

THE COMMONWEALTH TECHNOLOGY RESEARCH FUND:

**ADVANCING TECHNOLOGY AND ECONOMIC
DEVELOPMENT IN VIRGINIA BY INVESTING IN HIGHER
EDUCATION RESEARCH**



**ANNUAL REPORT
JULY 1, 2007 – JUNE 30, 2008**

**Submitted by the Fund Administrator:
Center for Innovative Technology
The Commonwealth of Virginia Innovative Technology Authority
October 1, 2008**

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EXECUTIVE SUMMARY

In accordance with §2.2-2233.1.E of Title 22, Chapter 22, Article 3 of the Code of Virginia, this report regarding the Commonwealth Technology Research Fund (CTRF) in FY2008 is respectfully submitted. The CTRF was created in the 2000 Session of the General Assembly to attract public and private research funding for institutions of higher education, in order to increase technological and economic development in Virginia. Awards from the Fund may be made to Virginia public institutions of higher education or their associated intellectual property foundations.

FY2008 awards reflected appropriations made in the 2006 and 2007 General Assembly Sessions. In 2006, legislators appropriated \$2 million for CTRF in the FY2007 budget. The following year, the General Assembly appropriated \$1 million for the CTRF, for a total of \$3 million in available funding for FY2008. In addition, the 2008 General Assembly appropriated \$1 million for FY2009 and \$1 million for FY2010.

In November 2007, a solicitation for proposals was issued. Its goals were to attract public and private research funding to institutions of higher education and to increase technology-driven economic development in Virginia by focusing on research with great commercialization potential.

Twenty-four applications requesting approximately \$9.1 million were submitted by six lead institutions. The Grant Allocation Committee (GAC; see Appendix A), a nine-member panel led by Secretary of Technology Aneesh P. Chopra and comprised of experts in science and technology from a range of disciplines, reviewed proposals and recommended six awards to the Innovative Technology Authority (ITA). The ITA approved the GAC's recommendations in February 2008.

The Commonwealth of Virginia invested \$1,845,178 in six projects that spanned information technology, life sciences, modeling and simulation, and nanoelectronics. The projects addressed the Fund Components of Industry Inducement, Strategic Academic Enhancement, and Technology Commercialization. Commonwealth funds were matched with \$2.1 million in private, university, and other funds. Collaboration was paramount: recipient institutions partnered with industry, other Virginia colleges and universities, and nonprofit organizations. Large corporate partners include Corning, Micron Technology, Inc., and Northrop Grumman Corp.

Job Creation and Retention

- The prospective CTRF project with Virginia Tech and the Institute for Advanced Learning and Research was a factor in Corning's decision, announced in December 2006 by Governor Kaine, to invest \$12 million and to create 50 new jobs in its Danville operation.
- Eastern Virginia Medical School estimated that its project with Hampton University will result in the creation of 125 new jobs in Hampton Roads, starting at a minimum average salary of \$70,000 per year.
- Product commercialization associated with the University of Virginia (U.Va.) project with local firm ContraVac for "SpermCheck® Immunochromatographic Devices" will generate 10-20 high quality jobs in Charlottesville in the first two years of commercialization.

Economic Development

- Hampton University projected that more than 2,000 patients a year will seek treatment at the new facility associated with the CTRF project. Visiting patients and family members will contribute to the local economy through hotel room nights, meals, and entertainment.

Intellectual Property

- The University of Virginia Patent Foundation will receive a 3% royalty of all SpermCheck revenues.
- A new Virginia company plans to license from George Mason University (GMU) intellectual property associated with the GMU award for “Self-Cleansing Intrusion Tolerance.”

An overview of each project follows, and the FY2008 annual report for each project is on file with the Fund Administrator. A Table of Grants is provided in Appendix B.

