

Commonwealth Research Commercialization Fund

Advancing Technology and Economic
Development in Virginia by Investing in Priority
Research and Commercialization Activities

ANNUAL REPORT

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Submitted by the Fund Administrator:
Center for Innovative Technology
on behalf of the Innovation and Entrepreneurship Investment Authority

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Executive Summary

In accordance with Code of Virginia Sections 2.2-2233.1 G and 2.2-2221 (18), and on behalf of the Innovation and Entrepreneurship Investment Authority (IEIA), the Center for Innovative Technology (CIT) respectfully submits this report regarding the performance of the Commonwealth Research Commercialization Fund (CRCF) in FY2014. The CRCF accelerates innovation and company formation in the Commonwealth, while solving important state, national, and international problems through technology research, development, and commercialization.

During the 2013 session of the General Assembly, \$4.8 million was appropriated to CRCF for FY2014 for the purpose of advancing science- and technology-based research, development, and commercialization to drive economic growth in Virginia. CIT issued two FY2014 solicitations resulting in \$4.2 million invested in 52 projects¹ and leveraging the Commonwealth's investment with approximately \$7.4 million in matching funds. CRCF projects are performed by young companies, universities, and research institutes across the state and align with Virginia's key strategic technology priorities as outlined in the Commonwealth Research and Technology Strategic Roadmap.

Program Impact

FY2014 CRCF awards, along with awards made in FY2012 and FY2013, tackle major challenges in sectors such as life sciences, cyber security, advanced manufacturing, and energy. Multiple CRCF awards, for instance, hold promise for innovative new diagnostics and treatments, including for brain, pancreatic, and urogenital cancers and for diabetes. Cyber security continues to be a critical focus of CRCF projects, from products targeting cyber security assessments to solutions that monitor and detect cyber attacks and malicious intrusions. These projects, with CRCF support, have the potential to have a profound and lasting benefit to citizens of the Commonwealth and to society at large through enhancing quality of life and in job, company, and intellectual property creation in Virginia.

Most CRCF projects are underway or have been recently completed, yet CRCF investments have already resulted in companies created, products launched, intellectual property developed, graduate students recruited, and other outcomes beneficial to Virginia. Public and private colleges and universities are participating in technology commercialization; Randolph College, the Virginia Military Institute, and Washington and Lee University, for example, are among new CRCF awardees whose students and faculty are collaborating with companies. FY2014 reports identified several early returns on the Commonwealth's investment.

- **Products/services introduced to market.** In FY2014, at least two new products and/or services have been brought to market in life sciences and modeling and simulation; at least one additional product/service is anticipated for near-term release. More than 12 organizations

¹ 52 projects were selected for funding; two organizations declined awards

² 146 projects were selected for funding since CRCF's inception; seven awards have been declined

reported being engaged in active discussions with companies and other organizations interested in licensing products.

- **New company formation.** At least four new companies in the life sciences and cyber security industries, some of which are university spin-outs, have been formed during FY2014 in the Commonwealth. Additionally, at least one CRCF recipient has expanded its operations into multiple locations across the state, and at least two non-Virginia companies have located all or a portion of their operations to the Commonwealth.
- **Additional funding leveraged.** CRCF award recipients reported over \$30 million in additional investments made in research and technology work after the conclusion of the CRCF projects. At least seven companies have noted sales and/or revenue, with reported totals of more than \$3 million, combined.
- **Partnerships formed.** Several notable partnerships have formed between CRCF recipients and other organizations, including, but not limited to: Reliant Medical Group, EMC, Amgen, Dominion Virginia Power, Bracco, and Northrop Grumman, as well as with colleges, universities, large pharmaceutical companies, and small businesses in and outside of Virginia.
- **Intellectual property created and licensed.** As reported in FY2014, more than 50 patents have been filed or are pending, including both full and provisional patents; 12 or more patents have been issued; more than ten invention disclosures have been issued; five or more products or technologies have been licensed; and other discussions have circulated around trademarks and trade secrets.
- **Publications prepared and accepted.** There are more than 100 total publications and symposia by Fund awardees. Of these, more than 70 publications and presentations have been published and accepted, respectively, as reported in FY2014; an additional ten publications have been submitted and are awaiting publication and nearly 20 publications are in preparation.

Project Samplings

CIT tracks projects during their period of performance and for five years after conclusion, as economic and technological outcomes are often realized a few years or more after a project is completed. The majority of projects from the FY2012 rounds have been completed, while most projects awarded in FY2013 are nearing completion or were recently finished. Projects awarded in FY2014 are almost all underway. Projects showcasing the Fund's effectiveness in contributing to the economic, technological, and well-being of the Commonwealth follow.

- Cavion, formerly Tau Therapeutics, of Charlottesville, has developed a unique and safe adjunctive therapy that enhances conventional and targeted cancer therapies and has the potential to

significantly improve the standard of care for glioblastoma, the most common and deadly type of brain tumor. Research has shown that pre-treating patients with the drug mibefradil prior to administering chemotherapy has shown a dramatic increase in lifespan in animal models and overcome drug resistance. In the year since project completion, the Cavion team has raised \$3.55 million in angel investments, received \$200,000 from the Commonwealth to partner with researchers at the University of Virginia and Virginia Commonwealth University to define an optimal dosing schedule for a clinical trial, garnered approximately \$2 million in sponsorship by the Yale Cancer Center for a new Phase I clinical trial, and connected with major pharmaceutical and venture firms to fund the drug development program. Cavion continues to hire new staff, primarily in Virginia.

