# Commonwealth Research Commercialization Fund

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

**ANNUAL REPORT**

**July 1, 2015 – June 30, 2016**

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

**October 3, 2016**

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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 FY2016. The CRCF accelerates innovation and drives economic development in the Commonwealth, while solving important state, national, and international problems through technology research, development, and commercialization.

Economic outcomes reported in FY2016 by CRCF award recipients identified early returns on the Commonwealth's investment and include $69 million in follow-on monies to support further technology advancement, $7 million in in-kind contributions, three companies formed, and eleven products or services launched. These and other outcomes, as well as several project profiles, are discussed below.

In FY2016, CIT issued one solicitation resulting in $3.4 million recommended for award in 48 projects[1] and leveraging the Commonwealth's investment with approximately $11.6 million in matching funds. These CRCF projects are being performed by companies, universities, and research organizations across the state and align with Virginia's key strategic technology priorities as outlined in the Commonwealth Research and Technology Strategic Roadmap.

The $3.4 million in awards comprised of a $2.8 million FY2016 General Fund appropriation plus carryover monies from grants that had not been fully expended or had been declined.

## Program Impact

CRCF awards seek to solve current and longstanding global challenges in industries such as life sciences, cyber security, advanced manufacturing, energy, and unmanned systems. CRCF awards, for instance, hold promise in biosciences for innovative early detection and analysis technologies for brain, breast, and pancreatic cancers; prevention technologies and therapeutics for diabetes; and wearable sensors that monitor various health concerns. Cyber security continues to be a critical focus of CRCF projects, from products performing cyber security assessments and identifying malicious intrusions and activity to solutions that secure networks and establish patterns to speed up incident remediation and prevent future attacks. Additional technologies, such as 3D modeling and simulation software for homeland security and energy harvesting devices, show the reach of Commonwealth innovation. These and other CRCF projects have the potential to have a profound and lasting benefit to citizens of the Commonwealth and to society at large by enhancing quality of life and economic development.

CRCF awards have, primarily, supported technology development at the proof-of-concept stage or earlier, setting the technology on a commercialization path and making it attractive for further

[1] 48 projects were selected for funding; three organizations declined their awards

investment and/or licensing. Milestones along what can be a multi-year path include clinical trials; FDA approval; investment from federal, private, or other sources; and beta product releases. Already, however, Fund investments have resulted in companies created, expanded, or acquired; products launched; revenue generated; intellectual property developed and licensed; key personnel recruited; and other outcomes beneficial to Virginia and beyond. FY2016 reports submitted by award recipients identified early returns on the Commonwealth's investment, and aggregate figures are outlined below.

- **Additional funding leveraged.** CRCF award recipients reported attracting more than $69 million in follow-on monies to support research and technology efforts after CRCF projects concluded. Sources of funding ranged from angel and venture capital to corporate partners to grant funding. An additional $7 million was leveraged from in-kind support and nearly $96 million has been reported as pending, with more than 50% from funding rounds that are underway.

- **Organizational growth and expansion.** In FY2016, at least three new companies were formed to commercialize or otherwise extend the reach of CRCF-developed technologies, at least four organizations expanded or established facilities, and at least two companies relocated their operations to the Commonwealth. More than 150 jobs have been created, including full-time and part-time and with hires ranging from students supporting a specific project to senior-level executives to consultants. Nearly 150 jobs with a similar spectrum have been retained. CRCF awardees reported more than $9.5 million in sales revenue over the past year, with three organizations each reporting figures of more than $1.5 million.

- **Products / services introduced to market.** At least 11 new products and/or services have been introduced to market, as reported by CRCF awardees in FY2016, and two organizations anticipate near-term releases; an additional 30 technologies were reported as under development, including at the beta, demo, or prototype stage. At least 250 licenses for CRCF-funded software have been sold.

- **Intellectual property created and licensed.** CRCF award recipients reported 19 patents awarded, more than 50 patents filed or pending, and 16 patents applications under development; this includes USPTO, PCT, non-U.S., and provisional patents. Additionally, eight invention disclosures have been reported, along with several trade secrets and trademarks. Three organizations have executed licensing agreements for their technology, ongoing licensing discussions were reported by several other organizations, and at least nine organizations have reported licensing IP from Virginia colleges and universities.

- **Regulatory applications and approvals.** Fund recipients reported that 16 clinical trials were completed, underway, or recently approved for CRCF-funded technologies. Additionally, at least two awardees are engaged in or on the path to pre-clinical research and investigational studies.

- **Publications prepared and accepted.** Articles by CRCF award recipients appear in respected industry journals, and recipients have given numerous presentations domestically and internationally about

their novel technology. In FY2016, more than 260 total publications and presentations were disclosed by CRCF recipients. Of this, more than 200 have been accepted and/or delivered, 35 have been submitted and are awaiting acceptance, and nearly 30 are being developed.

Each year CIT assesses and refines CRCF reportable criteria to best reflect the types of economic outcomes being demonstrated in the Commonwealth. For example, in FY2015, CIT began tracking academic IP, and FY2016 results demonstrate numerous awardees engaged in this licensing practice. Between FY2015 and FY2016, awardees reported nearly $141 million in cash and in-kind support and nearly 500 jobs created and retained.

