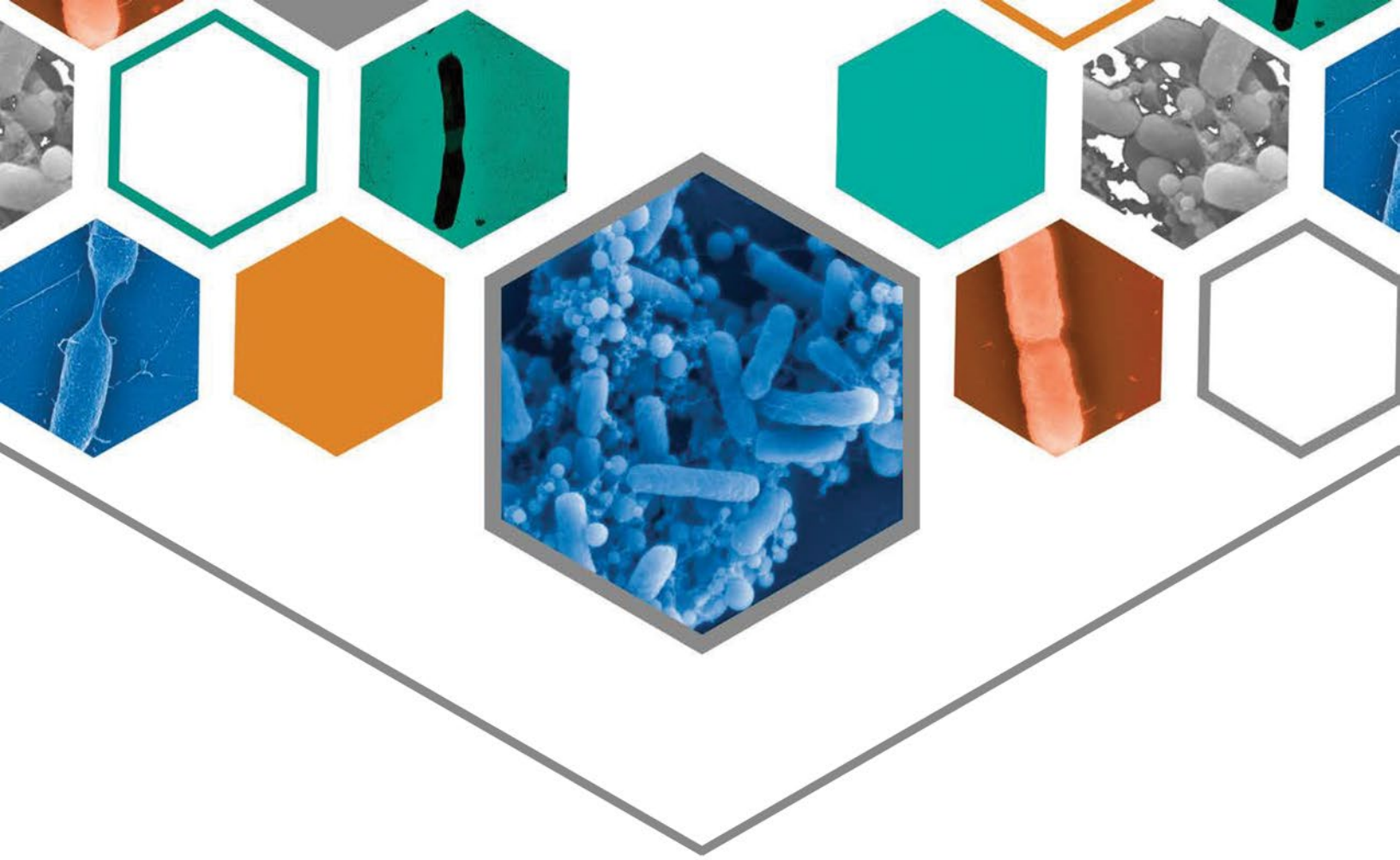


Office of the Vice President for Research

Annual Report

2017

TEXAS TECH UNIVERSITY
Office *of the* Vice President
for Research

On the Cover: The images on the cover are stylized examples of Salmonella Lubbock, a new serotype of the salmonella bacteria discovered in 2014 by Marie Bugarel, a Texas Tech research assistant professor in the Department of Animal and Food Sciences. Exploring the genetics of Salmonella Lubbock is opening doors to new insights into the evolution and ecology of salmonella in animal populations.

Dear Colleagues and Friends,

I want to start by thanking Dr. Guy Loneragan for his outstanding work as Interim Vice President for Research over the past 18 months. He and the staff of the research office have done a great job working with groups to build the research profile of the institution. The entire OVPR team has been very supportive during my transition into this new role, and I am extremely grateful for their efforts.

While I have only just arrived at Texas Tech, I have been very pleased to begin learning about all of the scholarly and creative activity across the campus, and I am excited for what the future holds. Texas Tech is a great university with deep tradition and loyal alumni. We are poised to dramatically improve our research profile. This potential was a major factor in drawing me to the university.

I want to emphasize is that the label "research" does not capture everything that we do and value as an institution. While the OVPR will be deeply involved in supporting research, we also need to support and promote creative activity within music and the arts, and scholarly activity within the humanities, the social sciences and many of the professional colleges on our campus.

I have met with a number of you during the past few months, and I see a desire to improve the institution convergent with President Schovanec's goal of making Texas Tech a top-50 public research university. I look forward to a strong partnership between the research office, the university leadership, faculty, staff, students and alumni. Our success cannot be built upon the vision or actions of a single person or office, but we can achieve our goals if we all work together.

Like all public research universities, we at Texas Tech face very real challenges. One of the most striking of these is the erosion of federal support for research. But, as I have traversed the university, I have been heartened to find exceptional faculty and students working on a broad diversity of research, scholarship and creative activity. This vitality is making a difference in our university community and our society. I am confident we have programs that can compete head-to-head with research at other top-tier research universities.

I look forward to meeting many more of you over the coming months. I want to hear your ideas and discuss your plans for building nationally competitive initiatives and I want you to share your concerns about how our office supports Texas Tech researchers and scholars.

Thank you for your warm welcome to the Red Raider family.

Sincerely,

Joseph A. Heppert, Ph.D.
Vice President for Research
Texas Tech University

Dear Friends and Colleagues,

2017 was an exciting time to be a part of Texas Tech University. We were witness to unprecedented growth in research and scholarship by faculty across the breadth of our great university. And while there are simply too many great discoveries to celebrate herein, this report provides a glimpse at a few of the great things happening at Texas Tech.

It is hard to succinctly capture the success of our faculty. Some measures include our research expenditures. The past year yielded records for total and restricted research expenditures, the latter being a measure defined by the Texas Higher Education Coordinating Board.

Total Research Expenditures

$184,340,105

Restricted Research Expenditures

$61,441,023

Other measures of our activities include, for example, how many research discoveries led to an invention disclosure or a licensed technology or even a start-up company. In these measures, 2017 was also a banner year. This aspect of commercialization and entrepreneurship is especially relevant because it represents a return on society's investment in our research in that their investment yields new technologies that improve lives and drive economic development.

Texas Tech Commercialization

All Patents Applications **59**

Licenses **18**

And while we reflect on and celebrate 2017, there are areas in which we would like to improve. For example, the scope of federal sponsorship of research is not where it could be – or where we want it to be – for a research enterprise the size of ours. Addressing areas like this will require a focused, coordinated and persistent approach. It is certainly something we can – and I believe, we will – achieve.

