

# Commonwealth Research and Technology (R&T) Strategic Roadmap

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## **Executive Summary**

November 1, 2011

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Innovation is essential to success and even more critical in times of constrained resources. Innovation is imperative for firms seeking a competitive advantage, for universities producing talented members of the workforce and world-class research, and for state and local governments cultivating environments that stimulate entrepreneurship and technology development. It requires smart investments in research, commercialization, and the infrastructure and environment that support strategically important industry sectors and technologies.

Virginia is often looked to as a leader in innovation. The Commonwealth's public higher education system is often cited as among the best in the nation. CNBC and Forbes.com have ranked Virginia as the top state for business. Virginia's continued economic leadership requires maintaining investment in research and innovation.

Unfortunately, Virginia lags behind other states according to accepted innovation indicators. The 2010 State New Economy Index, for example, ranked Virginia #21 in industry investment in research and development, and #25 in patents<sup>1</sup>. In the National Science Foundation (NSF)'s annual reporting of academic R&D expenditures, Virginia ranked #15 among all states in 2009.<sup>2</sup> A 2007 report by SRI International, prepared for the Virginia Economic Development Partnership (VEDP), indicated that in 2005 Virginia ranked second to last among its peer states for academic R&D expenditures per capita.<sup>3</sup> As of 2009, this ranking was unchanged. Seed-stage investments also lag; in 2010, Virginia had 29 seed-stage investments compared to 99 in Maryland and 263 in Massachusetts.<sup>4</sup>

Each year the members of Virginia's General Assembly are presented with funding requests for initiatives designed to support growth in specific industries and research areas. While sponsors of the initiatives argue that their requests are critical investments in the future of the Commonwealth, legislators can find it difficult to separate the wheat from the chaff during the brief but hectic sessions that include thousands of legislative and budget-related proposals.

During its 2011 Session, through HB2324, the General Assembly directed the Center for Innovative Technology (CIT) to create a Commonwealth Research and Technology (R&T) Strategic Roadmap to help guide legislators in their funding decisions. In accordance with Code of Virginia Sections 2.2-2221.2 D and 2.2-2221 (18), CIT respectfully submits the Roadmap. The results outlined in this report are the

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<sup>1</sup> The Information Technology & Innovation Foundation and Kauffman Foundation, *The 2010 State New Economy Index*, 2010.

<sup>2</sup> National Science Foundation, *Academic R&D Expenditures FY2009*, 2009.

<sup>3</sup> SRI International, *Assessing the Technology Industry Potential of the Commonwealth of Virginia*, November – December 2007.

<sup>4</sup> PricewaterhouseCoopers and National Venture Capital Association, *MoneyTree™ Report*, Q3 2006 – Q2 2011, 20 September 2011, [www.pwcmoneytree.com](http://www.pwcmoneytree.com).

product of a close collaboration from a team that included Virginia's private sector – led by the Commonwealth's ten regional technology councils, its colleges and universities, as well as federal labs and other research entities. A broad range of senior executives from industry, academia, federal laboratories, other research organizations, economic development offices, and the Research and Technology Investment Advisory Committee (RTIAC) contributed to the Roadmap. Additionally, CIT acknowledges the important contributions of the Secretariats of Technology, Education, and Commerce and Trade; VEDP; Virginia Tech; and Chmura Economics & Analytics in developing this Roadmap.

This report identifies industry and research areas worthy of economic development and institutional focus and offers a framework for aligning key industry sectors within the state. It is also intended as a guide for investing funds allocated through initiatives such as the Commonwealth Research Commercialization Fund (CRCF).

Legislation calls for the Roadmap to be submitted by November 1, 2011, and to be updated at least every three years. Because the CRCF program is tied to the review of the Roadmap, CIT is submitting this report regarding industry opportunities for investment on an accelerated schedule.

Opportunities outlined in this report are the result of a rigorous and iterative assessment process that included examination of Virginia's industry and research strengths from multiple perspectives. These strengths were compared to national and global initiatives and priorities to ensure relevance and direct market applicability. These opportunities not only represent high priority industries and research disciplines that promise favorable out-year growth, but variations thereof as well.