## Project Samplings

CIT tracks projects during their period of performance and for an additional five years, as economic and technological outcomes are typically realized a few years or more after a project is completed. The majority of projects from FY2012-FY2015 have ended; projects awarded in FY2016 are just recently underway. Projects showcasing the Fund's effectiveness in contributing to the economic, technological, and well-being of the Commonwealth follow.

- Through their FY2014 project, the AxonDx team, located in Earlysville, is developing a cancer cell detection system using fluorescently-labeled cancer-selective antibodies to distinguish cancer cells from white blood cells in a patient's blood. The goal of the work is to create a better and faster system for detecting circulating cancer cells and manufacture the system at a cost low enough to allow placement of the technology in medical centers and clinics around the world. The company has demonstrated major growth and success since its 2013 inception; over the past year this Virginia business has established clinical trials with top cancer researchers around the world, expanded the size of their facilities by more than four times, hired new staff, generated revenue, and publicly launched the nCYTE Dx™ instrument and nABLE software package.

- A team from the College of William and Mary has developed a technology to prevent aircraft bird strikes near airfields – a potential 95% reduction in costs associated with bird-aircraft collisions have been demonstrated, while also minimizing agricultural losses due to pest bird foraging and displacing nuisance birds that cause extensive repair and chronic clean-up costs. With FY2014 funding, Dr. John Swaddle and his team have created and commercialized the "sonic net," a novel, non-linear acoustic approach that interferes with avian communication while controlling precisely where the sound field goes so as to avoid noise pollution in the surrounding area. The system of speakers deliver broad frequency sounds to a specific locale and benefit multiple industry sectors, including aviation, agriculture, energy, as well as federal applications. Through a partnership with Midstream Technology, a Williamsburg-based, veteran-owned small company, the Sonic Net is available; to date, there are installations in the U.S., Ireland, and Singapore to solve bird-nuisance problems in food production, aviation, and retail industries. The technology is generating revenue, attracting follow-on funding, and creating jobs.

- University of Virginia researchers, led by Dr. Bobby Weikle through an FY2014 award, addressed the need and opportunity to develop a presently non-existent infrastructure for new and emerging high-speed semiconductor devices / systems under development for higher-frequency applications, such as broadband communications networks. The team founded and partnered with Dominion MicroProbes, Inc., a small, Virginia-based company, to develop and market the micromachined probe technology. Over the course of the CRCF project, Dominion MicroProbes entered into an agreement with Cascade Microtech, Inc., the world's largest probe manufacturer, to market and sell the technology, providing a vehicle for transitioning the team's work to market. Partnerships have also been fostered with Virginia Diodes, a small business in Charlottesville, and Ohio-based Lake Shore Cryotronics, Inc. The outcomes of the project have resulted in a new class of robust on-wafer probes that permit characterization of a broader array of circuit and device architectures than was possible with prior manufacturing technologies. The team's work continues through the development of probes for diagnostics and characterization of devices / circuits operating frequencies above 100 GHz, probes with replaceable tips which allow end users to make cost- and time-saving repairs, and probe / sensor technology that eliminates the need for expensive and cumbersome frequency extenders and their backend electronics.

- VoltMed, Inc., a Virginia Tech spin-out company located in Blacksburg, is focusing on developing medical devices and tools for diagnosis, evaluation, and treatment of clinical conditions, such as brain cancer. Through their CRCF project and complementary SBIR / STTR funding, the team has developed a platform to treat inoperable brain cancers using integrated nanosecond pulse irreversible electroporation, or INSPIRE™, therapy. This new, non-thermal focal ablation technique involves delivering a series of ultra-short bipolar pulsed electric fields that destroy tumors by structurally rearranging cells in a targeted region, and can be an alternative treatment for patients who are not candidates for surgical resection or other focal ablation technologies. VoltMed has recently licensed the technology from Virginia Tech, is in negotiations with an industry partner to further develop the technology, and has initiated conversations with medical device vendors to develop the first commercially available system. The team has successfully demonstrated INSPIRE™ on three canine patients with brain tumors and aims to treat additional canine patients over the next year. In addition to CRCF funding, VoltMed researchers were part of a team awarded $380,000 from the Virginia Biosciences Health Research Corporation (VBHRC).

- Researchers at the Commonwealth Center for Advanced Manufacturing (CCAM) in Disputanta have developed an intelligent tool that connects a machine's instruments to its controllers in order to provide previously unavailable information on its wear and conditions, particularly for rotating applications. The tool uses embedded telemetric sensors to communicate information about the cutting surface of a device to a data acquisition center located in or near the machine. Use of such a tool will increase efficiency in manufacturing, and has the unique potential to spawn a new industry in advanced manufacturing by combining additive manufacturing sensor design to machine tools or other embedded applications. With FY2014 funding, CCAM researchers designed, built, integrated, and tested the tool. They demonstrated that it's capable of wirelessly measuring the temperature of

the tool-chip interface during milling operations and can successfully transmit high-speed data. Significant interest from CCAM's industrial members and universities has been expressed in using the technology to enhance other advanced manufacturing research initiatives or to aid in actual manufacturing efforts; discussions with at least one organization are taking place for further technology refinement and commercialization.

