Virginia Higher Education Research Summit

June 9, 2014

Welcome by Peter Blake

SCHEV, in partnership with the Center for Excellence in Education, Center for Innovative Technology, Virginia Chamber of Commerce, Virginia Business Higher Education Council, and the Virginia Economic Development Partnership, hosted the Virginia Higher Education Research Summit on June 9th at the Omni Richmond hotel. The Summit brought together stakeholders in Virginia who are committed to supporting academic research and to showcase exemplary private/public partnerships between universities and the private sector. There were about 250 attendees.

Attendees were welcomed by opening remarks from Virginia Secretary of Education Anne Holton, who noted Governor McAuliffe’s recognition of the need for research at all levels of higher education and said that we are fortunate to have a leader who “gets it” and will actively promote research at our universities. Governor McAuliffe then addressed the group, saying that Virginia is facing a new economy. We should focus on becoming leaders in areas such as cybersecurity and genome-sequencing, and investment in research and development is key. We must have students, faculty, facilities, and equipment. Currently, we are 15th for federally funded research and he wants to shoot for being number one. He asked the public institutions to do a better job of collaborating and sharing equipment and facilities, but said that he will listen to strategies to help them be successful. Because of the new economy, we need to build a new future - it is an opportunity.

First Session: Virginia’s Academic Research Portfolio and Economic Gains

Guylaine Saint Juste from Capital One Bank served as the facilitator for a panel on Virginia’s academic research portfolio and economic gains.

Charles Steger, President Emeritus of Virginia Tech started the panel with a discussion about the United States’ competitiveness in the world economy:

- The tremendous growth of India and China has completely changed the game in university research. Those countries are not waiting for us to figure it out; their leaders stimulate the innovative culture that drives the new ideas and sometimes they generate whole new industries.
- In the United States, we have seen the effects on our businesses, not just through direct competition in workforce, but also through products and new technological capabilities.
- Countries are changing their laws to be able to compete in the world economy and nations that fail to act will fall behind.
- There is no shortage of studies that show we are falling behind, such as “Rising Above the Gathering Storm.”
• The fundamental measure of competitiveness is the quality of jobs. The jobs define the quality of life of our individual citizens. The tax revenue from those citizens and the firms that employ them will lead to fulfilling social needs – education, etc. A variety of economic studies show that more than half of GDP is attributed to progress in tech innovation, which leads to jobs and allows people across the world to compete.

• The US must compete by optimizing its resources. A report focused on research universities identified challenges and opportunities that must be addressed to provide the greatest return:
  - State funding for higher education, already eroding for more than two decades, was cut further during the recent recession.
  - Industry not partnering with universities. At a time when new ideas are needed more than ever, we need to change the paradigm.
  - Recommendations include providing greater autonomy and agility to the public research universities.
  - Greater collaboration and joint interests. We have done this, for example, in the project with UVA, VT, VCCS and Rolls Royce.
  - Competition for the top faculty is serious – when they walk out the door, millions of dollars walk out with them.
  - When states became proactive, they do add funding. In Virginia, we had the Commonwealth Technology Research Fund, but it was reduced to $13 million by the General Assembly and entirely unfunded during the next biennium.
  - Seed funding for researchers is important. Virginia universities lag other states in ability to attract top scientists.
  - Most successful R&D initiatives share features - Focused research, long term and sustained funding, collaborative efforts among higher education, business and government.
  - Another report recommended bringing in outstanding outside experts, developing strategic investment, and capitalizing on higher education institutions in the state.

• In national competitions, Virginia universities typically have not fared well, but we have had some successes. We need to put together the infrastructure to compete on this level. A state match would help us compete. Recent proposal cost $100,000 to put together and did not receive the award. There is an expectation that states will supply some level of match for federal funds. This seems like a no-risk strategy because if don’t get the grant, don’t need to put up the money.

• Historical separation between universities and private entities is rapidly dissolving. The pace we must move is set by development across the globe. The other countries are not waiting for us – the competition is aggressive and we are not keeping up. Effective and sustainable programs for life sciences, aeronautics, IT, etc. We have capacity and potential, but we need to change the barriers to innovation; universities, business and government all need to change.
James Murray, Jr., Court Square Ventures; member of VBHEC and former Rector of the College of William & Mary talked about the venture capital market.

