

**Report to the  
Senate Finance and  
House Appropriations Committees**

**Industry-Focused Regional Research  
and Development Centers**

December 31, 2007



**Department of Housing and  
Community Development**

## **PREFACE**

The Department of Housing and Community Development prepared this report on the activities of industry focused research and development centers that became eligible for funding under the provisions of item 104 N. of the 2006 Appropriations Act. A 2007 amendment to the this budget item required the Department to report to the Chairmen of the House Appropriations and Senate Finance Committees its findings concerning the costs and benefits of the centers. To complete this assignment, staff of the Department's Division of Community Development compiled information from the public, private and higher educational institutions involved in the start-up of the centers.

# **Report on the Regional Research and Development Center Budget Initiative**

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# **Report on the Regional Research and Development Center Budget Initiative**

## **INTRODUCTION**

In 2007, the General Assembly funded a budget initiative to bring university-level research through local research and development centers to distressed communities. The budget allocated \$660,000 in FY '07 and \$1,160,000 for FY '08.<sup>1</sup> The intent of the Regional Research and Development Center (RRDC) grant funding was to strengthen significant industry clusters through product and process design innovations using applied research. If knowledge is power, then distance from a research university can be a competitive disadvantage for industries seeking to innovate. The goal of this innovative economic development concept was to not only enhance industrial competitiveness using a distributive research model but to create an on-going research university presence in distressed communities. The desired outcome of active community-based research was to increase the competitiveness of a community's existing core high wage industries and provide the opportunity for knowledge-based economic development in communities that have been dependent on lower tech-lower skill industries.

The budget language identified two distressed localities by name as initial candidates for this initiative: Lynchburg, around the nuclear cluster and Hopewell around the chemical cluster. These localities were charged with partnering with a higher education institution to establish industry-focused research and development centers. The budget language did not limit the research to any particular university; however, the work initially began with Virginia Tech (VT).

The need for this assistance is clear. The Region 2000 area<sup>2</sup> for example, lost more than 6,000 jobs in the recent past due to the closure of just five companies. Although new jobs are being created, they typically do not pay the same wage rates as did the manufacturing sector. The manufacturing sector, which now employs about 21 percent of the total workforce, still provides the highest paying jobs in the area. Lynchburg's nuclear sector, with such companies as B&W (which combined the existing Babcock & Wilcox Company with the former BWX Technologies), AREVA and Flowserve, to name a few, employ almost 4,200 in the Lynchburg region. This is a significant portion of the region's employment.

In the summer of 2006, initial meetings took place with VT, representatives from the localities and DHCD to discuss implementation of the concept. The localities were at different stages of readiness. Lynchburg was in an excellent position to move quickly forward with the RRDC concept. Region 2000 leadership had made a conscious choice to create a locally grown knowledge-based economy. The goal is to build an intellectual infrastructure through research to replace typical economic development strategies that focus on physical infrastructure and new recruitment. The region was committed to knowledge creation, technology transfer and commercialization as well as developing and entrepreneurial culture and a science and technology literate workforce.

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<sup>1</sup> Budget item 104 N. The Governor's FY 2008 Budget Reduction Plan subsequently reduced the funding to \$580,000.

<sup>2</sup> Region 2000 includes the cities of Lynchburg and Bedford and the counties of Amherst, Appomattox, Bedford, and Campbell.

The Region 2000 Economic Development Council, Region 2000 Technology Council, and the Center for Advanced Engineering (CAE) had recognized the necessity of a local university research presence to reaching this goal. The region had been pursuing a local research relationship with VT and had even begun discussing possible research topics with the region's two major nuclear industry employers: AREVA NP and The Babcock & Wilcox Companies.

With both a strong local government commitment and a demonstrated keen interest by local industries, the effort in Lynchburg moved forward. A final proposal was approved by DHCD in November 2006 and the effort was under contract by February 2007. Negotiations around indirect costs led to some delays in getting under contract.

Hopewell, however, was in a less optimal position to implement this initiative. Several factors were working against implementation at that time. Local government was experiencing many significant leadership changes during 2006-2007 and this hampered local capacity. In addition, the companies demonstrated limited interest in surfacing research ideas that would lead to a robust agenda in keeping with the intent of the initiative over the long term. The leadership and local capacity issues have been resolved, but the need to identify key research opportunities remains. To that end, DHCD has provided Hopewell with a \$50,000 planning grant to identify other clusters in the region with an interest in university-based research.

Because the Hopewell initiative remains in a formative stage, this report will focus on the implementation of the Regional Research and Development Center initiative in Lynchburg. The report will cover three main areas: Concept Design and Implementation, Results and Recommendations.