- Manassas-based Ceres Nanosciences, Inc. is commercializing technology from George Mason University – an improved platform technology to collect, transport, and store biological samples at ambient temperatures in an easy-to-use collection card format. Ceres' Nanotrap toolset was supported through a CRCF FY2013 award, extending the reach of the company's SBIR Phase II award from DARPA. Since the project's conclusion, Ceres has performed on three grant projects under the Bill and Melinda Gates Foundation totaling over $1.4 million, has been awarded nearly $4 million in additional federal grant monies, and secured angel investments. Additional outcomes over the last two years include job creation, with some employees recruited from Virginia universities, and an expanded facility within the Prince William County Life Sciences Accelerator. Under a recently announced FY2016 award, Ceres will continue their work with the Nanotrap platform by refining their dried biofluid collection paper approach to address the need for reliable, simple, and effective sample collection and preservation technologies.

- Syncurity Corporation, an Arlington-based cyber security company established in 2014, has designed and built IR-Flow, a computer security incident response management platform (IRP) that automates cyber security alert and incident response handling. With the support of CRCF funding in FY2015, the team added functionality in IR-Flow with the ability to automate alert enrichment from computers, security tools, and other security services – a capability sought after by customers in order to handle alerts and investigate incidents faster. With the increasing amount of security alerts that can't be automated away, Syncurity has been able to semi-automate the mundane work that analysts do over and over, helping them get to the important alerts and incidents faster, while creating a system of record. During the ten-month project and in the four months since its conclusion, this young company has demonstrated success in the competitive cyber space. To date, Syncurity has closed multiple customers, including two Fortune 500 companies, is working closely with other several other Fortune 500 and other customers, and recently secured additional funding led by Timothy Sullivan. Additionally, two high-profile players and investors recently joined their Board of Directors: Timothy Sullivan, Founder of Fidelis Security Systems, and Tim Webb, the first money into Sourcefire, nPulse, and Fidelis. Syncurity was a member of the 2014 fall MACH37™ Cyber Accelerator cohort company, and has continued to support the accelerator in the cyber arena, such as by co-sponsoring an event at Black Hat in Las Vegas in August 2016; JP Bourget, CEO of Syncurity, also is a Stars Mentor for MACH37™.

## Program Overview

Since the inception of the CRCF program in FY2012, 616 applications were submitted from all of the Commonwealth's ten technology regions and, from these submissions, 232[2] awarded projects were announced. These announced awards total nearly $20 million, and are being leveraged with more than $50 million in committed matching funds, including federal awards. CRCF projects have covered the following technology sectors: advanced manufacturing, aerospace, communications, cyber security, energy, environment, information technology – including data analytics, life sciences, modeling and simulation, nuclear physics, transportation, and unmanned systems.

Projects funded by CRCF seek to positively impact Virginia's technology future and, per legislative direction, awards made for CRCF projects must support technology sectors identified in the Commonwealth Research and Technology Strategic Roadmap. 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 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 leverages its programs to facilitate company creation and growth. In relation to other CIT programs, CRCF is part of a pipeline, working closely with the Federal Funding Assistance Program (FFAP), the GAP family of funds, and the cyber security accelerator, MACH37™. CRCF also complements other funding programs in the Commonwealth, such as the Virginia Biosciences Health Research Corporation (VBHRC), a translational human health research accelerator program targeting collaboration between Virginia research universities and industry.

One $3.4 million solicitation was offered in FY2016 and included five programs: Commercialization, Eminent Researcher Recruitment, Matching Funds, SBIR Matching Funds, and STTR Matching Funds. Applications were invited from academia, federal labs, university research consortia, and the private sector.

- **Commercialization Program**
  Supported commercialization activities for products in the proof-of-concept phase that had a reasonable probability of enhancing the Commonwealth's national and global competitiveness. Eligible firms could have received less than $2 million in outside private investment, had cumulative commercial revenue less than $5 million over the last five years, and could have received no more than five SBIR and/or STTR awards.

[2] 232 projects were selected for funding since CRCF's inception; 14 awards have been declined

- **Eminent Researcher Recruitment Program**
  Supported public colleges and universities seeking to acquire or enhance research superiority in qualified technologies through the recruitment of a top scholar to its faculty.

- **Matching Funds Program**
  Enabled public and private colleges, universities, federal labs in Virginia, and university research consortia that include Virginia college and university member institutions to leverage federal and private funds designated for the commercialization of qualified research or technologies.

- **SBIR Matching Funds Program**
  Advanced technology commercialization and technology development efforts by Virginia-based technology businesses that had recently won a Phase I and/or Phase II Small Business Innovative Research (SBIR) award; awards could, for example, fill the gap between Phase submissions and/or assist with commercialization activities not supported by the federal award. Eligible firms could have received no more than five SBIR or STTR awards if applying to CRCF with a Phase I award and/or no more than ten SBIR or STTR awards if applying with a Phase II award, among other eligibility criteria.

- **STTR Matching Funds Program**
  Advanced technology commercialization and technology development efforts by Virginia-based technology businesses that had recently won a Phase I and/or Phase II Small Business Technology Transfer (STTR) award; awards could, for example, fill the gap between Phase submissions and/or assist with commercialization activities not supported by the federal award. Eligible firms could have received no more than five SBIR or STTR awards if applying to CRCF with a Phase I award and/or no more than ten SBIR or STTR awards if applying with a Phase II award, among other eligibility criteria.

Five technology sectors were eligible for funding in FY2016: cyber security; energy; information technology, specifically data analytics; life sciences; and unmanned systems, for air, ground, sea, or space.