- If want more research, need to incentivize; to do that, we must commercialize. Commercialization comes from government, incubators, accelerators, etc. It takes less money than you would think.
- In terms of investment in venture capital, in 1999, it was $50 billion; in 2000, $100 billion; last year, $24 billion. In 2000, pensions, endowment funds, etc., invested $100 billion in fresh capital in venture capital. But those investors don’t like venture capital anymore. The funds have done poorly for investors.
- Ten year averages: At first, was -4%; by 2012, the ten-year average was up to 5%. Now, it is 7.5%. Equity markets provide much better return and investors can get out easily.
- Another factor regards where the VCs make profit for investors. The vast majority of the high returns came from the public market – the IPO’s. But in the past four years, the economic recovery has barely changed the IPO markets; there is a 87% decline from the peak. There were 2700 venture businesses last year. If only 44% of those go public, the odds are very slim for a large return. This makes VC a shaky investment.
- Second observation about VC is that in the past decade the industry evolved from a large number of large firms to small firms that are very specialized. The current status of the VC industry is that on one side, there are huge funds, and on the other, there are a large number of micro-VC’s. This market has grown – now there are over 400 micro-VC funds. There is a robust environment for those who are launching very small businesses. There is a growth phenomenon with angels and incubators; the amount invested has doubled.
- Traditional VCs are being replaced by micro-VCs. Five years ago, there was 593 million invested; 216 million this year. Why is this happening? Look at where the money comes from. Most VC firms raised very little. “Glut of the micro-VCs”. Ten firms raised over $½ billion, another 12 raised $300 million, so they raised most of the capital in the sector. In the 2014 period, the number has inched up to nearly $10 billion. The amount invested per deal has risen dramatically.
- Where is it going? Late stage, profit-generating businesses. They bear no relationship to small start-ups. A university-based entrepreneur seeking funding has a pretty good chance, but start-up funding does very little. It is gone in 19 months, but it takes five years for a start-up to get up to speed. 75% of 2009 start-ups are dead; 21% were acquired and many at a loss to investors. Only small percent make it.
- What does this mean? It takes multiple forms of financing at different stages. It has been estimated that it takes five rounds of funding to get to be an IPO or stand-alone business. If you are an incubator business coming out of an institution, you need to think about where the next round of funding is coming from.
Dayna Grayson – New Enterprise Associates

- Ms. Grayson talked about her firm, which has been in business since the 1970’s:
  - It has $13.6 billion committed across 14 funds and a global reach, with ventures in India and China. Focus on technology and healthcare enterprises.
  - For an early stage project, NEA funds about $500 to $1 million – that is the seed round. Then they will go into a $5-10 million series. From there, they will go into $10 to $20 million. When they go public, they have raised $100-200 million.
  - In 2003, 36 companies achieved a billion dollar evaluation. NEA invested in nine of these, and eight at the early stages. VC has been right-sized – there was too much going into it ten years ago. It is not one of those industries where more money in, means more money out. It is a micro industry that is trying to deliver macro results. Gross R&D spend has decreased as a share of GDP.
  - NEA has funded projects at universities, and recently one at UVA.
  - The process starts with meeting with the inventor.

- Recommendations for attractive tech spinouts:
  - Liquidity is a problem because they hold funds for ten years. She has seen universities give more liberal control to the inventor. That really incentivizes the inventor to make it as commercial as possible. More equity control is desirable because it puts everyone on the same side of the table.
  - An anti-dilution clause will protect the amount of investment that a university commits. Royalties often decrease over time or are capped. The purpose is to keep the cash the company needs going back into it as it grows.
  - Regarding tech transfer offices, there are formulas for creating good ones. If you are starting one or trying to jump start one you have, staff it with previous entrepreneurs.

- Recommendations for healthcare spinouts:
  - On the healthcare side, conversations tend to start with the TTO.
  - Have a clear and reasonable conflict of interest policy.
  - Prioritize the most exciting projects. Venture capitalists are not trained to see everything as equal.
  - Have a mixture of equity and commercial rights in the terms.
  - Milestones should be delayed to encourage investment in clinical development.
  - Encourage a “translational” culture, recognizing research that focuses on a path from the lab to the clinic.

Questions – The moderator asked further about best practices.

- Ms. Grayson said it is really about the culture. When an institution in Boston compares itself to one on the West Coast, this helps the culture.
- Mr. Murray said it is counter-intuitive for those in public institutions to think this way, but if you are going to be successful in commercializing innovations, you have to pick favorites. You have
to support some over others and lose the sense of egalitarianism. Only a few institutions have that in their culture.

