Optimizing Virginia’s Competitive Advantage in the Global Knowledge Economy

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Presentation to the Virginia Research Investment Committee
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It is essential that we as a nation reaffirm, revitalize, and strengthen substantially the unique partnership that has long existed among the nation’s research universities, the federal government, the states, and philanthropy by enhancing their roles and linkages and also providing incentives for stronger partnership with business and industry. In doing so, we will encourage the ideas and innovations that will lead to more high-end jobs, increasing middle-class incomes, and the security, health, and prosperity we expect.

Virginia’s Challenge

• We urgently need additional significant private sector economic drivers.
  • Our economic growth rate is in decline
  • We are over reliant on dwindling defense funding – we must diversify
  • Low growth of high-paying jobs in growing industries
  • We are losing young talent to other states
  • Opportunities are passing by

• Our investments in universities are not yielding sufficient economic development

• Our economic development efforts are fragmented, localized and not aligned

From The VA Bioscience Economy Initiative, The_Virginia_bioscience_econ.pdf
Virginia Research Alliance
A Powerful Partnership for Innovation

• University partners include EVMS, GMU, ODU, UVA, VCU, VT, & W&M

• Commitment to:
  • Recruit and reward/retain world-class, innovation-focused academic scientists and engineers
  • Build and operate shared research and innovation tools, instruments and infrastructure for use by both academic and private sector innovators
  • Develop and sustain strong university-industry partnerships
  • Effectively translate research outcomes into products and services by creating alignment among federal, state and private sector initiatives
Virginia Research Alliance

Core Strategies

• Catalyze long-term state-wide growth of high tech, high wage, private industry

• Shared strategic commitment to collaboration, alignment & economic impact

• Focus on formation of innovation clusters/districts on statewide and regional scales

• Build on existing strengths in universities and in private sector

• Leverage state $’s (GO Virginia, VRIF) with private and federal $’s

• Measure ROI and report annually
Virginia Research Alliance
Operationalized

• VPRs empowered by SCHEV, VRIC, and University Presidents
• Multiple meetings over Spring-Summer-Fall 2016
• High priority opportunities for collaborative impact identified
  • IoT Economy – A Cyber Emphasis
  • Biosciences Economy – A Neuro Emphasis
The Case for Cyber
The Commonwealth is:

- a national leader in the $75B cybersecurity industry
- well positioned to capitalize on explosive growth in cyber-physical system (IoT) security that diversifies portfolio across multiple industry sectors
- at risk of losing competitive advantage as new opportunities emerge without investments in growth of a vibrant technology entrepreneurial ecosystem
VRIF support of Virginia’s universities strengthens the ecosystem for the Commonwealth to lead the nation in cybersecurity industries by:

- creating a network of leading talent across Virginia
- providing network of open access state-of-the-art facilities
- enhancing competitiveness for investment in cybersecurity research and commercialization
Cybersecurity: Opportunities & Threats for Virginia

Virginia ranks 2\textsuperscript{nd} in job postings and 1\textsuperscript{st} in concentrated demand, yet high projected growth of 38\% is lower than competitors.

- Virginia ranks 2\textsuperscript{nd} in number of cybersecurity companies (150) on Cybersecurity 500 list.
- Universities are critical to this ecosystem.
Cyber-physical system security is pervasive across multiple industrial sectors

- More than 30B connected devices by 2020
- Spending on IoT security to reach $120B by 2020 with overall cyber spending to be $500B-$1T from 2017-2021

Source: BI Intelligence, Gartner

Non-traditional wireless systems represent fastest growing segment of connected devices
High-Paying Cybersecurity Jobs

Virginia universities play a critical role in creating a talent pipeline.