In FY2016, CIT received 148 applications – a 68% increase in submissions over FY2015. Applications, requesting nearly $9.6 million, spanned all programs and industry sectors and represented nine of the Commonwealth's ten technology regions. Forty-eight awards were announced for the entire $3.4 million available; 45 awardees accepted funding. Recipients declined awards in FY2016 because the contingent matching federal SBIR or STTR award was not received. Awarded projects represented six of the ten regions and all eligible and strategically important industry sectors.

FY2016 CRCF awards, along with awards made since the program's inception, address a breadth of critical research areas. Projects in unmanned systems have the potential to strengthen the search and rescue process and pave the way for new types of robotic structures for use in unmanned vehicles. Biosciences continues to be an important sector for CRCF projects, and the focus of FY2016 awards spans innovative treatments for Parkinson's disease, diabetes, and chronic obstructive pulmonary

disease (COPD); cancer diagnostics; and new screening systems for macular degeneration. Cyber security preventatives and solutions continue to be a focus for the Commonwealth and CRCF. Recent awards seek to identify and track malicious attacks and secure the internet-of-things, among other focuses.

CRCF awards were approved 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 drawn from higher education, economic development, research institutes, venture capital firms, and technology corporations. The list of FY2016 RTIAC members is included as Appendix B.

A brief overview of each project announced for award in FY2016 is provided in Appendix A.

## FY2016 Program Administration

Administrative activities in FY2016 included overseeing the solicitation and RTIAC, outreach, and award management for projects funded in FY2012 through FY2015. CIT received $337,046 for Fund management.

As Fund Administrator and with the support of the RTIAC and Office of the Secretary of Technology, CIT developed the approach for the FY2016 solicitation, including program guidelines, review processes, and use of an online grants management system, CyberGrants, to facilitate application submissions and reporting. Following the review of 240 Letters of Intent (LOIs) – approximately 80% more than the number received in FY2015 – and subsequent proposal submissions, 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, including individuals from industry, academia, government, and the venture capital community, 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 approved the award selection, after which awards were announced.

CIT maintains information on the Fund, including solicitations and awards, on its website. In FY2016, press releases announced the request for proposals and, subsequently, award recipients. Outreach and communications also included social media, email announcements, webinars and speaking engagements. Outreach efforts were supplemented by the additional communication networks, including CIT's GAP and MACH37™ teams; Virginia's regional technology councils; individual colleges and universities, research organizations, and federal labs; the Virginia Biotechnology Association (VABIO) and other professional associations; the Virginia Economic Developers Association (VEDA); 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 announced in prior years and produced the FY2015 Annual Report. This included assessing project 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. Throughout the year, CIT provided oversight to ensure compliance with the CRCF guidelines and other requirements.

## Preparations for FY2017

The General Assembly and Administration appropriated $2.8 million to CRCF for FY2017, and CIT began planning for a new solicitation early in the fiscal year.

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

## APPENDIX A: FY2016 Award Details

| Award Recipient | Project Title | Project Description | Period of Performance | Principal Investigator | CRCF Award | Match |
|---|---|---|---|---|---|---|
| **COMMERCIALIZATION PROGRAM** | | | | | | |
| algorithmRx LLC | *Commercial Operation of aRx Statin Advisor in an Established Electronic Medical Record (EMR) System* | algorithmRx seeks CRCF funding to support its Statin Advisor®, a decision support tool that helps clinicians select the optimal statin/dose combination for their hypercholesterolemic patients. CRCF funds will allow the team to implement a population health application version of the tool to one or more beta sites. | 8/1/2016 – 2/28/2017 | Mr. Mark Tripodi | $45,000 | $45,000 |
| Blue Ridge Envisioneering | *Distributed Denial of Service (DDoS) Attack Alert Extensions (AE) to Border Gateway Protocol (BGP)* | Blue Ridge Envisioneering seeks to develop and deploy a commercial-grade Distributed Denial of Service (DDoS) attack reporting and mitigation system that is capable of coordinating resources across heterogeneous networks to defeat large-scale DDoS attacks. | 6/16/2016 – 6/16/2017 | Mr. Harley Green | $49,937 | $49,937 |
| Cambrian Design and Development LLC | *Real Time, Continuous Acoustic Monitor for Characteristic Crying of Babies with NAS* | Cambrian is creating an automated real-time monitoring system to assess babies with neonatal abstinence syndrome (NAS). CRCF funds will be used to continue an ongoing project through the expansion of human subject research and acoustic feasibility studies. | 7/1/2016 – 12/31/2016 | Mr. Michael Abbott | $50,000 | $50,178 |
| Contraline, LLC | *Contraline: An Echogenic, Vas-Occlusive Male Contraceptive That Can Be Inserted, Imaged, and Reversed Non-Surgically Using a Standard Ultrasound* | Contraline is developing a long-lasting, non-hormonal, and reversible male contraceptive. This project will focus on testing and optimizing a polymer gel formulation using in vitro assays and performing Vasintomy™ in rats. | 7/1/2016 – 6/1/2017 | Dr. John Herr | $50,000 | $85,955 |