- Another recommendation is to bring the VCs in early to look at innovations. They are very experienced at funding start-ups and will have ideas about how best to commercialize.

**Remarks from Mark Warner via Video:**

Senator Warner commended SCHEV and said research is very important to Virginia’s future and America’s future. In an ever-competitive world, must always find ways to do better. He made five points:

1. Now more than ever, it is important for us to continue federal commitment to research, whether NIH, DoD, NSF, etc. In so many areas, we are close to actually realizing investments that have been made for decades. The bad news is that starting in 2015, the federal government, in terms of being a funding partner, is coming under stress again. The effects of sequestration and dramatic cuts in research dollars will all start rushing back in October 2015. He and all elected officials will need to put together a grand budget that takes on entitlement and tax reform, or we will see the draconian cuts that we saw before.

2. Continuing focus and need to look at commercialization. Progress has been made at almost every university in Virginia, but this is an area where we always have to stay focused and makes sure we do a better job in IP and commercialization. There is still progress to be made to ensure faculty members can take great ideas to market and maintain a piece of that idea while staying inside the university setting. We need to recognize that other states, like California and even Maryland, have done a better job on commercialization of IP.

3. There is a new model we have created in Virginia, which is actually modeled on one in TX. It brings together members of all of the academies in Virginia to engage in a once-per-year effort. The first session happened in DC. [The summit was the Virginia Summit on Science, Engineering and Medicine (VSSEM)] It will now expand and include top-notch researchers who may not yet be members of our national academy, but it is hoped that great scientists across the Commonwealth will come together and collaborate and share opportunities.

4. There are great opportunities for Virginia universities to become national and international leaders:
   
   a. Composites: He has worked with NASA and secured grants. Work at NASA Langley to help Virginia become the next center for advanced composites.
   b. Big data: We are the beneficiary of being adjacent to the federal government. As we pass legislation that adds transparency to federal spending, more often we will see pressure on government and other large entities to share enormous amounts of data. There are privacy concerns, but developing various IT applications is where Virginia can be a leader.
   c. Personalized medicine: We have seen tremendous growth of life scientists around Virginia. Enormous research around mapping of human genome is happening and we are on the cusp of great discoveries. In Virginia, we could carve out an area of expertise.
d. Cybersecurity: Much of the intelligence community is located in Virginia. This is one of the areas, even in tight budget times, that will see additional research funds. In Virginia, we need to put a stake in the ground.

e. Unmanned aerial systems: Virginia is one of six states that got FAA designation to be a test area. Clearly debates around privacy need to be fully litigated. But, we are looking at enormous potential in this area, not just for military purposes, but for agriculture, policing, delivery of goods. It will have an explosive growth, and why not in Virginia? Virginia is already a leader in aerospace; why not let Virginia be a place where these systems are designed and built?

Remarks from Senator Tim Kaine

Gil Bland read letter from Senator Kaine providing his wishes for a successful conference.

Public-Private Partnerships – Exemplary Models

Joann DiGennaro introduced Jeff Gallagher, from Virginia Bio, as the moderator for the next panel.

Mr. Gallagher introduced the panelists: Don Brown, Director of the Data Science Institute at UVA; Paul Fisher, from VCU, Professor and Chair of the Department of Human and Molecular Genetics, who is in the top 5% of NIH funded investigators; Michael Friedlander, from VT, founding Executive Director of Virginia Tech Carilion Research Lab, which focuses on cellular processes in the brain; Richard Heller, Director of the Frank Reidy Research Center for Bioelectrics at ODU, which focuses on non-viral gene therapy; and Duminda Wijesekera, professor in the Computer Science Department at GMU.

Dr. Don Brown (UVA) spoke about the Data Science Institute at UVA:

- Background: Massive growth in amount of data since 2003. The variety of data is immense – have massive amount of textual data; imagery; full-motion video. This is providing an enormous challenge. Need to have computational techniques to bring all the data together and integrate it. We need to provide education and it is critical that we take on policy issues in a straightforward way.
- Demand: We need 1.5 million data-literate managers and data science is interdisciplinary. The Data Science Institute at UVA is relatively new. In 2011, President Obama made a speech about big data and many universities jumped on. UVA does not do things so quickly – it took two years and two summits to discuss. But they had support from President Sullivan.
- The Data Science Institute is the confluence of computation, science, engineering, mathematics, stats, and law. It is advised by business and government partners.
- Massive data sets require new computations paradigms and massive pattern recognition. Traditional processor architecture cannot address these problems. Micron Technology has developed a new processing chip – the Automate Processor. For a task such as finding a genetic sequence in common, across a library of genomes, it speeds up a thousand times from
traditional methods. This integrates multiple disciplines. It can be used to detect sepsis, a life-threatening infection which is usually diagnosed too late.