- In FY2012, Virginia Tech was the recipient of a CRCF award that supported the recruitment of Dr. Robert Gourdie, a leading heart regenerative medicine scholar, to the university and the Virginia Tech Carilion Research Institute. Throughout the course of the project and in the year since the project concluded, the team has secured nearly \$3 million in additional grants/investments and nearly \$9 million in pending grant applications, recruited three cardiovascular researchers to the faculty, hired seven lab employees, published 21 papers and edited a book, and filed two patents and executed options on seven licenses. Dr. Gourdie's company, FirstString Research Inc., established a location in Roanoke, recruited its first employee there, and attracted \$7 million in grant funding. Additionally, and of major note, the team has completed three Phase II clinical trials which have achieved respective primary and secondary endpoints, and FirstString is in discussions with the FDA for approval to proceed with Phase III clinical trials. For the accomplishments of the Phase II clinical trials, the team has been accepted for publication in the *Journal of Investigative Dermatology*, a milestone representing the first successful pharmacological targeting of a gap junction protein – the proteins responsible for direct communication between cells.
- Power Fingerprinting (dba PFP Cybersecurity), a Virginia Tech spin-out company, is creating game-changing cyber security solutions to assess the integrity of a variety of critical platforms and detect attacks. PFP's unique air-gapped approach enables critical embedded devices, such as cyber-physical systems, to be directly monitored for intrusions. The approach is effective even when the devices have limited resources and are based on legacy platforms not supported by current monitoring solutions. Furthermore PFP is developing options to detect counterfeit semiconductors, such as relabeled or used parts, as well as chips tampered with hardware Trojans. PFP's technology has been validated in multiple platforms and scenarios, including a pilot with Savannah River National Lab. Recent efforts have culminated in the near-term release of the P2Scan, a commercially available, portable scanner for critical infrastructure, capable of extracting baselines and performing run-time monitoring on industrial control systems. In addition to CRCF support, PFP has received funding from the Defense Advanced Research Projects Agency, Department of Homeland Security, U.S. Army, U.S. Air Force, and National Science Foundation. The company continues to raise funds to accelerate commercialization efforts; \$1.15 million has been raised to-date, with plans to raise a second round from strategic investors.

- The University of Virginia and Charlottesville-based company Neoantigenics LLC are conducting research on a specific protein expressed in a broad range of human cancers in order to develop antibody-based drugs directed at this tumor marker and diagnostic tests that will guide personalized patient therapy decisions. Based on results from ongoing projects surrounding this work supported by CRCF, a pharmaceutical collaborator has made a parallel equity investment in Neoantigenics, in addition to in-kind expertise and access to key proprietary technology through a three-year collaboration. To-date, the teams have raised \$1.7 million to fund this R&D work. A Series A funding round is planned for mid-2015, with interest expressed from multiple pharma venture firms to participate or syndicate in the round – a rare occurrence for a Virginia-based biotech firm. Through a CRCF Eminent Researcher Recruitment award, UVa was able to on-board to its faculty Dr. Eusebio Pires, a critical hire to the cancer-oocyte antigen research being conducted at UVa and advanced through the University and Neoantigenics. The research has led to a fundamental new insight into the nature of cancers originating in a wide variety of tissues.
- At the College of William & Mary, R&D is underway on a technology that will benignly displace problematic birds from airfields in order to reduce bird strike risks and, on secondary and tertiary levels, minimize agricultural losses due to pest bird foraging and displacing nuisance birds that cause extensive repair and chronic clean-up costs. In early testing, the “sonic net” technology, which uses non-linear acoustics, has reduced the presence of flocks by approximately 50%, and more research is underway. A Williamsburg, Virginia company, Midstream Technology LLC, has licensed the patent-pending technology and together the teams are seeking additional funding for larger-scale field tests, potentially in partnership with Dominion Power who seeks solutions for keeping birds away from power substations and the Federal Aviation Administration, among others.
- CRCF-funded ClearEdge 3D, Inc. is developing and commercializing the first automated modeling software to create fully three-dimensional computer models of buildings, streetscapes, and entire cities. Prior to ClearEdge technology, it could take hundreds of hours and tedious manual tracing of laser scans or photogrammetry point clouds to create a full 3D model of an average city building; with the company’s product, 3D modeling time is reduced by up to 90%. The widespread availability of fully 3D city models and streetscapes will have a profound impact on the personal navigation, commercial real estate, design/construction, first responder, security, and defense industries.
- A research team at the Virginia Military Institute is working closely with Attochron, a California company that has recently relocated operations to the Commonwealth. Together, VMI and Attochron are in the inaugural phase of exhibiting a revolutionary wireless telecommunications technology that will increase the efficiency and data-carrying capacity to previously unattainable levels, while reducing costs. Currently, the team is in discussions with major wireless broadband telecommunications carriers and others in the value chain regarding the technology and its potential. Demonstrations at VMI and in the Lexington, Virginia area are planned for fall 2014.

- S34A, Inc., an Arlington-based small business focused on developing software and hardware solutions that provide investigators with the capability to conduct forensic analysis of solid state storage devices, has completed CRCF-funded work to validate, refine, and finalize design specifications for a set of hardware and software tools that can be used for hidden data extraction. Leveraging knowledge from the project, S34A won a \$750,000 SBIR Phase II two-year contract from the Department of Homeland Security. The contract allows the company to employ two full-time researchers and additional part-time experts. Additionally, the federal and state labs that participated in S34A's customer requirements survey agreed to beta test products.
- A University of Virginia team has developed an innovative approach and tool which addresses cyber threats by providing point defenses at the application layer using System-Aware Cybersecurity – a security layer embedded into a critical system to protect critical system functions in the face of ongoing cyber threats. The team has built a prototype of a secure application appliance platform, or System-Aware Sentinel, to provide additional protection to critical system functions on a mission-critical, unmanned aerial platform. As a result of CRCF and other funding, the team was successfully able to spin out Mission Secure, Inc., headquartered in Charlottesville, which was scheduled for launch in August 2014. CRCF funds allowed the team to attract successful and capable management personnel and high-net-worth angel investors to take research from the lab and bring it to production applications.