| Award Recipient | Project Title | Project Description | Period of Performance | Principal Investigator | CRCF Award | Match |
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| Counter-Drone Research Corporation | *Rogue UAS Detection -- Prototype Development* | CDRC's goal through this CRCF project is to prove the concept of a radio-frequency-based drone detection and interdiction solution in an airport test. The test will use a deployed sensor to detect, locate, and track a representative "threat drone" and then hijack it and force it to safety. | 6/16/2016 – 12/16/2016 | Mr. Timothy O'Shea | $49,963 | $61,250 |
| Covenant Therapeutics, LLC | *Development of a New Clinical Diagnostic Test to Assess Inflammation Relevant in COPD* | Covenant Therapeutics' project addresses chronic obstructive pulmonary disease (COPD) by developing a commercial assay kit that would allow the biological activities of the leukotriene A4 hydrolase aminopeptidase (LTA4H AP) activity to be accurately measured in clinical and pre-clinical samples. | 7/1/2016 – 6/30/2017 | Dr. Yun Shim | $50,000 | $56,288 |
| Epodose | *Weekly EPO Peptide Analog with No Immunological Side Effects* | Epodose will demonstrate in vivo the immunological safety of two erythropoietin (EPO) analogs with the goal of improving two drugs that were removed from market in June 2014 due to immunological side effects. | 7/1/2016 – 6/30/2017 | Dr. Cyrille Gineste | $37,800 | $44,900 |
| eTrans2020, Inc. | *Connected Vehicle Cyber Security* | eTrans has been developing a set of applications designed to validate and test connected vehicle systems. The project proposes to extend this proof-of-concept system to allow it to automatically test connected vehicle systems for cyber security vulnerabilities. | 6/20/2016 – 12/23/16 | Mr. John Estrada | $50,000 | $74,964 |
| eTrans2020, Inc. | *Connected Vehicle Data Analytics* | Through this project the eTrans team will develop a suite of analytics tools specifically designed to gather, compress, evaluate, and present data generated by connected vehicle technologies – technologies that will create safer roads. | 6/20/2016 – 12/23/16 | Mr. Robert Baily | $50,000 | $88,394 |

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| Green kW Energy, Inc. | *On-Site Waste Biomass-To-Energy Modules* | This project intends to commercialize and bring to market a novel, yet financially and technically viable, renewable energy production process that will serve the needs of Virginia's farms and food processors. | 8/1/2016 – 7/31/2017 | Dr. John Novak | $50,000 | $50,000 |
| Locurity Inc. | *Identity and Access Management for Enterprise by Recognizing Common Patterns in User's Gait (Biometric) and in User's Home-Office Commute to Determine User's Relative Location at Access Time Using Smartphone Sensor Data* | The main goal of this project is to determine the technical feasibility of Locurity's method for remote identity assurance and identity proofing that doesn't compromise user privacy or usability. | 8/15/2016 – 2/15/2017 | Mr. Shrikant Palaskar | $50,000 | $66,706 |
| Netarus, LLC | *Automated Data Capture and Analysis of Unmanned Vehicle Data* | Through this project, Netarus will further develop its SiteTrax complete analytics solution to provide the end-users of unmanned systems with an automated data storage platform that can also analyze the data in near real-time. | 7/1/2016 – 3/1/2017 | Mr. Christopher Machut | $45,000 | $56,400 |
| PhotonVision, LLC | *Noninvasive Blood Glucose Monitor Based on Fiber-Optic Distributed Sensing* | This project aims to develop a novel noninvasive blood glucose monitor based on absorbance spectroscopy and fiber-optic distributed sensing that will be implemented into a wearable device with multiple sensing elements. | 7/1/2016 – 6/30/2017 | Dr. Yunjing (Dorothy) Wang | $50,000 | $50,000 |
| Pierce Global Threat Intelligence, Inc. | *Extended Identification and Tracking of Malicious Actors* | Through this project, PierceMatrix seeks to increase the ability for artificial intelligence and automation to detect hackers and help companies advance their security without the need for rare and costly experts. | 6/16/2016 – 9/30/2016 | Mr. Roy Stephan | $49,980 | $62,913 |

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| Ryzing Technologies | *Braided Inflatable Robotic Technology* | Ryzing Technologies intends to combine the strength and dexterity of traditional robotics with the low mass, ease of transportation, and relative simplicity of soft, inflatable robotics. This project will focus on fabricating and testing prototypes to establish the technology's capabilities. | 6/20/2016 – 5/1/2017 | Mr. Ryan Gundling | $45,000 | $63,060 |
| Shevirah Inc. | *Commercialization of Mobile Device and Internet of Things Operating System Security Testing Software* | Shevirah will expand its existing software to test the reach, capabilities, and to measure the security risks of wearable technology as part of the Internet-of-Things. | 6/27/2016 – 12/31/2016 | Ms. Georgia Weidman | $50,000 | $50,000 |
| Shevirah Inc. | *Commercialization of Mobile Phishing Awareness Training Software* | Shevirah will build anti-phishing behavior modification modules for its software to automate the security testing of wearables in the field. | 6/27/2016 – 12/31/2016 | Ms. Georgia Weidman | $50,000 | $50,000 |
| SoundPipe LLC | *Co-Injection Drug Delivery with Contrast-Enhanced Intravascular Ultrasound* | The goal of this project is to provide proof-of-concept for enhanced drug delivery and image guidance using co-injection – a drug delivery technique where ultrasound is applied to a mixture of microbubbles and drug to enhance drug delivery. | 10/1/2016 – 3/31/2017 | Dr. Joseph Kilroy | $50,000 | $102,260 |
| SoundPipe LLC | *Dose Control with GUIDE-Tx for Patient Tailored PAD Therapy* | SoundPipe will develop and evaluate a patient-tailored 3D drug delivery approach that could lay the groundwork for a new minimally invasive method adaptable to the specific needs of peripheral artery disease patients. | 1/1/2017 – 5/31/2017 | Dr. Joseph Kilroy | $50,000 | $104,147 |
| SphynKx Therapeutics, LLC * | *Development of a High-Throughput Screening Assay for Sphingosine Kinase Inhibitor Therapeutics* | This project will allow SphynKx to progress its technology through IND-enabling studies on a drug candidate to enhance kidney endothelial function. | 7/1/2016 – 12/30/2016 | Dr. Brandon Thorpe | $50,000 * | $50,000 * |
| UpHex, LLC | *Multi-Channel Advertising Analysis* | This project seeks to automate the reporting process for digital ad agencies by building a data automation and delivery service that will automatically fetch, standardize, and deliver data in a unified, digestible format. | 7/1/2016 – 12/31/2016 | Mr. Bradley Kipp | $50,000 | $50,000 |