Too Few Professionals

2 MILLION: Global shortage of cybersecurity professionals by 2019

3X RATE OF CYBERSECURITY JOB GROWTH VS. IT JOBS OVERALL, 2010-14

84% ORGANIZATIONS BELIEVE HALF OR FEWER OF APPLICANTS FOR OPEN SECURITY JOBS ARE QUALIFIED

53% OF ORGANIZATIONS EXPERIENCE DELAYS AS LONG AS 6 MONTHS TO FIND QUALIFIED SECURITY CANDIDATES

77% OF WOMEN SAID THAT NO HIGH SCHOOL TEACHER OR GUIDANCE COUNSELOR MENTIONED CYBERSECURITY AS CAREER

89% OF U.S. CONSUMERS BELIEVE IT IS IMPORTANT FOR ORGANIZATIONS TO HAVE CYBERSECURITY-CERTIFIED EMPLOYEES

>17,000 vacant cyber jobs in Virginia

Growing needs for higher-level Security+X skills:

- Data science
- Wireless
- Advanced Manufacturing
- Autonomous vehicles
- Energy Systems
- Health and Medical Devices
- Financial / Insurance / etc.

Bachelor's 61%

Master's or Ph.D. 23%

Associate's 16%
Virginia’s Current University Capabilities

Number of faculty actively engaged in research and instruction
> 150

Annual extramural expenditures in research and instruction
> $70 M

Centers and Institutes with >$5M Ann.
- Applied Research Institute
- Applied Research Corporation
- Center for Secure Information Systems
- Data Science Institute
- Hume Center for National Security

Select sector-specific with >$2M Ann.
- ASSIST Center
- Biocomplexity Institute
- Center for Air Transportation Systems
- Mid-Atlantic Aviation Partnership
- Transportation Institute

Virginia Cyber Range

*Estimated (minimum amounts)
Technology Entrepreneurial Ecosystem

The DC region ranks among the top ten cities in the US where startups received the most venture funding, and Virginia leads the DC region. Virginia is uniquely positioned near the Federal government and its various agencies.

Source: Tech.co

Network of universities with leading expertise are central to vibrant ecosystem.
Select Security and Related Sector Industry Partners*

Supported > $15M in cybersecurity and sector programs over last 3 years

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*confidential list - many publicity restricted
Select Cybersecurity and IoT Start-ups

VA University-based start-ups raised >$100M in venture funding in 5 yrs

Scit Lab, 2007, Federal funding
PFP Cybersecurity, 2010, $0.3M raised, CIT gap funds, Blue Venture
Invincea, 2011, $21.1M raised, New Atlantic Ventures, Aeris, Dell
Optio Labs, 2012, $11.6M raised, Allied Minds
Federated Wireless, 2012, $34.0M raised, Allied Minds, Woodford, P3 Capital
DataFission, 2013, commercial sales
PsiKick, 2014, >$20M raised, Osage Partners, New Enterprise, U Michigan
HawkEye 360, 2015, $18.3M raised, Allied Minds, In-Q-Tel, Raytheon, Razors Edge
Counter Drone Research Corp, 2016, CRCF awardee
Cyvision Technologies, sales to US government
Cyberrock Inc., CRCF awardee, Federal funding
VRIF Support to Enhance Cybersecurity Ecosystem

State-wide university network of:

- Security+X talent aligned with university strengths and translation goals
- State-of-the-art open access cyber facilities
- Industry, govt, venture partners
- Curriculum and training materials
Publications can be accurately benchmarked and provide a measure of expertise and reputation.

Comparison to SCHEV Peers: Cybersecurity

Strategic investments in talent and infrastructure would enhance competitiveness of Virginia universities in cybersecurity-related efforts when compared to top-ranked peer institutions.
Size of the bubbles indicates that emphasis of cybersecurity-related research as compared to the total is high compared to peers.

The Case for Neuro
Economic Motivation for Commonwealth

- Neurological diseases and conditions estimated **$1 Trillion per year societal cost**, and burgeoning

- **$5 Billion Federal BRAIN initiative** across NIH, DoD, VA, NSF

- **Treatment and Neurotechnologies market** – $12.3 Billion* per year by 2020 and rapidly increasing
  - Neuroprosthetics
  - Neuromodulation
  - Neurorehabilitation
  - Neurosensing – diagnosis, control and medication delivery


- **Jobs comparables** - analogous to Biomedical Engineering (BME) in 2005-2010
  - Intersection of Medicine, Engineering, Basic Sciences
  - BME Jobs now growing at 23%
    (US Bureau of Labor Statistics)
  - Average starting salary with Bachelor of Science degree: $86,220 per year

- **Enhanced workforce productivity**
- **Reduced Medicaid cost burden**
Opportunity: Strength through Collaboration