Program Overview

Since the inception of the CRCF program in 2011 legislation, 380 applications were submitted from all of the Commonwealth's ten technology regions and from these submissions, 146² projects have been awarded CRCF funding. Funded projects cover all technology sectors.

Per legislative direction, awards made for CRCF projects must support technology sectors identified in the Commonwealth Research and Technology Strategic Roadmap; moreover, projects funded by CRCF seek to positively impact Virginia's technology future. The Roadmap, a comprehensive planning tool Virginia leaders use to help determine research areas worthy of economic development and institutional focus, identifies technology sectors with the most commercial promise and that will drive economic growth throughout the state. The Roadmap is developed through a consultative process that includes the Commonwealth's private sector technology community, academia and other nonprofit research organizations, and economic development professionals.

CIT also leverages its programs to facilitate company creation and growth. In relation to other CIT funding programs, CRCF is part of a pipeline, working closely with the Federal Funding Assistance Program (FFAP) and the GAP family of funds. CRCF also complements other funding programs in the Commonwealth, such as the Virginia Innovation Partnership (VIP), a statewide network designed to

² 146 projects were selected for funding since CRCF's inception; seven awards have been declined

accelerate innovation and economic growth and the Virginia Biosciences Health Research Corporation (VBHRC), a translational human health research accelerator program targeting collaboration between Virginia research universities and industry.

Two solicitations were offered in FY2014. The fall solicitation was a limited submission solicitation funded through FY2013 rollover monies and targeting the Commonwealth's universities and research organizations; the Eminent Researcher Recruitment and Matching Funds Programs were offered. The spring solicitation expanded to include the private sector and political subdivisions; the solicitation included six programs: Commercialization, Eminent Researcher Recruitment, Facilities Enhancement Loan, Matching Funds, SBIR Matching Funds, and STTR Matching Funds.

- **Commercialization Program**

This program targeted young companies with product(s) in the proof-of-concept phase. Firms eligible for this program were established on or after January 1, 2012.

- **Eminent Researcher Recruitment Program**

This program targeted public colleges and universities seeking to acquire or enhance research superiority in qualified technologies through the recruitment of a top scholar to its faculty.

- **Facilities Enhancement Loan Program**

This program helped public and private universities and political subdivisions establish and/or upgrade facilities used to commercialize qualified research or technologies, including those developed at the institutions and by Virginia's private sector.

- **Matching Funds Program**

This program helped public and private colleges, universities, other research institutes, and federal labs in Virginia leverage federal and private funds designated for the commercialization of qualified research or technologies. Funds could be used to advance research to readiness for intellectual property protection, private sector investment, and/or help to qualify institutions for funding competitions.

- **SBIR Matching Funds Program**

This program helped advance technology commercialization by young Virginia-based technology businesses that had won a Phase I and/or Phase II Small Business Innovative Research (SBIR) award in any one of six technologies identified below. Firms eligible for Phase I matching awards were established on or after January 1, 2011, while firms eligible for Phase II matching awards were established on or after January 1, 2009.

- **STTR Matching Funds Program**

This program helped advance technology commercialization by young Virginia-based technology businesses that had won a Phase I and/or Phase II Small Business Technology Transfer (STTR) award in any one of six technologies identified below. Firms eligible for Phase I matching awards were established on or after January 1, 2011, while firms eligible for Phase II matching awards were established on or after January 1, 2009.

Technology sectors eligible for funding in FY2014 were program-specific; the Commercialization and SBIR and STTR Matching Funds Programs invited applications in six high-priority sectors: advanced manufacturing, specifically robotics, 3D printing, or remote monitoring and sensing; cyber security; data analytics; energy; life sciences; and modeling and simulation. The Eminent Researcher Recruitment, Facilities Enhancement Loan, and Matching Funds Programs were open to submissions in all technology areas identified in the Roadmap as strategic opportunities for the Commonwealth.

In FY2014, 96 applications were received for five of the six available CRCF programs, totaling \$7.9 million; applications were not received for the Facilities Enhancement Loan Program. Applications represented nine of the Commonwealth's ten technology regions and covered 11 strategically important industry sectors. Applications in FY2014 exhibited a strong emphasis on the area of life sciences, though a significant number also focused on advanced manufacturing and energy. Fifty-two awards were made, and 50 awardees accepted funding. Awarded projects represent nine of the ten regions and ten industry sectors: advanced manufacturing, aerospace, communications, cyber security, data analytics, energy, environment, information technology, life sciences, and modeling and simulation.

CRCF awards were selected by the CIT Board of Directors following a multi-step review process that included funding recommendations made by the Research and Technology Investment Advisory Committee (RTIAC). The RTIAC is a legislatively-established body comprised of representatives from higher education, economic development, research institutes, venture capital firms, and technology corporations.

A brief overview of each project is provided in Appendix A.

Preparations for FY2015

The General Assembly and Administration appropriated \$2.8 million to CRCF for FY2015 and planning will begin in early in the fiscal year.

The Fund Administrator will continue to monitor projects and will report them for up to five years after their period of performance in order to capture commercialization results and economic outcomes, including job and company creation, and new revenues.

Administration

Administrative activities in FY2014 included overseeing two solicitations and the RTIAC, outreach, and award management for projects funded in FY2012 and FY2013. CIT received \$205,000 for Fund management.