While 2017 was an exciting year, the future holds even greater promise as we look forward to our centenary. We broke ground on a state-of-the-art multidisciplinary research facility. This building will allow faculty to engage in research not previously possible at Texas Tech. It will help them push the boundaries toward discoveries that change the way we think and ultimately, will benefit society. In addition, during the 85th Texas Legislature, Texas Tech was appropriated $4.17 million to support a planning initiative for a School of Veterinary Medicine in Amarillo that would represent a collaborative effort with the Texas Tech University Health Sciences Center and reflect a vision to meet rural veterinary health care needs in the State of Texas. Working with industry, academic, and philanthropic partners, Texas Tech will use these funds to evaluate the financial and academic feasibility of the school and to seek additional philanthropic support to fund facilities. And we also are extremely fortunate that Joe Heppert has agreed to be our VPR. His experience and vision is exactly what Texas Tech needs to lead our research enterprise to the next level, and firmly plant Texas Tech on the map of the highest tier of public research universities as it enters its second century.

I would also like to acknowledge the great team that makes our office what it is today. The OVPR touches all aspects of research and scholarship at Texas Tech, and its contribution to entrepreneurism and economic development continues to grow. It has been a true privilege for me to work every day with such a dedicated and supportive team.

Guy Loneragan
Associate Vice President for Research
Former Interim Vice President for Research

The Changing Role of the Office of the Vice President for Research

By Guy Loneragan

The research enterprise at Texas Tech, like many institutions, has historically been a very linear process. A researcher has an idea, submits a proposal to a sponsor, and – if funded – conducts the work.

Occasionally, the project results in an invention such as a novel project or process that becomes intellectual property (IP). If lucky, the IP might even receive patent protection, and if even luckier still, the IP might be licensed to a company and generate some income.

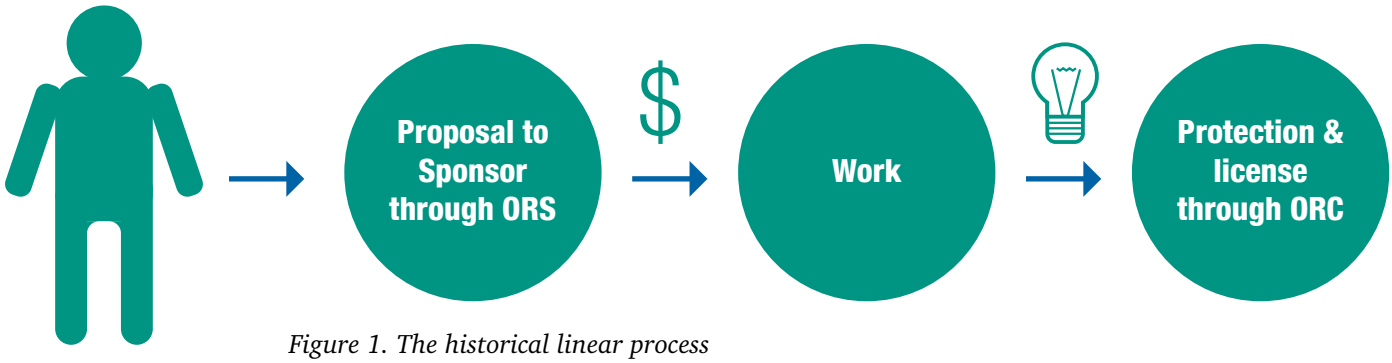


Figure 1. The historical linear process

But things are changing – and they are changing for the better. Leading research universities have found that when they add important elements to this model, they can circularize the research process. With the right focus, this becomes a virtuous cycle that drives additional research opportunities and funding.

For example, adding mechanisms to foster technology acceleration, entrepreneurial education to foster faculty/student-led start-ups, incubator, accelerator and mentorship programs for new companies, and partnerships with the city and local business community results in a culture of entrepreneurialism that then attracts leading corporations to the area. These companies, originally attracted to the IP generated at the university, the researchers behind the IP, and to the start-up companies, fund additional work at the university.

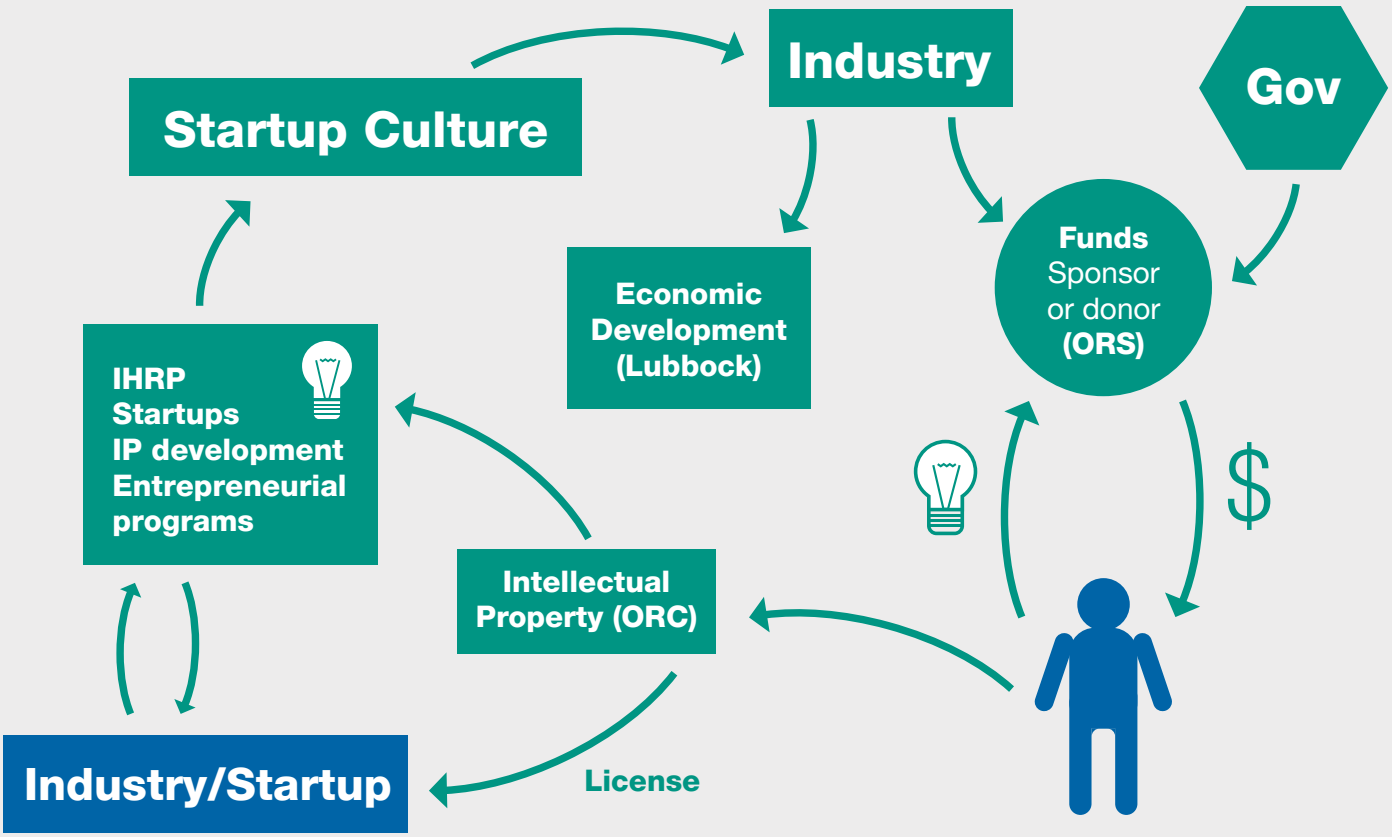


Figure 2. Circularized process that becomes a virtuous cycle

This in turn makes researchers more competitive in applications to federal sponsors. All of this increased research then results in more inventions and so it goes on. It becomes a virtuous cycle. A culture of start-ups that attract companies to the area acts as a driver for economic development, providing proximate experiential learning opportunities for students in high-tech environments. It becomes positive for so many.

At Texas Tech, we are working to build a virtuous cycle. We are not there yet but we are making great strides. Under the leadership of David Snow, the Office of Research Commercialization is working more closely with faculty, staff and students with their IP. They have also developed a first-of-its-kind licensing option to dovetail into the work at the Innovation Hub.