BACKGROUND

The Commonwealth Technology Research Fund (CTRF) was created in the 2000 Session of the General Assembly to leverage federal and private investment in research at Virginia’s public universities. The ultimate goal of this investment was to increase technological and economic development in Virginia. The original legislation and amended legislation of March 2003 created the four Fund components:

- **Strategic Academic Enhancement Program:** This component was based on the evidence that top-ranked departments are disproportionately successful in attracting external research funds. This program provided funds to help strong departments in Virginia’s universities become world-class research organizations. Funding under the strategic academic enhancement program was typically used for recruitment packages for new faculty, purchase of specialized equipment, renovation of laboratories, funding for graduate research assistants, and similar activities.
- **Matching Funds Program:** Under this component, universities applied to the CTRF for matches to federal or private grant proposals that they were preparing to submit. These matching funds not only helped to qualify institutions for grant competitions, they also reflected the state’s and institution’s commitment to the project and influenced decision-makers regarding the feasibility and value of the proposed research.
- **Industry Inducement Program:** This component helped universities to upgrade their research capacities in key departments in order to attract specific companies to locate or expand in Virginia.
- **Commercialization Program:** This component enhanced the capability of the universities to commercialize technologies developed through their research.

In its 2006 Session, the General Assembly appropriated \$2 million in the state’s FY2007 budget for the Commonwealth Technology Research Fund. In its 2007 session, the General Assembly appropriated an additional \$1 million in the FY2008 budget. The General Assembly designated FY2007 funding for the primary purpose of enhancing the capability of institutions of higher

education to commercialize technologies developed through their research: the budget called for funds to support collaborative, translational research aimed at the commercialization of discoveries, including pre-investment funding to support prototyping and proof-of-concept testing. FY2008 funds were to be used to enhance research opportunities at public institutions of higher education in accordance with 2.2-2233.1 C. of the Code of Virginia; this section of the Code calls out the four components named above.

ACTIVITIES TO DATE

In order that the Fund take full advantage of its ability to drive innovation in the Commonwealth, FY2008 activities focused on broad program awareness and a proposal evaluation and selection process that met the Fund's objectives.

Secretary of Technology Chopra took a great interest in the Fund as a tool to substantially expand research and development (R&D) "top down" and "bottom up." In the case of "top down" R&D, the CTRF was viewed as a catalyst to collaborative R&D between Virginia research institutions and Fortune 500 companies that perform limited or no research and development in Virginia. It was envisioned that collaborative R&D could result in significant economic impact in Virginia. In the case of "bottom up" R&D, awards from the Fund would advance R&D concepts of university researchers, including through intellectual property commercialization performed by the best and brightest at Virginia's institutions of higher education.

Fund Guidelines were previewed in August to academia, industry, and government, and issued in November 2007. The Office of the Secretary of Technology and the Center for Innovative Technology prepared the guidelines in collaboration with the State Council for Higher Education in Virginia and the Virginia Economic Development Partnership. The Grant Allocation Committee and the Innovative Technology Authority reviewed and approved these guidelines.

Twenty-four applications requesting approximately \$9.1 million were submitted by six lead institutions: EVMS, GMU, U.Va., ODU, VCU, and VT. These institutions partnered with other Virginia schools, including Christopher Newport University, Hampton University, James Madison University, Norfolk State University, and the College of William & Mary. The Grant Allocation Committee reviewed proposals in January 2008 and recommended six awards to the Innovative Technology Authority (ITA). The ITA approved the GAC's recommendations in February 2008 and authorized and directed the Virginia Department of Planning and Budget to disburse funds to the six recipient institutions.

The Commonwealth of Virginia invested \$1,845,178 in six projects that spanned information technology, life sciences, modeling and simulation, and nanoelectronics. The projects addressed the Fund Components of Industry Inducement, Strategic Academic Enhancement, and Technology Commercialization. Commonwealth funds were matched with \$2.1 million in private, university, and other funds. Collaboration was paramount: recipient institutions partnered with industry, other Virginia colleges and universities, and nonprofit organizations. Large corporate partners include Corning, Micron Technology, Inc., and Northrop Grumman Corp.

Eligible Disciplines

The guidelines provided that the following disciplines were eligible for awards. The Chairman of the Innovative Technology Authority (ITA) could authorize awards in other disciplines, provided that such action was reported as required by legislation.