- In summary, interdisciplinary teaching and research requires new organizations, time and hard work to convince colleagues, and commitment at all levels.

**Dr. Paul Fisher (VCU), Professor and Chair of the Department of Human and Molecular Genetics,** spoke about cancer-reversing research.

- Cancer Terminator Virus: His department is developing a model to look at genes that are causing cancer. It works in all the tumors they looked at. It works through systemic delivery of viruses, wrapping the viruses in a bubble so the immune system does not destroy them. The viruses will find the tumors themselves. They can use this to make viruses that only replicate in cancer.
- Funding innovative research is extremely difficult in the present environment! Very difficult to obtain and retain government funding, so there is a dire need for alternative sources to fund innovative research for the road to the clinic and beyond.
- Funding sources include federal grants (NIH, NSF, DoD), private research foundations, institutional, philanthropy, biotechnology startups, industrial, state support, or a combination involving multiple stakeholders.
- What models work? A cooperative approach involving all stakeholders.

**Dr. Michael Friedlander, Director of the Virginia Tech Carilion Research Institute:**

- Virginia Tech Carilion Research Institute (VTCRI) opened in September 2010. There was a startup investment of $70 million.
- Guiding principles - Identify the opportunity landscape; become really good at a few things; recruit/retain the right people; be disruptive but fit into the environment; fully engage partners and the community; build diverse teams; build around challenges, not disciplines; celebrate and reward innovation failure; identify and build strategic partnerships.
- Economic snapshot:
  - 24 faculty research team leaders; 165 employees; payroll $9.9 annually.
  - 286 grants submitted; 58 under review; 23 completed at $10.8 million.
  - $166 million in economic impact.
  - 165 FT employees from 16 states and other countries. People involved in training and education – 55 med students carrying out research. 15 VT PhD students carrying out dissertation research. 30 UG students doing research. 38 postdoctoral fellows. Psychology, biology, biomedical engineering, etc.
  - A new PhD program was created in Translational Biology, Medicine and Health. There will be 30 students per year, taught by 187 faculty from thirty departments at seven colleges. Three themes of study – neuroscience; cardiovascular, cancer/virology/immunity. Why emphasize neuroscience? Brain disorders account for more hospitalizations, etc. than any other health
issue, and there is a lot of federal funding available. NIH announced $4.5 in new brain research money.

- VTCRI has forged many collaborations with other research centers to create innovative solutions in these research areas. This is a timely opportunity for VA’s universities, government and industry to work together.

**Richard Heller (ODU), Director of the Frank Reidy Research Center for Bioelectrics**, spoke about the Center’s work.

- The Frank Reidy Research Center is a multi-disciplinary center founded in 2002. Physical and biological scientists are housed together.
- It is a leader in an international consortium on bioelectrics, which researches pulsed power, which affects cell functions. It protects the cell and prevents molecules from gaining access. There are many medical applications of the research.
- Commercialization and partnerships:
  - Nanosecond ablation technology - Two current licenses on skin and internal tumors.
  - Plasma – New company for chemical disinfection.
  - Wound healing – negotiating license for platelet gel.
  - Ischemia – talks initiated.
- For discovery and development, there is a need for adequate resources and expertise. Industry partnerships play a large role.
- The future of the Center:
  - Electric and electromagnetic field are powerful tools – there are translational opportunities and multiple new applications.
  - Partnership opportunities with other Virginia institutions, government agencies, industry.

**Dr. Wijesekera (GMU),** spoke about research collaborations.

- Dr. Wijesekera spoke about research collaborations that result in great academic research and economic and societal developments.
- Visible impacts from research collaborations:
  - GMU professors have created many small businesses resulting in immediate benefits.
  - There is also collaborative work with industry and they have joint proposals with companies such as Siemens, Airlnk, Lockheed-Martin, SAIC, MITRE, and Technica.
  - Funding from the Center for Innovative Technology Programs to create products from academic research.
- There are also non-conventional ways to create partnerships:
  - A scholar from a university working part-time at a business offering expertise, consultations and feed students;
  - open source partnerships with business R&D – interfaces with university PI’s to enhance and/or break code;
o sharing late-breaking ideas between trusted academic and industrial partners.