As Fund Administrator and with the support of the RTIAC, CIT developed the approach for the FY2014 solicitations, including program guidelines, review processes, and use of an online grants management system, CyberGrants, to facilitate application submissions and reporting. Following the review of Letters of Intent (LOIs), CIT led a multi-step proposal review process. CIT performed an internal compliance review to determine which applications advanced to examination by subject matter experts. These subject matter experts – individuals from industry, academia, and government – evaluated and rated proposals. Those that advanced were reviewed by the RTIAC. The RTIAC assessed projects and recommended to the CIT Board of Directors those which should be funded. The CIT Board made final selection decisions, after which awards were announced.

CIT maintained information on the Fund, including solicitations and award announcements, on the CIT website. Press releases described the request for proposals and, subsequently, award recipients. Outreach and communications also included email announcements and speaking engagements. Outreach efforts were supplemented by the additional communication networks of Virginia's regional technology councils; individual colleges and universities, research organizations, and federal labs; the Virginia Biotechnology Association (VABio); the State Council of Higher Education for Virginia (SCHEV); the Virginia Economic Development Partnership (VEDP); and the Administration.

Also as Fund Administrator, CIT managed awards and produced the FY2013 Annual Report. This included assessing performance on an ongoing basis. Additionally, CIT provided support to external organizations, state agencies, and researchers from academia, industry, and other members of the technology community that desired information about the Fund and future solicitations. Lastly, throughout the year, CIT provided oversight to ensure compliance with the CRCF guidelines and other requirements.

APPENDIX A: FY2014 Award Details

Fall Solicitation

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
EMINENT RESEARCHER RECRUITMENT PROGRAM						
Virginia Tech	<i>Recruitment of Eminent Researcher in Nanoparticle Cancer Therapeutics Development</i>	The Virginia Tech Carilion Research Institute is recruiting an eminent cancer researcher.	7/01/2014 – 6/30/2015	Michael Friedlander	\$250,000	\$250,000
TOTAL EMINENT RESEARCHER RECRUITMENT PROGRAM AWARDS:					\$250,000	
MATCHING FUNDS PROGRAM						
College of William and Mary	<i>Algal Aquaculture for Nutrient Assimilation and Removal</i>	This project advances the use of a cost-effective in-water algae growth system to remove sediments and nutrients above EPA-mandated total maximum daily loads, as a way to return the Chesapeake Bay to health.	1/6/2014 – 6/30/2015	William Cooke	\$100,000	\$100,000
College of William and Mary	<i>Developing Sonic Net Technology to Reduce the Risks of Bird-Aircraft Collision</i>	Collisions between birds and aircraft cause multi-billion dollars in damages annually in civil and military aviation, grounding aircraft and causing injury. This project is developing a technology that will benignly and sustainably displace problem birds from airfields to reduce bird strike risks.	1/13/2014 – 1/12/2015	John Swaddle	\$99,781	\$99,781
Commonwealth Center for Advanced Manufacturing	<i>Knowledge Capture and Integration</i>	This project focuses on developing a structured approach to knowledge capture for different manufacturing processes, including knowledge management strategy and software architecture for capturing, analyzing, modeling, and utilizing intuitive and explicit knowledge gained by advanced manufacturing industry experts.	1/6/2014 – 12/31/2014	Kevin Farinholt	\$99,810	\$181,700

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
Eastern Virginia Medical School	<i>New Combination Therapy for Type 1 Diabetes</i>	Currently, Type 1 diabetes patients require lifelong insulin injection to sustain life, and are at risks for complications including heart attack, stroke, blindness, kidney failure, leg amputations, and devastating neuropathic pain. The goal of this project is to identify a new commercially viable therapy for people with Type 1 diabetes.	1/6/2014 – 1/5/2015	Yumi Imai	\$100,000	\$100,000
Old Dominion University Research Foundation *	<i>Real-Time Fusion of Medical Images for Personalized Image Guided Diagnosis and Therapy</i>	This project focuses on a software system for medical applications and devices required in personalized medicine, including for 3D medical image fusion in image-guided neurosurgery for deep brain surgery, for the treatment of Parkinson's and Alzheimer's diseases, and tumor resection for brain cancer and emerging medical simulators.	12/6/2013 – 1/5/2014	Nikos Chrisochoides	\$100,000	\$100,000
Randolph College	<i>Assessing the Quality of Harvested Rainwater for Residential Use</i>	Rainwater harvesting provides a solution to two pressing environmental issues in Virginia and across much of the United States: excess run-off and strained water supplies. Rainwater harvesting systems collect run-off from roofs and other surfaces and supply water for toilets, irrigation systems, laundry, and other uses. This project examines the quality of harvested rainwater in existing and experimental rainwater harvesting systems to support the design and marketing of a new modular rainwater harvesting system.	1/10/2014 – 4/30/2015	Sarah Lawson	\$23,910	\$25,906
Region 2000 Research Institute dba CAER	<i>Impact of Digital I&C Failures on Human Performance</i>	This project is a follow-on project to a CRCF FY2012 fall award. In this continued work, a series of experiments is being conducted to investigate the impact of degraded or failed digital instrumentation and control (I&C)	1/6/2014 – 12/31/2014	Bob Bailey	\$79,712	\$170,904