## **CONCEPT DESIGN AND IMPLEMENTATION**

### **Organizational Structure and Governance**

The RRDC project has been overseen by a 501 (c) (3) organization, the Region 2000 Research Institute (R2RI) doing business as The Center for Advanced Engineering and Research (CAER). CAER was formed to develop an industry-focused regional research and development center to drive the development of innovative products and processes by providing local access to university and federal research and inventions. It has a 12-member board comprised of industry representatives and members of the Region 2000 economic development and technology councils<sup>3</sup>. The role of the CAER to-date has been oversight of the research and development grant and activities as well as determining strategic research priorities.

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<sup>3</sup> Planning is underway to merge the Center for Advanced Engineering, a 501 (c) (3), with an education focus, and the CAER. This will create a 20-member board for CAER and ensure that the region has one entity that integrates a robust educational agenda with a research agenda. Both are components needed to create a vibrant knowledge-based economy.

## **Conceptual Framework**

While physical research centers may ultimately be developed, the initial RRDC concept is less about “bricks and mortar” and more about establishing a framework to bring university research into the community and on-site with the companies.

The key mechanism for that is the Liaison Professors. These are senior university faculty in a specific field assigned to the project to identify and prioritize research and development opportunities of interest to the region’s companies. Their role is also to establish connections with appropriate university faculty and industry personnel in order to conduct research of mutual interest. In the case of Lynchburg, the Liaison Professors are from the Mechanical Engineering Department at Virginia Tech. In addition to Liaison Professors, other faculty and graduate students will be involved in research on a project-by-project basis based on the specific research being conducted.

Another aspect to the research effort in Lynchburg is the Seed Grant program, which is funded through VT’s indirect costs. VT proposed re-investing the funds derived from its indirect cost for the initial two years back into the effort as small grants to faculty to support additional research projects. The intent of the seed grant program is to jump start a research project using the seed grant money to leverage additional funding. The implementation and results section will provide additional information about this program.

## **Project Definition, Management and Control**

Given the varied research needs of the companies and the goal of innovation, the initiative needed an operational structure permitting the rapid initiation of new projects without being slowed by individual contract negotiations around such time consuming issues as Intellectual Property (IP). Based on this goal, CAER and VT decided to work under a series of agreements. CAER and VT initially signed a broad Memorandum of Understanding (MOU) to work together on nuclear research so that the RRDC grant could get under contract. A more detailed collaboration agreement called the Master Research Agreement (MRA) was developed and executed. This agreement outlines specific terms and conditions, roles of the CAER and VT general intellectual property positions, and payment terms. This has served as a master agreement over all of the individual research projects undertaken by the VT for the CAER project.

Each individual research project has been authorized and initiated by a Project Plan with a Statement of Work. These plans reference the MRA and are the mechanism to outline the goals, tasks, collaborating parties, IP ownership, deliverables and schedule for a specific project.

## **Industry Involvement**

Initially, individual and joint meetings were held with the region's major nuclear companies: AREVA and B&W. From these meetings joint agenda of research interests was developed and included such topics as:

- Evaluations of coating technologies (e.g., thermal spraying, sputtering, ion beam, and electrochemical)
- Analysis and modeling of manufacturing processes and equipment (e.g., plate rolling and welding)
- Simulation of production lines and process flows
- Engineering diagnostics
- Access to large scale computing

In addition, while it was outside the scope of the RRCD, there was strong agreement on the need for a formal Nuclear Design Engineering degree program at Central Virginia Community College (CVCC) to create the pipeline of skilled workers needed by Lynchburg's nuclear cluster. Although CVCC offers local students graduate level engineering and technical courses through the Commonwealth Graduate Engineering Program, companies in the region were requesting a specific curriculum and coursework on nuclear engineering.

## **Implementation and Results**

It has been a little more than a year since CAER and Virginia Tech agreed to work together on the nuclear cluster research and much has been accomplished. Many of the early months were devoted to developing the agreement infrastructure through the MRA, which was executed in May 2007. With only minor modifications, accomplished through work statements on individual projects, the terms of the agreement and the handling of intellectual property have been satisfactory to all parties. This structure has in fact served the overall effort very well and has contributed to smooth project operations and management and quick initiation of the individual projects.

The Virginia Tech MRA has led to a total 10 projects. Two of these projects have been completed and three more are in progress. Another five projects have been funded through the Seed Grant program. Two other projects have been developed and authorized by the CAER Board but only one can be initiated at this time due to the loss of carry forward funding.

The research to-date has involved approximately four faculty members and seven graduate research assistants from the Virginia Tech Mechanical Engineering Department.

