workforce

But it is not just finding STEM-related workers to fill the job demand that is a critical workforce need in the APG Region; it is also the ability to meet the continuing education and training needs of the workforce that stands out. This is particularly of critical importance to the military organizations located at APG.

The 2012 study on Accelerating University Talent Development and Research & Development Collaborations at Aberdeen Proving Ground identified from discussions with senior staff at APG the critical importance of having access to post-baccalaureate and master’s level education resources at APG. A common hiring practice at APG is to bring on well-qualified, recent bachelor’s degree graduates with the expectation that they will pursue advanced education and training, including for many their master’s degree, while working at APG. Moreover, in a tight budgetary climate, being able to cross-train existing DoD workforce has taken on more importance at a time when doing more with less is being demanded.

A key issue regarding this post-baccalaureate and master’s level education for APG organizations is that it needs to go beyond simply book learning. What is missing in many distance learning approaches is the hands-on learning and application needed for advanced skills development. A key interest raised by several of the senior staff interviewed is having applied post-baccalaureate and master’s level courses and programs available that couples teaching basic methods with research projects involving topics relevant to the organizations at APG. One senior staff person referred to this as creating “journeyman” scientists and engineers.
An excellent example is the recent development of a Master of Science and an associated Post-Baccalaureate Certificate program in supply chain management by Towson University. This integrated program is applied, with students completing a capstone supply chain management project. Because the program is integrated and does not focus only on one aspect of supply chain management, such as transportation or procurement, program graduates will be prepared to move into positions in many fields vital to military bases, including supply chain, purchasing, procurement, and logistics manager positions. Towson University has been offering these supply chain management courses at APG with enrollment reaching over 60 DoD civilian workers at APG. The development of the program was partially funded by a grant from the Maryland Higher Education Commission (MHEC), made through its BRAC Higher Education Investment Fund. This program funds high-impact projects meeting the needs of the individuals and communities affected by BRAC.

Going forward, this type of integrated post-baccalaureate certificate and master’s program is needed at APG in engineering and information technology fields, particularly cybersecurity and system of systems engineering. These engineering and information technology fields will require more specialized instructional laboratories in close proximity to APG than found in the case of supply chain management. These instructional laboratories in close proximity to APG might offer a platform for more applied research activities to be done in concert with universities and defense contractors.

A critical limiting factor in offering these more integrated post-baccalaureate and master’s degree programs is the lack of coordination across APG organizations that results in missed opportunities to address significant skill needs across APG organizations. As might be expected given the diversity and number of organizations at APG, each organization has been pursuing education and training for itself. The result is that there is no listing of education and training activities taking place across APG organizations to help in coordination and instead there has been a mushrooming of ad-hoc and limited engagements with universities that lack an integrated program focus. The missing ingredient has been a mechanism to help sort out the common skill needs across APG organizations. Most promising is a new initiative being advanced to create an educational partnership between APG and the APG Region’s University Center at HEAT in coordination with the Northern Maryland Higher Education Advisory Board to establish a clearinghouse function for education and training to better match needs/requirements of APG with educational providers. The University Center is a State designated Regional Higher Education Center and is located within 5 miles of APG. It is strongly supported in the community by Harford County Government, APG and Harford Community College. The University Center is poised to undertake a significant expansion of the facility to accommodate expanded degree programs and course offerings in the future. The University Center Staff has played a vital role in working with APG leadership on this initiative. This effort is still unfolding, but is critical to be advanced for APG organizations to raise the bar on their education and training activities and create a high quality DoD workforce for the future.
Similarly there is a need to grow the next generation of DoD research scientists for those organizations at APG more involved in basic research and technology concept formulation requiring doctoral level skills—such as the Edgewood Chemical and Biological Center and the ARL’s Weapons Materials Research Directorate. In this case, it is not the delivery of integrated programs that matter, but exposing promising doctoral and post-doctorate researchers to the particular significant issues that DoD faces and recruiting a cadre of these high level students to pursue their research careers in military labs.

The best success in actually recruiting these doctoral level students upon graduation depends upon having them work closely with APG as students or upon graduation. Still, bringing doctoral and post-doctoral fellows into existing APG facilities is difficult to manage on a significant scale so alternative approaches for creating that proximity need to be explored, and might be addressed by having them co-located at nearby university sites for advanced applications development used in master’s level education programs or at other designated collaboration research centers. This might also enable the greater use of summer or short-term research project activities with doctoral students as well as sponsoring post-doctoral fellows at APG.

This strong ongoing demand for integrated post-baccalaureate and master’s degree programs, along with the need for more interaction with doctorate-level researchers, points to the importance of having university resources in close proximity to APG.

**Fostering mixed use, transit-oriented place-based development in the APG Region**

While the APG Region has been successful in creating a commercial real-estate market for technology-oriented Class A Office and Flex Building space in close proximity to APG, a closer examination reveals a scattered development of technology-oriented office parks along Route 40 and Route 22 (see Figure 5). What is particularly missing is high quality mixed-use development in the APG Region. As it now stands, outside of the Water’s Edge Corporate Center, the technology-oriented office parks in the APG Region offer few amenities and access to housing (see Table 7).
Figure 5: APG Region’s Class A Office Park Market Scattered in Office Parks Along the Routes 40 and 22 Corridors
Table 7: Limited Mixed Use Development Associated with Class A Office Park Developments in the APG Region

<table>
<thead>
<tr>
<th>Office Park Name</th>
<th>Building Stage</th>
<th>Square Footage</th>
<th>Percent Occupied</th>
<th>Building Type</th>
<th>Mixed-Use</th>
<th>Amenities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water’s Edge Corporate Center</td>
<td>Existing</td>
<td>406,640</td>
<td>82.1%</td>
<td>Office</td>
<td>Yes</td>
<td>Shopping, Restaurants, Housing, Convention Center (under construction)</td>
</tr>
<tr>
<td>The GATE at Aberdeen Proving Ground</td>
<td>Existing/Proposed</td>
<td>750,088</td>
<td>77.5%</td>
<td>Office/Flex</td>
<td>Partial</td>
<td>None</td>
</tr>
<tr>
<td>HEAT Business Center</td>
<td>Existing</td>
<td>170,415</td>
<td>63.7%</td>
<td>Flex</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>Riverside Corporate Center</td>
<td>Existing</td>
<td>74,820</td>
<td>89.8%</td>
<td>Flex</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>Bel Air South Professional Center</td>
<td>Existing</td>
<td>67,272</td>
<td>44.3%</td>
<td>Office</td>
<td>Partial</td>
<td>None</td>
</tr>
<tr>
<td>Crossroads Commerce Center</td>
<td>Existing</td>
<td>165,775</td>
<td>92.8%</td>
<td>Flex</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>Box Hill Corporate Center</td>
<td>Existing</td>
<td>191,570</td>
<td>89.5%</td>
<td>Office</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>North Gate Business Park</td>
<td>Existing</td>
<td>291,339</td>
<td>12.4%</td>
<td>Office</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>Fieldside Commons</td>
<td>Existing/Proposed</td>
<td>480,000</td>
<td>0.0%</td>
<td>Office</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>Aberdeen Corporate Park</td>
<td>Existing/Proposed</td>
<td>265,900</td>
<td>0.0%</td>
<td>Office</td>
<td>Partial</td>
<td>None</td>
</tr>
</tbody>
</table>

This scattered and lack of mixed use development is in sharp contrast to emerging best practices and makes the APG Region’s commercial real estate market less competitive than other developments in nearby real estate markets, such as White Marsh and ongoing development of the University of Delaware’s STAR Campus at the former Chrysler site. In White Marsh, already an established commercial real estate market for the Baltimore metropolitan area with ready access to a large retail mall, a “new urbanism” development plan has been announced to build 1,700 housing units near a mixed-use business park as part of the 1,000-acre Baltimore Crossroads @95 development.7 The University of Delaware’s development of its 272-acre STAR Campus will seek to attract research and development partnerships in energy, environment, national security/defense, and health and life sciences through providing modern mixed-use land uses, which may include retail and housing, as well as a new train station.8

These efforts at White Marsh and the University of Delaware’s STAR Campus reflect national trends in the physical development of university research parks towards incorporating mixed-use, live-work-play environments. The beginnings of these mixed-use developments were found in many of the new university research parks brought on line over the last decade, such as

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7 Alison Knezevich, “County touts ‘new urbanism’ in development plan for Route 43 in White Marsh,” Baltimore Sun, April 24, 2013
8 See STAR Campus Development Plans at http://www.udel.edu/star/downloads/STC_Executive_Summary.pdf
Centennial Campus (affiliated with North Carolina State University), Mission Bay (affiliated with the University of California San Francisco) and the Fitzsimmons Life Science District in Colorado (affiliated with the University of Colorado’s academic medical center). A soon-to-be-released benchmarking of university research park developments by the Association of University Research Parks and Battelle, will document this growing trend towards strategically planned “live-work-play” developments to offer businesses a high-value environment that creates the dynamic, lifestyle communities that attract high-skilled, technology professionals to a region.

These trends in university research park developments towards increased mixed-use development are in line with broader real estate trends towards creating the physical environments that capture the characteristics that drive rising urban stars as identified in the ongoing World Winning Cities research program by Jones Lang LaSalle of LaSalle Investment Management.⁹

- **Being Technology Rich:** Technology hubs—whether Raleigh-Durham or Austin, Texas or Helsinki, Finland—with high-value, knowledge-intensive industries linked to strong research and educational infrastructures—are seen as key to offering the quality of life needed to retain and attract highly educated knowledge workers.