Under the leadership of Kimberly Gramm, a suite of new entrepreneurial programs have been developed to serve faculty, staff, students and the community at the Innovation Hub at Research Park. For example, new technology acceleration programs around an NSF-funded I-Corps grant is benefiting many of our faculty and student inventors. Accelerator programs are helping companies in a variety of fields. And a new iTTU Mentor program matches seasoned CEOs with new companies to help them be successful.

In the coming year(s), look for a lot of great things to happen across the OVPR as we work to build a virtuous cycle that benefits Texas Tech, those that work here or attend the university, the city, our state and the nation.

Research Highlights

Texas Tech's excellence in research, scholarship and creative activity cannot be measured only in dollar amounts. Our faculty and staff are making impacts in numerous ways. Faculty members are developing new, more efficient ways to detect cancer, remembering the Texans who helped to liberate the concentration camps of World War II and finding ways to better integrate sustainable energy sources onto the nation's energy grid. Our faculty are working across disciplines by combining art and research into lightning. Another project is weaving the arts into medicine. And a new center is training faculty to improve their communication in the classroom and to the public.

A few of our many accomplishments in research, humanities and creative arts are profiled here.

Abstract Art Meets Atmospheric Science

Eric Bruning's research focuses on understanding how lightening works within a thunderstorm and how that could help scientists predict when a storm will turn dangerous.

When science meets art, the result is as brilliant as the lightning at the heart of the research.

Eric Bruning, Texas Tech associate professor of atmospheric science, is focused on understanding how lightning works and whether that knowledge could help scientists predict where and when a massive thunderstorm could turn dangerous – a capability that would save lives on the ground.

Tina Fuentes, a nationally known artist and former director of the School of Art, has worked with Bruning to illustrate his work.

Their collaboration came as a result of Bruning receiving a CAREER Award from the National Science Foundation (NSF) in 2014.

"An important part of the grant, from NSF's point of view, is how you will do active outreach and education, and I was interested in doing something a little bit outside the box," he said. "I've always enjoyed data visualization and looking at our data in graphical form. So I figured it would be interesting to work with someone who has a lot of experience working visually."

Tina Fuentes worked with Bruning to capture his research through abstract art.

Fuentes went to meteorological conferences, sat in on Brunings' students' presentation and went storm chasing with him.

While her two-dimensional art is stunning, Fuentes wasn't quite satisfied. Inspiration hit one day when Fuentes was watching the weather on TV. She realized the green-wall technology used to project the image behind the meteorologist could work for her.

"I made a makeshift green wall in my studio and I wore a green suit," she said. "We were able to pull me out of the video and all you see are my paint strokes."

As for the science, Bruning is one of the few meteorologists who is studying lightning. Most scientists in that field are from a physics or electrical engineering background. Bruning is trying to describe how lightning fills a cloud.

“Everyone has seen lightning coming from the bottom of the cloud, but there is probably 10 times more lightning inside the cloud that you don’t see,” he said. “I’m looking at how the turbulence in the cloud ends up making very small flashes when it’s really turbulent and very large flashes when it’s smoother inside the cloud.”

The result of Bruning’s work could combine with the radar images scientist use now to predict severe storms and improve public safety warnings.

“If there are a numerous thunderstorms in an area, the question becomes how to tell which one is the most dangerous,” he said. “If we can better understand how the turbulence of the storm is affecting lightning, then we may be able to use the characteristics of lightening to determine which storm is the one that could become most dangerous.”

After a couple of years working together, the scientist is convinced that the artist is capturing what he is seeing in the clouds.

“Tina has stripped away the normal scientific trappings and captured the essence,” he said.

Their work is featured in an exhibit at the Museum of Texas Tech University.

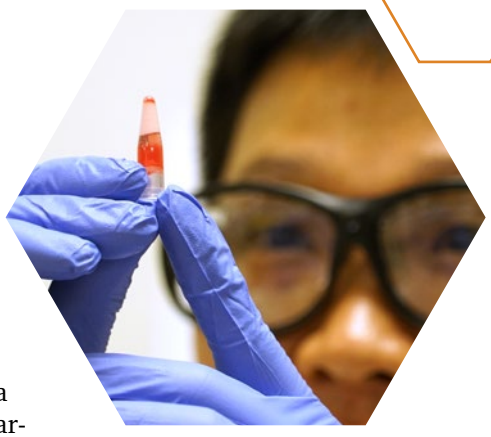
New Technology Detects Cancer Cells Circulating Through Blood Stream

Picking a single cancer cell out of trillions of blood cells is delicate, expensive work. Existing techniques are not affordable for medical facilities in rural areas or with limited resources.

Wei Li, an assistant professor in the Texas Tech Department of Chemical Engineering, is part of a research group that published a paper in the online version of the American Chemical Society’s Journal Applied Materials and Interfaces detailing a new method that could be a major step forward in cancer diagnosis.

The article details how a tiny, hollow glass bubble about half the width of a human hair could lead to a fast, inexpensive way to pick cancer cells out of a patient’s blood.

“Cancer cells can break off from a tumor site and travel through the blood to a find a new host, creating yet another tumor,” said Li. “Detecting these cells early can aid physicians in devising treatment at a much earlier state of the disease. And early detection of cancer is key to improving survival rates.”



Wei Li’s new technology uses a tiny, hollow glass bubble about the width of a human hair that could lead to a faster more affordable way to detect cancer cells in the blood.

Li is working with hollow glass bubbles that are coated with a special nanofilm that attracts cancer cells, but not blood cells. A sample of a patient’s blood is put into a plastic tube containing the bubble and it is shaken for a few minutes. Cancer cells will attach to the bubbles and will float to the surface while normal blood cells will sink to the bottom.

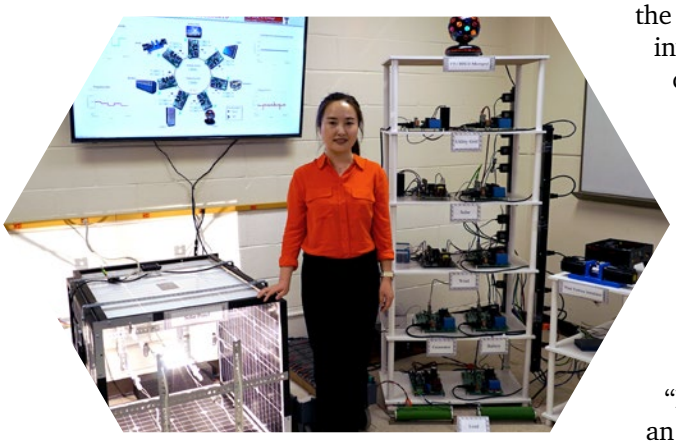
Li believes this technology has other applications beyond cancer detection. The same system could preserve cells isolated from blood that need to be sent to distant medical facilities for testing.

"Big cities have testing facilities," he said. "But rural areas most often do not. It's easy to draw blood and get a test done if you live near a testing facility. But some tests must be done within four hours of drawing the blood. We think our microbubble system could preserve the cells isolated from blood for a long enough time to get them to a facility. Proving this concept is the next phase of our research."

The work described in the journal article is the basis for a new project that recently received $200,000 from CPRIT, the Cancer Prevention and Research Institute of Texas.

Bringing Renewable Energy Seamlessly onto the Nation's Electric Grid

The growth in production of renewable energy sources such as wind and solar power is a double-edged sword for the nation's energy needs. While wind turbines and solar arrays are providing clean and sustainable energy, getting that energy onto the nation's aging power grid is bringing new challenges to power systems.



Beibei Ren works with a laboratory-scale micro grid in her research to develop more efficient way to move power from wind turbines and solar arrays onto the nation's energy grid.