- Aerospace
- Biotechnology
- Energy
- Environmental and information technologies
- Healthcare
- Homeland Security/Defense
- High performance manufacturing
- Modeling and Simulation
- Microelectronics
- Nanotechnology
- Telecommunications
- Transportation

Awards and Recipients

Of the \$1,845,178 invested, \$1,000,376 will be spent in Year 1 research, \$692,042 in Year 2 research and \$152,760 in Year 3. There were no further FY2008 solicitations, as the General Assembly subsequently rescinded the remaining CTRF monies, \$1,154,822. As of June 30, 2008, recipients reported expending a total of \$54,639.

Several Virginia universities and prominent technology companies are collaborating on six projects in information technology, life sciences, modeling and simulation and nanoelectronics. Information on the effectiveness of the Fund in attracting public and private research funding and increasing technological and economic development in Virginia through such avenues as intellectual property creation and commercialization will be discussed in greater length in future reports. As of FY-end, the six projects had been underway between two and five months.

The Development of BioEclipse, the First Biologically Optimized Treatment Planning System for Proton Radiotherapy, Eastern Virginia Medical School Partners: Hampton University and Varian Medical Systems Fund Component: Strategic Enhancement

Dr. Richard Britten, Principal Investigator, Eastern Virginia Medical School (EVMS), was awarded \$487,910 from CTRF for this three-year project. The goal of this project is to develop a biologically-based treatment planning strategy to maximize the therapeutic effectiveness of conformal proton treatment, an advanced form of radiation treatment for cancer patients. Dr. Britten serves on the faculty of EVMS as an associate professor in the Departments of Radiation Oncology and Microbiology, and is an Adjunct Associate Professor in Physics at Hampton University.

Proton treatment represents the most advanced form of radiation treatment for cancer patients in the United States and is a rapidly expanding treatment modality worldwide. The newly commissioned Proton Treatment facility at Hampton University (HUPTI) will bring this new treatment option to Hampton Roads.

The investigators have identified several reasons why the biological depth dose profile of proton beams needs to be taken into account to improve tumor eradication and to minimize normal tissue side effects. The study is designed to obtain the relevant data on the biological response of tumor and blood vessel cells at various positions along the proton beam, and to use that data to develop a modified version of Varian's Eclipse treatment planning system, BioEclipse. BioEclipse will configure proton treatment plans that take into account the variable biological properties of protons at different depth doses. This will be the first biological based treatment planning system that takes into account both cell killing and radiation-induced ischemia.¹ Commercialization of the sub-routine that will be incorporated into Varian's Eclipse program is envisioned, but specifics have not been determined.

Progress to date includes the performance of some dosimetry studies, the hiring of personnel, the development of tools to obtain the necessary biological data that will provide the initial input parameters for BioEclipse and the development of some of the basic algorithms required to develop BioEclipse. As of June 30, 2008, expenditures totaled \$13,241.19.

Self Cleansing Intrusion Tolerance-Next Generation Security Technology (SCIT), George Mason University

Partner: Northrop Grumman Corporation

Fund Component: Technology Commercialization

Dr. Arun Sood, Principal Investigator, George Mason University was awarded \$86,013 from CTRF for this one-year project. The goals of this project are to test SCIT's ability to protect large business and government (LBG) information technology environments from attacks on their networks and the systems that run on them, and to commercialize the SCIT for the LBG market. Dr. Sood serves on the faculty of Mason as a Professor in the Department of Computer Science in the Volgenau School of Information Technology and Engineering. Dr. Sood is also the Director of the Laboratory of Interdisciplinary Computer Science.

According to Dr. Sood, "the complexity of modern information services, and the sophistication, pace, and variety of attack techniques requires a new thinking about the computer security problem. In spite of large investments in computer security, attackers continue to evade the most advanced intrusion prevention and detection systems. The problem stems in large part from the constant innovation and evolution of attack techniques, and rapid development of exploits based on recently discovered software vulnerabilities. The sophisticated cyber attacks lend importance to the concept of *intrusion tolerance*: a critical system must fend off or at least limit, the damage caused by unknown and/or undetected attacks."² SCIT Labs envisions having broad access to

¹ Britten, A. (2008) Commonwealth Technology Research Fund Annual Report: *The development of BioEclipse, the first biologically optimized treatment planning system for proton radiotherapy*, Norfolk, VA, Eastern Virginia Medical School.