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| Virgil Security, Inc. | *Moving to a Distributed Trust Model to Accelerate Commercialization of Virgil Security's Application Security Infrastructure* | The goal of this project is to develop and release a fully functioning distributed key management system prototype based on Virgil's Crypto library, blockchain, and external trust plugins. | 6/20/2016 – 12/31/2016 | Mr. Dmitry Dain | $50,000 | $55,000 |
| | | | | **TOTAL COMMERCIALIZATION PROGRAM AWARDS:** | **$1,072,680** | |
| | | | | **TOTAL COMMERCIALIZATION PROGRAM MATCHING FUNDS:** | **$1,367,352** | |
| **EMINENT RESEARCHER RECRUITMENT PROGRAM** | | | | | | |
| University of Virginia | *Safe and Secure Cyber-Physical Systems* | UVa will use CRCF funding to hire an eminent researcher in Safe and Secure Cyber-Physical Systems, with the recruit focused on the security of critical physical infrastructure. | 7/1/2016 – 6/30/2018 | Dr. Kamin Whitehouse | $195,000 | $426,046 |
| Virginia Commonwealth University | *Eminent Scholar in Pharmaceutical Engineering* | VCU seeks to recruit an eminent researcher to serve as director of the PhD program in pharmaceutical engineering, in VCU's developing center of excellence in pharmaceutical engineering. | 7/1/2016 – 6/30/2018 | Dr. Barbara Boyan | $250,000 | $250,000 |
| | | | | **TOTAL EMINENT RESEARCHER RECRUITMENT PROGRAM AWARDS:** | **$445,000** | |
| | | | | **TOTAL EMINENT RESEARCHER RECRUITMENT PROGRAM MATCHING FUNDS:** | **$676,046** | |
| **MATCHING FUNDS PROGRAM** | | | | | | |
| College of William & Mary * | *SUMO Biomarker Detection Reagents for Prostate Cancer Diagnosis* | The goal of this project is to develop and commercialize a new diagnostic for prostate cancer using SUMO, a small protein modifier that shows altered expression in prostate cancer cells that may represent an important biomarker protein for this disease. | 6/16/2016 – 6/15/2017 | Mr. Oliver Kerscher | $48,327 *(award amount revised from $96,962)* | $48,635 |
| Eastern Virginia Medical School | *New Strategy to Regain Beta Cells in Diabetes* | The goal of this proposal is to identify a new commercially viable therapeutic for diabetes by expanding preliminary data and testing the efficacy of the compound in mouse and human islets. | 7/1/2016 – 6/30/2017 | Dr. Yumi Imai | $100,000 | $100,000 |

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| Eastern Virginia Medical School | *Peptide Inhibitor of Complement C1 (PIC1): Pre-Clinical Toxicology* | EVMS has developed a novel compound to prevent or treat acute hemolytic transfusion reactions, life-threatening reactions that can occur within minutes after a transfusion begins. The purpose of this project is to conduct multi-dose toxicological evaluation of the compound. | 7/1/2016 – 6/30/2017 | Dr. Kenji Cunnion | $100,000 | $100,000 |
| Eastern Virginia Medical School | *Pre-Clinical Development of a Novel Approach to Preserve Beta Cell Function in Diabetes* | The goal of this proposal is to identify a new commercially viable therapeutic for diabetes through the development of proof-of-concept evaluation of two lead compounds. | 6/16/2016 – 6/15/2017 | Dr. David Taylor-Fishwick | $100,000 | $100,000 |
| The George Washington University | *Next Generation Power Generators with Selective Laser Melting of Thermoelectric Materials* | GWU seeks to develop a waste-heat-to-power thermoelectric generator using a selective laser melting additive manufacturing approach. | 7/1/2016 – 6/30/2017 | Dr. Saniya LeBlanc | $99,342 | $106,999 |
| McGuire Research Institute | *Injection of Nanoparticle for Ablation of Ganglionated Autonomic Plexi to Prevent Atrial Fibrillation* | Researchers at the McGuire Research Institute will use microinjection of a nanoformulation into candidate ganglionic plexus nerves to determine its anti-arrhythmic efficacy and effects on the nerve activity. The goal is to identify a preventative for atrial fibrillation. | 7/1/2016 – 6/30/2017 | Dr. Alex Tan | $99,970 | $99,970 |
| National Institute of Aerospace | *Ultra-High Energy Efficiency Footwear Power Generators* | This project is to develop and commercialize a footwear power generator with ultra-high energy efficiency that will address a current void for soldiers and others for a portable, versatile electrical energy harvesting device with high power density that is lightweight and safe. | 7/1/2016 – 6/30/2017 | Dr. Tian-Bing Xu | $100,000 | $175,000 |
| Southeastern Universities Research Association | *Development of a Disposable Surgical Probe for Nuclear Medicine-Assisted Surgery* | The goal of this project is to develop a surgical tool using a gamma-ray detecting probe to aid in the treatment of cancer that can reduce the chance of infection in patients during surgery. | 6/16/2016 – 6/15/2017 | Dr. Andrew Weisenberger | $99,986 | $105,441 |