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
		systems on human performance.				
Region 2000 Research Institute dba CAER	<i>Wireless Broadband Using LTE Repeater</i>	The objective of this project is to investigate and test the feasibility of using innovative spectrum access technologies to provide wireless communications in under-served localities in Virginia. The technology can lead to low-cost alternatives for providing broadband services and to the development of an infrastructure that would support a large-scale DoD testbed and provide for mobile communications in emergency scenarios.	1/6/2014 – 1/6/2015	Bob Bailey	\$97,891	\$132,997
University of Virginia	<i>Micromachined Probes for Manufacturing Diagnostics of High-Speed Electronic Components</i>	This project seeks to advance state-of-the-art manufacturing capabilities for high-performance semiconductors through research and development of new on-wafer probe technologies for device fabrication diagnostics and process monitoring.	1/1/2014 - 12/31/2014	Robert Weikle	\$100,000	\$138,165
University of Virginia	<i>New Molecular Imaging Technology for Safe and Inexpensive Cancer Screening</i>	Molecular imaging, using inherently safe medical ultrasound, is a recent technological development that has shown promise for safe, real-time, and low-cost early detection and diagnosis of cancer. This project seeks to validate and ultimately commercialize a new molecular imaging technology that will represent a substantial advancement in human healthcare.	1/6/2014 – 1/5/2015	John Hossack	\$100,000	\$100,000
Virginia Tech	<i>Development and Manufacturing of Fiberoptic Microneedle Devices for Cosmetic and Cancer Treatments</i>	The VT team has invented a fiberoptic microneedle device (FMD) platform technology that enables minimally-invasive delivery of light and therapeutic agents into soft tissues including brain, bladder, and skin. The project seeks to refine the	1/6/2014 – 1/5/2015	Christopher Rylander	\$100,000	\$100,000

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
		manufacturing process for FMDs and to advance the initial demonstration prototypes to be manufacture-ready.				
VMI Research Laboratories	<i>21st Century Laser Wireless R&D with Ultrashort Pulse Lasers</i>	To optimize the efficiency and capacity of broadband access for 4G mobile users, cellular carriers are searching for ways to increase the rate at which information is shared between cell towers, known as the backhaul capacity. The goal of this project is to establish a telecommunication link at VMI that will lead to a commercially ready system able to satisfy the backhaul needs of cellular carriers.	1/6/2014 – 9/30/2015	Stacey Vargas	\$99,576	\$100,125
Washington and Lee University	<i>Simultaneous Localization and Mapping in Python for RF-Denied Environments</i>	The W&L team has developed an algorithm known as SLAM to map an enclosed environment such as a room building, using small UAVs or other robots. Through this project, W&L will test the SLAM application programming interface in Python.	6/15/2014 – 8/15/2014	Simon Levy	\$19,286	\$19,312
TOTAL MATCHING FUNDS PROGRAM AWARDS:					\$1,119,966	
TOTAL CRCF FY2014 FALL AWARDS:					\$1,369,966	

* Indicates declined award

Spring Solicitation

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
COMMERCIALIZATION PROGRAM						
AxonAI, LLC	<i>Ant-Based Cyber Defense</i>	This project seeks to build and commercialize software which provides intrusion detection and prevention for	6/16/2014 – 6/16/2015	Sven Brueckner	\$50,000	\$50,000

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
		mobile devices, traditional networks, and mobile ad-hoc networks. Specifically, the current architecture is being modified to produce a prototype that can secure mobile devices and mobile ad-hoc networks, and conduct tests on already-identified potential customer networks.				
AxonAI, LLC	<i>Information Discovery with Active Models</i>	This project develops a prototype, conducts tests, and commercializes software to help military and intelligence analysts, investigators, lawyers, and journalists easily find knowledge in massive amounts of data using a cognitively intuitive interface.	6/16/2014 – 6/16/2015	Sven Brueckner	\$50,000	\$50,000
AxonDx, LLC	<i>Development of a Circulating Tumor Cell Identification and Characterization System</i>	Many cancers are deadly because they are asymptomatic until the tumor progresses beyond its original site; the ability to detect solid tumors while they are small and easily resectable will significantly increase survivability. This project seeks to develop a tool that can be easily integrated into a pathologist's workflow and is based on familiar microscopy methodologies. The ultimate goal is to use the tool during annual physicals for the earliest possible detection of small malignant lesions.	6/16/2014 – 6/15/2015	Jeffrey Smith	\$50,000	\$50,000

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
Cardinal Mechatronics	<i>Non-contact Measurement of Patient Respiratory Rate with a LWIR Camera System</i>	This project evaluates current sleep study technologies such as the sensors that measure temperature or pressure changes at the nose or mouth for the purpose of measuring respiratory rate and/or detecting sleep apnea or hypopnea. The team proposes a long-wave infrared (LWIR) camera-based system that can measure the change in temperature of a surface with no direct contact. The project will develop the hardware and software to measure the respiratory rate with the LWIR camera and compare the results with the standard sensors in a series of sleep study trials.	6/16/2014 – 6/15/2015	John Bird	\$49,960	\$58,646
Nanofoundry, LLC	<i>Development of In-Line Monitoring of Magnetic Properties in a Micro-Channel Reactor System for Nanoparticle Manufacturing</i>	This project seeks to develop critical technology for the manufacturing process. The technology, in-line monitoring of magnetic properties of the additive material during the chemical manufacturing process, will provide real-time feedback to the control systems, a critical component to producing a consistent, highly performing product. These advances can lead to improvements in electrical efficiency and size and cost of power transformer and conditioning systems used for electronics.	6/1/2014 – 12/31/2014	Everett Carpenter	\$15,000	\$15,000
NextGen Diagnostics	<i>Commercializing NextGen Diagnostics</i>	This project seeks to collect validation data from a variety of study systems to demonstrate the utility and efficacy of using next-generation sequencing technologies to provide faster and more accurate results compared to culture-based methods.	6/16/2014 – 6/15/2015	Keith Crandall	\$50,000	\$85,000
Ultrasonic Probe	<i>UltraSonographic</i>	Periodontal disease is the primary cause of	6/17/2014 –	Jack Singer	\$50,000	\$50,000