- **Resort/Urban Hip with Urban Sustainability:** The quality of the urban environment will become a more important determinant of city competitiveness, particularly in mature cities. Cities will be making substantial efforts to improve their urban landscapes and their cultural and entertainment offerings, recognizing that they are the key ingredients in attracting and retaining well-educated knowledge workers.

In the future, university research parks may be transformed into broader districts creating the vibrant industrial commons for technology-based economic development that is envisioned as key for regional competitiveness, as highlighted by Harvard professors Gary Pisano and Willy Shih in their work on restoring American competitiveness.

**Without tackling the issue of mixed use development in the APG Region, especially along the Route 40 and 22 corridors, the region’s efforts to promote the growth of technology industry development and to attract STEM-related workforce will be hampered.** If the Class A office development in the APG Region were undertaken in a more cohesive manner around a particular site, not only would it stand out more as a signature technology park it would be easier to advance mixed use development as is being done across university research parks throughout the U.S. and Canada. Given the scattered nature of Class A office space development in the APG Region, it may be more appropriate to think of the region in terms of a broader technology district that spans efforts to create mixed-use development nodes serving existing Class A office space developments and future Class A office space developments in the future.

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⁹ See [http://www.joneslanglasalle.com/Pages/WorldWinningCities.aspx](http://www.joneslanglasalle.com/Pages/WorldWinningCities.aspx)
Summary – An Integrated Program for Advancing the University Research Park

A further analysis of the APG Region’s technology industries, innovation potential, workforce and talent and commercial real estate point to a set of significant assets to build upon and gaps to address across the development challenges for advancing the APG Region’s technology hub in the years ahead. These assets and gaps are summarized in Table 8 below:

Table 8: Summary of Assets and Gaps in APG Region’s Technology Development

<table>
<thead>
<tr>
<th>Key Factor</th>
<th>Assets To Build Upon</th>
<th>Gaps to Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development Challenge: Growing the Technology Industry Base in the APG Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology Industry</td>
<td>Major gains in tech industry for APG Region</td>
<td>Tech industry growth stalled in APG Region after 2007</td>
</tr>
<tr>
<td></td>
<td>Increased presence of C4ISR related defense contractors</td>
<td></td>
</tr>
<tr>
<td>Innovation</td>
<td>Many inventors living in APG Region</td>
<td>Few companies in APG Region assigned patents, winning SBIR awards from APG organizations and venture-backed</td>
</tr>
<tr>
<td></td>
<td>Significant base of SBIR and patent activity associated with APG tenant organizations</td>
<td></td>
</tr>
<tr>
<td>Development Challenge: Addressing Workforce Issues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STEM Occupational Demand</td>
<td>Strong projected demand for high-skilled workforce across range of skills from scientists to engineers to math and computer sciences to business and financial operations.</td>
<td>Many of the newer and mid-to-small tech companies finding it hard to fill high-skilled jobs and not connected to top talent being generated</td>
</tr>
<tr>
<td></td>
<td>Key need for integrated, hands-on post-baccalaureate and master’s programs to support APG – C4ISR, Chem/Bio, Business/Financial</td>
<td></td>
</tr>
<tr>
<td>STEM Occupational Supply</td>
<td>Highly educated/skilled residents in region (42% AA degree or higher)</td>
<td>Many of the high educated/skilled residents commute</td>
</tr>
<tr>
<td></td>
<td>Significant top talent generation of new university graduates just outside of APG Region</td>
<td>Hard for universities to aggregate demand and serve needs of APG organizations and contractors</td>
</tr>
<tr>
<td></td>
<td>STEM activities in region growing new pipeline initiatives – Towson-HCC new 2+2 facility; UDel-HCC-Cecil-DTCC Regional Cybersecurity Education Alliance</td>
<td></td>
</tr>
<tr>
<td>Development Challenge: Fostering a High-value Place Strategy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial Real Estate</td>
<td>Established significant Class A Office &amp; Flex Market around APG</td>
<td>Class A Office and Flex Market is scattered across Routes 40 and 22 – lacks sense of place</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High vacancy rates found in Class A and Flex Limited mixed use development</td>
</tr>
</tbody>
</table>
While each development challenge requires focused attention, it is important to recognize how inter-related these development challenges are and the importance of working on each simultaneously in order to successfully advance the APG Region’s technology hub in the years ahead. For instance, while there are specific targets of opportunity for growing the technology industry base in the APG Region, particularly outreach to SBIR companies and expanding the activities of existing defense-related technology firms that have located in the region in recent years, these business development efforts depend upon tapping the potential pools of STEM-related workforce and having more attractive and competitive mixed-use real estate developments in the region. Similarly, sustaining workforce development will not succeed without ensuring growing demand for STEM-related jobs and having the high-value, mixed use developments that technology professionals seek. And, advancing mixed use development in the region depends upon having strong demand by growing companies seeking space and growing pools of technology professionals. So the best way to conceive of the challenges is as inter-related program activities and not stand alone initiatives as depicted in Figure 6.

**Figure 6: Inter-related Challenges for Growing the APG Region’s Technology Hub**

These inter-related challenges are also shaped by the ongoing needs of the military organizations at APG. Of immediate importance is the need for continuing education and training involving integrated post-baccalaureate and master’s programs, but APG needs to move forward the planned educational partnership with the University Center at HEAT and the Northeast Maryland Higher Education Advisory Board (NMHEAB) to better coordinate APG needs and improve the engagement with universities in meeting these needs. In light of the demand for hands-on instruction and close linkages with applied research and development, there is a clear need for university activities in close proximity to APG—but this will only take place if APG’s needs can be aggregated so that university programs can be sustained. In the future, as pace of retirements pick up, the challenge of recruiting a top flight STEM workforce at APG will likely become an issue. Having in place the types of workforce mechanisms to tap potential pools of graduates at nearby universities as well as residents working in STEM related fields who commute to jobs outside of the region will be critical, along with having the attractive mixed-use developments that technology professionals seek in communities in which they choose to live.
Recommended Program, Governance and Funding Approaches

The results from the close examination of the Aberdeen Region’s position in technology-based economic development over the past decade suggests that there have been many gains for the region that can be built upon, but significant gaps persist and need to be addressed. The three development challenges identified for the Aberdeen Region—growing the regional industry base, addressing workforce development and fostering “live, work, play” development—stand as strategic priorities, which if effectively addressed will enable the region to reignite the growth of its technology hub.

To advance these strategic priorities, a focused set of program activities were identified tailored to the specific assets and gaps in technology development found in the Aberdeen Region and finalized in consultation with the Project Advisory Committee. These program activities include:

- Targeting outreach marketing to companies doing business with APG organizations, including SBIR companies and those involved in C4ISR and Chem/Bio initiatives.
- Establishing commercialization services to promote homegrown technology development among the base of inventors residing in the Aberdeen Region.
- Supporting the proposed educational partnership with APG to aggregate and serve as a clearinghouse and program development facilitator.
- Advancing specialized institutes in high priority skills development and R&D areas requiring university collaborations, such as cybersecurity and chem/bio defense.
- Developing a talent connector to graduates of nearby universities and high-skilled residents for meeting the demands for STEM-related workforce.
- Advancing transit-oriented mixed use development hubs for growing the Aberdeen Region’s Technology District.

Together, these six program activities can serve as the basis for a comprehensive University Research Park Initiative for the Aberdeen Region recognizing that the Aberdeen Region is evolving more along the lines of a technology district with technology hubs rather than a traditional contiguous research park. Part of this reflects the way APG is organized with two physically separated areas separated by six miles comprising one Post, and part of this reflects the pattern of scattered development that has taken place in the region, particularly across the Route 40 and 22 corridors.
The development of these recommended program activities have been guided by several key principles, namely:

- Program activities should seek to leverage broader partnerships across military, state, university, industry and county resources;
- Best practices should inform the design of program activities in a way tailored to meet the circumstances found in the Aberdeen Region;
- Design of these program activities should inform key decisions related to governance and funding approaches, so that form follows function; and,
- Seek to engage private sector and APG organizational participation and leadership in steering the program activities, while ensuring dedicated resources are identified to implement and work collaboratively with private sector and APG organizations.

Table 9 summarizes the program development activities across their governance, operations, funding approaches and best practices examples.