• **Factors for success:**
  o Industry, consortia, can direct and advise academia of needed “research of consequence” that needs immediate solutions, including potential economic impact.
  o Academia can attempt to apply their more academic work to solve existing problems.
  o Jointly solve problems that have an immediate economic impact.
  o Venture into new areas.

**Questions**

There was a question about barriers to innovation.

• Matching the support and capital to the academic side.
• Making sure the culture can work so that conflicts are managed. Ex. – investigator came up with exciting new idea and very quickly built a business. Investors quickly jumped on and he moved to Boston. We didn’t move quickly enough to realize we could compete. Need a very supportive structure.
• Innovation is in the mind of the beholder.
• Protecting technology has become more important than ever.
• Barrier is being able to communicate on the same level.
• Understanding each other’s requirements and limitations. Bringing everyone together to make music out of the collection of people.
• Notions about failure – need to recognize that it is OK to fail. Fail fast, fail often.
• Communication and partnership – moving innovation into commercialization becomes more adversarial instead of focusing on how to solve the problems.
• The timeline – 5-10 years – can be a barrier. There needs to be patience and realization that there won’t be instant gratification.

What are some concrete examples of how to organize ourselves differently to be able to pursue opportunities?

• Finding incentives and rewards at the state level. We have incredible intellectual capital, but also find that at other institutions. We need to incentivize to work together to go after those big grants.
• As a state, we need to get heads around trying to act in a multi-institutional way. It is not only money but a time commitment. Let’s prioritize and be serious about it.

Other speakers made the point that it is important to identify winners; how do you do that?

• Picking talent is never easy. What companies invest in is the quality of the investigating team, what they have accomplished.
• You have to be willing to make a mistake and fail. The truly innovative aspects will not always be successful, but other things come out of it.
• Sometimes we take the easy road and just buy the established talent. What really takes leadership is finding the young talent; those people need time to develop.
• The talent is critical, but other factors need to come together at the right time. Look and see that things are lining up well for a particular project and make a holistic judgment.
• Key factor is combining disparate areas for impact. You get great ideas and not all of them work, but it can be a home run to put different areas together.

Lunch – Gil Minor spoke about the meeting being Joann DiGennaro’s dream and credited her for making it happen. The State Council will be more proactive in coming years and today is a wonderful start. He introduced Christopher Jones, Corporate Vice President and President of Northrup Grumman’s Technical Services sector.

Christopher Jones:

Education of students in STEM and preparing them for the workforce is key. Although his remarks will be on STEM, they can be taken more broadly for other career fields. STEM is important for Northrup Grumman. The stakes are high. We have learned to engage youth early and at every level. The first two years in college are crucial because that is when students drop out of STEM programs. Most business people care deeply about education; our industries are dependent on innovative talent pool. To fall behind in technology means you may never catch up again and that would be disastrous.

Partnership is important. There are many great examples of partnerships. We need to synchronize strategic STEM workforce development. Philanthropy is important, but simply donating money is not enough. Need leadership and more focused, tailored research activities.

Examples of partnerships:

• NG and University of Maryland created the first honors program focused exclusively on cybersecurity. There is a recognition that over half of students who enroll in STEM drop out. NG agreed to integrate the students into paid internships. This is helpful for students of all backgrounds. The company also supplies mentors. There is great impact for students and teachers. Students learn team-building skills and get real-world learning opportunities.
• University of Maryland Baltimore County created a gateway summer research program for non-US citizen which allows them to gain professional experience. This is an example of international outreach.
• There is a new partnership between NG and Conservation International in Costa Rica focused on conducting field studies.
• More conventional partnership also merit mention, such as a company sponsoring high school students in AP science. Different businesses have different workforce needs. All of these organizations are doing a good job.
• In the Northeast, there is another partnership at the University of Massachusetts with the Massachusetts Competitive Partnership to increase minority representation in STEM disciplines.
• NG is also involved with the Society of Women Engineers and the Society of Black Engineers.

The STEM problem has been intractable. We have the tools to make a difference and it is a choice, not an inevitability. To succeed, we must address all levels – K-12, middle, high, college, and also when they are about to graduate and when they enter the workforce. Money and funding is necessary but it isn’t where it needs to be. Take a look at organization and see what type of partnerships will help to improve the pipeline.

Questions:

From the perspective on the corporate side, what recommendations do you have for smaller institutions about how to go about engaging?