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
LLC	<i>Periodontal Probe</i>	tooth loss and a major contributor to other systemic and chronic diseases, many of which could be prevented or treatment with better early detection. This project seeks to facilitate better early detection and treatment through a non-invasive, painless ultrasound technology that would more accurately and precisely detect periodontal disease.	12/31/2014			
UpHex, LLC	<i>UpHex Commercialization</i>	This project seeks to further develop and accelerate an analytics monitoring service for digital agencies and their clients that: aggregates data from third-party services into one place; monitors select metrics for anomalies against predicated values; and notifies users when important events occur.	8/1/2014 – 12/31/2014	Bradley Kipp	\$50,000	\$50,000
TOTAL COMMERCIALIZATION PROGRAM AWARDS:					\$364,960	
EMINENT RESEARCHER RECRUITMENT PROGRAM						
University of Virginia	<i>Companion Diagnostics and Targeted Therapeutics for Treating SAS1B Positive Cancers</i>	This project advances the translational research capacity at UVA and within the Commonwealth through inter- and intra-institutional collaboration in novel cancer diagnostics and therapeutics. UVA is recruiting Dr. Eusebio Pires to lead a team to develop diagnostic assays and targeted biological therapeutics for precision, personalized medicine for patients with uterine, ovarian, pancreatic, and renal cancers. Dr. Pires is a critical hire for the university to achieve its 5-year goal of becoming an NIH “Comprehensive Cancer Center”.	7/1/2014 – 6/30/2017	John Herr	\$249,862	\$249,862
Virginia Tech	<i>Recruitment of Eminent Researcher in Infectious</i>	The Virginia Tech Carilion Research Institute is recruiting Dr. Griffith Parks, one	7/1/2014 – 6/30/2015	Michael Friedlander	\$250,000	\$250,000

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
	<i>Diseases and Immunology</i>	of the country's eminent infectious disease researchers. Dr. Parks is a leading scientist whose discoveries are making major contributions to elucidating the innate immune responses to a diverse group of medically important viruses. Dr. Parks will be leader in Virginia Tech's growing health sciences infectious disease and immunology research program.				
TOTAL EMINENT RESEARCHER RECRUITMENT PROGRAM AWARDS:					\$499,862	
MATCHING FUNDS PROGRAM						
College of William and Mary	<i>Manufacturing Polymers with Advanced Performance through Graphene-Based Nanoparticle Additives</i>	The W&M team has two novel cost-effective and scalable methods which allow for manufacturing advanced polymers via incorporation of graphene. This project focuses on achieving improved material performance and cost savings in two major applications: polyamides used in pipes for oil transport and exterior coatings for the paint industry. The novel approach significantly improves water absorption and hardness.	8/1/2014 – 7/31/2014	Hannes Schniepp	\$100,000	\$149,731
Eastern Virginia Medical School	<i>Development and Commercialization of a New, Sensitive and Chemo-Responsive Anti-SIAH-Based Monoclonal Antibody Detection Kit to Determine and Quantify the Efficacy of Chemotherapies in Real Time for Virginia Breast Cancer Patients with Metastatic Diseases</i>	In this project, EVMS researchers are assessing the chemo-induced changes in SIAH expression pre-, during-, and post-neoadjuvant chemotherapy with other known clinicopathological parameters including MRI and breast-specific gamma imaging. The aim is to develop an SIAH-based early detection kit to quantify, predict, and personalize chemotherapies for each Virginia breast cancer patient with metastatic disease.	7/1/2014 – 6/30/2015	Amy Tang	\$100,000	\$100,000
Eastern Virginia Medical School	<i>Development of Selective 12-Lipoxygenase Inhibitors</i>	This project will develop potent and specific small molecule inhibitors of 12LO	7/1/2014 – 6/30/2015	Jerry Nadler	\$100,000	\$100,005

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
	<i>for Type 1 Diabetes</i>	as a promising new treatment for diabetes.				
George Mason University	<i>Manufacture Large-Area Two-Dimensional Semiconductor Materials for Portable, Flexible and Transparent Electronics</i>	This project seeks to develop advanced manufacturing technology to produce large-area, transparent two-dimensional semiconductor materials for next-generation portable, flexible, and transparent electronics.	7/1/2014 – 6/30/2016	Qiliang li	\$100,000	\$100,022
The George Washington University	<i>Technical Feasibility and Potential Commercial Impact of High-Efficiency Solar Cells Enhanced with Quantum Dots</i>	Motivated by the advancement of nanotechnology, a team of physicists and engineers at GWU is developing new, efficient solar cells that will use unique properties of quantum dots to raise conversion efficiency of solar light into electricity.	6/16/2014 – 6/15/2015	Andrei Afanasev	\$50,000	\$104,113
Old Dominion University Research Foundation	<i>Advanced Single Axis Solar Tracking System for Enhanced Energy Generation</i>	This project focuses on the second stage of development of a photovoltaic tracking system, one that is ready for mass production. Specifically, the focus is on optimizing the structural efficiency, reducing fabrication and installation costs, improving durability, and minimizing maintenance.	6/16/2014 – 6/15/2015	Michael Seek	\$25,000	\$106,658
Southern Virginia Higher Education Center	<i>Advancing Commercialization in Virginia of Southern Yellow Pine Cross-Laminated Timbers Through Materials and Process Testing</i>	This project seeks to develop adhesive materials and advanced manufacturing production processes necessary to bring a technologically-innovative construction material known as cross-laminated timber (CLT) panels to commercialization in Virginia. CLTs are a highly energy-efficient engineered structural wood product made from Southern Yellow Pine.	6/16/2014 – 6/15/2015	David Kenealy	\$78,724	\$78,724