**Table 9: Program Development Activity Summary**

<table>
<thead>
<tr>
<th>Program Activities</th>
<th>Governance</th>
<th>Operations</th>
<th>Funding Approaches</th>
<th>Best Practice Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Targeted outreach marketing to companies doing business with APG (i.e., SBIR cos, C4ISR cos, NBC Industry Group)</td>
<td>Economic Development Advisory Board</td>
<td>Primary economic development function</td>
<td>Existing economic development funding</td>
<td>Dayton Development Corporation</td>
</tr>
<tr>
<td>Commercialization services to APG Regional Inventors</td>
<td>URP Board to oversee &amp; advise on activities, funding</td>
<td>Economic development function for staffing to do outreach, generate network, solicit proposals, create mentoring</td>
<td>Need an ongoing source of public funding, Seek support from angel investors/serial entrepreneurs</td>
<td>Oklahoma’s Innovation to Enterprise (I2E) – OKC and Tulsa primarily Innovate Arkansas</td>
</tr>
<tr>
<td>Educational Partnership Clearinghouse</td>
<td>APG Organizations with participation of University Center @HEAT / NMHEAB</td>
<td>University Center at HEAT</td>
<td>APG and local with specific project support from State</td>
<td>Suburban MD Technology Council</td>
</tr>
<tr>
<td>Advancing Specialized Institutes for Cybersecurity and Chem/Bio University Collaborations</td>
<td>URP Board in conjunction with APG Organizations</td>
<td>Identify university lead with guidance of APG Possibly house as part of CERDEC technical support lead</td>
<td>APG, with specific project support from State and local government sources and industry</td>
<td>Air Force Institute of Technology</td>
</tr>
<tr>
<td>Program Activities</td>
<td>Governance</td>
<td>Operations</td>
<td>Funding Approaches</td>
<td>Best Practice Examples</td>
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<tr>
<td>Talent Connector for Students and Residents</td>
<td>University Center @HEAT / NMHEAB</td>
<td>Economic development function given need for close working relationship with companies Possibly tap university relationships of STEM Pipeline and Clearinghouse</td>
<td>Local with leveraging industry support</td>
<td>Students – Ohio Third Frontier, Massachusetts Life Sciences Center Existing Workforce: Pittsburgh Digital Greenhouse, Iowa, Oklahoma</td>
</tr>
<tr>
<td>Advancing transit-oriented mixed use development hubs for growing the APG Region’s Technology District.</td>
<td>Each of the planned TOD developments at Aberdeen and Perryville are being advanced by their local governments in broader partnerships with county, state and private sector. In the future, county and local government units and owners within the APG Technology District should be engaged and consider forming a public-private partnership collaboration.</td>
<td>Each unit of government and private developer would continue to be responsible for their own activities. Over time, as coordinated activities and shared services grow a more centralized set of operations might be advanced.</td>
<td>Each of the planned TOD efforts would involve its own mix of federal, state, local and private investment.</td>
<td>Dayton, Ohio Huntsville, Alabama</td>
</tr>
</tbody>
</table>

As a comprehensive initiative these six program activities reflect a breadth of activities that encompass what defines overall economic development for the Aberdeen Region. This is not surprising given how inter-related the development challenges are in the region. The recommended program activities span physical development, business development, innovation and commercialization, and education and workforce development.

To gain the support needed to make this Initiative successful it requires the broad support of the Aberdeen Region as a top economic priority. For Harford County, this means that the University Research Park Initiative must be a priority for the county’s Economic Development Advisory Board and overseen by it. Harford County’s Economic Development Advisory Board (EDAB) provides the private sector guidance and oversight for overall economic development activities with five established committees involving land use, technology, finance, workforce and tourism. It dates back to 1978 and today is comprised of 25 appointed members and seven liaisons. So, it has the reach and focus needed to oversee this comprehensive initiative.
One critical task to be performed by EDAB is to set the performance measures to ensure things are moving in the right direction. It is recommended that a set of overall performance measures be developed to align with the development challenges/strategic priorities for the Aberdeen Region. These overall performance measures may include:

- **Growing the Technology Base:**
  - Annual growth in technology jobs (source: Quarterly Census of Employment & Wages provided through IMPLAN to deal with non-disclosed data)
  - Growth rates compared to regional and national levels (source: Quarterly Census of Employment & Wages provided through IMPLAN to deal with non-disclosed data).

- **Addressing Workforce Development:**
  - Increase in STEM-occupational employment across APG organizations and industry (State’s occupational employment survey for region)
  - Tracking of job openings and long term vacancies (Tracking key employer web sites or job posting service)
  - Capturing more high-skilled residents working within the Aberdeen Region (source: American Community Survey).

- **Fostering a “Live, Work, Play” Physical Environment:**
  - Development of mixed use amenities within Routes 40 and 22 corridor (source: CoStar)
  - Absorption rates for Class A Office and Flex space (source: CoStar).

In addition, each program activity should have its own set of measures that include more inputs and outputs that eventually lead to the overall high level performance measures.

Below is a fuller discussion of each of the program activities addressing:

- Rationale for Aberdeen Region
- Best practice lessons
- Proposed program design
- Governance
- Operations
- Funding
- Performance Measures
Targeting outreach marketing to companies doing business with APG organizations, including SBIR companies and those involved in C4ISR and Chem/Bio initiatives

Rationale for Aberdeen Region

The Aberdeen Region cannot simply rely on facilitating defense contractor relocations to the region to ensure technology industry growth. It must reach out to companies doing business with APG organizations to root emerging technology companies in the region, expand the operations of defense contractors that are located in the region and address the situation where defense contractors have been slow to relocate even client facing activities in the Aberdeen Region.

The analysis demonstrates that pursuing these activities can continue to grow the region. Since few of the nearly 400 SBIR awards by APG organizations from 2010 to 2012 were even made to Maryland companies, let alone none in the APG Region, this is a ripe area for recruitment. Among the over 200 emerging technology companies awarded SBIR funding supported by APG organizations over the 2010-2012 period, their employment level reaches over 9,500 jobs. If APG can attract even 1 in 10 of these companies to locate their operations and grow within the Aberdeen Region, it would offer a major job infusion that has strong growth prospects.

Similarly, many of the defense technology-related contractors in the Aberdeen Region who relocated to the region to support the Army’s C4ISR center of excellence now based at Aberdeen continue to have significant employment in the Fort Monmouth region and in other sites to support these activities. Raising the level of operations of these companies in the Aberdeen Region can yield significant job growth.

Finally, many of the chem/bio defense contractors involved with the JPEO and USAMRICD remain in Northern Virginia and travel when needed to the Aberdeen Region. This grouping of companies would consider relocation to the Aberdeen Region with better awareness of the region and more focused attention on concerns and issues that they have in making the relocation.

Best practice lessons

Business development around major military research and development installations need to ensure the growth of deep capacities of companies that go beyond the client facing activities required by the military organizations. The technology focus areas of the military organizations need to become deeply rooted as technology industry competencies of the region.

This requires active engagement of business development organizations to do outreach and provide business incentives to likely companies to form, expand or relocate to the region. It also calls for a broader public-private partnership effort to brand the region based on the core competencies found both in the military organizations and the technology industry community as a way to gain the attention of technology companies in those focus areas. In establishing an external focused “brand name” campaign, a series of coordinated activities must come together to position a locality and communicate key messages on the depth and breadth in leading
industry clusters and competitive advantages. This can include media stories on successful companies and activities taking place in the region and a presence at targeted national conferences and trade shows.

The focus on collaboration extends to active outreach marketing through developing alliance marketing approaches as a means of identifying potential prospects. Alliance marketing involves drawing on key companies and APG senior officials to help identify strategic partners whose presence in the APG Region would facilitate better collaborations as well as deepen the technology industry strengths of the region.

This approach has been strongly embraced in the Dayton region, home to the Wright Patterson Air Force Base (WPAFB). Today, WPAFB is the headquarters for the Air Force Research Laboratory and houses a number of Air Force research directorates including materials and manufacturing, power and propulsion, sensors, human performance and air vehicles. The most recent Dayton Development Coalition’s annual report focuses on the collective team effort to advance regional economic development:

“A win for one has been a win for all, and we must continue that course into 2012 and beyond. Supporting Wright-Patterson and our defense installations is essential to the success of our region. Wright-Patterson is the largest single site employer in the state of Ohio and is irreplaceable. It is important that we continue to advocate for the critical defense missions and the men and women serving our country.

It is also imperative to our economy that we work hard to attract businesses and expand our existing companies, stimulate entrepreneurship, commercialize technology, and advocate for regional priorities—all of these strategies require everyone rallying together and speaking with one voice.”

One key for keeping everyone on-board is sharing the credit and taking stock of jobs and investments being made in the region—both from direct defense activities and from commercial jobs gained, retained or expanded. In total from 2005 to 2011, there were 9,140 industry jobs gained by the Coalition and its partners and 11,615 defense jobs. In addition, capital funding included $786 million from industry, $621 from the military and $159 million from the State of Ohio’s Third Frontier program.

Dayton now promotes itself through a public-private partnership—comprised of the City of Dayton, Montgomery County, the University of Dayton, CityWide Development Corp. and the Dayton Development Coalition—as the “Ohio Aerospace Hub for Innovation and Opportunity.” The vision of the Aerospace Hub is becoming the “magnet for aerospace entrepreneurs, innovators and business owners seeking opportunity in a live-work-play-learn environment that fosters creativity and growth.” It focuses on its key technology and industry cluster strengths found in propulsion, sensors, advanced materials, data and image processing, cyber security, RFID

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and other backend IT technologies, with an emphasis on supporting the growth of unmanned aerial systems.

It has also organized a set of local, state and federal benefits to create a sense of place and to offer real incentives for companies to locate in the region, including:

- **Sensor Funding**: The City of Dayton has awarded $450,000 to UDRI’s Institute for the Development and Commercialization of Advanced Sensor Technologies (IDCAST) to help create jobs in the sensor industry. The funds will be awarded to companies seeking to bring their sensor technologies to market in Dayton.

- **Development Fund**: City grant funding is available to qualified businesses engaged in projects resulting in the expansion or relocation of an existing company and creating jobs. The fund provides “gap” financing to reduce the amount of equity needed to complete an otherwise fully-financed project.

- **County ED/GE Fund**: The City of Dayton can apply for matching funds from the Montgomery County ED/GE program, which provides competitive funding to qualified area economic development projects.

- **Attraction Incentive**: This new program provides an annual grant payment for five years to qualified companies who create five or more new full-time jobs in the downtown area or within one of Dayton’s targeted industry clusters. The grant is based on 50 percent of the payroll taxes for the net new jobs.