Integrating energy from large-scale wind and solar farms onto the nation's power grid is placing a huge strain on the power inverters, which are the pieces of equipment that currently handle the energy transfer. Wind and solar farms produce large amounts of energy in unpredictable amounts, making it difficult for current equipment to handle the transfer onto the grid.

For example, to maximize their output, wind farms produce energy at varying rates based on wind and turbine speed. Power inverters are needed to convert that energy to electrical energy.

"Renewable energy is dynamic and unpredictable," Beibei Ren, an assistant professor in Texas Tech's Department of Mechanical Engineering, said. "Our technology provides a stable, efficient and reliable way to add the energy produced by wind turbines and solar arrays onto the electric grid."

Ren's new technology, known as Uncertainty and Disturbance Estimator (UDE)-based Robust Droop Control for Parallel Operated Inverters, could allow the huge amount of energy produced by the wind farms and solar arrays to be easily connected to the grid and should also improve power quality and reliability.

Working through the Office of Research Commercialization, Ren has a patent on the technology.

The next step for Ren, is to find partners and investors that will allow her to test her innovation commercially.

"We believe the technology is scalable. It works well in the laboratory, with different sources and loads of power," she said. "Now we need to apply it on a commercial scale and do validations for industry."

Ren's technology earned her a 2017 TechConnect Innovation Award. The national award honors the top early-stage innovations from around the world through a review process with rankings based on the potential positive impact the submitted technology will have on a specific sector of industry.

Heroes of the Holocaust

In April 1945, American soldiers witnessed unspeakable atrocities as they liberated prisoners from the Nazi concentration camps. Decades later, an interdisciplinary team of Texas Tech researchers is sharing the stories of a group of these soldiers who came from Texas, known as the Texas Liberators, with a new generation.

"The soldiers who liberated these camps were ordinary men," said Aliza Wong, associate professor of history and associate dean of the Texas Tech Honors College. "Many of these men came from rural areas. They had never traveled; some had never even been to a big city."

The Texas Liberators project began when Peter Berkowitz, former chairman of the Texas Holocaust and Genocide Commission (THGC), successfully petitioned the College Board to include the Holocaust in their Advance Placement U.S. history curriculum in 2016. He then approached Wong to develop resources for students and teachers.

While Berkowitz originally envisioned a digital textbook, inspired by her students and her high school-age son, Wong suggested the commission instead create an interactive app. "Using gaming as a portal to further an educational experience is a new concept in the classroom," Wong said. "If you ask a classroom of high school students how many have played 'Call of Duty,' most hands will go up. That is a mode of entry, a mode of engagement that a lot of students are comfortable with and excited about."

Top: Photo of the barracks at Dachua taken in 1945, courtesy of the National Holocaust Museum. Bottom: Using historic and current images, designers created accurate 3D renderings of the barracks.

Wong and a team from five different Texas Tech departments created an app to guide students through Dachau, a German concentration camp that held approximately 33,000 prisoners, through the eyes of a Texas Liberator.

In a 3D environment, students move through the camp visiting key buildings as they play the role of a Texas Liberator. Students also interact with the prisoners and the American soldiers in the camp, Wong said. Student can ask a question of a soldier in the app and a video clip will play showing a Texas Liberator describing what he experienced.

Through the app, and an accompanying website filled with resources for teachers and students, the Texas Liberators' stories will reach high school students across the United States and Canada.

A new book about the Texas Liberators has been published by Texas Tech University Press. The project also was the subject of a recent exhibition at the Museum of Texas Tech University.

Improving Communications Inside and Outside the Classroom

The Texas Tech College of Media and Communication recently opened the doors to their Communication Training Center (CTC). The center, a key feature of the Texas Tech Quality Enhancement Plan, was created to empower faculty members, instructors and graduate students to improve their oral and visual communication skills for the classroom and for peer, media and public audiences.

"The CTC strives to improve instructor communication and awareness in order to facilitate and positively impact undergraduate student learning," associate professor of communication studies and CTC director Luke LeFebvre said.

Located in the College of Media and Communications building, the CTC offers six signature workshops bi-weekly that help participants learn evidence-based strategies for understanding and creating optimal communication behaviors with other people.

In addition, the CTC also provides both custom and personalized workshops. Custom workshops are created to fit the needs of a group. The CTC has created custom workshops for the Center of Biotechnology and Genomics, Graduate Student Writing Center, the Innovation Hub at Research Park, Mandela Washington Fellowship for Young African Leaders and more.

In contrast, personalized workshops are geared for participants who attend either a signature or custom workshop and provides them with individualized help from CTC staff with a presentation, poster or other communication-oriented project.

"All of our workshops have been a resounding success," LeFebre said. "We have had over 300 participants in less than a year. Our average workshop rating is a 4.5 out of 5."

LeFebre also said a graduate student who attended the CTC workshops emailed him to say, "Every instructor, conference presenter and job applicant who will be delivering a teaching or research presentation needs to spend the time learning these principles and skills taught at the CTC. It will make them more dynamic, their presentations more impressive and the college and university more positively perceived in the field."

Along with the workshops, the CTC conducts assessments of classroom communication and student engagement – specifically of high impact core curriculum courses that have the largest number of undergraduate students. Using the Class-Level Survey of Student Engagement (CLASSE), a two-component tool that compares faculty expectation with student reports of their experience in the classroom, the CTC is able to work at limiting dissatisfying experiences in core courses by improving communication to positively impact student retention rates and minimize dropout, withdrawal or failure rates among undergraduate students.

"We believe at the CTC that the difference between knowing and teaching is communication, and we work to help others improve their knowledge and skills for communicating," LeFebvre said. "The great part of our center is that communication transcends disciplines and the skills we teach make people more effective and efficient when creating meaning with others."

Art and Medicine Combine for Innovative Health Care Solutions

Just as ailments of the body can be cured by medicine, ailments of the soul can be cured by the arts. While the two may seem like unrelated pathways to achieving better health, they have more in common than meets the eye. Thanks to a project headed by Texas Tech University's Talkington College of Visual and Performing Arts, the Texas Tech Health Sciences Center (TTUHSC) Schools of Medicine and Nursing, these commonalities have been given life in the Arts Initiative in Medicine (AIM).

First introduced in the fall of 2015, AIM was created to acknowledge the importance of providing Texas Tech students with alternative paths in the arts that also serve the public good. The project was also created to facilitate research collaborations among faculty across the Texas Tech and HSC campuses in three major areas:

- Arts in the Medical Environment
- Arts and Medicine Collaborative Research
- Arts and Medicine/Curriculum Development.

Bolstered by a $100,000 grant from the CH Foundation, as well as seed money from the university and federal funding, AIM has seen steady growth from a small group of interested faculty to a now thriving interest group with programs on both campuses and with partners across the country.

"I'm happy to say this group has grown exponentially over the past year or so now," Talkington College of Visual and Performing Arts (TCVPA) Dean Noel Zahler said. "We now have 16 multidisciplinary research teams working on different projects. Almost every college in the university has been tapped so that these are robust teams doing an enormous amount of work together."

As for the projects influenced by AIM, they expand into almost every health area from stroke victims to breast cancer to autism, with each dependent on faculty interest. Some of the successfully completed or substantially underway projects include the following:

• A collaboration between the School of Theatre and Dance and Houston Methodist Hospital to train College of Visual and Performing Arts personnel in the teaching behind Houston Methodist's "music4everyone" program with the focus on developing arts-based curriculum for special populations, including those on the autism spectrum which curriculum may eventually become a part of a certificate program

• A research collaboration between the School of Theatre and Dance, Psychological Sciences and the Department of Theatre at the University of Maryland, Baltimore County utilizing fMRI technology to study neural and cognitive effects of Fitzmaurice Voicework®; the project has received $15,000 in initial support from the Texas Tech Neuroimaging Institute

• A research collaboration between the School of Theatre and the School of Nursing studying the effectiveness of utilizing acting methodologies (Meisner, Audience Engagement/Intake Modes, Subtle Energy Awareness) with nursing students to enhance their communication skills and decrease nervousness prior to taking their OSCE exams (involving interactions with live patients)

• Implanting music, dance, and theater performances, as well as art exhibits into the hospital setting to enrich the lives of patients and the hospital setting

• A collaboration between graduate students from the School of Theatre and Dance and faculty from the Speech, Language and Hearing Research at TTUHSC to work with participants in the Stroke/Aphasia Recovery (STAR) Summer Arts Program, a TTUHSC community outreach program

• A research project collaboration between faculty from the College of Human Sciences and the School of Art to study the effects of the arts on hospital design with a focus on wayfinding

"I think that's what the arts initiative in medicine really does," Zahler said. "It's unorthodox and unusual but I think it's a direction that we have to go in both in terms of our own knowledge and how we can demonstrate that what we do should be of general interest."