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
Southwest Virginia Higher Education Center Foundation	<i>Novel Lyme Disease Vaccine for Wildlife and Other Mammals</i>	This project focuses on the development of an oral bait formulation version of a VCU-developed Lyme disease vaccine that can be used to control local populations of infected white-footed mice and ticks, with the ultimate goal of breaking the enzootic cycle of Lyme disease.	7/1/2014 – 6/30/2015	Ed Rogers	\$86,883	\$117,956
University of Virginia	<i>A pH-Resistant Nanoparticle Platform for Oral Delivery of Insulin</i>	Insulin injection is the therapeutic approach to treating Type 1 diabetes and a major component of therapy in Type II diabetes. However, lack of adherence to the therapy is a significant problem. This project seeks to reduce the number of required insulin injections, improve patient adherence, and reduce waste and increase access to insulin therapy throughout the world.	7/1/2014 – 6/30/2015	Mark Kester	\$100,000	\$100,000
University of Virginia	<i>Efficient Programming for Automata Processors</i>	There is a need to develop tools and libraries to make programming easy in order to reduce the barriers to commercial adoption. This project focuses on the development of libraries and programming languages to support new categories of applications on the automation processor, as well as demonstration software to shower the power of the automation processor.	7/1/2014 – 6/30/2015	Kevin Skadron	\$100,000	\$100,000
University of Virginia	<i>Integration of Nano-Structured Oxides as Energy Generating Thermal Barrier Coatings</i>	This project aims to develop fabrication processes necessary to integrate Strontium Niobate (Sr2Nb2O7) and doped Sr2Nb2O7 films into thermal barrier coatings used to protect steam turbine and high performance jet engine blades.	8/1/2014 – 7/31/2015	Patrick Hopkins	\$100,000	\$100,000
Virginia Commonwealth	<i>A New Strategy for Buprenorphine Oral Delivery</i>	Opiate addiction continues to be a serious health problem in the U.S. and throughout	6/16/2014 – 6/15/2015	Phillip M. Gerk	\$100,000	\$100,001

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
University		the world, and new treatment products and strategies are still needed. Buprenorphine and naloxone are used together in order to prevent drug diversion and abuse. Both have low oral bioavailability and extensive presystemic metabolism in the liver, thus convenient oral dosing is not feasible. This project seeks to establish an effective and clinically feasible approach for buprenorphine oral systemic dosing.				
Virginia Commonwealth University	<i>Olfactory Implant Device</i>	Currently there are no treatments to restore the sense of smell, especially following head injury, viral infections, and in the normal aging process when damage to the olfactory nerves often occur. This project advances the development of a new VCU-invented biomedical device that is designed to incorporate odor sensing technologies and implantable electrodes to restore smell function.	7/1/2014 – 6/30/2015	Richard Costanzo	\$100,000	\$100,000
Virginia Institute of Marine Science, College of William & Mary	<i>Optimizing Commercial Production of Triploid Crassostrea Virginica through Development of Elite Tetraploid Brood Stock</i>	This project seeks to begin the process of testing new lines of tetraploids – a genetic construct paramount to continued expansion of oyster aquaculture in Virginia – to further enhance commercial triploid production. Continued improvement of oyster varieties could easily double the value of the industry in Virginia and spur further growth throughout the Chesapeake Bay.	11/1/2014 – 10/31/2016	Standish Allen	\$100,000	\$100,002
Virginia Tech	<i>Advanced Manufacture and Testing of a Brain Cancer Treatment</i>	Patients with the brain cancer glioma have about a year to live once diagnosed. Virginia Tech researchers have uncovered that a protein may hold the key to patient	7/1/2014 – 12/31/2015	Robert Gourdie	\$100,000	\$100,000

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
		resistance of the anti-cancer drug temozolomid. This project is testing the effectiveness of a gene-based drug targeting the protein using a gene vector carried by an engineered virus.				
Virginia Tech	<i>Hydrokinetic Energy Harvesting for Distributed Power Supply</i>	The Virginia Tech team is developing a robust system for on-demand harvesting of clean, renewable energy from tides and rivers using a unique oscillator-generator system to enable effective power generation from currently untapped water sources. This project seeks to develop a desktop-scale prototype device that will demonstrate the system's unique capabilities.	7/1/2014 – 6/30/2015	Mark Stremler	\$61,414	\$61,414
Washington and Lee University	<i>Structure from Motion (SfM) Geological Modeling using Terrestrial and Aerial Imagery from a Vertical Take Off and Landing Unmanned Aerial Vehicle (VTOL UAV)</i>	This project seeks to develop a low-cost software-hardware solution for creating extremely high resolution 3D computer models from conventional photos taken in the field. The solution will use recent advances in computer vision research, as well as improvements in unmanned aerial vehicle technology to allow collection of 3D positioning information that is difficult to obtain with conventional methods.	6/16/2014 – 6/15/2015	Christopher Connors	\$38,000	\$52,777
TOTAL MATCHING FUNDS PROGRAM AWARDS:					\$1,440,021	
SBIR MATCHING FUNDS PROGRAM						
algorithmRx LLC	<i>Computer-Assisted Clinical Decision-Support Tool for Management of Statins</i>	This project seeks to supplement an existing SBIR Phase II project for a predictive medical algorithm that identifies the most effective statin medication and dose for patients with high blood cholesterol to achieve their goal blood level.	6/16/2014 – 12/16/2014	Stephen Hutcherson	\$50,000	\$1,469,645
Biosensor Tech	<i>SBIR Phase I: Development</i>	Addressing a current need to improve upon	7/01/2014 –	Xinchuan Liu	\$50,000	\$150,000