The first phase of the Roadmap has identified the following sectors for investment in the Commonwealth, including research and technologies eligible for CRCF funding in the October 2011 solicitation:

- **Advanced Manufacturing**, with particular interest in semiconductors, unmanned vehicles, robotics, remote monitoring and sensing, surface engineering, chemicals, advanced materials, and nanotechnology – especially nanoelectronics and nanomedicine
- **Aerospace**, with particular interest in launch vehicles and commercial space flight
- **Communications**, with particular interest in broadband and wireless telecommunications
- **Cyber Security**, with particular interest in data center security, network and perimeter security, authorization and authentication technologies, disaster recovery and continuity of operations technologies, and application and device security
- **Energy**, with particular interest in smart grid, green construction including retrofitting, nuclear plant safety and support, wind technologies, biofuels, and waste-to-energy applications
- **Environment**, with particular interest in marine science and water and air quality monitoring and control
- **Information Technology**, with particular interest in software and application development and data management, analytics, and storage

- **Life Sciences**, with particular interest in biotechnology, biomedicine, health IT, bioinformatics, biomarkers, biometrics, personalized medicine, remote care delivery, drug discovery, and computer-assisted drug design
- **Modeling and Simulation**, with particular interest in energy, transportation, healthcare, and homeland security and defense applications
- **Nuclear Physics**, with particular interest in advanced manufacturing, energy, environment, life sciences, information technology applications, and a 4<sup>th</sup> generation light source
- **Transportation**, with particular interest in vehicle telematics, vehicle and driver performance monitoring, and intelligent transportation systems

Properly structured intellectual property (IP) agreements help foster innovation; as called for in legislation, IP will be addressed as part of any CRCF award.

Investments targeted at the intersection of industry capabilities and direction, research strengths, and economic development can create a multiplier effect that increases the benefit of the CRCF and other industry/research growth initiatives.

Two of Virginia's strongest and most promising sectors not only run across multiple regions but are also enabling technologies. The Information Technology and Modeling and Simulation sectors facilitate development in Transportation, National Security, Healthcare, Advanced Materials and Manufacturing, Energy, and Environment. Similar synergies across regions and technologies can be found in Life Sciences, Aerospace, and other sectors and subsectors. Likewise, investments in Cyber Security and Remote Monitoring and Sensing could have impact across multiple sectors and regions. Identifying and funding these high-impact technologies will have widespread benefit to individual regions and to the Commonwealth as a whole.

Given these synergies and past tendencies to function independently of one another, opportunities exist for the Commonwealth and regions to benefit from sharing complementary goals, expertise and resources. By showcasing the Commonwealth's priorities and indicating areas of particular strength or capabilities, regions will be able to take advantage of others' accomplishments, thus improving Virginia's standing as a whole. For example, sensing and measurement technologies were identified as a priority in Hampton Roads, Region 2000, and Roanoke-Blacksburg. This technology, furthermore, spans the Communications, Energy, Aerospace, Transportation, and Defense industries. Investments in this industry, therefore, would have widespread benefit across the Commonwealth.

Virginia's strengths and priorities help establish its competitive advantage. Capabilities in target sectors have been cultivated for years, as demonstrated in such reports as 2003 Assessment of Virginia's College and University Research Programs by then-Governor Warner's Research Panel, the 2007 SRI/VEDP Assessment of Technology Industry Potential in the Commonwealth, and the 2007 report of the Virginia Research and Technology Advisory Commission (VRTAC), Collaborative Research and Development Strategies for the Commonwealth of Virginia.

Not only do its strong and most promising capabilities align with national priorities, but the effects extend internationally as well. Virginia boasts a close proximity to the federal government; this and a multitude of other factors, including its ports and airports, skilled and highly educated workforce, renowned educational system, and pro-business climate, strengthen its competitive advantage. The iterative nature of the R&T Roadmap plots a wise course in this rapidly changing environment: to regularly review and, as needed, revise Virginia's strategic technology direction and investments. The next phase of the Roadmap also will be accelerated and is scheduled to be delivered in May 2012. Phase II will:

- Refine where efforts should be focused, including basic and applied research opportunities
- Develop a process for cataloging research endeavors
- Review and potentially revise the IP policy for CRCF awards
- Address capital construction needs when timing aligns with work by the State Council of Higher Education for Virginia (SCHEV) and the academic community

The Commonwealth Research and Technology Roadmap is the first state-wide community, university, and industry technology tool developed by stakeholders for the purpose of planning, investing, and communicating the future of technology development. This strategic process will enable more efficient resource utilization and maximize public and private return on investment. In addition to improving efficiencies in industry development, this initiative improves global competitiveness by accelerating the rate of new technology development and production.