OVPR Highlights

Office of Research Commercialization

The 2016-17 academic year has been a record-setting one for the Office of Research Commercialization (ORC). The office is charged with identifying university research with the greatest commercial value, filing patents on those technologies to secure the inventor's rights, and licensing the technologies to business partners who want to translate these Texas Tech innovations into commercial products and services and bring them into the market place. The office helps researchers through the patent process and also licenses inventions to university startup companies formed by an inventor or student or to an established external company.

Across the Texas Tech System, the ORC received 128 invention disclosures. The ORC filed a total of 42 new provisional patent applications and filed 49 non-provisional patent applications. The ORC executed 19 license or option agreements and generated $991,116 in gross revenue from licensing during the year, a 46 percent growth over the prior year.

Texas Tech University inventors contributed 77 of the 128 new invention disclosures, of which 30 were protected with new provisional patent applications. The office also filed 29 non-provisional patent applications and executed 18 license or option agreements during the year.

New Licensing Agreement Introduced

To make it easier for faculty members and students to spin lab discoveries into new startup companies, ORC developed a new type of licensing agreement called a Validation License. Unlike the typical license agreement, which includes various upfront costs for the company founder and negotiation of license terms, the Validation License is a fast and easy way for an entrepreneur to secure patent rights for a Texas Tech invention with no upfront payment or the time required to negotiate license terms. The company is able to validate the technology, develop a business plan, and even secure funding prior to making any financial investment in the patent rights.

Innovation Awards

During the year the Office of Research Commercialization assisted three researchers in earning 2017 TechConnect Innovation Awards for their work. The national award honors the top early-stage innovations from around the world through a review process with rankings based on the potential positive impact the submitted technology will have on a specific sector of industry.

Beibei Ren, an assistant professor in Texas Tech's Department of Mechanical Engineering, received the award for her work to develop a new technology that provides a more stable and reliable way to integrate wind turbines, solar arrays and energy storage systems onto the nation's electric grid.

Shelby Lacouture, senior research associate in the Center for Pulsed Power and Power Electronics in Texas Tech's Department of Electrical and Computing Engineering, received the award for his work in developing a hand held device that can measure the flow of an electric current.

Robert Stump, assistant professor in the Department of Emergency Medicine at the Texas Tech University Health Sciences Center El Paso, earned the award for developing a novel medical device – a no suture chest tube that can be used to expedite treatment in the emergency room or on the battlefield of collapsed lungs caused from chest wounds.

GAP Peptides, LLC

Carder Brooks (left) and Cole Seifert form GAP Peptides, LLC to commercialize a new method of producing the peptides used in many pharmaceutical therapeutics, cosmetics and many other products.

One of the year's success stories for ORC is an exclusive license to a university start-up company, GAP Peptides, LLC. The company was formed to commercialize a new method of producing the peptides used in many pharmaceutical therapeutics, cosmetics, and diagnostics. The new method provides a more efficient synthesis with greater crude purity than current industry standards. The estimated market potential is $16 billion annually. This new method of peptide synthesis was invented by Guigen Li, professor in the Department of Chemistry and Biochemistry and Cole Seifert, a Ph.D. student in his lab.

The invention was disclosed to the ORC in August 2015. The invention was assessed as patentable and the first patent application was filed in December of that year. In 2016, an option agreement was signed with Seifert, the company's founder, giving him control of the patent rights while he assembled a team to validate the technology and explore funding options.

During the next eight months the company GAP Peptides, LLC was formed, investors were found, the provisional patent was converted into a non-provisional application, and an exclusive license agreement was executed with the ORC.

The company plans to open in January 2018 in space leased from the Innovation Hub at Research Park. Gap Peptides, will produce high quality research-grade peptides for customers in the pharmaceutical, cosmetic and diagnostic industries.

Innovation Hub at Research Park

The Innovation Hub at Research Park (the Hub) has established a number of programs that create an entrepreneurial mindset, connect innovators across all disciplines and support the expansion of a knowledge-based economy based upon Texas Tech's research capabilities. The Hub offers programs to assist faculty, staff and students who want to take their ideas and inventions and create viable startup businesses.

The following programs were developed, launched, supported by or improved at the Innovation Hub at Research Park in 2016-2017 through the innovation and entrepreneurship resources are

1) Red Raider IDEA Competition
2) Red Raider Startup
3) iLaunch Competition
4) Spark Conference
5) NSF ICorps Regional SW Node
6) "innovate" TTU Mentor Program
7) TTU Accelerator (improved)
8) TTIME (improved)
9) University Innovation Fellows
10) Hub Orientation/Safety
11) Hub Camp
12) Young Entrepreneur Academy
13) NSF ICorps Workshop
14) TECH CEOS (Rawls College of Business student organization)
15) Co-working Membership

available to student, faculty, and entrepreneurs through the Hub.
Approximately $389,000 was disbursed for technology validation and early stage startup funds. The 15 programs offered resulted in significant impact for the Texas Tech community and its service region.

Seven startups were launched with 57 percent of the teams consisting of Texas Tech faculty.

Eleven mutually beneficial partnerships were created engaging organizations such as the Lubbock Angel Network.

A cornerstone of the Hub programs is the "innovate" TTU Mentor program (iTTU). Thirty four mentors from industry, technical and entrepreneur experts from the Texas Tech community gave 1,285 volunteer hours equating to a value of $321,000.

The key to the Hub's success is communicating to external audiences and create awareness of innovation and entrepreneurship initiatives. News releases, television and social media stories about startup stories resulted in 2.8 million media hits. Attention to marketing resulted in the highest number to date of 8,692 attendees participating in programming and facility utilization for entrepreneurship focused projects/initiatives.

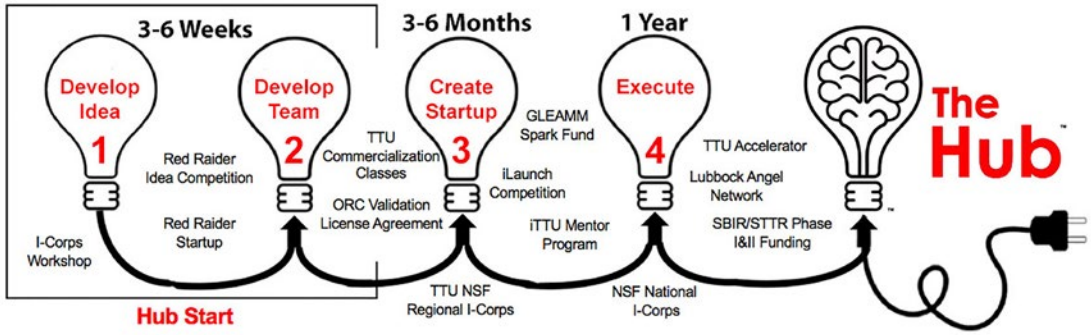
The Flow Raider team won $50,000 from the Spark Fund for its bio-inspired, micro-scale structures as surface coating for wind turbine blades and transport vehicles for improved aerodynamic performance. Pictured are, from left: Luciano Castillo, Don Kay and Clay Cash Foundation Engineering Chair in Wind Energy and chief science officer, Kimberly Gramm, senior managing director of the Hub, Burak Aksak, assistant professor mechanical engineering and chief technical officer, Annie Soble, GLEAMM director, and Humberto Bocanegra, postdoctoral research associate in mechanical engineering and chief executive officer.