While specific details and outcomes of the research are technical and proprietary, a general description of the work being done for AREVA and B&W as examples is appropriate.

## **AREVA**

AREVA is a worldwide energy company and nuclear service provider (design and construction) based in France. Lynchburg is the company's North American headquarters for its USA nuclear design component and 1,500 are employed there. This location is focused on US federal approval for third generation plant design, which is already operational in Europe, as well research for fourth generation design. As concerns about CO2 emissions, greenhouse gases and global warming continue to grow, interest in generating more power through the use of nuclear energy has also grown. AREVA is seeking to address safety concerns as well as make power generation more efficient. To that end, AREVA has centered their research projects on fluid dynamics simulation with the goal of making more electricity using less uranium through innovative plant design. One key project has been the Heavy Reflector project. Typical pressurized water reactors use a water blanket between the core and the reactor vessel to cool the components as well as shield the reactor vessel from neutron damage. The AREVA evolutionary power reactor (EPR) uses a metal blanket instead of a water blanket. This heavy reflector increases power efficiency and reduces neutron damage. This project used computational fluid dynamics (CFD) to analyze the flow and temperatures of this design to better understand its operation and improve its performance. This research was critical to the recent submission of EPR design plans to the Nuclear Regulatory Commission (NRC), which is discussed later in this report, allowing AREVA to make up significant ground with competitors with earlier submittals to the NRC

## **B&W**

The newly re-organized Babcock & Wilcox Companies<sup>4</sup> has three of its four units headquartered in Lynchburg and employs 2,300. Activities in Lynchburg include engineering, manufacturing of components and field service. One key area of research that has been the focus of the work with Virginia Tech is the welding of dissimilar materials specifically as it relates to the temperature of the weld. The research has examined the temperature profile of welds with the goal of being able to control the temperature within a certain acceptable range. The goal is to develop a non-contact mechanism to evaluate temperature information about components during welding, enabling component distortion and shrinkage to be addressed. Such research will lead to enhanced quality and safety of the welds.

### **The Seed Grant Program**

The Seed Grant Program has five projects underway, including a continuation of the B&W project discussed above as well as an optical mouse tracking system and security simulator. These five projects will return approximately \$175,000 of VT indirect costs back to the research initiative as well as serve to leverage additional funding for the research. The Seed Grant Program has taken on a more important role than expected due to the loss of approximately

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<sup>4</sup> As of November 27, 2007, the Babcock & Wilcox Companies announced an internal re-organization that puts its operations in four units. Three of the four units are headquartered in Lynchburg including the nuclear power group (NPG), the technical services group (TSG) and the nuclear operations group (NOG). The reorganization is designed to help the company in the growing nuclear power market.



\$131,000 in 2007 carry forward funding as several of the research projects that had been budgeted for using FY 2007 funds must now be supported through the Seed Grant program.

<b>Lynchburg Regional Research and Development Center Metrics</b>		
<b>University Partnerships</b>		
	<b>VT</b>	<b>UVA</b>
<b>Funded Projects</b>	<ul style="list-style-type: none"> <li>➤ <b>10 total</b></li> <li>➤ 2 Completed (B&amp;W &amp; AREVA)</li> <li>➤ 3 In progress (AREVA)</li> <li>➤ 5 In progress through Seed Grant program (AREVA)</li> </ul>	<ul style="list-style-type: none"> <li>➤ <b>2 total</b></li> <li>➤ 2 In progress (AREVA)</li> </ul>
<b>Faculty &amp; Students Deployed</b>	<ul style="list-style-type: none"> <li>➤ 4 faculty members/ 7.5 graduate research assistants</li> </ul>	<ul style="list-style-type: none"> <li>➤ 0.4 faculty members/ 2.1 graduate research assistants</li> </ul>
<b>Research Contacts Established</b>		
<b>Virginia</b>	<ul style="list-style-type: none"> <li>➤ Liberty University, Sweet Briar College, James Madison University, College of William &amp; Mary; also tech transfer contacts with Virginia Tech Intellectual Properties (VTIP) and UVA Patent Foundation</li> </ul>	
<b>Federal</b>	<ul style="list-style-type: none"> <li>➤ Oak Ridge National Labs, NASA Langley, Idaho National Labs</li> </ul>	

### **Outreach to Other Institutions**

Through the RRDC project CAER's interactions with higher education have not been limited to Virginia Tech. The University of Virginia (UVA) has also shown great interest in working with CAER on two nuclear cluster projects. CAER and UVA are developing an MRA but are working the two current projects under a general MOU.