• If you look at list of top 10-20 schools that NG partners with, they are not all very large, highly ranked, etc. You should understand where students go, what companies hire graduates. For example, there is a small community college near facility that does aircraft repair, etc., and NG works with them on curriculum, etc., and hires many of their graduates. Look at the curriculum to determine what the school is known for and how can it align with industry. Do some market research if it is not immediately apparent.

Gil Minor – In light of the Governor’s comments about falling behind, it is sort of obvious that we are at risk. As far as scale, is the large amount of outreach that you are doing enough, if all companies need that? Will it move the ball? What can we do to help move the ball?

• Many other companies are focused and involved; NG not doing more than anyone else. There is a lot of activity…but just throwing money at a problem will only get you so far. Have to have more active engagement, more personal involvement – activities that are in sync.

Forecast of Future Market Demand and Trends

Joann DiGennaro introduced Bobbie Kilberg, the President and CEO of NOVA Technology Council, who moderated the next panel. The Technology Council has 1000 member companies doing many things with partnering and matching universities with the private sector. Mrs. Kilberg is a graduate of Yale Law School. In 2001, she was appointed to President’s Council of Advisors on Science & Technology.

Dr. James Ellenbogen (MITRE Corporation) presented on “Thoughts on Trends and Strategies for Increasing the Prominence and Impact of R&D at Virginia Universities”.

The objective and vision for the presentation is to help make Virginia universities among the three or four acknowledged world leaders in science and technology R&D.
• Motivation – VA universities are academically excellent – many fine staff and R&D, strong efforts at outreach/partnerships, plus extensive efforts to push schools to top in R&D funding.

• He looked at the rankings from US News and World Report. This only has United States rankings, but it is really international competition. China ranks universities because they want to send their students here to study. The top tier for them are Harvard, Stanford, UC-Berkeley, and MIT. Mid-range – Cambridge, Caltech, Princeton; U of Washington, UC- San Fran. UVA and VT are at 101-150 and 151-200, respectively.

• These rankings are not strictly correlated with total R&D expenditures, i.e. strategy matters. Extent and pace of recent and prospective advances suggest that any useful long-term R&D strategy must sound like science fiction. Think about breaking the mold. The leaders stimulate and benefit from a large web of vibrant technological and commercial enterprises in their immediate areas.

• Near-term steps:
  o Systematically improve grant proposal writing by faculty. VA has not been particularly good at it.
  o Communicate more aggressively, widely, and effectively with communities and business in the state, as well as outside. Be able to explain work to a wide audience so that people will write about us. Promote traveling lectureships and partnerships.
  o Hire a PR firm

• Middle-term:
  o Encourage faculty to be first to try “far out”, sci-fi sounding ideas.
  o Enhance the perception and the fact that innovators in VA are bold and willing to try anything.
  o Aggressively recruit extremely talented faculty and students with unconventional ideas.

• Long-Term
  o Virginia Creativity Corridor: Use a new transportation infrastructure with a rapid rail line. It would be comparable to Dulles corridor. This would build up surrounding communities and a large swath of the Commonwealth.

• Summary
  o Faculty and administrators should work to improve the clarity of external communications and enhance the perception of Virginia universities.
  o Be bold and unafraid to first out beyond the edge.
  o Connect all of them geographically.

Donald Hamadyk – Newport News Shipbuilding

Challenges:

• Academia wants to publish, but industry tends to be conservative and wants to protect IP by limiting publishing.

• Corporate fiscal constraints – R&D funding tends to be small compared to government grants.
• Compliance barriers.
• University-affiliated research centers and applied research labs. Virginia universities might be well-served by understanding that model and emulating it.
• Virginia does have tax incentives, but the cap tends to be too low for industry to take advantage. Could this be addressed? NN has certain skills that are not addressed in programs at institutions – e.g., welding. From a practical standpoint, it may take too long to get through the contracting process for workforce.

Opportunities:

• One key technology NN has worked on is augmented reality. It could dramatically change the way they build ships. These focus areas could evolve into collaborative efforts. CNU is creating an augmented reality lab. We are excited to see the possibilities. Re-invigoration of tier-one membership at CCAM. Momentum to commercialize, upsize, etc., will bring success. CCAM has created firewalls to protect international student involvement.

Sean Kanuck – Office of the Director of National Intelligence

In his position, he deals with security of electronic, global-position satellites, foreign cyber-espionage, international law and strategic affairs.