- 157 Faculty across Commonwealth with funded research in Neuro
- $96M per year in directly funded research (NIH, foundations, industry)

Major research strengths and capabilities across a broad spectrum

- Neurodegenerative diseases
  - e.g., Alzheimer’s, Parkinson’s, muscular dystrophy
- Traumatic Brain Injury
- Central Nervous System Injury

- Learning and Cognition
- Autism
- Epilepsy
- Addiction
- Imaging
- Genomics
- Big data
Current Industry & Nonacademic Partners

- **Health Systems**
  - INOVA
  - Carilion
  - Kings Daughters Childrens Hospital
  - UVA Health
  - Veterans Administration

- **Neurodegeneration**
  - Michael J Fox Foundation
  - Janelia Farms

- **Injury & Trauma**
  - NFL
  - NCAA

- **Pharma**
  - Astra Zeneca
  - Medimmune
  - Boehringer Ingelheim

- **Big Data**
  - Booz Allen Hamilton
  - Mitre
  - IBM Watson
  - Parabon

- **Neurotechnologies**
  - Imaging
    - Philips
    - Siemens
    - PETNET
    - Johnson & Johnson
    - Focused Ultrasound Foundation
    - DuPont
Neuro: Intellectual Property & Startups

- **UVA Licensing & Ventures Group (2012-16)**
  - 56 invention disclosures in neuro
  - 40 licensing deals
  - 3 startups

- **VCU Innovation Gateway (2012-2016)**
  - 63 invention disclosures in neuro
  - 11 licensing deals
  - 4 start-ups

- **VT, GMU, W&M, ODU, EVMS (2012-2016, data still being gathered)**
  - >10 invention disclosures in neuro
  - >10 issued patents
  - > 3 start-ups

- **SBIR/STTR opportunities**
- **INOVA Venture Fund**
- **VBHRC, CIT**
Peer Comparisons

Research and translation leaders

• MIT
  • McGovern Institute for Brain Research, estab. Feb’ 2000 ($350M philanthropic gift)
    - 250+ researchers and support staff: 1 Nobel Prize, 1 National Medal of Science, 5 National
      Academy of Science, 3 National Academy of Medicine, 1 HHMI Investigator
  • 85,000 nsf, including Dept. of Brain and Cognitive Sciences, Picopower Inst. for Learning and
    Memory, Martinos Imaging Center, OpenMind Computer Cluster, other cores

• CalBRAIN (California Blueprint for Research to Advance Innovations)
  • Estab. 2014; collaboration across University of California System
    • Seed support – focus upon new technologies for monitoring widescale brain activity
      • $2M in seed funds awarded thus far
    • Support for Federal funding opportunities

• Regional: Major centers at U Maryland and North Carolina with faculty from Medicine, Engineering and Sciences (similar to new BRAIN Institute at UVA)
Areas Meriting VRIF Support in Neuro

1. Commonwealth Professors: Key Faculty hires and retentions (highest priority)

2. Establish Commonwealth Core Network of critical instrumentation at common rates for all sites (VCore)

3. Procurement of critical instrumentation not currently available from throughout the VCore Network

4. Translational Neurotechnology program initiative
   • Modeled after highly collaborative and successful i6 Grant from Department of Commerce
Virginia Innovation Partnership
Department of Commerce i6 Challenge 2012
Linking talent, ideas and capital across the Commonwealth

- Diverse review group
- Annual venture capital summit
- Mentoring network

Challenges:
Motivating proposals from all regions
Sharing ideas freely across the network
Maintaining engagement of teams

Match Funding: Other university $, corporate, and non-profit organizations
Virginia Innovation Partnership (VIP)  
2012-2014 Program Summary

• 147 Total Submissions Received
• 12 Number of Academic Institutions
• 36 **Projects funded**
  Total funding awards - year 1 ($838,000) - year 2 ($800,000)
• 13 **New ventures launched**
  • Eastern Virginia Medical School (1)
  • George Washington - Science and Technology Campus (1)
  • Old Dominion University (1)
  • University of Virginia (4)
  • Virginia Commonwealth University (4)
  • Virginia Tech (1)
  • William and Mary (1)
• $4.3M+ Follow-on funding received from state/federal agencies, industry and private investors to advance the projects
Virginia Research Alliance
A Powerful Partnership for Innovation