As can be seen in the above chart, CAER has had very aggressive outreach to other Virginia colleges and universities as well as with other laboratories across the nation. The aggressive outreach enhances the robustness of the research available to Lynchburg's nuclear cluster allowing a broader range of work to be done in Lynchburg. Given the complexity of the issues being researched and the limited time that this initiative has been under way with the late adoption of the budget in 2006, it is unrealistic to expect additional job creation so soon. However, it is safe to say that this initiative has meant in the short-term that research that may have been performed elsewhere has in fact stayed in Lynchburg and Virginia and in that sense has retained jobs. In addition, the commitment of the state's resources to research sends a strong message of commitment to our existing industries in a field that is growing and is highly competitive.

This commitment is incredibly important in light of the recent announcement by AREVA that it plans to create up to 500 jobs in the US. The proposed expansion will be based on approval by the Nuclear Regulatory Commission (NRC) of its recently submitted EPR nuclear reactor design. As mentioned earlier, specific research conducted using RRDC funds accelerated the submittal of the design. This was extremely critical due to the fact that competitors had submitted designs to the NRC several years ago. Based on an existing operational history of this design in Europe, AREVA anticipates a timely review of the design and the ability to receive approval to begin to sell the design to utilities.

### **Educational Opportunities**

As mentioned earlier one of the goals of the CAER was to start the transition of the regional workforce through advanced education in nuclear engineering. The availability of such an option can also support employee retention as well as recruitment. To that end, VT has initiated a nuclear certificate option to its Masters of Engineering program. The first course in the certificate option was taught to 20 graduate students this past fall. Four of those students were AREVA employees in Lynchburg who took the course through the Commonwealth Graduate Engineering Program's distance education network. VT has also added an undergraduate nuclear course in the Mechanical Engineering Department.

### **LESSONS LEARNED AND RECOMMENDATIONS**

Experience with an innovative economic development approach such as the Regional Research and Development Center initiative provides many insights on how to improve the concept in the future. Although, there is no additional state funding to continue the effort into the future, it is still important to capture the lessons learned. These fall into two main categories: the community economic development lessons learned and the concept implementation level. Some of the key leanings are presented below.

#### **Concept Implementation Lessons**

- 1) **Master Research Agreement.** Although negotiation of this agreement delayed somewhat the initiation of on-the-ground research, both CAER and VT agree that establishing a framework for determining IP policies at the outset is the best course of action. As stated earlier this work done at the front end meant that there increased efficiency in getting individual projects under way in a timely fashion. It also meant that time could be spent on developing the individual statements of work for a particular project. This could be an important model for other such endeavors.
- 2) **Liaison Professor.** This position is a key component to the success of the research initiative and served an invaluable function in guiding the research and coordinating the participation of other faculty and students. An important next step in continuing the research initiative would be to create a liaison relationship at a level within the higher

education institutions that can reach across all pertinent fields and disciplines, such as a Technology Transfer office.

### **Community Economic Development Lessons**

- 1) **Local Capacity.** In this regard the two communities were at very different stages. The Lynchburg region had already been strongly committed to a technology-based economic development strategy and has developed both the organizational infrastructure and industry relationships needed to pursue this. Thus, both government and industry have been partners through the years in the assessment of industry needs and the pursuit of the mechanisms to address them. While the public sector should not lead the research agenda, the capacity and active engagement of local government are critical to its success.
- 2) **Industry-led Local Research Interest.** A critical factor to success of this type of an initiative is that the industries have a need, interest and organizational structure for significant research to happen at the Virginia location, especially in the case of large, multi-national companies. In the case of the nuclear cluster, this existed. The two largest firms had headquarters in Lynchburg and thus were able to make the decision to conduct research at that location. It may be difficult to initiate significant research interest in branch plant locations because the research priorities are determined and the actual research performed at some distance from Virginia.

## **APPENDIX A**

### **Budget Item 104 N., Chapter 847, 2007 Acts of Assembly**

N. Out of the amounts for Community Development Services shall be provided \$660,000 the first year and \$1,160,000 the second year from the general fund to support the creation of industry-focused regional research and development centers. Funds shall be used to provide grants to two communities, which may include but are not limited to Hopewell and Lynchburg, which will partner with a higher education institution in the development of the regional research and development centers. These centers will support existing industry clusters by providing research on product and process development and enhancements. *The Department shall submit a report to the Chairmen of the Senate Finance and House Appropriations Committees by December 31, 2007, on the benefits and costs of the two regional research and development centers, including but not limited to the number of jobs created or retained by participating industries, investments made by participating institutions of higher education, and number of joint higher education-private sector projects.*