• Regarding demand for these areas at highest level of national and international concerns, there is an annual threat assessment at highest level of national security and cyber-security came first on list.
• Geo-politics – issues like cyber, biotech, big data, manufacturing/3D printing – will drive geopolitical advances.
• Discussions of climate change, water politics.
• Interdisciplinary studies – Ideally, analyst should understand technology and also have language/culture knowledge of area, advancements in modeling and big data. Not only do you need teams, but each member of the team should have all of those skills. US cyber-command needs to be staffed with trained individuals. A lot of education can be done to keep knowledge base alive and growing.
• Trends:
  o Increasingly, threats coming from technologies – both in new tech and disruptive use of existing tech.
  o Seeing social media playing a role in geopolitical events.
  o Increased dependence on digital devices and wireless connectivity in everyday life. The Department of Homeland Security certifies programs and several are in Virginia.
• Funding: Cybersecurity is one area that is holding its own with federal funding. The importance is understood. Given proximity, there is a lot of opportunity for Virginia universities in this area.
Christopher Yochim, Director of External Relations for AstraZeneca

- Worked for AstraZeneca (AZ) for more than 30 years; the company has developed many partnerships with university researchers.
- Creativity and Novelty in Strategic Alliance:
  - Establishing an institute and Co-Location
  - Multiple partners
  - Master agreements
  - Pre-competitive industry consortium
  - Foundations and venture philanthropy
  - Sharing and fostering
  - Virtualization - In neuroscience, really need innovative new science
  - Translational science and personalized medicine/biomarkers – will be one of the key factors that help the healthcare system meet demands. It involves tailoring therapies for individual patients in a way that is safer – not cookbook approach.
  - Open innovation industry approaches.
- Relationship between Astra Zeneca and UVA – In 2009, Cardio-Vascular and metabolism group prioritized academic alliances.
- University of Dundee has a pre-competitive industry consortium founded in 1998. It is working pre-competitively with universities and other pharma companies to build scientific knowledge.
- Disease foundations and venture philanthropy are also having impact on relationships. Instead of just funding PI’s, they can fund small biotech companies. Collaborations and open innovation will help accelerate pipeline of new medicines.

Questions – as you look at tech transfer offices, what do you look for? Do you have any examples of exemplary policies and procedures?

- The model that has been attempted at VT had a good foundation. Regarding trying to effect contractual relations at universities, they had difficulty with contracting offices and he would hesitate to hold up any one as an example. It has its challenges. Each university should focus on making the process streamlined while also having solid legal agreements.
- There are some technologies that in initial stages were supported by government funding, then went on to be used in more mainstream way. It acted as an incubator.
- Message for academic administrations, deans, etc. is to emphasize culture within the institution and importance of working collaboratively with industry.

Question from Dr. Levin on Twitter – what are your thoughts on where arts and humanities fit in the framework?

- Issue of communication. In an era of rapid tech movement, the need for agility, communication, and coordination is exponentially more important.
• In keeping with the idea of entrepreneurship, need to train to look outside university for measures of success, rather than traditional academic pipeline.
• If students study in regional studies, languages and also understand IT, they would make ideal intelligence analysts.

Question regarding cybersecurity – it appears that every area now has a security perspective; what is your opinion regarding whether every area will have a security aspect?

• It is a misnomer to focus on cybersecurity in isolation. To put it in terms of threat analysis and risk management and risk mitigation is correct. As more and more of an enterprise is being stored in cyber space, cyber space should be treated as important part of the enterprise.
• Also recognize that cybersecurity is not merely a software issue, as it is treated now. It can be a hardware issue. That is an opportunity for innovation.

After a break, keynote speaker Dr. Reginald Brothers, of the U.S. Department of Homeland Security, was introduced.

Introduction – The pace of adoption of technology has increased rapidly, e.g. took 100 years for general population to adopt the telephone, but only 10 years for it to adopt the cellphone. Advancements are being made now, for example in 3D printing, and we don’t know how they will affect the future. It’s not just the future, it is now. There is a convergence of math, physics, biology - multi-disciplinary education.

If we are going to continue to innovate, we have to innovate across broad areas and have breadth as well as depth, cross-pollination across areas. There is also the issue of being multi-lingual. We need people who will understand the language of different areas and translate. A lot of research has been done on different innovative styles.

Co-creation is innovation across teams of individuals. The academic community should be part of these things. Experiment as opposed to demonstration. Demonstration is showing what is expected. Experimentation means being encouraged to fail so can push forward.