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| Southeastern Universities Research Association | *Development of Light Weight, Low Power Neutron Sensor Compatible with Unmanned Systems* | The goal of this project is to use boron nitride nanotubes to develop a light, compact, and low-power neutron detector that would be suitable for use on compact unmanned vehicles. | 6/16/2016 – 6/15/2017 | Dr. Andrew Weisenberger | $75,000 | $106,818 |
| University of Virginia | *Accelerating Machine Learning with FPGAs* | UVa researchers will focus on graph analytics and graph classification, to develop a library of fundamental routines to provide "plug and play" field programmable gate array acceleration that enables customers to mine their data more effectively and increase productivity. | 7/1/2016 – 6/30/2017 | Dr. Kevin Skadron | $100,000 | $100,000 |
| Virginia Commonwealth University | *Chelation-Directed C-H Activation Reactions Catalyzed by Palladium(II) Supported on Multi-Walled Carbon Nanotubes [Pd(II)/MWCNT]* | CRCF funds are sought to overcome current limitations to C-H activation methodologies in the pharmaceutical industry that otherwise are highly sought for their atom economy, cost savings, and synthetic utility. VCU researchers will continue the development of chemical transformations to carry out N-chelation-directed C-H activation transformations. | 7/1/2016 – 6/30/2017 | Dr. Keith Ellis | $100,000 | $102,500 |
| Virginia Commonwealth University | *Skintronics: Wireless, Skin-Wearable Electronics for Monitoring of Electrocardiogram* | VCU proposes to develop a prototype, skin-wearable ECG monitor based on nanomaterials, referred to as 'SKINTRONICS'. VCU will conduct computational modeling to design a mechanically flexible/stretchable nano-electrode and circuit system. | 6/16/2016 – 6/15/2017 | Dr. Woon-Hong Yeo | $98,585 | $98,585 |
| Virginia Institute of Marine Science, College of William & Mary | *NIRS Based Quantification of Chronic Oyster Disease for Advanced Breeding Objectives* | This project seeks to further refine Near-infrared Reflectance Spectroscopy (NIRS) as a method to quantify infections of Dermo-disease in oyster aquaculture, which has the potential to significantly increase survival rate for spat-on-shell production. | 7/1/2016 – 6/30/2017 | Dr. Standish Allen, Jr. | $68,796 | $68,841 |
| Virginia Tech | *Ocean Wave Energy Harvesting* | VT seeks to design and commercialize an innovative ocean wave power takeoff based on a mechanical motion rectifier with high efficiency and reliability. | 7/1/2016 – 12/31/2017 | Dr. Lei Zuo | $100,000 | $100,000 |

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| Virginia Tech | *Railroad Energy Harvesting System* | The objective of this project is to meet the increasing safety and economic need of distributed power supply for the smart, railway infrastructure by developing and commercializing an electromagnetic railway energy harvester capable of harnessing reliable and predictable power anywhere along a railway, with access to the electric grid. | 7/1/2016 – 12/31/2017 | Dr. Lei Zuo | $100,000 | $100,000 |
| | | | | **TOTAL MATCHING FUNDS PROGRAM AWARDS:** | **$1,390,006** | |
| | | | | **TOTAL MATCHING FUNDS PROGRAM MATCHING FUNDS:** | **$1,512,789** | |
| **SBIR MATCHING FUNDS PROGRAM **** | | | | | | |
| Ceres Nanosciences, Inc. | *Development of Nanotrap-Enabled Dried Matrix Spot Collection Cards* | This project advances the Ceres dried biofluid sample collection paper manufacturing and collection of targeted application data sets. | 7/1/2016 – 1/30/2017 | Mr. Ben Lepene | $49,990 | $880,447 |
| dbS Productions LLC | *Integration of UAV Optimal Search Allocation Algorithm with Search and Rescue FIND Software* | dbS seeks to fully integrate the use of UAVs into the search process to use all possible tools to locate a missing person. CRCF funding will allow development of a UAV feature that fully integrates aerial searching into formal search planning. | 7/1/2016 – 7/1/2017 | Mr. Robert Koester | $50,000 | $750,000 |
| iHealthScreen Inc. | *A Novel Image Based Screening System for Early Detection of Age-Related Macular Degeneration* | With CRCF funding, iHealthScreen will develop a telemedic platform using retinal imaging to facilitate large-scale population-based screening from both urban and remote areas for early detection of age-related macular degeneration. | 9/1/2016 – 2/28/2017 | Dr. Alauddin Bhuiyan | $48,750 | $240,212 |
| Pancopia, Inc. | *Rapid Activation of Biological Wastewater Treatment Systems* | Pancopia is currently developing a prototype wastewater system for the space station. With CRCF funding, the team plans to adapt the technology to treat municipal wastewater where it has the potential to remove organic carbon and nitrogen while significantly lowering energy costs, chemical use, and residual handling costs. | 6/16/2016 – 1/31/2017 | Mr. William Cumbie | $49,939 | $128,863 |