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
LLC	<i>of a Highly Reliable Continuous Wireless Monitoring System for Cardiac Patients through Implantable Sensors</i>	transthoracic intracardiac catheters that carry major risks of infection, embolization, and bleeding, this project develops a battery-free and wireless pressure sensing system for monitoring physiologic parameters in neonatal and pediatric cancer patients.	6/30/2015			
NextGen Diagnostics	<i>NextGen Diagnostics Proof of Concept</i>	This project represents an emergent and powerful tool for both diagnosing and monitoring populations for infectious diseases. The goal is to develop, standardize, and validate a metagenomics pathogen identification platform for use in detection and biosurveillance contexts, using aquaculture-related fish species and their infectious agents as relevant application.	6/16/2014 – 6/15/2015	Keith Crandall	\$50,000	\$155,000
PaneraTech, Inc.	<i>Structural Imaging of High Temperature Furnace Walls</i>	This project supplements an NSF SBIR Phase II award to develop a wireless sensor system for structural health monitoring of furnaces used in the glass manufacturing industry.	7/01/2014 – 3/30/2015	Yakup Bayram	\$49,996	\$50,369
Rivanna Medical	<i>Needle Guidance with High-Resolution Handheld Ultrasound</i>	This project supplements an NSF SBIR Phase II award to develop a handheld general purpose and 3D spinal anesthesia guidance device. Specifically, the project focuses on improved image performance using a proprietary technology termed “synthetic focusing”.	7/1/2014 – 12/31/2014	F. William Mauldin	\$50,000	N/A
Rivanna Medical	<i>New Sensor Technology for Guidance of Orthopedic Joint Injections using Compact Ultrasound</i>	This project supports R&D activities related to the development of a specular surface reconstruction from multi-angle interrogation transducer product, which is intended from the growing point-of-care orthopedic joint injection market.	7/1/2014 – 12/31/2014	F. William Mauldin	\$50,000	N/A

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
SoundPipe LLC	<i>Methods for Simultaneously Guiding and Effecting Neointimal Hyperplasia Prevention</i>	This project complements an SBIR Phase I award to develop a combined ultrasound imaging and therapy catheter system for ultrasound and microbubble enhanced delivery of antiproliferative drugs to prevent neointimal hyperplasia following angioplasty. Specifically, work evaluates methods of simultaneous imaging and delivery.	7/14/2014 – 12/14/2014	Joseph Kilroy	\$48,428	\$213,212
VoltMed Inc. *	<i>Developing a Minimally Invasive Catheter-Based Probe for Targeted Drug Delivery to the Brain (SBIR Matching Funds)</i>	The goal of this project is to develop a flexible catheter-based probe for intracranial applications of a blood-brain barrier disruption platform that is compatible with other ablation technologies for treating vascular and venous diseases in a minimally invasive manner and with a greater degree of success.	7/01/2014 – 6/30/2015	Michael Sano	\$50,000	\$700,000
TOTAL SBIR MATCHING FUNDS PROGRAM AWARDS:					\$398,424	
STTR MATCHING FUNDS PROGRAM						
Cell Free Bioinnovations Inc.	<i>Mobile Electricity Generation Powered by Biohydrogen from Biomass Sugars Catalyzed via Cell-Free Biosystems</i>	This project expands upon an existing NSF STTR project that seeks to scale up high-yield hydrogen production from biomass sugars plus water mediated by cell-free enzymatic biosystems and develop prototype mobile energy generators. Specifically, this goal of this project is to decrease commercialization and technical risks of the biohydrogen generator.	7/1/2014 – 12/31/2014	Zhiguang Zhu	\$49,999	\$225,000
Springbok, Inc.	<i>Big Muscle Data Tool that Transforms Athletic Training</i>	This project accelerates the commercialization of technology that reveals new information about the muscles of athletes. Currently only blunt tools are available to assess each athlete's strength, thus causing training and rehabilitation	7/1/2014 – 6/30/2015	Xue Feng	\$50,000	N/A

Award Recipient	Project Title	Project Description	Period of Performance	Principal Investigator	CRCF Award	Match
		approaches to be developed via experience and trial and error. The technology proposed in this project solves the problems of unknown optimal muscle characteristics by using magnetic resonance imaging, image processing, muscle modeling, and data analytics.				
VoltMed Inc.	<i>INSPIRE Therapy: Real Time Treatment and Monitoring of Pancreatic Cancer</i>	This project focuses on the development of an outpatient endoscopic-based platform that is ideally suited for the treatment of inoperable and/or metastatic cancers.	7/1/2014 – 12/31/2014	Rafael Davalos	\$50,000	\$225,000
TOTAL STTR MATCHING FUNDS PROGRAM AWARDS:					\$149,999	
TOTAL CRCF FY2014 SPRING AWARDS:					\$2,853,266	

* Indicates declined award

FY2014 Funding Totals

PROGRAM	FY2014 TOTAL
Commercialization Program	\$364,960
Eminent Researcher Recruitment Program	\$749,862
Matching Funds Program	\$2,559,987
SBIR Matching Funds Program	\$398,424
STTR Matching Funds Program	\$149,999
ALL PROGRAMS	\$4,223,232

APPENDIX B: RTIAC Members

The following individuals were members of the Research and Technology Investment Advisory Committee (RTIAC), the group responsible for making award recommendations to the CIT Board of Directors, in FY2014.

- **Martin Briley**, President and CEO, Virginia Economic Development Partnership (VEDP)
- **Vikas Chandhoke**, Vice President for Research and Economic Development, George Mason University (Mason)
- **Dan Gonzalez**, Principal, Avison Young
- **Rodger Harvey**, Interim Vice President for Research, Old Dominion University (ODU)
- **Bob Kahn**, Chairman, CEO & President, Corporation for National Research Initiatives (CNRI)
- **Dennis Manos**, Vice Provost for Research and Graduate/Professional Studies, College of William and Mary (W&M)
- **Ken Newbold**, Associate Vice Provost Research and Scholarship, James Madison University (JMU)
- **Rob Patzig**, Senior Managing Director and CIO, Third Security
- **Finis Southworth**, Chief Technology Officer, AREVA