² Sood, A. (2008) Commonwealth Technology Research Fund Annual Report: *Self cleansing intrusion tolerance – next generation security technology*, Fairfax, VA, George Mason University.

the server market, making it an attractive partner for service providers and such security management firms as Symantec.

The basis of the SCIT platform is covered under four patent pending activities, and the project involves the testing of four SCIT servers in the laboratories of partner Northrop Grumman Corporation. Progress to date has included collaboration to build the environment and planning the required testing. In addition, the team performed the porting of the SCIT software to ESX platform and developed a “SCITized” simple web server. The project received media attention and an exclusive license between GMU and SCIT Labs is expected to be signed in the third quarter of 2008. As of June 30, 2008, expenditures totaled \$8,376.85.

**Towards Establishment of an Industry-State-Federal National Center in Nanoelectronics:
Quantum Dot Spintronic Systems, University of Virginia
Partners: Micron Technology and the Nanoelectronics Research Initiative
Fund Component: Strategic Enhancement**

Dr. Stuart Wolf, Principal Investigator, University of Virginia (U.Va.), was awarded \$425,542 from CTRF for this two-year project. The goals of this project are to demonstrate working prototypes of spintronic switches and to build the basis for the establishment of a world-leading research center at U.Va. for future nanoelectronic technologies. Dr. Wolf serves on the faculty of U.Va. as a professor in the Department of Materials Science and Engineering and also as a professor of Physics. He also is the Director of U.Va.’s Institute for Nanoscale and Quantum Scientific and Technological Advanced Research (nanoSTAR).

In his annual report, Dr. Wolf indicated that the combined overall computer chip markets for memory and for logic are over \$200 billion. He explained that “there has been much speculation in the semiconductor industry about a replacement for the venerable complementary metal oxide semiconductor (CMOS) devices in future logic circuits and, over the past decade, spin devices have emerged as viable candidates since they are inherently low power because of some very fundamental physical principles.”³

With prior support, the team established that germanium implanted with manganese becomes magnetic and demonstrated that they can create ferromagnetic quantum dots. The team is developing the infrastructure to demonstrate a magnetic exchange switch.

Discussions with the Nanoelectronics Research Initiative (NRI) have been undertaken regarding locating a research institute at UVA that will be a focus for electronics that are beyond CMOS. Project progress to date includes initiation of contact with Micron, Intel and NRI and the preparation of a white paper as the initial step toward the establishment of an NRI Institute based in Virginia. As of June 30, 2008, expenditures totaled \$4,514.36.

³ Wolf, S. (2008) Commonwealth Technology Research Fund Annual Report: *Towards establishment of an industry-state-federal national center in nanoelectronics: quantum dot spintronic systems*, Charlottesville, VA, University of Virginia.

**Precision and Clinical Testing of SpermCheck® Immunochromatographic Devices,
University of Virginia**

Partner: ContraVac, Inc.

Fund Component: Technology Commercialization

Dr. John C. Herr, Principal Investigator, University of Virginia (U.Va.), was awarded \$194,700 from CTRF for this fifteen-month project. The goal of this project is to gain regulatory approval from the Food and Drug Administration for three SpermCheck® immunochromatographic devices for home testing of male fertility. Dr. Herr is a Professor of Cell Biology and a Professor of Urology at U.Va. engaged in studies of the cell and molecular biology of gamete formation and early development. He also directs the Center for Research in Contraceptive and Reproductive Health, a unit developing new approaches for male and female fertility management.

Dr. Herr reported that the Virginia biotechnology company, ContraVac, was formed to advance this technology. SpermCheck Vasectomy was FDA approved in Q1 2008. He expects FDA approval of SpermCheck Fertility in December 2008 or the first quarter of 2009. Investigators currently are seeking regulatory approval in Canada and Europe. Sales of SpermCheck Vasectomy are anticipated to begin in Q4 2008.