Plus, it helps to package the State of Ohio’s Job Creation Tax Credit, R&D Investment Loan Fund, R&D Investment Tax Credit, Third Frontier Internships, as well as federal SBA financing through a local development agency and real property tax exemptions through federal, state and local programs.

It is aggressively seeking out prime contractors to expand and relocate in the Dayton region. Noted within the Dayton Development Coalition’s 2011 report were the expansion of GE Aviation to locate a new R&D Center in the region and the attraction of two out-of-state companies, Virginia-based EWA Government Systems, Inc. and Security Innovations, Inc. Dayton is also placing a strong focus on supporting and attracting SBIR companies aligned with the Air Force Research Laboratory.

**Proposed program design**

In developing a brand name or theme for the APG Region the focus should be on creating an awareness of the region, such as Research Triangle Park or Silicon Valley, in which the regional awareness of the brand is now linked to its strengths in technology development. In the case of Aberdeen which has many technology drivers having a simple brand of the “Aberdeen Technology District” might create the sense of place and then allow for focused messages on particular
technology areas of focus such as “cyberwarfare” or “sensor and detection systems” or “advanced material solutions”.

In terms of the active outreach marketing, there are three principal targets of technology industry leveraging the presence of APG. One is emerging technology companies involved with the SBIR program supported by APG organizations. The Aberdeen Region needs to build upon its initial business incubation programs to serve as landing sites for these companies. This includes ensuring space that offers:

- Flexible leasing terms short term stays
- Favorable rental cost
- Ability to create classified space.

This should become a key focus at the existing county incubator, the Harford Business Innovation Center, as well as at the county’s new shared work space, the Groundfloor at Harford.

As these emerging technology companies open offices in Aberdeen, an active program of business networking needs to be undertaken, so that these companies can quickly build relationships with APG organizations as well as with more established defense contractors in the region. While the ongoing programming by the NMTC and Army Alliance are good forums, a more personalized approach is needed involving one-on-one meetings and perhaps leading to more formal protégé-mentoring relationships.

A key value proposition to help root these SBIR-funded emerging technology companies is connecting them with the prototyping and testing facilities based at APG serving CERDEC, CECOM, ECBC and WMRD. For an emerging technology company, these prototyping and testing facilities help address the valley of death in the commercialization of technologies, which for the military involves being able to not only be scaled up, but scaled to meet very unique military specifications. These prototyping facilities offer a unique resource for taking bench level technologies into larger prototypes that are able to be integrated within military specifications as part of solutions on military computer networks, armored vehicles, war fighter equipment and other military platforms. During the Iraq and Afghanistan war efforts, these prototyping facilities were essential to meet specific needs of the military for quickly transitioning new technologies and are an essential component for the military to transition promising technologies into solutions that meet military specifications.

The other two principal targets for active outreach marketing leveraging the presence of APG are existing technology-related defense contractors for expansion if they are already in the region or relocation if they do not have a regional presence. It is important to note that having a growing network of emerging technology companies present in the Aberdeen Region will become a key selling point to existing businesses to ramp up their own activities in the region. These emerging technology companies are a key way for new technologies to be introduced into existing defense contractor integrated solutions for the government. So having a strong presence in the Aberdeen
Region of these emerging technology companies will demonstrate that there is a real technology innovation capacity in the region.

Still, there will be the need to work with Army contractors associated with APG organizations to either expand or relocate to the APG region. This will involve active outreach, but also the ability to offer targeted incentives based on investment and job creation. Harford County’s recent participation with the State of Maryland to offer incentives for the expansion of Smith’s Detection is an excellent example. Going forward, it is recommended that the Counties of Harford and Cecil put in place formal local incentives for expansion and attraction, such as what the City of Dayton has done with its attraction incentive to provide a grant for up to 50 percent of payroll taxes for technology companies creating five or more new full-time jobs in a designated area.

**Governance**

This targeted outreach effort is an essential business development service of the Harford County Office of Economic Development and Cecil County Office of Economic Development. For Harford County, the overall governance falls under the responsibilities of the Economic Development Advisory Board, and a similar industry-led economic development oversight group is found in Cecil County.

**Operations**

Day to day operations would be staffed and performed by the Office of Economic Development in Harford County and Cecil County, respectively.

**Funding**

This is a core service of county economic development and so would be funded out of the county budget.

**Performance Measures**

Process Measures:
- Leads identified
- Leads qualified
- Leads closed

Outcome Measures:
- Investment funding leveraged
- Jobs created
Establishing commercialization services to promote homegrown technology development among the base of inventors residing in the Aberdeen Region

Rationale for Aberdeen Region

A notable weakness in the technology industry development in the Aberdeen Region is the weak presence of emerging, innovative companies in the APG Region, with a few notable exceptions of homegrown, high-growth tech companies. Overall, there have been only four venture capital backed companies since 2003 and four SBIR funded companies across all federal agencies from 2008–2012.

Still there is a strong base of inventors living in the Aberdeen Region. While many of these inventors are associated with companies just outside the region, a significant number of inventions involve individuals not assigning their technology to companies, or being assigned to nearby universities or to the Army. These non-company assigned IP offers an opportunity to advance commercialization services.

Best practice lessons

Best practices recognizes that technology commercialization is a critical complement to the process of identifying discoveries and then protecting those discoveries as intellectual property and finally managing the licensing of that technology to new or existing companies. Technology commercialization recognizes that there is a major gap—or valley of death—between technology transfer and developing technologies into products that can have market success. This involves a number of activities, such as assessing the technology and its potential markets against current products in the marketplace (e.g., technology and market assessments). It also involves developing the product itself, and optimizing its engineering and design to meet price points of the marketplace. More importantly it involves mentoring and helping to develop the business and management team and securing the sources of equity and working capital that will carry the product and/or firm through various stages of maturity until it becomes an established company/product in larger domestic and global markets.

An excellent example is Oklahoma’s Innovation to Enterprise (i2E) effort under contract to the State of Oklahoma. i2E plays an important role in positioning Oklahoma technology entrepreneurs to grow viable businesses. One key way of preparing them is by helping them focus their business plans and strategies through hands-on mentoring and entrepreneurial assistance to move through a technology commercialization model linked to business success. It also helps through a concept fund that i2E manages for the State, which is designed to provide Oklahoma start-up companies with pre-seed, proof-of-concept funding, in incremental stages, to develop a marketable concept or product. Funding amounts range from $25k to $200k and require a dollar-for-dollar match. This investment allows for the commercialization of new products and processes.

i2E also helps entrepreneurs secure angel financing and has established a certified Service Provider Program, which identifies proven, quality service providers—representing fields of
intellectual property law, corporate law, business consulting, marketing, engineering, science, and financial consulting—interested in providing assistance and support to technology entrepreneurs. The most important contributions of I2E are both helping to stimulate investment deal flow and improving the quality of deal flow to private investors.

Since beginning its operations in 1998, I2E has served over 560 entrepreneurs and start-up companies. Among its key metrics are:

**Economic Impact:** The Oklahoma Department of Commerce recently completed a study of the economic impact of 11 Oklahoma companies receiving $4.5 million in SEED Funding from I2E. The Department of Commerce concluded the direct economic impact to be $37.3 million with additional indirect impact of $11.8 million, indicating a total economic impact of almost $50 million. I2E investment of $23.8 million in Oklahoma companies has leveraged an additional $402 million in private investment.

**High Quality Job Growth:** I2E assisted companies’ experienced 39 percent job growth in FY2012 with an average wage of $70,643 compared to 1.3 percent job growth statewide and an average wage of $37,246.

**Increased New Firm Success Rate:** The failure rate for small business start-ups nationwide is slightly over half in the first 4 years. Companies funded by I2E see a much better success rate with more than 2/3 making it past the 4 year mark...an increase of almost 41 percent.

Arkansas has adapted the Oklahoma i2E approach for its situation. The state’s economic development agency has contracted with Winrock International, an Arkansas-based non-profit development organization, to provide technical assistance to emerging entrepreneurs. These services are delivered through a team of qualified consultants to provide:

- Technology product assessments
- Market feasibility analysis
- Intellectual property advice
- Commercialization strategies
- Business plan development
- Coaching and mentoring assistance
- Product and concept valuation.

This effort by Innovate Arkansas leverages other venture financing initiatives in the State of Arkansas for proof-of-concept and commercialization funding, SBIR phase one (grants for helping prepare), and angel investor incentives. Figure 6 shows the overall ecosystem in place in Arkansas that Innovate Arkansas can leverage.
Figure 6: Arkansas Eco-System Leveraged by Innovate Arkansas Efforts

- Arkansas has put in place since 2008 a broad set of program initiatives across the inter-connected value chain necessary to advance knowledge-based economic development.

Since 2008, 135 emerging companies have been assisted across the pipeline of state programs, generating 1,259 direct jobs and 3,251 total employment impact with average wages double the level of the average private sector and for every $1 of state investment another $2.66 in private investment has been leveraged.