The HUB hosted the inaugural Spark Conference April 27-28. The Spark Conference is a two-day conference focused on excellence in industry, inventors and investment in innovation. The event featured a presentation by the Office of Research Commercialization and the iLaunch Competition sponsored by the Lubbock Economic Development Alliance, Global Laboratory for Energy Asset Management and Manufacturing (GLEAMM) Innovation Poster Showcase, and the GLEAMM Spark Fund Presentation. More than 300 people attended this meeting, and 30 teams competed for funding. Approximately $225,140 in funding was awarded to encourage the research teams and seed early stage start-up companies.

Texas Tech faculty have been successful in the National Science Foundation (NSF) I-Corp program. The program helps scientists and engineers learn to develop their innovations for transfer to the marketplace. Four faculty members have received national I-Corp funding total of $400,000. The HUB's regional I-Corp program has produced 33 teams. Texas Tech received $83,000 as a supplemental I-Corps award from the National Science Foundation. Texas Tech and partner institutions also received $3.4 million for the renewal of the Southwest NSF I-Corps Node to support commercialization of our research. Texas Tech's partners are Texas A&M, the University of Texas at Austin, MD Anderson and Rice University.

TEXAS TECH UNIVERSITY
Innovation Hub
at Research Park

Commercialization Timeline



Step 1 Identify a team, video pitch, invention disclosure, business model canvas
Step 2 Confirm team, create pitch deck, identify a mentor, develop value proposition
Step 3 Revenue model, in-depth customer discovery, 50 interviews, access to funding
Step 4 Conduct 125 customer interviews, commercialization plan, Hub certification

Research Development

The Research Development Team (RDT) offers early-stage proposal development assistance for large-scale, center-like proposals and for new faculty or first time submissions.

The team provides a number of services including access to editors knowledgeable in grant writing to assess the readability, clarity, and organization of a proposal; developing strategies to connect faculty with program officers, and offering workshops and research development videos to assist faculty.

The team also conducts a high-level review of a grant proposal in its near finished state to increase competitiveness, and meet with faculty to discuss the reviewer comments on declined proposals and help strategize for a resubmission.

RDT also assist new faculty getting started with research by providing a roadmap to OVPR resources, including external funding opportunities.

In addition to the declined proposal Swift Critique Appraisal and Notification (SCAN) Sessions, RDT now offers pre-proposal SCANS as well. The team will conduct a review of your grant proposal in its near-finished state (1/2-2/3 complete). This high-level review will focus on the solicitation's review criteria and the agency's expectations. To take advantage of this service, send your proposal and solicitation to rdt.vpr@ttu.edu.

Another new service is program officer assistance, in which the team guides a researcher through the process of connecting with program officer(s). We will help you develop a brief summary of your research, as well as key points and questions for the phone call with the program officer(s).

RDT has developed a series of 2-3 minute informational videos on various research development topics to help researchers be more successful.

RDT exceeded its goal of serving 500 Texas Tech researchers during the 2016-17 academic year by almost 200.

Faculty served

682 Total

SCANS	51
New Faculty Assistance	113
Proposal Support	168
Workshops	39
Other	311

Office of Research Services

The Office of Research Services (ORS) provides proposal, administrative and management services for sponsored projects. Sponsored projects include grants, contracts and cooperative agreements—from both the public and private sectors—which support research, instructional and service projects. ORS provides budgeting assistance to researchers submitting proposals and are the final submission mechanism for the university. ORS also negotiate and execute all sponsored project agreements.

During the 2016-17 academic year, ORS submitted 1,032 proposals totaling $456,839,840 and Processed/Negotiated 524 awards totaling $65,814,341.

Proposals Submitted **1,017**

Awards Processed/ Negotiated **531 $65,857,235**

ORS continued to offer many opportunities for engaging and assisting faculty in the research process, including New Faculty Research Orientation and training in Budget Basics, NSF and Cayuse. Additionally, ORS collaborated with Accounting Services for a successful term of Raider Research University, which provides department research administrators and support staff involved in sponsored project administration information, training and resources.

ORS staff participated attended and made presentations at national and regional research administration conferences.

Responsible Research

The area of responsible research incorporates all divisions and committees that support safety, responsible research and compliance at Texas Tech including Environmental Health and Safety, Export and Security Compliance, Human Research Protection Program, and Animal Care Services.

These areas work collaboratively with the academic community to promote safe, responsible and productive research practices and foster dialogue about ethical concerns that arise naturally from creative endeavors.

Environmental Health and Safety continued to partner with academic units to update key infrastructure needed for research and teaching. Two notable projects completed in AY16-17 were the addition of modern fume hoods to an organic teaching lab in the Department of Chemistry and Biochemistry and the renovation of Professor Michelle Pantoya's energetics research laboratory in the Department of Mechanical Engineering. These projects improved efficiency, increased opportunities for students and expanded the scope of research at Texas Tech.

One natural outgrowth of the expanding research, collaboration, and commercialization efforts of Texas Tech faculty is the need to manage potential conflicts of interest. During AY16-17, OVPR's financial conflict of interest administrator served as the coordinator for a new Conflicts of Commitment Committee that reports to the President.

Animal Care Services supported the installation of two new canine research facilities that will allow Texas Tech scientists to explore new research questions about canine olfaction and about patterns of adoption from community rescue shelters.

The Human Research Protection Program's website now provides faculty researchers with an up-to-date snapshot of the numbers of proposals undergoing IRB review.

Faculty Development

The OVPR's Faculty Development program administers numerous activities to promote faculty success in research, scholarship, creative activities and the pursuit of external funding.

Programs include internal funding opportunities for early-stage proposal development and interdisciplinary collaborations. The office also promotes deserving faculty for targeted fellowships and other awards that garner national prestige for the faculty member and the university, and oversee internal research awards.

This year the Targeted External Faculty Awards Program was expanded from 29 to more than 200 eligible awards making it possible for more faculty to be included. A new recognition program to celebrate faculty achievements at the national and international level was established.

A road map was developed to increase federal research expenditures at Texas Tech based on case studies of 12 schools that have been successful in increasing expenditures.

The monthly Faculty Research Club continues to draw attendance and sponsorship external to the OVPR has been secured for the entire upcoming year.

Export and Security Compliance

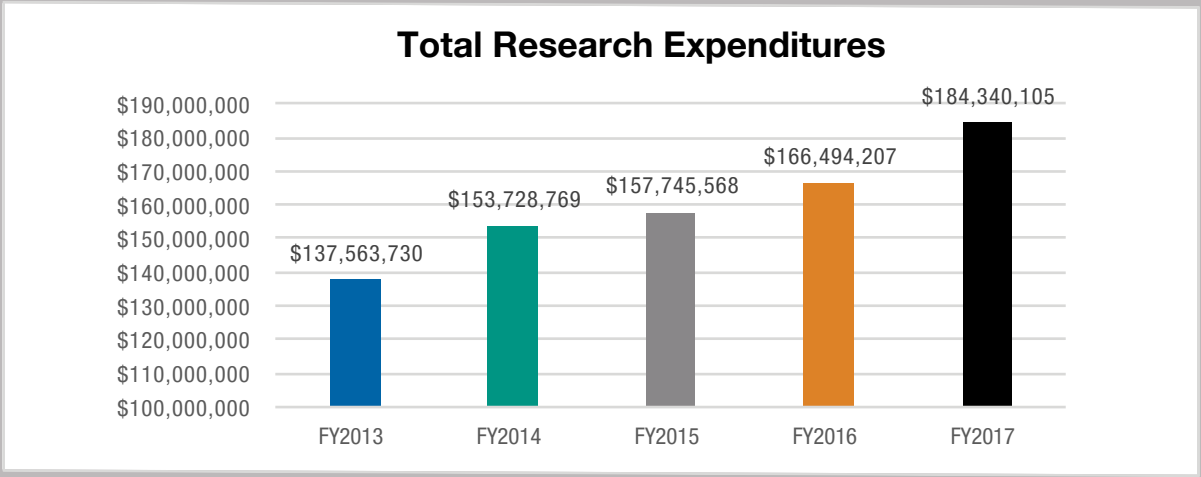
The Export and Security Compliance Office supports faculty, departments, and colleges as they make better-informed decisions regarding international collaborations and research.