In addition, to create awareness with urologists for SpermCheck Vasectomy ContraVac will partner with another company currently calling on urologists. ContraVac has commenced negotiations for a worldwide exclusive license to market SpermCheck Vasectomy with Matritech, Inc. Matritech sells a point-of-care immunoassay branded BladderChek® that is used by urologists to detect an antigen associated with bladder cancer. These discussions are the result of the excellent interest in SpermCheck Vasectomy at the American Urological Association Meeting in May 2008.⁴

According to Dr. Herr, following FDA approval of the SpermCheck products, the current manufacturer, Princeton BioMeditech (PBM), now located in Princeton, New Jersey, may construct a new manufacturing facility at the North Fork Industrial Park in Charlottesville using revenue from the SpermCheck products. Once the facility is constructed, PBM is interested in working with multiple departments at U.Va., including the Cancer Center, Hybridoma Facility, to develop diagnostic products to new analytes in a variety of medical areas. In addition to the above mentioned progress, the December 2008 issue of the Journal of Urology has accepted the first article resulting from the research project, a report on the clinical and consumer trials for SpermCheck Vasectomy, and the journal will feature the target biomarker used in the SpermCheck test as the Journal's cover. As of June 30, 2008, expenditures totaled \$20,801.83.

A Radiolabelled Carbonaceous Nanomaterials Center (RCNC), Virginia Tech

Partners: Virginia Commonwealth University, Carillon Clinic, and IBA Molecular

Fund Component: Strategic Enhancement

Dr. Harry Dorn, Principal Investigator, Virginia Tech (VT), was awarded \$200,000 from CTRF for this two-year project. The goal of this project is to establish a Radiolabelled Carbonaceous

⁴ Herr, J. (2008) Commonwealth Technology Research Fund Annual Report: *Precision and clinical testing of spermcheck immunochromatographic devices*, Charlottesville, VA, University of Virginia.

Nanomaterials Center (RCNC) for preparing new diagnostic and therapeutic radiolabelled samples that will lead to commercial development and improved capabilities in cancer diagnosis and treatment. Dr. Dorn serves on the faculty of VT as a professor in the Department of Chemistry, College of Science. He founded and is the Director of the Carbonaceous Nanomaterials Center.

The tumors to be addressed first by the new technology are gliomas, which are the most common primary brain tumors and are currently incurable. Dr. Dorn's team's strategy reflects their research in fullerene radiolabelled pharmaceuticals with direct encapsulation of radionuclides and takes advantage of an innovative delivery technique. Dr. Dorn indicated in the annual report that "the initial phase of this work involved the design and engineering of the metallofullerene generators including the development of separation and functionalization protocols for the radiolabelled particles. In the design of these units particular attention was given to the radiation and chemical safety aspects of the new materials as they relate to both their production and subsequent transportation/use in accordance with current institutional guidelines. The VCU group has extensive experience with the use and handling of radioactive substances both in the clinical and the laboratory setting."⁵

The project investigators are unaware of competing technologies. Progress to date has included supporting experiments and the initial design of a new radiolabelled Kratschmer-Huffman prototype generator. Completion is scheduled in November 2008. Intellectual property disclosure forms have been filed at both VCU and VT for prior work related to this research, and other disclosures are expected to be filed in early FY2009. As of June 30, 2008, expenditures totaled \$7,704.54.

**Glass Extrusion Process Analysis and Optimization Research, Virginia Tech
Partners: Institute for Advanced Learning and Research and Corning Inc.
Fund Component: Industry Inducement**

Dr. Ronald Moffitt, Principal Investigator, Virginia Tech (VT) and the Institute for Advanced Learning & Research (IALR), was awarded \$451,013 from CTRF for this two-year project. The goals of this project are to enhance the understanding of the characteristics and related production processes for specialty glasses produced at Corning's Danville, VA manufacturing facility. Dr. Moffitt serves on the faculty of VT as a Research Associate Professor and is based at the IALR serving as the Director of the Advanced & Applied Polymer Processing Institute.