Proposed program design

An effective technology commercialization program can be established in the APG Region, which helps to root new company formation in the region. The sources of technology will come from entrepreneurial inventors resident in the region and leveraging inventions associated with APG organizations. The focus of the effort will be to work with new, technology-based entrepreneurs as they seek to turn their inventions and high-tech service concepts into viable commercial enterprises. The specific services to be provided will bring together the technology community in the APG Region and will focus on leveraging state technology investment programs. Among the key services should be:

- Developing a network of advisors resident in APG Region with technology, market and business expertise – There already exists in the Aberdeen Region a cadre of technology domain and entrepreneurial experts with a range of skills. Some of these technology experts are employed by the region’s technology industry, while others simply call the region home and work outside the region. These experts can be tapped to bring expert
teams of entrepreneurial mentors and advisors together to assess and mentor entrepreneurial inventors in the formation of new businesses. An excellent example is the network that the Boulder County Innovation Center (now known as the Innovation Center of the Rockies) has organized to assess and mentor local early stage companies. The Innovation Center has developed a database of more than 1,000 screened and qualified advisors with specific technology domain expertise to support local early stage companies and to inform the commercial assessment of early stage innovations to guide its commercialization approach, including connecting it with investors and management teams. Since its start in 2005, the Innovation Center reports working with more than 80 inventions to commercialize its technologies, which have resulted in 8 new startup companies that have generated $75 million in new capital raised and created so far over 400 jobs.

Once this network is established, a logical next step for advancing commercialization of high potential inventions is organizing an APG Region angel network.

Engaging consultants who can perform market assessments and offer likely commercialization paths – To help fill the gaps in the network of advisors and to provide more detailed market assessment it is recommended that based on recommendations of the advisors, a more systematic review by consultants or a market research firm be undertaken to provide an initial systematic assessment and path to commercialization. One example already noted is what Innovate Arkansas provides through its pool of consultants. Another example is the use of an existing market research firm as done by the Small Business Innovation Office of Connecticut Innovations to offer assistance to early stage technology companies, many of whom are considering pursuing SBIR funding. Through a contract with Foresight Science and Technology, Connecticut Innovations offers funding for a Go/NoGo® as an early stage weeding tool for disclosures or ideas that identifies significant barriers and potential paths to commercialization. These reports evaluate competitiveness, intellectual property, and marketability and can provide validation that a company’s idea is sound and worthy or prevent further time and investment in an idea without merit. Most importantly they are completed within a 3 to 4 week period, so are timely.

• Provide a competitive APG Region technology commercialization fund to address technology validation and proof-of-concept funding. Similar to what i2E provides through its Concept Fund, it is important to position an emerging technology company for further funding, including SBIR funding, to have initial technology validation and proof of concept work done. Another region that does this is the Central New York through its regional, business-led economic development organization, CenterState CEO. Through a program known as Grants for Growth. CenterState CEO provides funding for applied research projects to evaluate the technical merit of promising innovation ideas of up to $25,000. It then offers prototyping and scale-up of those efforts with funding of $75,000 to $150,000 through convertible debt notes. Since 2006, CenterState CEO has made 35 awards, which have leveraged nearly $5 million in private sector and university
participant matching support, plus leveraged an additional $37 million in follow-on funding, leading to 52 patent applications and awards and 97 jobs.

A unique feature that the Aberdeen Region can offer in addressing these technology validation and proof-of-concept efforts is to collaborate with the prototyping and testing facilities located at APG. This in-place capacity is hard to replicate even at universities and it offers the benefit of supporting a key capability at APG.

What is important about these technology commercialization services is that the APG Region does not have to carry the follow-on rounds of assistance. It can view its services as a catalyst to position emerging technology companies in the APG Region to tap into larger pools of federal and state funding available for technology ventures. For instance, the Maryland Department of Business and Economic Development’s Enterprise Investment Fund makes direct equity investments in emerging technology companies, usually at the first round of institutional financing and works with emerging companies to move them into their next stage of development as a viable business. The amount of investment ranges from $150,000 to $500,000. Enterprise investments are generally in the form of equity, but follow the terms of the lead investor. For those technologies associated with APG organizations, another possible program to tap is TEDCO’s Technology Commercialization Fund (TCF), which provides up to $100,000 to support projects for Maryland-based emerging technology companies that are pre-revenue to achieve early technical milestones that are critical to moving further along the commercialization pathway and lead to follow-on investments. And, of course, a key focus should be on tapping the federal SBIR program, which many APG organizations are involved.

**Governance**

This effort should be overseen by the University Research Park (URP) organization since it already brings together industry leaders and connects well to APG organizations around advancing the region’s technology development. In particular, the URP is a logical place to develop the network of technology experts and to help in evaluating the merits for providing market assessments and technology validation project grants.

**Operations**

To support the URP’s governance of this effort, it is recommended that there be a staff position in Harford County available to provide the day-to-day support for these services, including outreach, maintaining databases and scheduling presentations, reviews, etc. This staff position would also be a good person to be involved with the outreach to out-of-state SBIR companies, since many of them might seek to tap these services.
Funding

It is expected that County economic development funding of approximately $250,000 annually can support this technology commercialization initiative. This would allow for:

- Part-time position in the County Office of Economic Development @ $50,000 to $75,000;
- 10 to 15 market assessment reports @ $5,000 each, so $50,000 to $75,000; and
- $100,000 for technology validation funding, which is expected to be tapped by 5 to 10 companies.

Performance Measures

Process Measures:
- Development of the Network of Technology Experts
- Number of Inventions/Early Stage Companies assessed
- Market assessments and technology validation projects undertaken

Outcome Measures:
- New start-up companies locating in the APG Region
- Investment funding leveraged, including follow-on state and federal awards
- Jobs created
Supporting the proposed educational partnership with APG to aggregate, serve as a clearinghouse and program development facilitator

Rationale for Aberdeen Region

There is currently a lack of coordination across APG organizations that result in missed opportunities to address significant skills needs across APG organizations. This reflects the diversity and number of organizations at APG, with each organization pursuing its own education and training needs. The result is that there no listing of education and training activities taking place across APG organizations to help in coordination and instead there has been a mushrooming of ad-hoc and limited engagements with universities that lack an integrated program focus. The missing ingredient has been a mechanism to help sort out the common skill needs across APG organizations.

At the same time, universities cannot commit to a significant presence in the Aberdeen Region without having a clear understanding and means for aggregating demand for educational and training services. Today, a range of universities do offer mostly individual courses, which typically attract 10 to 15 participants, and are unable to sustain more integrated degree and certificate programs.

A new initiative to create an educational partnership with the APG Region to establish a clearinghouse function for education and training to better match needs/requirements of APG with educational providers is most promising and needs to be fully supported and advanced.

Best practice lessons

The Montgomery, Maryland Technology Council formed back in the late 1980’s, which later grew into the Suburban Maryland Technology Council and then the Technology Council of Maryland, was initially organized around the educational and training needs of the technology industry community located in the Rockville and Gaithersburg area. These technology companies in upper Montgomery County faced a lack of accessible and nearby graduate higher education facilities, degrees and courses for its workforce.

By undertaking a cooperative competition approach to working with multiple higher education institutions, the Council was able to encourage public and private education institutions to meet various needs of regional employers. A critical initiative was instituting a biennial education and training survey of technology employees in the region. The Council also used networking efforts to bring together academe, industry and the public sector.

Key value of an educational partnership initiative

- Would address the mushrooming of ad-hoc relationships and lack of coordination in education and training found at APG
- Would offer APG organizations a dedicated resource to help them better aggregate needs and identify potential education partners
- Offer educational partners easy point of access and better awareness of requirements
The result was the formation of the Shady Grove Campus of the University of Maryland System, as well as the attraction of a satellite campus of Johns Hopkins University. The focus of activities has been on degree and certification programs, not simply individual course offerings. This led to the creation of the Universities at Shady Grove, an innovative partnership of nine public universities on one campus in Shady Grow. Each of the nine partner universities provides a highly sought after academic program, which enables a focused talent pipeline development approach to address key workforce development skill needs.

For instance, more than 1,400 graduate studies are served at the Shady Grove Campus of the University of Maryland System, with key degree programs including:

- Master’s in Cybersecurity offered by UMBC
- Master’s in Engineering offered by University of Maryland, College Park
- Master’s in Biotechnology offered by both UMBC and University of Maryland, College Park
- Master’s in Management offered by both Towson University and University of Maryland, College Park
- Graduate Certificates in Database Systems, Informatics and Information Technology by the University of Maryland University College.

**Proposed program design**

The new initiative to create an educational partnership is being advanced with the APG Region’s University Center at HEAT in coordination with the Northeast Maryland Higher Education Advisory Board. This approach makes great sense since it builds upon established capacities, furthers the connection of APG to the region and taps organizations that are well suited to serve as an honest broker and facilitator.

This initiative is highly strategic for the APG Region since the APG organizations represent the region’s largest driver for higher education services. So, while this effort is still unfolding, there are a number of critical approaches that should be considered in light of the URP imperative to build higher education capacity in the region and the broader demand for talent in the APG Region.

One important approach to build higher education capacity in the Aberdeen Region would be for the education partnership to be structured to maximize the opportunity for creating a sustainable presence of high quality university graduate degree and certificate programs in the APG Region. This approach calls for moving beyond course by course offerings across many university providers as presently takes place. Similar to what has been created at Shady Grove, Maryland, it is recommended that a more relationship model with universities be pursued where the needs of APG can be set out in different educational areas and then based on the level of demand, a competitive process for selecting university partners can be established. As part of this effort, the
selection criteria should include whether universities are willing to customize the emphasis of their degree and certificate programs to address the more specific needs of the military. The result of this capacity-building approach would be to raise the bar on the university graduate education and training activities offered at APG and ultimately to create a higher quality DoD workforce for the future.