Science and Technology Ecosystem

• When looking across the ecosystem, some universities have different places where they perform. For example, in talking to academic deans, it was clear they didn’t understand what DoD did. DoD needs to be informed of basic research coming up and what it means. Likewise, academics need to understand DoD concerns.
• Homeland Security focus is in areas such as cyber, chem/bio, explosive detection, disaster, etc. The fundamental core problem is speed to action, speed to decision. When you think of emergency preparedness, the issues that leaders face is that they are inundated with info, some of which is wrong, and they need to make a quick decision. There are decision tipping points,
for example, when do you declare to evacuate or to shelter in place. Homeland security’s goal is to give them more time.

- Institutions can look at national strategy and see the cross-cutting ideas, such as in cybersecurity, data analytics, screening, modeling/simulation, training, and situational awareness.

- University outreach: His agency has nine centers of excellence. They aren’t just single institutions, but they partner up with other institutions. It’s time we do a better job of engaging universities.

Wrap-Up – Tom Skalak, Vice President for Research at the University of Virginia, described what he heard throughout the day:

- What is needed is a range of partners – public and private – to bring knowledge to markets and drive the knowledge economy. Seven years ago, the U.S. passed the America Competes Act, which contained support for research and revitalizing R&D. Virginia needs a Virginia Competes Act to create state policy and infrastructure. Would it be productive? Yes, because we are already punching above our weight. We are leveraging state funds at an 8 to 1 ratio. Research staff are creating leverage for the knowledge economy and competing for venture capital. We have the ability to do much more. Create jobs and innovation so that Virginia will become more visible in world’s economy.

- Another thing we heard is that it is time for action – How?
  - Focus on biological sciences and engineering, computer science, and composites. Chemistry and physics are the underpinnings of those fields. We have to do these things with corporate partners with collaborations that are authentic, long-term, and aligned with their missions.
  - Investment in arts and design as well as STEM because investment in liberal arts is a way to have possibility of moving in a new direction.
  - Fund graduates and postdoc’s and have a strategy for retaining faculty.
  - Maintain agility and stay on cutting edge of research. Avoid incremental work – that makes you a follower and we can’t compete globally as a follower. Due to externalities we have to maintain the ability to make agile judgments. It is not a fixed roadmap. The innovation ecosystem is more like a bubbling swamp than a road set in concrete.
  - Top sources of capital want to see the early stages of innovations. Ms. Grayson said that 80% of her firm’s investment in IPO’s were with firms they met early. Need early stage funding to get ready for high quality funding. Use a tailored model for partnerships. Invest in getting venture capital into universities early. Perhaps engage in more entrepreneurial education. Focus higher education on innovation and creating new things.

- There is a difference between a university system and one that encourages research and entrepreneurship. There is a need for basic research and not everyone can be involved in innovation. What we want to know is what can we look forward to with industrial partners -
funding? Grad students? Creating a greater cache around our universities can help recruit graduate students. It would help attract greater external funding. For example in California, tremendous institutes are being established by billionaires. He hasn’t heard of that happening in VA. Also, inter-disciplinary work and connecting to enterprises that are doing innovative, deeper work. We have the talent, now we need the capital too.

Peter Blake concluded with four items that he will submit to Council:

1. Assessment of facilities and equipment and determine needs for sensible investment, perhaps a bond investment, to enable us to be more competitive. Could be set up as a match to federal funds.
2. Continue to press for significant and sustained investment in human capital – faculty and students.
3. Will do what we can to facilitate partnerships and collaboration – inter-disciplinary, allowing new models for exploration and discovery.
4. Identify opportunities for improvement in market readiness. Could include proof of concept, talent attraction, outreach, and marketing.

Delegate Scott Lingamfelter shared three things to think about:

1. Consider the fact that we have a tremendous inventory of specialized equipment in institutions of higher education, estimated worth of $1 billion. An accurate listing could reduce duplication in various locations and prevent acquisition of new equipment.
2. A list of capabilities that each institution has could also reduce duplication and increase capabilities.
3. Generate a system to provide technical services to other institutions and private industry for pay, e.g., use of a university’s wind tunnel.
4. Legislative challenge: He intends to ask JCOTS to study and recommend actions required to implement this idea regarding equipment. Virginia should have the best articulation of any state in the nation.
5. One of the real challenges in R&D is the exploitation of IP. Sometimes in our zeal regarding R&D, we forget about ROI. Commercialization is where we will find the jobs, economic development.