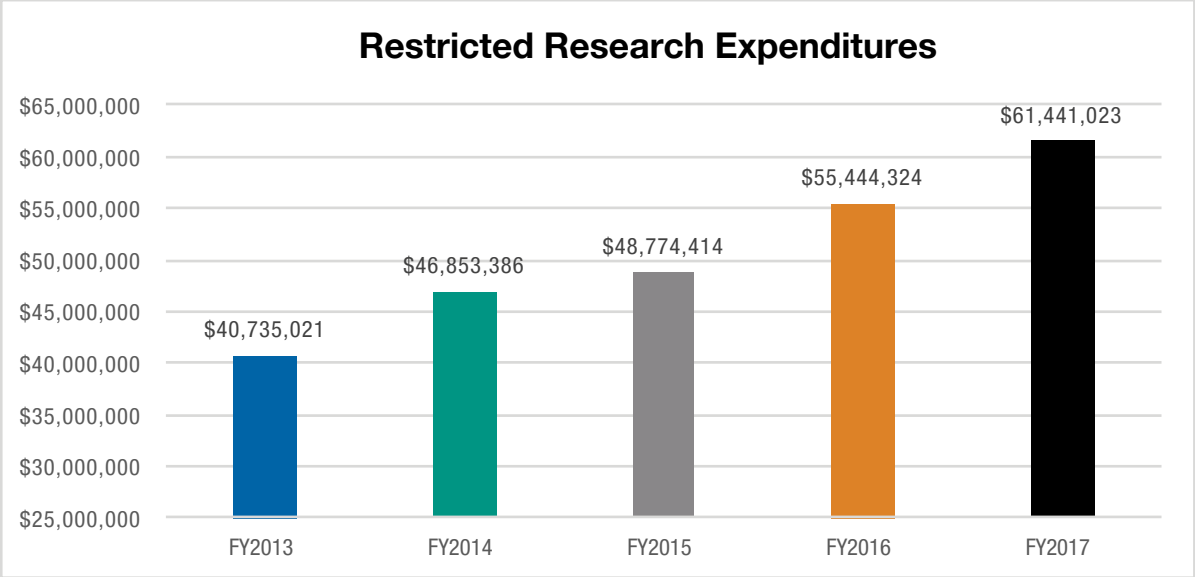
These functions are now organized in a central office, which serves as a command center to support faculty and staff in analyzing export control and facility security issues. The managing director obtained certification as an Export Compliance Professional in both Export Administration and International Trafficking in Arms Regulations. The office also added another staff member to better help faculty with export control issues.

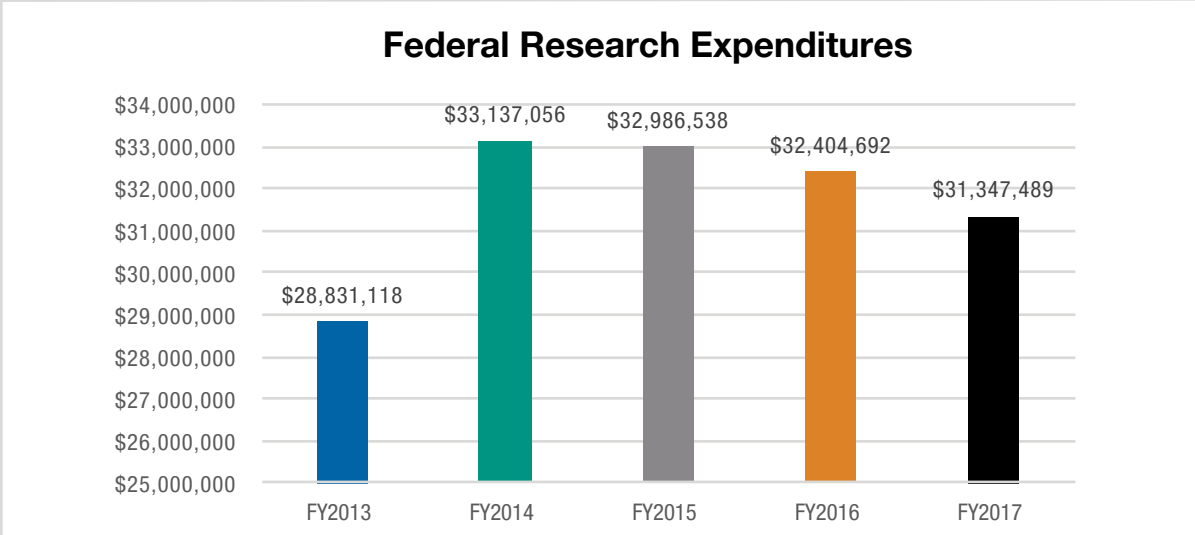
The office instituted a rigorous process that allows restricted party screening to be done by "gate-keepers" across campus, who forward identified export control risks to the office for evaluation. As a result, all international partnerships, travel, research projects, visiting scholars, H-1B visa applicants and vendors are screened against federal and international restricted party lists.

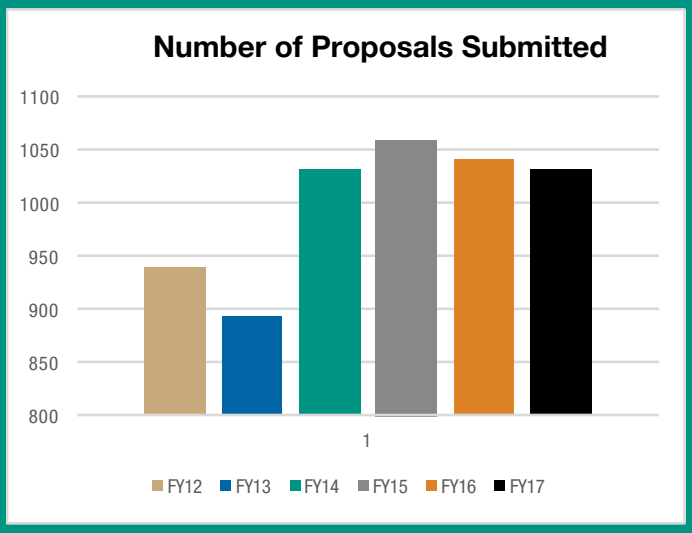
The office successfully obtained a license from the Department of State for a $1.2 million project, allowing researchers to complete and ship a prototype to international partners.