Second, the University Center at HEAT in coordination with the Northeast Maryland Higher Education Advisory Board should seek to fully engage the technology-related defense contractor community and serve their individual and broader community needs for talent development. The emphasis on advancing sustained graduate level degree and certificate programs to serve APG needs would be a positive step for then including defense contractors. It would also offer creative accelerated Master’s programs to attract talent to the APG Region, such as five year master’s degree program with undergraduates attending those schools having a job waiting for them and so complete their security clearance while they get their master’s.

The effort to create sustained graduate level degree and certificate courses may require state and local support for specific projects related to advancing the university presence in the APG Region, as was done in constructing the new Towson University building on the campus of Harford Community College.

**Governance**

APG organizations will need to take the lead in the governance with participation from leadership drawn from board members of the University Center@HEAT/NMHEAB.

**Operations**

As part of the education partnership with APG organizations, staffing will be housed at the University Center@HEAT.

**Funding**

Funding will largely be supported by APG organizations for the clearinghouse function, but state and local support would be helpful for specific projects related to establishing capacity-building university presence in the APG Region.

**Performance Measures**

Process Measures:
- Creating the clearinghouse—number of offerings required
- Advancing more capacity building graduate degree and certificate offerings in collaboration with APG
- Engaging universities to meet demand on a sustainable basis with customize programs and local offerings involving instructional labs.
Outcome Measures:

- Number of APG staff attending and level of satisfaction
- Number of APG degree and certificate completers
- Number of industry attending graduate programs in region and satisfaction
- Number of APG degree and certificate completers

**Advancing specialized institutes in high priority skills development and R&D areas requiring university collaborations, such as cybersecurity and chem/bio defense**

**Rationale for Aberdeen Region**

As identified in the 2012 study on *Accelerating University Talent Development and Research & Development Collaborations at Aberdeen Proving Ground* from discussions with senior staff at APG, there is a critical need to have more hands-on learning and a theory-to-application-to-practice approach to create effective, advanced skills development in more emerging technology areas. One senior APG staff member likened this to creating “journeyman” scientists and engineers with expertise in these emerging technology fields. At the same time, there is an opportunity for advancing collaborations with universities, particularly around applications development and other applied research and development. There is a wide range of opportunities for such R&D collaborations, such as applications for modeling of cyber-agent behaviors, system of systems network design, analysis, testing and experimentation and use of systems biology for detection and countermeasure development.

Such an approach will require specialized instructional and applications laboratories for use by APG staff and so need to be in close proximity to APG. These instructional and applications laboratories may also serve as platforms for more basic and applied research activities to be done in concert with universities and defense contractors.

**Best practice lessons**

The 2012 study on *Accelerating University Talent Development and Research & Development Collaborations at Aberdeen Proving Ground* noted the approach of the Naval Postgraduate School located in Monterey, California in its master’s level systems engineering program as offering the deep skills to practice development required for a top tier DoD workforce. It offers access to advanced application laboratories for instruction and emphasizes its research programs tapping the combined expertise of faculty and students. It also tailors its courses to be able to address classified materials and topics.

But the Naval Postgraduate School is not alone. The Air Force at Wright Patterson has its own graduate school of engineering and management as well as an institution for technical professional continuing education, known as the Air Force Institute of Technology (AFIT). The
history of AFIT is quite informative\textsuperscript{11}. Not only did it focus on specific areas of expertise to develop, but in some critical areas it worked with universities to kick-start its efforts. The history of AFIT dates back to the fledging days of powered flight in the 1920’s when it became apparent that the progress of military aviation was closely dependent upon the availability of military specialists in aeronautical science and allied technical fields. By 1926, Congress had authorized the creation of the development of the Institute of Technology. Still, it was not until after World War II that the present form of the Institute took form as a graduate education center. In 1954, Congress gave it authority to grant degrees, which was initially focused on aeronautical and electrical engineering—being accredited at the undergraduate level in 1955, master’s level in 1960 and PhD level in 1965.

Soon AFIT was under pressure to expand its range of offerings, particularly to deal with the worldwide logistics demands being placed on the Air Force. Ohio State University was selected to research, develop, and present certain phases of it and to provide the bulk of professional and academic resources. Over the decade of the 1960s, Ohio State University provided all logistics education at AFIT. All logistics faculty were on contract with the Ohio State University Research Foundation, and were deemed adjunct faculty of the College of Commerce and Administration. In 1963, the School of Logistics changed its name to the current School of Systems and Logistics in order to reflect its systems management program. This remained the case until 1972 when the Air Force hired the OSU teaching faculty as civil servants, retained its own Deans and Department Heads and thereby assumed full management of the School of Systems and Logistics. AFIT’s efforts to link with universities continues in new ways today. It currently has in place an agreement with the University of New Mexico to allow Air Force officers and civilians to earn degrees in science, technology and management by combining credits from the University of New Mexico and AFIT.

Another approach to leverage universities for sustained graduate degree and certification programs, combined with research programs, is the approach used by Oak Ridge National Laboratories and the University of Tennessee. Five UT-ONRL joint institutes have been formed to address high priority scientific and engineering areas, including a Joint Institute for Advanced Materials, Joint Institute for Biological Sciences, Joint Institute for Computational Sciences, Joint Institute for Heavy Ion Research and Joint Institute for Neutron Sciences. Each of these Joint Institutes pursue joint faculty appointments, develop core centers and set out education and training programs. While each Institute approaches graduate education differently, there is an active interaction with graduate students in each Joint Institute. For instance, the Joint Institute for Advanced Materials awards stipends to graduate students pursuing their degrees in advanced materials to complete their PhDs while working on projects with ORNL researchers. The Joint Institute for Biological Sciences, meanwhile, is helping to establish the country’s first interdisciplinary doctoral degree in energy bioscience in collaboration with the Bredesen Center for Interdisciplinary Research and Graduate Education at the University of Tennessee. A third approach is used by the Joint Institute for Computation Sciences which not only hosts graduate

\textsuperscript{11} Adapted from AFIT’s web site—see http://www.afit.edu/about.cfm?a=history
students from UT for research projects, it also offers regular training programs on high performance computing for the University of Tennessee researchers given its wide application to various science disciplines.

**Proposed program design**

It is critical in approaching the development of specialized institutes in high priority skills development and R&D areas to recognize that there is not a one-size-fits-all approach. Instead, each specialized institute will need to be tailored to its specific requirements.

As illustrations of possible specialized institutes, two specific opportunities arose from discussions during this project work:

**Cybersecurity.** As noted in *Accelerating University Talent Development and Research & Development Collaborations at Aberdeen Proving Ground*, cybersecurity is one of the broadest and most critical talent and applied research collaboration areas of need at APG. It is broad for two reasons. First, APG’s technology focus on cybersecurity goes beyond information assurance of computer systems to include a focus on the device level cybersecurity from radar to sensors to handheld devices that touches upon embedded systems and signal processing algorithms. Second, APG’s mission focus is not simply the protection of information and network systems, but also includes cyberwarfare and how to attack computer and network systems. So, creating the quality cybersecurity workforce at APG requires a multi-skilled one. Yet, cybersecurity is also one of the most challenging talent pipeline issues facing APG because the demand for cybersecurity trained professionals across military, intelligence and civilian sectors well exceeds supply nationally.

Further discussions for this project reveals that the need for raising the competencies of the existing cybersecurity workforce is found across multiple organizations, of which not all are associated with C4ISR or with RDECOM. It spans across CECOM, CERDEC, ARL (SLAD, CISD), and ATEC. Typically this existing APG staff has strong skill sets in electrical engineering, but not in the areas of computer engineering and computer sciences. So this may call for more tailored graduate certification programs and perhaps even more leadership development programs on cybersecurity involving interaction with academic and industry leaders to share experiences and approaches in addressing common issues.

At the same time there is a need to build the pipeline for new workforce in cybersecurity for APG that meets its broad-skill needs in cybersecurity. Across the APG organizations involved there may be as many as 20 new hires even in today’s fiscally constrained environment, and this number may only grow in the years ahead.

Together the demands for existing workforce skills development and for future workforce calls for stronger linkages with nearby universities, who excel in cybersecurity, such as UMBC, UM College Park and Johns Hopkins University, as well as advancing the new talent pipeline efforts of the University of Delaware-led Regional Cybersecurity Education Alliance, which connected to the community colleges in the APG Region.
From a research and development perspective, the recent presentation by Henry Muller, Director of Intelligence and Information Warfare Directorate (I2WD) at CERDEC to the Army Alliance notes the challenges of how to further the integration of the Army’s focus on next generation systems of systems engineering design, analysis, testing and experimentation into cybersecurity solutions and points to the value of fostering stronger university and business partnerships. Having these relationships in close proximity to APG is demonstrated by the recent solicitation for Technical Information Engineering Services (TIES) in support of intelligence, electronic warfare and information system development for CERDEC’s I2WD. This solicitation calls for having a Sensitive Compartmented Information Facility (SCIF) within 30 miles of APG or within the APG local travel area.

One could envision having an integrated Cybersecurity Leadership, Education and Training Institute at Aberdeen involving universities with lead faculty members who would have proper security clearance to undertake the hands-on instructional and theory-to-application-to-practice educational programs needed by existing APG workforce and selected students for an accelerated master’s to become part of APG’s future workforce, while also helping to lead a broader Leadership Academy and furthering research within a secured environment on how to further the integration of the Army’s focus on next generation systems of systems engineering design, analysis, testing and experimentation.