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| Polymer Exploration Group, LLC | *Ice-Release Coatings* | Through this CRCF project, PEG will develop a dual-function product with easy ice-release and erosion-resistant features enhancing their current ice-release coating technology. | 7/1/2016 – 6/30/2017 | Dr. Wei Zhang | $50,000 | $957,994 |
| Rivanna Medical, LLC | *Bone Fracture Detection by 3D Bone-Enhanced Ultrasound in the Emergency Department* | Rivanna Medical has developed a bone fracture diagnosis technology that enables rapid and accurate diagnosis of bone fractures at the bedside. With CRCF funding, the team will design, implement, and validate a simulation framework for optimizing this technology's ultrasound beamforming algorithm. | 6/16/2016 – 12/31/2016 | Dr. Will Mauldin | $50,000 | $1,498,850 † |
| Synthonics Inc. | *Levodopa Pharmacokinetics Optimization by Metal Coordination* | Synthonics is developing a novel oral levodopa delivery method for the treatment of Parkinson's disease using bismuth subdopate (BSD). With CRCF funding, it will conduct a preliminary investigation using BSD to identify the relationship between particle size and absorption with the end goal of optimizing the final formulation to be submitted in an IND to the FDA. | 6/16/2016 – 12/16/2016 | Dr. Thomas Piccariello | $50,000 | $2,235,301 |
| | | | | **TOTAL SBIR MATCHING FUNDS PROGRAM AWARDS:** | **$348,679** | |
| | | | | **TOTAL SBIR MATCHING FUNDS PROGRAM MATCHING FUNDS:** | **$6,692,657** | |
| **STTR MATCHING FUNDS PROGRAM **** | | | | | | |
| Cell Free Bioinnovations Inc. * | *Low-Cost Biosynthesis of Sugar Phosphates by Enzyme Cocktails without ATP* | The goal of this project is to co-express and immobilize the enzymes involved in the production of sugar phosphates from starch, which will enable the domestic biomanufacturing of low-cost sugar phosphates to decrease the manufacturing costs of existing drugs and leave a smaller environmental footprint. | 7/1/2016 – 12/31/2016 | Dr. Daniel Wichelecki | $50,000 * | $225,000 * |

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| Covenant Therapeutics, LLC * | *Optimization of New Anti-inflammatory Agent to Treat Lung Disease* | In this project, Covenant Therapeutics seeks to design and synthesize the second-generation leukotriene A4 hydrolase aminopeptidase (LTA4H AP) activators for the treatment of chronic obstructive pulmonary disease (COPD). | 6/16/2016 – 6/15/2017 | Dr. Mikell Paige | $50,000 * | $1,060,864 * † |
| **TOTAL STTR MATCHING FUNDS PROGRAM AWARDS:** | | | | | **$100,000** | |
| **TOTAL STTR MATCHING FUNDS PROGRAM MATCHING FUNDS:** | | | | | **$1,285,864** | |
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| **TOTAL CRCF FY2016 AWARDS:** | | | | | **$3,356,365** | |
| **TOTAL CRCF FY2016 MATCHING FUNDS:** | | | | | **$11,598,188** | |

## FY2016 Funding Totals

| PROGRAM | FY2016 AWARD COUNT | FY2016 AWARD TOTAL | FY2016 MATCH TOTAL |
|---|---|---|---|
| Commercialization Program | 22 | $1,072,680 | $1,367,352 |
| Eminent Researcher Recruitment Program | 2 | $445,000 | $676,046 |
| Matching Funds Program | 15 | $1,390,006 | $1,512,789 |
| SBIR Matching Funds Program | 7 | $348,679 | $6,692,657 |
| STTR Matching Funds Program | 2 | $100,000 | $1,285,864 |
| **ALL PROGRAMS** | **48** | **$3,356,365** | **$11,598,188** |

* Indicates declined award

** Matching funds provided toward the CRCF project are the federal SBIR / STTR awards and may include additional awardee-contributed match

† SBIR or STTR award is pending; figure is projected

## 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 FY2016.

- **Martin Briley**, President and CEO, Virginia Economic Development Partnership[3]
- **Claudio Cioffi**, Interim Vice President for Research and Economic Development – George Mason University[4]
- **Steve Clinton,** former Vice President and COO – Sebesta, Inc. (*retired*)
- **Deborah Crawford,** Vice President for Research – George Mason University[4]
- **Morris Foster**, Vice President for Research – Old Dominion University
- **Cheryl Giggetts,** Senior Vice President – AECOM, Technology Solutions
- **Dan Gundersen**, Interim President and CEO – Virginia Economic Development Partnership [3]
- **Yvonne Harris,** Vice Provost for Research and Scholarship – James Madison University
- **Bob Kahn**, Chairman, CEO & President – Corporation for National Research Initiatives
- **Dennis Manos**, Vice Provost for Research and Graduate/Professional Studies – College of William and Mary
- **Venkat Rao,** Director, Chem-Bio Programs – Parsons
- **Scott Tolleson,** Managing Director – New Richmond Ventures

[3] Mr. Gundersen replaced Mr. Briley by virtue of position in March 2016
[4] Dr. Crawford was appointed by virtue of position in May 2016, filling the role vacated by Dr. Cioffi in 2015