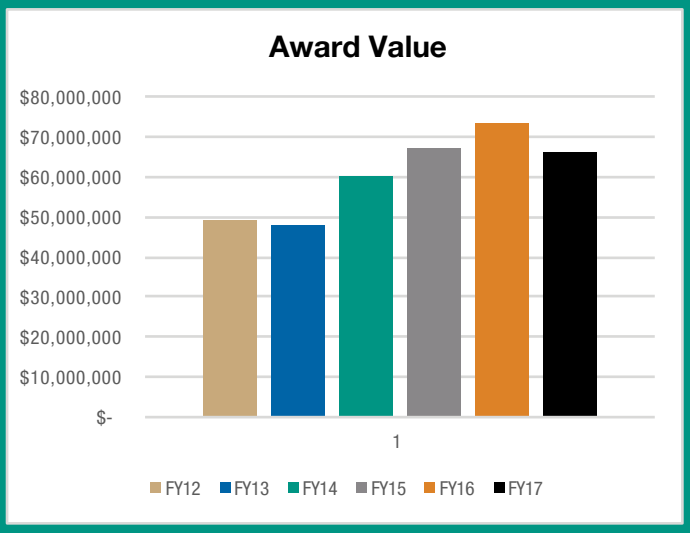
Research Metrics

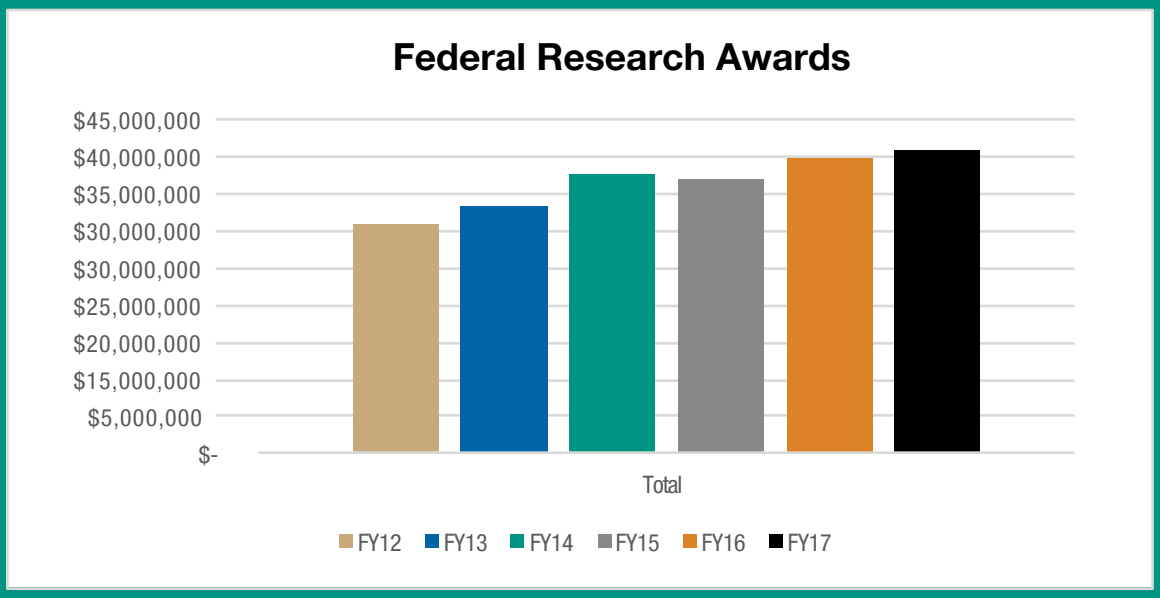


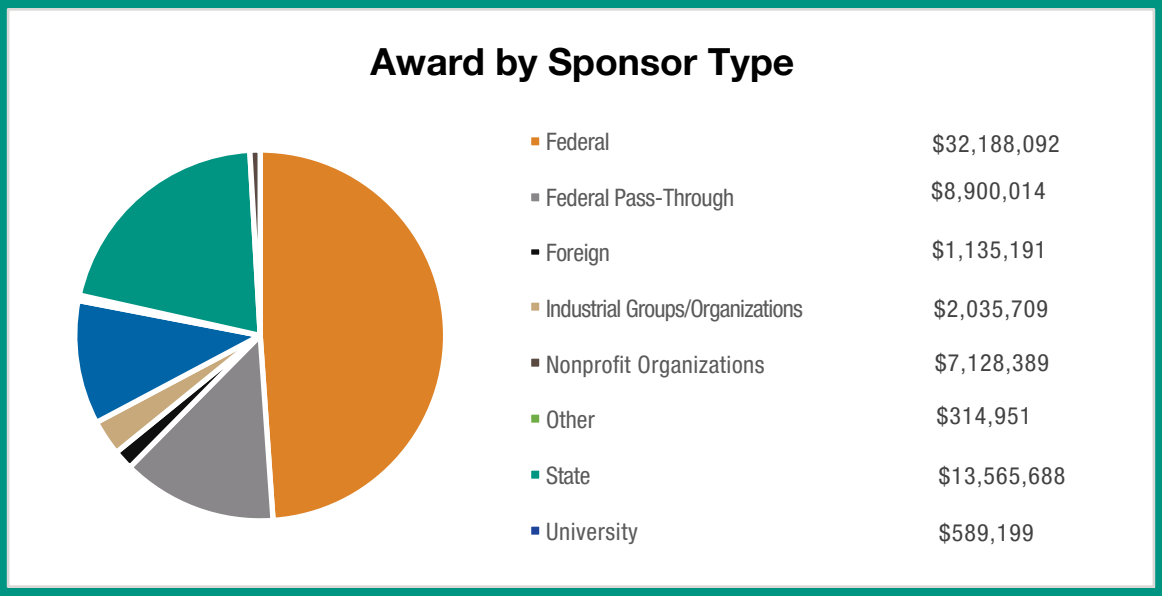





Number of Proposals Submitted
1100
1050
1000
950
900
850
800
1
FY12 FY13 FY14 FY15 FY16 FY17


Award Value
$80,000,000
$70,000,000
$60,000,000
$50,000,000
$40,000,000
$30,000,000
$20,000,000
$10,000,000
$-
1
FY12 FY13 FY14 FY15 FY16 FY17


Federal Research Awards
$45,000,000
$40,000,000
$35,000,000
$30,000,000
$30,000,000
$25,000,000
$20,000,000
$15,000,000
$5,000,000
$-
Total
FY12 FY13 FY14 FY15 FY16 FY17


Award by Sponsor Type
Federal $32,188,092
Federal Pass-Through $8,900,014
Foreign $1,135,191
Industrial Groups/Organizations $2,035,709
Nonprofit Organizations $7,128,389
Other $314,951
State $13,565,688
University $589,199

Disclosures, Patents and Licenses FY2015-FY2017

Institution		2015	2016	2017
ASU	Disclosures - ASU	0	0	0
	Provisional Patent Applications - ASU	0	0	0
	Non-Provisional Patent Applications - ASU	0	0	0
	Licenses - ASU	1	0	0
	Gross Revenue from Licensing - ASU	$0	$0	$0
	Disclosures, Patents and Licenses FY2015-FY2017			
HSC		2015	2016	2017
	Disclosures -TTUHSC	37	22	24
	Provisional Patent Applications - HSC	9	4	8
	Non-Provisional Patent Applications - HSC	15	21	9
	Licenses - HSC	2	5	1
	Gross Revenue from Licensing - HSC	$150,690	$138,221	$165,731
	Disclosures, Patents and Licenses FY2015-FY2017			
HSC EP		2015	2016	2017
	Disclosures - HSC El Paso	15	11	20
	Provisional Patent Applications - HSC El Paso	10	3	4
	Non-Provisional Patent Applications - HSC El Paso	6	6	11
	Licenses - HSC El Paso	1	0	0
	Gross Revenue from Licensing - HSC El Paso	$2,565	$0	$19,084
	Disclosures, Patents and Licenses FY2015-FY2017			
TTU		2015	2016	2017
	Disclosures - TTU	49	66	77
	Provisional Patent Applications - TTU	14	22	30
	Non-Provisional Patent Applications - TTU	18	28	29
	Licenses - TTU	10	11	18
	Gross Revenue from Licensing - TTU	$526,307	$537,802	$806,302
	Disclosures, Patents and Licenses FY2015-FY2017			
System		2015	2016	2017
	Disclosures	101	99	128
	Provisional Patent Applications	33	29	42
	Non-Provisional Patent Applications	39	55	49
	Licenses	14	16	19
	Gross Revenue	$679,562	$676,023	$991,116
			%change	46.61%