Chem/Bio Defense. A very different approach is needed in a specialized institute for the Chem/Bio Defense area. Here the focus is on collaborative research and development, leveraging the close proximity of unique facilities and pathogens that only APG staff and civilians with proper security clearances can handle. The ultimate goal is to expose existing APG scientists to new techniques and advances, such as systems biology, while also exposing promising doctoral and post-doctorate researchers to the particular significant issues that DoD faces and using that opportunity to recruit a cadre of these high level students to pursue their research careers in military labs.

This Chem/Bio Defense Institute would span detection and countermeasures, and would focus on raising collaboration opportunities with military research universities (Uniformed Services University for Health Sciences) and civilian universities. It would seek collaborations on Broad Agency Announcements of DHS or DARPA and then team with universities or industry. This collaborative teaming effort would benefit from having a less classified space where APG scientists could more easily collaborate with university faculty, post-doctoral and graduate students. One possibility is the reuse of the USAMRICD wet lab facility that is being replaced.

**Governance**

APG would need to be in the lead on the governance, which would vary Institute by Institute.
**Operations**

URP should facilitate development of each Institute, including helping to identify and collaborate with lead university under the guidance of governing board.

**Funding**

Local support to enable the URP to facilitate development of each Institute...approximately $50,000 for consulting, travel, etc. Seek APG organization support for operations, complemented by state funding for specific projects, such as facilities.

**Performance Measures**

Process Measures:
- Creating the clearinghouse—number of offerings required
- Advancing more capacity building graduate degree and certificate offerings in collaboration with APG
- Engaging universities to meet demand on a sustainable basis with customize programs and local offerings involving instructional labs.

Outcome Measures:
- Number of APG staff attending and level of satisfaction
- Number of APG degree and certificate completers
- Number of industry attending graduate programs in region and satisfaction
- Number of APG degree and certificate completers
Developing a talent connector to graduates of nearby universities and high-skilled residents for meeting the demands for STEM-related workforce

Rationale for Aberdeen Region

In today’s global, knowledge-based economy, local communities are increasingly competing based on their ability to educate, train, and recruit a qualified workforce that meets the needs of industry and other major employers. As the National Governors’ Association points out in their series on State Leadership in the Global Economy: “CEOs report that the availability of technically trained talent is their top priority—one that often determines where they locate high-value investments.”

The APG Region as an emerging technology hub, already has a strong demand for high-skilled STEM occupations. The most recent occupational forecast by the State of Maryland’s Office of Workforce Information and Performance estimates that there will be nearly 544 job openings in STEM occupational fields for the APG Region. If the APG Region is successful in accelerating its growth in technology-based industry, this demand for high-skilled STEM workers will grow even larger.

The APG Region brings significant assets in its potential to meet this demand for STEM workers. Its residents are highly educated and skilled, with over 42 percent of working age adults holding a college degree. There is also a significant pool of university graduates in STEM fields nearby, with 42 universities in Maryland, Delaware, Pennsylvania and New Jersey within a 45 to 90 minute commute to APG, generating well over 2,000 graduates each year in STEM fields. Plus, STEM activities in the APG Region continue to grow and offer a local talent pipeline to fill STEM workforce demand.

Still, the APG Region needs to address how to connect and ensure the transferability of skills from both the significant base of new university graduates and resident workers in order to maximize its talent potential for STEM workforce development. Many of the newer, mid-to-small tech companies to the APG Region are finding it hard to fill high-skilled jobs and do not bring the strong relationships to nearby institutions and local residents found among more established firms. A particularly important pool of experienced STEM workers found in the APG Region are the thousands of residents in the APG region who commute outside of the region for work. This includes nearly 6,000 computer, engineering and scientific workers and nearly 15,000 management, business and financial workers.

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Best practice lessons

Connecting to talent is increasingly becoming the focus of workforce development efforts targeted to STEM fields. One increasingly used tool is internships and other experiential learning activities that help make students aware of local employers and also help local employers recruit future workers. An added benefit is that internships can provide students needed job experience that employers value very highly. And, in a DoD job market, a successful internship at the end of a student’s junior year, or after the first year of a master’s program, can allow the time needed to gain security clearances.

The National Association of Colleges and Employers annually tracks employment experience of college students. In 2012, it found that 40 percent of employer full-time hiring of college graduates came from their own internship and other experiential learning programs, with nearly 60 percent of interns accepting full-time employment with the company for which they interned.13 Leading technology development initiatives such as the Ohio Third Frontier and the Massachusetts Life Sciences Center feature internships as a key means to connect area students with local employers. In the Massachusetts Life Sciences Center internship effort the host companies commit to providing a dedicated mentor and project, with subsidies used as a human capital subsidy program for small and early stage companies, while larger companies can hire from the pool of student candidates. Since the program was first started in 2009, over 1,200 interns have been placed in 340 companies in Massachusetts.14

More challenging is the effort to recruit experienced, high skill workers. States and regions have pursued efforts to reach out to publicize the quality of career opportunities, quality of life and even help in matching workers to jobs in their states and regions. This includes state efforts such as Project Boomerang in Oklahoma and the Iowa Careers Consortium. In Huntsville, Alabama, home to the Army’s Redstone Arsenal, the regional Chamber of Commerce has an active marketing campaign to attract high-skilled workers to the region, focusing on Huntsville as “a smart place”. In this effort, it features all of the live-work-play advantages that Huntsville offers to technology and other high-skilled professionals, plus features a “find a job” website that provides information about civilian jobs at Redstone Arsenal and features a job matching service for job seekers and employers. A more hands-on focus to match workers with specific skill sets to employers is the Pittsburgh Digital Greenhouse, which in its early years focused on helping in talent recruitment for firms coming to Pittsburgh to pursue lab-on-a-chip technology development, and later focused more broadly on electronics and robotics. What has been learned from these efforts is the importance of creating a public-private partnership which develops and maintains dynamic databases of jobs and skilled workers, conducts outreach marketing and serves as a key point of access for job seekers and employers in selected areas.

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13 See http://www.naceweb.org/internships/
14 See http://www.masslifesciences.com/grants/challenge.html
Proposed program design

The objective of the talent connector would be to ensure that APG Region is recognized as a talent rich community by tapping into skilled, experienced resident workforce who commute as well as the growing STEM pipeline within the region and the large base of undergraduate and graduate STEM students from nearby universities.

For tapping resident workforce that commute, it is proposed that the APG Region STEM Talent Connector activities include:

- Maintaining an up-to-date database of available high-skilled positions among the region’s firms and APG organizations.
- Undertake active outreach to local residents to identify those in STEM occupations working outside of the region and providing a single point of contact for them to consider positions in the region, including serving as an honest broker to match interested workers with employers and providing information on requirements for gaining security clearances.
- Developing a cadre of trained, volunteer peer career mentors to consult with local residents in STEM occupations on facilitating their transitions to new job opportunities in the region.
- Targeting education and training programs to close any gaps on specific software applications or knowledge of federal contracting, etc.

For STEM pipeline and broader access to large base of university students nearby the APG Region,

- Support a matching grant program for mid to small technology firms in the APG Region seeking STEM interns.
- Partnering with local workers in the region who are university alumni of nearby universities and career services offices at their former schools to speak about the career opportunities in the APG Region and quality of life.

Governance

The best organization to advance help oversee the Talent Connector initiative would be the governing board of the University Center @HEAT/NMHEAB.

Operations

The day-to-day operations should be carried out by a staff person in economic development for each County given the importance of connecting to the targeted technology employers and
resident workers in close coordination with staff at University Center @HEAT/NMHEAB and the Susquehanna Workforce Network.

**Funding**

It is expected that County economic development funding of approximately $250,000 annually can support this Talent Connector initiative. This would allow for:

- Part-time position in the County Office of Economic Development @ $50,000 to $75,000 with benefits.
- Up to 75 to 100 interns, providing up to 50 percent of the cost or $2,000 per internship.

**Performance Measures**

Process Measures:

- Employers providing job openings and number of positions.
- Employers seeking to participate in internship program.
- Local residents in STEM occupations participating in Talent Connector activities.

Outcome Measures:

- Number of interns and attraction of interns to full time positions upon graduation.
- Number of local residents in STEM occupations who commuted outside of the region taking STEM jobs in the region.
Advancing transit-oriented mixed use development hubs for growing the Aberdeen Region’s Technology District

Rationale for Aberdeen Region

While the APG Region has been successful in creating a commercial real-estate market for technology-oriented Class A Office and Flex Building space in close proximity to APG, a closer examination reveals a scattered development of technology-oriented office parks along Route 40 and Route 22. What is particularly missing is high quality mixed-use development in the APG Region. As it now stands, outside of the Water’s Edge Corporate Center, the technology-oriented office parks in the APG Region offer few amenities and access to housing.

Of particular concern is that without more quality mixed use development, the APG Region’s commercial real estate market will be less competitive than other developments in nearby real estate markets, such as White Marsh’s new urbanism development efforts and the University of Delaware’s STAR Campus at the former Chrysler site.

This effort towards advancing mixed use development is of critical importance given the high vacancy rates of recently constructed Class A office space in the APG Region and the low absorption rates experienced in recent years.

Best practice lessons

As noted earlier, there is a significant and long-term trend in university research park development towards increased mixed-use development. The beginnings of these mixed-use developments were found in many of the new university research parks brought on line over the last decade, such as Centennial Campus (affiliated with North Carolina State University), Mission Bay (affiliated with the University of California San Francisco) and the Fitzsimmons Life Science District in Colorado (affiliated with the University of Colorado’s academic medical center). A soon-to-be-released benchmarking of university research park developments by the Association of University Research Parks and Battelle, will document this growing trend towards strategically planned “live-work-play” developments to offer businesses a high-value environment that creates the dynamic, life-style communities that attract high-skilled, technology professionals to a region.

