

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

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## **EXECUTIVE SUMMARY**

November 1, 2014

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Innovation is widely recognized as the premier path to economic expansion, and success in innovation requires smart investments not only in the infrastructure and environment that support strategically important industry sectors and technologies, but in research and commercialization to advance those promising sectors.

Virginia is often looked to as a leader in innovation. The Commonwealth's public higher education system is repeatedly cited as among the best in the nation. CNBC and Forbes.com consistently rank Virginia among the top states for business<sup>1</sup>, with Forbes.com ranking Virginia #1 in 2013<sup>2</sup>. Virginia's continued economic leadership requires maintaining investment in research and commercialization, as well as the ecosystem that surrounds innovation.

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

As a result, in 2011 the General Assembly directed the Center for Innovative Technology (CIT) to create the Commonwealth Research and Technology (R&T) Strategic Roadmap to help guide legislators in their funding decisions. The Roadmap 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 a guide for investing funds allocated through initiatives such as the Commonwealth Research Commercialization Fund (CRCF). The iterative nature of the R&T Roadmap provides for regular review in what can be a rapidly changing environment and, as needed, revisions to Virginia's strategic technology direction and investments. The initial Roadmap was submitted in November 2011. In accordance with Code of Virginia Sections 2.2-2221.2 D, CIT respectfully submits this update.

The Roadmap is the product of ongoing collaboration from a team that includes Virginia's private sector, led by the Commonwealth's ten regional technology councils, its colleges and universities, federal labs and other research organizations, and economic development officials. 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) contribute to this examination of Virginia's strengths and priorities.

Virginia's Innovation Dashboard, the [Innovation and Entrepreneurship Measurement System \(IEMS\)](#), uses key metrics and outcomes to track the performance of Virginia's innovation economy. This web-

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<sup>1</sup> CNBC. (2014). *America's Top States for Business*. [www.cnbc.com/id/101758236](http://www.cnbc.com/id/101758236)

<sup>2</sup> Badenhausen, K. (2013, September 25). *Virginia Tops 2013 List of the Best States for Business*. [www.forbes.com/sites/kurtbadenhausen/2013/09/25/virginia-tops-2013-list-of-the-best-states-for-business/](http://www.forbes.com/sites/kurtbadenhausen/2013/09/25/virginia-tops-2013-list-of-the-best-states-for-business/).

based portal tracks such measures as federal R&D investments in Virginia, federal technology research and commercialization awards, and university patents and start-ups. Although Virginia enjoys a reputation as a top-tier innovation state, there are several key areas in which the Commonwealth's performance needs to improve. The 2014 State New Economy Index, for example, ranked Virginia #22 in industry investment in research and development and #18 in patents<sup>3</sup>, compared to, respectively, #15 and #18 in the 2012 report<sup>4</sup>. The reports also indicate a decline in Virginia's venture capital ranking between 2012 and 2014, from #7 to #19. In the National Science Foundation (NSF)'s annual reporting of academic R&D expenditures, Virginia ranked #15 among all states in 2012<sup>5</sup>, unchanged from its 2009 ranking<sup>6</sup>. Additionally, according to Jeffrey Sohl of the University of New Hampshire's Center for Venture Research, in 2013 Virginia had a slightly lower angel yield rate than mid-Atlantic states (VA: 13.3; mid-Atlantic: 16.0) and a much smaller proportion of angel capital in the seed and start-up stage (VA: 45%; mid-Atlantic: 76%)<sup>7</sup>.

The IEMS allows policy makers to easily track the Commonwealth's innovation ecosystem. The Roadmap assesses research and technology strengths that represent opportunities in high-priority industries and research disciplines with promising out-year growth.

The FY2015 Roadmap identifies the following sectors as research and technology strengths and opportunities that represent high-priority industries, subsectors, and research disciplines with promising out-year growth.

- **Advanced Manufacturing**, with particular interest in additive manufacturing, semiconductors, unmanned vehicles, robotics, remote monitoring and sensing, advanced materials, and nanotechnology – especially nanoelectronics and nanomedicine
- **Aerospace**, with particular interest in launch vehicles and commercial space flight
- **Communications**, with particular interest in developing next-generation broadband networks, wireless telecommunications, and next-generation 911 infrastructure
- **Cyber Security**, with particular interest in enterprise networks, critical infrastructure security, authorization / authentication / identity management technologies, cloud-based security, data and application encryption and key management, and mobile / device security
- **Energy**, with particular interest in clean coal, smart grid, nuclear plant safety and support, wind technologies, biofuels, efficiency, and waste-to-energy applications

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<sup>3</sup> The Information Technology & Innovation Foundation and Kauffman Foundation. (2014). *The 2014 State New Economy Index*.

<sup>4</sup> The Information Technology & Innovation Foundation and Kauffman Foundation. (2012). *The 2012 State New Economy Index*.

<sup>5</sup> National Science Foundation. (March 2014). *Higher Education Research and Development Survey, Fiscal Year 2012*.

<sup>6</sup> National Science Foundation. (July 2011). *Academic Research and Development Expenditures, Fiscal Year 2009*.

<sup>7</sup> Sohl, J. (2014). *The 2013 Seed and Start-up Equity Capital Market in the Commonwealth of Virginia*.

- **Environment**, with particular interest in marine science and water and air quality monitoring and control
- **Information Technology**, with particular interest in data analytics
- **Life Sciences**, with particular interest in biopharma, health IT, bioinformatics, biomarkers, personalized medicine, remote care delivery, medical devices and software, diagnostics, 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

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 strong and most promising sectors, Cyber Security and Data Analytics, cross multiple regions, and investments will support growth in multiple industries important to the Commonwealth, including National Security, Healthcare and Life Sciences, Advanced Manufacturing, Education, Energy, and Government. Similar synergies across regions and technologies can be found in Advanced Manufacturing, Energy, Life Sciences, and other sectors and subsectors. Identifying and funding these high-impact technologies will have widespread benefit to individual regions and to the Commonwealth as a whole.

Industry strengths and niche opportunities are profiled in the Roadmap along with a sampling of industry, university, and research institute strengths and priorities. These materials are augmented with profiles of Virginia universities and research institutes on CIT's website, [www.cit.org/initiatives/research-and-technology-strategic-roadmap/](http://www.cit.org/initiatives/research-and-technology-strategic-roadmap/).

Research requires specialized facilities and equipment; at Virginia's public universities, such infrastructure requests may be captured in the Commonwealth's Six-Year Capital Outlay Plan. Most capital projects requested by Virginia's public universities support objectives other than research. However, as in past years, the latest Six-Year Capital Outlay Plan includes research facilities and / or equipment, or facilities that share such purposes as research and teaching.