Strong scientific and engineering knowledge of the know-why of the Danville plant's glass forming operations will contribute to the economic efficacy and help ensure the Danville facility can maintain a constant stream of new and novel products. The focus of this research is to obtain a clear description of the molten glass sheet characteristics through experimental observation, determine the source(s) of sheet imperfections through modeling and simulation, and establish design and control parameters that substantially reduce or eliminate the sheet production and product quality problems. These objectives will be achieved through sensor system development and evaluation for high-temperature process diagnostics and control computational modeling and

⁵ Dorn, H. and Fatouros, P. (2008) Commonwealth Technology Research Fund Annual Report: *A radiolabelled carbonaceous nanomaterials center (RCNC)*, Blacksburg, VA, Virginia Tech.

simulation of glass flow and heat transfer through the vertical and horizontal conditioners and the slot die.

This project was implemented in May 2008. Project activities included preparing detailed experimental and computational approaches, finalizing intellectual property issues, and hiring four researchers. A kick-off meeting is scheduled by early September 2008. As of June 30, 2008, funds had not been expended.

ADMINISTRATION

Administrative activities in FY2008 covered the award process, from the development of proposal and reporting guidelines to proposal solicitation and receipt to award notification and coordination. In addition to disseminating information and responding to inquiries from universities, industry, and government representatives, the Administrator handled media announcements and inquiries. The Fund administrator engaged throughout the year with the research community about CTRF activities and opportunities, and it coordinated and oversaw award and media notifications. The Administrator supported the CTRF Grant Allocation Committee; support included administrative and logistical support for meetings and regular correspondence with the GAC regarding the proposal process.

APPENDIX A

COMMONWEALTH TECHNOLOGY RESEARCH FUND GRANT ALLOCATION COMMITTEE MEMBERS

The Honorable Aneesh P. Chopra (chair)
Virginia Secretary of Technology

Mr. Mark A. Frantz
General Partner
RedShift Ventures

Dr. Krishna Kodukula
Executive Director
SRI International, Center for Advanced Drug Research (CADRE)

Dr. Daniel J. LaVista
Executive Director
State Council of Higher Education for Virginia (SCHEV)

Mr. Terrence C. Leslie
University and Academic Relations Manager
Micron Technologies

Dr. Robert E. Lindberg
National Institute of Aerospace
President and Executive Director

The Honorable Joe T. May
Virginia House of Delegates, and
Chairman and Chief Technology Officer
EIT, Inc.

Mr. Gary McLaren
Deputy Director
Virginia Economic Development Partnership

Ms. Cheryl Moore
Chief Operating Officer, Janelia Farm Research Campus
Howard Hughes Medical Institute

APPENDIX B

Title	Period of Performance	Lead Institution	Principal Investigator	Total CTRF Award	Academic Match	Private / Other Match	Total Match*
Towards Establishment of an Industry-State-Federal National Center in Nanoelectronics: Quantum Dot Spintronic Systems	2/1/2008 – 1/31/2010	University of Virginia	Stuart Wolf	\$425,542	\$215,978	\$210,000	\$425,978
Precision and Clinical Testing of SpermCheck® Immunochromatographic Devices	2/1/2008 – 4/30/2009	University of Virginia	John C. Herr	\$194,700	----	\$194,700	\$194,700
Self Cleansing Intrusion Tolerance-Next Generation Security Technology (SCIT)	3/1/2008 – 2/28/2009	George Mason University	Arun Sood	\$86,013	\$1,013	\$85,000	\$86,013
The Development of BioEclipse, the First Biologically Optimized Treatment Planning System for Proton Radiotherapy	4/1/2008 – 3/31/2011	Eastern Virginia Medical School	Richard Britten	\$487,910	\$150,000	\$338,000	\$488,000
A Radiolabelled Carbonaceous Nanomaterials Center (RCNC)	2/1/2008 – 1/31/2010	Virginia Tech	Harry Dorn	\$200,000	\$399,399	\$75,000	\$474,399
Glass Extrusion Process Analysis and Optimization Research	5/1/2008 – 4/30/2010	Virginia Tech / Institute for Advanced Learning and Research	Ronald Moffitt	451,013	\$241,992	\$209,021	\$451,013
Totals				\$1,845,178	\$1,008,382	\$1,111,721	\$2,120,103

* Matches did not include federal funding