An excellent example of how this mixed use development is playing out in benchmark regions is the transformation of downtown Dayton, Ohio into a technology district. First to ensure high quality commercial real estate development in close proximity to research and development drivers, Dayton is pursuing Tech Town, located on the site of a former GM factory in Downtown Dayton. It offers close proximity to Wright-Patterson Air Force Base, while serving as a location where business, academia and government work together strategically to support the region’s core competencies. Within Tech Town there are technology intermediary organizations that provide services to companies. They include:
• **The Institute for the Development and Commercialization of Advanced Sensor Technology (IDCAST)** – IDCAST is a world-class center of excellence in remote sensing and Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) sensing technology. Leveraging the strengths of Wright Patterson, and led by UDRI in collaboration with a number of academic, government, and business organizations, IDCAST was established as a Wright Center of Innovation through a $28 million Ohio Third Frontier award. The center aims to build on Ohio’s existing Federal, academic and industrial strengths in sensor technology, resulting in more rapid commercialization of sensor technology for medical, environmental and military applications. IDCAST provides 4,600 square meters of collaborative lab space, research facilities and incubator space for startup companies, enabling access to sensor test-beds and other cutting-edge equipment including the world’s most advanced infrared camera.

• **Dayton RFID Convergence Center**, which assists in the formation and growth of early stage RFID, sensor, and data management and mining technology businesses.

• **The Entrepreneur Center**, which provides incubation services and leased space to start-ups involved in information technology, biomedical technology, and prototype manufacturing.

• **National Composite Center**, which creates large-scale manufacturing methods, establishes industry standards, and develops and applies advanced composite technology to aerospace, defense, ground transportation, and infrastructure markets.

The Master Plan envisions that ultimately Tech Town will encompass approximately 400,000 square feet of office and research space and accommodate up to 2,500 new jobs.

Tech Town is situated close to housing, restaurants and other amenities. As the web site of Dayton’s Ohio Aerospace Hub explains what is emerging in downtown Dayton is a mixed use, live-work-play district anchored to the north by TechTown and to the south by the University of Dayton and its Research Institute. This dense, walkable district features a variety of housing styles in unique neighborhoods, visual and performing arts and entertainment, a Class-A Minor League Baseball park, a recreational river, bikeways, parks and award-winning healthcare institutions and schools, along with more than 200 acres of developable land.

Similarly in Huntsville, Alabama, home to the Army’s Redstone Arsenal, the Cummings Research Park continues its growth and transformation into a world-class mixed use development. This research park was started back in 1962 by a local industry leader, Milton K. Cummings, then president of the space and defense contractor Brown Engineering Company (now known as Teledyne Brown Engineering), with just 150 acres for the development of industry research and development facilities. Today, it spans nearly 4,000 acres in 175 buildings encompassing 9.5 million square feet of space and is home to 300 companies employing 25,000 workers. Housed within the research park is the University of Alabama in Huntsville, which was initiated after the formation of Cummings Research Park in 1969. Today, the University of Alabama in Huntsville is a research university with over $90 million in annual research funding and generates over 300 undergraduate degrees in highly technical and has an active graduate school program.
In 2007, a new lifestyle center was created within Cummings Research Park, known as the Bridge Street Town Centre. It includes 550,000 sq ft (51,000 m2) of retail space featuring a Monaco Pictures theater and 70 shops and restaurants including P.F. Chang’s. The center features a 10-acre lake, apartments, a one six-story, 150,000 sq ft Class A office building, and an eleven-story, 210-room Westin with 70 condominium residential units. And in the Fall of 2012, Belk announced it would build a two-story flagship department store at the shopping center. The store, expected to open in 2014, will be surrounded by 45,000 square feet of additional retail space, a large sit-down restaurant, and 900 new parking spaces.

So Cummings Research Park in Huntsville, Alabama has been transformed from just a commercial real estate development for technology companies into a technology district offering a high quality mixed use development with top technology industry companies and a research university presence. It is no longer simply governed as a commercial real estate development either. It now represents a formal public-private partnership. Park affairs are governed by a Board of Directors appointed by the City. Board members include the University President and representatives of certain large industrial tenants of the Park. There is also an Advisory Board representing all companies in the Park. Finally, there is an owner-tenant association that manages common areas of the Park. There is also an associated process for development approval that is managed by the research park in concert with the City of Huntsville Planning Department review and for land purchases which must be approved by the Huntsville City Council. By contract with the City, the Chamber of Commerce of Huntsville/Madison County markets, develops, and promotes the Park as the City’s lead economic-development agent. As Huntsville Mayor Tommy Battle explained in a recent news article: “Year after year, the Research Park has brought in high-tech sector jobs and above-average pay. It’s been the foundation of our economic development.”

**Proposed program design**

A key finding of the analysis is that without tackling the issue of mixed use development in the APG Region, especially along the Route 40 and 22 corridors, the region’s efforts to promote the growth of technology industry development and to attract STEM-related workforce will be hampered.

The likely first mover opportunities for mixed use development are planned transit oriented developments around the Aberdeen MARC station and the Perryville MARC station. These transit-oriented developments (TOD) create compact, walkable neighborhoods around transit or planned transit, offering convenient access to jobs, shopping, services, housing and recreation.

In Aberdeen, the development would create a mixed use development at the intersection of routes 40 and 22 in downtown Aberdeen and become an important hub for future developments along each corridor. As the 2012 Master Plan for the Aberdeen TOD explains: While located in the heart of downtown, the MARC station and its environs lack a strong identity and vibrancy. Today the

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15 Martin Swant, Cummings Research Park: Still growing despite federal budget struggles (Outlook 2013), Huntsville Times, March 1, 2013
character of the area is largely defined by a mix of auto-oriented uses along Philadelphia Boulevard (US 40) and a small, under-performing commercial district in need of connection to the community at large.

In Perryville, the TOD development would be linked with a greenway development of bicycle and pedestrian paths separated from the main road and become part of the planned Lower Susquehanna Heritage Greenway and East Coast Greenway intersecting in Perryville.

Another TOD development that should be given high priority is around the Edgewood MARC station. It stands just outside the gate of the Edgewood Post of APG and is situated in a community in need of redevelopment.

There is also a need to conceive of these TOD mixed use developments in the context of a broader Aberdeen Technology District for the APG Region. Given the scattered nature of Class A office space development in the APG Region, it may be more appropriate to conceive of this Technology District along key corridors with route 40 as the backbone from Edgewood through Aberdeen, Havre de Grace and across the Susquehanna River to Perryville. Along the way there would be additional corridors such as along route 22 from Aberdeen to the I-95 interchange encompassing developments just west of the interchange as well as encompassing routes 24 and 715. Along these corridors there should be efforts to create mixed-use development nodes serving existing Class A office space developments and future Class A office space developments.

In advancing this Aberdeen Technology District as a brand, there needs to be an engagement of owners and units of local government involved to advance the district as a place for development. This calls for a public-private partnership collaboration in which phased developments can take place to create common signage, marketing and discussions on ways to enrich the live, work, play environment found within the Aberdeen Technology District. In the future, there might be an effort to create an overlay zoning plan for broader development across these units of government.

**Governance**

Each of the planned TOD developments at Aberdeen and Perryville are being advanced by their local governments in broader partnerships with county, state and private sector. In the future, county and local government units and owners within the APG Technology District should be engaged and consider forming a public-private partnership collaboration. Initially this might be considered more of a forum for discussion on the development of the Aberdeen Technology District and ways to advance its development through coordinated actions. Over time, a more formal partnership plan for the Aberdeen Technology District could take form.
Operations

Each unit of government and private developer would continue to be responsible for their own activities. Over time, as coordinated activities and shared services grow a more centralized set of operations might be advanced.

Funding

Each of the planned TOD efforts would involve its own mix of federal, state, local and private investment.

Performance Measures

Process Measures:
- Advancing planned TOD efforts
- Establishment of public-private partnership forum to discuss advancing the Aberdeen Technology District efforts

Outcome Measures:
- Development of housing and retail within the Aberdeen Technology District
Conclusion

While the broader transformation of the APG Region into a world-class regional technology hub is still a work in progress, the analysis suggests that a focus on three inter-related challenges can serve as the basis for a successful URP Initiative. These three development challenges are:

- Growing the regional technology industry base in Aberdeen
- Advancing workforce development to meet the demands by technology industry and APG organizations
- Fostering “live, work, play” development to create a higher value physical environment to align with the commercial Class A office developments taking place in the region.

Addressing these development challenges will require a comprehensive effort spanning physical development, business development, innovation and commercialization, and education and workforce development. To gain the support needed to make this Initiative successful it requires the broad support of the Aberdeen Region as a top economic priority.

By working together, the opportunity for the APG Region to grow its technology base is substantial. If successful it is expected that what will emerge is a public-private partnership that will advance an Aberdeen Region Technology District. This Technology District will be centered around APG with key developments happening along corridors in the region, particularly the route 40 corridor from Edgewood through Aberdeen, Havre de Grace and across the Susquehanna River to Perryville and the route 22 corridor from Aberdeen to the I-95 interchange.
Appendix A: Advisory Committee Members

Denise Carnaggio
Danny DeMarinis
Dr. John Ferriter
John Gaughan
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David Jimenez
Gary Martin
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Mary Morris
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Nancy Spence
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